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Effect of Diabetes on Postoperative Ambulation following Below Knee Amputation

Amit Saraf¹, Ankita Gupta²

¹Assistant Professor, Dept. of Orthopaedics, ²Assistant Professor, Dept. of Medicine, Adesh Medical College Barnala Road, Bathinda

ABSTRACT

Background : Ambulation forms an important part of rehabilitation program after lower limb amputations. Diabetes Mellitus and its complications are commonly associated with amputation. In spite of this, there is an absence of studies on the effect of diabetes on the post operative ambulation of an amputee. This study analyses the role of diabetes as an independent factor affecting post operative ambulation and compares it with non diabetics. **Material and methods:** The present study followed 105 patients; 48 diabetics and 57 non diabetic amputees. Their post operative ambulatory level was compared by using Pinzur et al ambulation scale. Both groups were age, sex and BMI matched. **Results :** There was a worsening of ambulatory level in 33.3% diabetics as compared to 10.7% in non diabetics postoperatively. Of the prosthetic users, 78.4% were in non diabetic group and 21.6% were in diabetic group. 17.6% of prosthetic users required additional support, of whom 66.7% were diabetics. **Conclusion :** Diabetes Mellitus is an independent factor which has an adverse effect on the functional outcome of a patient after below knee amputation.

Keywords : Diabetes Mellitus, Below knee amputation, Ambulation

INTRODUCTION

Below knee (BK) amputation is the most common type of amputation in lower limbs. Despite continuous advances in limb salvage surgeries, a substantial proportion of patients still require major amputation. Diabetes Mellitus and its complications form nearly 40% of all causes of BK amputation¹. Other non diabetic causes include trauma, burns, cancer, congenital limb anomalies, vascular causes, life threatening infections like gas gangrene etc². Post operative ambulation forms an important aspect of rehabilitation of such amputees since it has a long lasting effect on the patients' social, economical, mental and physical outcome. Various modalities of a successful rehabilitation include :

1. Strengthening of muscles
2. Attainment of balance
3. Gait practice
4. Repeated practice³

Few studies^{4,5,6,7} have reported functional outcome after BK amputation but none has compared postoperative ambulation in diabetic and non diabetic amputees.

Attinger et al (2012) reported that the outcome of patients who undergo amputation for non diabetic causes cannot be compared with the outcome of diabetic patients due to association of diabetes with co-morbidities such as cardiac disease, peripheral vascular disease and/or renal failure. They reported a 64% ambulatory rate in diabetics after BK amputation.

Pinzur et al (1993) reported that 87% amputees regained their preoperative ambulatory status. This study however included all amputees (299) into one group of peripheral vascular disease which included diabetics (61%).

Corresponding Author :

Dr. Amit Saraf MBBS MS (Ortho)

Assistant Professor Dept. of Orthopaedics
Adesh medical college
Barnala road, Bathinda
Mob.: +919780029750

Vamos et al (2010) compared ambulatory status in two groups but sex was a confounding factor. They had 74.5% male in diabetic group as compared to 54.1% males in non diabetic group which was statistically significant.

Speckman et al (2004) reported a longer hospital stay and thus poor functional outcome in BK amputees who had pre-existing cardiac co-morbidities or renal insufficiency.

Stasik et al (2008) reported an overall incidence of 87% good functional outcome after BK amputation. The incidence was good because they did not grade the functional outcome and ability to walk was the only criteria.

Preceding studies suggest that there is a dearth of studies assessing the influence of diabetes on functional outcome of BK amputees. This study aims to assess the influence of diabetes on functional outcome of BK amputation by comparing it with non diabetics.

MATERIAL AND METHOD

This was a 10 year retrospective and one year prospective study done between 1996-2006 in Department of Orthopaedics, Christian Medical College, Ludhiana. A total of 148 patients of >45 years were initially enrolled in this study. Out of these 8 patients were lost to follow up. 17 patients subsequently underwent above knee amputation and 18 patients expired before 6 months of follow up which were excluded. Out of 18 patients who expired, 68% were in the diabetic group. Of the remaining 105 patients, 48 were diabetic and 57 were non diabetic. Both the groups were age, sex and BMI matched (Table 1). Non diabetics included the patients who underwent amputation due to trauma, burns, peripheral vascular disease and tumours.

Patients with amputation of ipsilateral / contralateral upper limbs, contralateral lower limbs, neurological deficit, physical disability hampering mobility and co-morbid conditions like cerebrovascular accident, were excluded.

METHODOLOGY

Although procedure was many times life saving, haste was avoided. The patient was first brought to

the best possible condition to survive surgical trauma. The patients either underwent an open amputation 81 (77.1%) or a primary closed amputation 24 (22.9%). Closure was done by either a Skew flap (24%) or Burgess closure (76%). In patients who underwent an elective surgery, a preoperative planning for ambulation was done by using following steps :

1. Preparing the patient by counselling for the impending surgery.
2. Providing conditioning exercises.
3. Teaching the use of orthotics/ walking aids for walking.
4. Transfer training and when necessary breathing and coughing exercises.

Physiotherapy was started the next day of surgery. Once the swelling was down patient was made to stand and walk with the help of crutches/ walker. When the stump had sufficiently healed and was strong enough to bear weight (usually 1-2 months post closure), patient was given prosthetic fitting. Ambulation of the patients was graded by using Functional Ambulation Scale proposed by Pinzur et al (1993) which was a modification of scale originally used by Hoffer et al (1973) (Table 2). All the patients were followed up for minimum six months upto 10 years with a mean follow up of 2 years.

RESULTS

Out of 48 diabetic patients, 16 (33.3%) patients showed a worsening of ambulatory level in the diabetic group whereas in non diabetic group only 6 (10.7%) suffered worsening of ambulatory level. The result was **significant** ($p < 0.05$).

It was also observed that level 6 ambulation was present in 22 (45.8%) patients preoperatively as compared to 13 (27%) patients postoperatively in the diabetic group. This level of ambulation was seen in 48 (84.2%) in preoperative and 45 (78.9%) in postoperative in the non diabetic group. Level 0 was observed in 2 patients in diabetic group and none in non diabetic group postoperatively. None of the patients had level 0 preoperatively in both the groups.

Out of 105 patients, 51 were using prosthesis

during a mean follow up of two years. Of these 51 patients, 40 (78.4%) were non diabetic and 11 (21.6%) were diabetic. The result was **statistically significant** ($p < 0.05$).

27 (52.9%) patients of the total prosthesis users were wearing the prosthesis for 6-12 hours per day and 20 of them were non diabetic (Table 3). Of the total 51 prosthetic users 9 (17.6%) were using additional support like crutches or walker. 6 (66.7%) of these amputees were diabetics.

DISCUSSION

After BK amputation, diabetics have a poorer ambulatory level as compared to non diabetics. Further the incidence of prosthesis usage and its duration was also less in diabetic group. Diabetics had to use additional support more often than non diabetics. It proves that diabetes significantly affects the functional outcome after BK amputation.

This finding can be attributed to the fact that inspite of absence of co-morbid conditions, DM may cause myopathies or diabetic neuropathies which can affect the ambulatory outcome in an amputee^{12,13}. Diabetic patients are often on one or more anti-diabetic drugs which cause myopathy, osteoporosis and early fatigue¹⁴. Consequently such amputees are reluctant to utilize prosthesis as their energy expenditure increases considerably during a walk.

Diabetic patients often have bony pains due to decrease in calcium content in bone and thus avoid putting weight on the limb left¹⁵. This compels the diabetics to more often use additional support while walking.

The earlier^{3,4,5,8} studies reported functional outcome after BK amputation. This study focused on the influence of diabetes as an independent factor affecting the functional outcome of BK amputees.

CONCLUSIONS

From the present study we conclude:

1. Postoperatively there is a significant decline in the functional level of ambulation in diabetics as compared to non diabetics and diabetes is an independent factor for this decline.
2. Prosthetic usage is significantly more in non

diabetics as compared to diabetics.

3. Non diabetics use prosthesis for longer duration as compared to diabetics.

4. More amputees in diabetic group have to use additional support for walking compared to non diabetics

Table 1: Age, sex and BMI matching

	Diabetic (48)	Non diabetic (57)	P value/ t score
Age	62.8±3.3	64±4.8	t = -1.46
Male	40	50	p = 0.52
Female	8	7	
BMI	26±3.2	27±4.3	t = -1.3

Table 2 : Pinzur et al (1993) ambulatory scale

Level	Walking capacity
6	Independent community ambulator
5	Limited community ambulatory
4	Unlimited household ambulatory
3	Limited household ambulatory
2	Supervised household ambulatory
1/0	Transfer- bedridden

Table 3 : Use of prosthesis in diabetics and non diabetics

	0-6 hours	6-12 hours
Diabetic	13	7
Non diabetic	11	20
Total	24	27

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Comparison between the effects of Aquatic Exercises and Land Based Exercises in the Treatment of Chronic Low Back Pain

Mohannad Hawamdeh¹, Ziad Hawamdeh², Ziad Ermely³ Islam Qaddah⁴, Dima Abu Soud⁵

¹The Hashemite University, Faculty of Allied Health Sciences, Department of Physical and occupational therapy, Alzarqa-Jordan, ²University of Jordan, Faculty of Medicine, ³University of Jordan, Faculty of Rehabilitation Sciences. ⁴Al-Tamayuz Center, ⁵Royal Medical Services.

ABSTRACT

Objective: To investigate the effect of aquatic exercises in treatment of low back pain and to compare these effects with land based exercises.

Subjects and Method: Thirty patients from both sexes between 20-45 years old with chronic low back pain due to bad posture and lack in activity of daily living were referred to take part of this study; they were recruited from outpatient clinic of Al_Tamayuz Physical Therapy Center (Amman-Jordan), during the period extending from Oct 2013 up to Dec 2013. They were randomly divided into two groups: experimental group (A) treated with Aquatic exercises, and experimental group (B) treated with Land based exercises.

Both groups received treatment three times a week for eight weeks (24 sessions of 1 hour duration). Baseline measurements included lumbar flexibility measured by modified Schober test, Visual Analogue Scale (VAS), McGill Pain Questionnaire (MPQ) and Barthel Index was taken for both groups before and after intervention.

Results: there was a significant improvement in all outcome measures for both groups after the end of treatment. A significant improvement ($p < 0.05$) was obtained in experimental group (A) compared to experimental group (B) in spinal mobility.

Both exercises media were relevant in the treatment of chronic low back pain with a significant improvement in experimental group (A).

Keywords: Low back pain, Aquatic exercise, Land Exercise, VAS, pain.

INTRODUCTION

Low back pain (LBP) is a common musculoskeletal occupational health problem and was found to be the

Corresponding Author :

Mohannad Hawamdeh PT, PhD

The Hashemite University, Faculty Of Allied Health Sciences, Department Of Physical And Occupational Therapy, Alzarqa-Jordan
Email: Mohannadhawamdeh@hu.edu.jo

leading specific cause of years lived with disability⁽¹⁾. Low back pain (LBP) is the most common cause of pain in the United States ^(2,3), resulting in substantial morbidity ⁽⁴⁾, disability ^(5,6), and costs to society ^(7,8). Chronic LBP (cLBP) lasting more than 12 weeks^(2,3,6). Aquatic exercise lowers joint stress, while offering higher density to cut the risk of fall injuries ⁽⁹⁾.

Physiotherapists have a wide variety of options to treat people with chronic low back pain ⁽¹⁰⁾. Exercise can be performed inside or outside the pool in the form of individual or group bases.

Hydrotherapy is defined as the external application of hot or cold water, in any form, for the treatment of disease ⁽¹¹⁾. Over the centuries, many cultures have used this simple.

Hydrotherapy is a viable rehabilitation alternative for the treatment of back pain and dysfunction. Water has unique physical properties that make it an ideal medium for the rehabilitation ⁽¹²⁾.

Warm Water is claimed to reduce Muscle tone and reduces Pain. ⁽¹³⁾. The warm water relaxes body generally and reduces anxiety ⁽¹⁴⁾. Group Hydrotherapy enables social interaction and also takes them from their main problem ^(15, 16, and 17).

Bender et al (2005) has suggested that there were no rigorous assessment on the effect of hydrotherapy for pain relief ⁽¹⁸⁾. However, Barker et al (2006) had carried out a study to investigate the efficacy of rating of perceived exertion to regulate exercise intensity for patients with chronic LBP while they undergo hydrotherapy ⁽¹⁹⁾. The authors found that relative exercise intensity was strongly associated with rating perceived.

The purpose of the study was to compare patient outcomes of two treatment packages: (A) An underwater exercise based program which added to the standard program components of warm water effect., and (B) a standard Land exercise program for chronic low back pain, which emphasized education, postural training and physical reconditioning. Our interest was in whether the aquatic based treatment would improve patient outcome, over that demonstrated by the standard land exercise program using several outcome measures.

MATERIALS AND METHOD

Subjects

Thirty patients from both sexes between 20-45 years old with chronic LBP due to bad posture and lack in activity of daily living were referred to take part of this study; they were recruited from outpatient clinic during the period extending from Oct 2013 up to Dec 2013. Five subjects were excluded because they didn't meet the inclusion criteria. A total of twenty five patients met the inclusion criteria. Their age ranged between 20-45 years from both sexes. They were randomly divided into two

groups: experimental group (A) treated with Aquatic exercises, and experimental group (B) treated with land based exercises. Both groups received treatment three times a week for eight weeks (24 sessions of 1 hour duration). Experimental group (A) consisted of 14 patients (7 males, 7 females). Experimental group (B) consisted of 11 patients (6 males and 5 females). 23 patients completed the study, two patients dropped out for their personal reasons. Patients who did not complete the study were two females from the control group (B); their data were not included in the analysis.

Inclusion criteria: - 20-45 year's old patients from both sexes.

- Patients with classical chronic low back pain result from bad posture, bad habits, and lack in activity of daily living.

Exclusion criteria:- Patients younger or older than the targeted age group.

Patients with history of hypertension, Heart problems, severe airway disease, and exercise induced angina, Incontinence subjects.

Treatment programs: The Experimental group (A) received aquatic and routine exercise (back strengthening and stretching exercises) under water; each session lasted for one hour three times a week for eight weeks, the experimental group (B) received exercises for low back pain; the exercises were carried out in outpatient department, one hour each session, three times a week for eight weeks. They included aerobic conditioning, flexibility exercises for the spine and extremities, postural correction, and strengthening of back and abdominal muscles. Follow-up assessment was done at four weeks and at the end of treatment.

Outcome Measures: The Visual Analog Scale (VAS) was chosen as the primary outcome measure and used to quantify pain intensity. The VAS, shown to be a reliable and valid measure ^(20, 21). It consists of a standard 10-cm line with verbal anchors indicating "none" at one end (0) and "severe" at the other (10). Participants were told to estimate their current level of pain by an appropriate mark on the line, with severe indicating the worse imaginable pain.

All patients were asked to complete the Pain Rating Index (PRI) of short form McGill Pain Questionnaire. The Pain Rating Index (PRI) of short form of McGill Pain Questionnaire was used to measure the sensory and affective components of pain^(22, 23). For each pain quality a value is given that rates the intensity of that specific quality. Pain qualities are categorized into two indexes: a. Sensory Words (S) found in items 1-11b. Affective Words (A) found in items 12-15. The sensory pain rating index score is obtained by adding items 1-11 with the highest possible score being 33. The affective pain rating index score is obtained by adding items 12-15, with the highest possible score being 12. The total score is recorded (PRI) by adding the sensory and affective scores.

Lumbar spine mobility was measured using the modified Schober method⁽²⁴⁾. Measurements were made with the subjects standing and facing away from the examiner.

Functional status was assessed using the Barthel index⁽²⁵⁾. Barthel index was rated by independent therapists, by asking the subject to perform the activity. A total of 10 activities are scored, and the values are then added to give a total score ranging from 0 (totally dependent) to 100 (completely independent). Lower scores indicate greater dependency.

The level of statistical significance was set at $P < 0.05$. All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS Chicago, IL, USA, version 15.0).

RESULTS

The age and the duration of LBP are shown in table 1. A two-tailed t-test for independent group showed no significant difference between the two groups, experimental group (A) and experimental group (B) with respect to age ($t=0.73$), duration of low back pain ($t=0.09$). The most common diagnosis with which patients were referred was degenerative joint disease and disc disease (28% experimental group (A), 0.9% of experimental group (B)). Prolapsed Disc (21% experimental group (A), 36.3% experimental group (B)) The remaining patients were diagnosed as suffering from lumbar canal stenosis (14.2% experimental group (A), 0.9% of experimental group (B)), muscle spasm (28.5% experimental group (A), 27.2% of experimental group (B)) and other mixed

diagnosis (0.71% experimental group (A), 0.18% of experimental group (B)).

Regarding VAS, The participants rated their pain before the treatment at 5.1 cm (median value, range 0–7.2 mm) on the VAS for experimental group (A) and 5.06 (median value, range 0–8.1 mm). After treatment the estimated pain was significantly ($p = 0.001$) reduced to 3.06 mm (range 0–5.2 cm) for experimental group (A), and significantly ($p = 0.001$) reduced to 2.83 (range 0–4.5 cm) for experimental group (B). No significant difference was noted between the two groups ($p = 0.24$).

Table 2.

Regarding McGill Pain Questionnaire (PRI), independent group t-test was used and showed that the difference between groups was not significant ($P = 0.62$).

Additionally, independent t-test was used to compare the 2 groups for the mobility the lumbar spine, it showed significant difference between the two groups ($p = 0.001$).

There was no statistically significant difference in Barthel Index scores between the two treatment groups. However, using the difference in means, it showed that there was difference in means of the experimental group (A) between baseline assessment and at after treatment. However, difference in mean of the experimental group (B) showed that there was slight difference in means between baseline assessment and after treatment.

DISCUSSION

Although the results revealed only one statistically significant difference effect between experimental group (A) and experimental group (B) in the Modified Schober test, moderate improvements were identified in Barthel Index outcome measure. Interestingly, for the majority of outcome measures, the two groups scored better than baseline after treatment.

Our results showed that the water based intervention was found to be more effective in improving lumbar range of motion. Water immersion decreases axial loading of the spine and, through the effects of buoyancy, allows the performance of movements that are normally difficult or impossible

on land⁽²⁶⁾. It has been also suggested that the physical properties of water (buoyancy, reduction of gravitational stress, viscosity and hydrostatic pressure).

The main outcome measurements, VAS for pain assessment, PRI of MPQ, Barthel Index for functional independence showed significant improvement in both experimental group (A) and experimental group (B) with no significant difference between the two groups. Functional recovery and return to work are considered important rehabilitation goals in the treatment of patients with chronic LBP and may be sometimes even more important than pain relief itself. It may be considered that pain relief leads to improved mobility and improved functional performance in most activities of daily living. The lack of difference between the two groups indicates that the improvement observed may be contributed to the therapeutic effects of exercise⁽²⁷⁾.

The MPQ, a valid and reliable measure widely used in physiotherapy and rehabilitation settings for LBP provides a more multidimensional analysis of

pain^(28,29). Both experimental groups A and B showed improvement in score after treatment. The PRI gives a clear indication of the overall pain experience. It may be that the changes observed in the MPQ reflect an overall change in several or all of the dimensions of pain as measured by the MPQ, but may not specifically define the amount of analgesia produced by any one treatment modality. Indeed, De Conno et al (1994), who compared several pain measures to a novel measure of pain reduction over time (pain relief scale), stated that the VAS was more closely related to a pain relief scale than the McGill (PRI) measure⁽³⁰⁾. This may explain the results in the study that there was no significant difference in PRI between the two groups.

CONCLUSIONS

This study showed that both exercise media were relevant in the treatment of chronic low back pain with a significant improvement in aquatic exercise therapy group in spinal mobility and pain. Also, results showed that there was very slight improvement in Barthel index means of scores.

Table 1: Demographic characteristics of the study patients

	Experimental group (A) n= 14	Experimental group (B) n=11
Sex (M/F)	(7/7)	(6/5)
Pain duration (mean ± SD)	7.2 years ± 2	7.5 ± 2.5
Diagnosis (n)		
Degenerative changes	4	1
Prolapsed disc	3	4
Lumber canal stenosis	2	1
Muscle spasm	4	3
Others	1	2

Table 2: Outcome measures by treatment group and time of assessment

	Experimental group (A) Mean (s.d)	Experimental group (B). Mean (s.d)	P value
Before treatment			
VAS	5.11 (1.49)	5.06 (1.51)	0.87
Pain Rating Index	24.17 (6.59)	27.00 (5.78)	0.06
Barthel index	71.14 (10.51)	72.71 (9.02)	0.50
Schober test (mm)	30.63 (5.41)	30.17 (3.89)	0.69
After treatment			
VAS	3.06(0.91)	2.83(0.71)	0.24
Pain Rating Index	24.5 (6.1)	25.2 (5.46)	0.62
Barthel index	79.4(7.7)	78.4(6.8)	0.57
Schober test (mm)	50 (7.1)	44 (6.0)	0.001

Conflicts of Interest: There is no conflict of interest.

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Contribution of Shoulder Joint and Elbow Joint on Grip Strength Measurement in Healthy Adults

Bahuguna Pritika¹, Sharma Satish², Ruchika², Richa³

¹Physiotherapist, ²Lecturer; ITS Paramedical College, Muradnagar, Ghaziabad, ³Physiotherapist, SMC, Indian Airforce, Subroto Park, New Delhi

ABSTRACT

Background: We aim to determine the contribution of shoulder joint and elbow joint on grip strength. There are researches which aimed to find out the effect of positions of shoulder joint in different angles on grip strength. Similarly individual elbow positions were to find out the effect on grip strength. Hence there is no study which aimed to find out the contribution of both joints on grip strength.

Materials and Method: 100 healthy subject were selected for grip strength measurement in different angles of shoulder and elbow joint. All the subjects were seated comfortably and the grip strength measurements were taken at different elbow (0°, 45°, 90°, 135° and 180°), and shoulder joint (0° and 90°) positions.

Results: The result reveals that the highest mean grip strength was recorded when the shoulder was positioned in 180° of flexion with elbow in complete extension (28.88±8.8). The minimum value was recorded at 0° shoulder when elbow was 90° flexed (25.69±9.1). So this proves that both elbow and shoulder joint contributes to the grip strength.

Conclusion: In this study, both elbow joint and shoulder joint positions are having an effect on grip strength measurements in healthy adults.

Keywords: grip strength, dynamometer, positions

INTRODUCTION

Grip strength test is commonly used to evaluate the integrated performances of muscles by determining maximal grip force that can be produced in one muscular contraction. Measurement of grip strength is an important component of hand rehabilitation, because it helps establish a baseline for treatment and it is a measure of the effectiveness of therapy.^{1,7}

Grip strength is an important element of hand function; it has been seen to correlate strongly with overall upper limb ability and can serve as a sound indicator of hand function in some populations.

Corresponding Author: Satish Sharma Lecturer
I.T.S Paramedical College, Muradnagar, Ghaziabad,
Uttar Pradesh E.mai: satish_sharma15@yahoo.com
Phone. No.: 09868365699

Dexterity skills, such as precision and control, are required as basic components of hand function; and they have been seen to have an impact on hand function and the overall functional ability of individuals.^{2,3}

Grip and pinch strength measurements provide an objective index of the functional integrity of the upper extremity^{6,16}. Grip strength correlates closely with whole body protein,^{7,8} body cell mass⁹, anthropometrically measured arm muscle mass, and even with body mass index (BMI)¹⁰, loss of weight or muscle mass invariably results in decreased muscle. Grip strength is affected by the body postures of the upper extremity¹¹.

Therapists have often used the 10% rule as a general guideline to set goals in assessment of hand

grip strength. The rule states that a person's grip strength in the dominant hand is approximately 10% greater than that in the non dominant hand.¹⁵

In an attempt to establish more rigorous grip strength testing procedures, the American society of hand therapists (ASHT) suggested that grip strengths be measured with the client seated in a straight backed chair with feet flat on the floor. The tested extremity should be held adducted against the body in neutral position, the elbow flexed to 90° and the forearm in neutral rotation.^{1,11,17} There are also numerous daily tasks that require gripping in positions other than this standard position. Thus, for clinical and ergonomic reasons, it is necessary to understand how deviations from this standard position affect grip strength

Grip strength is measured using a number a number of different measurement tools, eg the oxford muscle scale, and various instruments such as strain gauges eg MIE digital pinch/grip analyser, mechanical instrument such as the smedley or stoelting dynamometer or hydraulic instruments such as jamar dynamometer¹⁸. A number of devices have been used to measure hand grip strength, including hydraulic dynamometer, pneumatic bulbs, spring gauges and various electronic instruments. Hydraulic dynamometers are used widely and have been shown valid and reliable in healthy subjects. These instruments measure peak force and test protocols have been standardized for the position of the elbow, wrist and shoulder.¹⁹ The standard adjustable handle was set at the second handle position¹²

Various studies have demonstrated that body positioning can affect grip strength performance. Grip strength measurements were found to be significantly lower when subjects were supine compared with grip strength scores recorded with subjects in a standing or seated positions.¹² Some investigators recorded strongest grips were recorded while the shoulder was in 180° flexion and the elbow extended. the weakest grip was found while the shoulder was in 0° and the elbow in 90° of flexion. In addition to the studies two other studies have found grips to be strongest when the elbow was extended. Only one author found that grip strengths measured with the elbow in 90° of elbow flexion were stronger than grip strengths measured with the elbow in extension.²⁰

The main purpose of the current study is to establish the variation in grip strength in different positions of shoulder(0°, 45°, 90°, 135°, 180°) and elbow(90° flexion and 0° extension)

METHOD

Study Design and Patients: A quasi experimental design is used in this study through convenience sampling, 100 healthy subject were selected for grip strength is measure in different angles.

Procedure: 100 Healthy subjects from the student population of ITS Paramedical college were selected. Informed consent was signed.. Standard adjustable hydraulic dynamometer was used and set at 2 handle position. Subjects were seated in backrest chair foot supported in the floor according to ASHT.

All subjects were right hand dominant. Each subject's name, gender, age and BMI were recorded. Height is measured in cms and weight is measured in kgs. BMI is calculated by the formula $wt/(ht)^2$.

There were 10 positions in which dynamometer has to be pressed and grip strength was documented..

PS 1 - 0° shoulder flexion with 0° elbow flexion.

PS 2 - 45° shoulder flexion with 0° elbow flexion.

PS 3- 90° shoulder flexion with 0° elbow flexion.

PS 4- 135° shoulder flexion with 0° elbow flexion.

PS 5-180° shoulder flexion with 0° elbow flexion.

PS 6-0° shoulder flexion with 90° elbow flexion

PS 7-45° shoulder flexion with 90° elbow flexion

PS 8-90° shoulder flexion with 90° elbow flexion.

PS 9-135° shoulder flexion with 90° elbow flexion

PS 10-180° shoulder flexion with 90° elbow flexion.

After the subject was positioned with the dynamometer in the hand examiner instructed the subject to "squeeze as hard as possible" "harder harder, relax". To counterbalance any order effect of the starting position, we randomly assigned each subject to one of the ten measurement sequence. A minimum of 2 minutes rest was allowed between the measurement. 3 trials were

recorded for the calculation purpose.

DATA ANALYSIS

Data was analyzed by using spss 15 software. Descriptive statistics were used to find out the mean and sd of the positions. Followed by post hoc analysis (bonferroni) which analysed the pair wise comparison of different positions.

RESULTS

The demographic data of 100 healthy adults shows Mean age is 21.3 yrs±2.8, mean weight is 57.04kg±9.2, mean height is 163.01cm±2.1 and mean BMI is 21.43±2.1.

The result reveals that the highest mean grip strength was recorded when the shoulder was positioned in 180° of flexion with elbow in complete extension(28.88±8.8). The minimum value was recorded at 0°shoulder when elbow was 90° flexed(25.69±9.1).

A significant difference in mean grip strength in PS1 (27.43±9.9) versus PS6 (25.69±9.1) and PS 5 (28.88±8.8) versus PS 10 (27.99±8.7) in which grip strength was found to be significantly higher when the elbow is held in full extension. However mean grip strength of, PS 4(28.30±9.1) versus PS 9 (27.58±8.4) also shows higher mean grip strength in full elbow extension which is insignificant.

The mean grip strength of PS 2 (26.51±9.2) versus PS 7 (26.72±8.3) and PS 3(27.43±9.3) versus PS 8(27.46±8.5) shows lower mean in elbow extended positions which means shoulder is contributing more in these two positions

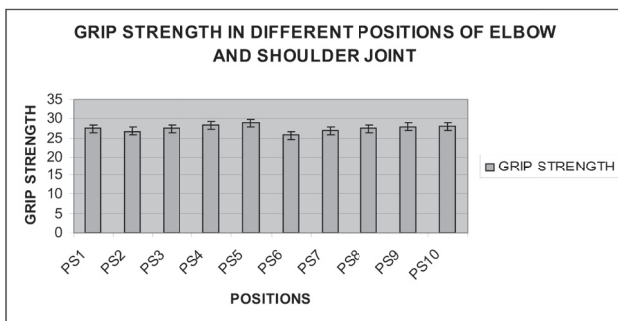


Fig 1: showing mean and standard deviation of all ten position

Table 1: comparing the grip strength in 10 positions

Shoulder flexion	Elbow flexion	p value
0°shoulder	0°	.024*
	90°	
45°shoulder	0°	1.0ns
	90°	
90° shoulder	0°	1.0ns
	90°	
135°shoulder	0°	1.0ns
	90°	
180°shoulder	0°	.045*
	90°	

* -significant, ns-non significant

DISCUSSION

The study investigated the effect of different shoulder positions {0°,45°,90°,135°,180°} and elbow positions{0°,90°} on grip strength on healthy adults. The result reveals that the highest mean grip strength was recorded when the shoulder was positioned in 180° of flexion with elbow in complete extension(28.88±8.8).This finding may be speculated that the synergistic muscles of the back and shoulder may be able to act to their best advantage when shoulder is elevated at 180° flexion during grip. This can be proved by previous study.(su.lin,sang 1994)¹ regarding grip strength in different positions of elbow and shoulder. The overhead position appears to allow those proximal muscles involved to be stretched beyond their normal resting length, which would theoretically increase their efficiency for optimum exertion according to the principle of length tension relations (lehmkuhl and nordin).^{21,22}

In present study minimum value was recorded at 0°shoulder when elbow was 90° flexed(25.69±9.1). This may be speculated that the seated subject had to maintain forearm position against gravity and hence more force generated in order to stabilize the gravity.This is shown in previous study .(Lorie G Richards 1997).¹⁷ Additionally the standardized arm positioning (i.e. 90°elbow flexion) as recommended by ASHT, minimizes the occurrence of unwanted compensation or overflow, thus resulting in the lowest grip strength (Su,Lin,Chan 1994)¹

In present study the different shoulder positions with respect to their 0 and 90 elbow positions was measured. Analysis revealed significant difference

in mean grip strength in PS1 (27.43±9.9) versus PS6 (25.69±9.1) and PS 5 (28.88±8.8) versus PS 10 (27.99±8.7) in which grip strength was found to be significantly higher when the elbow is held in full extension. However mean grip strength of, PS 4(28.30±9.1) versus PS 9 (27.58± 8.4) also shows higher mean grip strength in full elbow extension which is insignificant. It can be due to length tension relationships of the muscle involved. Flexor digitorum superficialis is the only primary flexor that crosses the elbow joint; therefore, elbow position may affect the strength performance of this muscle.as a muscle is placed in a shortened position, it may become incapable of generating the tension necessary to achieve a functional contraction.²⁰

The mean grip strength of PS 2 (26.51±9.2) versus PS 7 (26.72±8.3) and PS 3(27.43±9.3) versus PS 8(27.46±8.5) shows lower mean in elbow extended positions which means shoulder is contributing more in these two positions. It can be due co activation of proximal and distal upper extremity muscles has been shown to occur during gripping. There are two plausible explanations for this co-activation. First, in primates, a single corticomotor neuron cell has been shown to elicit a response from both proximal and distal muscles of limb. Thus the motor command to generate a grip may elicit activity in the proximal shoulder muscles. Secondly ,the multi articular muscles of the arm play a role in transferring forces at elbow and shoulder. For example, generating a grip force activates the extrinsic flexors and extensors of the wrist and fingers which also cross the elbow joint creating forces and moments in three directions. These forces and moments are balanced by the biceps brachii, which also acts at shoulder, thus completing the chain of musculoskeletal forces.. However, the biceps may have a role in this balance during gripping tasks (Joanne rodgen)²³

The study has some limitation that it was done on normal healthy and asymptomatic population only so the results can not be generalized to overall population.

FUTURE RESEARCH

- Compare grip strength measurements in different elbow and shoulder joint positions for different shoulder pathologies.

CONCLUSION

In this study, both elbow joint and shoulder joint positions are having an effect on grip strength measurements in healthy adults

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Effect of Mobile Use on Reaction Time

Nadiger Vidya M,¹ Ravikiran Kisan², Vikas V³, Sindhuja⁴, Deshpande DV⁵

¹Professor, Physiology Department, SSIMS & RC Davangere, ²Associate Professor, Department of Physiology, KodaguKodagu Institute of Medical Sciences, Madikeri, Kodagu district, 571204, ³M.B.B.S Student, ⁴Postgraduate Student, Physiology Department, ⁵Professor and Head, Physiology Department, SSIMS & RC Davangere

ABSTRACT

Aims: To compare auditory and visual reaction time in mobile users and non user.

Settings and Design: Cross sectional observational study.

Method and Material: Thirty subjects (Male:Female 19:11) using mobile and 30 (Male:Female 13:17) subjects who were not using mobile were recruited for the study. The reaction time was recorded for auditory (4 different frequency) stimuli and visual (blue, red, green and yellow) stimuli. As soon as the stimuli was perceived by the subject, he responded by pressing the response switch by the index finger of the dominant hand. The display indicated the response time.

Results: In the present study all visual and most of the auditory stimulus had evoked significantly prolonged reaction time in chronic mobile users when compared to the control group. The reaction time with respect to visual stimulus of red, blue, green and yellow was found to be prolonged in chronic mobile users. Also the reaction time to auditory stimulus of 3 different types of sounds was found to be significantly increased.

Conclusions: The reaction time with respect to the red, blue, green and yellow visual stimulus is found to be prolonged in chronic mobile users. This points out to the fact that such subjects could more vulnerable for accidents as traffic signals also have the same colour lights. Also the reaction time to the auditory stimulus of different horn sounds were shown to be prolonged in chronic mobile users. This points out to the fact that chronic mobile users are more prone to traffic accidents.

Keywords: Mobile, Radiation, Auditory, visual, Reaction time

Key Messages: Chronic mobile use is threat to well being of man and his society. The study, suggest two important implications for use of cellular phones. First, the use of cellular phones in our daily life must be reduced. Secondly, in unavoidable conditions, who regularly spends more than 5 hours on mobile must try to reduce the direct exposure to the mobile by finding an alternate way of communication.

INTRODUCTION

Mobile phones have been in extensive use for a relatively short period of time, and their technology has progressively changed, from analogue to digital

Corresponding Author:

Ravikiran Kisan

Associate Professor, Department of Physiology,
KodaguKodagu Institute of Medical Sciences.

Madikeri. Kodagu district. 571204

Phone Numbers: 9945447207

E-mail : drravikiran@kisan@gmail.com

systems. Over the past decade, the use of mobile phones has increased significantly with about 840.28 million mobile phone subscribers as of 2011.¹ The WHO has classified mobile phone radiation on the IARC scale into Group – 2b - possibly carcinogenic.² Recently, various studies have highlighted the negative effects of cell phone exposure on human health and concerns about possible hazards related to cell phone exposure have been growing.^{3,4} Exposure to such a radiation emitted by mobile phones could affect health directly.^{3,4} Few studies focus on the possibility of a relationship between mobile phone use and its

roll on various factors like the cardiovascular system, sleep and cognitive function, as well as localized and general adverse effects⁴ and mainly reaction time.^{4,5} Pulsed high-frequency electromagnetic field from the mobile phones has shown to affect human sleep and sleep electroencephalogram.⁶ Furthermore, epidemiological studies suggest that drivers on the cell phone are up to four times more likely to be involved in an accident.⁷ Reaction time is one of the important methods used to study a person's central information processing speed and fast coordinated peripheral movement response. Reaction Time is independent of social-cultural influences and can purely indicate the efficiency or dysfunction of biological process in brain. For any response to occur the stimulus initially activates the sense organs and the impulse is then conducted to the brain and from the brain is sent back to execute the movement required to accomplish the task. Slowed performance is usually accompanied by prolonged simple reaction time.^{8,9} The purpose of this study was to compare the reaction time of chronic mobile users and age and gender matched control subjects.

SUBJECTS AND METHOD

The study was approved by institutional human ethical committee. After obtaining informed written consent thirty subjects (Male: Female 19:11) who were using mobile since 2 – 5 years for 4 to 6 hours/day were recruited for the study. Age and gender matched 30 (Male: Female 13:17) subjects who were not using mobile or less than 1 year and less than 1 hour/day were taken as control. All subjects were non-smokers, non-alcoholics with normal vision and hearing. (Table 1)

The auditory reaction time (ART) and visual reaction time (VRT) were conducted reaction time apparatus supplied by Inco instruments. The instrument has two modes of providing stimulus - audio stimulus (continuous sound on speaker of four different frequency sounds) and visual stimulus (shooting blue, red, yellow and green lights). The reaction time was recorded for auditory low to high frequency of 4 different sound stimuli and visual reaction time for blue, red, green and yellow light stimuli. As soon as the stimuli was perceived by the subject, he responded by pressing the response switch by the index finger of the dominant hand.

The display indicated the response time in seconds. They were given 10 trials and after repeated practice, three readings for each parameter were noted. The average of three readings as taken as the value for reaction time task and was noted in the subject's record profile.

RESULTS

The mean reaction time values and standard deviation (SD) were expressed in seconds for different stimuli and subjects were shown in table 2 and table 3.

Table1: Demographic data of subjects

	Control Subjects		Mobile users		P Value
	Mean	SD	Mean	SD	
Age (Years)	20.37	5.25	22.90	5.23	0.07
Height (cms)	170.10	5.36	169.13	5.27	0.48
Weight (kgs)	58.07	9.48	58.60	8.25	0.81

Table 2: Visual reaction time in control subjects and mobile users

VRT	Control Subjects		Mobile users		P Value
	Mean	SD	Mean	SD	
Blue	0.46	0.13	0.92	0.31	<0.001
Yellow	0.52	0.17	0.88	0.31	<0.001
Red	0.53	0.16	0.86	0.28	<0.001
Green	0.53	0.14	0.85	0.31	<0.001

Table 3: Auditory reaction time in control subjects and mobile users

ART	Control Subjects		Mobile users		P Value
	Mean	SD	Mean	SD	
1	0.55	0.17	0.81	0.20	<0.001
2	0.66	0.25	0.93	0.31	<0.001
3	0.74	0.39	0.85	0.32	0.23
4	0.69	0.27	1.02	0.34	<0.001

DISCUSSION

In the present study all the visual and most of the auditory stimulus had evoked significantly higher reaction time in chronic mobile users when compared to the control subjects. The visual reaction time of the mobile users has a highly significant increase when compared to the control subjects. Even the auditory reaction time of all sounds show a significant increase in mobile users when compared to the control subjects.

The WHO has classified mobile phone radiation on the International Agency for Research on Cancer (IARC) scale into Group 2B - possibly carcinogenic. That means that there "could be some risk" of carcinogenicity, so additional research into the long-term, heavy use of mobile phones needs to be conducted.²

Studies have shown that stress proteins which are unrelated to thermal effects, since they occur for both extremely low frequencies (ELF) and radio frequencies (RF), which have very different energy levels.¹⁰ A positron emission tomography study has shown that exposure radiofrequency signal waves within parts of the brain closest to the cell phone antenna resulted in increased levels of glucose metabolism.¹¹

Luria Roy et. al. confirmed that longer (slower) response times to a spatial working memory task when exposed to radiofrequency radiation from a standard GSM cellular phone placed next to the head of male subjects and showed that longer duration of exposure to RFR may increase the effects on performance.¹²

The reaction time with respect to the red, green and yellow visual stimulus is found to be prolonged in chronic mobile users. This points out to the fact that such subjects could easily be involved in accidents as traffic signals also have the same colour lights. Also the reaction time to the auditory stimulus of different horn sounds were seen to be prolonged in chronic mobile users. This points out to the fact that chronic mobile users are more prone to traffic accidents. Hence chronic mobile use is a real threat to the well being of man and society.

The results of the study that has been described, carries two significant implications for use of cellular

phones. First, the use of cellular phones in our daily life must be reduced by a significant level. Secondly, businesses whose employees regularly carry on transactions by spending more than 5 hours on mobile must try to reduce the direct exposure of mobile phones by finding an alternate way of communication.

CONCLUSION

It can be concluded that reaction time is prolonged with chronic mobile use. This results in more probability for such subjects to be easily involved in accidents because the reaction time to the visual stimulus of traffic signals lights and the auditory stimulus of the honking of other vehicles will be prolonged. Hence chronic mobile users need to be more attentive during driving vehicles as they may be more prone to accidents. This may prove to be a real threat to the well being of man and society.

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GBS following Tumour Excision: Physiotherapy Management

Vivek Sharma¹, Harraman Kaur², L K Malhotra³, N Sairam³

¹Consultant Physiotherapist, ²Sr Consultant Physiotherapist, ³Sr Consultant Neurologist, Department of Neurosciences, VIMHANS, Delhi, India

ABSTRACT

This case report discusses the clinical presentation of a 70 year old male developing pure motor paraplegia with bladder and bowel incontinence, following a tumour removal surgery of buccal mucosa carcinoma. The clinical presentation was a less commonly seen variant of GBS and the diagnosis was confirmed on electro-physiology. The case summary highlights the chief findings of neurological examination, investigations, medical and physical therapy management of the patient. The physical therapy assessment and the exercises progressed over the 6-month period are mentioned in detail. Physiotherapy management of GBS during the acute stage focuses on respiratory care, and preventing complications like muscle atrophy, contractures, pressure sores through passive movements, positioning, splinting etc. Later in the recovery phase emphasis is on progressive strengthening of muscles, improving functional outcome and building up patient's endurance. Individual with incomplete recovery may benefit from orthotic support, gait aids and other assistive devices.

Keywords: Guillain Barre Syndrome, GBS, Tumour Excision, Physiotherapy, Post surgery, Paraplegia

INTRODUCTION

Guillain- Barre Syndrome (GBS) is an acute demyelinating polyneuropathy presumably related to immunological mechanisms, involving the spinal roots, peripheral nerves and occasionally the cranial nerves^{1,2}. The usual clinical presentation is symmetrical flaccid paralysis of all four limbs which may begin in the lower limbs and spread to the upper limbs (ascending type). Proximal muscles are involved as much as the distal muscles. Muscles of the neck and trunk may also be affected. There may be involvement of muscles supplied by the cranial nerves as well as autonomic dysfunction^{1,3,4}.

Incidence rate of 1.18-2 per 100,000 populations has been reported worldwide. Men are affected twice as often as women^{5,6}. At present, accurate etiology is not understood and is thought to be triggered by many factors including bacterial or viral infection,

vaccination, drugs, trauma, and surgery etc^{6,7}. GBS after surgical operations and anesthesia has recently been discussed more often^{8,9,10,11,12,13}. Reports are rare and restricted to case presentations. We report a case of GBS following muco-buccal tumor removal surgery.

CASE DESCRIPTION

History: A 70 year old male with acute onset paraplegia was referred to Neuro-Rehabilitation department of our hospital. He belonged to a medium socio-economic status and not working currently and was staying with his son. Neurological examination revealed flaccid paraplegia, with Grade 1/5 strength and normal sensory examination in both lower limbs. Knee and ankle jerks were absent and plantars were mute, bilaterally. Sensory-Motor examination of both upper limbs was normal. He had bladder and bowel incontinence. Higher mental functions & Cranial nerve examination was also normal.

He was a known case of hypertension and type 2 diabetes mellitus and was taking regular medication for the same. There was no other significant medical

Corresponding Author:

Vivek Sharma

M.P.T (Neuro), +91-9212096877,
viveksharma607@gmail.com

and surgical history except that he developed a gradually progressive ulcer proliferative lesion on the left side of buccal mucosa over a period of past 6 months which was diagnosed as squamous cell carcinoma. Patient underwent radical left hemi-mandilectomy and reconstruction surgery for the same. On the 4th postoperative day patient developed weakness of both lower limbs, with urinary retention, following which MRI Brain and whole spine were done, which did not reveal any significant parenchymal involvement except for mild degenerative disc changes in cervical spine. Nerve conduction studies of upper and lower limbs revealed absent F waves in median, ulnar and both common peroneal and posterior tibial nerves. CMAP amplitude was decreased in both posterior tibial and common peroneal nerves along with left ulnar nerve. Sensory nerve conduction studies were normal. These findings were suggestive of severe axonal motor polyradiculoneuropathy- Guillian Barre Syndrome. The patient was then put on intravenous immunoglobulin for a period of 5 days and then referred to our hospital for neuro-rehabilitation.

PHYSIOTHERAPY MANAGEMENT

The patient was admitted for neuro rehabilitation. At the time of admission, patient had grade 1/5 strength in both his lower limb muscles. The passive range of motion was full in hip, knee and ankle joints. The upper limb strength was grade 5/5 in all muscles bilaterally. There were no complaints of pain, paresthesias or numbness. He had intact pin prick, touch and joint position sense in upper limbs, lower limbs and trunk. There was no muscle wasting and fasciculations seen. He had no breathing difficulty. He had poor trunk control in sitting and restricted equilibrium reactions because of trunk and lower limb weakness. Barthel index score was 20/100 (he was independent in feeding, grooming and partially dependent in dressing). The physiotherapy goals set for the patient were to prevent contractures, pressure sores and muscle atrophy; and progressive active exercises while monitoring fatigue and over use. The family member was advised 2 hourly position change between supine and side-lying. In supine lying, the ankles were placed in neutral with the help of foot end board and legs were maintained in semi flexion with the help of 2 pillows under both knees. In side-lying, the hip and knees were kept flexed with

a pillow between the two legs and trunk supported. The family member was also advised to daily inspect the skin for any redness or pressure sore, especially over sacral, heel and knee area. The patient was provided with an air-mattress. He was put on a muscle re-education programme and exercises to improve trunk control in sitting. Muscle re-education programme was carried out once daily by the physiotherapist and included exercises in gravity minimized plane for hip, knee and ankle muscles; and isometric exercises for quadriceps, hamstrings and gluteal muscles. All exercises were performed with tapping on the muscle belly in conjunction with the therapist's assistance. Each exercise was repeated 10 times with breaks in between as per the patient's fatigue. The exercises performed were as follows: in supine lying, hip flexion-extension with knee flexed, hip abduction-adduction with knee flexed, hip rotations, pelvic bridging, supine to side rolling, and in side lying knee flexion and hip flexion-extension in grade 2. Exercise to improve trunk control in high sitting included sitting with both hand support on bed and gradually one hand support, supported trunk forward, backward and sideways bending, reaching activities, ball catch and throw with one hand; gradually progressing to bilateral reach-outs and ball catch-throw activities. Sitting was practised for around 10 minutes during the session and patient was asked to repeat the sitting exercises along with his family member, twice more daily. Tilt table standing was started with gradual progression to upright posture, monitoring any complaints of giddiness, discomfort, sweating; initially for 10 minutes and by the end of 1 week to 90, for half an hour daily. Patient received physiotherapy for 6 days per week during the in-patient stay.

After 1 month of inpatient rehabilitation, patient was discharged on a home exercise programme. At the time of discharge, his lower limb strength improved to grade 2/5 and his Barthel index score was 25/100 owing to some improvement in transfer abilities, although he still required major help. Home exercise programme included active assisted exercises in against gravity plane and resisted exercises in gravity minimized plane along with isometric exercises. Various exercises included hip and knee flexion-extension, hip abduction-adduction in supine and side lying, knee extension in high sitting, isometric

quadriceps, hamstrings and gluteal exercises, pelvic bridging. Patient was asked to hold each contraction for 3-5 seconds and perform 10 repetitions of each exercise, once a day. He was advised to progress each exercise in terms of hold time and assistance provided. Sitting balance training was also continued at home.

Patient came for a follow-up after 3 months. His lower limb strength was grade 3/5 now. He was able to sit on a stool without hand support for few minutes and perform bilateral arm movements without losing balance, and could stand with the help of knee support in the parallel bars. He had developed tightness of bilateral hip adductors, hamstrings and tendo-achilles. His Barthel index score increased to 45/100 because of improvement in toilet use, transfers and mobility. His home exercise programme was reviewed and resisted exercises were started for hip, knee and ankle muscles with ½ kg weight, 5 sec hold, and 10 repetitions each. He was made to assume kneeling position. Standing balance training in parallel bars were started (placing foot on floor- forward and sideways with right and left leg alternately, ball catch and throw with both hands, ball kicking with each leg, mini squats and placing foot on a low step alternately with right and left leg). He was asked to practice these standing exercises 10 times each, atleast twice a day apart from bed-side exercises. The exercises in standing were gradually to be performed with lesser and lesser support. He was advised to continue them as a part of home exercise programme.

Patient again came for a follow up after 6 months. His muscle strength in lower limbs had improved to grade 4/5. He was now able to walk inside his house with one person's support and without the use of knee gaiters. The Barthel's index score had increased to 70/100 with main improvement in transfers, mobility and stairs climbing activities. His home exercise plan was revised and strengthening exercises were performed with 1kg weight cuff resistance. All the exercise was done against the plane of gravity with a 5 second hold and 10 repetitions each. Balance exercise were also made complex (stepping on high step forwards, sideways and backwards, ball kicking forwards and sideways with ach leg, heel and toe standing, marching on spot, single leg standing, full squats). He was asked to continue these exercises as

a part of home plan as he was an out-station patient. He was advised to walk around in house as much as possible. During all time, he was asked to avoid over-exertion and monitor his fatigue. The patient is due for the next follow up.

During the entire rehabilitation programme, patient was put on clean intermittent catheterization (CIC) and his bladder-bowel control is still a challenge. He has been referred to a urologist for further management. He also had regular follow-ups with his oncologist.

DISCUSSION

Physical therapists often manage patients with GBS. In most of the cases it is preceded by an infection, however GBS after surgical operation is rare and only few case reports have been documented. Post operative GBS has been documented in surgeries like spinal fusion for adult scoliosis, lumbar disc surgery, organs and bone marrow transplantation, thalamotomy for tremor, resection of lung cancer and cranial surgery^{8,9,10,11,12,13}. Our patient developed GBS after the surgery for his oral carcinoma.

GBS is a neurological condition resulting primarily in muscle paralysis and the weakness is usually symmetrical and can involve all four limbs; however, there can be variants of GBS^{3,14}. In most patients the paralysis ascends from legs to trunk, arms, and cranial muscles and reaches a peak of severity within 10 days. Occasionally the pharyngeal-cervical-brachial muscles are affected first or constitute the entire illness. A syndrome comprising ophthalmoplegia, ataxia and areflexia also represents a variant of GBS. Paraparetic, ataxic and purely motor or purely sensory forms of the illness have also been observed^{3,6}. Symptoms of autonomic dysfunction include decreased sweating, orthostatic hypotension, constipation, flaccid urinary bladder etc. Portions of the clinical picture frequently appear in isolated form and cause diagnostic confusion. Our patient also had an unusual presentation in the form of paraparesis.

GBS is a clinical diagnosis. The most important laboratory aids are the electro diagnostic studies and CSF examination. Although the clinical presentation of this patient was not typical for GBS and may point towards spinal cord involvement but electrophysiology supported the GBS diagnosis.

Intravenous immunoglobulin and plasma exchange are effective treatment options in GBS^{6,15}. Diligent supportive care is essential to minimize the risk of mortality like monitoring and management for respiratory failure and any airway compromise, autonomic dysfunction etc^{6,16}. There may be recovery without any treatment in few cases. While good functional recovery is observed in 85% of the patients, death is seen in 3-8% of the patients^{3,6,15,21}.

Although most patients with GBS need rehabilitation, there are no long term rehabilitation outcome studies or comparisons of different techniques of rehabilitation. In neuromuscular diseases the therapy should not over fatigue the motor unit as it may impede recovery and cause paradoxical weakening¹⁷. Physiotherapy management during acute stage of GBS focuses on respiratory care, passive movements, positioning, splinting, gentle strengthening exercises and managing other complications associated with prolonged immobilization. Compression garments, gradual position changes and use of tilt table is essential in managing postural hypotension^{5,14}.

Later in the recovery phase we can include strength training, aerobic training and functional activities. During recovery phase despite profound weakness physiotherapy management becomes more vigorous focusing on strengthening exercise that includes isometric, isotonic, isokinetic, manual resistance and progressive resistance exercises, performed with care to avoid over exertion¹⁸. Hydrotherapy has also been found to be beneficial in improving mobility and muscle strength. Functional training activities including bed mobility, mat exercises, pre-gait and gait training should be carried out. Partial body weight support system can also be used during gait training. Gradually balance and gait training should be made more complex. However fatigue remains to be a problem of concern and limits functionality in most of the patients. Severe fatigue persists in 80% of patients and is unrelated to age, duration or severity of initial illness^{19,20}. Individuals with incomplete recovery may benefit with provision of gait aids, wheelchair or orthotic support.

CONCLUSION

GBS is a neurological disorder resulting primarily

in symmetrical muscle paralysis involving all four limbs and occasionally its variants are seen in clinical practice. In majority of the cases GBS has been reported to occur after an antecedent infection and in few cases as an outcome of surgical procedure. Our case report documents GBS development after tumour excision i.e hemi-mandilectomy and reconstruction surgery for oro-mandibular tumour and presented with clinical features of predominant paraplegia with bladder/bowel involvement. The overall prognosis of GBS is good once the acute stage subsides but recovery is prolonged. Physiotherapy management will assist the patient in minimizing disability, improving functional outcomes and quality of life.

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Assessment of Shoulder Posterior Structure Tightness in Badminton and Lawn Tennis Players

Shweta S Devare Phadke¹, Stuti Dixit², Sujata Yardi³

¹Asst.Professor, ²M.P.T, ³Prof.&Director, Dept. of Physiotherapy, Pad Dr. D.Y. Patil University, 6th floor, Pad Dr. D.Y. Patil Medical college Bldg; Sector 5, Nerul , Navi Mumbai

ABSTRACT

Introduction- Shoulder injury is potentially a career ending problem for professional racket sports players. They need to achieve a delicate balance between shoulder mobility and stability to maintain optimal sports performance. Their action creates a large amount of compressive forces on the shoulder. Infraspinatus muscle, most commonly get injured, because it slows down shoulder internal rotation (IR) by eccentric contraction. Injury leads to posterior soft tissue tightness. Glenohumeral rotations are important in maintaining shoulder static and dynamic postures in Badminton and Lawn Tennis players. Hence the **purpose** of this study is to assess for Posterior shoulder soft tissue tightness along with glenohumeral internal rotation deficit (GIRD) and glenohumeral external rotation gain (GERG) in Badminton and Lawn Tennis players. This assessment will help to identify potentials for future injury in the shoulder joint. **Methodology:** 80 Healthy badminton and lawn tennis players above the age of 18 years and playing badminton or lawn tennis as a competitive sport for more than 5 years were selected. All subjects were screened, informed about the study procedure, purpose and consent taken. Data were collected on standardized forms and encoded for computerized analysis using Graph Pad InStat Version 3.10, 32. Within the group paired 't' test was used. **Conclusion** measurable posterior structure tightness in dominant arms of both badminton and tennis players along with associated IR deficit present. Thus shoulder is vulnerable for injury. **Clinical Implication** : Assessment of shoulder should be done on a regular basis on asymptomatic players especially for GIRD, GERG and Posterior Structure tightness in order to avoid any future injuries. Posterior structures stretch (sleepers stretch) shoulder be included in their routine along with rotators strengthening program.

Keywords : Shoulder posterior structure tightness, Badminton players , Tennis players .

INTRODUCTION

Shoulder injury represents a significant clinical challenge for health care professionals, who are responsible for prevention of injury. In Badminton and Tennis strokes especially in the final serving or the follow through phase, the predominant muscle activity is eccentric in nature as the athlete is absorbing the energy and decelerating the racquet and the upper limb. This action creates a large amount of compressive forces on the shoulder, these repetitive forces have speculated to result in secondary changes which may contribute to alteration in shoulder rotation. Increases in posterior soft tissue tightness in shoulder and decrease in shoulder IR have been

clinically linked to several conditions in other sports too (throwing athletes). It has been reported that no side to side difference in posterior or anterior glenohumeral translation in players indicate that tightness of Posterior soft tissue structure other than the capsule may be causing these rotational difference and pathological characteristics. Hence objectives of study were 1. To assess the difference in GIRD, GERG, posterior structures tightness in dominant and non dominant shoulder of Badminton & Lawn tennis players. 2. To compare which sport is more prone to posterior soft tissue structure tightness.

METHODOLOGY

STUDY DESIGN: Cross Sectional

SAMPLE SIZE: Total sample size - 80

- 40 Badminton players,

- 40 Lawn Tennis players

STUDY SUBJECTS: Healthy badminton and lawn tennis players above the age of 18 years, playing badminton and lawn tennis as a competitive sport for at least 5 years .

EXCLUSION CRITERIA: • Recreational players
• Pain or stiffness in shoulder, • Past history of any shoulder injury

• Surgery on shoulder, • Any cervical spine pathology

MATERIALS: • Goniometer • Bubble inclinometer

Procedure

Measuring GIRG and GERG: The measurement was taken by standard Goniometer. The athlete lies supine on a plinth with the knees flexed to 90° to stabilize the trunk. The arm is abducted 90° and the elbow is flexed to 90°. The tester is positioned at the head of the athlete with one hand under the acromioclavicular joint to stabilize the scapular and the opposite hand free to guide the shoulder through testing motions. A towel placed under the humerus to maintain its position in the plane of the body. Athlete actively Perform internal and external rotation(ER) of the humerus until an "endpoint" is felt or seen. The therapist observed for elevation of anterior humerus and lateral movement of scapula as indications of the end point. During passive testing, the scapula stabilized over the anterior humerus and the shoulder gently moved into internal rotation until a firm endpoint is felt or the scapula begins to elevate.

POSTERIOR SOFT TISSUE TIGHTNESS

All the measurements were done by bubble inclinometer. The athlete lies on the plinth in supine position. First, the humerus was grasped distally and moved into crossed chest adduction with neutral rotation until the movement ceases (firm end feel), indicating the end of shoulder tissue flexibility. During the test, the scapula was palpated at the lateral border and stabilized by hand. The test was aborted and restarted if the subject was unable to relax or if the scapula could not be stabilized effectively. The horizontal adduction range of motion is measured by the inclinometer by a tester and recorded by a recorder. The recorder placed the inclinometer parallel to the humerus next to the medial epicondyle. The measured angle indicates the amount of flexibility of posterior shoulder tissue. A greater angle indicates more flexibility of the shoulder tissue. This measurement was taken bilaterally.

The reliability and validity of tightness measurement:

Lin and Yang (2006) have previously described the intra tester and inter tester reliability and validity of measuring posterior and anterior structure tightness. The intra tester and inter tester reliabilities for shoulder tightness measurements are good (intra tester ICC = 0.82 and 0.91; inter tester ICC = 0.82 and 0.89). The validation testing was performed on patients with stiff shoulder. Patients with stiff shoulder showed significant relationships between decreased humeral internal rotation ROM and posterior shoulder tightness ($R^2 = 0.448$), as well as between decreased humeral external rotation ROM and anterior shoulder tightness ($R^2 = 0.499$).

RESULTS

Table 1 : Badminton players show statistically significant range of motion variation in dominant shoulder.

	IR dominant	IR non dominant	GIRD dominant	GIRD non dominant
Mean	73.825	82.325	14.150	7.850
SD	7.848	8.453	7.365	8.298
Significance	p < 0.001 (Extremely Significant)		p < 0.001 (Extremely Significant)	
	ER dominant	ER non dominant	GERG dominant	GERG non dominant
Mean	106.73	97.45	16.725	8.85
SD	5.760	10.614	5.760	8.778
Significance	p < 0.001 (Extremely significant)		p < 0.001 (Extremely significant)	

Post. Structure tightness	Dominant	Non dominant
Mean	12.2	18.525
Standard Deviation	4.746	4.531
Significance	p < 0.001 (Extremely significant)	

Table 2: Tennis players show statistically significant range of motion variation in dominant shoulder.

	IR dominant	IR non dominant	GIRD dominant	GIRD non dominant
Mean	63.725	82.125	19.225	8.000
SD	16.164	8.010	9.242	7.871
Significance	p < 0.001 (Extremely significant)		p < 0.001 (Extremely significant)	
	ER dominant	ER non dominant	GERG dominant	GERG non dominant
Mean	112.55	104.15	20.975	15.150
SD	15.465	10.222	7.624	10.222
Significance	p < 0.001 (Extremely significant)		p =0.0012 (Very significant)	

Post. Structure tightness	Dominant	Non dominant
Mean	22.7	29.550
Standard Deviation	4.778	5.378
significance	p < 0.001 (Extremely significant)	

DISCUSSION

40 badminton players with mean age of 21.175 years and 40 lawn tennis players with mean age of 33.825 participated. Study reveals a measurable IR difference in dominant (D) and non dominant (ND) arms even in asymptomatic badminton players. The D shoulder of throwing and racket-sport athletes consistently demonstrates adaptive glenohumeral internal and external rotation range of motion when compared with the ND limb. Based on a review of the literature, it appears that they demonstrate significantly more glenohumeral ER and significantly less glenohumeral IR in the dominant playing arm. Loss of IR has received the most attention of these two adaptations as it relates to injury in the dominant shoulder¹. Strictly speaking GIRD is the measured difference of IR between D and ND arms. This difference, however, is present to some degree in most athletes and isn't sufficient to mark the clinical importance of the loss in IR seen in the disabled throwing shoulder¹. Burkhart et al. (2003a) when they described the term, dealt with this issue by defining "symptomatic" GIRD as an IR loss of greater than 25° in D vs. ND arms, and was the first definition for clinically significant GIRD¹. In this study we found out that asymptomatic players also had decreased IR and excess of ER on the D arm but the ratio of GIRD: GERG fell into a normal range (0.8) suggesting that

they were not prone to injuries (GIRD: GERG ratio more than or equal to 1 then it indicates that the subject is prone to shoulder injuries). The biomechanics and the kinematics of stroke along with repetitive overload imposed on the rotators could be one of the main reasons for decreased IR and increased ER. In our study Posterior soft tissue tightness was significantly present in D compared to ND arms of players. An increase in posterior shoulder tightness has been attributed to reactive scarring of the posterior capsule in response to movement-induced repetitive micro trauma^{19,1}. Posterior rotator cuff tightness, from either connective tissue contracture or muscle spasm or increased muscle tone, is also thought to be common in the athlete. Uncompensated loss of IR without an accompanying increase in ER is believed to result from contracture and thickening of the posteroinferior portion of the glenohumeral joint capsule due to the repetitive microtrauma imparted during the deceleration.^{1,18,19,20} According to the statistical analysis the result of measurements comparing Dominant (D) vs. Non Dominant (ND) arm for Lawn tennis players showed that there was increase in GIRD in D then in ND arms with a mean difference of 2.403° increase in GERG in D then in ND arm with a mean difference of 5.825°. These values signified that there was measurable difference in IR and a gain in ER range of motion even in asymptomatic lawn tennis players.

In this study we found out that asymptomatic lawn tennis players also had decreased IR and excess of ER on the D arm but the ratio of GIRD: GERG fell into a normal range (0.412) suggesting that they were not prone to injuries. In Lawn tennis players Posterior structure tightness was more on the D arm. Adaptations in glenohumeral rotation have been demonstrated not only in tennis athletes but also in baseball players. These range of motion adaptations result in a decrease in IR of the shoulder as shown in our study. The decrease in shoulder IR observed, particularly on the dominant side, was due to an adaptation of the posterior shoulder musculature and capsular structures to the tennis stroke (Chandler et al.) . Hence we hypothesised that a decrease in IR of the shoulder results in a decrease in the efficiency of force production thereby increasing the chance of injury to the shoulder musculature. This altered and less efficient form not only contributes to shoulder pain.

There is repetitive short duration, high velocity, musculoskeletal demands in tennis and one might expect similar characteristics in other racket sports. Incidence of badminton injuries is low compared to other sports⁷. The risk of exposure to injury in badminton was 2.9/1000 badminton hours⁸. The extent of training time, usually exceeding 20 hrs per week in subjects has to be regarded as being the most important pathogenic factor⁹. The total workload can be estimated by the intensity, frequency & duration of play or practice. In our study the subjects were practicing badminton for 4 hours/day, 6 days/week. The average workload was 8 hours/week & did not exceed 10 hours/week for any player. Hence, in view of the findings, we assume that subjects with this workload of training are not prone to affection of GIRD: GERG ratio into injury range. Posterior structure stretch along with external rotator strengthening should be inculcated in athlete's routine. The sport-specific demands of repetitive strokes may result in an altered mobility-stability relationship in the shoulder. These underlying mobility adaptations include attenuation of the anterior-inferior capsule, leading to increased anterior humeral head translation (e.g., micro instability); loss of scapular upward rotation, leading to diminished acromial elevation and rotator cuff impingement; increased posterior shoulder tightness, leading to posterior-superior humeral head migration

and type II superior labrum anterior to posterior (SLAP) lesions and alterations in rotational range of motion, leading to a variety of pathologic entities.

CONCLUSION

There is measurable posterior structure tightness in dominant arms of both badminton and tennis players along with associated IR deficit.

CLINICAL IMPLICATION

Assessment of shoulder should be done on a regular basis in asymptomatic players also especially for GIRD, GERG and Posterior Structure Tightness in order to avoid any future injuries.

Posterior structures stretch (sleepers stretch) shoulder be included in their routine along with rotators strengthening program.

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Conflict of Interest : We, Phadke S, Dixit S, Yardi S state that there is no conflict of interests with other people or organizations about our work.

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Ethical Clearance : Padmashree Dr. D. Y. Patil University ethic committee clearance taken reference no. PDDYPU/0276/2011/ 8.

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An Assessment of Hand Eye Co –ordination, Hand Grip Strength and Pinch Strength in Dentists

Nalini Y C¹, Veena Umesh B²

¹Assistant Professor, Department of Physiology, BGS Global Institute of Medical Sciences, Bangalore – 560060,

²Associate Professor Department of Physiology, Kempegowda Institute of Medical Sciences, Bangalore - 560070

ABSTRACT

Context: Dentistry is a profession characterized by performing small, co-ordinate movements in a confined area, within the limited space of a small operatory and use of instruments like vibratory tools. It requires manual dexterity, particularly fine motor skills, spatial techniques and hand eye co ordination. It has been documented that despite the ergonomic advances in dental equipment, intense use of dentistry tools and instruments is associated with posture abnormalities, decreased muscle strength and increased risk of developing musculoskeletal disorders. **Aim:** In the present study motor functions of dentists was performed and compared with controls. **Methodology:** All measurements were made by a single observer on 60 subjects. Hand eye co-ordination was measured using nine peg hole test in both hands, hand grip strength by Jamar hand dynamometer and pinch strength of thumb by using pinch gauge.

Results: Unpaired t test was applied to compare the two groups. Our study shows a significant difference ($P < 0.05$) in hand eye co-ordination and grip strength in dentists and no significant difference in pinch strength.

Conclusion: Motor functions of the hand are altered in dentists..

Keywords: Dentists, hand eye co – ordination, hand grip strength, pinch strength.

INTRODUCTION

Dentistry is a profession characterized by performing small, co-ordinate movements in a confined area, within the limited space of a small operatory using vibratory tools and instruments for various investigation and treatment procedures.¹

Dental work requires repetitive motions, as well as sustained postures for performing procedures. Dentists are therefore at risk for cumulative trauma disorders (CTDs) or repetitive strain injury, a condition

associated with repeated or sustained movements of upper limbs and neck in challenging postures for long hours.² CTDs may affect different tissues including muscles, tendons and nerves. CTDs among dentists most commonly affect the upper body causing pain or other symptoms at the neck, shoulders, elbows, forearms, wrists, or hands.^{3,4}

Ideally, the dentist's hands, wrists, and forearms should be positioned in a neutral position during functional activities whenever possible. If the dentist's wrists are routinely positioned in extremes of wrist flexion or extension, the risk for carpal tunnel syndrome is increased.⁴

Quality of dentistry performed depends on the ability of the operator to control the hand held instrument in three dimensional settings. It requires manual dexterity, particularly fine motor skills, spatial techniques and hand eye co ordination.⁴ Muscle

Corresponding Author:

NALINI. Y.C

Lecturer

Department of Physiology,
BGS Global Institute Of Medical Sciences, Bangalore
– 560060, Ph – 080-656550007, Fax – 080-656550007,
Email – drnaliniyc@gmail.com.

fatigue and discomfort are reported to play a relevant initiating role in CTDs.⁵

MATERIAL AND METHOD

30 dentists practicing dentistry for a minimum period of 5 years working at least 15 hours or more in a week were recruited for this study from various dental colleges and private practitioners in Bangalore. Subjects having any musculoskeletal deformity involving upper limbs and any old or acute injury like fracture of upper limb were excluded. 30 age and BMI matched subjects who were not into any upper limb strenuous activity formed the controls. The study was approved by the Institutional Ethics Committee. A written informed consent was taken from all subjects. General physical examination - Height, Weight and BMI were recorded and details regarding work schedule, and symptoms if any were obtained to fulfill the inclusion and exclusion criteria. The dominant hand in study population and control population was right hand, so all the tests were carried in right hand followed by left hand including 2 left hand dominant subjects. The following tests were conducted.

Hand eye co- ordination: The 9 Hole Peg Test is a simple, timed test of fine hand eye motor coordination.⁶ Reliability and validity have been assessed and norms are available. The test involves the subject placing 9 dowels in 9 holes. The pegboard should be placed in front of the subject, with the container holding the pegs on the side of the right hand. The Nine Hole Peg Test is conducted with the right hand first and later repeated with left hand.

One practice trial (per arm) was provided prior to timing the test. Timing was performed with a stopwatch and recorded in seconds. The stop watch was started when the subject, touched the first peg. The stop watch was stopped when the subject, places the last peg in the container. Subjects were scored based on the amount of time it takes to place and remove all 9 pegs.

Hand grip strength: The purpose of this test is to measure the maximum isometric strength of the hand and forearm muscles. The standard, adjustable-handle Jamar dynamometer was used to measure grip strength. For standardization, it was set at the second handle position for all subjects. The dynamometer was lightly held around the readout dial by the

examiner to prevent inadvertent dropping.⁷

For each of the tests of hand strength, the subjects were seated on a chair with a straight back, without armrest with the feet flat on the floor with their shoulder adducted and neutrally rotated, elbow flexed at 90°, forearm in neutral position and wrist between 0° and 30° dorsiflexion and between 0° and 15° ulnar deviation.^{8,9}

The subject was asked to squeeze the dynamometer with maximum isometric effort, and maintain it for 3 seconds. No other body movement was allowed. Three attempts for each subject were conducted, alternating right and left hands with one-minute rest between two attempts to overcome the fatigue. All the subjects were evaluated in same position and under the same protocol. The dynamometer was reset to zero prior to each reading of grip strength, and it was read to the nearest increment of two.

Mean of the three trials was considered for analysis. The results were compared between right and left hand.

PINCH STRENGTH

Pinch strength was assessed using Pinch gauge.¹⁰ Thumb pulp was placed over the lateral aspect of proximal interphalangeal joint of the index finger, other fingers flexed; and the gauge was placed with dial facing up.¹¹

The subjects were instructed to place the lateral side of their index finger of right hand on the underside of the gauge and their thumb pulp on top and squeeze maximally 3 times and the mean of the three readings was obtained. The same was repeated with the left hand.

Calibration of both the instruments was tested periodically during the study.

Statistical analysis: Unpaired t test was applied to compare the two groups. SPSS; version 13 was used for analysis.

Findings : Our study comprised of 15 males and 15 females in control group and 13 males and 17 females in dentists, giving a total sample size of 60. There was no difference in baseline parameters like height (cm), weight (kg) and BMI between the control and the dentist group. ($P > 0.05$) (Table 1)

Table 1: Comparison of height, weight, BMI between Dentists and controls

Parameter	Group	Mean	P-Value
Height (cm)	Control	164.47±9.42	0.920
	Dentist	164.73±10.93	
Weight (Kg)	Control	64.80±9.23	0.556
	Dentist	63.23±11.17	
BMI (kg/m ²)	Control	24.41±4.25	0.308
	Dentist	23.35±3.71	

Data expressed in mean ±SD

There was a statistical difference in hand & eye co-ordination of both hands between the two groups as dentists group took a longer time to complete the task. (P<0.001) (Table2)

The mean handgrip of right hand was found to be higher in control group compared to dentist group and the difference between them was found to be statistically significant (P<0.001) while no difference was observed in the left hand. (P<0.656) (Table 2) There was no statistically significant difference (p>0.05) in pinch strength of both hands between control group and dentists, though the value was lower in the dentists. (Table 2)

Table 2: Comparison of Hand-eye Co-ordination, Hand Grip and Pinch strength between Dentists and controls

Hand	Group	Hand-Eye Co-ordination (Seconds)	Hand grip (p/f)	Pinch Strength (p/f)
Right	Control	21.91±2.72	56.40±18.12	11.17±2.78
	Dentist	19.43±2.08**	26.33±8.83**	10.97±3.50
Left	Control	23.88±2.67	53.87±18.92	10.73±2.68
	Dentist	21.51±1.82**	51.37±24.08††	10.27±3.43

Data expressed in mean ±SD. The *represents comparison with control group. The † represents comparison between right and left hand of the dentist group. *P<0.01, ** P<0.001, † †P<0.001

Table 3: Gender difference in hand-eye Co-ordination, Hand Grip and pinch strength

Parameter	Hand	Control male	Control female	Dentist male	Dentist female
Hand-Eye Co-ordination (Seconds)	Right	23.00±2.80	20.82±2.22*	20.07±1.61	18.94±2.31
	Left	24.90±2.98	22.85±1.91*	22.17±2.01	21.00±1.54
Hand Grip (p/f)	Right	64.27±20.73	48.53±10.85*	32.85±8.89	21.35±4.60*
	Left	64.07±19.99	43.67±10.93*	68.92±25.19	37.94±11.54*
Pinch strength	Right	12.66 ±2.74	9.66±1.91*	13±3.41	9.41±2.73*
	Left	12±2.61	9.46±2.13*	11.84±4.16	9.05±2.19*

Data expressed in mean ±SD. The * represents comparison between males and females in control and dentists group. *P<0.01

Gender differences exist in hand eye co-ordination, hand grip strength and pinch strength between the right and left hands in general population. Hand eye co-ordination in control male and female is within the normative range in both hands. There is no gender difference in hand eye co-ordination of the right hand in dentists while in left there is a statistically significant difference between males and females similar to the general population.

There is statistically significant difference in hand grip strength and pinch strength between males and females in dentist group similar to general population.

DISCUSSION

This study comprised of 15 males and 15 females in control population and 13 males and 17 females in dentists, giving a total sample size of 60. Physical parameters like height (cm), weight (kg) and BMI between the control and the dentist group were similar. (Table 1)

The hand eye co-ordination test can independently assess component tasks such as the time it takes to grasp, move, position, and reach while transferring small pegs from a large target to a small target.

It is reported that on an average, healthy male adults complete the NHPT in 19.0 ± 3.2 seconds with the right hand and in 20.6 ± 3.9 seconds with the left hand. For healthy female adults, the NHPT was completed in 17.9 ± 2.8 seconds and 19.6 ± 3.4 seconds with the right and left hand respectively.⁶

The hand & eye co-ordination of both hands was found to be higher in control group compared to dentist group and the difference between them was found to be statistically significant. The finding is consistent with one of the requirements of a dentist. Surgery and dentistry are two professions that are generally assumed to require a high degree of manual dexterity or psychomotor skill.¹²(Table 2)

The gender difference what is observed in the general population does not exist in the dentists group (Table 3). The Crawford Small Parts Dexterity Test was administered to seventy-one freshman dental students at Fairleigh Dickinson University in New Jersey. This test previously had been used to evaluate potential applicants who wanted to work in engraving, etching, or watch assembly. This study showed that students improved on this test over four years when tested at the beginning and end of dental school, suggesting that dental instruction improved on skills involving perception and dexterity.¹³ Probably due to years of practice, the hand-eye co-ordination are improved over time and the difference between male and female also is obscured.

A study done by Ingrid et al. on dominant hand of dentists, dental hygienist, dental assistants concludes that dentists' assistants have better manual dexterity than controls, and our results are similar to this.¹⁴

Comparison of Hand Grip: The mean handgrip strength of right hand was found to be higher in control group compared to dentist group and the difference between them was found to be statistically significant. Mean hand grip strength between right and left hand in controls was not statistically significant. In contrast the hand grip strength was lower in right hand when compared to left hand in dentists and the difference was statistically significant. (Table 2)

This could be because dentists mostly use high speed and low speed hand pieces and it has been noted that in workers exposed to vibrations like

dentists, people working in mining, forestry often complain of decreased muscular force¹⁵ and it seems that this is a constant phenomenon, present not only during work but also at rest.

The impaired muscle function in the full hand grip, which also engages the local muscles of the hand, may be based on an injury to muscle tissue, nerve tissue, or a combination of both induced by vibration. Experimental studies have shown that vibration may damage nerve fibers and infraneural micro vessels as well as muscle fibers.¹⁵

Another study done by Akesson³ on female dental personnel states that dentists were more affected than dental hygienists, primarily due to grip force, increased exposure time, and use of high and low-speed hand pieces that run at frequency levels most likely to cause impairments.

Vibration-induced muscle injury also has been documented on laboratory rats. Following several days of vibration exposure at a frequency of 80 Hz, muscle fiber degradation and changes were noted in plantar muscle sections. Animal experiments also demonstrated that the directly exposed muscles were more affected than the proximal muscles.¹⁶

COMPARISON OF PINCH STRENGTH

In our study we found that mean pinch strength was lower in dentists in right and left hand when compared to control population but their difference was not statistically significant (Table 2). Pinch strength is statistically different in males and females in control group and the same is observed in the dentists group. (Table 3)

Roquelaure and colleagues demonstrated an increased risk of developing CTS due to repetitive tasks (cycle time less than 10 seconds) involving a pinch force more than 10 N.¹⁷

A study done by H. Dong et al. compared thumb pinch force between six dentists and six senior-year dental students and found that dental students applied greater mean peak pinch force compared to dentists, this is because increased experience in periodontal scaling leads to the application of less pinch force to accomplish scaling.¹⁸

CONCLUSION

Dentists are prone to develop work related muscular skeletal disorder due to repetitive motion of hand, awkward posture and use of vibratory tools, resulting in altered hand function. Contrary

to popular belief that musculo skeletal disorders is of higher prevalence among older dentists, it is also observed commonly among younger dentists as they use excessive force while using instruments when compared to older and experienced dentists and also adopt awkward postures. In dental curriculum adequate emphasis should be given about adoption of correct postures and adequate period of rest in between procedures. Yearly examination of sensory and motors functions of hand in dentists will help in early diagnosis of RSI, and prevention of complications thereby help in retaining full functional capability of hand irrespective of years of practice in dentistry.

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Conflict of Interest – None to be declared

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Bachelor of Physiotherapy Students -Use of Online Technology as Part of their Learning Practices: a Case Study

Sumit Kalra¹, Nidhi Kalra¹

¹Asst. Prof; Banarsidas Chandiwala Institute of Physiotherapy, Maa Anadmai Marg, Kalkaji, New Delhi 110019.

ABSTRACT

Objective: Aim of this study is to identify areas of need within clinical education, to explore what all tools students are familiar with and whether those tools have the potential to meet the identified needs of clinical education and are the students using those tools as part of their learning practices. The results of this study will be used to help in deciding future clinical education and research practices in physiotherapy.

Design: Cross sectional, descriptive design.

Method: This study was conducted in Physiotherapy Institute, offering Bachelor of Physiotherapy, in the year 2012-13 among all undergraduate physiotherapy students (N=189). Data was collected by means of survey questionnaire with closed and open ended questions.

Result & Conclusion: Ninety five percent (95%) had internet access at home, 82% reported using the internet during the learning process but 80% of the students think that lectures are still a better way of studying and face to face contact with teacher is important. Almost everybody felt that if lectures were integrated with technology they become more informative and interesting.

Keywords: *Physiotherapy, digital technology, medical education*

INTRODUCTION

Clinical education and the supervisory process it involves an important and distinct part of health care education. ⁽¹⁾ As medical educators we often deliver complex material in a format that does not allow the positive learning engagement recommended by cognitive researchers and theorists, as we never have had much exposure to pedagogical theory or training. ⁽²⁾ Like in physiotherapy profession that emphasizes on evidence based practice it is vital that we not lose focus on the non technical skills that are required for effective clinical practice (Higgs et al 2004)

The rapid development of digital technologies and their use in education enable individuals to interact within the educational domain in new ecologies of learning. Specifically social networking adaptive technologies like blogs, wikis etc involve students in situations that require them to employ a growing

assortment of cognitive skills in order to perform and solve problems in these digital environments, these skills can be referred to as digital illiteracies. ⁽⁴⁾

Theory suggests that clinical educator and students should engage in an intentional, structural process of changing roles during the course of clinical education experience and that non technical competencies such as communication, collaboration and reflection are crucial for effective practice and may be developed in the clinical education setting. Developing a clearer understanding of the current status of physiotherapy education can assist educators in the use of available tools or in developing a new model that addresses demands of new generation of physiotherapists who require more than a solid foundation of clinical skills. ⁽⁵⁾

Therefore the aim/ purpose of this study is to identify areas of need within clinical education, to

explore what all tools students are familiar with and whether those tools have the potential to meet the identified needs of clinical education and are the students using those tools as part of their learning practices. The results of this study will be used to help in deciding future clinical education and research practices in physiotherapy.

METHODOLOGY

Research Setting & Sample

This study was conducted in Physiotherapy Institute, offering Bachelor of Physiotherapy in the year 2012-13 among all undergraduate physiotherapy students.

Study Design: Cross sectional, descriptive design.

Data collected by means of survey questionnaire with closed and open ended questions.²

Procedure: The survey was administered to all registered students. The researcher was present during the surveys in order to address any questions that might arise. Data were captured using double entry to ensure consistency and accuracy, and was analyzed descriptively. Responses to open-ended questions were analyzed thematically by the first and second authors, until consensus was reached.

Ethical Considerations: The project was approved by the Institutes Ethical Committee and the permission to conduct the survey was obtained from the Director of the Institute. Participation in the survey was voluntary with written informed consent from the students and they could withdraw at any time with no negative consequences. Anonymity of participants was insured by not gathering personally identifiable information and all data was kept confidential and secure.

Source of Funding : Nil

RESULTS: One hundred and fifty questionnaires were distributed among all undergraduate students in the department. The sample included all students who completed and submitted the questionnaire (N=140), indicating a response rate of 93%. Male: female ratio is 1:6.

Access to computers and the internet

Ninety five percent (95%) had internet access at

home and the other respondents reported accessing the internet from internet cafes, friends' homes, family members' homes and parents' workplaces. All students had access to the internet on campus. Of the students who connected to the internet from home, 52% used broadband, 37% used a 3G modem, and 19% used a dialup modem. Forty Eight percent (48%) students reported using a desktop computer to access the internet, 47% used a laptop, and 60% used phones.

Use of collaborative online tools and services

Out of 140, 89 respondents (82%) who reported using the internet during the learning process, 75% reported that they used it mainly to retrieve information. 93% reported belonging to a social network, with 7% checking it hourly, and 30% checking it at least once a day. Fewer than half of the students who reported belonging to a social network (49%) used it as part of their studying. The students who did use their social networks as part of their studies used it for either administrative tasks (e.g. confirming test dates), getting information (e.g. content for assignments), asking for help and to a limited extent, discussion.

Students who did not use social networks as part of their learning used reasoning that fell into two main categories: it was distracting; it was for socializing and not studying.

72% students used Wikipedia to read some information. 50% of the students use the internet mainly to consume content. However, almost half of them also create content by sharing photos with each other. Only 30 % students had the idea about Blogging/ podcast.

80% of the students think that lectures are still a better way of studying and face to face contact with teacher is important. One of the main areas in which they wanted to see further use of online tools was for additional means of communicating with lecturers. Students requested greater use of email, cellphones, social networks and blogs.

DISCUSSION

This study clearly indicates that now students are using technology quite often though most of the participants are using it for social networking and

less for learning processes. Their responses highlight a poor understanding of several other online tools like blogs, podcasts etc which are helpful in the development of collaborative and reflective skills. The online activity that respondents were most familiar with included reading Wikipedia and sharing social messages. This suggests that these participants used the internet mainly for consumption of content, rather than collaboration and discussion.

If educators wish to make use of ICTs to develop non-technical skills like reflection and reasoning, they will have to encourage activities that incorporate discussion, collaborative work and reflective engagement.

Students expressed preferences for visual engagement as part of their study but they didn't seem to realize that social networks could facilitate these aspects of their learning practice. Instead, they used the internet and their social networks to gather and share administrative information and to consume content.

While most of these participants valued lectures as useful ways of learning they also wanted to add online learning activities and additional channels of communication to the curriculum.

Together with the fact that 60 % of respondents reported using their mobile devices to access the internet, this would seem to indicate that this group of students are prepared for synchronous learning when off campus. This is a positive result, especially in light of the fact that other students have also reported valuing communication as a an important component of learning in clinical contexts, similar results were as a study done by Ernsten & Bitzer, 2009.

ICTs have been shown to encourage the development of collaborative, reflective and reasoning skills that may help students move away from memorizing content. If assessment does indeed drive learning then educators must ensure that their use of ICTs fosters the development of the non-technical skills that are relevant for clinical practice, rather than merely challenges students to find content.

Some of the findings challenge conventional wisdom about the possibilities and uses of ICTs. For example, although we know that ICTs offer

unprecedented opportunities for additional and different kinds of communication, there is very little evidence of such use for teaching and learning purposes. This is despite the fact that learning itself requires dialogue, engagement and communication; and despite the fact that ICTs are used extensively for communicative purposes outside the educational context. ⁽⁶⁾

The growth of these technologies has led to the emergence in the educational technology field of the concept of mobile learning.

This learning model, that supports wireless communication, offers a number of undeniable advantages for overcoming the above-described limitations of using desktop machines. These advantages include the following:

- Lower cost. (Savill-Smith & Kent, 2003).⁷
- Portability. (Roschelle, Pea, Hoadley, Gordon, & Means, 2001).⁸
- Face-to-face interaction (Cortez, Nussbaum, Rodríguez, López, & Rosas, 2005).⁹
- Efficient organization of the learning resources used in a given activity is facilitated (Zurita & Nussbaum, 2004b).¹⁰

These aspects of the mobile model lay the groundwork for a pedagogical proposition that uses technology to support teaching processes based on collaborative dynamics.

The researchers also reported higher learning outcomes for students involved in collaborative placements as opposed to traditional placements. ⁽⁵⁾

LIMITATION

The fact that 85% of participants in this case study were females indicates that there might be gender bias present in the results. The survey may have yielded better results if the questions were more precise and open ended.

Acknowledgement: all the participants of the study and director of the institute from where the subjects were taken

Conflict of Interest - nil

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A Study to Measure the Endurance Capacity of Transversus Abdominis in Normal Individuals

Sheshna Rathod¹, Hemal Paneri¹, Disha Solanki²

¹Tutor cum Physiotherapist, Government Physiotherapy College, Jamnagar. ²Physiotherapist, Guru Govind singh Government Hospital, Jamnagar

ABSTRACT

Background: Core muscles of lumbar region are responsible for lumbar spine stability. Low endurance capacity of abdominal muscles is a risk factor for low back pain. **Objectives:** To find out the endurance capacity of transversus abdominis in normal individuals. **Methodology:** 70 subjects were taken. Transversus abdominis isolation test was performed by positioning subject in prone lying with the arm at the side. Drawing in manoeuvre was taught to them. Pressure Biofeedback was placed under the abdomen and below the navel. Pressure Biofeedback cuff was inflated up to 70mmhg. Subjects were then asked to do drawing-in manoeuvre till there was decrease of 10mmhg and asked to maintain this pressure for 10 seconds. Each subject performed the repetitions as per their capability. 10 repetitions consisted 1 set and such 3 sets were taken. The averages of 3 sets were taken for analysis. **Results:** The present study shows that endurance capacity of Transversus Abdominis in normal individuals is with mean 4.78 and SD 1.44. **Conclusion:** Endurance capacity of Transversus abdominis muscle in normal individuals is less.

Keywords: *Transversus abdominis (TrA), Endurance, Core stability, Low back pain, Pressure Biofeedback Unit (PBU).*

INTRODUCTION

From a functional anatomy perspective, trunk muscles can be classified as either global or local muscles.¹ The global muscles, such as the Rectus Abdominis (RA) and External Obliques (EO), produce torque and transfer the load directly between the thoracic cage and the pelvis. The local muscles, such as the Transversus Abdominis (TrA) and Lumbar Multifidus are associated with the segmental stability of the lumbar spine during whole-body movements and postural adjustments.^{2,3} So, the functions of local muscles are necessary to enhance segmental stability of the spine.⁴⁻⁵ Trunk muscles acts as prime movers

during dynamic activity and are important stabilizers of the spine.⁶ Without the dynamic stabilizing activity from the trunk muscles, the spine would collapse in the upright position.⁷ Both superficial (global) and deep (core) muscles function to maintain the upright posture. The global muscles are unable to stabilize individual spinal segments except through compressive loading. The core muscles respond regardless of direction of motion. They provide dynamic support to individual segments in the spine and help to maintain each segment in a stable position so that the inert tissues are not stressed at the limits of motion.⁸

Transversus abdominis and multifidus are the deep muscles which have segmental attachments in the lumbar spine and are therefore able to provide segmental control. Studies have shown that the deep fibers of the multifidi and Transversus abdominis are the first muscles to become active when there is postural disturbance from rapid extremity movements.⁹ The Transversus abdominis (TrA) is the deepest of the abdominal muscles and responds

Corresponding Author: - Dr. Sheshna Rathod,
Tutor cum Physiotherapist, Government
Physiotherapy College, Jamnagar. Address: C-4,
Block no. 37, Nursing Quarters, Beside Government
Physiotherapy College, Rameshwernagar, Jamnagar.
E-mail ID: sheshnarathod@yahoo.com,
Mobile no. – 9327383558.

uniquely to postural perturbations. It attaches posteriorly to the lumbar vertebrae via the posterior and middle layers of the thoracolumbar fascia and through its action develops tension that acts like a girdle of support around the abdomen and lumbar vertebrae. The Transversus abdominis also has a coordinated link with the perineum and pelvic floor muscle function. The “drawing-in” manoeuvre is used to activate the Transversus abdominis voluntarily and with training, produces the most independent activity of this muscle.¹⁰ It has been shown that activation and function in the Transversus abdominis changes (delayed and more phasic) in patients with low back pain, possibly indicating less effective stabilizing action.¹¹ Studies have also documented that training this muscle for postural control and stability improves the long term outcome.¹²

Strength is critical for controlling large loads or responding to large and unpredictable loads; but only about 10% of maximum contraction is needed to provide stability in usual situations. Slightly more strength might be needed in a segment damaged by disk disease or ligamentous laxity when muscles are called on to compensate for the deficit in the passive support.¹³

Greater percentages of type I fibers than type II fibers are found in all back muscles, which reflects their postural and stabilization function. Inactivity has been shown to change muscle fiber composition and may be one reason for decreased function in patients with low back pain.¹⁴ In a study that looked at 17 mechanical factors and the occurrence of low back pain in 600 subjects (ages 20 through 65), poor muscular endurance in the back extensors muscles had the greatest association with low back pain.¹⁵

Endurance in muscles is necessary to maintain postural control. Sustained postures require continual, small, adaptations in the stabilizing muscles to support the trunk against fluctuating forces. Large repetitive motions also require muscles to respond so as to control the activity. In either case, as the muscles fatigue, the mechanics of performance change and the load is shifted to the inert tissue supporting the spine at the end ranges. With poor muscular support and sustained load on the inert supporting tissues, creep and distension occur, causing mechanical stress. In addition, injuries occur more frequently after a lot of

repetitive activity or long periods of work and play when there is muscle fatigue.¹⁶

Some authorities suggest that muscle is a potential source of low back pain¹⁷. They argue that failure of muscles to protect passive structures from excessive loading may result in damage to these pain sensitive structures and produce pain.¹⁸ Enhancing muscle endurance, therefore, may help to reduce low back pain. Poor endurance of the trunk muscles may induce strain on the passive structures of the lumbar spine, leading eventually to low back pain. Fatigue after repetitive loading also leads to a loss of control and precision, which may predispose an individual to developing low back pain. Therefore, trunk muscle endurance training has been recommended to elevate fatigue threshold and improve performance, thus reducing disability.¹⁹

Trunk stability is believed to play an important role for lumbar spine injury prevention and rehabilitation. An especially important function of muscles is their contribution to trunk stability and it is thought that the co activation of several trunk muscles is needed to achieve a degree of spinal stability beneficial for both the prevention and the treatment of low back injury.

Some researchers have postulated that endurance may be more important than “instantaneous muscle strength” in prevention of back pain. The frequency of low back pain has been shown to be greater in groups with high fatigability of the trunk extensors and flexors. These muscles must have the ability to sustain an isometric contraction to support the trunk in any given position.²⁰

There is growing evidence suggesting that the structure and function of the deep trunk muscles are altered in persons with Low Back Pain.²¹ Contraction of the Transversus Abdominis and Multifidus, which normally occurs in an anticipatory manner to limb movement, has been observed to be delayed and attenuated in those with Low Back Pain. Stabilization exercise programs seek to improve the strength, endurance, and/or motor control of the abdominal and lumbar trunk musculature, often emphasizing the Transversus Abdominis and Multifidus muscles.²²

The Pressure Biofeedback Unit (PBU) is often used by clinicians and researchers to indirectly evaluate

Transversus Abdominis (TrA) muscle activity. The reproducibility of PBU in measuring Transversus Abdominis muscle activity in patients with chronic nonspecific low back pain ranged from satisfactory to excellent with chronic nonspecific low back pain.²³ In order to effectively assess the participant's Transversus Abdominis endurance effectively, a test was designed to target the Transversus Abdominis called the abdominal draw-in test. A pressure biofeedback unit was employed to measure the contraction of the Transversus Abdominis over a period of time with the subject aiming to keep the Transversus Abdominis activated in order to keep the pressure reading of the PBU within the required range.²⁴

Hypothesis

Hypothesis: Endurance capacity of Transversus Abdominis is decreased in normal individuals

Null hypothesis: There is no change in endurance capacity of Transversus Abdominis in normal individuals

Materials and Methodology

Study Design: - An observational study

Sampling: - Random sampling.

Sample Size: - 70 subjects.

Inclusion Criteria:

- Normal healthy subjects
- Subjects with age group between 20-30 years.
- Only females were included

Exclusion Criteria

- Subjects with acute or chronic low back pain
- Contraindications for abdominal muscle strengthening such as pregnancy, osteoporosis, spinal tumors etc.
- History of lumbar / abdominal surgery or trauma
- Subjects who had any known neuromuscular disorders.
- Males were excluded from this study to minimise variation morphological differences.
- Any deformities in spine.
- Subjects with any cardiovascular or respiratory disorders.

- Subjects with Body Mass Index > 30 kg/m²

MATERIALS

- Pressure Biofeedback
- Couch
- Piece of paper
- Stop watch

PROCEDURE

70 subjects according to inclusion criteria were taken. With the subject in prone, the Pressure biofeedback unit was placed horizontally under the abdomen (centered under the navel). Inflate the cuff upto 70 mmHg and ask the subject to perform a drawing-in maneuver. Ask the subject to assume a neutral spinal position and attempt to maintain it while gently drawing in and hollowing the abdominal muscles. Instruct the subject to breathe in, breath out, and then gently draw the belly button in toward the spine to hollow out the abdominal region. Substitute patterns such as movement of the pelvis, flaring or depression of the lower ribs, lifting of the rib cage, bulging out of the abdominal wall and increased pressure through the feet should be avoided. A decrease of 6 to 10 mmHg during the drawing in maneuver indicates proper activation of the deep abdominal muscles. The manometer was placed on the side of the subject such that they can constantly watch the pressure changes. The subject was asked to perform maneuver till there was decrease of 10mmhg pressure in manometer and maintain it for 10 seconds. Each subject performed the repetitions as per their capability. 10 repetitions consisted 1 set and such 3 sets were taken. The averages of 3 sets were taken for analysis.

RESULTS

TABLE 1:- This table shows endurance capacity of Transversus Abdominis in normal Individuals.

	Mean	SD
Endurance capacity of Transversus Abdominis	4.78	1.44

Here, mean is 4.78 and SD is 1.44.

DISCUSSION

The present study shows that endurance capacity

of Transversus Abdominis in normal individuals is with mean 4.78 and SD 1.44. This suggests that endurance capacity of Transversus Abdominis is less in normal individuals.

It is known that trunk muscle weakness as a risk factor for low back pain.²⁵ Core stabilisers are frequently associated with the development of Low Back Pain, due to impairments in muscle strength and motor control, which are required to maintain normal posture and stability during periods of activity²⁶. It has been shown that there is a link between motor control deficits in muscles of the local stabilizing system, particularly the transverses abdominis and lumbar multifidus and the development of low back pain. These muscles appear to lose their normal anticipatory function in some subjects, exhibiting delays in activation, and thus a loss of their normal pre-programmed function for support²⁶. It was consequently assumed that the TrA, by means of its connection to the lumbar fascia, is dominant in controlling spinal stability²⁷. Therefore any weakness or lack of control of this muscle would lead to back pain. There is a relationship between poor coordination of paraspinal muscles and Low Back Pain²⁸. These changes are suggested to be due to disuse and pain as well as reflex inhibition of the core muscles. Forces that challenge the spine are of interest because a decrease in spinal stability is hypothesised to place stress and excessive load on the spinal joints and tissues, which eventually results in Low Back Pain²⁹. Thus assessment and measurement of the impairment associated with muscular problems linked with Low Back Pain must take priority²⁴. The Transversus Abdominis muscle is recognised in the literature as playing a vital and protective role in maintaining a healthy core and aiding lumbar biomechanics in the dampening of external forces applied to the lumbar spine. Strength, co-ordination and timing of transversus abdominis muscle contraction may be important in stabilizing the low back, and contraction of this particular muscle may be one factor capable of preventing and reducing low back pain in sport and in activities of daily living³⁰. Research has shown the occurrence and recurrence of Low Back Pain to be associated with the dysfunction of the deep abdominal muscle, transversus abdominis. The role of the TrA has been demonstrated to be of great importance in

continuous spinal stabilisation during movement. Evidences suggest that the oblique abdominals and transverses abdominis may not always be optimally recruited or may fatigue in their stabilising role even in normal, currently asymptomatic individuals. Thus loss of active stabilisation capacity of these muscles may be one of the possible processes involved in the development of back pain³¹.

Clinical Implication:- Early strengthening of core muscles helps to prevent low back pain

Conclusion:- The endurance capacity of Transversus abdominis in normal individuals is less.

Limitations:-

- Small sample size
- Limited age group
- Male subjects were not included

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Conflict of Interest: There is no Conflict of Interest.

Source of Funding: There was no funding taken for this study from any agency or institution.

Ethical Clearance: The study was been approved by relevant ethical committee.

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A Study to Compare the Physiological Cost Index of Wheelchair Propulsion at two different Elbow Positions in Healthy Individuals

Priyank Galchar¹, Neela Soni², Yagna Shukla² Anjali Bhise³,

¹M.PT-Rehabilitation, ²Sr.Lecturer, ³Principal, Govt.Physiotherapy College, Ahmedabad

ABSTRACT

Background: Wheelchair propulsion with optimal physical performance and at lowest energy cost is one of the important aspects which need to be considered during wheelchair skill training. Difference in wheelchair-seat configuration will affect ergonomic requirement of wheel chair locomotion which will in turn affect load imposed on cardio respiratory system. So purpose of this study was to compare energy expenditure of wheel chair propulsion at two different elbow positions.

Materials and Methods: A 5 minute wheelchair propulsion test was conducted among 50 healthy male individuals at 60 and 100 degrees of elbow flexion adjusted by changing wheelchair seat configuration. Physiological cost index and rate of perceived exertion (RPE) of wheelchair propulsion was measured for both positions and compared for statistical difference.

Results: Mean Physiological cost indexes of wheel chair locomotion at 60 and 100 degrees of elbow flexion were 0.9 and 0.12 respectively with significantly lower physiological cost index ($p < 0.01$) at 100 degrees of elbow flexion. The distance covered during elbow position of 100 degree flexion was significantly higher ($p < 0.05$) than that with 60 degree flexion. The rate of perceived exertion (RPE) was not significantly different for both positions. ($p > 0.05$)

Conclusion: Wheelchair seat configuration with 100 degrees of elbow flexion is optimal for physical performance and is energy efficient compared to that of 60 degrees of elbow flexion.

Keywords: *Physiological cost index, wheelchair propulsion, elbow position*

INTRODUCTION

Upper limb pain and dysfunction are common among people who use manual wheelchairs for mobility. For example, surveys involving as many as 450 wheelchair-based individuals find that as many as 73 percent report some degree of chronic upper-limb pain, which they attribute primarily to wheelchair propulsion and transfers.^{1,2}

Repetitive mechanical loading of shoulder during manual wheelchair propulsion has been significantly affect health and active community participation. Conventional hand rim wheelchair do not meet essential ergonomic requirement in terms of seat comfort and locomotion. They impose relatively high loads on the cardio respiratory system and remarkably inefficient in terms of energy cost of

locomotion.³

A major problem in wheelchair locomotion is that optimum physical performance at lowest energy cost can only be attained when the wheel chair-seat configuration and propulsion mechanism comply in an optimum manner to the functional characteristics of the user.¹

A reasonable expectation for both the potential user and prescriber is the selection of wheelchair that allows maximum performance and mobility for user. Similarly, it would seem to be in the interest of providers, vendor and manufacture to deliver a wheelchair compatible with maximum performance and mobility. While it is difficult to obtain hard information on the efficacy of wheelchair prescription, anecdotal evidence seems indicate that it is less than

optimal and quite variable, particularly in the case of the first prescription for a prospective user.⁴

Due to a growing interest in wheelchair sports, the development of sports wheelchair lead to task specific devices based on contemporary knowledge of product design and vehicle mechanics. Although in wheelchair to the physical characteristics of the user has been recognized as a prerequisite for success.⁵

Efforts are reduce to mechanical demand on the upper extremity of manual wheelchair users. For example, materials and construction can significantly reduce the mass of system (>35% reduction between standard and ultra light chairs), thereby reducing the magnitude of tangential component of the reaction force needed to propel the chair.⁵

Energy is defined as the "capacity of physical system to perform work". Energy exists in several forms such as a heat, kinetic or mechanical energy, light, potential energy, electrical or other forms. The SI unit of the joule (J) or Newton-meter(Nm).⁶

Energy expenditure is an important parameter in the assessment of orthotic treatment or during wheelchair prescription in paraplegics. Estimation of energy cost of ambulation provides functional efficiency of the user, locomotors efficiency of the wheelchair and potential benefits of the propulsion system.⁶

In able body subjects, heart rate and oxygen uptake have linear relation up to submaximal workloads. This has enabled the clinician and the researchers to monitoring the heart rate alone. Heart rate shows linear relation to oxygen uptake.⁶

Both speed and heart rate have been used as a indicator of efficiency and energy cost of locomotion but their combined use was first reported by Mac Gregor in 1979, who highlighted the problems of factor other than work load which may cause heart rate variability. He introduced a new method of finding the energy expenditure and it was termed as physiological cost index (PCI).⁶

$PCI (\text{beats/meter})^6 = \frac{\text{Steady propulsion heart rate} - \text{Resting heart rate (beats per minute)}}{\text{propulsion speed (meter/minute)}}$

The purpose of this study was to compare energy expenditure of wheel chair propulsion at two different

100 and 90 degree elbow flexion positions.

METHODOLOGY

An Observational study was performed on convenient sample of 50 subjects at Govt. Physiotherapy College, Civil hospital, Ahmedabad. The subjects were selected by simple random sampling.

Inclusion criteria were

- (1) Patients who are willing to participate in the study
- (2) Age: 20-30 years.
- (3) Only male subjects were selected.
- (4) Subjects who were already trained for wheelchair propulsion for at least 3 days.

Subjects excluded were

- (1) Any musculoskeletal abnormality preventing appropriate seating or propulsion of wheel chair.

PROCEDURE

A written consent form was taken from participants who fulfilled the inclusion and exclusion criteria. A procedure was explained to them.

A standard wheelchair was used on which subject was seated with elbow remain in 60 degree of flexion when the wrist at top dead centre of hand rim and for 100 degree of elbow flexion seat height is increased by using cushion of 4 inches. Subjects were given 5 minutes time at the starting line to sit quietly in order to attain a steady resting heart rate which was measured by Pulse ox meter. Subjects were instructed to propel wheelchair at their normal speed on a standard levelled corridor (which had a walkway of 30 meters) for a minimum duration of 5 minutes to attain a steady physiological heart rate.

At the end of 5 minutes, they were instructed to stop and immediately heart rate was measured by using Pulse ox meter. The Distance covered by subject was measured by calculating the number of rounds covered by subjects multiplied by 30 meters (walk way distance) and the extra distance was measured using an inch tape. Wheel chair propulsion energy expenditure using PCI was calculated. Borg scale for Rate of perceived exertion was taken at end of test for both elbow positions.

DATA ANALYSIS

Mean of the PCI, Total distance covered and RPE at 60 and 100 degree elbow flexion position was taken and then standard deviation was calculated. Paired T-test was applied for comparison of PCI, Total distance covered and RPE at both angles.

RESULTS

Total 50 subjects were randomly selected. Paired T-test was applied for comparison of PCI, Total distance covered and RPE at both angles. For PCI P value is < 0.0001, for Total distance covered P value is <0.0001. So both are highly significant. For RPE P value is more than 0.05. So it is not considered significant.

Table 1: Mean PCI at 60 and 100 Degree Elbow flexion.

Elbow flexion Angle	MEAN ± SD	P
At 100 degree flexion	0.6 ± 0.12	< 0 .0001
At 60 degree flexion	0.83 ± 0.15	

Table 2: Mean of the Total distance covered at 60 and 100 degree elbow flexion.

Elbow flexion Angle	MEAN ± SD	P
At 100 degree flexion	350.4 ± 39.18	< 0 .0001
At 60 degree flexion	309.5 ± 30.05	

Table 3: Mean of RPE at 60 and 100 degree elbow flexion.

Elbow flexion Angle	MEAN ± SD	P
At 100 degree flexion	9.8 ± 0.12	>0.05
At 60 degree flexion	10 ± 0.15	

DISCUSSION

The results of present study showed that the energy expenditure is less and Distance covered at the end of 5 minutes is more at 100 degree elbow flexion position compare to 60 degree elbow flexion position. RPE (Borg scale) is same for both elbow flexion position. RPE (Borg scale) is not significant may be due to shorter period of wheel chair propulsion. This study consisted of only male patients to avoid any

gender influences in energy expenditure.

The study was done by Masse et al collected kinematic and electromyographic activity from five men with paraplegia in six different seat position in wheelchair he found that the lower seat positions were most efficient in that they corresponded with lower EMG activity and pushing frequency as well as smoother upper limb motion⁷.

Another study was done by Van Der et al (1985) he studied the effect of seat height on energy consumption and kinematics in nine wheelchair subjects. He concluded that elbow angle 60-80 degree is most appropriate for wheel chair propulsion⁴.

Similar study was done by Brubaker et al (1986) in which they report elbow angle 100-120 degree is most appropriate for wheel chair propulsion. This study shows that oxygen cost and ventilation is also less at 100-120 degree elbow flexion. Also indicated that push angle and push time is highest at 100-120 degree elbow flexion with result in reduction of stroke frequency with constant.⁵

Increased cardiorespiratory response originates from an increased trunk flexion during the push phase increases the reach of the arms with respect to the rims. Moreover, the weight of the trunk may assist in generating torque in the propulsion. These aspects lead to increased muscle activity of the trunk muscles, and thus enhance energy cost.⁵

Also higher seat position leads to decreased level of abduction, flexion and extension of the upper arm, which in turn may affect the effectiveness of the pectoralis major and deltoidus anterior as a prime mover of the upper arm in the sagittal plane.⁵

CONCLUSION

The Results of Present study concluded that Energy Expenditure is less and Distance covered is more at 100 degree elbow flexion position compare to 60 degree elbow flexion.

CLINICAL IMPLICATION

Present study implies that seat height should be given due consideration during wheelchair prescription as it may affect wheelchair performance during wheelchair training program.

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Conflicts of Interest: There were no personal conflicts of interest.

Ethical Clearance: Ethical clearance was taken from Institutional committee.

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To Study the Influence of Total Body Workout in women with abdominal obesity

¹P Ramya Krishna, ²K Madhavi

¹MPT Department of Physiotherapy, ²Professor and Principal Incharge, Department of Physiotherapy, Sri Venkateswara Institute of Medical Sciences (SVIMS), Tirupati, Andhra Pradesh

ABSTRACT

AIM: To study the influence of total body workout in women with abdominal obesity.

NEED OF STUDY: Obesity is an important public health problem worldwide. Its prevalence is increasing with changes in dietary habits and activity level. Those who are overweight are at higher risk for a variety of disabling and life threatening chronic conditions and premature mortality. Obesity is categorized morphologically as total body obesity and abdominal obesity. The individuals with abdominal obesity are prone for several cardio metabolic risk factors and exaggeration of insulin resistance. General obesity is usually treated with lifestyle and dietary modification and increasing the intensity of physical activity. Some studies reveal that level of obesity is not the important; it is the level of physical activity of an individual decides the morbidity and mortality rates. An overview of literature has concentrated on weight reduction methods (medical and surgical) for general body obesity. A very few studies are done on regulation of abdominal obesity and specific protocols were not designed to treat abdominal obesity. Hence, it is required to find out the influence of total body workout and specific abdominal exercise in women with abdominal obesity.

OBJECTIVES OF THE STUDY

- ✓ To study the effect of total body workout on physical factors in women with abdominal obesity by evaluating body mass index, waist circumference.
- ✓ To study the effect of total body workout on physiological factors in women with abdominal obesity like visceral fat %, body fat% through body mass analyser.
- ✓ To study the effect of total body workout on functional factors in women with abdominal obesity like vo_{2peak} through bicycle ergometer.

SETTING: Department of physiotherapy, SVIMS, tirupati, Andhra Pradesh.

SUBJECTS: 30 subjects who met inclusive criteria were selected by random sampling method and divided into experimental and control group. (15 in each group)

METHOD: A total of 30 abdominally obese women participated in this study. They were randomly divided into two groups: experimental group (group1) a 12 weeks aerobic exercise programme 45 minutes/day, 6 days/week under supervision were done and in control group (group2) the above exercises were taught and advised to do in home. The subject's Body Mass Index, Waist Circumference, Visceral Fat %, Body Fat% and Vo_{2peak} were assessed before and after the completion of aerobic exercise programme.

RESULTS: According to the data analysis, a significant difference was found between the pre and post

test values of Body Mass Index, Waist Circumference, Visceral Fat %, Body Fat% and VO_2 peak in both experimental and control groups ($p < 0.05$), but comparatively more significant changes was found in the experimental than the control group ($p < 0.05$).

CONCLUSION: Total body workout had significant influence in women with abdominal obesity. There was a significant change in physical factors like body mass index, waist circumference, physiological factors like visceral fat %, body fat % and functional factors like vo_2 peak. Hence, it is concluded that 12weeks total body workout is effective in women with abdominal obesity.

Keywords: Obesity, abdominal obesity, body mass index, waist circumference, visceral fat%, body fat%, vo_2 peak, aerobic exercise.

INTRODUCTION

Obesity is the major health hazard in the recent years. It is an epidemic of 21st century. Its prevalence is increasing in both developed and developing nations.

Obesity is defined as an excess body fat and results from an interaction between genes and the environment. ⁽¹⁾ Obesity can be classified as *Gynoid* obesity, *Android* obesity and total body obesity.

Gynoid obesity is lower body obesity i.e., excess fat deposition in hips and buttocks It is mostly seen in women and castrated men. It is also named as 'pear shaped' type of obesity. Android obesity refers to excess fat deposition in abdominal region. It is otherwise called as 'abdominal obesity', 'central obesity', 'apple shaped' obesity. It is seen in both men and women. It is emerging as an important driving force behind the deterioration of cardiovascular and metabolic risk in general population.

Sedentary lifestyles and energy rich foods are the major causes of obesity. Abdominal obesity is considered as an independent predictor of several risk factors like cardiovascular disease, hyperinsulinemia, dyslipidemia etc., increasing the mortality and morbidity rates².

Those who are overweight are at higher risk for a variety of disabling and life threatening chronic conditions and premature mortality. Obesity results not only in medical consequences but it has a strong enworse relationship with social position. Obesity is handled with lifestyle modification, weight reduction protocols apart from surgical treatment (liposuction and bariatric surgeries).Asian Indians

are a high risk population with respect to diabetes and cardiovascular disease, and the numbers are consistently on the rise.

The prevalence of metabolic syndrome in Asian Indians varies according to the region, the extent of urbanisation, lifestyle patterns and socioeconomic cultural factors. Recent data show that 1/3rd of urban population in India's major cities have metabolic syndrome.⁽⁷⁾

The above factors reveals the relation between the abdominal obesity and elevated cardio metabolic risk and helps to identify the population most at risk with the presence of intra abdominal adiposity and to consider the implications for interventions to improve cardiovascular outcomes in these populations.

Therefore, the purpose of this study is to know the effects of 12weeks aerobic exercise programme on waist circumference, body mass index, visceral fat %, body fat% and VO_2 peak in women with abdominal obesity.

MATERIALS AND METHODOLOGY

Place of study is College of physiotherapy, SVIMS, Tirupati, Andhra Pradesh, India. Study design is an Experimental study – prospective randomised clinical trial. Subjects were randomly divided into two groups (experimental and control groups) and all the participants were provided with informed consent. Sample size is 30 subjects (15 in each group). Inclusive criteria is age : 25 – 45 years, females gender, Waist circumference >80cm, Married post partum women. Subjects with Cardiac diseases, Respiratory problems, Musculoskeletal and Neurological disorders, Pregnant women are excluded.

Interventions: (12 weeks aerobic exercise programme for 45minutes/day, 6days/week).

EXPERIMENTAL GROUP: Subjects were commenced with warm-ups for 10 minutes which includes stretching's, followed by aerobics for 25 minutes which includes free exercises, abdominal exercises and step aerobics. Exercise session ends with cool down period for 10 minutes which includes stretching's. **CONTROL GROUP:** Subjects under control group were given home advice of aerobics exercise programme as prescribed for experimental group.

Outcome measures:

Outcome measures are:

waist circumference,

body mass index,

visceral fat%,

body fat%,

vo₂peak.

Materials used are 1) Inch tape to measure waist circumference(cm), 2) Body mass analyser - OMRON KARADA SCAN to measure body mass index, visceral fat% and body fat%, 3) OMRON BP apparatus to measure blood pressure(mmHg) and heart rate, 4) Cycle ergometer to measure vo₂peak through astrand nomogram, 5) Stop watch to monitor the protocols.

STATISTICAL ANALYSIS

The entire analysis has been carried out using IBM SPSS Inc. 20. Version. The main objective of the work is to observe the statistical significance in the variables BMI, WC, VF, BF and VO₂PEAK. The data is collected on two time periods i.e., Pre and Post. Here, each variable is measured on these two time periods. Since, all the variables in the study are quantitative; the suitable statistical technique is to analyze and meet the objective is the Paired Samples t-test. To test the significance between the control and experiment with respect to different variables, the Independent samples t-test has been performed.

RESULTS

According to the data analysis, a significant

difference was found between the pre and post test values of all five body parameters in both experimental and control groups ($p < 0.05$), but comparatively more significant changes was found in the experimental than the control group ($p < 0.05$).

DISCUSSION

Sedentary lifestyle is threatening the health of every individual in every moment of life that encourages or increases the risk of obesity, muscle weakness, postural deficiencies, diabetes, hypertension and coronary artery disease. Abdominal obesity is considered as an independent predictor of several such risk factors and morbidity.

Intra abdominal adiposity occurs through altered secretion of adipocyte-derived biologically active substances (adipokines), including free fatty acids, adiponectin, interleukin-6, tumour necrosis factor alpha, and plasminogen activator inhibitor-1, and through exacerbation of insulin resistance and associated cardio metabolic risk factors. A large amount of visceral fat becomes easily inflamed, leading to a chronic low-level inflammatory state which increases your risk even further.

Regular physical activity is associated with a reduction in visceral fat, even if there is little or no change in weight. If you are losing fat, especially visceral fat, you are probably gaining lean body mass. The result can be that your weight stays the same, even though your waist circumference decreases. Obviously, if you are losing weight as well as reducing your waist circumference, you are losing even more visceral fat.

The present study investigated the effects of 12 weeks total body work out on Waist circumference, body mass index, visceral fat%, body fat% and Vo₂max in women with abdominal obesity. The exercise programme resulted a decrease in the subject's WC, BMI, VF%, BF% and VO₂PEAK.

According to the data analysis, a significant difference was found between the pre and post test values of WC, BMI, VF%, BF% and VO₂PEAK in both experimental and control groups ($p < 0.05$), but comparatively more significant changes was found in the experimental than the control group ($p < 0.05$).

Babalola, J.F. reported that 8weeks aerobic

exercise programme shows no significant difference in body fat% between both groups during the pre and post test ($p>0.05$) and concluded that a long duration of exercise programme and calorie intake must be taken into consideration.⁽³⁷⁾

Irwin, et.al. reported that an increase in the duration (mins/week) of physical activity was significantly associated with a reduction in the subjects' total fat.⁽⁴⁶⁾

According to the results of independent t-test, the important finding of this study was that 5 independent measures (WC, BMI, VF%, BF%, VO_2 PEAK) demonstrated a strong response to the effects of 12weeks total body workout in women with abdominal obesity.

CONCLUSION

Total body workout had significant influence in women with abdominal obesity. There was a significant change in physical factors like body mass index, waist circumference, physiological factors like visceral fat %, body fat % and functional factors like vo_2 peak. Hence, it is concluded that 12weeks total body workout is effective in women with abdominal obesity.

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Ethical Clearance: Approval granted by ethical committee of college of physiotherapy, SVIMS.

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Conflict of Interest

Obesity is the major health hazard in the recent years. specially abdominal obesity is a leading cause for morbidity and mortality. Changes in life style (Sedentary lifestyles, energy rich foods, physical inactivity, transport facilities) is the main causative factor for developing obesity. My conflict of interest is

to regulate the abdominal obesity by specific aerobic protocols and to provide awareness about the role of exercises than other treatment options (medication/ liposuction) in reducing weight which will reduces cardiovascular and metabolic risks.

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Physiotherapy Treatment in Plantar Fasciitis: a Case Report

Punia Sonu¹, Aman²

¹Teaching Associate ; ²Student, Department of Physiotherapy Guru Jambheshwar University of Science and Technology
Hisar (Haryana)

ABSTRACT

Objective: To determine the effectiveness of physiotherapy treatment in patients with plantar fasciitis.

Materials and Method: A rehabilitation protocol was followed to treat diagnosed planter fasciitis patients.

Result: In this study, patients was able to do activities of daily living without pain, after receiving physiotherapy management.

Conclusion: This study concluded that this rehabilitation protocol have a significant effect in reducing pain in planter fasciitis.

Keywords: *Planter fasciitis, Physiotherapy.*

INTRODUCTION

The plantar fascia is a thick, fibrous, relatively inelastic sheet of connective tissue originating from the medial heel, where it then passes over the superficial musculature of the foot and inserts onto the base of each toe.¹ The function of the plantar fascia is twofold : statically, it stabilizes the medial longitudinal arch; dynamically, it restores the arch and aids in reconfiguring the foot for efficient toe-off.¹ It enables propulsion through space, adaptation to uneven terrain, absorption of shock, and support of body weight. ⁴Plantar fasciitis is an inflammation of the plantar fascia, near the fascia's calcaneal attachment. The Chief initial complaint is typically a sharp pain in the inner aspect of the heel and arch of the foot with the first few steps in the morning or after long periods of non-weight bearing. ¹ on examination, the patient usually has tenderness around the medial calcaneal tuberosity at the plantar aponeurosis.⁵

Kwong et al classified it as a syndrome caused by repeated trauma to the plantar fascia at its origin on the medial tubercle of the calcaneus. Historically, the literature attributes plantar fasciitis to faulty

biomechanics such as excessive pronation. Cornwall stated that difficulties result when the joints of the foot are continually functioning beyond a normal end range. Researchers have also reported faulty biomechanics and plantar fasciitis in subjects with a higher-arched foot. A review of the literature reveals that a person displaying either a lower- or higher-arched foot can experience plantar fasciitis.⁴ the disorder appears in sedentary populations with seven percent of adults aged 65 years or older found to have plantar heel pain. It also makes up one quarter of all foot injuries in runners and up to 8% of all injuries to people participating in sporting activities.¹⁰

Plantar fasciitis is one of the most common causes of heel pain, accounting for almost 15% of all foot related complaints (Lutter, 1997), affecting the middle aged (40-50). More women than men are affected by this condition, with about 65% reported to be overweight.³ In the non-athletic population, it is most frequently seen in the weight bearing occupations, especially factory workers, store men and nurses. Lutter (1997) reports that 65% of the non-sports demographic are overweight, with unilateral

involvement most common in 70% of the cases. Most of the literature is in agreement that plantar fasciitis occurs most commonly after the fifth decade, and has been attributed to atrophy of the fat pad (Sherreff, 1987).⁹

Chandler and Kibler reported a 10% occurrence rate in runners.⁴ Plantar fasciitis represents the fourth most common injury to the lower limb and represents 8 -10% of all presenting injuries to sports clinics (Ambrosius 1992, Nike 1989).⁷ Plantar fasciitis commonly causes inferior heel pain and occurs in up to 10 percent of the U.S. population. Plantar fasciitis accounts for more than 600,000 outpatient visits annually in the United States has been reported to affect between 10% and 20% of injured athletes.⁸ It is highly prevalent with one recent United States study estimating that one million patient visits each year at office-based physicians and hospital outpatient departments are for the diagnosis and treatment of plantar heel pain.¹⁰ Although 5–10% of patients progress to surgery, the majority of cases ostensibly resolve within 6–18 months of therapy, leading some authors to suggest that plantar fasciitis represents a self-limiting condition. While conservative therapy appears to be mainstay of treatment, there is controversy regarding the most efficacious programme.⁸

Risk factors of plantar fasciitis include structural abnormalities, overweight, age-related degenerative changes, occupations those falling into this category include teachers, construction workers, cooks, nurses, military personnel, and athletes training for long distance running events. or activities that require prolonged standing and/or ambulation, and training errors.

Literature indicates that plantar fasciitis be successfully treated using a conservative approach like using therapeutic modalities used to alleviate symptoms may include ice, deep friction massage, ultrasound etc. Achilles tendon stretching exercises, sole modification and NSAIDs may be helpful. In recalcitrant cases of plantar fasciitis, however, surgical treatment may be necessary to return the patient to normal activities of daily living.¹ In a narrative review of randomized controlled trials, Stuber concluded that the use of joint mobilizations and manipulation, stretching of the plantar fascia and Achilles tendon,

orthotics and night splints were recommended over other forms of conservative treatment.⁶ In general, plantar fasciitis is a self-limited condition. However, symptoms usually resolve more quickly when the interval between the onset of symptoms and the onset of treatment is shorter.

ETIOPATHOGENESIS

Plantar fasciitis has been linked to excessive stress placed on the tissue as a result of athletic activity, muscle weakness or tightness, improper shoes, increase in body weight, aging, inadequate footwear and occupation.³ Plantar fasciitis is usually not the result of a single event but more commonly the result of a history of repetitive micro trauma combined with a biomechanical deficiency of the foot. Finally, degenerative changes that come with age, such as atrophy of the heel fat pad, may also increase ones risk.²

Mechanism for development of plantar fasciitis: Most likely this number is in the thousands. With each step, the load of the body weight to be applied to the arch causing the arch to drop. This drop in the arch makes the ball of the foot and heel to spread further apart. The fascia in the foot goes into tension to resist this force. If this tension in the fascia is greater than the fascia can handle, the fascia is damaged and the area will become inflamed. The load applied to the foot is divided into two types: **Intrinsic load** stems from the muscles contracting to move the foot. Much of the intrinsic load applied to the fascia results from the calf muscles. The plantar fascia is part of a larger structure termed the **CT band** (CT is an acronym for Calf to Toes). The main components of the CT band are the calf, Achilles tendon and plantar fascia. All these components are linked so that tension on any part of the CT band increase tension in the entire system. Of the 3 components of the CT band, the plantar fascia is the weakest link. **Extrinsic load** refers to all the other loading factors in the plantar fascia other than the intrinsic load. Some of these factors are body weight, frequency of steps, and duration of standing.

DIAGNOSIS

Pain associated with plantar fasciitis may be throbbing, searing, or piercing, especially with the first few steps in the morning or after periods of inactivity. The patient will report pain, severe on first weight

bearing in the morning or on rising after a prolonged period of rest (e.g. after a long car journey).¹² Pain will usually be localized over a small area near the origin of the fascia at the proximal insertion into the medial tubercle of the calcaneus. Pain with passive dorsiflexion of the hallux, thereby loading the plantar fascia. Because of the intimate anatomical relationship between the plantar fascia and the triceps surae, dorsiflexion of the ankle joint will also commonly elicit pain.⁹

Some of the more serious systemic diseases and tumours can present as simple overuse injuries such as plantar fasciitis. The practitioner must therefore always take the most complete history and listen to the patient for the clues that may indicate a more sinister diagnosis. The following are some of the diagnoses that may result in heel pain^{5, 9}

PRINCIPLES OF MANAGEMENT

In general, plantar fasciitis is a self-limiting condition. Symptoms usually resolve more quickly when the time between the onset of symptoms and the beginning of treatment is as short as possible. For a successful management, it is important to correct the problems that place individuals at risk for plantar fasciitis, such as increased amount of weight bearing activity, increased intensity of activity, walking on hard surfaces and wearing incorrect shoes. Early recognition and treatment usually lead to a shorter course of treatment as well as increased probability of success with conservative treatment measures.

PHYSIOTHERAPY TREATMENT

The following protocol was followed.⁹

Rest: Rest is the first treatment for plantar fasciitis. Ask patient to keep weight off foot and weight shifting during standing until the inflammation goes away. Swimming is the best alternative activity.¹

Activity Modification: Decrease distance and duration of walking or particularly running, switching from jumping or running activity to activities such as swimming or cycling to reduce the stress on foot, changing the exercise surface (e.g. from concrete to grass).^{1,9}

Shoes modification: Shoes should have an arch support and cushioned heels. Worn shoes

may aggravate plantar fasciitis because of lack of cushioning. However, too much arch support can cause the fascia to stretch a longer distance. This causes it to pull harder at its attachment to the heel, causing pain over the short-term and a repetitive injury over the long-term. Arch support that is too high and close to the heel can pull the fascia directly from the heel.

If the heel is sensitive to the touch or if the fat pad under the heel is thin from age, disease, excessive use on hard surfaces, or too much weight, a soft heel pad can be used to protect the heel. Heel cushions are usually just placed in the back of the shoe, but not placing them under the shoe insert or orthotic will reduce the effect of the arch support, if there is arch support.^{1,5} A viscoelastic heel cup or a small cushioned doughnut can be placed over the medial calcaneal tubercle to reduce ground reactive forces acting on the proximal aspect of the plantar fascia.¹ Sole Modification a sponge rubber cushion with its center removed may be placed under the heel, or a hole may be drilled into sole of shoe at the site of inflammation and covered with sponge rubber.

Ice: Ice is applied in the treatment of plantar fasciitis by ice massage, or by an ice pack.^{2, 6} Ice packs are usually used for 15 to 20 minutes. Icing is usually done after completing exercise, stretching, strengthening and after a day's work.

Contrast Bath: Also play important role in reduction of swelling and inflammation by vasoconstriction and vasodilatation effects. 3:1 is used for in it with starting from hot water and also end with hot water, given for 15 min.

Stretching : As soon as swelling and pain begin to subside it is important to start a proper stretching program. The stretching should be gentle and prolonged, using a slow, static stretch. Each stretch should be performed three times a day holding each stretch for 15-20 sec. and repeating five times each session.^{11,9,14}

1. Calf Stretch in sitting and standing position for 15-30 seconds and Repeat 7-10 times.

2. Plantar fascia stretch:

Ask patient to roll bare injured foot back and forth from heel to mid-arch over a frozen ice filled bottle.

Repeat for 3 to 5 minutes. This exercise is particularly helpful if done first thing in the morning.

3. Soleus and Posterior Tibialis Muscle stretch:

Lean against a wall for support and to assist with stretching. Position as above: however, this time gradually bend both knees toward the wall until feel a mild pull in the back of legs. Remember to keep heels in contact with the ground and keep the toes pointing forward. Hold position for 10 seconds and repeat 7 to 10 times.

Strengthening : The following exercises performed three times per day for 30 times each session will help provide muscular support to a weakened plantar fascia.

1. Towel curls to strengthen intrinsic muscles of the foot
2. Towel pickup
3. Calf raises (unilateral and bilateral)
4. Picking up marbles
5. Resisted Thera-Band exercises for the lower leg (Resisted dorsiflexion, planterflexion, inversion and eversion)

Strong foot muscles promote better overall functioning of the foot and thereby can help take some of the tension out of the fascia.^{1,6} Stretching and strengthening exercises can help the fascia become more flexible and can strengthen muscles that support the arch, thereby reducing the stress on the fascia.

Ultrasound: Ultrasound is given to prevent formation and to remove inflammatory exudates from the site of inflammation. Hence ultrasound has more roles in decreasing pain and prevents adhesion formation and inflammation.²⁰

Dosage in acute stage

Frequency: 1 MHz, Mode: pulsed

Intensity: 0.2-0.8 watt/cm²

Dosage in chronic stage

Frequency: 1 MHz, Mode: continuous

Intensity: 1.8 watt/cm, Duration: 8 min

DISCUSSION

5 cases of plantar fasciitis were seen during clinical training. 4 patients were female and 1 patient was male in age group of 17 to 62 years. Cases I and II had pain in right sided heel while cases III and IV had left sided pain case IV has bilateral pain. All patients had been suffering from pain since 1 week to 3 months. Chief complaints of patients were reported with difficulty in prolonged standing and severe morning pain making unable to stand. They reported pain on initial steps after a period of inactivity which relieved after walking for some time. On examining the patients on basis of aggravating and relieving factors Case I stated that pain was aggravated by prolonged standing and relieved by rest. Case II stated pain relief by initiating walking. Case III reported pain aggravation with cold weather and lifting heavy weight and relief with initiating walking. Case IV stated pain exacerbation by prolonged walking and alleviation by rest with plantar flexion. On Observation all patients had no changes in skin color except case I. Gait pattern was normal in case II, III & case V and was antalgic in case I & case VI. Case I & case II, V were using flat shoes. Case III was using sports shoes and case IV was using high heels footwear. Inspection revealed no swelling in II, V cases and present in I, III, IV. Palpation revealed temperature changes in case I & case VI. Tenderness was common sign in all patients. On functional testing active dorsiflexion with toes extension revealed pain in cases I & IV. Passive dorsiflexion with toes extension revealed pain in all the cases. The PT treatment received by all patients comprised of bed rest, shoes modifications, ice massage, ultrasound and stretching and strengthening exercises. Patients reported considerable pain relief after physiotherapy treatment. Thus, it is concluded that all patients suffering from plantar fasciitis requisite physiotherapy treatment for better prognosis.

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Ethical Clearance : The research was approved from the ethical committee of department of physiotherapy, guru Jambheshwar University of science & technology, hisar.

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Comparison of Different Isokinetic Velocity Spectrum Exercises on Peak Torque Quadriceps Muscle

Khanna S¹, Khokhar V K², Ruchika³

¹Assistant Professor, Department of Physiotherapy, Christian Medical College and Hospital; ²Associate Professor, Trident College of Education, Meerut ; ³Physiotherapist, Bal Dharmath hospital, Jind.

ABSTRACT

Isokinetic exercises are those exercises, which are performed with a specialized apparatus that provides variable resistance to movement so that no matter how much effort is entered, the movement takes place at a constant speed. The Isokinetic peak torque is one of the important parameters to evaluate the athletic performance or to prevent knee injury. The clinical application of Isokinetic include documentation of patient progress, rehabilitation exercise regimens the use of normative data and analysis of force velocity or power velocity relationships. In the following study total of 40 patients were taken and were divided in four groups Group A (n=10) (Isokinetic training protocol I), Group B (N=10), Group C (n=10) (Isokinetic training protocol III) and Group D (n=10) (Isokinetic training protocol IV). Paired t-test was used to compare the effectiveness of peak torque within the groups. ANOVA test was used to find the relation between two variables i.e. different Isokinetic velocity spectrum exercises and peak torque. On applying ANOVA the result was found to be significant with F-value 7.58 at $p < 0.05$. In conclusion, modified velocity spectrum protocol starting from high velocity is more effective in increasing quadriceps peak torque than other three protocols.

Keywords: Isokinetic dynamomete, Torque, Quadriceps, Velocity

INTRODUCTION

Isokinetic is defined as dynamic muscular contraction when the velocity of movement is controlled and maintained constant by a special device. Isokinetic dynamometry concepts were first put forward by Perrine (1960). Isokinetic exercises were first introduced by Hislop et al (1967) and since then it has been widely used in rehabilitation. Isokinetic exercises are mode of resistance exercises. Resisted exercises are those in which external force is applied to the action of working muscle to improve strength and endurance. Isokinetic exercises in contrast to other forms permits maximum muscle

contraction throughout full range of point movement so it is referred as "Accommodating resistance exercises". Isokinetic exercises are those exercises, which are performed with a specialized apparatus that provides variable resistance to movement so that no matter how much effort is entered, the movement takes place at a constant speed.

These exercises are used to test and improve muscular strength and endurance. Isokinetic exercises utilize machines that control speed of contraction within the range of motion. It combines both isometrics and weight training best features. It provides muscular overload at a constant speed while muscle mobilizes its force through full ROM.

The Isokinetic peak torque is one of the important parameters to evaluate the athletic performance or to prevent knee injury. The clinical application of Isokinetic include documentation of patient progress,

Corresponding author:

Dr. Supriya Khanna_{PT}, Assistant Professor,
Department of physiotherapy, Christian Medical
College and Hospital, Brown road, Ludhiana. Email:
supriyaarora84@gmail.com

rehabilitation exercise regimens the use of normative data and analysis of force velocity or power velocity relationships.

A relationship between torque exerted by muscle group and joint angle is useful both in clinical settings and in human factors. Relationships between torque and joint angle determined by three major factors i.e. cross sectional area of muscle, length tension relationship of muscle, mechanical characteristic of lever system. Isokinetic is mainly used because of ease of measuring muscle torque. It is also used to test and train functional characteristic of muscle as it recruits and train both type I and type II muscle fibres by varying the velocity of movement over the course of exercise session.

REVIEW OF LITERATURE

Brodie and Balzoloulus (1989) did a study on effects of Isokinetic training on maximum peak torque output of swimmers using Akron Isokinetic dynamometer¹. In this study one group trained shoulder and knee flexors and extensor muscle groups. Pre and post training tests assessed the effects of this training. A control group was not included in this study because of limited subject availability. 6 male members volunteered as subjects in this study. Their age, weight and height values are decided. After completion of the study they concluded that Isokinetic training resembled the functional action of the sport that can have beneficial effects on muscular force development.

Siquera et al (2002) did a comparative study on Isokinetic dynamometry of knee flexors and extensors among non-athletes, jumper athletes and runner athletes⁵. Their purpose of study is to dynamically evaluate through Isokinetic tests the peak torque, total work and average power of knee flexors and extensors muscles of the jumper and runner athletes and compare them to those of non athletic population. 54 volunteer divided into three groups- 20 runners, 14 jumpers and 20 non athletes (control group) were evaluated. The criterion for age inclusion is in between 18-30 years. At last they concluded that dominance factor is only significant factor for non-athletes.

Rosene and Fogarty (2001) did a study on Isokinetic hamstrings: quadriceps ratio in inter

college athletes and their objective is to compare the difference in concentric hamstrings: quadriceps ratio among athletes in different sports at three different velocities and 81 males and females college athletes were taken in the study. After their study concluded that the hamstrings: quadriceps ratio increased as velocity increased and no difference existed for hamstrings: quadriceps ratio for sport⁴.

Fabis et al (2007) did a study on impact of Isokinetic peak torque of quadriceps and knee flexors after anterior cruciate ligament reconstruction with hamstrings². Their purpose of study was to evaluate the peak torque of knee flexors and quadriceps muscle at 12th and 24th week. For those 20 patients female and 12 males with mean age of 31.5 year were volunteered. All patients underwent 12 weeks of Isokinetic training for 20 min 5 times a week beginning 12 weeks after surgery. After their study they concluded that 12 weeks Isokinetic training can increase peak torque of hamstrings and quadriceps by 20% and 24% respectively.

Keskula et al (1995) did a study on effects of Isokinetic velocity spectrum exercise on average power and total work³. In this study they compared the influence of performance of different velocity exercise progression on average muscle power and total work production. 22 college students were assigned randomly to four exercise trials each containing an Isokinetic exercise training session involving dominant knee extensors and flexors. Each exercise trial consisted of 2 sets of 10 repetitions at 30 degree, 90 degree, 150 degree and 210 degree per second. The pre and post test and experimental session muscle function measurement were assessed. After their study they concluded that when performing velocity spectrum type training performing faster speed sets early in the exercise session will produce a greater average power.

METHOD AND METHODOLOGY

All subjects were taken from MM University campus.

Sample size	-	40
Sampling method	-	Random
Inclusion criteria		

- Age group 18-27 years

- Normal individuals
- Gender - Male
- BMI(18-28Kg/m²)

Exclusion criteria

- Surgery
- Any injury of lower limb
- Neurological condition
- Any musculoskeletal pathology

PROCEDURE

After satisfying the inclusion and exclusion criteria, the methodology and procedure were explained and a written consent was obtained from all the subjects prior to the study. A demonstration of how to perform the procedure was given to each subject individually before the commencement of procedure. An experimental design was used in this study with one independent variable (isokinetic exercise) and one dependent variable (peak torque). 40 college students (males) were designed randomly to four exercise trials. They were randomly allotted to four groups, ten each for four protocols. Participants were instructed to refrain from participating in heavy resistance weight training or endurance training during the study. Participant neither had history of knee pathology or surgery in either leg.

Isokinetic concentric quadriceps femoris peak torque of bilateral leg was measured at 40^o, 100^o, 160^o and 220^o per second. Each subject was instructed to perform maximal contraction with one-minute rest period between two sets of contraction. The maximal concentric peak torque occurring during ten repetitions were recorded for data analysis. Subjects were verbally encouraged during testing sessions to induce maximal contraction.

RESULTS

The data was statistically analyzed by using SPSS 13.0 software package. Paired t-test was used to compare the effectiveness of peak torque within the groups.

ANOVA test was used to find the relation between two variables i.e. different Isokinetic velocity spectrum exercises and peak torque.

There are four groups Group A (n=10) (Isokinetic training protocol I), Group B (N=10), Group C (n=10) (Isokinetic training protocol III) and Group D (n=10) (Isokinetic training protocol IV). 10 subjects were taken in each group A, B, C and D with the mean age of 22.50±2.42, 20.60±2.57, 21.20±1.62 and 22.50±2.52 respectively, mean height of 1.74±0.5, 1.72±0.6, 1.72±0.052 and 1.73±0.56 respectively, mean weight of 68.4±9.85, 64.6±4.81, 71.8±8.62 and 68.4±9.86 respectively and mean BMI of 22.6±3.19, 22.1±1.66, 24.4±2.71 and 22.4±3.18 respectively.

The mean value of peak torque before training for group A was 140.62±36.83, for group B was 153.57±52.21, for group C was 158.09±8.71 and for group D was 172.89±3.13.

The mean value of peak torque after training for group A was 186.98±19.83, for group B was 183.48±21.72, for group C was 199.44±35.15 and for group D was 229.35±13.83.

Paired t-test was used statistically to compare the mean value of peak torque for group A before and after training. The results were found to be significant for peak torque (t-value=2.96) at p<0.05.

Similarly paired t-test was used statistically to compare the mean value of peak torque for group B before and after training. The results were found to be significant for peak torque (t-value=1.44) at p<0.05.

Similarly paired t-test was used statistically to compare the mean value of peak torque for group C before and after training. The results were found to be significant for peak torque (t-value=3.33) at p<0.05.

Similarly paired t-test was used statistically to compare the mean value of peak torque for group D before and after training. The results were found to be significant for peak torque (t-value=6.02) at p<0.05.

One way ANOVA test was used to compare the mean difference of peak torque for group A, B, C and D respectively. The result was found to be significant with F-value 7.58 at p<0.05.

Table 1: Mean, standard deviation, minimum and maximum age of subjects:

	N	Minimum	Maximum	Mean	Std. Deviation
Age	40	18	27	21.7	2.301
Valid n (list wise)	40				

Table 2: Mean, standard deviation, minimum and maximum weight of subjects:

	N	Minimum	Maximum	Mean	Std. Deviation
Age	40	56	86	68.3	9.857
Valid n (list wise)	40				

Table 3: Mean, standard deviation, minimum and maximum height of subjects

	N	Minimum	Maximum	Mean	Std. Deviation
Age	40	1.6	1.8	1.728	0.0556
Valid n (list wise)	40				

Table 4: Mean, standard deviation, minimum and maximum BMI of subjects

	N	Minimum	Maximum	Mean	Std. Deviation
Age	40	18	28	22.87	2.68
Valid n (list wise)	40				

Table 5: Mean, standard deviation, minimum and maximum BMI of subjects:

	Minimum	Maximum	Mean	Std. Deviation
Peak Torque Pre	88	247.13	156.2915	36.94
Peak Torque Post	144	249.13	199.811	29.39

Table 6: ANOVA test to compare between the groups:

		Sum of Squares	Df	Mean square	F	Sig
Peak Torque Pre	Between groups	5319.089	3	1773.03	1.332	0.279
Peak Torque Post	Between groups	13042.269	3	4347.423	7.579	0.001

DISCUSSION

In this study the individuals were divided into four groups A, B, C and D. The subjects divided in each group were similar in relation to their age, weight; height and BMI as the result of mean values were found to be insignificant between the groups. In this study the mean value of peak torque before training for group A was 140.62±36.83, for group B was 153.57±52.21, for group C was 158.09±8.71 and for group D was 172.89±34.13. After training the mean value of peak torque for group A was 186.98±19.83, for group B was 183.48±21.72, for group C was 199.44±35.15 and for group D was 229.35±13.23 respectively. Data comparison between protocols

were first assessed using paired t-test and follow up procedures consists of ANOVA run on each dependent variable and the result was found to be significant with F-value 7.58 at p<0.05.

Results obtained in the present study are supported by the Keskula et al (1995). The present study reveals that protocol 4 produced greater peak torque than protocol 1, 2 and 3. As the faster speeds sets are associated with greater torque production and less fatigue.

The result of present study are supported by the studies of Moffroid et al (1969) and Rothstein et al(1983) which concluded that power could be calculated with the use of peak torque⁶. The results

are calculated in all studies are statistically significant and hence the results can be implemented in the clinical practice.

LIMITATIONS

The limitation of the study is sample size. The current study evaluated forty subjects and large sample size would have yielded more statistically significant results. Further, studies need to examine other factors such as different velocities spectrums, repetitions, interaction of fatigue and velocity spectrum training and also the effect of Isokinetic training on patients with different pathologies. The result obtained from the future studies considering the above mentioned factors can enhance the implementation of the Isokinetic training protocol in clinical practice.

CONCLUSION

In conclusion, modified velocity spectrum protocol starting from high velocity is more effective in increasing quadriceps peak torque than other three protocols.

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Source of Funding: Nill

Ethical Clearence: Taken

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Effect of Vibration on Motor Functions in Post Stroke Hemiplegic Patients

Bisht Pooja¹, Sharma Satish², Richa³, Govil Kanika⁴

¹MPT (Neurology) ;²Lecturer, ITS Paramedical College, Muradnagar ; ³Physiotherapist, SMC, Indian Airforce, Subroto Park, New Delhi ;⁴Assistant Professor, ITS Paramedical College, Muradnagar

ABSTRACT

Background: We aim to investigate whether the direct application of vibratory stimulation improves motor functions in post stroke hemiplegic patients.

Materials and Method: We studied 45 patients who sustained first ever ischaemic stroke. Patients were randomly allocated to the "Direct application of vibratory stimuli group", "Stretch Group", or "Rest group". After relaxing in a supine posture for 30 min, subjects received the interventions for 5 min. The Modified Ashworth Scale scores, WOLF motor function test was recorded before and immediately after each intervention.

Results: Rest group shows no significant changes in Modified Ashworth Scale scores and WOLF motor. The Direct application of vibratory stimuli group showed significant improvement in Modified Ashworths Scale immediately after the intervention. The changes in Modified Ashworth Scale scores observed in the direct application of vibratory stimuli group significantly differed from those in the Rest group and the Stretch group. No group shows any significant changes in WOLF motor function test functional assessment score.

Conclusion: The present study provide good evidence of anti spastic effect of DAVS but no significant improvement in motor functions in post stroke hemiplegic patients.

Key words: Modified Ashworth Scale; spasticity; vibration, stretching, wolf motor function test.

INTRODUCTION

Stroke is an event caused by the interruption of the blood supply to the brain, usually because a blood vessel bursts or is blocked by a clot. This cuts off the supply of oxygen and nutrients, causing damage to the brain tissues.¹ It is a major public-health burden worldwide.²

Damage to the pyramidal tract and its

accompanying para-pyramidal (corticoreticulospinal) fibers gives rise to the upper motor neuron syndrome.³ Spasticity has generally been assessed clinically through physical examinations using measures such as the Modified Ashworth Scale (MAS)⁵, Tardieu scale⁶, Pendular test⁷ etc. The effects of different treatments of muscle spasticity such as stretching⁸, weight bearing⁹, joint positioning¹⁰, electrical stimulation¹¹, oral medications¹², shock wave therapy¹³, ultrasound therapy¹⁴, cryotherapy¹⁵, vibration¹⁶ have been examined.

Vibration is a mechanical oscillation that can be defined by frequency and amplitude.¹⁸ There are two methods of applying vibration to the human body. In the first method vibration is applied directly to the muscle belly^{18,19,20} or to the tendon.²¹ In the second method, vibration is applied indirectly to the muscle

Corresponding Author:

Satish Sharma

Lecturer I.T.S Paramedical College, Muradnagar,
Ghaziabad, Uttar Pradesh

E.mai: satishsharma@its.edu.in

Phone. No.: 09868365699

being trained (whole body vibration).²² To activate the muscle most effectively, vibration frequency should be in the range of 30–50Hz.¹⁸

Stretching, the process of elongation⁸ is one currently used technique in the physical management of spasticity.²⁵ During stretching, tension is applied to soft-tissue structures.²⁶

The Motor functions are impaired after stroke.²⁹ Arm function recovery is notoriously poor in stroke patients.³⁰ The Wolf motor function test is an instrument with high interrater reliability, internal consistency, test-retest reliability, and adequate stability.³²

Recent studies have shown the antispastic effect of direct application of vibratory stimuli to the spastic muscles of hemiplegic limbs in post stroke patients.⁵ There are lack of studies that show the effect of vibration on motor functions. Purpose of this study is to know whether localized vibration have any effect on improving motor functions in post stroke hemiplegic.

METHOD

Study Design and Patients: A quasi experimental design is used in this study. Through convenience sampling, 45 post stroke hemiplegic patients were selected on the basis of inclusion and exclusion criteria and were randomly assigned into 3 groups i.e. direct application of vibratory stimuli (DAVS) group, stretch group and rest group. Inclusion criteria were: Post stroke Middle Cerebral Artery lesion patients, onset of stroke > 4 weeks, both male and female patients, age: 30 – 60 years, increased muscle tone of the affected upper limb biceps brachii muscles (MAS score ≥ 1), Receiving no stimulant or relaxant medications (including anti-spasticity and anti-convulsion medications, and pharmacological injections), no peripheral nerve injury, no history of any other neurological problem like head injury, is able to follow and obey commands.

Exclusion criteria were Folstein MMSE score below 23, severe aphasia, dementia, any hearing/visual problems. Stroke diagnosis was based on computed tomography (CT) or magnetic resonance imaging (MRI), as well as neurological functions. The study was conducted without altering the existing

medication regimes of the patients. MAS score and WOLF FAS score was measured prior to and after the intervention.

Procedure: After meeting the inclusion and exclusion criteria MAS score and WOLF FAS score was measured. After relaxing for 30 min in the supine posture, subjects received the interventions for 5 min. The subjects in the DAVS group receive vibration with a two 50 Hz vibrators on the belly of the biceps brachii and abdominal side of the forearm for 5 minutes.

The subjects in the stretch group lay in a supine position with maximal extension of the elbow, wrist and finger joints, using a hand-and-forearm stretching device. The subjects in the Rest group lay in a relaxed, supine posture for 5 min.

Measurement of muscle tone: The extent of spasticity was measured using the Modified Ashworth Scale (MAS) for the biceps brachii and wrist flexor muscles. The MAS is an established and reliable instrument, which uses a 6-point scale to score the average resistance to passive movement for each joint.

Motor function assessment: Motor functions were assessed with wolf motor function test (WMFT). The WMFT quantifies the movement ability of the upper extremity through functional timed tasks.¹⁶

Data analysis: A pre- test, post- test experimental control group design was used for the study. Data was tabulated on master chart. Statistical analysis was performed using SPSS 16.0 version software. Oneway analysis of variance (ANOVA) was used to compare difference for age and pre and post analysis of MAS and WOLF. Kruskal wallis test was used for between group analysis of MAS and WOLF pre and post. Independent T test was use for within group analysis of pre and post for all groups. Mean difference between the pre and post was calculated and further analysed to find out which of the group i.e. Group A, Group B and Group C is better. Significance level was set at $P < 0.05$.

RESULTS

The DAVS ($p=0.00$) and stretch group ($p=0.01$) demonstrated a significant decrease in the MAS score as compared to rest group ($p=1.00$). No improvement was seen in any group regarding WOLF FAS score p-

value for DAVS, stretch and rest group was 1.00.

Statistically significant differences were observed between pre and post reading of MAS between DAVS, stretch and rest group.

Pre and post analysis for MAS and WOLF was done by Kruskalwalli test.



Figure 1 showing Pre post analysis of MAS for all groups

Statistically non significant differences were observed between pre and post reading of WOLF FAS between DAVS, stretch and rest group

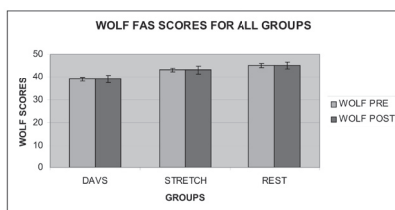


Figure 2: showing pre post analysis of wolf for all groups

DISCUSSION

We compared the efficacy of DAVS with that of stretching the spastic muscles or the resting condition using randomized controlled methods. Changes in spasticity were assessed with MAS scores. Our result shows improvement in the MAS scores in DAVS group and stretch group whereas rest group did not shows any improvement. Motor functions were assessed with wolf motor function test. Our result did not show improvement in WOLF FAS scores of any group.

We used modified ashworth scale to assess spasticity. Spasticity was reduced immediately after the intervention in the DAVS and stretch group. One reason of spasticity reduction may be associated with tonic vibratory reflex. DAVS treatment is intended to apply multiple vibratory stimuli simultaneously to the fully stretched spastic muscles of upper limb.

The vibratory stimuli initially produce intense contraction (known as TVR) of the spastic muscles. After a continuous application of vibratory stimuli on the muscles, the spasticity levels got reduced which can be justified by the previous study done by Noma et al⁶.

Another possible reduction of spasticity can be increase in temperature. Skin temperature can be elevated by friction between the vibrator and skin²⁶. This can cause relaxation of muscular and other soft tissues but also to a decrease in gamma afferent fibre activity that would lead to a decrease in impulses from the muscle spindles with a consequent inhibition of impulses to the alpha fibres⁶.

Vibration may reduce spasticity by modification of corticomotor excitability and reduces muscle tonus in stroke patients²⁸. The effects of stretching on spasticity may be explained by a change in the excitability of motor neurons supplying the spastic muscle. When there is an upper motor neuron lesion, as in CVA or spinal cord injuries, there is an increase in motor neuron excitability that is clinically manifested as increase in tone and increased tendon reflexes²⁷

Application of a stretch following eccentric contractions decreased motor neuron excitability and may thus be beneficial to decrease spasticity whilst strengthening the muscle⁶. The time duration for which spasticity reduce is more in vibration than stretching³

Our study shows that DAVS is significantly better than stretching. DAVS reduces spasticity more than stretching intervention, which can be speculated by the fact that the strength on TVR tends to increase with increasing muscle length. An elongation of the muscle spindles makes the spindles more susceptible to the vibration stimulus so the combined effect of vibration and muscle lengthening in DAVS is more than the stretching alone; where the muscle lengthening occurs alone, thus enhancing TVR to a smaller extent.³⁶

Motor functions were not improved in any of the group. This may be due to weak motor response to vibration. of spastic muscle. This may be due to an enhancement of some inhibitory reflex rather than to a decrease of the excitatory vibration reflex. Since

the various end organs are not equally sensitive to vibration systematic variations of the vibration, frequency in spastic patients may help to elucidate this problem concerning concealed reflexes³⁶.

In conclusion results of the present study provide good evidence of anti spastic effect of DAVS but no significant improvement in motor functions

FUTURE RESEARCH

- Larger number of sample size should be included to confirm our results and generalize the results to population outside our sample population.
- Quality of life should also be assessed for the patients.

CONCLUSION

The present study provide good evidence of anti spastic Effect of direct application of vibration stimulus but no effect on motor function improvement in post stroke hemiplegic patients

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Conflict of Interest: The present study does not have any conflicts of interest and Author has no issues if IJPOT shares data and materials of present study. The author adheres to all the policies of IJPOT.

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Ethical Clearance: The ethical clearance has been taken from the Ethical Committee of I.T.S Paramedical College, Muradnagar, Ghaziabad, Uttar Pradesh

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Correlation of Severity of Urinary Incontinence to the Quality of Life in Females with Stress Urinary Incontinence

Zarna Ronak Shah¹, Ami V Mehta², Priyanshu Rathod³, Neeta J Vyas⁴

¹Junior Lecturer ,SBB Physiotherapy College, V.S.Hospital Campus, Ahmedabad ;

²Associate Professor Obst. and Gynec. Dept, Sheth V.S. General Hospital and Sheth Chinai Maternity Hospital, Smt. NHL Municipal Medical College, AMCMET, Ahmedabad. ³Principal, School of Physiotherapy, R K University, Rajkot;

⁴Principal, SBB College of Physiotherapy, V.S. Hospital Campus, Ahmedabad

ABSTRACT

Background: Urinary incontinence is highly prevalent in females than males and still there is under reporting of it due to lack of education and awareness. Many studies have proven that mild to moderate degree of urinary incontinence can be cured by physiotherapy. But because of under reporting we fail to help incontinent females. Females use to take it for granted and compromise their quality of life by avoiding attending social functions, travelling and other out door activities. Because of this they feel frustrated and depressed and so the aim of this study is to find out whether severity of urinary incontinence is correlated with quality of life .

Methodology: Total 33 females with stress urinary incontinence were asked to fill up two questionnaires: 1) Severity index and 2) Incontinence impact questionnaire short form 7 (IIQ-SF 7). The total scores of these two scales were calculated and correlated using spearman's test.

Results: The r value= 0.574 with p=0.0005 showing highly significant moderate positive correlation between these two scales.

Conclusion: The severity of urinary incontinence is significantly correlated with quality of life of female with stress urinary incontinence. As the severity increases the quality of life decreases and vice versa.

Keywords: Stress urinary incontinence, severity, quality of life.

INTRODUCTION

Urinary incontinence is defined by the International Continent Society as "Involuntary loss of urine". Urinary incontinence is frequently associated with a negative impact on quality of life of the patient¹. Stress urinary incontinence is "the involuntary loss by effort, exercise , sneeze or cough." Stress urinary incontinence is more common in female than male. This is because of their physiology and post pregnancy changes in body. The weak pelvic floor muscles are culprit for stress urinary incontinence. The female with weak perineal muscles will have weak external sphincter and so they will

not be able to control the urine while increased intrabdominal pressure. This increase in pressure can be while coughing, sneezing or while lifting heavy weight. So, the females with stress urinary incontinence suffer from problem of urine leakage at these particular situations.

Although Urinary Incontinence is not a life-threatening condition, It has a physical and psychological effect on the patients, while at the same time it charges them with an additional financial burden¹. Though, the prevalence of urinary incontinence is very high in India, very few researches have been done on severity and quality of

life of urinary incontinent females. Researchers have designed, developed and suggested the use of various questionnaires which are completed by the patients themselves. With these appropriate questions the degree of effect of urinary incontinence on patients' health and quality of life is revealed, graded and evaluated more objectively.²

For measuring severity of incontinence, weighted pad test can be done which measures the volume of urine leakage. According to the volume of urine leakage, the severity can be graded in to mild, moderate and severe. Incontinence severity index is another scale made up of two questions on frequency and volume of urine leakage. The multiplication of the individual score of the two questions will give total score. This total score will grade the severity. Many questionnaires are available for measuring quality of life of patients with urinary incontinence like SF 36, King's questionnaire, urinary impact questionnaire and Incontinence impact questionnaire short form 7. These entire questionnaires can be used in all cases of urinary incontinence irrespective of its type.

The consequences of urinary incontinence may be considerable, often causing embarrassment, stress, frustration, loss of dignity, depressive feelings and limitations in activities because of (fear of) leakage of urine^{3,4}. Urinary incontinence not only has a negative effect on a woman's physical and sexual life, but may also impede her social interactions due to insecurity about her own hygiene⁵.

Many females with stress urinary incontinence do not like to participate in social gatherings due to fear of leakage and embarrassment in public. They even avoid travelling for more than an hour and thus avoid going out with family. They have accepted this leakage as a part of their life and have compromised their quality of life. On the other side many females with stress urinary incontinence use diapers, behavioural modifications or timed voiding techniques in context to enjoy their life like other normal females. These modifications are often seen in western countries and in educated females. In India still there is lot of under reporting of stress urinary incontinence and so it becomes very difficult to educate them and to improve their quality of life. So, in this study it has been tried to correlate the severity of incontinence to the quality of life.

Our purpose behind this study is to know whether severity affects quality of life in females with urinary incontinence. So that we can include education of females (regarding use of diapers, behavioural modifications, timed voiding and dietary modification) as a part of physiotherapy management for urinary incontinence.

Objective of the study: To find out the correlation between severity of incontinence and the quality of life in females with stress urinary incontinence.

Hypothesis: There is a correlation between the severity of urinary incontinence and quality of life in female with stress urinary incontinence.

Null hypothesis: There is no correlation between the severity of urinary incontinence and quality of life in female with stress urinary incontinence.

METHODOLOGY

This is a cross sectional correlation study. Total 39 females reporting to physiotherapy department for stress urinary incontinence were assessed and screened out for stress urinary incontinence. Informed consent forms were signed by the subjects and they were asked to fill up the incontinence severity index . The severity index used here is sandvik severity index⁶ which contains two questions regarding frequency and quantity of urine leakage. The 0 score of severity index means no incontinence and so 2 females with 0 score were excluded from the study. Other 2 had grade 2 uterine prolapsed and 2 had urge incontinence. So, total 33 females were included. These 33 females had filled incontinence impact questionnaire also⁷ The total score of severity index was correlated with total incontinence impact questionnaire score. Both the questionnaires were translated in to Gujarati by experts and then were used for patients.

The Sandvik severity index tells us about the severity of incontinence. Its score ranges from 0 to 12. 0 means no incontinence and 12 means severe incontinence. Incontinence Impact Questionnaire scale (IIQ-SF)⁸ is used to measure the quality of life of the incontinent patient. The scale has 7 items regarding how much quality of life is affected due to incontinence. All questions' answers can be given in 0 means no affection to 3 means maximum affection.

The average score of items responded to is calculated. The average, which ranges from 0 to 3, is multiplied by 33 1/3 to put scores on a scale of 0 to 100⁸. Here, we have directly calculated the total score which ranges from 0 to 21.**Results:**

Table 1: Statistical values of the data

Total no of subjects	33
Age range	22-62 years
Mean age	44 years
Mean score of severity index	3.45
Mean score of IIQ-SF	6.33
Spearman r	0.574
P value	0.0005 highly significant

Table 2: Number of the subjects in different severity grades and their IIQ-SF mean score

Severity grade	Severity index score	Total no of subjects	IIQ-SF score (mean)
Slight	1-2	18	4
Moderate	3-6	11	9
Severe	8-9	3	12

STATISTICS

The severity index and IIQ-SF scales are ordinal scales and so for their correlation nonparametric Spearman’s correlation coefficient was calculated. At 95% Confidence interval $r = 0.574$ and $p=0.0005$ showing highly significant but moderate level of positive correlation between the two scales. This shows that as one score increases other also increases. And as one decreases other also decreases.

DISCUSSION

The result of this study shows that there is a highly significant moderate level of positive correlation between the severity scale and quality of life scale in females with stress urinary incontinence($r = 0.574$). This means that as the score of severity index increases , the score of IIQ-SF 7 will also increase. Higher score of severity index shows more severe urinary incontinence and higher score of IIQ-SF 7 means more affected quality of life. So, as the severity of incontinence increases, the quality of life decreases.

Our study result is supported by studies done by Tennstet et al⁹ and Huang et al¹⁰.

Surprisingly one female aged 45 had score 12 on severity index showing very severe incontinence where as she had score 2 on her IIQ-SF form. This might either be a mistake or the female might not have understood the questionnaire properly.

The association between health related Quality of life and urinary Incontinence severity has been previously described by several authors in context of care seeking behaviors¹¹. However, although most studies have reported a positive relation between Urinary Incontinence severity and specifically designed measures of quality of life for urinary incontinence, the correlation varies from weak, moderate and strong¹².In 2007, Albo and Coworkers in their preoperative assessment of 655 females with urinary incontinence reported that only modest correlation existed between the patients’ symptoms self assessment and the quality of life measures¹³.Likewise, Murray and co-workers reported a rather low correlation between urinary incontinence and quality of life in the pre surgical setting($r < 0.40$); nevertheless, such a correlation increased in the post treatment setting($r > 0.70$)¹⁴. In our study the correlation is moderately positive showing modest relation between severity and quality of life in stress urinary incontinent females. This may be because all subjects in this study had stress urinary incontinence. Stress urinary incontinence is a condition where females are aware of the situations when the chances of leakages are the most e.g. while coughing, lifting heavy weights etc.... and so they can either avoid such situations or can modify like wearing diapers in travelling. Such modifications will be difficult in mixed or urge incontinence and so the correlation in these types are suppose to be strong¹⁵.

Janka et al have found in their study that there is no relation between the type and quality of life in incontinent patients. It is the severity that affects quality of life rather than type¹⁵. According to them, the stress urinary incontinent females can easily improve their quality of life as they are aware of their situations in which the chances of leak are higher. Still

the correlation in this study is not weak showing that females of our culture are not aware and not educated regarding improving their quality of life.

Urinary incontinence is related to reduced personal and social life and to reduced total quality of life¹. It may seriously affect sociability, and the social gatherings the patient attends are modified so that possible unpleasant moment and embarrassment by sudden loss of urine are avoided¹⁶. The matter of incontinence is often just a reason for the loss of independence for elderly people. So apart from treating them with modalities and exercises it becomes part of physiotherapist's duty to educate incontinent patients and make them aware.

In the area of women's health, this study can prove to be helpful and important due to the fact that so many females with stress urinary incontinence just compromise their quality of life and do not bother about it. Women's awareness programs have to be conducted and their problems need to be discussed to avoid under reporting.

CONCLUSION

The severity of urinary incontinence is significantly correlated with quality of life of female with stress urinary incontinence.

Limitation:

- Higher age range of subjects
- Modified calculation of IIQ SF
- We have taken only stress urinary incontinent patients
- Only females were included so this study can not be extrapolated to other cultures and are not generalizable to all ages.
- Self reported questionnaire can lead to bias in data

Conflict of Interest: No

Ethical Approval: Ethical approval is taken from institutional ethics committee.

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Effect of Task Specific Treatment in Patients with Unilateral Neglect

Patole R R¹, Kulkarni V N², Rairikar S A³, Shyam A K⁴, Sancheti P K⁵

¹Masters of Physiotherapy, ²Associate Professor, ³Principal and Professor, Sancheti Institute College of Physiotherapy, Pune. ⁴Orthopaedic Surgeon, Sancheti Institute for Orthopaedic and Rehabilitation. ⁵Chairman, Sancheti Institute for Orthopaedic and Rehabilitation.

ABSTRACT

BACKGROUND: Unilateral neglect (ULN) has a significant impact on rehabilitation compared with stroke patients without neglect, patients with the disorder have relatively poor functional outcomes even after controlling for differences in overall severity.

AIM & OBJECTIVE: To study the effect of task specific treatment in patients with unilateral neglect.

METHOD: Total 10 Right sided stroke patients with unilateral neglect were recruited for the study. All patients were assessed using two outcome measure i.e. Catherine Bergego Scale (CBS - To assess ULN) and Functional Independence Measure (FIM - To assess ADLs). 6 weeks intervention program (thrice a week) including visual scanning, visual scanning in functional task and Affolter's guiding technique and compensatory strategies were given. Post treatment evaluation was done by using CBS and FIM.

RESULT: Post treatment both CBS and FIM scores showed significant improvement ($p=0.005$).

CONCLUSION: The present study indicates that task specific treatment is effective in improving functional outcome in unilateral neglect patients and in reducing the neglect symptoms.

Keywords: stroke, task specific, treatment, unilateral neglect

INTRODUCTION

Stroke or brain attack is the sudden loss of neurological function caused by an interruption of the blood flow to the brain¹.

Unilateral neglect (ULN) is defined as the inability to perceive, respond to, or orient to stimuli in the space opposite to brain lesion². It is characterized by failure to attend or respond to stimuli on the side of space opposite to a brain lesion.

Both right and left hemispheric stroke patients show ULN in acute phase³. Right hemispheric lesions show chronic neglect³. The non-dominant (usually right) hemisphere has responsibilities regarding attention because it maintains attention in both right and left hemispaces. The dominant (usually left) hemisphere in contrast only attends to contralateral hemisphere. Patients with right parietal lesions often have hemineglect for the left side of space. With lesions of dominant hemisphere, the non-dominant hemisphere can attend well enough to both side of space; where hemineglect does not occur as a prominent feature. With bilateral lesions may be required to show neglect of right hemisphere⁴.

Unilateral neglect is most damaging to an older stroke patient who also has a lower performance in their activities of daily living or those elderly who are still working. Unilateral spatial neglect leads to

Corresponding Author-

Rashmi R Patole

Mailing Address- :

Sancheti Institute College of Physiotherapy,
12, Thube Park, Shivajinagar, Pune – 411 005,
Maharashtra (INDIA). Telephone:020 – 25539393
Mob. No.- 9960098721 Fax No: 020 - 25539494
E-mail: patole.rashmi77@gmail.com

increased risk for injury and is also associated with poor functional outcome⁵. It is seen that severe unilateral neglect patient collides into his or her surroundings, tends to ignore food on one side of the plate, or attend to only one side of his or her body.

To treat unilateral neglect it is very essential to know the functional impact of neglect in these patients. It is observed that due to lack of awareness and lack of effective assessment⁶ of ULN functional outcome of the patients is getting affected. ULN is associated with poor functional recovery following stroke, few studies have specifically addressed physiotherapy outcomes in relation to problem. In a study, it was stated that the motor performance of patients with neglect was worse than patients without neglect at both acute and chronic stages⁷.

There is dearth of literature showing the effect of task specific management of stroke patients with unilateral neglect. This suggests need to develop effective and integrated treatment protocol to treat unilateral neglect patients. The purpose of the present study was thus to find out the effect of task specific management on the functional outcome of stroke patients with unilateral neglect.

METHOD

An experimental study was done between 2010 and 2011. Twenty one subjects of left hemiparesis were screened, out of which 11 patients fulfilled the inclusion criteria of the study.

STUDY PROCEDURE

Study and study design were approved by the local ethical committee. Written consent, to be a part of the study was taken from subjects. Consent was taken for any photograph or videos taken during the study. Subjects were assessed with the help of evaluation proforma along with the Catherine Bergego Scale (CBS) to verify presence of unilateral neglect. Functional independence measure (FIM) score was obtained before starting with treatment session, for the assessment of Activities of daily living. All the patients had undergone 6 weeks training session. CBS and FIM scores were obtained at the end of 6 weeks training program.

Exercises were given thrice a week for 6 weeks. Exercise program included general management and

techniques to treat ULN like; visual scanning, visual scanning in functional task, Affolter's technique, compensatory strategies, etc.

DATA ANALYSIS: Pre treatment and post treatment CBS score and FIM score values were compared by using wilcoxon's signed ranks test.

DISCUSSION

This study shows that task specific treatment improves the functional outcome of stroke patients having unilateral neglect.

In the present study it was found that there was significant difference between pre treatment and post treatment mean values (17 and 4.5 respectively) of Catherine Bergego Scale (CBS) and similarly pre and post treatment values (83.6 and 112.2 respectively) of Functional Independence Measure (FIM). The results were found to be significant at $p=0.005$ for both CBS and FIM.

The treatment which we had incorporated in the intervention program included basic day-to-day tasks such as eating food from a plate, grooming, etc. The Catherine Bergego Scale had similar components like grooming and shaving left part of face, wearing left sleeve/ slipper, eating food on left side of plate, cleaning left side of mouth after eating, spontaneous leftward gaze orientation, etc. which has helped for both assessment of the patient in functional task as well as in the task specific treatment. Many studies have proved that task specific training aids in the functional recovery^{8,9} of the patient by means of cortical reorganization¹⁰. This scale indicated not only the severity of the unilateral neglect symptoms but also monitored the changes in the neglect behavior at the end of this study.

In present study the comparison between pre and post treatment values for CBS has shown significant difference ($p=0.005$) showing good functional outcome.

In a study done by Yong Mi Kim¹¹ CBS score have shown significantly higher recovery of function after treatment. Similarly, Plummer P et al⁶ also stated that CBS is useful scale for measuring functional impact of neglect in various range of everyday activities.

In this study the comparison between pre and

post treatment values for FIM has shown significant difference ($p= 0.005$) suggesting good functional recovery after intervention protocol focusing functional tasks.

It is mentioned earlier that FIM is an indicator of independence in functional activities, as it also includes activities of daily living such as eating, grooming, dressing, etc. It has previously stated that the intervention program used in this study had included activities which are required in daily life. Therefore giving task specific training in these patients and with repetition of the task there was improved performance in daily activities. This is has been proved with increased functional independence measure scores post treatment.

Dora YL Chan et al¹² did a study to know the efficacy of the motor relearning approach in promoting physical function and task performance for patients after a stroke. They used FIM as an outcome measure to the functional outcome and got positive effect of their therapy on functional performance.

The present study showed significant improvement in both the outcome measures i.e. CBS and FIM. This improvement in the functions can be attributed to task specific treatment which was reflected as decline in post treatment score of catherine bergego scale and improved score of functional independence measure post treatment session. This suggests that both CBS and FIM showed recovery of functions after the intervention program.

In many studies, unilateral spatial neglect has consistently been identified as a negative predictor for a patient's recovery of independence in daily living^{13,14}. Patients with neglect show reduced overall and cognitive-communicative functional performance and outcome than patients without neglect¹⁴.

As we know that neglect results in impaired attention towards and impaired arousal of affected side, our focus of treatment was towards improving attention and awareness towards the affected side. Therefore we had included affolter guiding technique and visual scanning in the intervention program. Affolter technique was based on the tactile- kinesthetic input, in which focus was given on the completion of task rather than on the performance of the task. Here, patients were allowed to make mistakes during the

treatment to use problem solving skills¹⁵. Visual scanning is a behavioral strategy which allows and trains the patient to compensate visually for impaired scanning of the neglected side¹⁵.

Kerstin Tham et al¹⁶ did similar study which showed improved awareness of disabilities might improve the ability to learn the use of compensatory techniques in performance of ADL in clients with unilateral neglect. They showed the requirement of effective intervention strategies to improve the functional performance in ULN patients.

The possible explanation for the improvement in function could be the role of neuroplasticity. Neuroplasticity (plasticity) is the ability of the brain to change and repair itself¹⁷. Brain plasticity may be divided into injury-related and use-dependent cortical reorganization. Use-dependent cortical reorganization is influenced by external stimuli. The importance of physical intervention among the external stimuli that facilitate brain plasticity is well recognized¹². With the development of functional neuroimaging in recent years, several studies have been reported upon cortical reorganization induced by physical intervention in stroke patients¹⁸. Task-oriented approach among the physical interventions for stroke patients is based on the recognition that the goal of motor control is the control of the movement required to approach a particular task, and this includes the acquisition of motor skills as a consequence of repetitive practice. It has been proved earlier that recovery of function after brain lesions is associated with recruitment of brain regions which are not typically assigned for function¹⁹. Reorganization of neural mechanisms is a dynamic process which is influenced by person's active efforts to meet environmental and task demands²⁰. With repeated practice of the task there is functional reorganization of central nervous system, which results in better outcome in functional activities.

In this study, after the intervention it was found out that task specific exercises had positive effect on abilities to perform daily activities which was measured by the FIM. While pre treatment CBS score showed poor reintegration into everyday task at the baseline assessment and the declining post treatment CBS score showed that the participants had diminished neglect severity after the exercise

program. This suggests that task specific treatment in acute rehabilitation phase is necessary for better functional outcome.

CONCLUSION

The present study indicates that task specific treatment is effective in improving functional outcome in unilateral neglect patients and in reducing the neglect symptoms.

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Effect of Abdominal Muscle Fatigue on Maximum Voluntary Ventilation (MVV)

Richa Rai¹, Guneet Kaur¹, Charu Chopra¹, M P S Negi²

¹Assistant Professor, Banarsidas Chandiwala Institute of Physiotherapy, Kalkaji, New Delhi

²Statistical Consultant, Institute for Data Computing and Training, Lucknow (UP), India

ABSTRACT

Background: Amongst the various tests for flows and volumes, Maximum Voluntary Ventilation (MVV) is a parameter that reflects lung volume changes, respiratory muscle functioning, compliance of the thorax lung complex and airway resistance. The MVV is defined as the maximum amount of air that a healthy subject can breathe over a specified period of time i.e. 12 seconds and is expressed in L/min. In certain circumstances where the diaphragm and other Inspiratory muscles are subjected to an excessive load or are fatigued, the role of expiratory muscles in contributing to ventilation and supporting Inspiratory muscle function could be significant. Moreover, abdominal muscle loading has been shown to contribute to an increased effort sensation & this intensification of dyspnoea in circumstances where the abdominal muscles are heavily recruited could also be of clinical significance because it may contribute to exercise intolerance.

Aim: Our aim was thus to establish the importance of abdominal muscle training in pulmonary rehabilitation by demonstrating the effect of Abdominal muscle fatigue on the 12-s maximum voluntary ventilation (MVV).

Material and Method: The Study Design was Experimental and 21 healthy physiotherapy students. Spirometry MVV manoeuvre was performed as per ERS guidelines & ACSM protocol was used to establish the abdominal muscle fatigue. Pre and post MVV values were recorded.

Findings: The MVV level of all subjects at baseline had a mean of 104.50 ± 12.31 L/min while after intervention it decreased and had a mean of 100.06 ± 10.94 L/min.

Conclusion: It was concluded that implementing a primary non respiratory activity (sit ups) has an effect on the Maximum Voluntary Ventilation in normal subjects.

Keywords: Abdominal Muscle, fatigue, MVV

INTRODUCTION

Amongst the various tests for flows and volumes, Maximum Voluntary Ventilation (MVV) is a parameter that reflects lung volume changes, respiratory muscle functioning, compliance of the thorax lung complex

and airway resistance as assessed by Sheldon, R.L.¹. The MVV is defined as the maximum amount of air that a healthy subject can breathe over a specified period of time i.e. 12 seconds and is expressed in L/min by Millre, M.R.², Hankinson, J. and Brusasco, V., 2005, ATS/ERS task force. It can be used as a tool for assessment of respiratory muscle weakness as quoted by Gibson, G.J., Whitelaw, W. and Nikolaos, S.N.³ in 2002. The accurate estimation of MVV is critical for interpretation of maximal sustainable ventilation (MSV). MSV is a measure of endurance of ventilatory muscles and is expressed as a fraction of MVV as

Corresponding Author:

Richa Rai

Assistant Professor, Banarsidas Chandiwala
Institute of Physiotherapy

studied by Clanton, T., Calverly, P.M. and Celli, B.R⁴. in 2002.

Previous studies done by De Troyer, A. et al in 1983⁵ and Campbell, E. J. M. 1952⁶ have demonstrated that expiratory muscles can act as accessory muscles of inspiration. Abdominal muscle contraction increases expiratory flow and reduces functional residual capacity, allowing the respiratory system to work at a lower volume was also demonstrated by De Troyer, A. et al in 1991⁷. They also studied that the elastic and gravitational energy stored during expiration by the action of abdominal muscles is subsequently released during inspiration, and, therefore, inspiratory muscle work is shared by the expiratory muscles. Furthermore, contraction of the abdominal muscles displaces the diaphragm into the thorax, lengthening its fibres and placing them on a more advantageous portion of their length-tension curve, thereby increasing their capacity to generate force was cited by Grassino, A. et al in 1978⁸ and Gandevia, S. C., R. B. Gorman, D. K. McKenzie et al in 1992⁹. In circumstances where the diaphragm and other inspiratory muscles are subjected to an excessive load or are fatigued, the role of expiratory muscles in contributing to ventilation and supporting inspiratory muscle function could be important.

Fatigue can defined as a loss of capability to generate skeletal muscle force and/or velocity which is accompanied by recovery during rest as per NHLBI workshop summary 1990¹⁰.

Also to establish the abdominal muscle fatigue the ACSM^{11,12} test's has strict guidelines recommended in 2010 for how to set-up the test and rules for how to administer the test.

Moreover, abdominal muscle loading has been shown to contribute to an increased effort sensation by Suzuki S. et al in 1992¹³. Intensification of dyspnoea in circumstances where the abdominal muscles are heavily recruited could also be of clinical significance because it may contribute to exercise intolerance.

Our aim is to establish the importance of abdominal muscle training in pulmonary rehabilitation by demonstrating the effect of Abdominal muscle fatigue on the 12-s maximum voluntary ventilation (MVV) which provides an estimate of the ventilatory reserves available to meet

the physiologic demands of exercise^{14,15}.

MATERIAL AND METHOD

The Study Design was Experimental and 21 healthy physiotherapy students from the institute were recruited for the study on consent and after seeking the clearance of the Institute's Ethical and Research Committee for the study. The subjects were females of the age 20-30 Years with a Normal Body Mass Index (18.5- 24 Kg/m²) and a MVV > 80% MVV_(pred). Those who had an abdominal strength of the score "good" as per ACSM guidelines were cooperative & capable of understanding the procedure were recruited for the study^{11,12}.

Subjects with history of recent respiratory tract infection, hospitalization due to any clinical syndrome or pathological condition, any musculoskeletal deformity which can affect pulmonary functions or the ability to perform the protocol, smoker & on any kind of hormonal treatment were excluded. The instrumentations used were Spirobank G, Metronome & Stop Watch.

On day one, abdominal strength grading was done and practice MVV manoeuvre was given. On Day two, Spirometry MVV manoeuvre was performed as per ERS guidelines & ACSM protocol was used to establish the abdominal muscle fatigue^{11,12}. At the end of the sit-up bout, subjects would again complete the MVV measurements within approximately ten minutes of the completion of the exercise.

Table 1: Demographic characteristics of studied subjects

Characteristics	Mini mum	Maxi mum	Mean	SD
Age (yrs)	20	25	21.90	1.51
Height (cm)	148	175	158.95	6.97
Weight (kg)	40	68	51.07	7.02
BMI (kg/m ²)	17	25	20.18	2.11

FINDINGS

Data were summarised as Mean ± SD. Pre and Post MVV data was compared by paired t test. Pearson

correlation analysis was done to see the association of change (pre-post) with demographic characteristics. A two-tailed ($\alpha=2$) $p<0.05$ was considered statistically significant.

The demographic characteristics of studied subjects are summarised in Table 1. The age, height, weight and BMI of all subjects ranged from 20-25 yrs, 148-175 cm, 40-68 kg and 17-25 kg/m² respectively with mean (\pm SD) 21.90 \pm 1.51 yrs, 158.95 \pm 6.97 cm, 51.07 \pm 7.02 kg and 20.18 \pm 2.11 kg/m² respectively.

Table 2: Baseline and post MVV levels (Mean \pm SD, n=21) of studied subjects

MVV (L/min)		t value (DF=20)	p value
Baseline	Post		
104.50 \pm 12.31 (85.0-143.5)	100.06 \pm 10.94 (82.8- 128.6)	2.77	0.012

Table 3: Correlation (n=21) of change (baseline-post) of change in MVV with demographic characteristics

Demographic characteristics	Correlation (r) value
Age	0.03 ^{ns}
Height	0.27 ^{ns}
Weight	0.28 ^{ns}
BMI	0.13 ^{ns}

Numbers in parenthesis indicates the range (min-max) ns- $p>0.05$

The baseline and post- protocol MVV levels of all studied subjects are summarised in Table 2. The MVV level of all subjects at baseline ranged from 85.0-143.5 L/min with mean (\pm SD) 104.50 \pm 12.31 L/min while after intervention (abdominal muscle fatigue after sit ups) it decreased and ranged from 82.8-128.6 L/min with mean (\pm SD) 100.06 \pm 10.94 L/min. Comparing the MVV levels at two periods, t test revealed significant ($p<0.05$) decrease of 4.2% at post protocol as compared to baseline (104.50 \pm 12.31 vs. 100.06 \pm 10.94, $t=2.77$; $p=0.012$).

DISCUSSION

Inspiratory muscle fatigue has been assessed in normal subjects during resistive breathing¹⁶, maximal

ventilation¹⁷, and whole body exercise¹⁸. During these tasks, abdominal muscles are vigorously contracting to achieve expiration and to facilitate subsequent inspiration⁵. Inspiratory muscle fatigue has been extensively investigated in normal subjects. Because the work of breathing is mainly performed by the inspiratory muscles, this muscle group is likely to be exposed to severe loading and fatigue. Reduction in inspiratory muscle strength can be of substantial clinical importance and may play a role in respiratory failure. However, there is evidence that abdominal muscles, through a variety of mechanisms, are also functionally important when ventilation increases. These muscles vigorously contract to achieve expiration, reducing expiratory time and thus contributing to increased breathing frequency.

Previous studies⁵ have also demonstrated that expiratory muscles can act as accessory muscles of inspiration. Abdominal muscle contraction increases expiratory flow and reduces functional residual capacity, allowing the respiratory system to work at a lower volume. The elastic and gravitational energy stored during expiration by the action of abdominal muscles is subsequently released during inspiration, and, therefore, inspiratory muscle work is shared by the expiratory muscles⁷. Furthermore, contraction of the abdominal muscles displaces the diaphragm into the thorax, lengthening its fibers and placing them on a more advantageous portion of their length-tension curve, thereby increasing their capacity to generate force^{9,8}. In circumstances where the diaphragm and other inspiratory muscles are subjected to an excessive load or are fatigued, the role of expiratory muscles in contributing to ventilation and supporting inspiratory muscle function could be important.

The present study evaluated the effect of abdominal muscle fatigue on maximum voluntary ventilation (MVV) on 21 subjects. The MVV level of all subjects at baseline ranged from 85.0-143.5 L/min with mean (\pm SD) 104.50 \pm 12.31 L/min while after intervention (inducing abdominal fatigue by sit ups) it decreased and ranged from 82.8-128.6 L/min with mean (\pm SD) 100.06 \pm 10.94 L/min. Comparing the MVV levels at two periods, t test revealed significant ($p<0.05$) decrease of 4.2% post protocol as compared to baseline.

Christopher L. Gomez in 2009¹⁹ published the

primary finding of their study showing that the implementation of sit-up exercise to exhaustion inducing significant decreases in measures of respiratory muscle strength (MIP, MEP) as well as respiratory muscle endurance as demonstrated by the Incremental Breathing Test task. This was the first time that decrease in respiratory muscle strength and endurance measures were recorded following a primarily non respiratory maneuver (abdominal sit ups). They also showed that abdominal exercise to task failure decreased inspiratory muscle strength.

Dimitris Kyroussis et al also studied the abdominal muscles as the principal muscles of active expiration²⁰. To investigate the possibility of abdominal muscle low-frequency fatigue after maximal ventilation in humans, they stimulated the nerve roots supplying the abdominal muscles. They too concluded that after maximal ventilation in humans there is a reduction of twitch Pga and, therefore, of low-frequency fatigue in abdominal muscles.

Similarly studies conducted by A. Aliverti et al²¹ also quote that during exercise, abdominal muscle recruitment during expiration accounts for the reduction in FRC, whereas its gradual relaxation causes (Pab) abdominal Pressure to fall throughout inspiration, in striking contrast to the rise in Pab during quiet breathing. They concluded that the diaphragm's main role during exercise is to generate flow, rather than pressure. If, however, the diaphragm primarily generates flow while only doubling Pdi (Diaphragmatic pressure), the pressure required to displace the abdomen and rib cage must be produced by other muscles. Evidently, the abdominal muscles are used to displace the abdomen, and the rib cage muscles are used to displace the rib cage. They had stated a triple role to the abdominal muscles during exercise: 1) their contraction during expiration accounts for all the decrease in end expiratory volume, 2) their gradual relaxation during inspiration allows RCa (the diaphragm apposed parts of the ribs) to expand synchronously with RCp (lung apposed part of the rib) and minimizes the difference in pressure acting on the two rib cage compartments, and 3) the resulting fall in Abdominal pressure throughout inspiration permits the diaphragm to act as a flow generator. In this analysis they assigned two previously unrecognized roles to the abdominal muscles during exercise: they allow the diaphragm

to contract quasi-isotonically, and they prevent rib cage distortion. The former role is played by allowing Pab to decrease throughout inspiration, in parallel with Ppl (pleural Pressure), so that Increase in diaphragmatic pressure is minimized. The latter role they ascribed to the deflationary action of abdominal muscles on RCa²¹.

This is also supported by De Troyer A. who studied the mechanical action of the abdominal muscles in 1983⁵.

E.J.M Campbell also concluded that the abdominal muscles do not have a significant expiratory role in the erect posture except at very high levels of pulmonary ventilation²².

The appreciation of the coordinated function of inspiratory and expiratory muscles when the demand placed on the respiratory system is increased and the finding that maximal ventilation results in fatigue of both muscle groups raise the question of whether abdominal muscle fatigue could be clinically relevant. After heavy exercise, diaphragmatic fatigue may occur²³. In such circumstances, abdominal muscle fatigue could also be a reasonable hypothesis because these muscles vigorously contract to facilitate respiratory pump function and also to support, flex, and rotate the body. Moreover, abdominal muscle loading has been shown to contribute to an increased effort sensation¹³. Intensification of dyspnea in circumstances where the abdominal muscles are heavily recruited could also be of clinical significance because it may contribute to exercise intolerance.

CONCLUSION

We thus conclude that implementing a primary non respiratory activity (sit ups) has an effect on the Maximum Voluntary Ventilation in normal subjects, though further investigations are required to examine the effect of training of abdominal muscles on the respiratory parameters, to benefit those in disease state from these types of training.

Conflict of Interest: None

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Ethical Clearance: The Study sought the clearance of the Institute's Ethical and Research Committee.

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Effect of Shoulder Exercises on Functional Performance in Paraplegic Wheelchair users having Shoulder Pain

Dondal K¹, Kulkarni V², Patole R³, Rairikar S⁴, Shyam A⁵, Sancheti P⁶

¹Clinical Physiotherapist, ²Associate Professor, Department of Neurophysiotherapy, ³Clinical Physiotherapist; ⁴Principal, Sancheti Institute College of Physiotherapy, ⁵MS-Orth, Indian Orthopaedic Research Group, ⁶MS-Orth, Chairman Sancheti Institute for Orthopaedics and Rehabilitation

ABSTRACT

Background: The patients with Spinal Cord Injury (SCI) excessively overload the upper extremity especially the shoulder using them more frequently in activities than people without SCI. Shoulder pain may limit daily performance of basic daily activities in these patients and these may benefit from rehabilitation. Many tasks involved in the independent function at home and in community are painful for individual with shoulder pain. This study was designed to find out the effect of shoulder strengthening and stretching exercises.

Aim: To find out effect of shoulder exercises on functional performance in paraplegic wheelchair users having shoulder pain.

Purpose: To determine effects of supervised shoulder strengthening and stretching exercises in reducing the pain and resulting improvement in functional performance in individuals with SCI.

Method: This randomized Clinical Trial recruited total 30 post SCI paraplegic wheelchair users having shoulder pain. Subjects were assessed using Wheelchair Users Shoulder Pain Index (WUSPI), Constant Murley Scale (CMS), Katz index of independence in activities of daily living (ADL) and Canadian Occupational Performance Measure (COPM).

Experimental group received one month treatment program (3 times in a week) including strengthening and stretching exercises; the control group did not receive any treatment. Post treatment evaluation of both groups was done.

RESULT: Post therapy experimental group showed significant improvement ($p < 0.005$) in outcome measures WUSPI, CMS and COPM except Katz index of independence in ADLs.

CONCLUSION: There was improvement in pain and functional performance in paraplegic wheelchair users having shoulder pain after treated with shoulder strengthening and stretching exercises for one month.

Keywords: exercises, paraplegic shoulder pain

INTRODUCTION

Shoulder pain and related dysfunction are common problems in SCI (Spinal Cord Injury) patients ^[1]. SCI is a low incidence, high cost disability requiring tremendous changes in an individual's lifestyle. The incidence is 4 times greater in males than in female and majority of them in the age group of 16-30 years ^[2].

Corresponding Author:

Dr Vivek Kulkarni (PT)

Sancheti Institute College of Physiotherapy,
12, Thube Park, Shivajinagar, Pune – 411 005,
Maharashtra (INDIA).

Telephone: 020 – 25539393, Fax No: 020 – 25539494

Email: vnkulkarni19@yahoo.co.in

Independence in functional performance is a major goal in rehabilitation of person with SCI [1]. Most individual with high level SCI will rely on wheelchair as their primary means of locomotion in their home and community even the patients with paraplegia who has mastered in ambulation with crutches and orthosis will choose to use wheelchair as a primary means of locomotion as it provide a lower energy expenditure, greater speed and safety [3].

The wheelchair users with paraplegia put an intense load upon the muscles and joints of the upper extremities during wheelchair propulsion and in almost every other daily activity such as transfer, driving, pressure relieving maneuver and household activities, as the functions that are normally performed by the trunk and lower extremity must now be performed by upper extremity only [4]. Eriksetal [5] found that shoulder pain was shown to be associated strongly with limited shoulder ROM.

The shoulder pain is associated with variety of factors. These factors include duration of injury, weight bearing, wheelchair use, poor sitting posture, age, body mass index, muscle imbalance at shoulder joint complex and decreased ROM. The pain is biomechanical in nature [6].

Shoulder pain may not initially limit the wheelchair users ability to perform activities independently, it may have functional cost such as rapid fatigue, loss of endurance, decreased speed or efficiency of movement, low tolerance for prolonged work or leisure activity and decreased cardio-respiratory endurance. Eventually wheelchair users with shoulder pain may eliminate functional activities that are associated with pain [7].

The purpose of this study was to determine the effects of supervised shoulder strengthening

and stretching exercises in reducing the pain and resulting improvement in functional performance in individuals with SCI.

MATERIALS AND METHODOLOGY

An experimental study was done between 2009 and 2010. Forty five subjects of SCI from Paraplegic Rehabilitation Centre were screened, out of which 30 Patients with complete or incomplete SCI below T1 who are using manual wheelchair as a primary mode of mobility for at least 1 year were included in the study.

STUDY PROCEDURE

Ethical approval was taken from ethical committee. The rights of human and/or animal subjects were protected. The purpose and general procedure of the tests was explained to the subjects and all questions were answered before beginning. Subjects were selected according to the inclusion and exclusion criteria and were screened for the shoulder pain. Written consent, to be a part of the study was taken from subjects. Subjects were randomly divided into two groups of 15 each, Experimental group and Control group. The subjects were then assessed using the assessment proforma advised for the study and using the outcome measures. Subjects underwent pre intervention assessment and at 4 weeks with-

- 1) Wheelchair users shoulder pain index (WUSPI) [8]
- 2) Constant Murley Scale (CMS) [9]
- 3) Katz index of independence in activities of daily living [10]
- 4) Canadian occupation performance measure (COPM) [11]

TABLE NO -1 Showing Outcome measures used

Sr. No.	Outcome Measure	Used For		
1	Wheelchair users shoulder pain index (WUSPI)	To define shoulder pain experienced during pre defined activities while using wheelchair		
2	Constant Murley Scale (CMS)	To evaluate shoulder pain	Subjective Parameter	1)Degree of pain on performing ADL 2)Ability to perform ADL
			Objective Testing	1)AROM 2)Shoulder power
3	Katz index of independence in activities of daily living	To assess functional status		
4	Canadian occupation performance measure (COPM)	To measure individuals self perception of occupational performance		

The intervention started on the next day after the baseline assessment. Subjects in experimental group participated in 45 min of shoulder strengthening and stretching exercise program 3 times per week for 4 weeks.

STATISTICAL ANALYSIS

Statistical tests were done using SPSS version 14. Baseline demographic data (age, gender, time since onset of SCI) of both the groups were compared using unpaired t test. Baseline values of the four outcome measure –WUSPI, CMS, KATZ and COPM were compared for both the groups using Mann Whitney U Test. For Comparison in between two groups for mean change scores of all the four outcome measures at baseline and post treatment Mann –Whitney U Test was used. (Comprising two independent samples, ordinal data).The significant level was set as $p < 0.05$.

RESULTS AND TABLES

Pre and post evaluation were made 1 to 3 days before and 1 to 3 days after the treatment period respectively.

TABLE NO 2-Showing Results

Parameter	Group	Baseline		After 4 weeks		Mean change	P value	
		Mean	SD	Mean	SD			
WUSPI	E	78.93	14.23	57.7	13.68	21.23	0.0001	
	C	71.2	20.24	69.9	19.82	1.3	0.0637	
CMS	E	66.02	9.5	76.6	11.53	10.57	0.0001	
	C	67.2	9.77	67.53	9.32	0.3333	0.4631	
KATZ	E	4.86	0.51	4.86	0.51	0	0	
	C	4.86	0.35	4.86	0.35	0	0	
COPM	E	P	4.64	0.99	6.32	1.04	-1.68	0.0001
		S	4.7	1.05	6.32	1.02	-1.61	0.0001
	C	P	5.33	1.18	5.44	1.30	-0.10	0.3223
		S	5.34	1.21	5.41	1.27	-0.06	0.6221

DISCUSSION

This comparative study included 30 paraplegic wheelchair users having shoulder pain which were divided into 2 groups control and experimental (15-15 patients respectively). Experimental group received 4 weeks exercise program. Post therapy experimental group showed significant improvement ($p < 0.005$) in outcome measures WUSPI, CMS and COPM. But no significant difference was noted in Katz index of independence in ADLs.

Shoulder pain becomes a difficult issue limiting functional capabilities in paraplegic patients. Especially as the wheelchair mobilisation is dependent on shoulder functions and patients depends on upper

limbs for all activities of daily living. Prevalence of rotator cuff tear has been shown to be high in long term paraplegics. Also the structural and functional changes of the shoulder joint are more severe and the risk of development of shoulder girdle damage is significantly higher in individuals with long-term paraplegia than in age-matched controls [12]. Thus shoulder functions may deteriorate over a period of time and may lead to severe restriction of quality of life for paraplegics. Early intervention and preventive strategies in these patients need to be planned. Few studies have reported on various techniques and intervention programmes. Many studies showed that stretching and strengthening show greatest potential on reducing pain and improving function in paraplegics with shoulder pain [13-17]. As patients involved in our study were from paraplegic rehabilitation centre, during the baseline assessment itself, patients from both the groups had high score of Katz Index. So, in our study there was no difference between baseline and post treatment values of the Katz index of independence in ADL in the experimental group and the control group. Post treatment experimental group showed improvement in performance and satisfaction score of COPM which suggested that shoulder stretching and strengthening

exercises are exactly targeting the patient’s problem and providing improvement in functional and occupational performance as well. Post therapy our study showed significant difference between baseline and post treatment values of the wheelchair users shoulder pain index (WUSPI), Constant Murley Scale (CMS), Canadian Occupation Performance Measure (COPM) in the experimental group. But control group did not show any improvement. Katz index of independence in activities of daily living (ADL) did not show any improvement in score after treatment. This study showed that shoulder strengthening and stretching exercises were beneficial in improvement of shoulder pain and functional performance in paraplegic wheelchair users.

CONCLUSION

There was improvement in pain and functional performance in paraplegic wheelchair users having shoulder pain after treated with shoulder strengthening and stretching exercises for one month.

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Conflict of Interest – None

Source of Funding- Self

Ethical Clearance – An ethical clearance was obtained from the Institutional Review Board. Reg No: ECR/90/Inst/MH/2013.

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Efficacy of Compound Resisted Exercises on Functional Gait Parameters of Spastic Cerebral Palsy

Rashij M¹, HR Rai², Siva Priya³, Sinil Das⁴, Nikhil NP⁵, Linshina T⁶

¹PhD Scholar, ²Professor and Head, Orthopedics, Nitte University, Mangalore

³Physiotherapist, Goodlife Clinics, Coimbatore, ⁴Director, VKM Child Development Centre, Valancheri, Kerala,

⁵Assistant Professor, Physiotherapy, Nitte University Mangalore., ⁶Physiotherapist, VKM Special School, Valancheri, Kerala

ABSTRACT

OBJECTIVE - To study the efficacy of “Compound Resisted Exercises” on gait parameters of spastic CP

DESIGN - Informal experimental design (before and after no control group design)

SETTING - Child Development Centre, Valancheri, Kerala

PARTICIPANTS - 26 spastic cerebral palsy children with a mean age of 4.6 years, including 9 male and 18 females were studied for a total duration of 8 months. All the children were selected following strict inclusion and exclusion criteria. The study group was a mix of children with crouching, hemiparesis and vertical knee stiffness. Following the baseline evaluation procedures, the children were treated with specially structured compound resistance exercises under the NSCA guidelines. Post intervention data were collected at the end of 4 months of training.

OUTCOME MEASURES - Gait speed, 1 minute walk test, timed up and go test, 30 seconds sit to stand test, 10 meter walk test, Community Balance and Mobility scale, “Modified Ashworth Scale”

RESULTS – The pre and post test values were treated statistically using SPSS software. Student ‘t’ test and Wilcoxon signed rank sum test were used to study the significance. Also an analysis was done to assess the effects of the intervention on subgroups of CP

CONCLUSION - Compound resistance training is effective to improve the gait parameters in spastic cerebral palsy children. Children with crouching demonstrated superior improvements in the gait parameters compared to children with hemiparesis and stiff knee

Keywords: Spastic Cerebral Palsy, Gait Parameter, Compound Resisted Exercises, Types of CP gaits

INTRODUCTION

Muscle strength and power are essential components for any individual to perform activities in daily life and to study new functions. Without appropriate muscle strength, it is unable to carry out

even the basic motor tasks. Cerebral palsy is a chronic non progressive neurological condition in which the child characterizes very low muscle strength.^{1,2} Spasticity, impaired motor control, deformed body alignments are few other clinical presentations of CP which vary depending on the severity of the neurological involvement and thereby restricts these children to dependency.³

Corresponding Author:

Rashij M

PhD Scholar, Nitte University, Mangalore.

E mail shiju9999@gmail.com

It was believed that spasticity is the major reason for the limitation of motor functions in CP children

and therefore only, therapeutic approaches were focusing on reducing the spasticity.⁴ However these days there are a lot of research conclusions which has proven resistance training can produce changes in muscle strength of adult spastic conditions like stroke, head injury etc., without decreasing the flexibility.⁵⁻⁹ It is believed that, compound resistance training can favor worthy progress in the motor skills, including gait. Many researchers have recommended studying the effect of strength training in spastic CP ambulation.⁹⁻¹³

This study was carried out to analyze the effectiveness of compound resisted exercises on gait parameters in spastic CP. In this paper, we report our observations and conclusions on efficacy of compound resisted exercise on spastics using 1 minute walk test, 10 meter walk test, 30 second sit to stand test, Community Balance and Mobility Scale, speed, Timed Up and Go tests and Modified Ashworth Scale. So this study emphasizes on the resisted exercises which could improve the muscle strength and may provide independency for CP children in performing their daily activities.

METHODOLOGY

The study design was an informal experimental design (before and after no control). 27 spastics were included, 18 females and 9 males with a mean age of 4.6 years. The samples were identified from 'Child Development Centre', Valancheri, Kerala. The duration of this study was for 8 months. Ethical approval was obtained from Nitte University, Mangalore.

The inclusion criteria's were spastic CPs, GMFCS I – II,¹⁴ 2 – 8 years of age.¹⁴ Any other type of CPs, GMFCS III and above, children with perceptual and cognitive dysfunction, physical deformities, systemic diseases etc. were excluded. Participation consent from each parent was obtained for documentation purpose.

An universally followed pediatric assessment format was used to obtain the outcome measurements. These included the 1 minute walk test, 10 meter walk test, Community Balance and Mobility test, Timed up and go test, 30-s sit-to-stand test, Modified Ashworth Scale and speed. The subjects were engaged into 1 month of pre-intervention training as per the NSCA

guidelines.¹⁴

The spastic children were receiving compound resisted exercises which included both concentric and eccentric activities like vertical squats, leg press, inclined rowing, sit to stand, half knee rise, step up (lateral/forward), hamstring curls with hip extension and ankle plantar movements, back kicks, resisted diagonal open kinetic movements, resisted bridging, prone aero-plane, cycling, resisted reverse cycling and vertical arching. Free weights, elastic band, tubes and manual resistance were used as the resistors for the open kinetic activities. The therapy included a warm-up period for 5–10 minutes, exercise period of 30–35 minutes and cool-down period of 5 minutes, which altogether lasted 45–60 minutes, given with 40–60% of 1RM on non-consecutive days for 16 weeks. 1 minute rest between each exercises was allowed as the children senses the first sign of fatigue.¹⁴

The post intervention data were taken 4 months later. During the second half of the study, one child with vertical knee stiffness was excluded due to irregular attendance for therapy sessions. 26 subjects among the identified samples completed the study, which included 19 children with crouching, 5 hemiparesis and 2 vertical knee stiffness.

RESULTS

The availed data were analyzed using SPSS-17. The probability value used as the critical value to determine statistical significance was less than 5%.

Table 1. Demographic data of study participants

	Crouch	Hemiparesis	Stiff Knee
Mean Age	4.8	5.2	3.1
Male	7	1	1
Female	12	4	2
GMFCS I	5	3	0
GMFCS II	11	5	2

All the outcome measure identified for the study were easily administrable without any special training. The average time taken for 1mWT, 10MWT, 30sST, speed, TUG and MAS were less than 3 minutes whereas CBMS took around 20 minutes to perform.

The mean of pre and post intervention data were analyzed using student't' test to identify the efficacy

of compound resistance exercises in spastics. The results showed significant improvement in 1 minute walk test, 10 meter walk test, speed, Timed Up and Go tests ($p=0.000$). (Table 2)

Table 2. Comparison of Pre and Post intervention data student 't' test

Outcome Measures	Mean	SD	SE	P
1 MWT in Meter Pre – Post	-6.115	5.062	.993	.000
10m WT in Seconds Pre – Post	4.154	3.552	.697	.000
TUG in Seconds Pre – Post	3.385	3.034	.595	.000
Speed (m/sec) Pre – Post	-.12077	.10377	.02035	.000

The median of pre and post intervention data were analyzed to identify the efficacy of intervention by 'Wilcoxon Signed Rank Sum Test'. The results showed significant improvement in 30 second Sit to Stand and Community Balance and Mobility Scale (Table 3)

Table 3. Comparison of Pre and Post intervention data 'Wilcoxon Signed Rank Sum Test'

Outcome Measures	Significance	p
30s SST in No's Pre	0.5	.000
CB& M Post	0.5	.000

Before the intervention, the average gait speed of children with crouching was documented as 0.48m/sec whereas the hemiparesis were .7m/sec. The stiff knee CP had the least walking speed, 0.19m/Sec. Slight improvements were noted following the intervention where the gait velocity were recorded as 0.62, 0.81 and .22 m/sec for crouch, hemiparesis and stiff knee children respectively.

A comparative study on the mean and median values of the intervention outcome measurements were performed between the subgroups. Among the three subgroups of spastic CPs, only crouching had statistically significant improvements compared to others.

Table 4. Comparison between pre and post intervention date between groups

Type	Outcome measures (Pre and Post)	p
Crouch	1 MWT	.000
	10m WT	.000
	TUG	.000
	Speed	.000
	30s SST	.000
	CB&M	.000
Hemiparesis	1 MWT	.021
	10m WT	.070
	TUG	.178
	Speed	.098
	30s SST	.066
	CB&M	.043
Stiff Knee	1 MWT	1.000
	10m WT	.795
	TUG	.500
	Speed	.910
	30s SST	.310
	CB&M	1.000

DISCUSSION

Gait analysis of children with cerebral palsies demand more concerns. Neglecting earlier signs and symptoms of muscular co-activations, inter muscular in-coordination and spasticity can negatively influence their development. There are varieties of freely available clinical evaluation tools for the clinical therapists to assess the status and record the progress of the treatments related to gait.

This study has witnessed the clinical availability

of all spastic gait patterns described by Rodda and Graham (2001).¹⁵ These includes hemiplegia with drop foot, hemiplegia with true equinus gait, hemiplegia with stiff knee gait, hemiplegia with hip flexion gait, true equinus crouches gait, jump gait, apparent equinus gait, crouch gait.

Most spastics were showing marked co-activation of lower limb muscles. This phenomenon was described by Koscielny (2004),¹⁶ as "excessive co-activation within and between body-segments could be responsible for at least 3 times higher energy cost for walking in children with cerebral palsy. It is reported that these co-activation of muscles or abnormal synergies can be reduced by strengthening exercises and thereby reduce the energy expenditure and improve motor control.

In this study, the researcher has observed both male and female children are equally affected with CP. The reports from World Health Organization states that cerebral palsy can affect both gender in equal ration.

All children with cerebral palsy had significantly reduced muscle power. Children with CP complain of fatigue at very low intensive activities also. These weaknesses were observed more on the proximal muscles in crouching in contrast to the distal muscular weakness in hemiparesis. There were similar observation reported by Corry et al (1999),¹⁷ Rodda and Graham (2001).¹⁵

The age group selected for this study had limitations to perform higher complex exercises compared to many similar studies. However, the interventions were appropriately customized depending on the abilities of each child, but without changing the basic principles. The National Strength and Conditioning Association¹⁴ refers that there is no minimum age for participating in resistance training, if the participants have emotional and intellectual capacity to follow directs and perform their maximal effort. Rodda and Graham (2001).¹⁵ in their review of RCTs, that there is no reason to believe that appropriate age to start progressive resistance exercise training is different in CP.

GMFCS scale was administered to select the subjects for this study since the motor functioning is related to age and severity of CP. The use of GMFCS

is recommended by Dodd et al (2003).¹¹The RCTs by these authors included children classified at GMFCS level I and II, with some classifies at GMFCS level III.

The children with crouching had the classical picture of dorsi-flexion with hip and knee flexion. The hip flexion is because of weaker Gluteus Maximus, which is a major external rotator when the hip is extended as stated (Delp, Hess et al and Delp, Ringwelski, et al.)¹⁸⁻²⁰ Also, Spastic medial hamstring, ilio-psoas or the adductors are additional contributors to the internal rotation in most of the cerebral palsy clients (Sutherland DH et al²²and Chong et al.)²³

CPs with crouching were having pseudo adduction, i.e. Internal rotation at the hip joint made the limb to appear adducted [Perry - 43].²² Gage (1991)²³ reported that it is the tensional deformities shifts the direction of muscle action from the normal line of gait progression. There are reports stating that spastic adductors, limb length discrepancy and hip subluxation are observed in the coronal plane. Rodda and Graham (2001)²³described that the children with mild coronal and transverse plane issues recovers better treatments, might be due to the better angles of muscle pull.

The children with crouching had lesser baseline outcome values compared to the hemiparesis. Crouching requires considerable muscular efforts to prevent collapse (Peat and Hyman).²⁴ In contrast, the Hemiparetics substitutes this effort by spending 80% of the gait cycle on the uninvolved leg.³² We propose the possibility of low placed COG in crouching may also contribute to slow gait speed. Further studies are recommended on this.

The subjects displayed strength gain and better motor skills without observable hypertrophies from the 3rd week of intervention. This achievement are believed to be because of the neural adaptation Le-Mura (2004).²⁵ He says, strength gains through resistance exercises in two stages; the first weeks of training remodel the nervous system (motor learning like recruiting the correct muscles in the proper sequence) and once the "learning" phase begins to diminish, remodeling of the muscle takes place.

Olaf-Verschuren et al (2011)²²argues that resistance training involving only multi joint exercise is of limited benefit on strengthening very

weak muscles. They recommend single-joint muscle strengthening for very weak muscles.

Spasticity remained more or less unchanged with the intervention in all the three categories of CP. The ROM of hamstrings, adductors, rectus femoris, soleus and gastrocnemius muscles were assessed to confirm the effect of intervention on spasticity. This observation correlated with the reports of earlier studies.⁹⁻¹⁵

Since there were remarkable clinical recovery in the muscle strength of CP between the age of 2 – 8 without any reported complications and difficulties, we recommended extending the study to a higher age group of children. Also, the relationship between age related musculo-skeletal adaptation of CP and effect of compound exercises can be studied further in detail.

Limitations of this study were disproportional subgroups and lack of long term follow-ups. Statistics on individual categories of CBMS were not performed. Further study has to be done on this.

CONCLUSION

- GMFCS is an ideal tool to recruit participants in intervention studies related to CP.
- Compound resistance training is effective to improve gait parameters in spastic CP.
- Children with crouching demonstrated superior improvements in gait parameters compared to hemiparesis and stiff knee.

Conflict of Interest: None

Source of Fund: Self

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A Comparative Study of Flow and Volume Oriented Incentive Spirometry after Upper Abdominal Surgery Using PFT Studies

Vaibhav M Kapre¹, Manish Shukla²

¹Associate Professor, ²Assistant professor, MGM Institute of Physiotherapy, N-6, CIDCO, Aurangabad.

ABSTRACT

Objective of the study: To compare the efficacy between flow and volume oriented incentive spirometry (IS) after upper abdominal surgery using PFT studies. To determine the effectiveness of spirometer use after abdominal surgeries to prevent post operative pulmonary complications

Study Design: Experimental study design was adopted for the study.

Subjects: 40(20 in group 1 and 20 in group 2) patients from male surgery ward who had planned for upper abdominal surgery were randomly selected. Selection of these patients were based on inclusion criteria.

Sampling Criteria: Systemic Random sampling method is used

Procedure: 40 patients from male surgery ward who had planned for upper abdominal surgery were randomly selected. Before investigation of IS post operative parameters of FVC, IC, and MVV was investigated for any restrictive condition.

Group1 (flow oriented spirometer) :20 subjects were selected in this group. Subject was taught pre operatively the use of this type of IS.

Group 2(Volume oriented spirometry):20 subjects were selected in this group. They were given a volume spirometer (Voldyne spirometer

Follow up of the patient under study: The PFT values for improvement of the parameters of FVC, IC and MVV was taken on day, 15th day, 1st month and 2nd month.

Out come measures : Spirometer investigation for FVC, IC and MVV was performed with patient in seated position using RMS medispiral PC based computer interfaced machine. Pulmonary values were based on effort (best of three). They were done preoperatively and post operatively on intervals of 15th day, 1st month and 2nd month respectively.

Result: There is no significant difference between volume and flow oriented spirometry in the mean values of FVC and highly significant difference in IC and MVV.

Conclusion: Different types of incentive spirometer differ considerably in their post operative performance. These difference seen to be clinically relevant because of their impact on post operative incentive spirometer performance. The volume oriented Incentive spirometry allows improved maximal sustained inspiration and therefore might be more suitable for post operative respiratory muscle training.

KeyWords: Volume oriented Incentive spirometry, Flow oriented Incentive spirometry, Abdominal surgeries, Post operative pulmonary complications.

INTRODUCTION

Respiratory complications are the leading cause of post operative morbidity and death. Lung complication occurs in 25%-50% of patient undergoing major surgery. After abdominal surgery they reach a maximum within 48 hour. Full incision surgery of upper abdomen has more pulmonary complication then chest surgery and is followed by 20-40% of complications compared to 2-5% with lower abdominal surgery.

Recovery from major surgery is primarily endangered by postoperative pulmonary complications (PPCs), eg; atelectasis, pneumonia, or pulmonary dysfunction,^{1,2} Taking into consideration that effective therapy of postoperative respiratory disorders still is difficult, the importance of effective prophylactic and therapeutic respiratory training must be emphasized. At present, incentive spirometry is used clinically as part of the routine prophylactic and therapeutic regimen in preoperative respiratory care. However, the efficacy of incentive spirometry still is controversially discussed.

The most popular mechanical maneuver has been incentive spirometry (IS).^{3,9} IS has been shown to be at least as efficient as other methods (intermittent\ positive pressure breathing, deep breathing exercises). It is used extensively because it encourages deep breathing and needs minimal supervision.

So, this is a study to compare between the efficacy of volume and flow oriented incentive spirometer in a period of 2 month to reduce the PPCs after upper abdominal surgeries.

METHODOLOGY

TYPE OF STUDY: Single blinded prospective study.

STUDY SETTING: Study was performed at MGM Institute of physiotherapy Dept. Aurnagabad

DURATION OF STUDY: Duration of the study is of 2 months.

SAMPLE DESIGN

Sample Size: 40 patients (20 in group 1 and 20 in group 2)

Sampling Criteria: Systemic Random sampling method is used to divide the patients in to two groups.

SELECTION CRITERIA

Inclusion criteria:

1. Non smokers
2. Only male patients were included.
3. Age between 35-45
4. Height between 170-175cm
5. Elective upper abdominal surgery with vertical incision.

EXCLUSION CRITERIA

1. Patient with no pre operative obstructive or restrictive pulmonary disoreder.
2. patient with no history of cardiac disease
3. No history of hypertension
4. With no systemic disease
5. Presence of severe sensory or cognitive deficit
6. Presence of any other medical co-morbidities.
7. Patients were excluded if they were already enrolled for some other form of studies.

VARIABLE OF THE STUDY

Independent variables: flow and volume oriented incentive spirometer.

Dependent variables:

- Forced Vital Capacity (FVC)
- Inspiratory Capacity (IC)
- Maximal Voluntary Ventilation (MVV)

MATERIAL

1. Spirometer – RMS , medspiror Pc based with computer interfaced machine for measurement.
2. Flow oriented incentive spirometer (Hudson 1200cc\sec)
3. Volume oriented incentive spirometer (Voldyne spirometry 5000 manufactured by Sherwoot Medical.Saint Louic,USA)
4. Nasal clip
5. Gauze piece

PROCEDURE OF STUDY

40 patients from male surgery ward who had planned for upper abdominal surgery were randomly selected. Selection of these patients were based on inclusion criteria.

Preoperative investigation for FVC, IC and MVV - the patient were then informed regarding the procedure and purpose of the study in detail individually. They were randomly assigned to group 1 and group 2. They were taught preoperatively the use of respective IS. Each patient duly signed his consent form.

Ethical committee of MGM Institute of Health Sciences, Aurangabad had approved the protocol for the present study. All selected patients were having general anesthesia during surgery and vertical mid line incision. All patient were stable in condition before participating in the study.

Before investigation of IS post operative parameters of FVC, IC, and MVV was investigated for any restrictive condition.

Group1: 20 subject were selected for this group. Subject was taught pre operatively the use of Flow oriented spirometer type of IS. All subject received the same instruction on second post operative day.

Group 2: 20 subjects were selected in Volume

Table no. 1: Comparison between group 1 (flow oriented IS) and group 2 (volume oriented IS) in the mean values of FVC.

FVC	Group 1 mean±SD	Group2 mean±SD	't' value	'p' value	results
Pre operative	4.47±0.07	4.47±0.07	0	P>0.05	Not Significant
15 th day	3.31±0.47	3.50±0.39	1.46	P>0.05	Not Significant
1 month	4.18±0.41	4.43±0.42	1.67	P>0.05	Not Significant
2 month	4.52±0.48	4.69±0.41	1.21	P>0.05	Not Significant

After applying unpaired t-test there is no significant difference in the mean values of FVC in flow oriented IS and volume oriented IS.

Table no. 2: Comparison between group 1 (flow oriented IS) and group 2 (volume oriented IS) in the mean values of IC.

IC	Group1 mean±SD	Group2 mean±SD	't' value	'p' value	Results
Preoperative	3.37±0.17	3.66±0.27	4.14	P<0.01	Highly Significant
15 th day	2.93±0.19	3.16±0.17	4.6	P<0.01	Highly Significant
1 month	3.25±0.17	3.48±0.70	4.6	P<0.01	Highly Significant
2 month	3.38±0.14	3.60±0.15	5.5	P<0.01	Highly Significant

After applying unpaired t-test there is highly significant difference in the mean values of IC in flow oriented IS and volume oriented IS both pre and post operatively. There is also highly significant difference

oriented spirometry group (Voldyne spirometer) On second post operative day patient were investigated as restrictive and was intervened with volume IS.

Follow up of the patient under study:

- The PFT values for improvement of the parameters of FVC, IC and MVV was taken on day, 15th day, 1st month and 2nd month.

DATA ANALYSIS AND RESULTS

Group-1 (flow oriented incentive spirometer)

After applying paired t test, there is highly significant difference between the preoperative mean value of FVC, IC and MVV with post operative 15th day, 1st month and 2nd month respectively i.e. p<0.01

Group2 (volume oriented incentive spirometer)

After applying paired t test, there is highly significant difference between the preoperative mean value of IC with post operative 15th day, 1st month and 2nd month respectively i.e. p<0.01.

between group 1 and group 2 preoperative and post operative 15th day, 1st month and 2nd month in IC value i.e. p<0.01.

Table no. 3: Comparison between group 1 (flow oriented IS) and group2 (volume oriented IS) in the mean values of MVV.

MVV	Group 1 mean±SD	Group2 mean±SD	't' value	'p' value	Results
Preoperativ	150.2±12.72	156±13.03	1.97	P<0.05	Significant
15 th day	115.95±17.59	130.05±21.85	2.27	P<0.05	Significant
1 month	140.7±15.01	155.2±14.03	3.22	P<0.01	Highly Significant
2 month	149.8±10.33	165.15±7.49	5.38	P<0.01	Highly Significant

There is highly significant difference pre operatively and highly significant difference post operatively on 2nd month.

There is also significant difference between mean values of MVV between group 1 and group 2 on preoperative and post operative 15th day i.e p<0.01.

There is also highly significant difference preoperative and post operative on 1st month and 2nd month in mean value of MVV i.e. p<0.01.

Our results shows that, there is significant difference between pre operative and 15th day to 2nd month PFT variables of FVC, IC and MVV of group 1 (flow oriented IC) and highly significant difference of same in group 2 (volume oriented IS). There was no significant difference for FVC between group 1 and group 2. but there was highly significant difference for IC and MVV. So it can be said that, there is no significant difference between volume and flow oriented spirometry in the mean values of FVC and highly significant difference in IC and MVV.

DISCUSSION

Our results shows that incentive spirometry technique is an effective treatment in improving pulmonary functions i.e. FVC,IC and MVV for patients with post abdominal surgeries there exists manifolds variables, whether patient related (age, concomitant pulmonary disuse) or care related (e.g. type of surgery , anesthesia or analgesia) have an impact on efficacy or reparatory care and yield results.

Surprisingly to date very studies concerned with incentive spirometry focused on the technical aspects of different incentive spirometers and their potential impact on clinical incentive spirometry performance. During incentive spirometry an additional Wbimp generated by the device that depends on constructional

characteristics such as the diameter of the spirometer cylinder and the shape of and weight of the plate or ball that is lifted by the inspiratory effort. The patient has to overcome this additional Wbimp by increased inspiratory effort.

Incentive spirometry can be useful in patients who are resistance or unable to cooperate fully with maximal inspiratory efforts. Post operative hypoxemia may be reduced with this technique which uses the principles of sustained inspiration using a feed back device to achieve maximal inflation pressure in the alveoli and maximal inhaled volume. Incentive spirometer can be used independently by the patient. This technique ensures that each inspiration is physiologically optimal and is reproduced precisely from one inspiration to the next. Patient who are at surgical risk benefit from being taught the use of incentive spirometer during pre operative teaching by the physical therapist to promote better inflation of lung with incentive spirometry post operatively.

CONCLUSION

Different types of incentive spirometer differ considerably in their post operative performance. These difference seen to be clinically relevant because of their impact on post operative incentive spirometer performance. There is no significant difference between volume and flow oriented spirometry in the mean values of FVC and highly significant difference in IC and MVV. The two differ in additional work of breathing (WBimp) in clinical setting where volume oriented IS is with low additional WBimp which improves respiratory muscle function. Thus volume oriented Incentive spirometry allows improved maximal sustained inspiration and therefore might be more suitable for post operative respiratory muscle training.

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CONFLICT OF INTEREST

SUGGESTIONS

- Similar study with large sample size with other type of abdominal and \ or thoracic surgery should be carried out.
- More subjects with some respiratory disease should be carried out to see the effectiveness of incentive spirometer in pulmonary diseases.

LIMITATIONS

- Analysis of other parameters in pulmonary function.
- Analysis of blood gases for PO₂ and PCO₂ measurement during insentive spirometer.

Funding: Self funded.

Ethical Clearance: Ethical committee of MGM Institute of Health Sciences, Aurangabad had approved the protocol for the present study.

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Correlation between Patellofemoral Pain and Foot Posture

Ravinder Kaur Marwaha¹, Apurva V Ranade², Amala V Sahasrabudhe², Pranita Jaiswal³, Savita Rairikar⁴, Parag Sancheti⁵

¹Associate Professor, ²BPTH, ³M.P.Th Student, ⁴Principal and Professor, Sancheti Institute College of Physiotherapy.

⁵Chairman and Orthopedic Surgeon, Sancheti Institute for Orthopedics and Rehabilitation, Pune, Maharashtra

ABSTRACT

Background : Patellofemoral pain syndrome (PFPS) is the most common cause of knee pain. It is caused by imbalances in the forces controlling patellar tracking during knee flexion and extension, particularly with overloading of the joint. The position of foot plays important role in patellofemoral biomechanics. Altered foot position causes abnormal biomechanical changes in patellofemoral joint causing pain. Abnormal foot position and subsequent rotation of the lower extremity has been hypothesized as being contributory to patellofemoral pain (PFP). The purpose of this study was to correlate between patellofemoral pain and foot posture.

Objectives

- To find out intensity of pain on visual analogue scale.
- To find out foot position on foot posture index.
- To find out functional status on Patellofemoral Pain Severity Scale.
- To find out correlation between intensity of pain, foot posture index and Patellofemoral Pain Severity Scale.

Method: Hundred subjects were included diagnosed with patellofemoral pain syndrome. The pain of the subjects was evaluated on Visual analog Scale. To check the involvement of patellofemoral joint Clarke's test was performed. Foot position was evaluated using Foot Posture Index. Functional status was evaluated on Patellofemoral Pain Severity Scale.

Results: There was positive correlation between intensity of pain and foot posture index (r value= 0.340), negative correlation between intensity of pain and Patellofemoral Pain severity scale (r value= -.378).

Conclusion: In This study it was found that there is a positive correlation between patellofemoral pain and foot posture and negative correlation between patellofemoral pain and Patellofemoral Pain Severity Scale.

Key words: Patellofemoral pain syndrome, Foot Posture Index, Patellofemoral Pain severity Scale, pronated foot.

INTRODUCTION

Patellofemoral pain syndrome is also called as "Anterior knee pain". The Patellofemoral joint is a complex articulation that depends on both dynamic and static restraints for stability. The patella articulates with the intercondylar groove on the anterior aspect

Name of Corresponding Author:

Dr. Ravinder Kaur Marwaha

Associate Professor M.P.Th (Musculo)

Address: Essenseia A-202, near Talab factory,
Kondhwa Budruk, Pune 411048. Phone No. –
9823236752, Email id: drravinder82@gmail.com

of the distal portion of femur and is connected to tibia by the ligamentum patellae. Its articulating surface is covered with smooth hyaline cartilage. As the knee flexes, the patella enters the intercondylar groove with its inferior margin making first contact, and then it slides caudally along the groove. With extension, the patella slides cranially. If patella movement is restricted, it interferes with the range of knee flexion and may contribute to an extensor lag with active extension¹

Patellofemoral pain syndrome can also occur following a knee injury if the muscles of the quadriceps, especially the vastus medialis on the medial, become inhibited or considerably weakened. Other factors which can cause patellofemoral pain include, Overloading, over pronated Feet, Pronated or flat feet which causes the knee to rotate inwards affecting the alignment of the patella and Q-angle. Repeated bending and loading, may lead to damage of the underlying structures and cause pain. A larger Q angle is common in women due to their wider pelvis. This is why more women suffer with this condition than men².

Patellofemoral pain syndrome may be caused by overuse, injury, excess weight, patellar tracking disorder. The main symptom of patellofemoral pain syndrome is knee pain, especially when sitting with bent knees, squatting, jumping, or using the stairs. When bending and straightening the knee, several muscles surrounding the joint act together to cause the patella to run in a straight line within the intercondylar groove, formed by the Femur and Tibia. If any of the structures are particularly tight or weak, this causes an imbalance which can result in the patella mal-tracking³.

Foot Posture Index (FPI) is a one of the diagnostic clinical tool aimed at quantifying the degree to which a foot can be considered to be in a pronated, supinated or neutral position. The FPI evaluates the multi-segmental nature of foot posture in all three planes⁴.

One of the study was done in 2010 on "Foot and ankle characteristics in patellofemoral pain syndrome: a case control and reliability study", which showed that the individuals in the PFPS had a more pronated foot posture when assessed by the foot posture index

and longitudinal arch angle, and for all measurements relative to subtalar joint neutral⁵.

Another study was done In 2008 on "The correlation between pes planus and anterior knee or intermittent low back pain" which concluded that Moderate and severe pes planus was associated with nearly double the rate of anterior knee pain and intermittent low back pain, while mild pes planus was associated with no higher rate for these problems⁶.

Literature shows, many studies were done on patellofemoral pain and Foot posture having significant results but there was no correlation done between the two. Thus, the purpose of the study was to find the correlation between the Patellofemoral Pain and Foot Posture.

METHOD

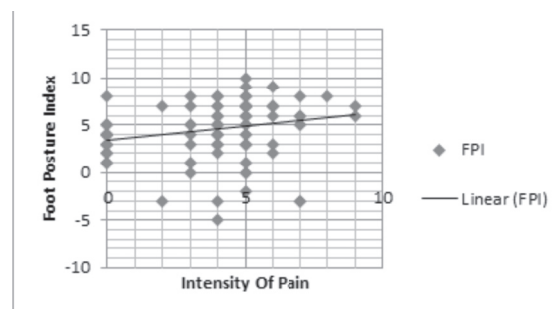
Hundred subjects in the age group of 20-50 yrs (Mean 44.78, SD +/-6.33) who were diagnosed as patellofemoral pain were included, prior consent from the patients was taken. History of pain and symptoms was noted. The Pain was evaluated on Visual Analogue Scale. Clarke's test was performed to check the involvement of patellofemoral joint. Foot position was evaluated using Foot Posture Index and patients were asked to fill the Patellofemoral Pain severity Scale.

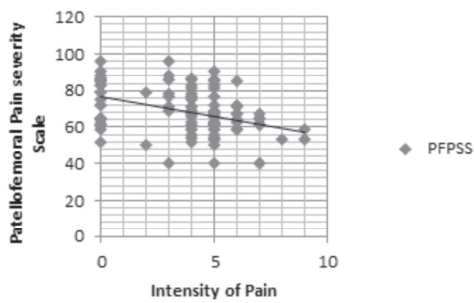
DATA ANALYSIS

Spearman's correlation test was used to correlate between intensity of pain and foot posture index and to correlate intensity of pain and patellofemoral pain severity scale. All the analysis was done using SPSS version 12.

RESULTS

Graph 1- Intensity of Pain and Foot Posture Index



Graph 2-Intensity of Pain and Patellofemoral Pain Severity Scale

DISCUSSION

In this study 100 subjects were included, 84 were females and 16 were males as females are more predisposed to PFP because of increased Q angle due to wider pelvis. Also, due to increased weight, there is more compressive loading over the knee. In a study by Boling m et al (Sep 2009) it was seen that females are more likely to develop PFPS than males⁷.

This study shows that there was a significant correlation between altered foot position and patellofemoral pain (PFP). It also shows that intensity of foot position leads to functional disability with respect to daily activities. Patellofemoral pain mainly occurs due to altered biomechanics of the patellofemoral joint which places increased compressive forces at the PF joint. Daily activities such as squatting, descending stairs cause repetitive micro trauma (grinding) leading to thinning of articular cartilage. Over a period of time, there is subchondral bone exposure, synovial irritation and inflammation which give rise to pain. In a study by Gerbino et al (Feb. 2006) it was proved that main cause of pain is exposure of subchondral bone⁸.

From the Graph 1, it is found that there is a positive correlation between intensity of patellofemoral pain and altered foot position. Patellofemoral pain mainly occurs due to altered biomechanics of the patellofemoral joint which places increased compressive forces at the PF joint. Daily activities such as squatting, descending stairs cause repetitive micro trauma (grinding) leading to thinning of articular cartilage. Over a period of time, there is subchondral bone exposure, synovial irritation and inflammation which give rise to pain. In a study by Gerbino et al (Feb. 2006) it was found that main cause

of pain is exposure of subchondral bone⁸.

The foot position in patients with patellofemoral pain is evaluated using foot posture index and patients with altered foot posture showed more pronated foot posture than supinated foot. In a study done by Barton CJ and Bonanno D (May 2012) it was found that patients with PFP showed overpronated foot posture^{4,9}.Foot pronation often occurs in patients who lack a supportive medial arch. It causes a compensatory internal rotation of the tibia or femoral anteversion that upsets the patellofemoral mechanism causing pain. Compared with a normal foot, a high-arched foot provides less cushioning for the leg when it strikes the ground. This places more stress on the patellofemoral mechanism causing patellofemoral pain¹⁰.

The probable cause for PFP in patients with normal foot posture can be other factors causing PFP like overuse or overload injury. During activities like squatting, stair climbing the compressive load over patella is more increasing the grinding of patella contributing pain¹⁰. In a study by mark s. Juhn [1999 Nov 1; 60(7):2012-2018] it showed that overload and overuse injury can be one of the cause of PFP¹⁰.

From Graph 2, it was seen that there is a negative correlation between Patellofemoral Pain Severity Scale and Intensity of Patellofemoral Pain. It shows that more the intensity of pain less is the functional outcome of the patient. As squatting, stair climbing, sitting for prolong time with knee flexed, walking all these activities causes change in the biomechanics of the patellofemoral joint.

When the foot is over pronated, the calcaneus goes into eversion. It also causes medial rotation of the talus further causing medial torsion of the tibia. This leads to lateral tilting of the patella and alters kinetics of patella over the femur causing repetitive grinding during flexion and extension of the knee more the intensity of pain less is the functional capacity of the patient. In patients with over pronated foot there is change in the biomechanics of the patellofemoral joint. In daily activities like squatting, prolonged sitting with knees flexed places excess compressive forces on the patella causing repetitive grinding of patella leading to thinning of articular cartilage and exposing subchondral bone. This increases pain

and in turn impairs functionality of the patient¹². R Thomee et al (Jan 2007) showed that more pain was associated with increased activity¹¹.

It is found that there is a positive correlation between intensity of patello femoral pain and altered foot position. In the patients with altered foot posture the intensity of pain ranged from moderate to severe. The study shows that there was a significant correlation between altered foot position and patellofemoral pain (PFP). It also shows that intensity of foot position leads to functional disability with respect to daily activities.

Foot evaluation is often neglected in cases of patients with patellofemoral pain as altered foot position is one of the causes of patellofemoral pain. Evaluation of foot posture in patients with patellofemoral pain should be done as it can improve the effectiveness of the treatment and use of foot orthosis have been proved effective in such patients¹¹.

CONCLUSION

In this study it was found that there is positive correlation between patellofemoral pain and foot posture and negative correlation between patellofemoral pain and Patellofemoral Pain Severity Scale.

Acknowledgement

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Conflict of Interest – None

Source of Funding- None

Ethical Clearance- The study was approved by the institutional review board. Committee registration no.-ECR/90/Inst/MH/2013.

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Effect of Nervous Tissue Mobilization on Hand Function in Leprosy

Dabholkar Tejashree Ajit¹, Dabholkar Ajit S², Yardi Sujata³

¹Assistant Professor, ²Associate Professor, ³Prof and Director, at Department of Physiotherapy, Pad.Dr.D.Y.Patil University, Nerul, NaviMumbai

ABSTRACT

Background & Purpose of the Study: Leprosy patients can have sensory as well as motor hand function involvement. Nervous tissue mobilisation has been reported to be an effective intervention for conditions like carpal tunnel syndrome though benefits are still under research. The effect of nervous tissue mobilization in leprosy is not studied. Thus this study studies effect of nervous tissue mobilization in leprosy hand.

Objectives: 1. Effect of nervous tissue mobilization on grip and pinch strength in leprosy.

2. Effect of nervous tissue mobilization on sensory hand function in leprosy.

Methodology: subjects with only type one leprosy hand were included in the study whereas those with type II & III and with Previous history of any neurological & musculoskeletal pathology.

Outcome measures: pinch strength by using pinch meter, grip strength using Jamar hand dynamometer, tactile sensitivity using Semmes-Weinstein monofilament and pressure threshold using pressure algometre.

60 subjects were randomly assigned into two groups Experimental (Group-A), and Control group (Group-B), All patients were evaluated for baseline data of the above mentioned outcome measure. Neural tissue mobilisation given for group A 3 times a week for 3 weeks. Follow-up evaluation was done at the end of each week and one week after 9th session. Participants in control group received sham neural mobilisation.

Results: Study revealed statistically significant improvement of pinch ($p=0.0006$, mean difference-6.967) & grip strength ($p=0.0400$, mean difference-8.500) in an experimental group. Pressure sensitivity improved significantly in experimental group ($p<0.001$, mean difference=-3.214). tactile sensitivity of ulnar shows statistically significant improvement of experimental group ($p=0.0366$, mean diff=0.213).

Conclusion: Nervous tissue mobilisation is effective in improving pinch and grip strength as well as sensory hand function in leprosy

Key words: leprosy hand, nervous tissue mobilization, strength, sensory.

INTRODUCTION

Corresponding Author :

Dr. Tejashree Ajit dabholkar

Address- Pad.Dr.D.YPatil university. Nerul, Navi Mumbai. Dept of Physiotherapy. 6th floor, Navi Mumbai 400708. Mobile No. 9167047445

The hand is an important sensory end organ. Leprosy is the condition which affects sensory as well as motor function of the hand. Patients with leprosy can have reduced sensation either due to end organ invasion by bacilli or by nerve trunk invasion. A stage

of functional blockage of conduction of nerve impulse almost always precedes visible pathological changes in the nerve.¹ The role of electrophysiological evaluation of nerve function in the diagnosis and assessment of different neuropathies is well established.² There have been few studies of motor nerve conduction in leprosy affected nerves^{1,3-11} and still fewer regarding sensory nerve conduction which have shown that marked slowing of conduction may occur in leprosy affected nerves. A significant decline of motor nerve conduction velocities has also been reported in clinically normal nerves in leprosy. All nerve fibres are not destroyed in leprosy; some functional fibres remain even in badly damaged nerves. Regeneration of nerve fibres has been demonstrated histologically proximal to the nerve swellings.^{12,13}

In an area of sensory loss, the outer zone reveals reduced sensitivity and the inner area shows complete sensory loss. In a study of ulnar nerve damage (up to 1 yr), it was revealed that the loss of nylon filament perception was in a wider area compared to that of temperature and pain, in that order¹⁴

The endothelium of endoneurial vessels, in affected nerves, generally was normal. Occasionally, however, gaps and fenestrations were seen and there were histological indications that leakage of blood plasma had occurred through the gaps and through the basement membrane of the endothelium.

Occlusion of endoneurial vessels was found only in the oldest patient and the degeneration of nerve fibers generally observed thus is considered not to be caused by ischaemia. Histopathology in epi- and perineurial vessels was definitely less pronounced than in endoneurial vessels.¹⁴ Nervous tissue mobilisations is a part of manual therapy that has been reported to be an effective intervention for certain conditions, including carpal tunnel syndrome. Neural mobilisation utilising tensioning techniques is used by physical Therapists in the treatment of patients with cervical and/or upper extremity symptoms. The underlying mechanisms of potential benefits associated are unknown. Hence this study is done to assess the effect of nervous tissue mobilisation on leprosy hand function.

MATERIALS & METHOD

60 subjects, diagnosed cases of leprosy, type

I as per WHO disability criteria¹⁵ are randomly selected for the study whereas subjects with type II & III and Subjects with psychological involvement were excluded from study. Subjects were randomly divided into Gr.A (Experimental) and Gr. B (control). All most all the patients in the study were cases of multibacillary leprosy and were under medications. Male to female ratio in our study was 2:1. All participants were evaluated for baseline data for pinch using pinch meter, Grip strength using Jamar Dynamometry¹⁶, pressure threshold using pressure algometer and tactile sensitivity using Semmes-Weinstein monofilaments (SW)¹⁷⁻¹⁸. Evaluation of same parameters were done on 9th session and 1 week after 9th session. The rationale for obtaining measures 1 week following 9th session was to determine if there were any lasting carryover after a 1-week period with no NM provided. Patients received either a NM or sham NM intervention for total 9 sessions. All data was analyzed using paired and unpaired 't' test. Neural mobilisations involved ulnar, median, and radial irrespective of which nerve is affected. Neural mobilisation designed by Dr. David Butler was given. Intensity of mobilisation progressed from grade I to IV as required to get complete range. A neurodynamic test for the median nerve was performed similar to those reported in the literature. The participant was positioned supine and the cervical spine was positioned in approximately 25° of contra lateral lateral flexion or when the first sense of increased resistance was perceived by the investigator, whichever occurred first. This option was provided to account for participants where a first sense of resistance was perceived by the investigator prior to achieving 25° of contra lateral lateral flexion of the cervical spine. This was followed by the following consecutive positioning procedures: (1) the application of passive scapular depression until a sense of resistance was perceived by the investigator; (2) 90° of combined shoulder abduction and external rotation; combined forearm supination, wrist extension, finger extension until a sense of resistance was perceived by the investigator; (3) elbow extension was then applied until a sense of resistance was perceived by the investigator or when shoulder girdle elevation was noted. A research assistant recorded elbow extension ROM with a universal goniometer; (4) the participant was asked to actively slide the head back to a neutral position; (5) the investigator applied

additional elbow extension until a sense of resistance was perceived or when shoulder girdle elevation was noted. Again, a research assistant recorded elbow extension ROM, as previously described. Participants rated predetermined sensory descriptors during the application of neurodynamic testing procedures. Sensory descriptors were rated via a 10- cm VAS during step 3 as described above.

All participants were blinded to their group assignment, while the investigator was aware of participant single blind trial. Participants received intervention 2 to 3 times per week until they completed 9 sessions.

The NM tensioning technique consisted of 2 exercises. The first exercise involved passively positioning the participant in the neurodynamic testing position. As the position was assumed, 10 cycles of passive elbow flexion/extension, at a rate of approximately 6 seconds per cycle (3 seconds into extension and 3 seconds into flexion), were provided (Upon moving from elbow flexion to extension, an initial sense of resistance perceived by the investigator was used as a sign to alternate directions.

Following the 10th cycle, a static hold was maintained while in elbow extension for 10 seconds. The second exercise involved the same initial neurodynamic test positioning, with the exception of any cervical

Components (i.e., the cervical spine was positioned in a neutral position). Instead of mobilizing the elbow, the participant was asked to perform active movements, consisting of cervical lateral flexion away from the test extremity, to and from a neutral position Participants were asked to only encounter an initial

sense of resistance when moving into the direction of lateral flexion. This was repeated for a total of 10 cycles. Following the 10th cycle, a static hold was maintained while in lateral flexion for 10 seconds.

Participants Who Received Sham Neural

Mobilization Participants in the sham NM group received a treatment consisting of manoeuvres that mimic the NM treatment but believed not to stress the neural tissues in the upper extremity The sham NM consisted of passively positioning the participants in the following consecutive positions: (1) a neutral cervical spine (0° of lateral flexion), (2) 45° of shoulder abduction without scapula depression, and (3) 45° of shoulder external rotation combined with 45° of elbow flexion with forearm pronation. This was immediately followed by 10 cycles of passive wrist flexion/extension at a rate of approximately 6 seconds per cycle (3seconds into extension and 3 seconds into flexion upon moving

From wrist flexion to extension, an initial sense of resistance was used as a sign to alternate directions. Following the 10th cycle, a static hold was maintained while in wrist flexion for 10 seconds. Neural mobilisation was given for ulnar and radial nerve bias as per the literature¹⁹. similar mobilisation for ulnar and radial component given as per the standard techniques.

Data analysis –Table 1 Demography

SR No.	GROUPS	MEAN AGE AND S.D	NUMBER OF SUBJECTS
1	A (Experimental)	34.53 ±10.37	N=30
2	B (Control)	37 ± 9.98	N=30

Table2 Change in outcome measures of hand.

	Pinch		pressure		Tactile						Grip	
	A	B	A	B	Ulnar		Median		Radial		A	B
					A	B	A	B	A	B		
PRE	19.77	19.03	6.88	6.01	3.39	3.59	3.24	3.24	2.96	2.93	34.28	51.83
POST	28.53	21.58	9.55	6.33	2.96	3.17	2.93	3.04	2.88	2.88	40.17	43.333
	P<0.0001**		P<0.0001**		P=0.0366*		P=0.203#		P=0.5#		P =0.0400#	

** extremely significant, *significant # not significant

DISCUSSION

Neural mobilization is advocated for treatment of neurodynamic dysfunction. To date, the primary justification for using neural mobilization has been based on a few clinical trials and primarily anecdotal evidence. Following a systematic review of the literature examining the therapeutic efficacy of neural mobilisation, 10 RCTs discussed in 11 studies were retrieved. A majority of these studies concluded a positive therapeutic benefit from using neural mobilization. However, in consideration of their methodological quality, qualitative analysis of these studies revealed that there is only limited evidence to support the use of neural mobilization.¹⁹

Pinch and grip strength depends on various factors including muscle strength and neuromuscular co-ordination. Normal extensibility and elasticity of nervous tissue is an important component. Butler mobilization is an effective technique.

A nerve when passing close to a joint is usually contained in a tunnel or attached with collagen fibers or fascia to the surrounding musculoskeletal components. Nerves run along a longitudinal axis in the upper limb thus mobilisation given during treatment cause breaking of the cross linkages. The nerves move towards the joint that is moving. The larger the amplitude of movements at a joint, more of the sliding phenomenon of the nerve occurs at the joint. Thus, large amplitude movements maintain the mobility of the joint as well as a nerve.

Nervous tissue mobilization helps to re-established the dynamic equilibrium of neural tissue and normalize the physiological function (Clinical Neurodynamics – Shaclock M.) .Vesicle clustering increases in responses to applied stretch. (Scott siechen et al.PNAS 2009). F- Actin polymerization (Scott Siechen et al. PNAS 2009)is seen with stretch. One possible effect of stretch on axons is the enhanced ion flux through stretch sensitive ion channels (Glogauer M,et al.J of cell sci 1997-98). In particular, Ca^{2+} influx can trigger increased Actin polymerization, force generation, regulation and downstream signalling cascades, as well as mediate vesicle localization under the membrane from which they are released. Mechanical stimulation using low frequency, low intensity ultrasound has been shown to excite

neurons in mouse brain by activating voltage gated sodium and calcium channels. Slow elongation cause structural changes in the form of -Modifications in Myelin sheath, Axon regeneration, Deposition of Endoneurial Collagen (Hara Y et al.Exp Neurol 2003).The nodes of ranvier open further as do the Schmidt-Lanterman clefts which affects the levels of local cytoplasm(Butler 1991 Mobilisation of nervous system Churchill Livinstone).

Mechanical Stimulation (Tyler WJ,et al.PLOS ONE 2008) using low frequency ,low intensity ultrasound has been shown to excite neurons in mouse brain by activating voltage gated sodium & calcium channels.

Muscle stretch thus might enhance the release of neurotransmitters either by elevating internal calcium concentrations or by increasing the sensitivity of transmitter release to calcium in the nerve terminal.(BM Chen and Grinnell SCIENCE 1995). Non neural component-During a neural tissue mobilization there is a stretch of the muscular component, which leads to an increase in the initial length of the muscles and hence there is a better contraction. (Frank Starling's Law- The force of contraction is proportional to the initial length)

The neural mobilization technique also resulted in improvements in ROM and sensory descriptors at 2 weeks and the carryover assessment. Coppeters et al¹³ has indirectly confirmed the neurodynamic test for the median nerve thus suggesting the nervous system is the limiting factor during the test.Neurophysiological effect of spinal manipulations have been previously reported in the literature²⁰Studies indicate that mobilization of nervous tissue increases peripheral blood flow, implying a physiological shift toward parasympathetic dominance (Kornberg).improved neurological properties is indicative of improved grip, pinch strength &improved sensory function. Sensory improvement is mainly seen in ulnar nerve as ulnar tactile sensitivity was mostly affected in study population. Tactile sensitivity was not much affected for radial &median group. Improvement of sensory parameters seen in our study is well supported with improvement seen in asymptomatic subjects following neural mobilisation.²¹

Conclusion: Nervous tissue mobilisation is effective

in improving motor as well as sensory hand function in leprosy

Conflict of Interest-None

Funding –Nil

Ethical Clearance- Given by Pad.Dr.D.Y.Patil University & research centre, Nerul, Navi Mumbai.

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Intertester and Intratester Reliability of Chest Expansion Measurement using a Cloth Tape

Ravi Solanki¹, Renu Joshi², Anjali Bhise³

¹Tutor, Government Spine Institute & Physiotherapy College, Civil Hospital, Ahmedabad 380016, Gujarat,

²Private Practitioner, Ahmedabad; ³Senior Lecturer & Principal Government Physiotherapy College Civil Hospital Ahmedabad 380016.

ABSTRACT

INTRODUCTION AND PURPOSE OF STUDY: For chest expansion measurement to be useful clinically, all therapists should obtain similar values. Without an ability to replicate measurements, therapists can not universally interchange or interpret measurements. So the purpose of study was to evaluate intertester and intratester reliability of chest expansion measurement with cloth tape in healthy young male adults.

STUDY DESIGN: Cross sectional observational study.

MATERIAL AND METHOD: Study was conducted at Government Physiotherapy College, Ahmedabad. Study includes 50 healthy male subjects with age group of 18 to 25 years and body mass index <25. Chest expansion was measured with cloth tape during 2 slow vital capacity maneuvers at axilla and xiphoid level in standing position by 2 investigators to determine intertester reliability and by same investigator after 20 minutes of rest to determine intratester reliability.

RESULTS: Intraclass Coefficient of Correlation was calculated which showed excellent intertester and intratester reliability ($r=0.91$ at xiphoid and $r=0.72$ at axilla). Z-test was applied to determine intertester reliability which showed insignificant differences in chest expansion values between 2 investigators. Results also showed greater reproducibility of chest expansion values at xiphoid than at axillary level.

CONCLUSION: The study shows excellent intertester and intratester reliability of chest expansion measurement in healthy young male adults. It also concludes better reliability of chest expansion measurement at xiphoid level.

Keywords: Chest expansion, Reliability, Cloth tape

INTRODUCTION

Chest expansion has been defined as difference between chest wall circumference at maximal inhalation and maximal exhalation. Mobility of chest wall is one of the important aspects of clinical

evaluation in various respiratory dysfunctions. In clinical settings, chest expansion measurements are used to evaluate mobility of chest wall in various restrictive pulmonary disorders like Ankylosing Spondylitis, Muscular dystrophies, Idiopathic scoliosis and Obstructive diseases like COPD.¹⁻¹⁴ Clinically, evaluation of patient's baseline status, effectiveness of pulmonary rehabilitation and progression of underlying respiratory or neuromuscular disorders with regard to chest wall motion and respiratory muscle strength is done by measuring chest expansion. Various devices have been used to measure chest expansion i.e. spirometry,

Corresponding author:

Ravi Solanki

M.P.T (Cardio-Pulmonary)

Tutor, Government Spine Institute & Physiotherapy College, Civil Hospital Ahmedabad 380016

Email: ravisolanki@gmail.com

respiratory inductive plethysmograph. In clinical settings, the method which is inexpensive and simple is most appropriate for professionals. Chest expansion measurement using cloth tape is straight forward and easy to apply in clinical practice.

Clinically, any outcome measurement which is used in the process of patient examination, treatment and re-examination should be meaningful and valid.¹⁵ Acceptable reliability and validity is necessary for any clinical outcome measurement to be useful. Without an acceptable reliability, the outcome measurement can not be universally interchanged or interpreted by professionals.^{16, 17} Therefore purpose of the present study was to find out interrater and intrarater reliability of chest expansion measurements using a cloth tape.

MATERIALS

Data sheet, cloth tape, pen. (FIGURE 1)

METHOD

Study design : Cross sectional observational study

Subjects: The study was at Govt. Physiotherapy College, Ahmadabad. We randomly selected 50 healthy males between ages of 18 & 25 who were students of Govt. Physiotherapy College, Ahmadabad. We excluded subjects with previously diagnosed lung disorders, body mass index >25, a history of previous smoking, or a history of trauma to the thoracic region.

Procedure : Subjects read & signed an informed consent & completed a medical history questionnaire. We instructed subjects to perform a slow vital capacity maneuver which consists of maximal exhalation followed by maximal inhalation to measure chest expansion. We used cloth tape to measure chest expansion.³⁰ Chest expansion was measured for upper chest & lower chest. Anterior site for measurement of upper chest was at level of 3rd intercostals space (FIGURE 2) & posterior was 5th thoracic spinous process. Anterior site for measurement of lower chest was at level of xiphoid process (FIGURE 3) & posterior was 10th thoracic spinous process. Both levels were determined by palpation & marked using a ball-pen. Measurements were obtained separately by 2 investigators (1 male & 1 female). We randomly

determined the order of measurement sites & investigator for each subject.

During data collection, each subject performed 2 vital capacity maneuvers for each site with rest & water, as needed, to minimize discomfort. The first investigator obtained measurement at each site, in standing, while the subject performed vital capacity maneuvers. Markings were removed before the 2nd investigator entered room, so that he/she independently locate landmarks without knowledge of prior markings. After 1st investigator finished, a 2nd investigator independently measured excursion. Approximately 20 minutes elapsed between intratester measurements.

FIGURE 1. MATERIALS

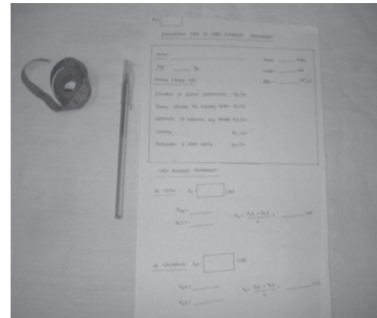
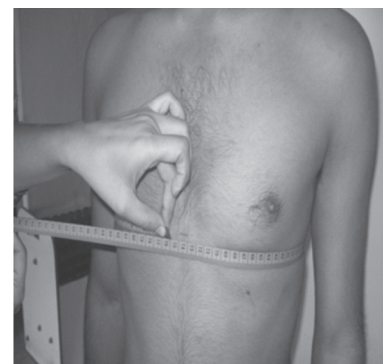


FIGURE 2. AXILLA LEVEL MEASUREMENT



FIGURE 3. XIPHOID LEVEL MEASUREMENT



RESULTS

• Data were analyzed by calculating intraclass correlation coefficient (r) & Z-TEST. We used Microsoft Excel 2003 for statistical analysis.

Level	Intertester	Intertester After 20 Minutes
Axilla	R = 0.84, Z = 1.61 (P>0.05)	R = 0.85, Z = 1.85 (P>0.05)
Xiphoid	R = 0.87, Z = 0.89 (P>0.05)	R = 0.93, Z = 0.07 (P>0.01)

Table 1: INTERTESTER RELIABILITY

Level	Intratester Investigator - 1	Intratester Investigator - 2
Axilla	R = 0.88, Z = 0.16 (P>0.05)	R = 0.93, Z = 0.75 (P>0.05)
Xiphoid	R = 0.93, Z = 0.03 (P>0.01)	R = 0.88, Z = 0.82 (P>0.05)

Table 2: INTRATESTER RELIABILITY

Table 1 show that intertester reliability of chest expansion at axilla level was 0.84 and after 20 minutes was 0.85. At xiphoid level was 0.87 and 0.93 after 20 minutes. Table 2 shows intratester reliability of chest expansion at axilla level and at xiphoid level for investigator 1 and 2.

DISCUSSION

Results show that values of intraclass correlation coefficient (r) were greater for xiphoid than axilla. Z values also suggest that there were insignificant differences in chest expansion values measured by 2 investigators & also by same investigator after 20 minutes. (P>0.05)

The results of this study suggest that chest excursion measurements provide a highly reliable index of chest wall mobility in subjects without impairment. The high consistency of chest excursion measurements obtained in this study may be attributed to consistent anatomical landmarks.

The Intraclass correlation coefficient in this study was substantially higher than those obtained in other studies. Vitalnen et al compared chest excursion measurements recorded at unspecified site

by 2 trained physical therapists on 39 patients with ankylosing spondylitis and found $r = 0.53$.²⁸ Similar values were reported by Burgos-Vargas et al who compared chest excursion measurements recorded at the 4th intercostal space by 2 undefined testers on 22 to 30 adolescents without impairment and found $r = 0.58$. Unlike our findings, both of these studies suggest that chest excursion measurements have poor reliability.

Similar to our results, Dueker et al & Robert et al demonstrated good to high intraclass correlation coefficient.^{7, 19, 17} Lapier et al also showed good intertester & intratester reliability in subjects without impairment.²⁹ In addition to documenting a high degree of reliability of chest excursion measurement, the results of our study suggest that site of measurement slightly affect reliability. The correlation coefficient was chest excursion measurement taken at xiphoid site compared to axillary site. This may be because the anatomical landmark for xiphoid site, the tip of xiphoid process, was a more exact landmark /or easier to palpate than the anatomical landmark for axillary site, the 3rd intercostals space. It is possible that greater degree of soft tissue mass around the upper chest may reduce the consistency of chest excursion measurements.

CONCLUSION

This study demonstrated excellent intertester reliability of chest excursion measurements in healthy young male adults. Results also suggest that reproducibility of chest excursion measurements is better when measured at xiphoid than the axillary site.

CLINICAL IMPLICATION

This study implies ability to replicate chest excursion measurements taken by therapists, so they can universally interpret or interchange measurements.

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Ethical Clearance: The study was approved by Institutional Ethical Committee, Government spine institute, Civil Hospital, Ahmedabad.

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Balance Status of the Elderly People and Factors Associated with it

Viswanathan¹, Mohandas Kurup², John William Felix³

¹Lecturer, Physical Therapy, ²Professor, Division of Physical Medicine and Rehabilitation, Rajah Muthiah Medical College and Hospital ³Reader, Department of Community Medicine, Rajah Muthiah Medical College, Annamalai University.

ABSTRACT

OBJECTIVE:

1. To find out the Balance status of the elderly people using Berg Balance Scale.
2. To study the factors associated with the balance status of the elderly using Berg Balance Score.
3. To find out the relationship of Berg Balance Score with falls among elderly.

STUDY DESIGN : Cross-sectional study.

PARTICIPANTS : 36 elderly people residing in old age homes.

METHOD: 36 elderly people residing in old age homes for at least 1 year were interviewed with a questionnaire followed by physical examination to collect data related to factors such as age, sex, BMI, habits, assistive devices used, number of drugs/day, co-morbidities, history of falls, fear of falls, six minute walk test and timed up & go test. Then all these factors were correlated with Berg Balance Score.

FINDINGS: Out of 36 elders, 11 had a Berg Balance Score (BBS) suggesting moderate risk and remaining 25 with mild risk for falls. Nobody was in the severe risk group. The following factors like assistive devices used, Systolic blood pressure, history of falls, fear of falls, six minute walk test (SMWT) and timed up & go test (TUG) were found to be significantly influencing BBS. The remaining factors such as Age, Sex, Body Mass Index (BMI), Habits, No. of Drugs/day, Co-Morbidities, Diastolic BP and Pulse rate were found to be not significantly influencing BBS.

CONCLUSION: Berg balance score influence most of the factors like assistive device used, history of falls, fear of falls, SMWT & TUG. Hence, above factors may be used to identify the elders who are at greater risk for falls. This may help in designing effective fall prevention programme.

Keywords: Falls, elderly, berg balance scale, influencing factors.

INTRODUCTION

As part of greying of world population, the number of elders in India is increasing at a fast pace; the older population presently in India is 90 million constituting about 8.3% of total population and by 2050, the number is expected to increase to 315 million, constituting 20 per cent of the total population.¹Balance impairment occurs in up to 75% of people aged 70 years and above². This is a major

contributing factor in increasing the risk of falling in the older population, resulting in an increase in serious outcome and associated with huge burden of care and health care costs. Incorporating a balance assessment helps in early identification of elders who are at greater risk for falls³. Simultaneously if we can identify the factors influencing balance, effective intervention can be applied to improve balance and thereby reducing the risk of falls and its consequences. Numerous literature^{4,5,6,7} extensively

used questionnaire, posturography, berg balance scale, six minute walk test and timed up & go test in elderly population to assess balance. This study uses Berg Balance Scale to assess balance function in elderly population and simultaneously tries to identify the related factors.

MATERIALS AND METHODOLOGY

SAMPLING DESIGN : Convenience sampling.

STUDY SETTING: Two old age homes, one in Chidambaram, and another in Mayiladuthurai, Tamilnadu.

MATERIALS : Questionnaire, Tape measure, Weighing machine, Berg Balance Scale, Six Minute Walk Test, Timed Up and Go Test.

INCLUSION CRITERIA

Apparently normal persons aged 60 to 90 years of both sexes.

Resides in old age home for more than one year.

Alert and can co-operate with the study.

Able to walk 10 feet with or without assistive devices.

METHOD

This study is a descriptive cross-sectional study enrolling 36 elderly people by convenience sampling who was residing in two old age homes. They were interviewed using the questionnaire followed by physical examination to collect data such as age, sex, height, weight, habits, assistive devices used, number of drugs/day, co-morbidities, history of falls, fears of falls and then screened using berg balance scale, six minute walk test and timed up and go test. Berg balance scale is a valid 14 item tool, its score ranging from 0-56. It took around 15-20 minutes to complete the test for each person⁸. Six Minute Walk Test described by Balke in 1963, primarily used to evaluate functional capacity, later applied to assess the balance of elderly persons⁹. Timed Up and Go Test basically developed to test the functional mobility of frail elderly persons¹⁰. Later it was sensitized to evaluate falls in community dwelling frail elderly^{11, 12}. Vital signs such as pulse rate and blood pressure were assessed in supine, sitting and lying to rule out

postural hypertension. Fall history for the past 5 years, number of falls, location of fall, time of fall and injuries associated with it were also collected.

The data so collected was statistically analyzed by SYSTAT 12 to find out the influence of various factors on Berg Balance Score.

FINDINGS

Statistical Analysis was done using Kruskal-Wallis, Mann-Whitney U-test and Spearman Correlation Co-efficient test. Of the 36 elderly people screened for balance using Berg Balance Scale, 30.6% of people had moderate risk, 69.4% with mild risk and no persons in high risk group. Factors such as assistive devices used, Systolic blood pressure, history of falls, fear of falls, six minute walk test and timed up & go test were found to be significantly influencing BBS. The remaining factors such as Age, Sex, BMI, Diastolic BP and Pulse rate were found to be not significantly influencing BBS. Total Berg Balance Score Mean is 43.7 and Median is 6.2. Pearson Correlation coefficient of number of falls in this study is -.335 & p-value of .04. Since, it is negatively correlated it is found that number of falls is inversely related to Berg Balance Score in the studied population.

Table 1: Demographic data (n=36)

Males	25%
Females	75%
Aged	60-69 27.7%
	70-79 47.3%
	80-90 25.0%

Table 2: Balance Scale Score

Berg Balance Score		
0-20	High risk	Nil
21-40	Moderate risk	30.6%
41-56	Mild risk	69.4%
Six Minute Walk Test		
Distance walked less		
	than 300 m	55.6%
	300 to 500 m	44.4%
Timed Up & go Test		
	Less than 10 s	27.8%
	10 to 19 s	69.4%
	20 to 29 s	02.7%
	More than 30 s	0%

Table 3: Factors influencing balance.	
Habits	
Nil	78.0%
Tobacco	16.6%
Alcohol	2.7%
Both	2.7%
BMI	
Under weight	19.4%
Normal	50.0%
Overweight	19.4%
Obese	11.1%
Assistive devices used	
Nil	77.7%
Stick	19.4%
Quadripod	2.77%
Co-morbidities	
Nil	50.0%
Diabetes Mellitus	11.1%
Hypertension	22.2%
Both	11.1%
Bronchial Asthma	05.6%
No. of drugs used	
Nil	41.6%
Less than 4	39.5%
4 and above	19.5%

Table 4. Falls Analysis	
Fear of falls	
Nil	50.0%
Present	50.0%
History of falls	
Within one year	
Nil	86.1%
Present	13.9%
One year to 5 years	
Nil	66.7%
Present	33.3%
Recurrent Falls	08.3%
Injuries	
Nil	63.8%
Bruises	04.0%
Lacerations	02.7%
Strain/Sprain	05.5%
Fractures/Dislocations	13.8%
Combined	01.9%
Others	08.3%

Table 5: Mean and SD of Berg Balance Score by the selected variables – Age, BMI, Co-morbidities, Systolic BP, Diastolic BP, Pulse rate, Timed up & go test.

VARIABLE	NO.OF PERSONS	MEAN	STANDARD DEVIATION	KRUSKAL-WALLIS TEST	P-VALUE
AGE					
60-69	16	45.31	5.1	4.232	0.121
70-79	11	44.45	4.6		
80-90	09	40.00	8.5		
BMI					
Less than 19.5	07	44.42	4.1	3.523	0.318
19.5 to 25	18	44.16	7.3		
25 to 30	07	40.42	5.1		
More than 30	04	46.25	4.6		
CO-MORBIDITIES					
Nil				7.093	0.006
Diabetes Mellitus	18	45.50	5.9		
	04	36.50	9.0		
Hypertension	08	45.12	3.3		
	04	39.50	4.8		
Both Bronchial Asthma	02	45.00	4.2		
SYSTOLIC BP (In mm Hg)					
Less than 120	13	47.23	4.0	8.525	0.014
120-139	14	43.00	5.3		
More than 140	09	39.77	7.8		
DIASTOLIC BP (In mm Hg)					
Up to 79	30	44.50	5.3	1.926	0.382
80-90	04	40.25	5.1		
Above 90	02	39.00	18.3		
PULSE RATE (per minute)					
Less than 70	09	46.3	2.6	4.140	0.126
70-80	08	41.8	6.9		
More than 80	19	43.3	7.0		
TIMED UP & GO TEST (in seconds)					
Less than 10	10	48.1	4.5	6.734	0.034
More than 10	26	42.0	6.0		

Table 6: Mean and SD of Berg Balance Score by the selected variables – Sex, Assistive devices, Number of Drugs/Day, History of Falls, Fear of Falls & Six Minute Walk Test.

VARIABLE	N O . O F PERSONS	MEAN	STANDARD DEVIATION	MANN-WHITNEY TEST	P-VALUE
SEX MALE FEMALE	09 27	46.9 42.7	6.5 5.9	163.5	0.124
ASSISTIVE DEVICES NOT USED USED	28 08	45.5 37.5	5.2 5.6	194.0	0.002
NUMBER OF DRUGS/ DAY NIL UP TO 4 MORE THAN 4	15 16 05	45.0 43.4 41.0	7.9 4.7 4.5	2.3	0.31
HISTORY OF FALLS NIL PRESENT	16 20	47.0 41.1	5.2 5.8	245.5	0.006
FEAR OF FALLS NIL PRESENT	18 18	46.4 41.0	5.4 6.0	237.5	0.017
SIX MINUTE WALK TEST DISTANCE WALKED LESS THAN 300 M 300 TO 500 M	20 16	41.5 46.5	5.7 5.8	83.5	0.015

DISCUSSION

Out of 41 elderly people residing in two old age homes, 36 had participated, three people were not willing to participate and two were sick. 75% were females and 25% were males. Age wise, they belonged to three groups viz., 60-69, 70-79, and 80-90. 27.7% were in 60-69 group, 47.3% in 70-79 group, and 25% in 80-90 group. A remarkable aspect of the study is that it is done in two old age homes where the participants are residents for more than a year. Hence, the environment is more or less uniform for all the participants.

Berg balance scale is used to assess both the static and dynamic balance. Berg Balance Scale is stratified in to three groups, viz., 0-20 as high risk of falls, 21-40 as moderate risk, and 41-56 as mild risk. Berg Balance Score in this study revealed no persons in the high risk group; 30.6% in moderate risk group and 69.4% were in mild risk group. This shows that the majority of the population screened were at low risk of falling. Along with Berg Balance Scale, Six Minute Walk Test, Timed Up and Go Test were also used to measure the other components of balance namely strength and mobility¹³. Most of the literatures used more than one assessment tool because they were equipped with distinct peculiarities and limitations. Hence, these instruments are applied together for better assessment of balance in elderly¹⁴.

In this study, various factors were analyzed in relation to Berg Balance Score. Factors such as assistive devices used, history of falls, fear of falls, SMWT, TUG were found to be significant and age, sex, BMI, co-morbidities, no. of drugs/day were found to be not significant.

Falls were analyzed to find out the impact and related factors. It was analyzed in two categories such as history of falls and fear of falls. In history of falls, number of falls within one year and one to five years was obtained. Out of 36 elderly people screened for falls, 16.7% people fell within one year and 33.3% people fell within five years. With regard to location, 66.7% had indoor falls and 33.3% had outdoor falls. Time of falls was predominantly more in morning with 66.6% and 16.7% each for afternoon and evening. Injuries associated with falls are 66.6% of people had bruises, laceration, strain, sprain and

fractures. Johnson et al examined the frequency and nature of falls and fall-related injuries among older women in the state of Kerala, India¹⁵. 74% had injuries such as bruises, cuts, fractures. Fractures associated with the falls in this study were colle's, neck of femur fracture and acetabular fractures. 50% of the studied population had fear of fall. Nandini Deshpande, PT, PhD et al and two others describe fear of falling as a serious problem in elderly and had similar results^{16, 17, 18}. Recurrent falls in this study accounts for 8.33%. Recurrent falls have been associated with increased physician contact, functional decline, admission to long-term care facilities, and mortality¹⁹⁻²³.

CONCLUSION

Berg balance score is influenced by factors like assistive device used, history of falls, fear of falls, SMWT and TUG in elderly people residing in old age homes. Identification of elders who are at greater risk for fall helps in designing effective fall prevention programme.

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Conflict of Interest : None.

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Ethical Clearance : We certify that this study involving human subjects is in accordance with Helsinki declaration of 1975 and as revised in 2005. Subsequently this study was cleared ethical committee.

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Effect of Repetitive Transcranial Magnetic Stimulation on Cortico Motor-Excitability and Motor Function of the affected Hand in Subjects with Stroke

V Srikumari¹, B Vengamma², G Parvathi³

¹Asst Professor, College of Physiotherapy SVIMS, ²HOD, Dept of Neurology, ³Former HOD, Dept of Physiology, SVIMS, Tirupati, Andhra Pradesh

ABSTRACT

OBJECTIVES: To Test the hypothesis that 10 days of high frequency (10HZ) repetitive transcranial magnetic stimulation (rTMS) with hand therapy elicit more improvement on motor recovery and motor function in the paretic hand than sham stimulation in patients with stroke and to examine the correlation between corticomotor excitability and motor function of the hand in stroke subjects at various time points of recovery.

METHOD: Forty normal control subjects were recruited to record MEP variables of APB muscle of both sides and compare it with 60 acute stroke subjects. 60 stroke subjects were randomly assigned to one of the two treatment methods. The rTMS group received high frequency (10Hz) rTMS to the affected hemisphere plus hand therapy for the hemi paretic hand and in sham rTMS group, patients received sham stimulation to the affected hemisphere and hand therapy to the hemi paretic hand. Corticomotor excitability was assessed by the central motor conduction time (CMCT) and motor threshold at baseline, after 5 days and 10 days following intervention. Motor function of the hand was assessed by the Jebsen hand function test (JHFT) at baseline, after 5 days and 10 days of intervention.

RESULTS: Normative values of APB was analyzed with ROC curve and compared with stroke subjects. Patients with rTMS group receiving 10 Hz rTMS plus hand therapy lead to a greater improvement in corticomotor excitability. Corticomotor excitability decreased and motor function of the hand improved following intervention ($P=0.001$). There was a significant correlation between the Corticomotor excitability and motor function of the hand in the affected hemisphere at various time points of recovery.

CONCLUSIONS: Focal stimulation of high frequency (10 Hz) rTMS to the affected motor cortex and 30 min of motor training twice a day for 10 consecutive days would enhance the Corticomotor excitability and improved motor function of the affected hand in stroke subjects.

Keywords: Stroke, rTMS, Corticomotor excitability, hand therapy.

INTRODUCTION

Globally stroke is the 3rd commonest cause of mortality ¹ and 4th leading cause of disease burden ²... The epidemiology of stroke in India observed that the age adjusted prevalence rates vary between 250 to 350 per 100000 populations in different studies. ³. The incidence study from the eastern India has show the adjusted annual incidence (per 1 lakh persons) of

stroke to be 124 in rural area ⁴ and 145 in urban area ⁵

Mainly the first 2-3 months after stroke is critical for recovery from upper extremity impairments and activity limitations ^{6,7}. In a study conducted by Kwakkel et al in stroke patients who were severely disabled patients showed that 38 % has regained some fine hand use and 12 % has regained complete fine hand use 6 months after onset ⁸.

Motor training of the paretic hand is administered during rehabilitation treatments also increases somato-sensory input and results in well documented behavioral gains⁹. The stroke rehabilitation is based on the concept of neuro plasticity

Transcranial magnetic stimulation is a new non-invasive and painless CNS stimulation in living and awake humans. Transcranial magnetic stimulation consists of rapidly changing magnetic fields to elicit electrical currents running parallel to the cortical surface via electromagnetic induction. TMS when synchronously applied to the human motor cortex engaged in motor training tasks enhances use dependent plasticity in the contra lateral hand⁹. On this basis of this knowledge, we aimed to study the effects of high frequency repetitive TMS on corticomotor excitability and motor function of the affected hand in subjects with stroke

MATERIAL AND METHOD

The study was conducted in the dept. of Neurology, Sri Venkateshwara Institute of Medical Sciences, from May 2010 to March 2012. All the recruited stroke patients were between 18-60yrs who had first ever ischemic stroke in the cortical or sub cortical area, between 10 days and 1month of onset both the right and left hemiplegics were included in the study. The exclusion criteria were patients with previous history of seizures and intracranial metal implants. Patients with cochlear devices, patients with implanted neuro stimulator. All patients and normal controls were excluded as per the IFCN criteria for rTMS candidates. Informed consent has been obtained from all the participants.

Forty normal control subjects with age 18 to 60 years who were asymptomatic healthy individuals were included in the study to record CMCT and motor threshold of the APB muscle with Magstim rapid stimulator (Magstim co ltd) and to compare with age and height matched 60 patients with stroke. The 60 stroke subjects were randomly assigned to rTMS (n=30) and sham rTMS (n=30) group who were followed for 10 days. The rTMS group received a train of 20 pulses at 10hz and 80% of resting motor threshold applied over the affected motor cortex with 70mm figure of eight coil placed parallel to the scalp. This train was repeated 8 times and delivered over 8

minutes session. After stimulation patients received motor training of the hand for 30 minutes twice a day. The motor training of the hand consisted of the lifting the peg boards, squeezing balls, picking up of the small and large objects for 10 days.

The sham rTMS group received stimulation with 70mm figure of 8 coil held perpendicular to the affected cortex with same stimulation parameters as administered to the rTMS group. These patients also received motor training of the hand similar to the rTMS group. Both the groups were measured for various outcome measures. Corticomotor excitability was assessed by motor threshold and central motor conduction time at base line, after 5days and 10 days of intervention.

Motor function of the hand was assessed by Jebsen hand function test at base line, after 5 days and after 10 days of intervention.

The various factors analyzed including continuous variables such as age, height and categorical variables like gender, side. Descriptive statistics for categorical variables was performed by computing the frequency. For the quantitative variables approximate normality of the distribution was assessed. Independent t-test was used to compare the differences in the mean values between rTMS and sham rTMS groups for continuous variables that were normally distributed. Pearson correlation coefficient was used to examine the correlation between the CMCT and JHFT at various time points of recovery.

The MEP variable of APB muscle in 60 patients with stroke and 40 normal control subjects were used to derive the appropriate "cut-off" values for defining the MEP that would be applicable for the ethnic population studied. ROC curve for MEP variables were plotted with (1-Specificity) on the x-axis sensitivity, on the y-axis using different "cut-off" levels of MEP to arrive at the choice of the most appropriate "cut-off" level.

RESULTS

40 normal control subjects with age and height matched were included in the study to record normal MEP variables to compare it with the 60 patients with stroke. The mean age of patients with stroke (n=60) was 49.57 ± 9.39 and mean age of normal controls

(n=40) was 47.73 ± 6.37 The mean height of patients with stroke was 157.93 ± 2.3 and mean height of normal control subjects was 157.53 ± 3.2 .

The mean age of patients in rTMS group (n=30) was 49.97 ± 8.2 and mean of sham rTMS group (n=30) controls was 49.17 ± 10.5 . The mean height of patients in rTMS was 157.93 ± 2.3 and mean height of sham rTMS group was 157.93 ± 3.2 .

Both the groups received the intervention and motor training for all the 10 days and showed the mean change in CMCT, motor threshold and JHFT from baseline to 5 day of intervention. Ten days of intervention with motor training brought the significant change in all the outcome variables in rTMS group when compared to sham rTMS group at $P < 0.000$.

The correlation between the CMCT and JHFT at various time points of recovery post intervention and motor training was analyzed using Pearson correlation coefficient. The table shows a significant correlation between motor function and corticomotor excitability in the affected hemisphere ($r=0.754$, $P=0.000$) at baseline. After 10 days of intervention similar significant correlation was found ($r=0.913$, $P=0.000$).

DISCUSSION

Normative values of MEP variables of APB for Indian population are not available in the published literature. In the present study an attempt was made to define the appropriate "cut-off" value for determining the high motor threshold and prolonged CMCT using ROC.

In the present study using the ROC curve, cut-off value of TMCT is 24 ms (sensitivity 100; specificity 100; AUC 1.000); cut-off value of cortical threshold is 65% (sensitivity 93.3; specificity 95; AUC 0.937); cut-off value of PMCT is 13.2 ms (sensitivity 85; specificity 55; AUC 0.633); cut-off value of spinal threshold is 55 % (sensitivity 76.7; specificity 70; AUC 0.793); cut off value of CMCT is 10 (sensitivity 100; specificity 100; AUC 1.000). These results are similar to earlier studies. Lee HG et al conducted a study in 92 volunteers free of neurological diseases and tested the MEP variables. There were 55 male and 37 female ranging in height from 130-180cm with a mean age of

34 years, Recording was done from abductor pollicis brevis in hand and the results of this study are: TMCT was 20.0 ± 1.5 ms, PMCT was 11.7 ± 1.1 ms, CMCT was $9.2 \pm$ ms¹⁰.

In the present study all the 60 hemiparetic stroke patients included in the study were recorded with the MEP variables of APB which showed increased motor threshold and prolonged CMCT at the baseline. Interhemispheric difference between the affected and unaffected hemisphere in subjects with stroke were statistically significant ($P < 0.0001$) for all the MEP variables studied. The responses of the affected hemisphere changed significantly after rTMS and motor training... The results of this study are consistent with earlier studies. 55 ischemic hemiparetic stroke patients were studied in the first week and evaluated by clinical scales with clinical follow-up over 6 months. The results obtained in this study clearly stated that the motor evoked potentials (MEP) is useful as an early prognostic indicator of motor and functional recovery¹¹.

Repetitive motor training in a simple task results in changes in MI excitability that are well documented. Focally increased amplitudes (specific to the training muscle) can be induced in as little as 30 minutes of training.¹², whereas increase in finger sequencing skill leads to long-lasting changes in M1^{13,14}. A recent study in the rat stroke model demonstrated there is a correlation between rehabilitation and spontaneous recovery processes early after stroke¹⁵. Rehabilitation started after 5 days of focal ischemia was much more effective than waiting for 1 month before beginning rehabilitation.. Similar type of changes has been shown in patients after stroke with greatest gains from rehabilitation occurring in first 6 months¹⁶.

The results of this study showed that motor function improvement after rTMS treatment is specific to the treatment (rTMS versus sham rTMS).. As anticipated 10 HZ of repetitive transcranial magnetic stimulation reduced motor threshold, CMCT and improved hand function ($P < 0.000$). Our results are similar to those two previous studies. Khedr et al conducted a study in 26 acute ischemic stroke who were assigned to real rTMS group and sham rTMS group. Patients of real rTMS group showed that 10 days of repetitive TMS of the affected motor cortex had beneficial effects as assessed 10 days after

intervention by the Scandinavian stroke scale, NIHSS and barthel index ¹⁷. Liepert et al (2000) examined the treatment effects on dexterity and motor cortex function in a single task-oriented session.. Using TMS, they observed that prior to training; the size of the representation in contralateral motor cortex was smaller for the paretic hand than the unaffected hand. Just after training most of the patients (7of 9) demonstrated improvement in dexterity.. Simultaneously the size of the representation in contralateral motor cortex of the paretic hand enlarged; where as that of the unaffected hand was same. ¹⁸. Pascual et al studied 21 normal, right-handed subjects (12men and 9 women, mean age 26.3years) were randomly assigned to receive either 1Hz, 10Hz, or sham rTMS.. Sham rTMS group did not show cortical excitability while 1Hz rTMS showed reduced and 10Hz rTMS enhanced cortical excitability ¹⁹.

At the cellular level rTMS induces changes in cortical excitability by hyper polarization or depolarization of the resting potential neuronal membranes. This effect is mediated by activation of

sodium and calcium dependent membrane channels and NMDA receptors ^{20,21} Mechanisms proposed to support rapid plasticity include uncovering of latent or existing connections, activation of existing but silent synapses, activity-dependent synaptic plasticity, and generalized excitability changes in postsynaptic neurons .Morphological changes, such as neurogenesis, synaptogenesis, and synaptic remodelling require time for full expression and therefore, may be involved preferentially in providing new cortical areas for further changes..

The findings of this study improved the understanding of the relationship between changes in motor function and in neurophysiology during post stroke recovery. In the present study a statistically significant positive correlation was observed between CMCT and JHFT at various time points of recovery (r = 0.931 P=0.000). Fregni et al studied the correlation between the resting motor threshold and Jebson Taylor Test . The correlation analysis showed a significant correlation between motor function improvement and cortico motor excitability change in the affected hemisphere (r = 0.69, P = 0.27) ²²

Cut-off.>24
Sensitivity : 100.0
Specificity : 100.0

Cut-off.> 65
Sensitivity : 93.3
Specificity : 95.0

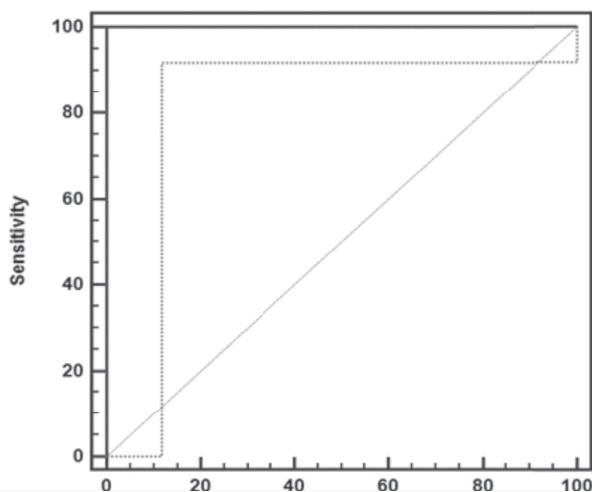


Figure 1a: ROC-Curve along the 95 % confidence bounds for calculating the cut-off value of TMCT. The area under the ROC curve (AUC) = 1.000; standard error= 0.000; 95%confidence interval=0.964 to 1.000; significance level P (Area=0.5) = 0.000

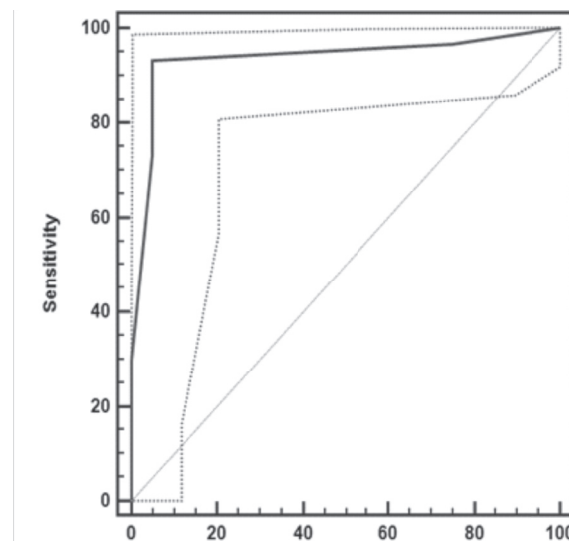


Figure 1b: ROC-Curve along the 95 % confidence bounds for calculating the cut-off value for cortical threshold .The area under the ROC curve (AUC) = 0.937; standard error= 0.0267; 95%confidence interval=0.870 to 0.976;Z statistic = 16.37; significance level P (Area=0.5)=0.0001

Cut-off.> 13.2
Sensitivity : 85
Specificity : 55

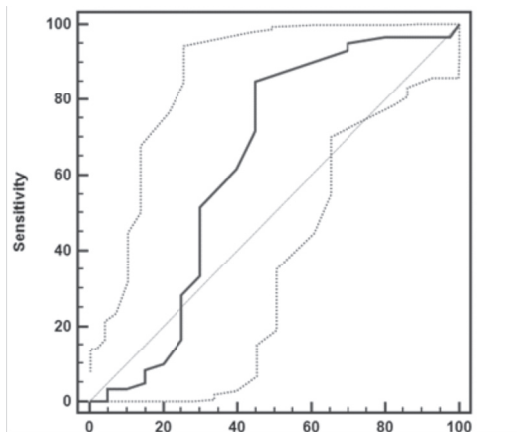


Figure 1c: ROC-Curve along the 95 % confidence bounds for calculating the cut-off value for PMCT. The area under the ROC curve (AUC) = 0.633; standard error= 0.0641; 95%confidence interval=0.531 to 0.727; Z statistic = 2.075; significance level P (Area=0.5)=0.0380

Cut-off.> 55
Sensitivity : 76.7
Specificity : 70

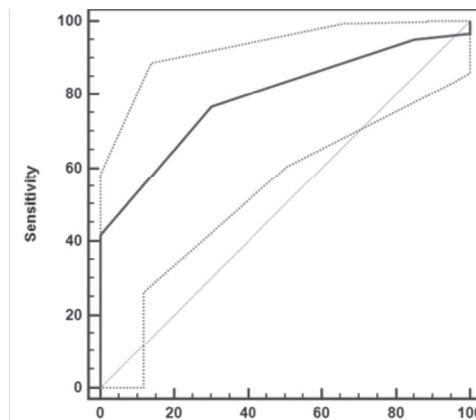
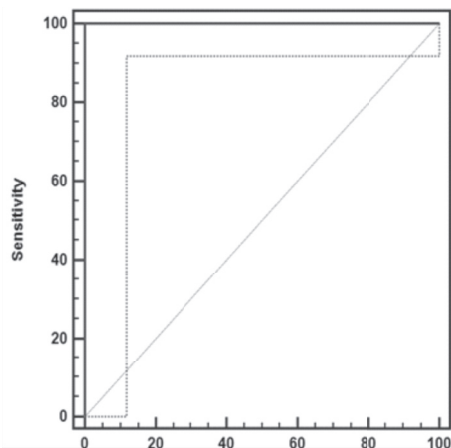


Figure 1d: ROC-Curve along the 95 % confidence bounds for calculating the cut-off value for spinal threshold .The area under the ROC curve (AUC) = 0.793; standard error= 0.0415; 95%confidence interval=0.701 to 0.868; Z statistic = 7.071; significance level P (Area=0.5)=0.0001Cut-off.> 10



Sensitivity : 100.0
Specificity : 100.0

Figure 1e: ROC-Curve along the 95 % confidence bounds for calculating the cut-off value for CMCT .The area under the ROC curve (AUC) = 1.000; standard error= 0.000; 95%confidence interval=0.964 to 1.000; significance level P (Area=0.5) =0.000

Table 1 Comparison of normal values of abductor pollicis brevis of various studies

Variable	Dvorak et al 1990 mean (SD)	Gheggi et al 1991 mean (SD)	Present study	
			mean (SD)	ROC cut-off
Mean TMCT	20.7 ms (SD=1.3)	20.5 ms (SD=2.0)	21.48 ms (SD=1.4435)	24 ms
Mean PMCT	15.6ms (SD=1.2)	13.6 ms (SD=1.0)	13.46 ms (SD=1.0486)	13.2 ms
Mean CMCT	5.2 ms (SD=0.6)	6.9 ms (SD=1.3)	8.02 ms (SD=1.0734)	10 ms
Mean Motor Threshold				65%
Mean Spinal Threshold				55%

SD= Standard deviation;; ms = milli seconds;; ROC= receiver operator characteristic

Table 2 : Comparison of mean change in CMCT, motor threshold and JHFT from baseline to 5th day of intervention in patients with stroke

Variable*	rTMS group (n=30)	Sham rTMS group (n=30)	P – value (2 -tailed)
Motor Th (%)	6.33±5.71	2.66±4.49	0.008
CMCT(ms)	1.54±0.8	0.79±0.53	0.00
JHFT(sec)	15.73±9.13	10.63±9.86	0.042

*Data expressed as mean ± SD ;ms=milliseconds SD= Standard deviation; sec=seconds

Table 3 : Comparison of mean change in CMCT, motor threshold and JHFT obtained in patients with stroke from baseline to 10th day of intervention

Variable*	rTMS group (n=30)	Sham group (n=30)	P- value (2 -tailed)
Motor Th (%)	12.83±4.48	5.33±5.40	0.000
CMCT(ms)	2.95±0.83	1.5±0.66	0.000
JHFT(SeCS)	28.96±9.89	16.23±9.7	0.000

*Data expressed as mean ± SD ms=milliseconds SD= Standard deviation; secs=seconds;

CONCLUSION

Good recovery depends to a great extent on the plasticity in the lesioned hemisphere. One such therapeutic approach is to try to increase brain plasticity in the lesioned region is through non-invasive brain stimulation. So this present study made such attempt of stimulating the affected brain with rTMS in acute stroke.

In conclusion 10 HZ of rTMS to the affected cortex and 30 minutes of motor practice twice a day for 10 days enhances corticomotor excitability and motor function of affected hand in subjects with stroke. High frequency rTMS provides a fast, effective, painless, safe and non-invasive treatment in stroke subjects. Despite the absence of side effects of rTMS in the study EEG would be an important monitor to include to warn of possible seizures.

The sample size of the patients included in this study was heterogeneous in terms of lesion. For the corticomotor excitability measurement we only measured motor threshold and CMCT. The other parameters of corticomotor excitability such as MEP amplitude and silent period were not measured, as these evaluations require other software in the TMS machine. Methodological problem of rTMS studies is sham method. We did not use the sham coil but

tried to follow the same procedure as provided in the literature for the sham group too.

Conflict of Interest: We don't have conflict of interest.

Ethical Clearance: IEC no: 136/Roc No A&E/2008/ IEC/SVIMS/2004 dated 9/02/2010.

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Developmental (Postural) Reactions as Precursor of Motor Development in Cerebral Palsy

Vijay Batra

M.O.Th, PhD, Occupational Therapist, Dept. of Neurology, G.B Pant Hospital, Govt. of NCT Delhi

ABSTRACT

The postural reactions are the basic unit of postural control, so assessment should emphasize on the same. The evaluation of both primitive reflexes and postural reactions constitutes a solid basis for the identification of neonatal and infantile motor disorders. Further, it guides the intervention process sequentially depending upon the status of postural reaction in children with cerebral palsy.

Keywords :Postural reaction; Cerebral palsy

INTRODUCTION

Cerebral palsy (CP) a heterogeneous group of persistent disorder of movement and posture caused by non-progressive defects or lesions of immature brain, is the most common cause of childhood physical disability¹⁸. The beginning of Motor development is found in reflexive movement. A reflex is an automatic movement performed without conscious volition, usually initiated by sensory stimulation. It is an immediate, stereotyped, obligatory response, but its strength may vary depending upon the state of arousal or previous learning of the infant. As a building block of movement, it provides the first change in distribution of muscle tone. The full term new born is dominated by physiologic flexion; reflexes offer the opportunity for extensor tone to come into play. As higher center of CNS system matures, reflex activity evolves to volitional movement, and the reflexes become integrated at anticipated times during the first year of growth. They never totally disappear however, and may emerge in times of stress to the system. By four to six months most primitive reflexes integrate / modify and no longer bring about a

stereotypic response.

With developmental maturation of higher neural structures, the primitive reflexes become inhibited; suppressed, diminished, integrated and postural reactions emerge. The Postural reactions respond to more global stimuli than primitive reflexes and last for a lifetime to support movement and balance.

Postural reactions include righting reaction, equilibrium reactions and protective arm extension⁸.

Significance of Developmental / Postural Reactions in Postural control

Postural reactions are those reactions that automatically provide for maintenance of body in an upright position through changes of muscle tone, in response to position of body and its parts. Postural responses are maturational motor skills that develop during first year and form the basis for the attainment of functional motor skills i.e. motor milestones.

Postural Reactions include righting reaction, equilibrium reaction and protective arm extension:

Righting Reactions [Neck Righting, Body Righting, Labyrinthine Righting (Prone), Labyrinthine Righting (Supine), Optical Righting]

Equilibrium Reactions [Prone, Supine, Sitting, Quadruped, Standing]

Protective Extension [Forward, Sideways &

Name of Corresponding Author & Address:

Dr. Vijay Batra, M.O.Th, PhD

A - 3 / 90, Paschim Vihar,

New Delhi 110063, India

(M) 09811147917

E Mail: vijaybatra@yahoo.com

Backwards]

Righting reactions support positioning of the head vertically in space, alignment of head & trunk and alignment of trunk & limbs. Both, Head Righting which aligns the eyes with horizon and aligns head with the trunk, and Body Righting which contributes to movement around body axis, are used to assume antigravity positions.

Equilibrium reactions provide balance when the centre of gravity is disturbed. They are more mature responses to regain balance than righting reactions and include counter rotation of head & trunk away from the direction of displacement and use of the extremities as they abduct & extend automatically. Maturation of higher centers of the Central Nervous System is essential before equilibrium reactions develop, beginning at approximately six months and maturing at about four years.

Protective arm Extension is used to prevent injury if the equilibrium reactions are unable to restore balance. Protective Extension emerges first to the front, then the side, then backwards. It may also be used to assess the maturation of the CNS and begins to be displayed at about six months in conjunction with attempts at sitting.

Developmental / Postural reactions are mechanisms acquired to help balance maintenance¹⁶. Balance is maintained through a complex physiologic mechanism in which the osteoarticular system, proprioceptive sensitivities, cerebellar & vestibular functions have important roles. Postural mechanisms are not true reflexes but rather are based on multiple input modalities, usually acting as a whole & it require cortical integrity & thus are not present in neonate, but instead develop postnatally as a basis for normal motor behavior⁸.

Development of Postural Control via ontogenesis of Postural reactions

The postural reaction undergoes the stages of postural ontogenesis. Postural responses are complex motor response characterized by certain stereotyped posture of the trunk, head and extremities when investigator / assessor attempts a sudden change of position.

The response at each chronological age is

different and expresses the Central Nervous System stages of maturation⁸. Also the presence, / absence are clinically related to underlying functional motor acts.

In the control of posture, two functional levels can be distinguished, the basic level deals with generation of direction specific adjustment, and the second level is involved in adaptation of the direction specific adjustment¹⁵. Hence Postural development starts with a repertoire of direction specific adjustments and suggests that basic level of control has an innate origin.

Postural control in upright posture requires various degrees of muscle activity for its maintenance, although many limb muscles can relax completely. Despite this, these muscles are ready to be activated to counteract any loss of balance or for performing a required task.

Neurophysiological basis of Postural (developmental) Reactions

Postural reactions are triggered by afferent inputs via receptors from joint, tendon, muscle, skin, inner organ, eye (telereceptor), ear (otoreceptor), and Labyrinth. Hence postural reflexes organized by the brainstem in response to vestibular, Proprioceptive and visual input are negative feedback to correct the unanticipated perturbation.

Underlying Neurophysiological basis of poor postural control in children with cerebral palsy

In children with spastic CP, agonist and antagonist muscles co-contrast and rarely work reciprocally⁴. The presence of co-contraction of agonist-antagonist muscle pairs of the upper and lower limbs is thought to be due to a deficit in the reciprocal inhibitory mechanism. The most likely explanation for this is a lack of facilitation of the I a inhibitory inter-neuron by the corticospinal projection^{12, 17}. Interestingly, for the trunk muscles, the developmental sequence is the opposite, with the dorsal and ventral trunk muscle changing from a pattern of reciprocal activity to co-activation that gives the required trunk stability for postural control, and independent limb movements for postural skills.

Possible Mechanisms of underlying movement & postural disorder in Cerebral Palsy can be explained

due to Lack of reorganization of Corticospinal projection, anticipatory motor control and interaction between agonist and antagonist muscle pairs⁸.

The lack of cortical control of movement will also result in an impairment of feed forward or anticipatory control of both postural and task related activity^{6,9,10}.

It had been observed that the basic organization of responses in children with spastic cerebral palsy remains intact but their modulation is deficient, whereas children with spastic dyskinetic cerebral palsy demonstrate abnormalities of the basic organization of postural adjustments. Children with cerebral palsy show impairment of postural adjustment that can be modulated by modifying the muscle action¹⁰.

However, the well integrated postural responses can be studied by breaking it down into its reaction components thereby assessing the righting, equilibrium and protective reactions.

Significance of postural reactions in children with cerebral palsy

The early CNS damage often produces an alteration in muscle tone, muscle stretch reflexes, primitive reflexes & maturation of postural reactions. This, in turn affects the postural control development in Cerebral Palsy⁷. The diagnostic relevance of the various postural reactions has been variably recognized with limited data available. Bleck⁵ underlines the predictive value of failure to develop postural reactions such as the parachute reaction and equilibrium in standing. Whereas Molnar¹⁴ stated that normal disappearance of primitive reflexes and delayed disappearance of postural reactions are more characteristic of mental retardation⁸.

Clinical utility of Postural reactions assessment

The assessment of primitive reflexes and postural reactions is clinically considered very important to assess maturation of central nervous system through observation of their primitive movement patterns.

The reflexes should be assessed individually for its presence / absence with respect to age of appearance and disappearance / integration. The assessment of postural reactions will help in

identifying the abnormal / pathological postural behaviors. The assessment of postural reaction can provide significant contribution for treatment planning, intervention & reevaluation^{1,2,3}.

Since developmental reflexes and reactions are the early precursors of motor development, an abnormality in suppression / Integration of primitive reflexes and the appearance of postural reactions reflect CNS dysfunction. So attention to, suppression / integration of primitive reflexes and development of postural reactions, allow an abnormality to be recognized early before delay in postural maturation and motor milestone is clinically apparent. Based on the postural reactions status, intervention based on the elementary unit of motor control i.e. Neurofacilitation of Developmental Reactions (NFDR) approach can be implemented in children with cerebral palsy^{1,2,3}.

An Insight towards development / modification of postural reactions in children with Cerebral Palsy- Future Research

Children with cerebral palsy are known to manifest persistent or delayed appearance of primitive reflexes and pathologic or absent postural reactions⁸.

Postural reactions are considered mature postural responses that persist as a basis for normal motor behavior⁸. The reflexes & reactions are considered important tools to assess Central Nervous System integrity of children with cerebral palsy. Therapy should aim at development / modification of appropriate reactions.

In the light of scanty evidence, the importance of postural reactions for early intervention during assessment and management, cannot be overlooked; hence this article emphasizes upon the significance of postural reaction in children with cerebral palsy.

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Comparison of Post Isometric Relaxation Exercise and Static Stretching for Hamstring Tightness Normal Individuals

Hiral Gandhi¹, Tanvi Thakkar², Tarpan shah¹

¹Assistant Professor, Shree Swaminaryan Physiotherapy College, Kadodara Char Rasta, NH No 8 & 6,394327 Surat,Gujarat. ²Physiotherapist, Lions Orthopaedic Hospital, Navsari

ABSTRACT

Present Study compared the effect of post isometric relaxation exercise and static stretching in hamstring tightness individual to find out effectiveness of hamstring stretching techniques from two techniques.40 subjects with no known musculoskeletal injuries or neurological deficits volunteered were included for the study. Subjects who fulfilled inclusion criteria within age group of 19-24 with hamstring tightness were recruited for the study and stretching and exercise was given for three weeks the participants were randomly divided in to two different groups.group one received static stretching and group two received Post isometric relaxation exercise and results of presentstudy shows that Post isometric relaxation exercise can be use as an effective therapeutic maneuver for improving ROM and flexibility of hamstring tightness in normal individuals.

Keywords: *Static stretching,*

INTRODUCTION AND BACKGROUND

The length of muscle tissue is thought to play an important role in the effectiveness and efficacy of human movement. Muscle tightness is the most common disorder in normal healthy individuals. Shortened muscle forms a major element of this condition and restricted. Flexibility is the key element and a contributing factor in many musculo skeletal problems¹.Hamstring tightness, the inability to stretch the muscle through in full range of Amplitude .Muscle is a prime mover and stabilizer of body that contains muscle spindle, as its functional unit and Golgi tendon organs plays important in determining the length and function of muscular components. Hamstrings (Biceps femoris, Semi tendinosis, and semimembranosis) are the long and powerful group of muscles that span the back of the thigh. Tightness of this muscle can play a role in sport related injuries, lumbar spine disorder and general low back pain. Flexibility and passive resistance of hamstring muscle in young adults using two Different stretching protocols concluded the need of hamstring stretching in young adults. Traditionally the most widely used method to increase ranges of motion is stretching

static stretching is slow speed, passive movement to place a muscle on stretch².Tissue elongation varies according to the type and duration of the force applied.However the research proved a low load, long duration stretch in place of a high load, brief stretch is required to produce greater tissue lengthening and remains even after the tensile stress is removed. Thirty second duration is effective amount of time to sustain a hamstring muscle stretch in order to increase range of motion³.Post isometric relaxation exercise also helps in lengthening of tight hamstring by its contraction and relaxation method. The term post isometric relaxation exercise refers to the effect of the subsequent reduction in tone experienced by a muscle or a group of muscles, after brief periods during which an isometric contraction has been perfor.⁴Antagonist of a shortened muscle group isometrically contracted inorder to achieve a degree of ease and additional moment potential in shortened tissue.⁵ Wilkinson suggests the need of stretching exercise for elongation of intra-muscular connective tissue.⁶Determined hamstring flexibility through active knee extension test- which has shown to have excellent test re test reliability. Physiologically full

stretch occurs in hamstring group only if the knee is fully extended with hip fully flexed.⁷ Biomechanically the synchronization between two joints is a complicated Proprioceptive and mechanical problem. This is complicated further when muscle units cross both joints. Muscle which has not been trained to employ their full amplitude may fall when required to pass through their full amplitude under rapid and stressful situation. This results in varying degree of muscle damage and specific stretching programs are needed on daily basis to prevent further injury.⁸ The alteration of the normal relationship among the alignment of the spine, the

Position of the pelvis and the length of the muscle attaching to the spine and pelvis contributed to development of LBP in Hamstring Tightness Galliet²². Lewit K suggested that the shortened muscle itself is a source of altered Proprioceptive information to the central nervous system affects the muscle and joints²³. Smith suggested that general stretching exercises can benefit athletes and social exercises in numerous ways, including improving flexibility, reducing the incidence of injury²⁴. Since there are many successful way of treating Hamstring tightness like mechanical, thermal treatment (Ice, stretch and spray, ultrasound, soft tissue massage, SWD) procedures which will increase hamstring flexibility. Severities of recurrence have not yet decreased. There are many manual medicine approaches described by many authors to achieve normal length of muscle, Myofascial Release Therapy (MRT) Neuro Muscular Therapy, (NMT) Muscle Energy Technique (MET). As Hamstring Tightness considered primary soft tissue restriction the use of MET plays primary role in treatment of these disorders. The use of these soft tissue manipulations may treat the Hamstring tightness and often used often used in combination for long lasting effects. Some authors hypothesized and reported that combination of these techniques have good effect in treating shortened muscle. MET is direct active post facilitating technique (also called as post-isometric relaxation technique – PIRT) which follow different principles individually Leon Chaitow²⁵. Though most of the treatment methods proved its merits on hamstring tightness this study is undertaken to compare the effectiveness of static stretching and PIRT in individual with Hamstring tightness.

MATERIALS AND METHODOLOGY

Subjects who have hamstring tightness bilaterally were selected through active knee extension test for the study. The whole sample composed of 40 subjects. The subjects were randomly divided into two groups by using simple random sampling method. Each group consists of 20 subjects. In a 3 week treatment program each group received the exercises for 3 times per week.

Group A consist of 20 subjects who received static stretching and group B consist of 20 subjects who received PIR exercise. All the subjects were informed that they are under the experiment and a prior consent of subject was sought before assessment. All the subjects' activity regimen, including exercise levels, throughout the study period of 3 weeks. 40 students of age group of 19-24, with hamstring tightness were included for present study. Individual with back pain. Individual with soft tissue injury. Individuals with inflammatory joints. Individuals with knee pain were excluded from the study. A wooden Table and a couch. A marker pen and stop watch. A plastic conventional universal goniometer were used for present study.

Procedure: Measurement taken by standard plastic goniometer with active knee extension test (AKE).

Active knee extension test: Subjects were instructed to assume a supine position on the examination table and both the hip and knee flexed 90°. The subjects then grasps behind the knees with both hands to stabilize the hips at 90 degree of flexion made marks over the lateral malleoles, and lateral femoral condyle. The subjects actively extend the knee in turn as much as possible. Then measuring the angle at the knee with a standard plastic goniometer axis at the lateral epicondyle, the stationary arm vertical and the moving arm in line with the fibula. For normal flexibility in the hamstring knee extension should be within 20 degree of full extension if hamstring are tight end feel will be muscle stretch.

Treatment Protocol: After taking assessment proper awareness and education was given about the technique which he/she under goes. Throughout the treatment procedure the patient was instructed to inform about the pain and other discomfort.

Post isometric relaxation exercise

Post isometric relaxation exercise for hamstring muscle. Subjects lie on back right knee and hip flexed, foot flat on the floor. Bring left leg up straight at the knee, until subjects can grasp angle with both hands. Find the barrier point in the thigh or buttock. Take a breath in and hold it using 25% of maximum effort, push away from you with left leg, while your hands resist producing an isometric contraction over the next 5 seconds. Let breath go quickly relaxing leg muscle but not arm. During the next 3 seconds pull the left leg closes to find new barriers pain.

RESULTS AND STATISTICAL ANALYSIS:

Mean and Standard deviation, students paired t test and students unpaired t test Used to calculate data. 3 weeks pre test adds post test values for all variables measured ad calculated. Hypothetical tests made for all data of variables between the groups by using unpaired and student 't' test respectively. The comparison may between 1st, 2nd and 3rd week of post test range of motion to check the significance.

Table: 1 Mean Age

Group	Total No. of Subjects	Age range from 19 to 24 years	
		Mean	SD
Group A	20	21.8	4.8819
Group B	20	21.32	4.6433
Total	40	-	-

Table: 2 Intergroup Comparison of Knee Extension between 1st, 2nd and 3rd Week of Post Test Mean Values

Movement	Group	N	Mean	Std- Deviation	't' test
Passive	A	20	8.4000	8.3417	p=.001
	B	20	17.200	4.6188	

These results show that there is significant difference in improvement of both active and passive range of motion.

Table 3: Intergroup Comparison of Every session Treatment Between mean of Pretest and post test values for Active KE

Group	Day	Paired Difference		t	P value
		Mean	SD		
A	1st week	9.2000	5.6789	8.100	.001
	2nd week	4.9200	2.2531	10.918	.001
	3rd week	3.2800	1.6462	9.962	.001
B	1st week	2.8400	1.8412	7.712	.001
	2nd week	2.7200	1.8824	7.7225	.001
	3rd week	1.8800	1.6411	5.728	.001

These results show that there is significant difference between knee active ranges of motion of treatment in both groups.

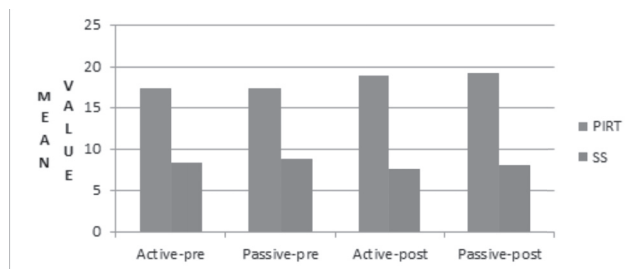
Table 4: Intergroup Comparison of Every session Treatment between Mean of pretest & Post test Values for Passive Knee Extension

Group	Day	Paired Difference		t	P value
		Mean	SD		
A	1stWeek	9.4800	5.7454	8.250	.001
	2ndweek	4.5600	2.4846	9.176	.001
	3rdweek	1.92	1.8009	5.331	.001
B	1Stweek	3.1200	2.3685	6.586	.001
	2ndweek	2.6000	1.6330	7.961	.001
	3rd week	3.0800	1.9131	8.050	.001

These results show that there is significant difference in knee extension passive range of motion of treatment in both groups.

Graph 1: Intergroup comparison between mean values of 1st, 2nd and 3rd pre-test and post test for ROM

Graph 1: Values represent inter group comparison between mean values of 1st, 2nd and 3rd pretest and post test for ROM.



Results shows that Post isometric relaxation exercise can be use as an effective therapeutic maneuver for improving ROM and flexibility of hamstring tightness in normal individuals.

DISCUSSION

Muscle tightness is one of the limiting factors for restricted range of motion and reduced flexibility of joint. Hamstring muscles are more prone for tightness causes Musculo Skeletal problems. This study focused on checking effects of static stretching and post isometric relaxation exercise in increasing ROM and flexibility of subjects with hamstring tightness. The data analysis and statistical inference have brought to check the effectiveness of SS and PIR exercise on two variables of the study which are ROM and flexibility. The PIR exercise has an effect in increase ROM and joint flexibilities. The static stretching also has an effect on increasing ROM and joint and flexibility of tight

muscle. When the results of PIR exercise and static stretching are compared the PIRT was found to be effective than static. Stretching in two variables by 3 weeks treatment programmers. This may be due to the reason that its contraction and relaxation method. In this isometric contraction increase ROM and relaxation reduces tension in tight muscle. This two technique increase flexibility and stretch sensitivity of the muscle which is followed by PIR exercise further improving lengthening reaction of muscle. Whereas static stretching primary effects is focused on tension of muscle and improves the flexibility. Inter group comparison of ROM showed very high significant difference improvement in Group A than group B in 2 weeks. In group A increase in ROM achieved in 3 weeks. Where as in group B increase in ROM 2 weeks itself. The result of my study proved PIRT may influence on tight muscle at a faster rate and more number of subjects achieved increase in ROM and flexibility of hamstring than static stretching.

CONCLUSION

This study led to the interferences that post isometric relaxation exercise and static stretching both are effective in improving the ROM in hamstring tightness and increase flexibility when both groups compared post isometric relaxation exercise found to be more effective than static stretching and also post isometric relaxation exercise. Produces more and fastest increase in ROM and flexibility when compare with static stretching. Therefore it is concluded that post isometric relaxation exercise can be use as an effective therapeutic maneuver for improving ROM and flexibility of hamstring tightness in normal individuals.

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Ethical Clearance: Shree Swaminarayan Physiotherapy College, Surat

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Effect of Physiotherapy Treatment on Frozen Shoulder: a Case Study

Punia Sonu¹, Sushma²

¹Teaching Associate, ²Student, Department of Physiotherapy, Guru Jambheshwar University of Science and Technology Hisar (Haryana)

ABSTRACT

Objective: To determine the effectiveness of physiotherapy management in patients with frozen shoulder.

Materials and Method: A rehabilitation protocol was followed to treat diagnosed frozen shoulder patient. Result: In this study, Reduction in pain, improvement in range of motion and able to do activities of daily living after giving physiotherapy management.

Conclusion: this study concluded that Various therapeutic techniques like hot packs, ultrasound, capsular stretches, strengthening exercises and home regime have a significant effect in reducing pain, increasing range of motion and stiffness of joints in frozen shoulder.

Keywords: Frozen shoulder, Physiotherapy.

INTRODUCTION

Frozen shoulder is also termed as adhesive capsulitis, stiff painful shoulder, or periarthritis is a common cause of shoulder pain is a common cause of shoulder pain. It is estimated to affect 2-5% of the general population.¹ Frozen shoulder is a rheumatological enigma.² Frozen shoulder is a ill-understood disorder. It affects the glenohumeral joint, possibly involving a non-specific chronic inflammatory reaction, mainly of the subsynovial tissue, resulting in capsular and synovial thickening. Frozen shoulder is used to denote a limitation of shoulder motion without abnormalities of the joint surface, fracture or dislocation. The onset of frozen shoulder is usually gradual and idiopathic. The disease occurs mainly in middle aged individuals and is usually self-limiting but the duration and severity may vary greatly.³ Most studies have suggested a self limiting condition lasting an average of two to three years, although significant numbers of people have residual clinically detectable restriction of movement beyond three years and smaller numbers have residual disability.¹

Frozen shoulder was first described as periarthritis by Duplay in 1872. Codman coined the term as 'frozen shoulder' in 1934. J.S.Naviaser coined the term 'adhesive capsulitis' in 1945. He found dense adhesions and capsular contractures causing in restriction of motion, intra-articular pain and microscopic evidence of reparative inflammatory changes in the glenohumeral joint capsule.

Many authors have attempted to explain the cause of frozen shoulder. Some have suggested an autoimmune phenomenon. Others have suggested the condition is a variant of sympathetic reflex dystrophy. However, patients generally do not improve after what is probably the most effective treatment for sympathetic reflex probably the most clinically useful classification of the frozen shoulder defines primary and secondary forms. In the primary form, no other identifiable systemic condition or local shoulder disease explains the patient's pain and loss of range of motion. Most of the literature on diagnosis and treatment refers to the primary form. In the secondary form, a predisposing condition usually is associated with the patient's pain and loss of movement. Patients with hemi paresis from a stroke or other upper motor

neuron lesion frequently develop a secondary frozen shoulder. Frozen shoulder might coexist with other local shoulder disorders, such as impingement syndrome. Other predisposing conditions include cervical spondylosis, recent thoracic surgery, thoracic (such as a Pancoast tumor), and coronary artery disease.⁵

Information on the treatment and prognosis of frozen shoulder is inadequate and based largely on individual practice experience rather than randomized controlled clinical trials. There is as yet no definitive agreement on the most effective form of treatment. Initial treatment is aimed at reducing inflammation and increasing range of motion. Thus analgesic and anti-inflammatory drugs are commonly used. Most type of treatment focus primarily on restoration of mobility. Although physical therapies such as massage, heat application, ultrasound, interferential treatment, osteopathic, chiropractic techniques and stretching and isometric exercise therapy are routinely prescribed, the efficacy is variable. Controversial results are reported with manipulation under anesthesia, distension arthrography, and arthroscopic surgery. In osteoporotic or postsurgical frozen shoulder, an open release with lysis of adhesions and capsule release is recommended. Intra-articular corticosteroid injection and suprascapular nerve block have also been strongly advocated. Metaanalysis of randomized controlled trials evaluating interventions for painful shoulder from 1966 to 1995, however, failed to find evidence to support or refute the efficacy of these interventions.

Acupuncture has been reported to be effective for the treatment of frozen shoulder or shoulder arthritis. Hansen reported that 5 minute acupuncture treatment sessions were equally as effective for neck and shoulder pain when compared with 20 minute sessions. However, there was an imbalance between the groups studied in terms of the pretreatment visual analogue score, and this combined with the limited trial size suggested these results may not be reliable.⁴

Manipulation under anesthesia combined with early physiotherapy alleviates shoulder pain and facilitates of shoulder function in patients with frozen shoulder syndrome.

Conservative management strategies for frozen shoulder frequently include combination of varied types of interventions such as rest, medications, acupuncture, physical agents, postural or ergonomic advice, slings and range of motion exercise programs. Therapy includes manual therapy; ROM exercises, specific stretching and strengthening exercises and aerobic program and modalities are available such as interferential therapy, ultrasound, and hot therapy. There is no doubt that physiotherapy treatment is promising and cost effective treatment option and aimed at relieving the pressure on nerves causing the inflammation and pain. This present study is done on patients' diagnosed frozen shoulder with a physiotherapy treatment protocol.

RELEVANT ANATOMY, ETIOLOGY AND PATHOLOGY OF SHOULDER

The shoulder is a complex, ball and socket synovial joint, composed of the humerus, scapula and the clavicle. The labrum is a ring cartilage that surrounds and deepens the glenoid cavity of the scapula. The resting position of the glenohumeral joint is 55° of abduction and 30° of horizontal adduction. What makes the shoulder unique among all the joints of the body is that its support, stability and integrity depend on muscles rather than bones and ligaments. However recent studies have shown that it is the group of muscles known as the rotator cuff that is most commonly involved in myofascial pathologies of the shoulder. The rotator cuff muscle group is comprised of the supraspinatus, infraspinatus, teres minor and subscapularis muscles. According to Klab, 95% of all cases of shoulder pain are attributable to the tendons of the rotator cuff becoming impinged between the greater tuberosity of the humerus and the anterior edge of acromion, especially during motions that positions the arm above the head. Thus, impingement syndromes are the most frequent type of shoulder pathology and often the result of the cumulative effect of the rotator cuff tendons constantly passing under the acromion hood.⁶

ETIOLOGY

The etiology of the frozen shoulder remains unknown. Lundburg and helbig et al proposed primary and secondary classifications for cases that occur spontaneous and for those that results trauma.

The primary, idiopathic cases are the most common and the least understood. The unknown stimulus produces profound histological changes in the capsule that are substantially different from changes produced by immobilization and degeneration. Secondary frozen shoulder commonly develops after a variety of antecedent episodes, such as central nervous system involvement, upper limb immobilization, and trauma to the arm, pulmonary cancer or infection, myocardial infarction, lengthy duration of intravenous infusion, cervical disk disease, rheumatoid arthritis, or diabetes mellitus. Quigley hypothesized that minor trauma or an episode of inflammation may produce pain, which eventually leads to disuse and the classical restriction of motion characterizing frozen shoulder. Lloyd and Lloyd suggested that secondary frozen shoulder develops when painful spasm limits activity and creates dependency of the arm.

PATHOLOGY

Features of this pathologic condition include chronic capsular inflammation with fibrosis and perivascular infiltration. Although several researchers found no evidence of inflammation, they concurred that fibrosis exists in the capsule. Chronic cases of frozen shoulder demonstrate constrictive capsulitis, characterized by adhesions of synovial folds; obliteration of the joint cavity; and a thickened, contracted capsule that eventually becomes fixed to the bone.⁷

BIOMECHANICS OF SHOULDER JOINT

Complex shoulder joint is comprised of mainly three joint glenohumeral joint, sternoclavicular joint and acromioclavicular joint. The coordinating movement of these joint during arm movement is referred to as scapulohumeral rhythm. Inman and Colleagues in 1944 showed the kinematics of the shoulder abduction, occurring at a ratio of 2:1. a full arc of 180° of shoulder abduction is the result of a simultaneous 120° of glenohumeral joint abduction and 60° of scapulothoracic upward rotation. **Stage 1** includes Glenohumeral movement alone for first 30°, inferior angle of scapula should not move and Clavicle elevate 5°. **Stage 2** includes Scapular elevation and upward rotation (20°) point glenoid cavity towards the ceiling humeral head glides inferiorly by 90° revealing a sulcus. **Stage 3 includes**

60° degree abduction, 90 degree lateral rotation of humerus, 30° rotation of scapula and 30-50° rotation up to 15 degree elevation of clavicle.⁸

DIAGNOSIS

The natural history of frozen shoulder follows a classic cycle of “freezing”, “frozen”, and “thawing”. There is an acute onset of pain that often worsens during the first weeks or months. The pain of frozen shoulder is present during both activity and rest, resulting in long term sleep disturbances. Arm movement of the shoulder also aggravates the symptoms. Limitation of the shoulder motion is the frequent symptom. Motion is guarded, and the arm is held against the body with the shoulder adducted and medially rotated. Functional activities that requires overhead reaching or behind the back may be difficult or impossible because of pain. Disuse atrophy may be evident in the rotator cuff. Capsular contractures limit the range and thus, produce a capsular end feel⁷. Both Yergason’s test¹¹ (resisted forearm supination with elbow flexed to 90°) and Speed’s test¹² (resisted shoulder forward flexion) are often positive. Other pathologies commonly found in the shoulder involve the muscles or tendons of supraspinatus, subscapularis and deltoid. These can be differentiated by the Empty can test (resisted abduction with arm at 90° abduction and medial rotation) and Lift-off sign (patient asked to lift hand off his or her lower back) and drop-arm test respectively.¹³

MANAGEMENT

Many treatments have been advocated for frozen shoulder. The existence of so many different treatments, each with its own group of enthusiastic supporters, suggests that no single treatment is unequivocally superior to others. The fundamental goal of treatment is to restore and maintain function. Corticosteroid injections have long advocated for treating frozen shoulder joint, into the adjacent soft tissues, or into the subacromial bursa¹. Many studies have included early mobilization and gentle range of motion exercises should be part of managing all patients with shoulder dysfunction. Exercise should be two types stretching exercises to prevent further loss of range of motion and promote faster return to normal range, and strengthening. A physiotherapist’s most useful role is in patient education and instruction

in appropriate exercise to prevent loss of further range and strength⁵ Among all the above treatments physiotherapy play a significant role in the treatment of frozen shoulder. After thorough assessment physiotherapy rehabilitation protocol was given to the patients. The protocol is as follows⁴.

PHYSIOTHERAPY MANAGEMENT (15 SESSIONS WERE GIVEN)

DAY 1-5

- Hot packs for 15 minutes so as to relax the muscles around shoulder complex.
- Ultrasonic therapy: 0.8 watts with 1 MHz frequency probe for 10 minutes for breaking the adhesions as well as relieving pain.
- Shoulder joint capsule stretching (4 times)
- GH Caudal glides (4sets of 10 rep. each)
- GH Posterior glides (4 sets of 10 rep. each)
- Long axis traction of glenohumeral joint (5 mins)
- Passive movements
- Finger ladder exercise
- Shoulder wheel exercise for 15 minutes
- Home regime
- Hot water fomentation
- Pendular exercises
- Wall finger climbing exercises
- Self assisted exercise.

DAY 6-10

Exercises are same while number of repetitions is increased

- Shoulder joint capsule stretching (6 times)
- GH Caudal glides (6 sets of 10 rep. each till end range)
- GH Posterior glides (6 sets of 10 rep. each till end range)
- Long axis traction of glenohumeral joint (7 times)
- Hold relax exercises (7 repts)
- Resisted exercises in available range are added (10 repts)

DAY 11-15

Exercises are kept same and the numbers of repetitions are increased.

- Hold relax exercise (10 repts)

- Resisted exercises in available range are added (15 repts)

PROCEDURE

5 patients (3 females 2 males) diagnosed case of frozen shoulder were randomly included in the study. They were assessed by a fixed assessment protocol prior to the commencement of the study. Subjects included whom had Painful, restricted active and passive range of motion of the shoulder, symptoms present for at least 1 month, absence of radiological evidence of glenohumeral joint arthritis and had capsular pattern of motion restriction. Subjects were excluded if any subject had taken local corticosteroid therapy currently and within the last 3 months, and had history of any neuromuscular diseases, Pregnancy and diagnosis of cancer within 12 months¹⁰.

DISCUSSION

Frozen shoulder is often diagnosed and managed. This is partially due to a lack of agreement about definitions and classification of this disorder, confusing terminology and difficulty differentiating it from other conditions. The frozen shoulder is characterized by an unknown etiology, spontaneous and gradual onset of pain and a global restriction of movement in the GH joint due to contractures and loss of compliance of the capsule. While the etiology is typically unknown, there can be a history of minor trauma and occasional significant injury. An important component of successful management of frozen shoulder syndrome is educating patients and informing them about the planned treatment modalities. Objectives of physiotherapy and rehabilitation applications in patients with frozen shoulder are to prevent disability, to increase functional capacity, and to provide pain relief .In this study five cases of frozen shoulder were taken, 3 females and 2 males. The age of patients were ranging from 35-60 years. All of them suffered from global restriction of movements and pain in the shoulder region. Patients also displayed a feature of nocturnal pain in common. A standardized assessment performa was used to assess the patient.

Case 1 presented with pain and stiffness in left shoulder, global restriction of movements and difficulty in ADL's .VAS score was 7 before treatment

and after physiotherapy treatment reduced to 3. Pain reduced and also stiffness in joint was reduced. She was able to activities of daily living. Case 2 presented with pain and stiffness in right shoulder, nocturnal pain, and restriction of movements. VAS score was 8 before treatment and after physiotherapy treatment was reduced to 4. Pain was reduced and also the stiffness in joint, range of motion increased. Case 3 presented with pain and stiffness in shoulder, nocturnal pain and global restriction of movements. VAS score before treatment was 8 and after physiotherapy treatment were 5. Joint stiffness was reduced and patient was able to do activities of daily living. Case 4 presented with pain and stiffness in shoulder, severe pain during sideways lifting, diabetic and history of trauma was there. VAS score before treatment was 8 and after physiotherapy treatment was reduced to 4. Pain was reduced, improved range of motion and he was able to do activities of daily living. Case 5 presented with stiffness and pain in shoulder, limitation of overhead and sideways movements, nocturnal pain. VAS scale before treatment was 7 and after physiotherapy treatment were 3 and reduction in pain, improvement in range of motion and able to do activities of daily living. All the patients were given physiotherapy treatment according to the condition for example ultrasound, hot packs, shoulder mobilization, capsule stretching, strengthening exercises for weak muscles and pain relief. Prognosis was found to be very effective after physiotherapy treatment.

CONCLUSION

The cases studied shows that physiotherapy plays an important role in treatment of patients suffering from frozen shoulder. Various therapeutic techniques like hot packs, ultrasound, capsular stretches, strengthening exercises and home regime have a significant effect in reducing pain, increasing range of motion and stiffness of joints in frozen shoulder.

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Conflict of Interest: There was no conflict of interest.

Ethical Clearance : The research was approved from the ethical committee of department of physiotherapy, guru Jambheshwar University of science & technology, hisar.

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The Effect of Training Core Stabilizers in Clerks with Low Back Pain

Sheshna Rathod¹, Nehal Shah²

¹Tutor cum Physiotherapist, Government Physiotherapy College, Jamnagar. ²Senior Lecturer, SBB College of Physiotherapy, VS hospital, Ahmedabad

ABSTRACT

Background: Low back pain is a significant public health problem associated with considerable disability, health care use and societal costs. Physiotherapists treating patients with low back pain must provide efficient and safe exercises which will enhance stability of vertebral column. **Aim:** To study the effect of training core stabilizers in clerks with low back pain. **Materials & Method:** An experimental study was carried out on 40 participants and divided into 2 groups. 20 participants in each group. Group A (Experimental group) underwent core stability exercises. Group B was Control group. Core stability exercises were given for one month. Outcome measures taken were Visual Analog Scale (VAS), Core stability gradations and Oswestry Disability Index (ODI). Pre and Post treatment measurements were taken. **Results:** There was significant improvement in VAS ($P < 0.0009$), Core stability gradation ($P < 0.0001$) and ODI ($P < 0.0001$) in group A compared to group B. **Conclusion:** Core stability exercises were effective in treating clerks with low back pain.

Keywords: Low back pain, Core Stability exercises, Pressure Biofeedback.

INTRODUCTION

Low back pain is among the leading cause of occupational injury and disability. Repetitive or static awkward body postures resulting from excessive bending and twisting will increase spinal stress and disproportionate loading to spinal structures¹. The consequences of low back pain are far reaching with sufferers experiencing high levels of disability, reduced quality of life and physical and psychological distress. These factors are associated with increase in absence from work, lost productivity and resulting economic costs². The muscular system provides major support to loaded spine during

normal function³. So injury would be more likely in presence of poor muscular protection. Lack of support by trunk musculature can occur with general weakness associated with sedentary lifestyle. This can occur due to repetitive activities of work environment or from training techniques and skill of recreational activities⁴.

Spinal stability is described in terms of three subsystems:

- Passive system (Inert structures / bones and ligaments)
- Active system (Muscle)
- Neural control system

Thus, three subsystems are interrelated⁵.

Transversus abdominis is deepest of abdominal muscle and responds uniquely to postural perturbations. It responds with anticipatory activity with rapid arms and leg movements. It has been shown that activation and function in transversus abdominis changes (delayed and more phasic) in

Corresponding Author :

Dr. Sheshna Rathod,

Tutor cum Physiotherapist, Government Physiotherapy College, Jamnagar. Address : C-4, Block no. 37, Nursing Quaters, Beside Government Physiotherapy college, Rameshwernagar, Jamnagar. E-mail: sheshnarathod@yahoo.com. Mob. 9327383558.

patients with low back pain, possibly indicating less efficient stabilizing action⁶. The multifidus has segmental attachments are able to control movement of spinal segment. In patients with low back pain, the fibers of multifidi quickly atrophy at spinal segment⁷.

Core stability strategies can be divided into two i.e. to restore coordination and control of trunk muscles to improve control of lumbar spine and pelvis⁸ and to restore the capacity (strength and endurance) of trunk muscles to meet demands of control⁹.

If the aim of rehabilitation exercise for low back pain is to enhance the mechanisms for stability of spine, it is necessary to facilitate a co-contraction in such muscles as transversus abdominis and multifidus⁷. Stability training follows basic principles of learning of motor control. The goal of initial phase of motor relearning is to contract deep muscles cognitively to increase precision and skill of contraction of local muscles. Once mastered, goal shifts to increase precision, increase number of repetition and hold time and decrease feedback. In associative phase, it involves performance of task in increasingly challenging position (e.g. sitting and standing) and integration of deep and superficial muscle function e.g. using leg loading tasks, PNF techniques and postural challenges. In autonomous phase it is achieved after considerable practice and experience. Task become habitual and automatic. Even transferring skilled movements to functional tasks¹⁰.

A pressure biofeedback is an inflatable cushion with three separate section used to monitor pressure between lumbar spine and supporting surface. Pressure changes in any of the sections of inflatable pad are detected via a standard pressure gauge calibrated in mm of Hg. Prior to test, cushion is inflated to fit into space between lumbar curve and exercise surface without forcing lumbar spine into hyperlordosis. A pressure biofeedback can be used to monitor effectiveness of co-contraction pattern as well as monitoring position of lumbar spine during testing and exercise to ensure safety during limb loading. Pressure biofeedback is used as visual feedback to aid in motor learning to show therapist that technique has been performed accurately and safely to monitor when fatigue and loss of stability occurs. Deep flat muscles and those close to vertebrae themselves need

to be activated in an appropriate pattern to protect and stabilize lumbar spine. This may be appropriate not only for those suffering back pain or pathology but also for those symptom free individuals who due to their particular work or sport or their sedentary lifestyle may require activation of these muscles for prevention of back injury and pain¹¹.

Hypothesis

Hypothesis: There is effect of training core stabilizers in clerks with low back pain.

Null Hypothesis: There is no effect of training core stabilizers in clerks with low back pain.

MATERIALS AND METHOD

Study Design: Experimental and randomized controlled trial.

Sampling Technique : Random sampling.

Sample Collection : Male and Female subjects with clinical diagnosis of mechanical back pain with age group of 30-45 yrs. and who were clerks were included.

INCLUSION CRITERIA

- Subjects who are clerks and having low back pain.
- Subjects having low back pain since more than 3 months.
- Subjects willing to participate.

EXCLUSION CRITERIA

Subjects with –

- Lumbar Spondylolysis
- Lumbar Spondylolisthesis
- Acute Disc Prolapse
- Any Neurological Disorders
- Any Other Musculoskeletal Disorders
- Hypertension and ischaemic heart disease

MATERIAL USED

- Plinth
- Pen
- Data Collection Sheet

- Weighing Machine
- Measure Tape.

Apparatus Used :

- Pressure biofeedback unit
- Shortwave Diathermy

Procedure :- Written consent was taken from the subjects. VAS, ODI and Core stability gradation were taken as outcome measures. 40 subjects were included in the study and were divided into two groups i.e. Experimental Group (Group A) and Control Group (Group B). Each group containing 20 subjects.

Both groups were treated with Shortwave Diathermy for 20 mins. for first 10 days. Along with it Core stability exercises in Group A and Isometric abdominal exercises in Group B were started. All the patients were on same medications as prescribed by the consultant. Familiarization with the procedure was done. All the patients were given back care advices.

FOR GROUP A

First 10 Days: Drawing in Maneuver: Patient was positioned in crook lying and instructed to draw the 'belly up' and in towards spine with normal breathing. Pressure biofeedback unit was used by placing cuff under lumbar spine and inflate to baseline of 40mm of Hg. Correct Drawing in Maneuver results in raising of pressure about 7-10 mm of Hg. Hold for 5-10 sec. and repeat the exercise for 5 times. Rest time was 10 sec. between each repetition.

Once patient has mastered Drawing in Maneuver the other exercises were incorporated along with it like, movement for both arms in flexion and extension alternately, while maintaining drawing in maneuver of abdomen. Repeat exercise for 5 times for each limb. Maintaining drawing in maneuver of abdomen in crook lying position slide both legs on plinth alternately. Repeat exercises for 5 times for each limb.

Next 10 Days: Some more complex exercises were added to previous exercises.

- Maintaining drawing in maneuver of abdomen in crook lying lift one feet off the plinth and flex and extend the knee.

- Maintaining drawing in maneuver in crook lying let one knee move away from midline and return while keeping feet in same place. Repeat exercises for 5 times for each limb.

Last 10 Days: Other exercises were incorporated in position of sitting and quadruped.

- In sitting, maintaining drawing in maneuver raise arm in flexion and extension.
- In sitting, maintain drawing in maneuver move knee into flexion and extension.
- In Quadruped position, maintaining drawing in maneuver slide hip and knee into extension and back to starting position.
- In Quadruped position, maintaining drawing in maneuver raise arm into flexion and back to starting position. Repeat all exercises for 5 times for each limb.

FOR GROUP B

Isometric abdominal exercises were taught. Hold for 5-10 sec. and Rest for 10-12 sec. Repeat 5 times and gradually increase the repetition upto 20 times.

Data Analysis : Here, Wilcoxon paired test was performed for analysis of VAS and Core stability grading within the group A and group B. Mann – Whitney test was performed for analysis of VAS and Core stability grading between the group A and B. For the analysis, SPSS version was used. Wilcoxon paired test was performed for analysis of ODI in group A and Paired t- test was used for analysis in group B. Unpaired t-test was used for analysis of ODI between the group A and B.

Results : Table 1 : Mean changes in VAS in Group A.

	Pre treatment	Post treatment	W-value	P-value
Mean	7.30	0.25	210	< 0.0001
Standard Deviation	0.97	0.78		

Table 2: Mean changes in VAS in Group B.

	Pre treatment	Post treatment	W-value	P-value
Mean	6.80	1.20	210	< 0.0001
Standard Deviation	1.36	1.10		

For the above table 1 and 2, Wilcoxon paired test showed a significant difference in mean of VAS for both group A and group B with P-value < 0.0001 respectively.

Table 3: Changes in VAS in Group A & B.

	Group A	Group B	u-statistic	P-value	α-value
Mean	7.05	5.65	77.500	0.0009	0.05
Standard deviation	1.09	1.13			

For the above table 3, Mann Whitney test showed a significant difference between group A and group B with P-value <0.0009.

Table 4: Mean changes in Core stability grading in Group A.

	Pre treatment	Post treatment	W-value	P-value
Mean	0.30	3.15	210	< 0.0001
Standard Deviation	0.47	0.81		

Table 5: Mean changes in Core stability grading in Group B.

	Pre treatment	Post treatment	W-value	P-value
Mean	0.15	0.55	36	< 0.0078
Standard Deviation	0.36	0.51		

For the above table 4 and 5, Wilcoxon paired test showed a significant difference in mean of Core stability grading for both group A and group B with P-value < 0.0001 and P – value <0.0078 respectively.

Table 6: Changes in core stability grading in Group A & B.

	Group A	Group B	P-value	α-value
Mean	2.85	0.40	0.0001	0.05
Standard deviation	0.67	0.50		

For the above table 6, Mann Whitney test showed a significant difference between group A and group B with P-value <0.0001.

Table 7: Mean changes in ODI in Group A.

	Pre treatment	Post treatment	W-value	P-value
Mean	45.76	8.21	210	< 0.0001
Standard Deviation	7.81	7.94		

For the table 7, Wilcoxon paired test showed significant difference in mean of ODI of Group A with P-value <0.0001.

Table 8: Mean changes in ODI in Group B.

	Pre treatment	Post treatment	P-value	t-value	df
Mean	46.67	24.86	<0.0001	12.618	19
Standard deviation	6.55	7.20			

Here, paired t test showed significant difference in mean of ODI of Group B with P-value <0.0001.

Table 9: Changes in ODI in Group A & B.

	Group A	Group B	P-value	t-Value	df
Mean	37.55	23.84	<0.0001	5.028	38
Standard deviation	9.00	8.24			

Here, unpaired t test showed significant difference between group A and group B with P-value <0.0001.

DISCUSSION

In the present study, patients with occupational low back pain were chosen, especially clerks who have a prolonged sitting posture. It is found that prolonged sitting is associated with low back pain. Angela Maria Lis et al¹² studied on association between sitting and occupational low back pain and concluded that sitting in combination with awkward posture does increase association with presence of low back pain. Rasmussen Barr E et al¹³ stated that not in short term but in long term stabilizing training seemed to be more effective than manual treatment in terms of improvement of individuals and decrease in need for recurrent treatment periods.

The results of the present study showed that experimental group had more improvement in mean changes in VAS than control group with p<0.0001. Improvement in multifidus cross sectional area, decrease in neutral zone and restoration of normal function is thought to be associated with decrease in pain.

Panjabi MM¹⁴ stated that increase in neutral zone was responsible for pain. So when there is decrease in neutral zone ultimately there is pain reduction. Hides J et al¹⁵ studied on long term effects of specific stabilizing exercises for first episode of low back pain. Following acute injury to low back. A deficit multifidus may leave injured segment susceptible to further injury. He concluded that specific exercise therapy may be required to restore normal muscle function. Kaul Rohini et al¹⁶ found that motor control deficit which is a major cause of back pain was significantly reduced by specific stabilizing exercises only.

The result of the present study showed that the mean changes in core stability (improvement) was more in experimental group than control group. There are two strategies one that aim to restore control and coordination of trunk muscle and other that aim to restore capacity of trunk muscle to meet demands of control.. The stability and control of spine is dependent not only on muscles but also on central nervous system which must determine requirements of stability to plan and implement strategies that meet these demands.¹⁷

Julie Hides et al¹⁸ found that transverses abdominis contracts bilaterally to form a myofascial band that appear to tighten and most likely improves stabilization of lumbopelvic region. Daneels L A et al¹⁹ studied on effects of three different training modalities on cross sectional area of lumbar multifidus muscle in patients with chronic low back stated that static holding component between concentric and eccentric phase was critical in inducing muscle hypertrophy.

Results of the present study showed that disability was significantly decreased in experimental group than the control group with p<0.0001. Monica Millisdotter et al²⁰ found that early neuromuscular customized training to have a superior effect of disability with a significant difference compared to traditional training it was aimed to regain and automatize feedforward recruitment of deep core muscles.

Clinical Implication :Core muscle stabilization exercises are important for treatment for low back pain.

Conclusion :- The conclusion of the study is that there

is effect in training core stabilizers in clerks with low back pain.

Limitations: • Large sample size was not taken for the study.

• Long term follow up was not taken.

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Source of Funding: There was no funding taken for this study from any agency or institution.

Ethical Clearance: The study was been approved by relevant ethical committee.

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Effect of Therapeutic Exercise on Pain and Psychological well-being in Patients with Knee Osteoarthritis

D Beulah Jebakani¹, GowriSethu², Arumugam Pahinian³, Arun Tipandjan⁴, R Megala Devi⁵

¹Reader in Physiotherapy, MTPG & RIHS, Puducherry, Ph.D scholar, Saveetha University, Chennai, ²Department of Physiology, Saveetha university, Chennai, ³Department of Physiotherapy, Sri Venkateswara college, Puducherry, ⁴Research Psychologist, ICPC&SR, Puducherry, ⁵Clinical Physiotherapist, Puducherry.

ABSTRACT

Objective: The aim of this study is to determine the effectiveness of therapeutic intervention compared with conventional physiotherapy for OA knee.

Design: A pre-test and post-test experimental design.

Setting: PMRC, Puducherry, India

Participants: knee osteoarthritis patients

Intervention: One group received therapeutic exercises and the other group received conventional physiotherapy for 3 sessions a week for 4 weeks.

Outcome Measures: The knee pain was measured using a VAS scale and Psychological wellbeing using Psychological General Wellbeing Index (PGWBI) before and after intervention.

Results: 118 participants (59 in therapeutic exercise group and 59 conventional physiotherapy group) completed the 4 week follow up. There was a significant statistical reduction of pain on comparison between the pre-test and post-test values of conventional and therapeutic exercise group ($P=0.000$). There was a statistical significant improvement of Psychological wellbeing on comparison between the pre-test and post-test values in therapeutic exercise group ($P=0.000$). The effect size analysis revealed that therapeutic exercise improves Psychological wellbeing and reduce pain.

Conclusion: Therapeutic exercises improved the psychological well-being of patients and reduced pain with Knee OA.

Keywords: Osteoarthritis, Psychological wellbeing, Pain, Therapeutic exercise, Physiotherapy.

INTRODUCTION

Osteoarthritis of the knee is reported to be a major health problem worldwide.^{1,2} Osteoarthritis of the knee can severely affect a person's quality of life.^{3,4} The etiology of knee OA is not clear, but its incidence increases with age^{5,6}. Recent evidence suggests that the causal effect of present pain condition on future disability may be at least partially due to depression. However, the role of psychosocial factors, notably

psychological well-being is less clear in the Indian context.

Pain and impairment are the key domains of burden in people with knee OA leading to a reduction in the quality of life^{7,8}. Literature suggests that knee OA pain is the root cause of both disability and depressive symptoms⁹. Emotional distress interacts with physical symptoms in complex way. Individuals with knee OA also require treatment that

addresses the psychological impairments that are found¹⁰. This is because to improve the psychological wellbeing of individuals with OA of Knee that occurs in old age. Psychological wellbeing (PWB) is a self-motivated state considered by a reasonable amount of harmony between an individual's abilities, needs and expectations, and environmental demands and opportunities¹¹. It is a satisfaction of one's desires and goals¹². While exercise is recognized as component of the management of knee OA, more clinically practicable regimens and relatively simple physical activities are still needed for greater compliance and better care in reducing pain and psychological well being.

Knee OA is ranked as one of the greatest stressors in life. Depression, anxiety and stress are also significant predictors of upcoming pain symptoms¹³⁻¹⁵. Depression and Chronic pain are each individually associated with poorer overall health status. Compared to either condition alone, patients with comorbid pain and depression experience greater healthcare costs, more disability, and higher morbidity and mortality¹⁶⁻²¹.

Treatment modalities: Many treatment have been developed, including non steroidal anti-inflammatory drugs, physical therapy modalities, and therapeutic exercises²². A growing body of evidence shows that exercise improves knee joint function and decrease symptoms.²³⁻³⁴ Therapeutic exercise in OA knee may prevent degeneration caused by disuse without causing further degeneration and pain as a consequence of joint deformity or incongruence^{28,35,36}. The American Academy of Orthopaedic Surgeons 2013 guidelines for the treatment of knee OA includes strengthening, low-impact aerobic exercise, neuromuscular education, and physical activity for those with symptomatic OA³⁷. There is some evidence from randomized controlled trials that strengthening exercise is associated with reductions in depressive symptoms in those with knee OA³⁸⁻³⁹.

The aim of this study is to determine the effect of therapeutic exercises compared with conventional physiotherapy for knee OA. The hypothesis is that therapeutic exercise and hot packs would be more effective than conventional physical therapy for decreasing pain and improving Psychological wellbeing.

METHOD

This study was conducted from April 2012 to December 2013 at Physical Medicine & Rehabilitation Centre. Puducherry, India. A total of 124 patients were recruited and due to dropouts during the intervention period, final analysis was done with 59 participants in each group. Among 59 patients, 19 were male and 40 female in the conventional and 28 male and 31 female in the therapeutic exercise groups. Patients of diagnosed unilateral knee OA in the age group 50-65 years and had sufficient English/Tamil language skills to complete the assessment tools were included in the study.

Subjects were excluded from the study if they had any of the following:

Presence of any neurological disease, uncontrolled low or high blood pressure, uncontrolled cardiopulmonary or respiratory condition, inability to rise from and return to a chair without assistance, any additional muscular skeletal diseases or surgeries, psychiatric illness and liability to co-operate.

Ethical committee approval and informed written consent were obtained.

Instruments used: The demographic data were collected from the participants.

The pain was measured using a VAS for knee pain in the previous week. VAS represents the severity dimensions by a 10-cm plain line with two anchor points of no pain and worst pain that one ever felt.

Psychological General Wellbeing Index (PGWBI)²¹ is a validated questionnaire of 22 items that measure self-reported intrapersonal affective or emotional states. Sub-scales are: Anxiety, Depressed mood, Positive Wellbeing, Self-Control, General health, and Vitality. Each response is rated ranging from 0 to 5 and summed to provide the composite score which ranges from 0 (negative affective) to 110 (positive affective).

Interventions: Therapeutic exercises, that included warm-up, active range of motion exercise, strengthening exercise, muscle stretching and cool down along with conventional physical therapy group, were applied to patients in therapeutic exercise group and patients in the control group received hot packs and isometric quadriceps exercise

as conventional physiotherapy for 3 alternate days a week for 4 weeks.

t test was used to compare pre and post test scores of both groups. All tests were two sided and a p value of 0.05 was considered significant. SPSS software (Version 18) was used for data analysis.

STATISTICAL ANALYSIS

Mean and standard deviations were used .Paired

Results

Table1: Demographic characteristics

Variables	Therapeutic Exercise		Conventional Physiotherapy	
	Frequency	Percentage	Frequency	Percentage
Age (in Yrs)				
50-55	29	49.2	25	42.4
56-60	23	39	18	30.5
61-65	7	11.9	16	27.1
Gender				
Male	28	47.5	19	32.2
Female	31	52.5	40	67.8
BMI				
18.6-24	12	20.3	11	18.6
25-29	23	39	31	52.5
330	24	40.7	17	28.8
Duration (in Yrs)				
3-6	38	64.4	31	52.54
7-12	21	35.6	28	47.45
Education				
High School	39	66.1	44	74.6
Secondary	9	15.3	2	3.4
Graduate	11	18.6	13	22

Table2: Psychological general well being index (PGWBI) of Therapeutic Exercise

	Pre test		Post test		t value	p value	Mean diff
	Mean	SD	Mean	SD			
Anxiety	8.458	0.407	18.57	3.621	16.91	<0.001**	-10.11±4.89
Positive Well-being	6.621	3.368	14.44	3.395	14.83	<0.001**	-7.814±4.04
Self-control	5.017	2.543	10.94	2.193	6.291	<0.001**	-5.932±2.70
General health	5.068	2.538	10.93	2.377	15.94	<0.001**	-5.864±2.82
Vitality	6.390	3.50	15.17	3.592	15.18	<0.001**	-8.780±4.44
Depression	5.119	2.792	10.96	2.042	5.554	<0.001**	-5.847±2.88
*Psychological well-being (Total)	37.44	16.01	79.95	17.70	16.93	<0.001**	-42.50±19.28

Table- 2 shows significant differences between the pre test and post test scores in all dimensions of the psychological wellbeing in the therapeutic exercise group, p.001, with the highest mean difference observed for anxiety and vitality dimensions.

Table 3: Psychological General Well Being Index scores (PGWBI) of Conventional therapy group

	Pre test		Post test		t value	p value	Mean diff
	Mean	SD	Mean	SD			
Anxiety	9.41	3.87	7.49	4.33	1.516	<0.001**	1.915±2.96
Positive Well-being	7.53	3.21	5.66	3.19	1.794	<0.001**	1.864±3.24
Self-control	5.37	2.82	4.78	2.41	1.902	<0.001**	0.593±2.29
General health	5.32	2.64	4.66	2.44	1.511	<0.001**	0.661±2.02
Vitality	6.83	3.27	6.02	0.81	1.383	<0.001**	0.814±2.62
Depression	5.47	2.60	4.78	2.77	1.385	<0.001**	0.694±2.23
*Psychological well-being (Total)	39.53	16.90	33.90	17.2	1.829	<0.001**	5.627±13.22

Table- 3 shows the pre test and post test scores in all dimensions of the psychological wellbeing in the conventional therapy group with the highest mean difference observed for anxiety and positive wellbeing dimensions.

Table 4: VAS mean difference and t value for pre and post test for VAS scores

	Groups	Pre-test		Post-test		t value	p value	Paired diff
		Mean	SD	Mean	SD			
VAS	Therapeutic exercise	6.23	0.95	3.29	18.35	18.35	<0.001**	2.942±1.232
	Conventional therapy	6.008	1.25	6.17	1.298	11.39	<0.001**	-0.161±0.711

When analyzing the pain using visual analog scale as seen from table 4, the pre and post test comparison showed significant difference in both therapeutic and conventional therapy groups with p0.01.

Table 5: Effect size showing comparison among group of psychological well being

Group	N	Effect size	Effect size
Therapeutic exercise	59	2.514	Very large effect
Conventional Therapy	59	0.331	Small effect

Pre and post test comparison of psychological wellbeing showed very large effect $r = 2.51$ for the therapeutic group.

DISCUSSION AND CONCLUSION

The purpose of the study was to determine the effectiveness of Therapeutic Exercise in reducing pain and improving Psychological well-being of patients with Knee Osteoarthritis. Today, different physiotherapeutic and other non-therapeutic interventions have been used for the management of patients with Knee Osteoarthritis. However identifying the best mode of intervention is a challenge to practicing physiotherapists. To overcome such issues, in this study we made an attempt to illustrate the best intervention practice for people with Knee Osteoarthritis by comparing conventional physiotherapy and Therapeutic exercise, using a pre and post design.

The current research showed that the results

of sub scale of psychological well-being differed across two groups. The overall result suggests that the therapeutic exercise improved the psychological well-being of patients with Knee OA when compared to conventional physiotherapy. When analysing the depression reduction process of two groups, it was found that the therapeutic exercise group showed a higher reduction of depression than the conventional group. It was evident from earlier studies that depression may be related to not only pain, but also to function in people with knee OA and the mechanism behind this depression can be attributed to the decrease in neurotransmitters such as serotonin and norepinephrine and increased level of cortisol⁴⁰. It can be perceived that the therapeutic exercise group experiences a positive psychological well-being due

to the lesser level of anxiety, depression and negative stress related emotions. Nonetheless one has to remember that variation in the psychosocial variables can be due to the perception of pain and function due to knee OA.

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The effect of TST with Trunk Restraint versus PNF Technique on Functional Performance of Upper Extremity in Acute Hemi paresis : a Comparative Study

Vishwas G Vaghela¹, Neha Udavat², Shradhdha Vala³

¹ Lecturer, Parul institute of physiotherapy, Vadodara, ² Physiotherapist, Brisbane, Queensland, Australia

³ Physiotherapist, Narhari Hospital, Vadodara.

ABSTRACT

Background & purpose:- Upper limb function was recently shown to improve following treatment with task specific training with trunk restraint. Proprioceptive neuromuscular facilitation is a good treatment for hemiparesis. No previous study was done to compare both the treatment techniques.

Objective:- The objective of the study is to determine the positive response of the task specific training with trunk restraint and Proprioceptive neuromuscular facilitation on upper limb function for patients with hemiparesis attributable to stroke.

Methodology:- 30 patients (21 male, 9 female; age range 45-65yrs) with anterior knee pain underwent a standardized history and physical examination. After the evaluation each subject was rated on Modified asworth scale for spasticity and then each subject was assessed according to Fugl-Meyer scale. The functional level perceived during each activity was rated on ARAT and CMHI. Following the assessment, all subjects were assigned into two groups. Group A treated with task specific training with trunk restraint and Group B was treated with Proprioceptive neuromuscular facilitation and after 12 weeks patients were again rated on ARAT and CMHI.

Study design: – Experimental design

Outcome measure:- 1 Modified asworth scale 2 Fugl-Meyer scale. 3 ARAT 4 CMHI.

Results:- Data for 30 patients were included in the data analysis. Between group analysis shows significance ($P < 0.05$) improvement in CMHI in both the groups. Whereas ARAT was ($P > 0.05$) not significantly improved in both the groups.

Conclusion: - Study concludes that Proprioceptive neuromuscular facilitation and task specific training with trunk restraint produces greater improvement in upper limb function than patients with only with task specific training with trunk restraint in terms of movement and function.

Key Words:- PNF, TST, ARAT, CMHI, U.L, CVA

Corresponding Address: Dr. Vishwas G Vaghela,
C/O Geetaben G Vaghela, Shrinath Society,
Narsoli Road, Shradhdha Bunglow, Bhiloda, Dist-
Sabarkantha. Ph no- 9427494513
E-Mail: vishwas.mpt@gmail.com

INTRODUCTION

The human brain is the center of the human nervous system.

The brain monitors and regulates the body's

actions and reactions. It continuously receives sensory information, and rapidly analyzes this data and then responds, controlling bodily actions and functions. The brainstem controls breathing, heart rate, and other autonomic processes that are independent of conscious brain functions. The neocortex is the center of higher-order thinking, learning, and memory. The cerebellum is responsible for the body's balance, posture, and the coordination of movement. At the age of 20, a man has around 176,000 km and a woman about 149,000 km of myelinated axons in their brains.¹

The cerebral hemispheres form the largest part of the human brain, Underneath the cerebrum lies the brainstem, resembling a stalk on which the cerebrum is attached. At the rear of the brain, beneath the cerebrum and behind the brainstem, is the cerebellum. The cerebral cortex is nearly symmetrical, with left and right hemispheres.

Each hemisphere of the brain interacts primarily with one half of the body, but for reasons that are unclear, the connections are crossed: the left side of the brain interacts with the right side of the body, and vice versa! Motor connections from the brain to the spinal cord, and sensory connections from the spinal cord to the brain, both cross the midline at brainstem level.

Stroke-A stroke or "brain attack" occurs when a blood clot blocks an artery (a blood vessel that carries blood from the heart to the body) or a blood vessel (a tube through which the blood moves through the body) breaks, interrupting blood flow to an area of the brain. When either of these things happen, brain cells begin to die and brain damage occurs. When brain cells die during a stroke, abilities controlled by that area of the brain are lost. These abilities include speech, movement and memory. How a stroke patient is affected depends on where the stroke occurs in the brain and how much the brain is damaged. Stroke is a neurological dysfunction due to an abnormality in cerebral circulation with resultant signs and symptoms that correspond to involvement of respective focal areas of the brain.²

Types of Stroke :

Ischemic Stroke:

In everyday life, blood clotting is beneficial. When you are bleeding from a wound, blood clots work to slow and eventually stop the bleeding. In the case of stroke, however, blood clots are dangerous because they can block arteries and cut off blood flow, a process called ischemia. An ischemic stroke can occur in two ways: embolic and thrombotic stroke.

Embolic-Stroke : In an embolic stroke, a blood clot forms somewhere in the body (usually the heart) and travels through the bloodstream to your brain. Once in your brain, the clot eventually travels to a blood vessel small enough to block its passage. The clot lodges there, blocking the blood vessel and causing a stroke. The medical word for this type of blood clot is embolus.

Thrombotic-Stroke: In the second type of blood-clot stroke, blood flow is impaired because of a blockage to one or more of the arteries supplying blood to the brain. The process leading to this blockage is known as thrombosis. Strokes caused in this way are called thrombotic strokes.

Hemorrhagic Stroke: Strokes caused by the breakage or "blowout" of a blood vessel in the brain are called hemorrhagic strokes.

Effects of Stroke: The specific abilities that will be lost or affected by stroke depend on the extent of the brain damage and most importantly where in the brain the stroke occurred. The brain is an incredibly complex organ, and each area within the brain has responsibility for a particular function or ability. The brain is divided into four primary parts: the right hemisphere (or half), the left hemisphere, the cerebellum and the brain stem.

Right-Hemisphere Stroke:- The right hemisphere of the brain controls the movement of the left side of the body. It also controls analytical and perceptual tasks, such as judging distance, size, speed, or position and seeing how parts are connected to wholes. A stroke in the right hemisphere often causes paralysis in the left side of the body. This is known as left Hemiplegia. at correspond to involvement of respective focal areas of the brain.²

Left-Hemisphere Stroke:-The left hemisphere of the brain controls the movement of the right side of the body. It also controls speech and language

abilities for most people. A left-hemisphere stroke often causes paralysis of the right side of the body. This is known as right Hemiplegia.

Cerebellar Stroke: The cerebellum controls many of our reflexes and much of our balance and coordination. A stroke that takes place in the cerebellum can cause abnormal reflexes of the head and torso, coordination and balance problems, dizziness, nausea and vomiting.

Brain Stem Stroke: Strokes that occur in the brain stem are especially devastating. The brain stem is the area of the brain that controls all of our involuntary, "life-support" functions, such as breathing rate, blood pressure and heartbeat.²

OBJECTIVES

1. Effect of task specific training with trunk restraint,
2. Effect of Proprioceptive neuromuscular facilitation,
3. Observe co-relation between both the treatment methods.
4. To determine the positive response of task specific training with trunk restraint and Proprioceptive neuromuscular facilitation on upper limb function in hemi paresis.

HYPOTHESIS

Experimental hypothesis: There may be a significant difference in the effectiveness of task specific training with trunk restraint and proprioceptive neuromuscular facilitation on upper limb function in hemiparesis.

Null hypothesis: There may not be significant difference in effectiveness of task specific training with trunk restraint and proprioceptive neuromuscular facilitation on upper limb function in hemiparesis.

STUDY DESIGN – Experimental study design

SAMPLES- 30 subjects with hemi paretic with upper limb involvement of age group between 45-65 years are taken . Each subject is evaluated for the study.

AGE GROUP –45 to 65 years.

INCLUSION CRITERIA

1. Age group 45-65 yr,
2. hemi paresis
3. duration more than 6 months and less than 1year.
4. Spasticity grading less than or equal to2/5 on modified ashworth scale.³
5. All the three arterial involvement,
6. Patients with non traumatic stroke
7. Both genders are eligible,
8. Any side involvement (right or left)are included.
9. Patient who can continue the treatment for all sessions,
10. Patients who can understand the commands and are able to answer about their condition.
12. Patients who are not taking any other treatment for upper limb disability.

EXCLUSION CRITERIA

1. Patients who have occipital lesions⁴
2. Patients who have cerebellar lesions⁴.
3. Patients who have orthopedic conditions like⁵
 - sublimation of shoulder joint
 - Post Fracture stiffness
 - contracture of affected upper extremity
4. Patients with neurological disability like ⁶
 - head injury
 - dementia
 - major depression
 - learning disorder⁵
5. Patients with visual impairment.⁵

METHODOLOGY

It is an experimental study design , a sample of 30 patients will be included in the study with a pre test and post test study design.

PROCEDURES

Group A - received task specific training with trunk restraint.

Group B- received Proprioceptive neuromuscular facilitation technique before performing task

training.

Statistical analysis of data is done with---

- 1) Independent t test.

TOOLS USED FOR THE STUDY

1. Evaluation chart,
2. Table⁷
3. arm chair with adjustable height
4. body and shoulder belt attached to chair
5. Stopwatch
6. Box
7. Blocks of various size ,shape and weight
8. glass, spoon, coins and pot
9. peg board
10. modelling dough for kneading activity.

Assessment of Modified Ashworth Scale.⁸

Study Duration: 12 weeks.

PROCEEDURE- Patients with upper limb disability underwent a standarised history and physical examination. A detail assessment was done and the assessment form was filled. spasticity was measured for every patient and was graded accordingly. Patients is made to lie supine on couch and the affected limb was moved passively through range. Patient were scored on modified ashworth scale.

After that, each subject was tested according to fugyl meyer assessment scale and was scored accordingly . Subjects are assigned in to 2 group (A and B).There are 15 patients in each group by convenient sampling. Treatment is of 6 session in 12 week.

Group A received task specific training with trunk restraint.

Group A treated with task specific training with trunk restraint which consisted of making the patient sit on a chair and a shoulder and trunk harness is tied around the patient to avoid trick movement which are performed during task completion. Now the patient is asked to perform the specific task like peg board exercise etc in the correct manner taught. Patient is adviced to perform these task exercise 3times /day .⁹

Group B received Proprioceptive neuromuscular facilitation technique before performing task training.

Group B treated with PNF and task specific training both which consisted of extension pattern of pnf prior to task specific training. Once pnf treatment session is over than patient is asked to sit on the chair , the chest and trunk harness is tied and nw the patient is asked to perform the task assigned. As pnf patterns can't be performed by the patient 2 sessions of pnf is given in the department and once task training is to be performed by self. ⁹

FINDINGS-RESULTS

Table 1. Group analysis within Group A and Group B on day 0. Within group analysis

Outcome measure	Group	Day	Mean	S.D.	T test value	Level of significance
A.R.A.T	A	0	16.80	1.85	.412	P>0.05
	B	0	16.53	1.68		
C.M.H.I	A	0	41.13	9.33	.149	P>0.05
	B	0	40.67	7.72		

Table 2. Group analysis within Group A and Group B on 6th week. Within group analysis

Outcome measure	Group	Day	Mean	S.D.	T test value	Level of significance
A.R.A.T	A	6 th week	26.73	2.25	.483	P<0.05
	B	6 th week	26.33	2.28		
C.M.H.I	A	6 th week	62.87	11.05	1.053	P>0.05
	B	6 th week	66.60	8.13		

Table 3. Group analysis within Group A and Group B on 12th week. Within group analysis

Outcome measure	Group	Day	Mean	S.D.	T test value	Level of significance
A.R.A.T	A	12 th week	43.67	5.52	2.251	P<0.05
	B	12 th week	47.93	4.83		
C.M.H.I	A	12 th week	83.67	5.81	1.544	P>0.05
	B	12 th week	86.47	3.94		

DISCUSSION

The study of 12 weeks structured,

- 1) Calculated t value of ARAT at Day 0 for both group is ,Which not significant at the level of 0.05 .And calculated value of CMHI at 0 is which is also not significant at level of 0.05.
- 2) In comparing the improvement on 6th week between both the group
 - a)- Calculated t tets value for ARAT is significant at 0.05 level .
 - b) Calculated t test value for CMHI is not significant at 0.05 level. This indicates that there was a significant improvement in CMHI in between group analysis at 6th week of study.
- 3) In comparing the improvement on 12th week between both the group
 - a) Calculated t tets value for ARAT is significant at 0.05 level .
 - b) Calculated t test value for CMHI is not significant at 0.05 level.

This indicates that there was a significant improvement in CMHI in between group analysis at 12th week of study.

The purpose of the this study was to

conduct a study which compare Task specific training with trunk restraint versus Proprioceptive neuromuscular facilitation with task specific training with trunk restraint for treatment of upper limb function in hemiparesis in terms of finding better and less time consuming treatment , by correcting the anterior trunk displacement and giving pnf pattern prior to task training, with reduced effort and better functional outcome measures.

Results indicates that in both the groups CMHI score increased significantly over time (P<0.01) . However , there was significant difference between both the groups over time.(P>0.05) that indicates that Group A and Group B have same level of functional improvement.

Stastical analysis revealed that values of Group post treatment CMHI values are less then Group B post treatment CMHI values .So, that PNF with task specific training with trunk restraint is better treatment choice for improving function of upper limb after stroke . PNF develops muscular strength and endurance, facilitates stability ,mobility , neuromuscular control, and coordinated movements and lay a foundation for restoration of function.

In this study , it was observed that the patients underwent pnf combined with task specific training

with trunk restraint . recorded more significant improvement in outcome of function as compared to task specific training with trunk restraint group .This shows that in treating upper limb in stroke the pnf combined with task specific training with trunk restrain produces Significant improvement in functional activity.

The results of this study for with in group analysis indicates that in comparative Analysis of the Pre and Post treatment data ,both group improved significantly (P<0.01) on all the scales in terms of function.

This proves that pnf with task specific training with trunk restraint is effective to improve functions in the subjects of upper limb disability after stroke .As well as task specific training with trunk restraint is also effective to improve function in the subjects of upper limb.

LIMITATIONS

- 1) No follow up was included in this study.
- 2) Task specific training and Pnf is not applicable to patients with many other conditions , because of many contraindication .
- 3) No objective outcome measurement was taken as outcome measure.

RECOMMENDATIONS

- 1) Follow up should be included to see the long term effects of treatment.
- 2) Further study can be done to find out more functional improvement in patients with upper limb hemi paresis attributable to stroke.
- 3) In further study objective measures should be included.

CONCLUSION

- 1) The use of PNF in patients with UPPER LIMB HEMIPARESIS produces significant improvement in UL Function.
- 2) The use of TASK SPECIFIC TRAINING WITH TRUNK RESTRAINT in patient with UPPER LIMB HEMIPARESIS produces significant improvement in UL function.
- 3) Comparing the effect of Task specific training with trunk restraint andPNF combined with task specific training with trunk restraint in both the group ,we can conclude that PNF combined with task specific training with trunk restraint produces greater improvement in UL function then Task

specific training with trunk restraint . But also both the group b does have significant improvement in function.

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Does Medial Arch Height Differs from Barefoot Runners to Shod Runners? – an Analytical Study

Watson Arulsingh¹, Ganesh Pai², Asir John Samuel³

¹Associate Professor, ²Professor, ³Lecturer, Alva's College of Physiotherapy Moodbidri, Dakshina Kannada District, Karnataka.

Abstract

Introduction and background: The integrity of foot arch plays a vital role in providing shock absorption in lower limb activities. Barefoot running is presumed to help retraining intrinsic foot muscle and causing a well developed medial arch of foot compared shod runners as reported by researchers and allowing proper stretch and recoiling effect on foot arch, thereby preventing injuries in runners. Thus this study was intended to analyze variation in medial arch height of foot among long, middle distance shod and barefoot runners.

Study design: cross sectional study.

Sampling method: convenient stratified sampling.

Methodology: For this purpose, 60 samples were selected. Namely 20 from barefoot runners, 20 from shod runners and 20 from controls in analysing their medial arch height with validated tool named normalized navicular height truncated (NNH) to see if there is real difference exist in arch height static weight bearing posture among these groups.

Results: ANOVA test was used to analyze significance of difference among three groups NNH and resulted in $p=0.88$ for right foot and $p=0.34$ on left foot.

Conclusion: The current study revealed no significant difference between these three groups in the evaluation of navicular height normalized.

Keywords: Normalized navicular height, runners, BMI

INTRODUCTION

Medial arch of foot plays a crucial role in absorption of shock that is encountered in almost all lower limb activities. The arch of foot functions as a spring during running by elongating until mid-stance and then recoils in second half of stance. The stretch reflexes initiated from this elongation of the foot intrinsic muscles facilitate shock absorption well at the ankle and knee through inhibition of soleus and quadriceps to permit the ankle and knee to adjust slightly as body weight is transferred to the leg¹. In a

much recent study, Lieberman *et. al.*² explained how medial longitudinal arch flattens and stores elastic energy with foot pronation in ambulation. Lieberman also added that unshod runners who adopt forefoot (FFS) or midfoot (MFS) strike have the advantage of loading medial longitudinal arch during the entire first half and latter half of stance phase in running as the windlass mechanism reaches maximum level of function. In shod runners as they use rearfoot strike (RFS) pattern, they lose advantage in using this mechanism because the medial longitudinal arch is unable to preload until both rearfoot and forefoot are in contact with the ground.

Evidences support forefoot and midfoot strike are commonly adopted by barefoot runners or in

Corresponding author :

Watson Arulsingh

E-mail: watsonarulsingh@yahoo.in.

Contact Number +91 9945892843

minimalists in order to protect the feet and lower limbs from specific impact-related injuries as they are reported to be high among runners.² In rear foot strikers foot arch does not lengthen even after the ball of the foot contacted the ground,³ whereas the longitudinal arch of the foot is loaded in three-point bending for forefoot strikers immediately as foot contacts the ground. Hence fore foot strikers uses extrinsic and intrinsic muscles of the arch differently than a rear foot strikers. If foot muscles respond in this way when running barefoot or in minimal, it is presumed to strengthen the arch's muscles more than shod running with arch supports. Another hypothesis raised by researcher⁴ that running shoes with arch supports might limit amount of arch collapse as well as arch lengthening that might be entirely opposite to the mechanics of barefoot running and presumed to have negative effect on arch muscles in shod runners. Hence it is assumed that FFS running might strengthen foot arch muscles more than RFS running. On this basis, one has to consider forefoot and barefoot running likely to require more foot muscle strength to avoid injury. A study has reported that runners who trained for five months in minimal shoes had significantly larger and stronger extrinsic muscles⁵.

Barefoot runners are reported to have less morphological changes in arch of the foot including lesser number of pesplanus⁶ and a lesser frequency of foot abnormalities.⁷ Some authors exclaimed that strong foot may be more supple and should be able to control excess pronation and other movements subsequently in preventing specific running injuries.^{8,9}

Robbins & Hanna (1987)¹⁰ studied on 17 runners who increased barefoot activity in the last four month, found to have had shorter arches of feet. He further suggested that modern running shoes are contributing to higher injury rate as they blocked sensory feedback from contact with ground, whereas barefoot runners reported fewer injuries and did not had longer arches. Hence barefoot running could be possible means rehabilitating intrinsic muscles of foot.

Though modern foot wears have originally evolved from simple foot coverings which meant to protect feet from thermal and colder climates as well

as mechanical protection from all environments¹, also reflecting different cultures, fashion. Researchers reported that modern footwear alters the way of running and that may decondition the feet. Cushioning and motion control features are needed in order to protect runners from injury. But recent studies have reported despite of the peculiar selection shoe type on the basis of foot morphology no changes in injury occurrence are observed with appropriately matching runners.^{11,12,13}

Numerous studies have recommended that a habitually barefoot is healthier compared to the habitually shod foot. Schulman¹⁴ reported that people who are habitually barefooted have relatively few foot disorders. Fiolkowskiet al. (2003)¹⁵ have analysed navicular drop (ND) pre and post with the induction of lidocaine (1% with epinephrine) by an orthopedic surgeon on tibial nerve. Abductor hallucis muscle electrical activity was monitored in his study. Their study demonstrated increase in navicular drop compared pre nerve block data. This increase in navicular drop after inducing nerve block with decreased intrinsic foot muscle activity indicates that intrinsic foot muscles play a vital role in support of the medial longitudinal arch in relaxed standing. Thus Reflection of arch integrity is might be seen by the measurement of arch height.

Headlee D al (2008)¹⁶ induced fatigue on foot intrinsic muscle by specific exercises and monitored abductor hallucis activity through surface electromyography correlating with navicular drop (ND) during static stance before and after induction fatigue. Subjects demonstrated more ND after fatigue ($p < 0.0005$). This again supports that intrinsic muscles of foot play a role in maintaining of the medial longitudinal arch in static stance. When these muscles get disrupted through fatigue, it led to increase in pronation through navicular drop test.

Foot Arch height usually determined by visual method, arch index, navicular height measurement and navicular drop test (ND), truncated navicular height normalized and still new evolving clinical methods are being evolved and tested for validity, reliability.

George S et al 2008¹⁷ in his study compared arch index and truncated navicular height with

gold standard radiological arch measurement in characterizing medial arch height of foot, reported that truncated navicular height correlated closely with radiological finding especially in calcaneal inclination angle compared to other clinical foot arch measurement he used. Ator¹⁸*et al.* (1991) and Vicenzino¹⁹*et al.* (2000) reported good reliability for measurement of NH (intraclass correlation coefficients (ICCs) greater than 0.94). But in order to get accurate NH according to various foot length, NH has to be normalized.

Rasch and Burke²⁰ reported that when foot is enclosed in shoe, small plantar muscles goes for atrophy as though they are immobilized, so with wearing supportive shoes compromises efficiency. When these muscles do not function strongly or efficiently, causes excessive pronation of the foot. When the intrinsic muscles are not able to convert the foot from a force absorber to a force transducer through stance, efficiency and power is lost, thus the body may have to seek other ways to gain speed. The result of these is often compensatory recruitment from the anterior musculature of the hip, which is already overactive.

According to Robbins (1987) and Bruggeman²¹ (2005), absence of arch support results in strengthening of the arch musculature. Morimoto and Okada²² (1985) reported long distance runners to have lower dorsal arch than throwers, jumpers and sprinters, and they speculated the cause to be the mechanical stress. M. Kouchi²³*et al* (2003) reported through their study that the runners had narrower heel, lower dorsal arch height, shorter heel to medial and lateral malleoli lengths, shorter heel to the base of 5th metatarsal than non-athletes of the same foot length.

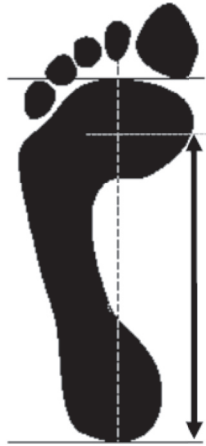
However, there is now considerable evidence that shoe-wearing also accentuates the height of the medial longitudinal arch.^{3, 24} Thus this study was mainly intended to analyze the variation medial arch height of feet among bare foot runners, shod runners and controls.

MATERIAL AND METHOD

Materials used: Metal ruler, plastic tray, ink, graph sheets, water soluble marker, pencil, scientific calculator, stadiometer, weighing scale, data sheet.

Method: Subjects were stratified in to three groups namely shod runner, barefoot runners and non runners. Overall sample size of 60 determined for this study with 20 from shod runner group, 20 from barefoot runner group and 20 from controls at convenient sampling method. Ethical review Board committee approval certificate obtained. Consent was obtained from every participant. Runners and controls who fulfills inclusion criteria chosen for this study. Long, middle distance habitually shod and barefoot runners with minimum of three years participation are selected for this study. Age group between 18 to 25 years and nonathletes of same age group included. Both genders were selected. Subjects were excluded if they had any congenital lower limb deformities, trauma in the feet other than event related, athlete with auto immune disorder and athlete with metabolic diseases, Smokers, participant with suspected or known cardiac problem, any other neurologically affected foot. Participants BMI were calculated. To measure medial arch height of foot normalized, truncated navicular height measure was used. Subject was made to assume relaxed standing position with feet positioned shoulder width apart. Navicular tuberosity was marked with water soluble marker. Navicular height was calculated by measuring distance from the most medial prominence of the navicular tuberosity to the supporting surface. Then subjects were made to stand on two graph sheets placed in front of them after dipping their feet in ink diluted tray for generating foot print. Demarcation of first MTP joint in foot print is made when subjects were maintaining their position on the graph. To calculate truncated foot length, distance between the two lines perpendicularly drawn from first MTP joint and from the most posterior aspect of the heel calculated (Figure 1). Then navicular height was divided by truncated foot length to derive normalized foot arch height. Values are documented as normal arch foot if NNH value fall within 0.22-0.31. If NNH values were less than 0.18 was documented as Flat foot¹⁷.

Figure.1: Normalized navicular height truncated. Figure 3

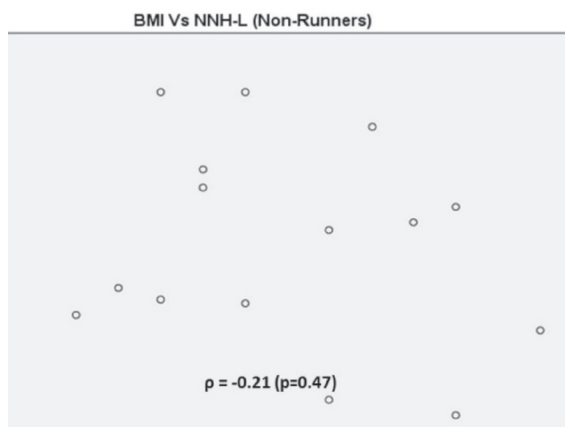


Statistical analysis: SPSS v-20 was used for data analysis. ANOVA test of significance was used to compare normalized navicular height (medial arch height of foot) among the three groups analyzed for this study. Pearson rank correlation coefficient (r) was used to establish correlation between BMI and NNH among these groups analyzed.

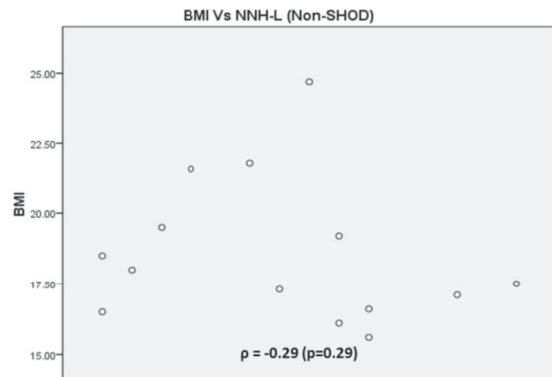
RESULTS

Data collected and NNH was compared among shod, barefoot runners and controls. ANOVA test was used to analyze right foot NNH among three groups, resulted in $p=0.88$ and left foot p value 0.34 reveals no significant difference NNH(medial arch height) between these three groups.

Figure 2

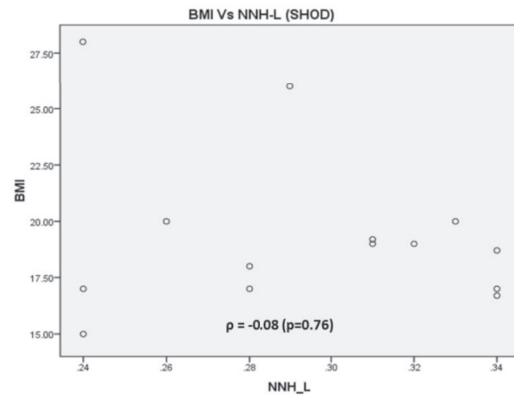


When correlating BMI to left foot NNH on barefoot runner group resulted in Pearson value of $r= -0.29$ ($p=0.29$).



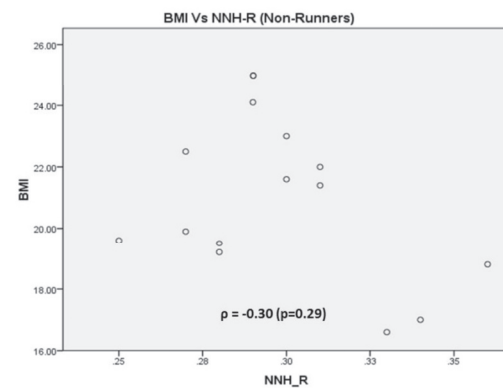
When correlating BMI to left foot NNH on non runners, r value was -0.21 ($p=0.47$).

Figure 4



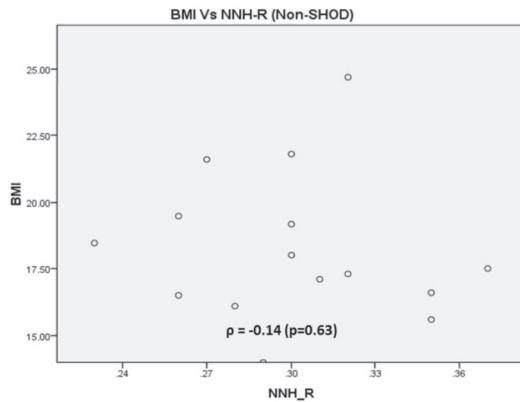
When correlating BMI to left foot NNH on shod runner group resulted in Pearson value of $r= -0.08$ ($p=0.76$).

Figure 5



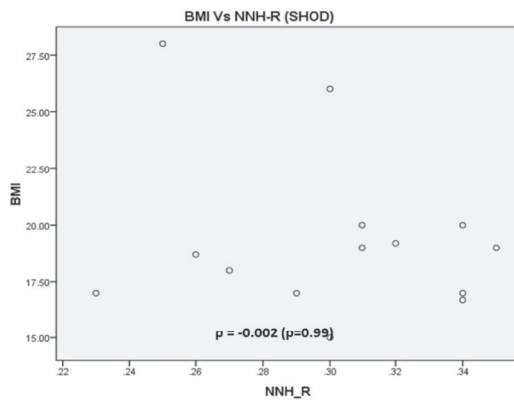
When correlating BMI to right foot NNH on non runner group resulted in Pearson value of $r= -0.30$ ($p=0.29$).

Figure 6



When correlating BMI to right foot NNH on barefoot runner group resulted in Pearson value of $r = -0.14$ ($p = 0.63$),

Figure 7



When correlating BMI to right foot NNH on shod runner group resulted in Pearson value of $r = -0.002$ ($p = 0.99$).

While correlating BMI to NNH on both feet of control groups resulted in Pearson value of $r = -0.29$ ($p = 0.37$), in barefoot runners $r = -0.16$ ($p = 0.56$) and shod runners $r = -0.24$ ($p = 0.38$).

Result of these correlations from Figure 2 to 7 reveals no correlation of BMI to NNH among samples analyzed.

DISCUSSION

The result of this study infers no significance of difference on medial foot arch height between shod, barefoot long and middle distance runners and controls. This is completely contrary to all claims made by researchers for the health benefit of barefoot running causing a well-developed foot arch and

shock absorbing function in preventing lower limb injuries in runners.^{4, 6,10,20,21}. Possibly in future if more number of samples added in each selected group may give more clear scenario to address all existing controversy in this issue.

Current study also revealed no correlation of BMI to medial foot arch height (NNH) among samples analyzed. Mette K Nilsson²⁵ *et al* (2012) reported lack of evidence in confirming whether BMI associate with medial arch height in static measures. Sneha sameer²⁶ *et al* (2012) reported obesity lowers the medial longitudinal arch of foot in young adult. Emma Cowley²⁷ *et al* (2013) reported that BMI did not predict the change in arch height.

When comparing gender variance to NNH by Independent T-test with 2 tailed significance analyses revealed on the right foot with the values of 0.866 and left foot value of 0.49 with an average value of 0.63 which reveals no significant difference in NNH among both gender indicates NNH (truncated) validated tool in measuring medial arch height for both gender despite of some morphological change in feet between both gender as reported in earlier studies^{28, 29}.

CONCLUSION

This study concluded that there is no significance of different exists in foot medial arch height between shod, barefoot runners and non runners. There was no correlation exist between BMI to arch height among three groups observed and analysis of this study revealed no significant difference of foot arch height (NNH) variation among both gender.

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Conflict of Interest – authors declared no conflict of interest in this study. Authors declared no biased results influenced by academic institution or any personal relationships.

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Effect of Physical Activity on Bone Mineral Density

Sheshna Rathod¹, Hemal Paneri¹, Disha Solanki²

¹Tutor cum Physiotherapist, Government Physiotherapy College, Jamnagar, ²Physiotherapist, Guru Govind singh Government Hospital, Jamnagar.

ABSTRACT

Background: Physical activity benefits the musculoskeletal system by the mechanisms affecting bone mass and density. Physical activity and exercise can impact on bone indirectly via parameters such as muscle strength and endurance. **Objectives:** To find out the relationship between the physical activity and bone mineral density. To find out the risk factors associated with low Bone Mineral Density. **Methodology:** Subjects were selected according to inclusion criteria. Global Physical Activity Questionnaires were given to subject to fill it and scores of questionnaire were analyzed. Bone Mineral Density of each subject were taken with the help of quantitative ultrasonic bone densitometry. **Results:** Study showed female with high level of physical activity have greater Bone Mineral Density than the low level physical activity. **Conclusion:** This study shows that there is a positive correlation between physical activity and Bone Mineral Density.

Keywords: Bone Mineral Density (BMD), Physical activity, Global physical activity questionnaire.

INTRODUCTION

Bone is one –third connective tissue. It is impregnated with calcium salts which constitute two-thirds part. The inorganic calcium salts (mainly calcium phosphate, partly calcium carbonate, and traces of other salts) make it hard and rigid, which can afford resistance to compressive forces of weight bearing and impact forces of jumping.

Despite its hardness and high calcium content the bone is a living tissue. It is highly vascular, with constant turn-over of its calcium content. It shows a characteristic pattern of growth. It is subjected to disease and heals after a fracture. It has greater regenerative power than any other tissue of the body,

except blood. It can mould itself according to changes in stress and strain it bears. It shows disuse atrophy and over use hypertrophy.¹

Bone remodels throughout life, as it responds to external forces (or load). Such as the pull of tendon and the weight of the body during functional activities. This change to form to match function is known as Wolff's law. Application of external forces (or loads) repetitively or over time causes osteoblast activity to increase, and as a result, bone mass increases. Without these forces, osteoclast activity predominates and bone mass decreases. Internal influences such as aging, nutritional, metabolic and disease processes also may affect bone remodelling.²

Effect of physical activity on BMD - Physical activity is the main factor to be healthy. Regular and moderate physical activity increases bone density and enables the growth of skeleton muscles in later years. Lack of regular and enough physical activity is a significant problem. Therefore, increasing the active life style is an important component. According to the American College of Sports Medicine (ACSM) and the American Dietetic Association, adults should do an at least 30-min moderate level activity every day

Corresponding Author :

Dr. Sheshna Rathod,

Tutor cum Physiotherapist, Government Physiotherapy College, Jamnagar. Address : C-4, Block no. 37, Nursing Quaters, Beside Government Physiotherapy college, Rameshwernagar, Jamnagar. E-mail: sheshnarathod@yahoo.com Mob.: 9327383558.

or most days^{4,5}. The results of many researches show that the habit of physical activity plays an important role in health protection and life quality, but fast technological developments cause a decline in physical activity level both in daily routine and in workplace^{5,6}, which increases the risk of obesity, coronary heart disease, insulin interdependent diabetes, osteoporosis and some types of cancer^{7,8,6,9,10}.

Regular physical activity also has positive effects on muscle power, joint movements, nervous systems and cardiovascular respiration¹¹. Therefore, individuals are suggested to do moderate or/and intensive activities in order to increase their physical activity levels and it is emphasized that first individual's activity levels must be determined to be able to make suggestions about their physical activity levels^{7,6}. Physical activity, which decreases with aging, is an important factor which affects both bone mass growth in teenagers and natural bone mass loss in adults. To stop this decline requires a lifelong effort to increase physical activity level as from childhood and adolescence¹². Bone mineral density is thought to be affected by age, gender, weight, height, smoking, alcohol intake, physical activity and especially heredity^{13,14}.

Physical activity has been shown to have a positive effect on bone remodelling. In children and adolescents, this activity may increase peak bone mass. In adults it has shown to maintain or increase bone density; and in elderly it has shown to reduce effects of age related or disused related bone loss.¹⁷ The specific effects of physical activity on bone health have been investigated in several studies. Bone density is said to be improved with high impact exercise and high load low repetition routines compared to low load high repetition.¹⁶

Physical activity and calcium intake play substantial role in the development of bone mass during developmental years.¹⁶ It is widely accepted that physical activity benefits the musculoskeletal system but the mechanisms affecting bone mass and density that are set off by physical activity in general and mechanical loading in particular are still poorly understood. According to the theory of the Mechanostat the bone-muscle interaction plays a dominant role. Thus, exercise should mostly affect bone indirectly via the muscle interface. Physical

activity and exercise can impact on bone indirectly via parameters such as muscle strength (local impact) and endurance (systemic impact). However, there is also a direct impact. In addition one has to consider confounding factors in all relations.¹⁸

An imbalance between bone synthesis and resorption, in which osteoclasts break down or absorb bone at a faster rate than the osteoblasts can remodel or rebuilt the bone, result in condition called osteoporosis. In osteoporosis, the bone have decreased mineral density (mass per unit volume) in comparison with normal bone and thus are weaker (more susceptible for fracture) than bones with normal density.²

To prevent osteoporosis various factors such as susceptibility to fracture, primarily in the hip, spine and wrist, physical activity and calcium intake are important. Weight-bearing exercise is suggested as a therapy and it may be associated to increase BMD and as a strategy for preventing sedentary lifestyle. Studies have shown that Quantitative Ultrasound bone densitometry is a technique for bone assessment.¹⁹

HYPOTHESIS

Hypothesis:- There is relationship between Physical activity and Bone Mineral Density

Null Hypothesis:- There is no relationship between Physical activity and Bone Mineral Density

MATERIALS AND METHODOLOGY

Study design: Co-relational design.

Sample selection: Random selection

Sample size: 38 subjects were selected with the mean age of 25 years.

INCLUSION CRITERIA

- Subjects were taken having age between 20 to 40 years.
- Only female subjects were taken.

Exclusion criteria:

- Subjects with musculoskeletal disorders.
- Subjects with cardiovascular disease.

- Subjects with neurological disorder.

MATERIALS

- Pencil
- Paper
- Questionnaire sheets.
- Ultrasonic bone densitometry

Procedure: 38 subjects were taken for the study. Every single participant was first informed about the study and a written approval was taken from each one of them. The physical activity of subjects was found with the help of **Global physical activity questionnaires**. All subjects were allotted a **Global physical activity questionnaires** and explained how to fill it. In the study, the short form of the questionnaire is used to assess the physical activity level. The calculation of the total score of the short form involves the sum of the duration (minutes) and frequency (days) of walking, moderate level activity and intensive activity. Physical activity levels are classified as physically inactive (<600 MET-min/week), moderate physical activity level (>600MET min/week) and high physical activity level (>1500 MET min/week). Subjects Bone Mineral Density was taken with the help of quantitative ultrasonic bone densitometry.

Statistical Analysis:- Pearson product moment correlation coefficient was performed for statistical analysis. SPSS version was used for statistical analysis.

Result

Table 1 :- This table shows co-relation between Physical Activity and Bone Mineral Density.

	Mean	SD	r value	P-value
BMD	0.91	5.46	0.11	<0.1
Physical activity	1057.89	6349.68		

This table shows mean of Bone Mineral Density 0.91, mean of physical activity by Global Physical Activity Questionnaire is 1057.89, SD of Bone Mineral Density is 5.46 and SD of Physical Activity is 6349.68, r-value is 0.11, P-value is <0.1. This table shows

positive co-relation between the Physical Activity and Bone Mineral Density.

DISCUSSION

The result of this study shows a positive correlation between Bone Mineral Density and Physical Activity. The bone mineral densities of females with both high and low physical activity levels, a statistically significant difference between females with high physical activity levels and those with low physical activity levels is found. It is found that females with high activity levels have higher bone values.

Exercise mostly affects bone indirectly via the muscle interface. However, exercise regimen with impact loading has a direct effect on bone. Apart from a particular loading pattern, strain intensity and variation are important parameters for the regulation of bone mass and density.¹⁸ According to Wolff’s law bone formation appears very sensitive to strains, as well as the magnitude of the applied load. Very low loads, well below the threshold for potential injury, may increase bone density²⁰

Longitudinal training studies indicate that strength training and high-impact endurance training increase bone density. Strain induction, the deformation that occurs in bone under loading, may cause a greater level of formation and an inhibition of resorption within the normal remodeling cycle of bone, or it may cause direct activation of osteoblastic bone formation from the quiescent state. Various mechanisms have been proposed for the transformation of mechanical strain into biochemical stimuli to enhance bone formation.¹⁹

Ruchan IRI studied a short form of International Physical Activity Questionnaire to determine the physical activity levels of the individuals. He concluded that females with high physical activity levels also have high bone mineral densities, showing a direct proportion between physical activity level and bone mineral density.²¹

Farr JN et al concluded that Physical Activity duration, frequency, and load were all associated with bone geometry and strength, although their

independent influences were modest and site specific. Low levels of Physical Activity may compromise bone development whereas high levels have only a small benefit over more average levels.²²

Anna Nordstrom et al stated that reduced physical activity is associated with Bone Mineral Density loss in the first 3 yr in weight-bearing bone. Sustained benefits in Bone Mineral Density are preserved 5 yr after intensive training ends.²³

Ed McNeely et al concluded that a regular program of high load (60-85% 1RM) training three or more times per week using a variety of exercises that challenge all major muscles has been shown to significantly increase bone density even in elderly adults.²⁴ N. Habibzadeh et al studied on The Effect of Short-Term Weight-Bearing Exercise on Bone Mass Density in Obese and Thin Young Girls and concluded that both thin and obese women can reduce the risk of bone loss by increasing their level of activity.²⁵ Takeru Kato et al effect of low-repetition jump training on bone mineral density in young women. It is concluded that low repetition and high-impact jumps enhance Bone Mineral Density at the specific bone sites in young women who had almost the age of peak bone mass.²⁶

It is seen that intensity of physical activities is a significant factor affecting the bone mineral densities. Bozkurt has found that people doing wrestling have higher bone mineral densities than those who do judo, running and taekwondo, which shows a direct proportion between physical activity level and bone mineral density.²⁷ Davison et al. noted in their study that hard and intensive physical activities have stimulating effects on bones.²⁸

Clinical Implication :- Physical activity aids in increasing bone mineral density. Such activities are helpful in preventing osteoporosis in postmenopausal females. Physical activities also prevents from certain conditions like coronary heart disease, obesity.

CONCLUSION

This study shows that there is a positive correlation between Physical Activity and Bone Mineral Density. The female with high level of physical activity have greater Bone Mineral Density than the low level physical activity.

LIMITATIONS

- Study was done on small sample size.
- Study was done on a limited age group of 20-40 years.
- Only female were taken as a subject.

Acknowledgement: I am grateful to subjects who participated in the study.

Conflict of Interest: There is no Conflict of Interest.

Source of Funding: There was no funding taken for this study from any agency or institution.

Ethical clearance: The study was been approved by relevant ethical committee.

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Effect of Aquatic based Endurance Training for Enhancing Cardiovascular Endurance in Normal Individuals

Vinod Kumar KC¹, Venkatesan Sreethar²

¹Associate professor, The Oxford College of physiotherapy, Bangalore-68, ²Associate Professor, Padamashree Institute of Physiotherapy, Bangalore.

ABSTRACT

BACKGROUND AND OBJECTIVES: The aim of this study is to determine the effectiveness of land based endurance training and aquatic based endurance training for enhancing endurance in normal individuals. This study is to find out the efficacy of aquatic base training in comparison with land based training in enhancing endurance in healthy individuals.

METHOD: 30 subjects were divided equally into 2 groups. Group A underwent land based training while Group B underwent aquatic based training. The outcome measures consist of RPP (rate pressure product), REC HR (recovery heart rate), RHR (resting heart rate) and 6MWD (6 minute walking distance) was measured before (pre-training) and after four weeks of endurance training. Descriptive analysis was used for data analysis.

RESULTS: In this study, land based training showed a mean improvement of 657.6 +58.451, 4.2 + 3.5, 3.2 + 0.77 and 35.4 + 23.35 for RPP, REC HR, RHR and 6MWD respectively, which was statistically significant at P = 0.05 and aquatic based training showed a mean improvement of 649+96.96, 5.4+1.63, 3.6+0.5 and 32.33+6.51 for RPP, REC HR, RHR and 6MWD, which was statistically significant at P = 0.05. The average difference between land based and aquatic based training were compared and it was found t = 0.0988, 1.8035, 1.0623 and 0.4963 for RPP, REC HR, RHR and 6MWD which had no significant difference (p =0.05) for enhancing endurance in normal individuals. Only the recovery heart rate was significant at P = 0.05

CONCLUSION: The results of this study show that both land and aquatic base training are effective and that there is no significant difference between these two mediums for enhancing endurance in normal individuals.

Keywords: cardiovascular endurance, land based endurance training, aquatic based endurance training, 6minute walking distance test, rate pressure product, recovery heart rate, resting heart rate. 6 minutes walking distance.

INTRODUCTION

The nation's fitness level has dropped dramatically owing to the adoption of a sedentary lifestyle. As a result, higher levels of obesity, coronary heart disease (CHD), diabetes and a range of other disease are being experienced. This can be prevented from participating in a fitness program. ¹ people should exercise at an intensity of 40-50 to 85% of VO₂

max or 55-65 to 90% of R max (lower number of unfit or sedentary individuals) for at least 20-60 minutes more than 2 days. Previously unfit individuals should exercise more than 2 days a week for at least 10 minutes. From a health perspective, further good news indicates that just moderate exercise performed to regularly reduce the risk of a first heart attack to the same extent as high-intensity workouts.^{2,3}

In modern society, physiotherapists have for many years used water to assist with their treatments for the rehabilitation of injuries and other medical conditions. Nevertheless, it is only more recently that exercises and fitness professionals have adopted water as an alternative medium for delivering programs to improve fitness and health⁴. When we exercise on dry land our skeletal muscular, cardiovascular, respiratory and other body systems are greatly affected by the forces of gravity. When we exercise in water, the effects created by the gravitational pull on the body are attenuated. However, water possesses its own unique properties which affect the body in a different way and provide us with a totally new experience⁴

The effects of the different attributes of water provide many benefits to the submerged body. The reduced effects of gravity and increased effects of buoyancy provide support to the body weight and lessen the strain placed on the weight-bearing joints. This makes water-based activities a potentially safer and more comfortable form of training⁵. Various training methods have been utilized by physiotherapists for enhancing cardiovascular endurance in sports people. Although aquatic exercises have numerous beneficial attributes as noted above pertaining to fitness development, there have been relatively few studies establishing its efficacy. The aim of this study is to determine the effectiveness of land based endurance training and aquatic based endurance training for enhancing endurance in normal individuals.

METHODOLOGY

Participants: 30 healthy individuals between 20-30 years of both sexes currently not suffering from any illness including water borne diseases like Typhoid, cholera, Nephritic / UTI conditions, Infectious disease, Contagious skin disease, Epilepsy, Hypotension and hypertension, recent or current radiation treatment, people with known history of Cardiac conditions, pulmonary conditions and musculoskeletal deformities and people with fear of water were included. They were selected from

SAMPLE SIZE AND SELECTION

A total of 30 individuals were selected for the study and were assigned to experimental Group

(A) land based training group and control group (B) Aquatic based training group with fifteen participants in each group. They were allocated randomly to the two groups using lottery method. The study was approved by the Ethical Committee and Informed consent was obtained from all the participants.

INTERVENTION

Group A included 15 subjects underwent land based endurance training program for 12 sessions at a frequency of three sessions per week for 4 weeks. Each session is divided into three parts

1. 5 min of warm-up and stretching activities

Spot jogs/ slow jogging, general stretching exercises for both upper limb and lower limb muscles

2. Interval training (main workout)

Main workout is for about 25 min, Subjects were asked to walk as fast as they can for about 10 mins, 5 mins active recovery and again 10 mins of walk

3. Cool-down and post exercise stretching for about 5mins, A slow, walking is performed, General stretching exercises for both upper and lower limb muscles, The exercise intensity was prescribed by using Borg's rate of perceived exertion of 13-15, which corresponds to 60-80% of vo₂ max^{8,9}.

In Group B 15 subjects underwent an aquatic endurance training program for 12 sessions at a frequency of three sessions per week for 4 weeks. Each session is divided into three parts

1. 5 min of warm up and stretching activities inside the aquatic pool, Spot jog/slow jogging, General stretching exercises

2. Interval training (main workout)

Main workout is for about 25 min, Subjects were asked to dress appropriately and walk as fast they can for about 10 min, 5 min of active recovery and again 10 min of walk inside the aquatic pool, The water level was maintained at chest height.

3. Cool down and post exercise stretching for about 5 min.

A slow/ restful walking is performed, General stretching exercises; the exercise intensity was prescribed by using Borg's rating of perceived exertion of 13-15, which corresponds to 60-80% of vo₂ max.^{4,5}

These were conducted by a trained physiotherapist. He supervised the exercise program for the initial 2 sessions and randomly for 60% of the remaining sessions.

OUTCOME MEASURE

Pre-endurance training 6 MWD test⁶ for both groups (Land and Aquatic group)

Subjects were instructed to walk from one end to the other end of a 100 Mts track in an open field at their own pace, while attempting to cover as much ground as possible in the allotted 6 min. Therapists encouraged subjects with the standardized statement “you are doing well” or “keep up the good work”. Subjects were allowed to stop and rest during the test, but were instructed to resume walking as soon as they felt able to do so.

At the end of the test following parameters were recorded: 6 min walking distance⁶, Peak systolic BP⁷, Peak heart rate⁷, Recovery heart rate at 2 min⁷. The outcome was measured by the same therapist who executed the treatment.

STATISTICAL ANALYSIS

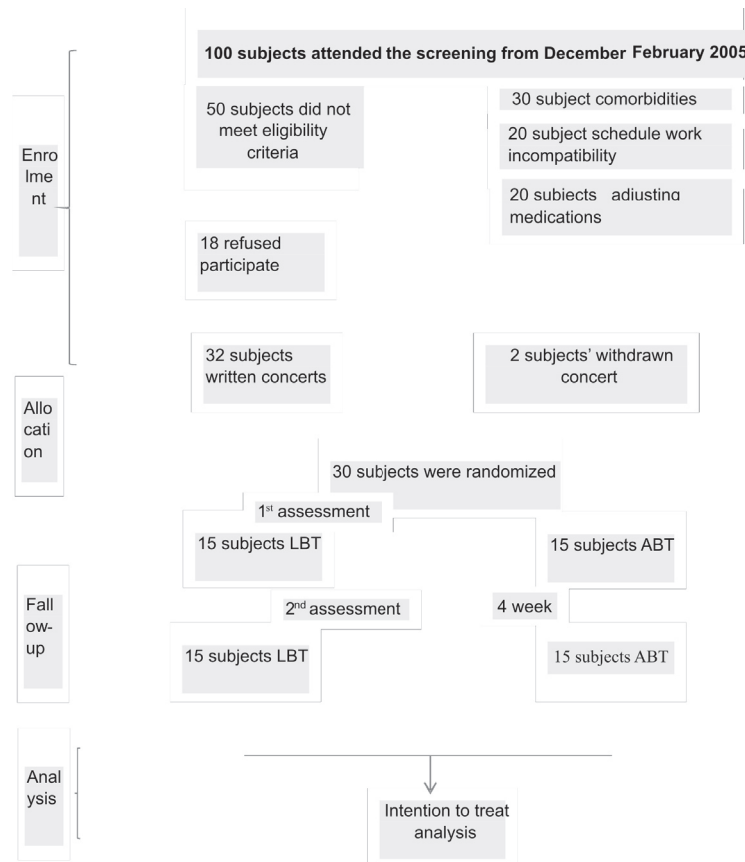
Difference in outcome between the two groups was analyzed using independent t test.

Pretest values between the groups were compared for homogeneity. The average improvement within the groups was compared using dependent t test.

RESULTS

There were 30 individuals who completed the study with 23 male and 7 female participants. The individuals were recruited over a period of 3 months. The mean age of group A (N= 15) was 23.27 (2.1) yrs and (group B) (N=15), was 24.2 (1.6) yrs. All the participants were healthy with no contraindication for participation in an intensive training program. The subjects were habitually active participating in a regular weekly physical activity (2–3 times a week, 35–60 min per session). Walking and aerobics were the principal activities reported by subjects. Both groups did not differ regarding the level of physical activity,

Figure 1. Diagram showing the flow of participants through each stage of the trial; LBT - land-based training, ABT-aquatic based training



which remained constant throughout the study.

As per the objective of the study, the data were collected for land based and aquatic base endurance training. All the participants who entered the trial completed the study. The following parameters were included Rate Pressure Product (RPP), Recovery Heart Rate at 2 min (REC HR), Resting Heart Rate (RHR), 6 Minutes Walking Distance (6 min MWD). The calculated f values for RPP= 2.479, REC HR=.539, RHR=.445 and 6MWD= .335 were greater than p=0.05 and hence the two groups are considered statistically similar to each other at the start of this study.

The mean improvement between the 2 groups of land and aquatic based endurance training were tested for significance using a dependent t test. The calculated t value were 43.550, 4.583, 16, 5.870 for

RPP, REC HR, RHR, 6MWD for group A respectively. For group B 25.922, 12.762, 27.495, 19.236 for RPP, REC HR, RHR, 6MWD for group A respectively.

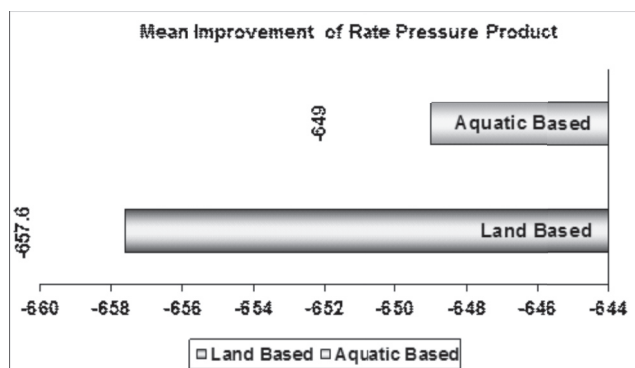
This clearly indicates that both land based training and aquatic based training will improve cardiovascular endurance significantly.

The analysis of significance for the improvement produced by land based training and aquatic based training was done using independent t- test, Parameters showed a calculated t value of 0.299 1.6236, 0.4963 which was insignificant at p=0.05, but heart rate recovery was only parameter which was significant. This indicates that both aquatic training and land based training produces similar improvements, which are not statistically variable.

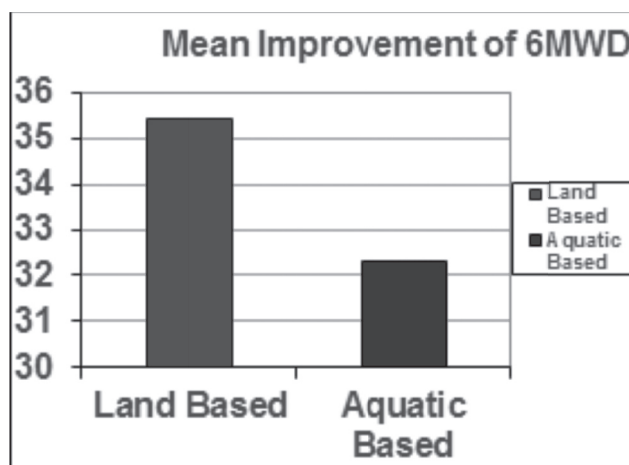
Table 1: Demographic and physical fitness data at study entry for the LBT and ABT in the intent to treat analysis and per protocol.

	LBT Group N=15	ABT Group N=15	LBT Group N=15	ABT Group N=15
Age, mean +/- SD yrs	23.27+/-2.12	24.26+/-1.62	23.27+/-2.12	24.26+/-1.62
RPP (MVO ₂)	29002.67+/-1113.742	28387.8+/-1638.4	29002.67+/-1113.742	28387.8+/-1638.4
REC HR(bpm)	90.133+/-2.924	89.4+/-3.56	90.133+/-2.924	89.4+/-3.56
RHR(bpm)	73.4+/-5.4	72.4+/-3.7	73.4+/-5.4	72.4+/-3.7
6MWD(meters)	626.06+/-52.0	655.33+/-52.217	626.06+/-52.0	655.33+/-52.217

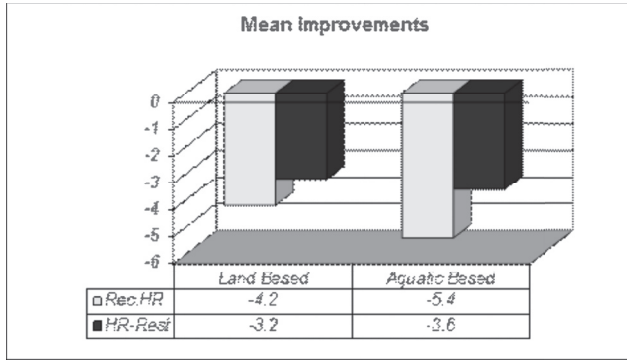
GRAPH 1: mean improvement of Rate Pressure Product



GRAPH 2: Mean improvement in Recovery and resting heart rate.



GRAPH 3: Mean improvement in 6MWD



DISCUSSION

The result of the study reveals that both the methods of training produce equivalent, if not identical improvement in cardiovascular endurance in normal individuals. In this analysis it should be noted that two parameters, which were recorded, showed different responses. The Recovery Heart Rate and resting heart rate were the parameters, which showed only minimal improvement in the land based training when compared to aquatic training. This can be due the reason that the density of water is approximately 800 times of air^{12, 13} and water provides a greater resistance to the movement than air, yet allows the joint to move more freely. The submerged body part encounters resistance in all directions of movement, which requires greater energy expenditure and puts more load on cardiac function, which may result in greater enhancement of endurance in subjects exercising in aquatic medium^{14, 15, 16}.

In contrast, the 6 MWD showed greater mean improvement in land based trained individuals when compared to aquatic trained individuals. The possible reason for this difference could be that the individuals those were trained on land were more familiar with the walking test (6 MWD) done to measure their endurance when compared to other group individuals: the specificity principal of exercise testing^{1, 10, 11}.

Another important factor which was noticeable was that the percentage of DOMS reported in individuals exercising on land was more when compared to the aquatic exercising group. This could be because of the fact that the pattern of muscle recruitment in land and water is different, in land most of the eccentric muscle work, which is one of the factors responsible for the development of DOMS and

majority of the muscle work will be dual concentric work. Therefore water-based exercise is generally more comfortable and there is less likelihood of experiencing muscle soreness during or after the water-based workout¹⁷.

The unique combination of buoyancy and the hydrostatic pressure of water allows greater resistance to the movement with relatively little strain to the joint structures when compared to land based training, which puts greater strain on the joint structure and predisposes it to injuries. Water can be an excellent medium to exercise; especially for elderly population who has age related degenerative changes like osteoporosis to whom exercising on land could be harmful. ^{18, 19}

The primary limitation of this study comes from the fact that it has very small sample size, especially when considering the fact that these subjects were clinically normal. This study included a very few female subject, so any differences between genders are not clearly demarcated. The intervention were performed for 4 weeks which is a shorter time to identify major cardiovascular changes. The age group considered in this study was too narrow. Also this study didn't consider the subjects height and body weight which could have an impact on outcome measures. The results of the current study needs to be evaluated with due consideration to the above mentioned issues and rectification of the current limitations are warranted of future studies.

CONCLUSION

Based on the statistical outcome and available literature, it is concluded that both land based and aquatic based endurance training methods produce equivalent, if not same effect on the enhancement of cardiovascular endurance. There was no significant difference between these two exercising mediums. It is concluded that "there is no significant difference between land based training and aquatic based training for enhancing endurance in normal individuals"

Nonetheless, given the benefits of aquatic medium, aquatic based endurance training should be considered as an alternative for land based training.

Conflict of Interest: Nil

Source of Funding: Self

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A Comparative Study between One Arm and Two Arm Functional Reach Test in Children with Balance Impairment

Pradhan Mamin¹, Sharma Satish², Richa³

¹Assistant Professor, Tripura Institute of Paramedical Sciences, Agartala, Tripura, ²Lecturer ITS Paramedical College, Muradnagar, Ghaziabad, ³Physiotherapist, SMC, Indian Airforce, Subroto Park, New Delhi

ABSTRACT

Background: The purpose of this study was to compare one arm with two arm functional reach test, thereby finding out the more challenging balance test among them in children with balance impairment. Since studies on typically developing youth has shown that one arm and two arm reach methods are correlated. Thus, further studies are needed to examine the validity of whether the two arm Functional reach test is more challenging balance test in children with balance impairment.

Materials and Method: Thirty subjects of age group 3-9 years with balance impairment (TUG score > 13 secs) living in a community were recruited for the study. All the subjects then undergo the One Arm and Two Arm Functional Reach Test. Then the reach values were calculated by both toe to finger and finger to finger method, thus resulting in a total of four measurements. Then a comparative study was done among all these measurements.

Results: Thus when we correlate the four measurements of FRT (1AFF, 2AFF, 1ATF, 2ATF) with the TUG, we found that the "r" value of two arm is more as compared to the "r" value of one arm. Thus proving the hypothesis that two arm FRT is more challenging than one arm FRT in children with balance impairment.

Conclusion: Both one arm and two arm functional reach test helps us to assess the balance in children, however two arm FRT was found to be more challenging balance test than one arm FRT in children with balance impairment. Thus, we can modify the commonly use one arm FRT by two arm FRT for assessing the balance more effectively in our clinical routine.

Abbreviations: TUG = Timed Up and Go Test, FRT = Functional Reach Test, 1AFF = One arm finger finger, 2AFF = Two arm finger finger, 1ATF = One arm toe finger, 2ATF = Two arm toe finger

Keywords: Balance, Timed Up and Go Test, Functional Reach Test

INTRODUCTION

Balance is a condition in which all the forces acting on the body are balanced such that the

centre of mass (COM) is within the stability limits, the boundaries of the base of support (BOS). The overall goals of the postural control system, stability and function are achieved through integrated CNS systems of control.¹

Corresponding Author:

Satish Sharma

Lecturer

I.T.S Paramedical College, Muradnagar,

Ghaziabad, Uttar Pradesh

E.mai: satishsharma@its.edu.in

Phone. No.: 09868365699

The ability to maintain postural control during other movements such as when reaching for an object or walking across a lawn, is operationally defined as dynamic balance. Both static and dynamic postural controls are thought to be important and necessary

motor activities.²

Children with many types of disabilities with mild motor problems have been shown to have dysfunction of postural control. These children may exhibit clumsiness and frequent falls during regular motor activities or may not be able to maintain a sitting or standing position independently.³

Balance impairments negatively affect function, leading to disability. These impairments negatively often restrict activity levels, produce abnormal compensatory motion behavior and may require support from devices or assistance from others. When imbalance is severe, falls can result, leading to secondary injuries.⁴

Some of the pediatric balance assessment tools most frequently used are Peabody Development Motor Scales (Folio and Fewell, 1983), Pediatric Evaluation of Disability Inventory (PEDI), Alberta Infant Motor Scale (AIMS), Bruininks-Oseretsky Test of Motor Proficiency, Functional Reach Test (FRT), Timed Up and Go test (TUG) etc. Other balance related items include one-foot hopping, tandem walking, and distance jumping.³

The timed "up and go" test, consists of recording the amount of time required to rise from a chair, walk 3m, turn around, return to the chair and sit down.⁵

Modified TUG is reliable in children as young as 3 years of age, provided that the child can understand instructions and the test is performed in an integrated manner without behavior variation.⁶

Functional reach test (FRT) is a new clinically accessible measure of balance. It is the difference between arms length and maximal forward reach, using a fixed base of support.⁷In pediatric population, the FRT has been proposed as a discriminative test and possible as a diagnostic test to document fit-forward mechanism of postural control.^{3,10}

Recent research done by Volkmann et. al. showed that changing the biomechanics and measurement method significantly effects the FRT scores in typically developing youth. Thus, change in the biomechanics by reaching with two arm affects the FRT scores. He shows that the two arm FRT increases the difficulty of the test as compared to one Arm FRT in normal typically developing youth. Thus, it was

hypothesized that two arm FRT is more challenging balance test than one Arm FRT in children with balance impairments.

METHOD

Study Design and Patients: A quasi experimental design is used in this study. Through convenience sampling, 30 subjects were recruited who were actively living in community. All subjects were screened using a screening form to ensure that the following inclusion criteria were fulfilled: child between 3-9 years of age, having good general health, able to follow simple verbal commands, able to ambulate independently without using walking aids, TUG score time more than 13 seconds.

Exclusion criteria for subjects were: Any illness which interferes with study like fever etc. , pain in the shoulder, decrease ROM of shoulder, contractures involving upper limb, visual problems, hearing impairments, sensory deficits etc.

Procedure: To meet the inclusion criteria of the study, all the subjects undergo Timed Up and Go Test.

In timed up and go test, time is measured which is required to rise from a chair, walk 3 m, touch the target, turn around, return to the chair and sit down again. All the children, whose TUG time score was more than 13 seconds, were included in the study. As the subjects met the inclusion and exclusion criteria, each subject then undergo the One Arm and Two Arm Functional Reach Test and the reach values were documented on a data collection form. For Functional Reach Test, the individual is positioned with the shoulder perpendicular to a wall on which a yard stick has been affixed at shoulder level and is instructed to hold arm out 90 degree of shoulder flexion. The individual is then asked to reach forward as far as possible without losing balance or taking a step. The length difference between the starting and ending reach positions is recorded.³

Each subjects stood barefoot with feet a comfortable width apart on a sheet of paper taped to the floor. The yard stick was fixed at the shoulder level. The end was aligned with the tips of the great toes, while the great toes were brought to the edge of the paper. This was the zero point for the toe to finger

reach score. (Fig.1)

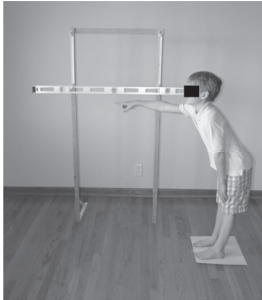


Fig.1: Child performing one arm FRT.

To obtain the One Arm FRT score the subject lean forward to reach and held the reaching position for approximately 3 seconds, while the measurement was noted.

To obtain the Two Arm FRT score the starting and reaching positions were measure in a similar manner. The two arms were extended forward to 90 degree of shoulder flexion with the hands clasped and the index fingers extended together.

DATA ANALYSIS

Data analysis was performed using SPSS software. Means and standard deviation (SD) values were reported for the TUG & the FRT scores. The correlation between the TUG score and each of the 4 measurement scores of FRT (1AFF, 2AFF, 1ATF, 2ATF) was quantified using a Pearson’s correlation coefficient. p value < 0.05 was taken as the level of statistical significance.

RESULTS

Total Thirty subjects were included in the study. The FRT (1AFF, 2AFF, 1ATF, 2ATF) and TUG scores of all the subjects were documented successfully as per the protocol.

TUG and 1AFF scores

The mean and standard deviation of TUG and 1 AFF were 18.86 ± 2.58 and 17.32 ± 3.45 respectively. The Pearson’s correlation coefficient was -0.75 which was statistically significant at p value < 0.05. (Table. 1, Graph. 1)

Table1: Correlation between TUG and 1AFF scores in children with balance impairment.

Variable	No. of samples (N)	Mean	Standard deviation (SD)	Pearson’s correlation coefficient
TUG	30	18.86	2.58	- 0.75
1AFF	30	17.32	3.45	

Graph.1: Correlation between TUG and 1AFF scores in children with balance impairment.

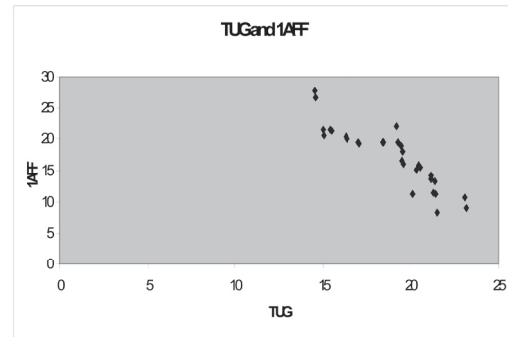


Table.2: Correlation between TUG and 2AFF scores in children with balance impairment

Variable	No. of samples (N)	Mean	Standard deviation (SD)	Pearson’s correlation coefficient
TUG	30	18.86	2.58	- 0.81
2AFF	30	16.41	3.66	

Graph.2: Correlation between TUG and 2AFF scores in children with balance impairment

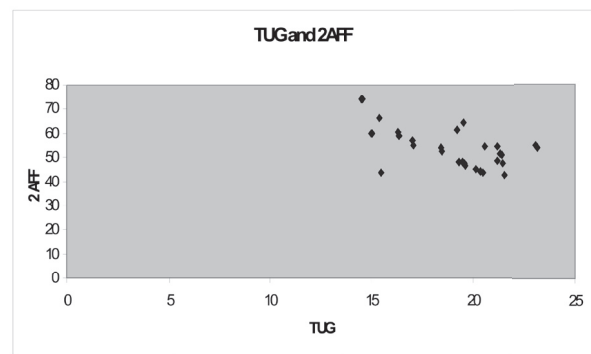


Table.3: Correlation between TUG and 1ATF scores in children with balance impairment

Variable	No. of samples (N)	Mean	Standard deviation	Pearson’s correlation coefficient
TUG	30	18.86	2.58	- 0.79
1AFF	30	60.56	4.22	

Graph.3: Correlation between TUG and 1ATF scores in children with balance impairment

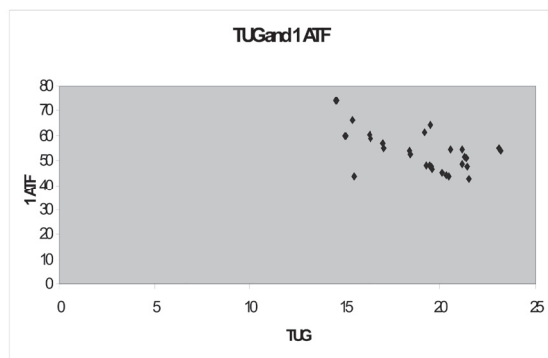
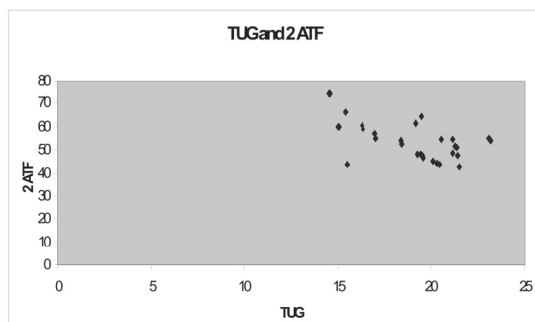


Table. 4: Correlation between TUG and 2ATF scores in children with balance impairment

Variable	No. of samples (N)	Mean	Standard deviation (SD)	Pearson’s correlation coefficient
TUG	30	18.86	2.58	- 0.89
2ATF	30	54.14	3.97	

Graph. 4: Correlation between TUG and 2ATF scores in children with balance impairment



DISCUSSION

While comparing the “r” values of all the four measurements of FRT, we found that the “r” value of two arm is more as compared to the “r” value of one arm.

Thus proving the hypothesis that two arm FRT is more challenging than one arm FRT in children with balance impairment. As it was assumed that two arm reach would limit trunk rotation and thereby, improve reliability of performance. This supports the previous report by Volkman et. al. He reveals that two arm increases the difficulty of the test while decreasing the variability of the trunk between tests and thus improve reliability.¹⁰

The “r” value of 2ATF was also found to be more than 2AFF, thus improving the reliability in children with balance impairment. The present study also supports this previous report of Volkman et al that toe-finger method was found to be more reliable compared to finger-finger method. Use of toe- finger method eliminated the variable of sway which apparently occurred when moving the arms forward. It was therefore evident that a change of the biomechanics of reach might not be reflected by the FRT scores using the traditional starting position of the hand.⁹

Toe-to-finger measurement methods have the advantage of using a fixed starting point rather than an inconsistent one. Thus 2ATF may be used an alternative method in the children with balance impairment.

FUTURE RESEARCH

- Compare functional reach with other clinical measures of balance.
- Functional reach should also be validated in other populations such as women and nursing home residents.

CONCLUSION

This study concluded that although, both one arm and two arm functional reach test helps us to assess the balance in children, however two arm functional reach test was found to be more challenging balance test in children with balance impairment.

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Conflict of Interest: The present study does not have any conflicts of interest and Author has no issues if IJPOT shares data and materials of present study. The author adheres to all the policies of IJPOT.

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Ethical Clearance: The ethical clearance has been taken from the Ethical Committee of I.T.S Paramedical College, Muradnagar, Ghaziabad, Uttar Pradesh

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Analyzing Upper Quadrant Neural Extensibility in Upper Trapezius Trigger Point Subjects

Sakshi Arora¹, Roshan Deep¹, Lipy Bhat², Abhishek Sharma², Ravinder Narwal²

¹MPT (Musculoskeletal) Department of Physiotherapy, ²Lecturers, Department of Physiotherapy, HIPMS, HIHT University, Dehradun, U.K.

ABSTRACT

Aim & Objective:- The aim of the present research was to analyze the existent of a relationship between upper quadrant neural extensibility and upper trapezius trigger points. The anatomical location and orientation of the upper trapezius muscle and nerves of the brachial plexus are having a close inter- relationship with each other. A new treatment approach can be formulated for trigger point rehabilitation on the bases of this relationship.

Methodology:- This experimental study was carried out with 100 subjects of both gender with age 15-40year at Himalayan hospital-Dehradun. The data was collected by taking outcome variables in form of elbow extension range and upper trapezius muscle length. Subjects were divided in two groups on the basis of presence or absence of trigger point. *Protocol:*Two procedures were performed similarly for both the groups i.e. ULTT 1 and upper trapezius muscle length tension.

Results :- Comparison was made for the resting and tension ranges for both the procedures within the group and between the groups. Result of this study signifies the Neural compromise earlier than the muscle length change in trigger point subjects.

Discussion:- Neural compromise is believed to occur earlier than muscle length change in trigger point subjects, thus neural mobilization should be added as an adjunct to trigger point rehabilitation.

Conclusion:- There exists a significant relationship between upper trapezius trigger points and neural extensibility.

Keywords :- Myofascial trigger point (MTrP), ULTT1, neural extensibility.

INTRODUCTION

The skeletal muscle is the largest organ in human body. It accounts for nearly 50% of human body weight and any of these muscles may develop pain and dysfunction¹. Dr. Janet Travell(1901-1907) is generally credited for bringing myofascial trigger points (MTrPs) to the attention of health care providers².

Simons et al defined a muscle trigger point as a tender point within a taut band of skeletal muscle that is painful upon compression, contraction or stretch and usually responds with a referred pain pattern distant from the point. These are of two

types active and latent. An active trigger point causes concordant patient related pain symptoms that are local and referred. Latent trigger points evoke both local and referred pain but without reproducing any symptom.

Furthermore, both active and latent trigger points can provoke muscle imbalance, weakness or altered motor recruitment in either the affected muscle or in functionally related muscle.³ There are more classifications which categorize trigger points as key and satellite, and the other one as primary and secondary.

A trigger point can be located anywhere in the

fascia, ligaments, muscles and tendon. Often the muscles used to maintain body posture are affected, chiefly the muscles in the neck, shoulder and pelvic girdle including the upper trapezius, scalene, sternocleidomastoid, levator scapulae and quadratus lumborum.⁴ The MTrP of each muscle has its own characteristic pain pattern ; therefore the distribution of pain can help identify which muscle may contain the responsible MTrP.⁵

MTrP is a relatively common illness estimated to affect 4-10 million Americans. Demographic studies show that it has a high prevalence in the U.S. of 3½% of all women and ½% of all men over the age of 18 years.⁶ Few studies in India report that prevalence of latent MTrP is quite common. 54% of female and 45% of male population has been found representing trigger points in shoulder girdle muscles⁷ MTrP are the hallmark characteristic of myofascial pain syndrome and features motor, sensory and autonomic components.⁸

The diagnosis of MTrP is accomplished by physical signs including : presence of a palpable taut band in skeletal muscle, presence of a hypersensitive tender spot in the taut band, palpable or visible local twitch response on snapping palpation, jump sign, presence of the typical referral pain pattern of MTrP, restricted ROM of affected tissues, muscular fatigue and autonomic phenomena.⁹

The anatomical location and orientation of the upper trapezius muscle and nerves of the brachial plexus are quite similar having a close inter- relationship with each other.¹⁰ Mobilisation of nervous system has recently emerged as an adjunct to assessment and treatment of pain syndromes. . With movement, the musculoskeletal system exerts non-uniform stresses and movement in neural tissues, depending on the local anatomical and mechanical characteristics and pattern of body movement. ¹¹ So, stressing one component will automatically affect the other.

Various physical therapy treatment options available to deactivate MTrP include manual therapies like ischaemic compression, spray and stretch, strain and counterstrain, muscle energy technique, transverse friction massage, trigger point pressure release etc. Then there are few more like

needling therapies, thermotherapy, ultrasound and laser therapy.⁹

There is lack of dearth of literature regarding the existent of a relationship between trigger points and upper quadrant neural extensibility .So the present research was to design to find out the existent of a relationship between upper quadrant neural extensibility and upper trapezius trigger points. A new treatment approach can be formulated for trigger point rehabilitation on the bases of this relationship.

METHODOLOGY

This experimental was carried out with sample size of 100 subjects who have been selected from physiotherapy department of Himalayan hospital.

Inclusion criteria:- Subjects of both genders between ages 15 – 40 yrs were taken with presence and absence of trigger point in the upper trapezius muscle.

Exclusion criteria:- Subjects having cervical radiculopathy, any traumatic condition of upper torso or any pathological condition were excluded from the study.

Instrumentation:- Vernier caliper, goniometer, couch, wooden wedge and a head restraint .

DATA ANALYSIS

The significant level was set at $p \leq 0.05$ and confidence interval was 95%. Paired “t” test was used to analyze and compare the muscle length and elbow ranges before and after the procedure within the group. Unpaired “t” was used to analyze and compare the muscle length and elbow ranges before and after the procedure between the two groups .

RESULT

The result presentation of data is based on the two groups including Group A (Trigger point subjects) and group B (Normal subjects)

Flow Chart

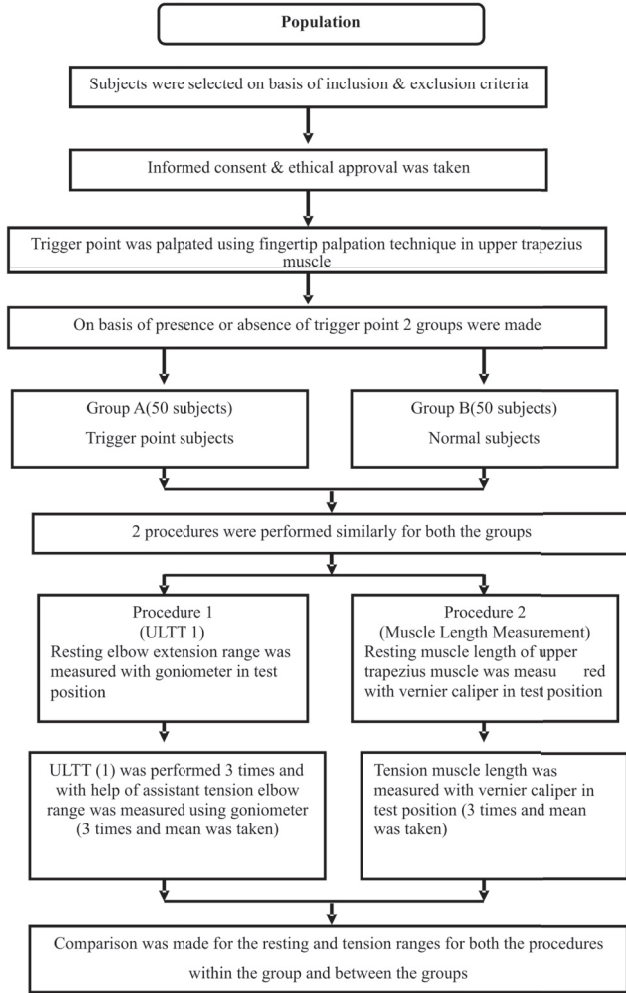


Table :-1 Comparison of resting elbow range and tension elbow range within group A (MTrP) & group B (Normal subjects).

Group A, Variables	Mean±SD	T value	P value
(RER)	6±5.261	26.440	0.001
(TER)	63.878±14.310		
Group B, Variables	Mean±SD	T value	P value
(RER)	3.54±4.550	21.526	0.001
(TER)	49.982±15.018		

Table :-2 Comparison between resting muscle length and tension muscle length within group A (MTrP) & group B (Normal subjects).

Group A (MTrP) Variables	Mean±SD	T value	P value
(RML)	16.868±2.130	28.423	0.001
(TML)	23.33±2.076		
Group B, Variables	Mean±SD	T value	P value
(RML)	17.224±2.427	26.292	0.001
(TML)	24.23±2.537		

Comparison of resting elbow range and tension elbow range between group A (MTrP) & group B (Normal subjects).

Fig. 1: Comparison of muscle length difference between group A(MTrP) and group B (Normal)

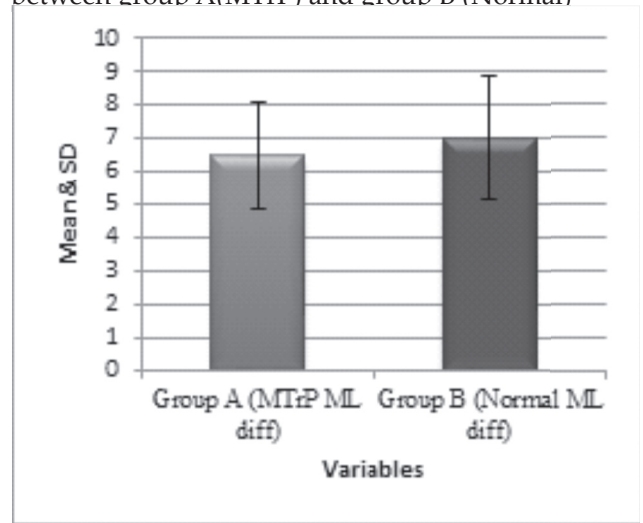


Fig 2: Comparison of elbow range difference between group A (MTrP) and group B (Normal)

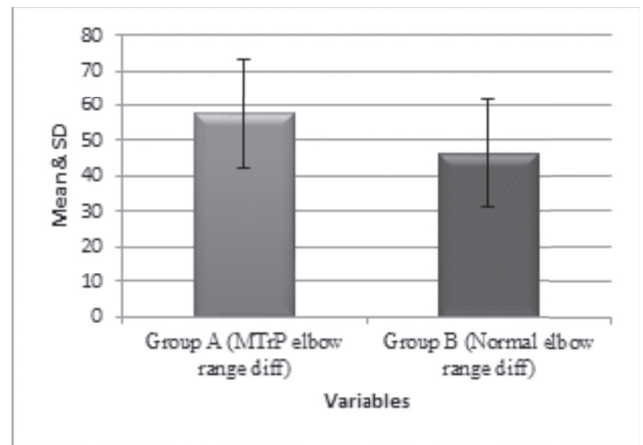


Fig 3: Comparison of RER between group A(MTrP) and group B(Normal)

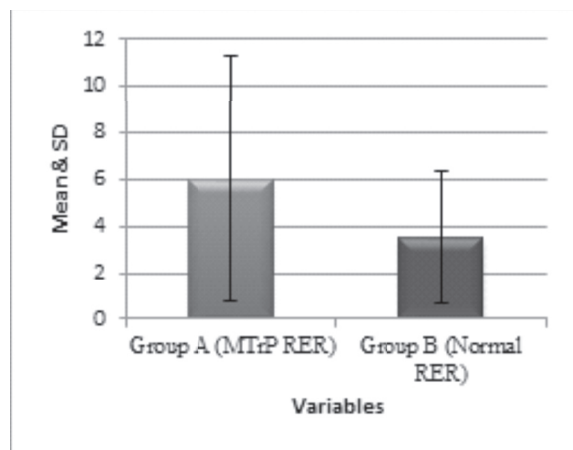
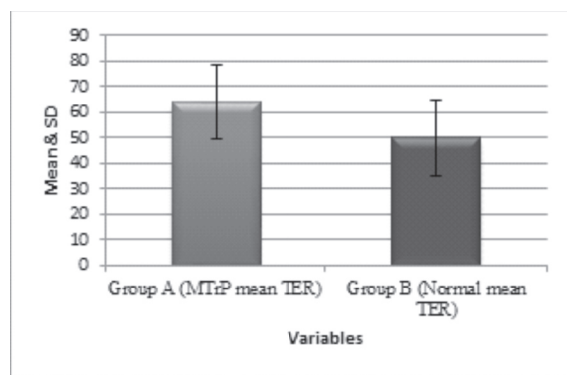


Fig.4: Comparison of TER between group A(MTrP) and group B(Normal)



DISCUSSION

The mechanical and physiological functions of the nervous and musculoskeletal system interact closely and there is no specific study done which analyzes both these components till date. Results of this clinical research were derived from the sample of 100 subjects with a mean age of 22-23 years and divided into 2 groups – trigger point subjects (group A) and normal subjects (group B) . Both groups underwent the same procedure i.e. ULTT 1 and measurement of length of upper trapezius muscle. Through this study we have analyzed that there exists a relation between trigger point and neural extensibility and also that neural compromise occurs earlier than the muscle length shortening in trigger points.

The various reasons for neural compromise occurring earlier can be attributed to many factors. There is a radiculopathic model theory for muscular pain given by Gunn opposing to Travell and Simons which postulates a neurological cause as the primary stimulus and trigger point as the secondary phenomena.¹²

There is a neuropathic model which states that the underlying neurogenic lesion in the afferent sensory axons lies in the peripheral nerve. It is the manifestation of this injury that is noted in the distal local muscle group.¹³

Johnson and Williams et al found that the anatomical locations and the orientations of the upper trapezius muscle and nerves of the brachial plexus share close inter-relationship with each other. From its origin at the occiput, ligamentum nuchae and seventh cervical spinous process this muscle has both vertical and oblique fibre orientation to its insertion into lateral one-third of clavicle, spine of scapula and acromion. Likewise the trunks of brachial plexus follow an oblique to transverse course from their origins at C4-T2 spinal nerves in their path through the thoracic inlet region to their emergence from axilla as peripheral nerves of upper limb.¹⁰

M. Zusman et al in his study concluded that presence of pain and trapezius activity during ULTT 1 seems to be a normal finding in subjects without any known pathology. The activity of biceps and triceps muscle seemed to be less since these work as stabilizing muscles for the elbow.¹⁴

David S. Butler in his study done on cubital and carpal tunnel syndrome reported that sliding techniques result in a substantially larger excursion of nerve than tensioning techniques. Longitudinal excursion and strain associated with a particular joint movement is strongly influenced by the position or simultaneous movement of an adjacent joint.

Like when considering median nerve at wrist, wrist extension resulted in a distal glide of approximately 9mm. This excursion increased by 30% (upto 12.6mm) if wrist extension was accompanied by elbow flexion, a movement that reduces the length of the nerve bed at the wrist (sliding technique) .

Similarly distal excursion decreased by 30% (upto 6.1 mm) if wrist extension was accompanied by elbow extension, which increases length of nerve bed and increases tension in nerve at elbow and thus hinders distal excursion (tensioning technique).

A similar trend was observed for ulnar nerve at elbow: nerve gliding was substantially large for the sliding technique than for the tensioning technique (8.3 vs 3.8mm) . Thus cervical contralateral side flexion acts as a sensitizing maneuver and this component was not used in the present study.¹⁵

No change in muscle length has been seen in trigger point subjects as the neural compromise was occurring earlier. Thus we infer that apart

from stretching and various other manual therapy treatments available, by neural mobilization we can correct the neural compromise and thus release the trigger point.

CONCLUSION

The present study demonstrates that there exists a significant relationship between upper trapezius trigger points and neural extensibility. We were unable to document any change in muscle length as the neural compromise occurred earlier. Therefore we conclude that neural mobilization can be used to correct the neural compromise and thus release the trigger point.

Clinical Relevance: Prevalence of latent MTrPs is quite common in the postural muscles especially in the postural muscles and since it remains in quiescent stage, an individual is not even aware of its presence. Various manual therapy treatments are available for releasing the trigger point and bringing the muscle back to normal, but nobody ever thought about the neural component. The following study has led to a new intervention and from this we conclude that neural mobilization can be used as a new treatment approach for trigger point release.

Future Research & Limitations: This study is limited in treatment for releasing the trigger point & duration of presence of latent trigger point is not known. Future research may be implemented by taking large sample size & neural mobilization treatment approach effect may be compared with other manual therapies

Conflict of Interest & Ethical approval: There was no conflict of interest was reported among all authors. This research work is approved by ethical committee of HIPMS, HIHT University (UK) India.

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Prevalence of Back Pain in Surat Metropolitan Transport Corporation Bus Drivers – a Cross Sectional Survey

Tarpan Shah¹, Deepa Desai², Hiral Gandhi³

¹Assistant Professor, ²Physiotherapy Intern, ³Assistant Professor, Shree Swaminarayan Physiotherapy College, N.H.No 8 & 6, Kadodara, Tal.Palsana, Surat

ABSTRACT

Background and Objectives: The study had been conducted with the aim to find out the association between position of seating in back pain of bus drivers and prevalence of low back pain. The occurrence of low back pain in bus drivers is a burden for the society. So this study on prevalence of low back pain in bus drivers open a new prospective in the field of occupational hazards and the means of prevention and rehabilitation. The objective of this study is to determine the correlation between the existing seating system and the prevalence low back pain in SMTC bus drivers.

Materials and Method: The study had been conducted on 100 bus drivers who satisfy the inclusion criteria. The subjects were selected by convenience sampling technique from the bus depot around Surat. The data were collected through a validated questionnaire about seating system and Oswestry disability Index questionnaire was used to assess the prevalence of low back pain, which is disabling them to continue their work. The subjects were instructed to fill up the questionnaire and the data were collected and analyzed.

Results: Out of the total population of 100 subjects the result shows the prevalence of back pain in the SMTC bus drivers, which shows 44% of subjects does not suffer from any low back symptoms at the moment. 53% of subjects suffer from mild low back symptoms at the moment whereas only 3% suffer from moderate low back symptoms at the moment.

Conclusion: The results of this study show that there is significant association between the bus drivers and low back pain.

Keywords: Bus drivers; Low back pain; Seating system; Prevalence, Oswestry disability index questionnaire

INTRODUCTION

In Surat SMTC is the Urban Transport Authority in the State of GUJARAT. It is responsible for providing safe, reliable and efficient bus transit and Para transit service in the Surat district. LBA is the most common and costly musculoskeletal problem affecting the working population. The consequences to injured workers range from temporary discomfort to permanent disability. Low back pain is a leading cause of disability in people under 45 years of age and accounts for roughly 40% of all disability claims in the West. In India, approximately 35% people suffer from

chronic back pain, which significantly hampers their day-to-day routine.¹Pain that occurs in an area with boundaries between the lowest rib and the crease of the buttocks. Low back pain is usually defined as either acute or chronic. Acute low back pain lasts less than a month and is not caused by serious medical conditions. Chronic low back pain persists beyond six months. It constitutes only 1% to 5% of all low back pain cases. Back pain may be triggered by various problems that occur along the ridge of bone and disc and stretch or pinch nerves within the spinal column: Injuries and small fractures can occur. The

facets can become malaligned or deteriorate. The spinal canal itself can become narrowed, a disorder called spinal stenosis.²The spine is a flexible, multi-segmental column bridging the interval between the base of the skull and the pelvis its requirements include maintaining an up-right posture yet allowing for flexibility, while at the same time providing a protective conduit for neurological structures. The fact that it provides all of these functions in most of us with little upset is an astonishing fact. There are many conditions that can cause back pain. Some of these are congenital, such as scoliosis. Most causes of back pain, however, result from injury or trauma. A study brings in to point of view that low back pain dominates 50% of musculoskeletal disorders in bus drivers as compared with office workers.³Several studies have investigated back pain among professional drivers. The occupational physical factors of postural stress, muscular efforts and long term exposure to whole body vibration were consistently associated with driving motor vehicles for extended period of time. Work place physical factors include heavy physical work, lifting and forceful movement, awkward postures; whole body vibration and static work postures static work postures of prolonged standing, sitting and sedentary work are isometric positions where every little movement take place. These postures are typically cramped or inactive and cause static loading on the muscles.⁴ Those jobs that entail a significant degree of lifting, bending twisting work standardization and monotony, sitting and standing correlate with pain in several studies.⁵According to Lazaeus B Folk man (1984) stress is defined as "a particular relationship between the person and the environment that is appraised by the individual as taxing or exceeding his or her resources and endangering his or her well being."⁶So in the present study we had tried to find out prevalence of lowback pain in drivers of SMTC Surat.

Fig. 1: Incorrect position



Fig. 2: Correct position



MATERIALS AND METHODOLOGY

In this questionnaire based survey SMTC bus drivers who have satisfied the selection criteria like No history of neurological problems and should have driven SMTC bus for more than one year and only Males were recruited. Exclusion criteria were Females, History of low back surgery, Systemic problems, Should not have pain before driving, Taking any analgesics were excluded. The samples are selected in the population i.e. the drivers working in SMTC, where they are selected by convenient sampling technique/procedure. A group of 100 bus drivers who has fulfilled the inclusion were undertaken to find out the prevalence of back pain. subjects were taken from SMTC bus station, sarthanna, surat station, kam rej, kapodara. as outcome measure Standardized seat questionnaire and Oswestry disability index were taken.

Procedure: Permission was obtained from the concerned person. Prior information about the study was given to the subjects. The purpose of the study was explained to all subjects who volunteered to take part in the study. An informed consent was taken in their own understandable language from each bus drivers. The subjects were selected based on the inclusion and exclusion criteria. Suitable time was set up with the drivers, to get the informed consent from the drivers and to distribute the questionnaire. 100 subjects having more than one year experience in the bus-driving field was taken part in the study. 16 bus drivers were selected from SMTC Bus Station, kamrej, 20 bus drivers were selected from SMTC Bus Station, kapodra, 23 bus drivers were selected from SMTC Bus Station, Surat station, 22 bus drivers were selected from SMTC Bus Station, sarthana and 19 bus drivers were selected from SMTC Bus Station, Kadodara. Each driver was allowed to answer the

whole questions separately. Any doubts regarding the questionnaire will be cleared at the same time. All the questions were explained to each driver in simple words and adequate time was given to them to answer each of the questions. It will be completed by the driver in the presence of the investigator. The answered questions will be collected at the end of the

session from each driver. The answered questions will be interrupted by the investigator. Description of questionnaire Two types of questionnaire were used in the study. 1. Drivers seat questionnaire 2. Oswestry disability index.

RESULTS AND STATISTIC ANALYSIS

In present study 100 subjects is undertaken to find the prevalence of back pain in bus drivers.

Table 1: Background Characteristics

Background characteristics	Range	Mean \pm SD
Years of driving	1-30	12.61 \pm 6.54
Current driving time	8-9	8.01 \pm 0.10
Current running time	5-9	7.88 \pm 0.54

Table 2: Number of years of driving and the pain intensity

Numbers of years driving	1	2	3	4	5	6
	No pain	Minimal Pain	Moderate pain	Fairly severe pain	Very severe pain	Worst imaginable pain
1 to 5 (n-12)	9	3	0	0	0	0
6 to 10 (n-19)	13	6	0	0	0	0
11 to 15 (n-25)	12	13	0	0	0	0
16 to 20 (n-25)	11	12	2	0	0	0
21 to 25 (n-15)	5	8	2	0	0	0
26 to 30 (n-4)	1	1	2	0	0	0
Significance	The Pain is significantly high for the number of driving years >16 years with p=0.006.					

Table 3: Rating features of Back

Back Features (n=100)	Dislike					Mode
	5	4	3	2	1	
Height	10	21	32	28	9	3
Shape/Contour	10	20	21	44	5	2
Lumbar support	3	16	19	38	24	2
Kidney support	2	9	40	26	23	3
Recline	5	14	32	32	17	2
Head Rest	-	1	10	30	59	1
Ease of Adjustment	-	11	55	23	11	3

Table 3 shows the rating of features of the Back support numbered from 1-5 where 5 is the dislike and 1 is the like.

Table 4: Oswestry Disability Index - 1

Sections	Responses types					
	1	2	3	4	5	6
1	54	42	4	-	-	-
2	73	15	12	-	-	-
3	53	43	4	-	-	-
4	68	19	13	-	-	-
5	67	14	19	-	-	-
6	60	28	12	-	-	-
7	60	29	11	-	-	-
8	83	12	5	-	-	-
9	63	34	3	-	-	-
10	64	11	25	-	-	-

Table 5: Oswestry Disability Index - 2

Oswestry Disability Index	Definition	Number and % (n=100)
0-20%	Minimal Disability	44
20-40%	Moderate Disability	53
40-60%	Severe Disability	3
60-80%	Crippled	-
80-100%	Bed bound	-
Inference	The mean back rest for the no pain (0-20%) is 18.00±3.41 and for the pain 16.84±3.39, the difference is near statistical significance with p=0.093, indicating the decreased score of back rest features.	

Out of the total population of 100 subjects the pie diagram shows the prevalence of back pain in the SMTC bus drivers, which shows 44% of subjects, does not suffer from any low back symptoms at the moment. 53% of subjects suffer from mild low back symptoms at the moment whereas only 3% suffer from moderate low back symptoms at the moment.

DISCUSSION

The transport drivers are found to have diseases of musculoskeletal, cardiovascular and digestive system. The assessment and treatment of bus drivers with low back pain needs a special approach, considering the amount of occupational workload they have to perform during the whole day. Since now a days due to the rapid growth of the Surat city which had led to the traffic congestion these drivers have to do over time work to transport the commuters from one place to the other safely. More importance should be given to preventive care in bus drivers with or without low back pain to limit or prevent symptoms from developing later in adult life. The results of this study are interpreted and discussed according to the objectives mentioned in the previous chapter and in regarding with the previous studies conducted in relation with this study. The results from this study further strengthen

the evidence that low back pain is a common disorder in bus drivers. The prevalence of low back pain in this study was 56 %. Data from similar studies based on an orthopedic medical history and medical history and physical examination found 84.5% of bus drivers in an urban area of California were found to be experiencing back or neck pain at the time of examination.² This wide variation in results may be due to many factors, including the population chosen, geographical location and cultural background. The high prevalence of low back pain could possibly result from the vulnerability of the musculoskeletal structures during this period of growth. It is a known fact that excessive compressive forces in bus drivers, which could possibly place stress on the soft tissues, like the muscles and ligaments making it very sensitive to minor strain, initiating low back pain.

Pain and weight of driver: The statistical analysis obtained in this study showed a positive correlation between the weight distribution among the bus drivers and the intensity of pain out of the 100 samples collected 42% of them were in between 71-95kg 54% of them were in between 46-70kg and on 4% were less than 45kg. It was found that as weight increases the pain also significantly increases. The level of significance found with $\chi^2=18.210$, with a p value of p=0.001%. In a similar study, Leboeuf-Yde

C2000⁷ stated due to lack of evidence, body weight should be considered a possible weak risk indicator, but there is insufficient data to assess if it is a true cause of LBP.

Back Pain and years of driving: The results found with the comparison of years of driving and the pain intensity also showed a positive correlation. 25 samples were having 16 to 20 years of driving history out of which 11 of them did not had pain and 14 of them had minimal or moderate pain. Were as among 25 samples that had 11 to 15 years of driving and pain intensity. Showed that pain is significantly high for the number of driving years more than 16 years with p value 0.006. Hence the current study implicates that as the number of years of driving increases the possibility of getting low back pain also is more. Six out of seven ergonomic factors were significantly related to the prevalence of back and neck pain after adjustment for age, gender, height, weight, and physical workload. Problems with adjusting the seat had the largest effect (odds ratio=3.52).

Driver's seat and driving: the rating of features of the seat pan the result shows the height, slope/contour, comfort, fore/aft range material, ease of adjustment has the mode of 3. Other feature of the seat pan like slope, depth, comfort, suspension has the mode of 2. The seat pan that portion of the seat on which an individual sits, directly supports the weight of the buttocks the seat pan should be wide enough to permit operators to make slight shift in posture from side to side. This helps to avoid static posture and accommodate a large range of individual buttock sizes the front edge of the seat pan should be well rounded downward to reduce pressure on the underside of the thigh, which can affect the blood flow to the leg and feet. Thus seat should be assessable and easy to use from a seated position. Krause In this study also, found the increased pain prevalence along with difficulty in seat adjustment. It shows that out of total percentage of selected drivers based on Oswestry disability index more than half (56%) were found to be with pain and remaining (44%) were without pain. In a similar survey of over 7000 Parisians drivers the importance of driving as a risk factor increased with driving time, and was especially significant for men who drove 4 hours or more each day.^{8,9}Sadri GH¹⁰ in his study to identify the risk factors involved in bus accidents and to design a model showing the relation between the bus driver's health status. He explained there is a significant correlation between the chance of bus accidents and the occurrence of low back pain, leg pain, neck pain, hypertension and migraine. Harry Saporta also found that, there was strong evidence

of an association between musculoskeletal disorders, workplace physical factors, and non-work related characteristics.¹¹

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Ethical Clearance: Shree Swaminarayan Physiotherapy College, Surat.

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Effect of Short duration Targeted Manual Therapy Approach in Plantar Fasciitis – a Randomized Control Trial

Sanjiv Kumar¹, Basvaraj Motimath²

¹Professor, ²Asst. Prof. KLEU Institute of Physiotherapy, Nehru Nagar, Belgaum India

ABSTRACT

Introduction - Bipedal locomotion is a unique feature of human and has the advantage of upright mobility. Hence foot becomes the most important weight loading and gets maximum pressure per unit area. Plantar fascia is a supporting structure at the bottom of foot and gets frequent abnormal stress and strain. The plantar fascia frequently gets inflamed due to overuse or stress which makes the bipedal activities difficult. The study aims to ease the discomfort in better way.

Objective: To compare the effectiveness of conventional therapy versus subtalar mobilization in plantar fasciitis

Study design: A randomized clinical trial.

Setting: Multispecialty hospital at Belgaum India.

Methodology: 28 individuals who met the inclusion criteria were recruited and randomly distributed into two groups i.e. Group A and B. 5 days intervention was given in which group A (n-10) received the conventional therapy (US, Exercise) whereas group B (n-11) mobilization . Pre-intervention and post intervention scores of VAS and Foot Ankle Disability Index was assessed and data were analyzed using t test.

Results: The pre and post comparison of VAS and Foot Ankle Disability score showed significant improvement in both group, however mobilization group (B) showed better and faster recovery compared to conventional group (A).

Conclusion: Both conventional and mobilization were proved to be effective in reducing pain and improving ankle foot function however mobilization group improved much faster and better than conventional group.

Keywords: Mobilization, Plantar fasciitis, Foot Ankle Disability Index, manipulation, exercises.

BACKGROUND AND INTRODUCTION

Background and Introduction - Bipedal locomotion is a unique feature of human beings and has the advantage of upright mobility. Hence, foot becomes the most important weight loading structure and gets maximum pressure per unit area. Plantar fasciitis (PF) is a painful inflammatory process of the plantar fascia, the connective tissue on the sole of the foot. It is often caused by overuse of the plantar

fascia or arch tendon of the foot. It is a very common condition and can be difficult to treat if not looked after properly.¹

The common causative factors can be classified as being biomechanical, environmental or anatomical.² However, most authors are in agreement that the most common causes of PF are overuse activities³, or poor biomechanics⁴, resulting in abnormal functional pronation. It is commonly associated with long periods of weight bearing. Among non-athletic

populations, it is associated with a high body mass index.⁵ Functional risk factors include tightness and weakness in the gastrocnemius and soleus muscles, Achilles tendon and intrinsic foot muscles^{3,6}. A stiff subtalar joint⁷, non-weight bearing rear foot varus, non-weight-bearing forefoot varus or functional leg length inequality also contributes to develop the condition. 4. Biomechanical factors are primarily responsible for PF that occurs in the elderly. This can be attributed to poor intrinsic muscle strength, acquired flat feet and reduced healing capacity of the body³.

In a review study the histological findings of 50 patients with heel pain, revealed that none of the samples exhibited any evidence of inflammation but, rather, degenerative changes in the fascia.¹ Hypomobile joints in the foot and ankle do not effectively absorb weight-bearing stress⁸ and such abnormal joint mechanics can result in prolonged pronation⁹. An alteration of normal biomechanics of the foot and ankle during gait will result in increased tensile strain on the plantar fascia⁷ because of its continuous "bowstring" attachment between the proximal phalanges and the calcaneus.¹⁰

Patients with plantar heel pain usually report insidious sharp pain under the heel, along the medial border of the plantar fascia to its insertion at the medial tuberosity of the calcaneus, upon weight bearing after a period of non-weight bearing.¹¹ The pain is worse in the morning, with the first steps after getting out of bed, after prolonged periods of inactivity or at the beginning of a workout.¹²

The condition plantar fasciitis is a nagging problem and a common condition which is treated by health care provider¹³. It can be treated by surgical and non surgical treatment methods¹⁴. Stretching is useful in the management of plantar heel pain. Short-term treatment of plantar heel pain, a two-week stretching program provides no statistically significant benefit in 'first-step' pain, foot pain, foot function or general foot health compared to no stretching. Patients receives either a single intervention or a combination of stretching, heel cups, NSAID's, ice, steroid injection, heat, night splints, strapping, or advice on new footwear and walking programs.¹⁶ 89.5% of the patients were treated successfully using a combination of anti-inflammatory medications.¹⁷

Achilles tendon stretches, relative rest, heel cups and occasional injections.¹⁸ In the acute phase, a significant inflammatory reaction may be present and modalities such as ice and ultrasound may be helpful.⁶ There are various studies regarding different interventions for plantar fasciitis, however there are very few literature comparing conventional treatment to targeted manual therapy, present study has restricted the study to two manual therapy techniques and short duration of treatment to minimize the suffering time among patients. This study is unique in terms of short duration and minimal intervention. Objective- Hence the objective of the study was to assess the effectiveness of conventional therapy and limited use of manual therapy in plantar fasciitis condition.

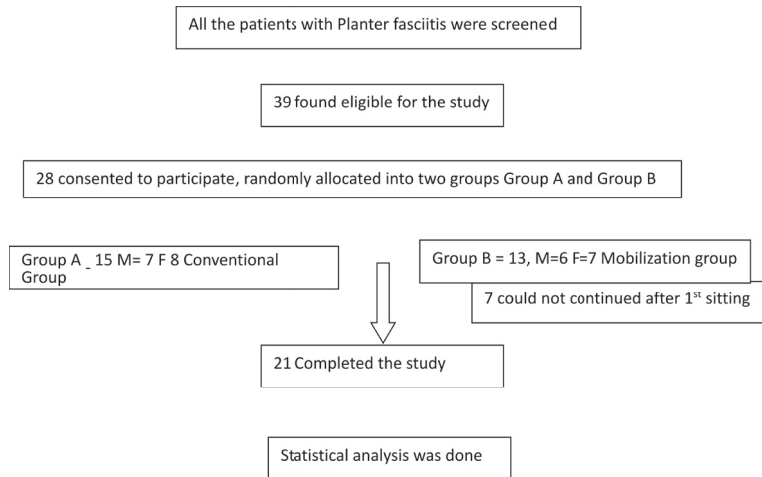
Methodology: The study was conducted at two multispecialty centers and patients were recruited from these centers. All the patients of these centers with plantar fasciitis were screened for the eligibility, out of which only 39 patients were found eligible and were asked for their willingness to participate, out of which 28 agreed to participate and they were randomly allocated in two groups, only 21 patients completed the 5 days of intervention.

Inclusion criteria were participant of age group between 20-50 years with pain in the plantar heel of primary origin, willingness to participate and duration of symptoms which was minimum of fifteen days and maximum of one month. Exclusion criteria The subjects were excluded if they have referred pain, pain of secondary origin, contraindication for mobilization, on steroid therapy, vascular compromise, earlier surgeries of ankle foot and knee, osteoporosis and arthritis. The institutional ethical committee has given ethical clearance for the conduct of the study. Examination- the patients were evaluated clinically and assessed for baseline information. Outcome measures were VAS and foot ankle disability index. VAS 10CM scale used and the information were taken on 1st 3rd and 5th day. Self reported Foot ankle disability index (FADI) was taken from each participants.

Intervention:- The study was conducted allocation patients in to two groups namely group A and group B. the patients in Group A were treated with conventional and group B were treated with joint mobilization. Patients of both groups were

advised home care in the form of hot water foot bath and self stretching.

Conventional therapy: in this the patients were given Ultrasound therapy of 1 w/ cm² continuous mode, with 1 MHz over a period of 5 minutes, followed by TENS application for 15 minutes by applying the electrodes over tender point of plantar fascia. The patients were given ankle foot mobility exercise and stretching of plantar fascia, gastrosoleus and other exercise.



Mobilization group: Patients were given lateral glide mobilization, hind foot distraction and ant-posterior talo-crural mobilization. Apart from mobilization they were also given Ultrasound and TENS for reduction of pain.

Statistical analysis and Results: The data was computed and analyzed using SPSS software; paired t test, Mann-Whitney and wilcoxon signed rank test were performed to assess the result. All the patients visiting the OPD with diagnosis of plantar fasciitis were screened for eligibility 39 of patients were found eligible for the study out of which 28 consented to participate and were randomly allocated in to group A (15- M7, F8) and group B (13, M6 F7). 7 Out of 28 dropped out after first sitting, only 21 subjects could complete the 5 days intervention program. The mean age of the group A was 36.3±7.71 and group B was 42.8±11.81, with no statistical significance. (Table 1) The male to female ratio was also not having any significant difference between groups A-B. The base line data VAS and FDI also not have any statistically significant difference with p value of .738 and .902 respectively.

Variable	Conventional (n=15)	Mobilization (n=13)	p value
Age	36.3±7.71	42.8±11.81	.155
Gender (M:F)	7:8	6:7	
VAS	7.9±1.10	8.1±.83	.738
FADI	53.6±13.8	54.2±7.19	.902

The patients were assessed for their pain symptoms on 10 CM VAS scale, the VAS was assessed on 1st, 3rd and 5th day. The patients treated by conventional methods got mean reduction of 3.5 from 1st to 5th day, shows significant improvement in pain score, where as in group B mean difference of 7.56 from 1st to 5th day. (Table 2)The result shows there is a good improvement in both the groups as far as VAS is concerned, however the mobilization group has shown nearly full recovery from the pain, the statistical analysis suggests the p value for inter and intra group comparisons are highly significant for day 3 and 5, and for mean reduction between day 1-5.

	Day 1	Day 3	Day 5	Mean reduction day 1 -day 5
Conventional (A)	7.9+/- 1.10	6.1+/.73	4.4+/- .69	3.5+/-1.26
Mobilization (B)	8.1+/- .83	2.5±1.1	0.54±.09	7.56±.93
P	.657	<.001	<.001	<.001
Mann-whitney test	2.334	3.978	3.985	3.933
P	.738	<.001	<.001	<.001

The FADI score was compared between and within the groups (table 3). Statistically day 1 data of VAS and day 1 data FADI were nearly similar for both the groups however 3rd and 5th day data shows better improvement in group B compared to group A. The inter group comparison suggests better results in both the parameters in mobilization groups.

	FADI 1	FADI 3	FADI 5	Mean increase
Conventional (A)	53.6+/-13.8	69+/-6.41	81.8+/-6,63	28.2+/-15.3
Mobilization (B)	54.2+/-7.19	89+/-5.95	102.3+/-1.79	48.1+/-7.91
p	.902	<.001	<.001	<.001
Mann-whitney test z	.496	3.883	3.920	2.966
p	.620	<.001	<.001	.003

Pre and post comparison within group for VAS and FADI and also pre and post comparison between groups suggestive of statistically significant improvement in both the groups. The results clearly correlate better improvement among individuals of group B.

Group	Outcome	Pre and post comparison within group		Pre and post comparison between group (Wilcoxon signed rank test)	
		Paired t	P	Z	P
Conventional (A)	VAS	8.720	P <.001	2.821	P <.005
	FADI	5.808	P<.001	Z 2.807	P<.005
Mobilization (B)	VAS	26.788	P<.001	Z 2.989	P<.003
	FADI	20.145	P<.001	Z 2.940	P<.003

DISCUSSION

The results of the present study reveal the fact that the problem of plantar fasciitis is common to both the genders, as the gender distribution was matched in both the groups. There was no statistically significant difference between the groups even in terms of age of the participants and duration symptoms. All the patients were of middle age and has history of over use activities like standing, walking, etc. the same finding was noticed by different authors over use and its relation to plantar fasciitis^{3,6,4}.

On evaluation it was found that most of the subjects were having tightness of ankle and foot plantar muscles, was also the finding by different authors.³ the biomechanical contribution of the altered flexibility also played significant role in aggravation of symptoms hence, subjects with reduced functional status of ankle and foot were having long and persistent symptoms. The individuals were having symptoms for at least minimum fifteen days or maximum of a month hence the study was for sub acute condition instead of chronic ones. the routine evaluation of the subjects was done and were also assessed for VAS and FADI, the baseline VAS score for conventional was 7.9 and mobilization was 8.1 these baseline information suggest that mobilization group score was marginally higher than conventional but not statistically significant. On day 3 the score for conventional group was 6.1 and mobilization group 2.5, and on day 5 for conventional group it

was 4.4 and for mobilization group 0.54 these data suggest that there were remarkable improvement in both the groups, however the group B showed better improvement than group A as far as VAS score is concerned. The improvement in VAS score may be attributed to the improvement in joint play in mobilization group and to improved flexibility in conventional group, as in conventional group patients were given ankle foot mobility exercises, stretching of plantar fascia, and also stretching of gastrosoleus to improve flexibility whereas mobilization of talocrural joint had improved mobility of hind foot joints, hence improved the biomechanical stress on pain sensitive structure. The FADI score which has compared between and within group suggested improvement in both the groups however the group B has shown better outcome than group A, hence the study suggests that the mobilization alone can improve the FADI and VAS scores as the ultrasound TENS were targeted to reduce pain and improve circulation and sensitivity. Mobilization helped to improve the mobility. Hence, in group B mobility, inflammation both were given targeted therapy where as in group A ultrasound, TENS were to reduce pain and stretching and mobility exercise to improve the flexibility of ankle foot area. Hence, in this study the design was to target the dysfunctional status of joints and inflammation of soft tissue, we could achieve effective handling by appropriate therapy. One study suggested that manual physical therapy and exercise is a superior method of management of plantar heel

pain at short and long term follow ups.¹⁵

Present study differs from the above mentioned study as we have selectively targeted the ankle using lateral glide and hind foot distraction and antero-posterior ankle mobilization in one group and in another group we used plantar fascia stretching and stretching of soft tissue of plantar aspect of ankle and foot we did not include the knee and hip exercises in our study. we kept two easily available valid reliable tool for the assessment. The study quoted earlier was having short and long term follow up whereas we have kept five days treatment plan and assessed the symptoms. In a case series patients with plantar heel pain, treated with an impairment based physical therapy approach emphasizing manual therapy demonstrated complete relief and full return to activity in two to seven treatment sessions.¹⁸ Hence our study suggests using targeted mobilization for the reduction of ankle and Subtalar joint dysfunction is a better method of choice as compared to other conventional treatment which induces faster functional recovery of the patients.

Conclusion In this study we could find that the conventional and mobilization groups has good effect in plantar fasciitis patients as far as the effectiveness is concerned the mobilization found to be more effective than conventional therapy.

Limitation: The prospective effect was not assessed in this study after intervention duration and small sample size.

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Conflict of Interest – The research work is self funded with approval of institutional ethical committee and has no conflict of interest.

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Determination of Optimal Dose of Tasks Practice during Constraint Induced Movement in a Patient with Severe Shoulder Pain following Stroke: a Case Report

Auwal Abdullahi¹, Sale Shehu², Zainab Abdurrahman³, Bashir Bello⁴

¹MSc Neurological Rehabilitation, ²BPT student; Department of Physiotherapy, Bayero University Kano; ³BSc Physiotherapy, Department of Physiotherapy, Aminu Kano Teaching Hospital; ⁴BSc Physiotherapy, MSc (Ed) Sport & Exercise sciences, PhD Physiotherapy Candidate, Department of Physiotherapy, Bayero University Kano Department of Physiotherapy, University of Ibadan

ABSTRACT

Introduction: Constraint induced movement therapy is a novel neurorehabilitation technique for upper limb following stroke. Its main components are massed tasks practice with affected limb and constraint of the unaffected limb for specific periods of time. Evidence of its effectiveness has been reported using various outcomes such as behavioural, neurophysiological and kinematics. However, patients with upper limb pain may find it difficult to practice massed tasks practice. Therefore, it is desirable to determine the optimal dose of tasks practice required for improvement in stroke patients with upper limb pain

Material/Method: Seventy five repetitions of 5 functional tasks (15 repetitions each) was carried out by 11 year old sub-acute stroke patient, once a day, 5 times a weeks for 6 weeks. The unaffected limb was constrained for 90% of the waking hours, 5 days a week for 6 weeks. Outcome was assessed using paediatric activity motor log (PMAL).

Findings: The result showed significant improvements at 3 and 6 weeks post-intervention that attained minimal clinically important difference (MCID).

Discussion/Conclusion: Pain is a limiting factor for tasks practice during CIMT. However, tasks practice in less than 100 repetitions could result in significant improvement.

Keywords: Stroke, Motor recovery, Motor learning, Tasks Repetition, Pain and Constraint induced Movement Therapy.

INTRODUCTION/BACKGROUND

Constraint Induced Movement Therapy (CIMT) is a form of physical activity employed in the rehabilitation of upper limb following stroke.¹⁻³It involves constraining of the unaffected upper limb, and massed tasks practice with the affected limb for specific periods of time.²⁻⁴ In children, the dose of the tasks practice during CIMT has been measured based on the duration in hours spent practicing functional tasks. This duration includes 6 hour of tasks practice

per day for 21 days;⁵ 3 hours per day for 2 weeks;⁶ and 2 hours per day for 2 months.⁷Although, childhood (3-9 years old), and adolescence (10-17 years old) are periods of marked physical activity;⁸ physical activity in these groups could be limited in the presence of pain in the upper limb. Price and colleagues concluded that, presence of pain such as in the shoulder following stroke, can prolong rehabilitation.⁹ However, it has been argued that even in the presence of pain, CIMT can be administered to some selected patients without exacerbating the pain.¹⁰

Nevertheless, there is no any study yet that clearly determined the optimal dose of tasks practice that would not exacerbate participants' pain or which they could tolerate. Although what constitutes dose of tasks practice is relative,¹¹⁻¹⁴ the most important factor for neuroplastic changes and the consequent improvement in function, is the number of repetitions of tasks practice.¹⁵ This number of repetitions required for the aforementioned improvements, has been reported to be in the region of 300 repetitions per session per day.¹⁶ In fact, we recently demonstrated efficacy to the level of minimal clinically important difference (MCID) following the use of 320 repetitions of tasks practice divided in 2 sessions per day in a patient 8 days post-stroke.¹⁷ However, performing tasks practice as high as 300 per session could be tasking, especially in the presence of pain.

Considering, the arguments we presented above, we feel there is a need to determine the optimal dose of tasks practice for stroke patients with shoulder pain. We therefore, report a case of an 11 year old boy with sub-acute stroke secondary to cerebral malaria that presented with upper limb functional

impairment and severe shoulder pain (level 8 on a 10 cm visual analogue scale).

MATERIAL/METHOD

Participant: The participant in this report was an 11 year old boy who experienced fever about 3 months back; and was managed medically in 2 different secondary level hospitals within the mentioned period. On admission in one of the secondary hospital, the patient noticed weakness in the left side of his body which made him unable to carry out his activities of daily living. Upon this notice, the patient was referred to Aminu Kano Teaching Hospital to be seen by a neurology team. The neurology team diagnosed him of stroke secondary to cerebral malaria and referred him for physiotherapy a week later. In physiotherapy, he was managed using traditional physiotherapy and forced use (constraint only without tasks practice) for 3 weeks; but no improvement was recorded. When our team saw this patient 3 weeks after the start of physiotherapy, we decided to design a CIMT for him. Detail of the participant's characteristics is presented in table 1 below.

Table 1: Participant's characteristics

Gender:	Male
Age:	11 years
Side affected:	Left
Type of stroke:	Ischaemic
Time since stroke:	4 months
Handedness:	Right
Comobidities:	Cerebral malaria
Mean Baseline MAL score:	4.02
NIHSS level of consciousness:	0

MAL= Motor Activity Log

NIHSS level of consciousness= 0 indicates that the patient was fully conscious

Intervention

- Dose of tasks practice

Five different functional tasks similar to the tasks we carry out during our daily activities were administered by a therapist. These same tasks were also taught to the patient and his mother. He was asked to practice at home each of the tasks 15 times

per session per day for 6 weeks. The details of the tasks including the dose are presented in table 2 below.

- Dose of Constraint

The unaffected upper limb was constrained for 90% of the waking hours using a whole arm sling, 5 days a week for 6 weeks. A logbook was designed to monitor compliance with the tasks practice and the constraint.

Table 2: Characteristics of the intervention

Tasks	No. of repetitions Per session	No. of session per day	No. of days per session	No. of weeks
1) Picking up a cup And drinking from it	15	1	5	6
2) Picking up a cell phone from a table and transfer it from one place to another	15	1	5	6
3) Putting on and removing shoes	15	1	5	6
4) Picking up a brush form a Table and brushing teeth with it	15	1	5	6
5) Writing the Hausa name 'BELLO'	15	1	5	6
Total number of tasks repetitions Per day	75			

Outcome: The outcome of this report was assessed using Paediatric Motor Activity Log (PMAL). PMAL is a semi-structured interview administered to a child's caregiver mostly the mother (Deluca et al., 2003).¹⁸ It consists of 22 items which are scored on a scale of 5 each; and two subscales namely, amount of use and quality of movement. The adult form of MAL has been reported to be highly reliable (Miltner et al., 1999).¹⁹ However, in our report, the test was administered instead by two of us (AA and SS).

Findings: The result of our assessment using the amount of use scale indicated a mild impairment of the left upper limb at baseline (4.02 on PMAL). After 3 weeks, there was a significant improvement in motor function (4.5 on PMAL). At 6 weeks, the improvement was more significant (4.95 on PMAL).

On the other hand, the quality of movement scale indicated a moderate impairment at baseline (3.61 on PMAL). At both 3 and 6 weeks post-intervention, the improvement attained minimal clinically important difference (MCID): +1.03 and +1.37 respectively. MCID has been defined as "the smallest difference in score in the domain of interest which patients perceive as beneficial and which would mandate, in the absence of troublesome side effects and excessive cost, a change in the patient's management".²⁰ Although the

MCID of quality of movement sub-scale has not been determined, we assumed that it would not exceed or come in short of the MCID for the amount use of sub-scale. MCID of amount of use sub-scale for the dominant hand has been reported to be 1.0.²¹ The result is summarized in details in table 3 below:

Table - 3 : Presenting the scores on individual items of PMAL at baseline, and 3 and 6 weeks post-intervention.							
Items	Amount of use			Quality of movement			
	Baseline	3 weeks	6 weeks	Baseline	3 weeks	6 weeks	
1) Hold a bottle	3.5	4	5	3	4	5	
2) Picking up and holding a small item while sitting in a chair	5	4	5	3	4	5	
3) Picking up a large object and Hold	4.5	4	5	3.5	4	5	
4) Eat finger foods	5	4	5	4	5		
5) Picking up an object out arm reach	3	4	5	4	4	5	
6) Push a button	4.5	5	5	3.5	5	5	
7) Open a door or cabinet	4.5	4	5	4	4	5	
8) Use arm to move across floor	4	4	4.5	4	5	4.5	
9) Take of shoes or socks	3.5	5	5	3.5	5	5	
10) Pull a toy with a string	4	4	5	4	5	5	
11) Turn a knob	4	5	5	3.5	5	5	
12) Pick up a cylindrical object (e.g crayon or drumsticks)	4.5	5	5	4	5	5	
13) Throw a ball or smaller object	4	4	4.5	3	4	4.5	
14) Hold a handle on a ridding, Pushing or pull a toy	3.5	4	5	2.5	5	5	
15) Push up front of body with weaker while on stomach	3.5	5	5	2	5	5	
16) Hold an object while in standing position	4	5	5	4	5	5	
17) Carrying object from place to place	4	5	5	4	5	5	
18) Stop or roll a ball	4	4	5	4	4	5	
19) Pop bubbles	4	5	5	4	5	5	
20) Push into sitting position	4	5	5	4	5	5	
21) Reach to be picked by parent	4	5	5	4	5	5	
22) Push arm through sleeve of clothing	3.5	5	5	4	5	5	
Total score	88.5	99	109	79.5	102	109.5	
Mean score	4.02	4.5	4.95	3.61	4.64	4.98	
Mean improvement from baseline	+0.48	+0.93		+1.03	+1.37		

DISCUSSION/CONCLUSION

Pain could be a limiting factor as per as performance of tasks practice during CIMT is concerned. However, this is a controversial subject in the field of neurological rehabilitation. Price and colleagues concluded that, shoulder pain in stroke patients can prolong rehabilitation;⁹ whereas, Underwood and colleagues reported that, tasks practice can be performed irrespective of the presence of shoulder pain.¹⁰ The latter study used 6 hours of tasks practice which is in the region of high dose.^{11,14} However, whether participants performed tasks practice for long or short duration, what may determine tasks performance in the presence of pain could be the number of repetitions of the tasks. In the literature, tasks repetitions as high as 300 within 1 hour, was reported previously.¹⁶ Thus, a higher number of repetitions could be possible within 6 hours; and this can cause repetitive trauma to the already paining shoulder. We therefore sought to determine the optimal number of tasks repetitions required for functional improvement in the presence of severe shoulder pain.

In this report, we found 75 repetitions of tasks practice per day, 5 days a week for 6 weeks to be the optimal dose of tasks practice required for functional improvement in the presence of severe shoulder pain. Although our result has an immediate implication for clinical practice, the finding cannot be generalized considering the sample size, level of the participant's impairment (mild) and his stage of stroke (sub-acute) which is an opportune time for functional reorganization.²²

CONCLUSION

It is possible to administer tasks practice in the presence of severe shoulder pain in stroke patients. However, tasks repetitions in less than 100 per session per day should be considered.

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Conflict of Interest: We declare no conflict of interest

Ethical Clearance: The patient and his mother

gave us consent to publish this case report

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An Assessment of Comparative of Effect of Four different Types of Hamstring Stretching Techniques on Hamstring Tightness

Tarpan Shah¹, Neha Vekariya², Hiral Gandhi¹

¹Assistant Professor , Shree Swaminaryan Physiotherapy College , Kadodara Char Rasta, NH No 8 & 6, Tal ;Palsana 394327 Surat, Gujarat; ²Physiotherapist at Savani Physiotherapy Clinic, Katargam Surat,Gujarat

ABSTRACT

Study compared the effect of four different types of Hamstring Stretching Techniques on hamstring tightness to find effective technique of hamstring stretching from four different techniques for hamstring tightness. 60 subjects with no known musculoskeletal injuries or neurologic deficits volunteered were included for the study. The participants were randomly divided into four groups,90/90 active stretch Group, 90/90 passive stretch group, Active assisted SLR (PNF) group, Passive SLR group among these 15 participants were randomly selected for each group between the ages of 18 to 25 and After 3 weeks, all groups showed significant results but group with 90/90 active stretch group showed significant result in comparison of four groups.

Key Words: *Straight Leg Raising, Proprioceptive Neuro muscular Facilitation*

INTRODUCTION AND BACKGROUND

Flexibility is an ability to move a single joint or a series of joints smoothly and easily through and unrestricted, pain free range of motion. Flexibility in Hamstrings muscle group is necessary for knee Movements as well as in many functional activities and in prevention of injury in which muscle group is elongated over hip and knee simultaneously.¹ Increase in Hamstring tightness may produce prolonged forefoot Loading and through windlass mechanism it increases repetitive injury to plantar fascia. Hamstring tightness tilts Pelvic Posterior which overstretches back extensors and reduces its Endurance.²

There is a lack of research on stretching and flexibility. Many clinicians recommend stretching, but few have attempted to prove its effectiveness. Suggested benefits include improved athletic performance and functional gains^{3,4}. In addition, stretching has maintained a time-honored role in health and fitness^{5,6,7,8}. Many factors influence an individual's flexibility like age, race, gender, circadian

rhythms, tissue temperature, strength training, stiffness, and warm-up have influenced flexibility^{9,10,11,12,13,14,15,16,17,18}. A proper stretching program is key to improving flexibility. Some research suggests that stretches be held for 30 seconds, with at least 3–4 sets^{19, 20, 21}. For maximum improvement in flexibility, it has been recommended that stretching has to be done 5 or more times per week^{22,23,24,25,26,27,28,29}. Static (or passive) stretches have some benefit but may not work as well as PNF stretches^{30,25,11}. Active stretching such as ballistic and PNF requires individuals to volitionally contract muscles. The PNF stretches use contraction of antagonist and then relaxation (CR). Alternatively, they can also employ contraction of the agonist of the lengthened muscle then relaxation (contract-relax, antagonist-contract (CRAC)). The CRAC stretches are reported to be more painful and cause more muscle trauma than other types of stretches¹¹. Additionally, nerve glide stretches, termed neuromobilization, are active stretches in which the nervous system is made taut and then slack. The PNF stretches may be done in combination with neuromobilization maneuvers. An example of a neuromobilization maneuver would be the slump test. The slump test is a seated straight

leg raise (SLR) in which a patient's neural structures have progressive stretch applied to elicit painful symptoms. Neural traction is experienced in the intervertebral foramen by actively dorsiflexing the ankle while flexing the cervical spine. Present study attempts to determine whether active stretches are more effective than passive stretches and whether adding a neuromobilization maneuver to active stretches enhances the stretch.

MATERIALS AND METHODOLOGY

In this experimental study, a total of 60 healthy young individual between the age group of 18-25years with less than 60% tightness of hamstring were allotted in four group of 15 Subjects with hamstring tightness. Subject who had no residual effect of previous injury were included in study. Subjects with known history of knee injury or any other disease affecting hip or knee joint, subjects with chondromalasia, history of knee injury, congenital deformation or any other disease affecting knee joint and hip joint, Any congenital deformation of knee joint and hip joint had excluded from the study. Study was conducted at Shree Swaminarayan Physiotherapy College, Surat. Materials used for the study include Universal goniometer, plinth, strap, paper and pen. Popliteal angle was used as outcome measure. Programme schedule: Before the study was undertaken 60 subjects were selected who satisfied all inclusion criteria. Before treatment whole procedure was explained to the subjects. Subjects were divided into four groups with 15 individuals in each group. Before treatment popliteal angle was measured with goniometer.

MEASUREMENT PROTOCOL

Choice of the lower extremity to be stretched was decided as right lower extremity for all of them. Each subject was ask to be in lying supine with the lower extremity being measured positioned at 90° of hip flexion by the help of stool kept above the lower trunk so that the subject keeps the femoral in touch with the stool and so 90° of hip flexion is maintained. The greater trochanter and the lateral epicondyle of femur and lateral malleolus are palpated and served as a land marks during measurement as outline by Norkin and White – The hip was maintained in 90° flexion while tibia was moved in to the terminal position

of knee extension, which was defined as a point at which the subject reported feeling discomfort. The universal goniometer value was then recorded. The measurement was taken by taking angle between the leg position and full knee extension. All subjects were measured on the same day and at the same time each week, before they had started stretching for that day. Measurement was taken on the stretched lower extremity at end of each week till 3 weeks during treatment period. Stretching protocol: Effective manual stretching technique required adequate stabilization of the patient and sufficient strength and good body mechanical of the therapist. Variation in the position of the patient and suggested hand placement made by therapist.

A. Prior stretching

- A. Position of patient selected was comfortable and stable.
- B. Direction of the stretch was exactly opposite the direction of tightness.
- C. Subject was explained that is important to be as relaxed as possible and to improve flexibility throughout stretching period.
- D. Procedure was explained to the patient.

Group A – 90-90 Passive stretch

Figure 1 .90-90 Passive Stretch



The 90/90 passive stretch (group A) was performed supine with a strap. Flexing the hip until the femur was perpendicular to the floor standardized the hip angle. By placing a strap around the ankle, each subject applied force to achieve passive knee extension.

Group B – 90-90 Active stretch

Figure 2.90-90 Active stretch



The 90/90 active stretch (group B) was performed supine, without a strap. Flexing the hip until the femur was perpendicular to the floor standardized the hip angle. Subjects applied active tension by actively extending their knees via quadriceps contractions. Subjects clasped their hands across their thighs for balance and to keep their hip angles steady, with the femur perpendicular to the floor.

Group C– SLR active-assisted stretch

Figure 3. SLR Active –Assisted Stretch



The SLR active-assisted stretch (group C) was performed supine against a wall, with the knee extended to 180. The hip angle varied across subjects. Each subject was asked to bring the femur as close to perpendicular to the floor as possible. Each subject placed a heel against a corner of a wall, and passive tension was applied to the posterior hamstrings. Additionally, subjects “pumped the foot” by actively dorsi flexing and plantar flexing the foot. A strap was used to aid in pumping the foot. This

added ankle motion is generally considered to be a neuromobilization maneuver .

Group D – SLR Passive stretch

Figure 4.SLR Passive Stretch



The SLR passive stretch (group D) was performed supine against a wall, with the knee extended to 180. The hip angle varied across subjects. Each subject was asked to bring his or her femur as close to perpendicular to the floor as possible. Each subject placed a heel against a corner of a wall, and passive tension was applied by gradually increasing the hip flexion angle.

STATISTICAL ANALYSIS:

Table 1: Table of Mean and Standard Deviation of 90/90 Active Stretch Group

90/90 ACTIVE STRETCH GROUP		MEAN	SD
	PRE	135.6	4.08
	POST	150.4	2.41

Table 2: Table of Mean and Standard Deviation of 90/90 Passive Stretch Group

90/90 PASSIVE STRETCH GROUP		MEAN	SD
	PRE	136.2	5.06
	POST	143	5.42

Table 3: Table of Mean and Standard deviation of Active assisted SLR (PNF) Group

ACTIVE ASSISTED SLR (PNF) GROUP		MEAN	SD
	PRE	132.4	4.58
	POST	148.6	4.15

Table 4: Table of Mean and Standard Deviation of Passive SLR Group

PASSIVE SLR GROUP		MEAN	SD
	PRE	137.5	5.39
	POST	146.8	4.44

Table 5: Table of Mean of all Four Stretch Group

GROUPS		90/90 ACTIVE STRETCH	90/90 PASSIVE STRETCH	A C T I V E ASSISTED SLR (PNF)	PASSIVE SLR
MEAN	PRE	135.6	136.2	132.4	137.5
	POST	150.4	143	148.6	146.8

RESULTS

After three weeks significant difference found in all four groups after stretching regime. Between all four groups 90/90 active stretch group $p=0.0001$ where $p<0.05$ showed significant result in ANNOVA. Statistical analysis was done using ANNOVA. All four groups showed significant result post stretching after 3 weeks.

DISCUSSION

The objective of this study was to compare 4 different stretching techniques to determine which one was most efficacious at improving hamstring flexibility. There were 2 types of stretches studied were active and passive. The results of this study demonstrate that both active and passive stretches were efficacious. At 3 weeks, improvements in hamstring flexibility were seen in both groups A and C. Group A used a 90/90 active stretch, which is a modified contract/relax PNF stretch, and group C performed an SLR with a neuromobilization component. The passive stretch group using a supine SLR against a wall also achieved an improvement.

The range-of-motion improvements in the SLR passive stretch group may be attributed to an increase in stretch tolerance found with static stretching . These improvements also may be attributable to the viscoelastic property changes that occur with “creep,” whereby the tension in the muscle-tendon unit diminishes over time²⁰. As with previous research, PNF stretches seem to be as beneficial as passive stretches. Furthermore, the addition of a neuromobilization component may be beneficial to

hip flexion and knee extension range of motion. The improvement seen in the neuromobilization group emphasizes the fact that flexibility is influenced not only by muscle elasticity but also by connective tissue/nervous tissue extensibility. One previous study showed a quicker return to play for injured athletes who used neuromobilization techniques^{8,13,25,26}. Compliance was not directly measured in this study. While participating in the study, all subjects kept stretching diaries.

Individuals reported that PNF stretches were more engaging and less boring than static stretches. A recent study showed no retention of knee range of motion at 3 weeks after a 3-week stretching program had been implemented³⁰. This conveys the importance of maintaining a stretching program. The improvements seen with the active and passive stretches suggested in this study will likely only continue if the stretching prescription is maintained indefinitely. Despite the randomized controlled design, this study has limitations. Not all items could be controlled, such as the activity levels of the participants. Also, the subjects were performing the majority of these stretches on their own, without the supervision of a therapist. Although the therapist watched them doing the stretches correctly in follow-up visits, there was no way to determine whether they were really keeping their hips at 90/90 when stretching independently. Researchers attempted to obtain measurements at the same approximate time of day for each measuring session to eliminate flexibility variations with circadian rhythms. Additionally, a high variability of data was observed in each group. Generalization of this study to clinical practice should

be confined to the demographics of the individuals we studied. Future studies on flexibility or stretching could be considered using functional, weight-bearing movements. Questions on the safety of neuromobilization maneuvers warrant investigation. Moreover, a clinical outcomes study on the utility of these types of stretches in subjects with specific injury diagnoses would be helpful.

CONCLUSION:

All four techniques help to decrease hamstring tightness and all techniques showed significant results post stretching after three weeks. Among four techniques 90/90 active stretch technique showed significant result in ANNOVA when statistical analysis was done. present study concludes that 90/90 active stretch technique is most effective in hamstring tightness.

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Ethical Clearance: Shree Swaminarayan Physiotherapy College, Surat

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Effect of Pulsed Magnetic Field on Cervical Dysfunction

Ahmed M Aboeleneen¹, Ashraf Darwesh²

¹Department of Basic Sciences, Faculty of Physical Therapy, Cairo University, Egypt; ² Department of Neuromuscular disorders and its Surgery, Faculty of Physical Therapy, Cairo University, Egypt

ABSTRACT

Objective : The purpose of this study was to investigate the effect of pulsed magnetic field on patients with chronic cervical dysfunction.

Materials and method: Twenty male patients with cervical spondylosis were involved, aged between 35– 50 years old. The patients were divided into two equal groups. Patients in the first group (control group) received a therapeutic ultrasound. Patients in the second group received pulsed magnetic field and therapeutic ultrasound. Treatment was done 2 times a week for 6 weeks. Range of motion and pain level were measured before and after treatment.

Results: There were significant differences within the two groups before and after treatment as cervical ROM of flexion, extension and lateral flexion increased and pain level decreased but there were no significant differences between the two groups after treatment .

Conclusion: Pulsed electromagnetic field, in conjunction with ultrasound, was effective in improving pain level and cervical ROM in patients with chronic cervical dysfunction.

Keywords: cervical dysfunction, pulsed magnetic field.

INTRODUCTION

Pain and impairment of the neck is common. It is estimated that 22% to 70% of the population will have neck pain sometimes in their lives. In addition, it has been suggested that the incidence of neck pain is increasing. At any given time, 10% to 20% of the population reports neck problems; Prevalence of neck pain increases with age and is most common in women around the fifth decade of life¹.

Neck pain has many causes which have been described and include discogenic disorders, osteoarthritis, trauma, tumors, infection, torticollis,

myofascial pain syndrome, and whiplash. Unfortunately, there are no established clearly defined diagnostic criteria for many of these entities. Similar to low back pain (LBP), the majority of patients who present with complaints of neck pain and neck related symptoms of the upper quarter have no identifiable pathoanatomical cause . Therefore, once serious medical pathology (such as cervical fracture or myelopathy) has been ruled out, patients with neck pain are often classified as having either a nerve root compromise or a mechanical neck disorder².

Magnetic field (MF) is the space permeated by the magnetic lines forces surrounding a permanent magnet or coil of carrying electric current. A magnetic field always exists when there is an electric current flowing. There are three types of MF: a static MF which is fanned in the case of direct current, a time varying MF and pulsed MF. The human body is transparent to the MF, so during application, it acts on all molecules, has no selective action^{3,4}.

Corresponding Author:

Ahmed M. Aboeleneen,

Department of Basic Sciences, Faculty of Physical Therapy, Cairo University, Egypt.

E-mail: ahmed.aboeleneen@pt.cu.edu.eg

Rest membrane potential is altered in diseased or damaged cells. If the ions move within an area of pulsating magnetic fields, they will be influenced by the pulsation rhythm. The resting membrane potential of the cell is proportional to the ion exchange at the cell membrane and the oxygen utilization of the cell is dependent on the ion exchange⁵. Pulsating magnetic fields have dramatical influence on the ion exchange at the cellular level and thereby improve the oxygen utilization of diseased or damaged tissues. Magnetic therapy is contraindicated in certain cases as hemorrhage or where electrical implants are in use. Previous studies indicated that PEMF of proper frequency, intensity and duration provides beneficial effects in a wide variety of cellular processes and mechanisms⁶.

AIM OF THE STUDY

The purpose of the study was to investigate the effect of pulsed magnetic field on pain level and ROM in patients with chronic cervical dysfunction.

MATERIAL AND METHOD

Twenty male patients with cervical spondylosis diagnosed by orthopedists and neurologists aged from 35 to 50 years old participated in this study. All patients had a continuous duration of complaining of pain more than 3 months and they were divided into two equal groups, group A served as control group and received ultrasound and group B served as study group and received pulsed magnetic field in addition to ultrasound. **Exclusion criteria:** Acute inflammatory diseases of musculoskeletal system, history of surgical approach to the neck, spinal instability or patients contraindicated to magnetic therapy

INSTRUMENTATION

1- (CROM) cervical range of motion device: The CROM accurately and quickly measures the range of sagittal, coronal and horizontal movements of the head and neck.

2- Magnetic field device: MAGNETO 2 chinesport Low frequency (1-100 Hz) magnetic therapy device, with power of 100 Gauss, its model is (EL0064). It consists of a control panel, bed and solenoid. The control panel must be connected to electrical mains supplying 230v at a frequency of 50 or 60 Hz.

3- Ultrasonic apparatus: Physiomed 91220 serial number 0035908, 230v~/0.3MA/50-60HZ) was used

Procedures

Evaluative procedures

Measurement of cervical flexion and extension:

- The subject sits erect in a straight-back chair with the sacrum against the back of the chair, the thoracic spine away from it, arms hanging at sides and feet flat on the floor. The CROM instrument is positioned with fastening the velcro straps snugly in line with the bows. First instruct the subject to nod his head to make a double chin (suboccipital flexion). Then encourage the subject to flex further until full cervical flexion is obtained. Take the reading on the sagittal plane meter.

- To measure cervical extension, first instruct the subject to nod his head back (suboccipital extension). Then have the subject extend further until full extension is achieved.

Measurement of cervical lateral flexion:

- The subject sits erect as with flexion and extension measurement. Instruct the subject to flex the head laterally to the left without rotation, keeping the shoulders level. Record the measurement from the lateral flexion meter. Then do the same for the right lateral flexion.

Pain assessment:

By using the (VAS) the patient was asked to place a mark along a 10 cm line to denote their level of pain

Treatment procedure:

1- Patients in the group (A) received ultrasonic of 1 MHz frequency, 1.5 watt/cm² power and continuous mode for 5 minutes to the target cervical area. Acoustic gel was used as a coupling a medium⁷.

2- Patients in the group (B) received the same program of the group (A) in addition to PMF with a frequency of 10 Hz, intensity of 20 gauss and duration of 15 min⁸. While patients in supine lying position the cervical region was exposed to PMF, 2 sessions per week for 6 weeks.

Statistical Analysis

Data was presented as mean and standard deviation. Paired t-test was used to analyze the data

within each group and unpaired t- test was used to analyze the data between study and control groups. The p-value was <0.05

RESULTS

General characteristics of the subjects:

The results showed no significant differences between the two groups for age, weight and height as shown in table (1).

Table (1): Physical characteristics of patients in each group.

Items	A		B		Comparison		S
	Mean	±SD	Mean	±SD	t-value	P-value	
Age (years)	40	±3.8	40.6	±2.7	0.287	0.781	NS
Weight (Kg)	76.8	5.67	77.8	4.91	0.29	0.77	NS
Height (cm)	173.4	6.76	172.8	7.66	0.13	0.89	NS

SD: standard deviation, P: probability, S: significance, NS: non-significant.

Differences in pain level, and cervical ROM pre and post treatment for group A:

1-Pain level:

The results revealed that there was significant decrease in the pain level in the group A after treatment as the P value was (0.009) as shown in table (2).

The results revealed that there was significant increase in ROM in cervical flexion , extension, right flexion and left flexion in the group A after treatment where the P values were (0.008) , (0.045), (0.022), (0.015) respectively as shown in table (2).

2-Cervical range of motion:

Table (2): Differences in pain level and cervical ROM pre and post treatment for group A.

Sig: significance S: significant. P: probability

Group (A)		Pre	Post	T	P	Sig
Pain		8.2± 0.83	5.8± 0.83	4.7	0.009	S
CROM	Flexion	39.8±3.96	44.4±3.36	4.9	0.008	S
	Extension	38.6±10.9	44.2±7.15	2.88	0.045	S
	Rt flexion	32.8±5.89	37.8±4.49	3.62	0.022	S
	Lt flexion	34±6.28	38.6±4.97	4.09	0.015	S

Differences in pain level, and cervical ROM pre and post treatment for group B:

1-Pain level: The results revealed that there was significant decrease in the pain level in the group B after treatment as the P value was (0.009) as shown in table (3).

2-Cervical range of motion: The results revealed that there was significant increase in ROM in cervical flexion, extension, right flexion and left flexion in the group B after treatment where the P values were (0.004) , (0.030), (0.003), (0.003) respectively as shown in table (3).

Table (3): Differences in pain level and cervical ROM pre and post treatment for group B.

Sig: significance S: significant. P: probability

Group (B)		Pre	Post	T	P	Sig
Pain		8.2± 0.83	5.8±0.83	4.70	0.009	S
CROM	Flexion	39.4±3.5	43.8±3.76	5.88	0.004	S
	Extension	39.8±11.07	47.4±7.16	3.314	0.030	S
	Rt flexion	30.8±2.94	37.8±3.83	6.67	0.003	S
	Lt flexion	30.6 ± 3.50	37.2± 3.11	6.4	0.003	S

Differences in pain level, and cervical ROM pre treatment between the two groups:

1-Pain level: The results revealed that there was no significant differences in pain level between group A and B before treatment where P value was (0.771) as shown in table (4).

2-Range of motion: The results revealed that there was no significant differences between group A and B in ROM for cervical flexion , extension, right flexion and left flexion before treatment where the P values were (0.87) , (0.86), (0.51), (0.32) respectively as shown in table (4).

Table (4) : Differences in pain level and cervical ROM between the two groups pre treatment.

		G(A)	G(B)	T	P	Sig
Pain		8 ± 1.22	8.2 ± 0.83	0.302	0.771	NS
CROM	Flexion	39.8 ± 3.96	39.4 ± 3.50	0.169	0.87	NS
	Extension	38.6 ± 10.94	39.8 ± 11.07	0.172	0.86	NS
	Rt flexion	32.8±5.8	30.8±2.94	0.67	0.51	NS
	Lt flexion	34±6.28	30.6±3.50	1.05	0.32	NS

Sig: significance NS: Non significant P: probability

Differences in pain level, and cervical ROM post treatment between the two groups:

1-Pain level: The results revealed that there were no significant differences in pain level between group A and B after treatment where P value was (0.83) as shown in table (5).

2-Cervical range of motion: The results revealed that there were no significant differences between group A and B in ROM for cervical flexion , extension, right flexion and left flexion after treatment where the P values were (0.79) , (0.50), (1.0), (0.60) respectively as shown in table (5).

Table (5): Differences in pain level and cervical ROM between the two groups post treatment.

		G(A)	G(B)	T	P	Sig
Pain		6 ± 1.87	5.8 ± 0.83	0.21	0.83	NS
CROM	Flexion	44.4 ± 3.36	43.8 ± 3.76	0.26	0.79	NS
	Extension	44.2 ± 7.15	47.4 ± 7.16	0.70	0.50	NS
	Rt flexion	37.8 ± 4.49	37.8 ± 3.83	0.00	1.0	NS
	Lt flexion	38.6 ± 4.97	37.2 ± 3.11	0.53	0.60	NS

Sig: significance S: significant. P: probability

DISCUSSION

This study was conducted to investigate the effect of PMF (frequency of 10 Hz, intensity of 20 Gauss and duration of 15 minutes per session, two sessions per week for six weeks) on pain and cervical ROM of flexion, extension and lateral flexion on patients with cervical spondylosis.

In this study the ROM of the cervical region was measured by the CROM device. It is a valid and reliable instrument for measuring cervical ROM.

Within the limitations of this randomized controlled study, statistically significant differences were detected in the control group in pain level (P was 0.009), and cervical ROM of flexion (P was 0.008), extension (P was 0.045), right flexion (P was 0.022) and left flexion (P was 0.015).

For the control group the improvement of pain level and cervical ROM might be due to that ultrasound increases the threshold of pressure produced by pain receptors. The velocity of large diameter nerve fibers (A beta) increased after application of ultrasound while the conduction velocity of small diameter nerve fibers (A delta) that are responsible for pain transmission decreased⁹. Also it causes a significant tissue heating that alters the viscoelastic properties of connective tissue making it more extensible⁷.

It was stated that ultrasound is used for relieving pain, decreasing muscle spasm and increasing tissue extensibility, it is mostly used in combination with stretching exercises to achieve optimal tissue length¹⁰.

Regarding the group B or the study group there were statistically significant differences in pain level (P was 0.009), and cervical ROM of flexion (P was 0.004), extension (P was 0.030), right flexion (P was 0.003) and left flexion (P was 0.003).

The analgesic effect of PMF therapy could be attributed to one of the following mechanisms:

First, the presynaptic inhibition or decreased the excitability of pain fibers¹¹. **Second**, the molecular mechanism of the effect of magnetic field may involve conformational changes in the ion channels or neuronal membrane¹². **Third**, evidence exists that PMF can modulate the actions of antibodies, hormones and

neurotransmitters surface receptor sites of a variety of cell types¹³.

The results come in agreement with **Jacobson et al**¹⁴ and **Hinman et al**¹¹ who revealed significant pain relief after application of PMF to the patients of CLBP.

The results also revealed that PMF appeared to be effective in improving cervical ROM. This occurred because the spine mobility was affected in cervical dysfunction patients as a result of pain avoidance behavior which caused the muscles and ligaments not to be used to their ultimate limits or full ROM. If the limited cervical ROM was maintained for a long period of time, the ROM would actually decrease as the soft tissues shorten and strength decreases.

These results can be explained by the work of **Van Nguen and Marks**¹⁵ who found that PMF decreases joint and muscle pain, decreases joint swelling and stiffness and improve soft tissue repair so increase mobility and quality of life.

These results are supported by **Holcomb et al**¹⁶ who found that PMF is useful in reducing pain and relieving of muscle spasm, so improves patient function and trunk ROM in CLBP patients.

These results come in agreement with **Hinman et al**¹¹ who reported that the application of MF to the musculoskeletal problems can reduce pain, inflammation and enhance the movement.

The results also revealed that, there were no significant differences between the two groups in pain level and cervical ROM after treatment and this may be attributed to the small sample size used in this study.

CONCLUSION

The results of the present study showed that PMF improves pain level and increases cervical ROM of flexion, extension and lateral flexion. Also, it indicates that PMF is a non-invasive, low-cost, non heating physical therapy modality and should be recognized as standard additional treatment for patients with cervical spondylosis.

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Ethical Clearance: We certify that this study involving human subjects is in accordance with Helsinki declaration of 1975 as revised in 2000 and that it has been approved by the relevant ethical committee.

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