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Effects of Exercise Intensity on Cardiovascular Variables During Concentric and Eccentric Resistive Knee Extensors Exercises in Adults under Isotonic Condition

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ABSTRACT

Background and Objectives: Resistance training in the form of concentric and eccentric exercise is a highly recommended form of exercise for athletes and also for individuals with or at risk of developing cardiovascular disease. The purpose of this study was to compare the effect of exercise intensity on cardiovascular changes during concentric and eccentric resistive knee extension exercise in adults under isotonic condition. *Methods:* A sample of 60 healthy subjects between the age group (20-30 years) was selected for the study. Each subject performed concentric resistive knee extension exercise at 85% of 1RM and 75% of 1RM and eccentric resistive knee extension exercise at 85% of 1RM of concentric + 30% of 1RM and 75% of 1RM of concentric + 30% of 1RM on Biodex multijoint exercise system 4 pro . Same numbers of repetitions were performed for concentric and eccentric contractions. SBP, DBP, HR, MAP were measured before and after each exercise. *Results:* Statistical analysis was done using single sample t-test. The results of the study indicate that there is difference in cardiovascular response at different intensities of concentric and eccentric activity. More variations are seen in cardiovascular variables after concentric activity at respective intensities as compared to eccentric activity. *Conclusion:* The result of the study suggests that eccentric exercise produce lower cardiovascular response than concentric exercise.

Keywords: *cardiovascular variables; concentric; eccentric; exercise intensity resistance exercise;*

INTRODUCTION

Isotonic exercise training is characterized by variable joint speed against a constant resistance. Exercising to develop and maintain muscular strength, muscular endurance and muscle mass is called as resistance training. There are several types of resistance exercises like isometric, isotonic i.e. concentric and eccentric with constant resistance and variable resistance, isokinetic/ hydraulics/pneumatics resistance exercises[1]. Dynamic muscle action can be performed with two types of action (1) concentric (shortening contraction) and (2) eccentric (lengthening contraction)

There are many physical and physiological adaptations that occur as a result of consistent resistance training[2]. Resistance exercise has a positive effect on human musculature, connective tissue, bone formation and metabolism[3,4]. One of the many cardiovascular adaptations to resistance training is the ability to tolerate higher blood pressure (BP) responses during exercise[2]. During resistance exercise several cardiovascular changes occur including increased systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate (HR), mean arterial pressure (MAP) and rate pressure product (RPP)[4,5]. The BP increases during resistance training possibly due to mechanical compression, pressure reflex, and/ or increase of intrathoracic pressure reflex, and/ or increase of intrathoracic pressure caused by Valsalva maneuver[6,7].

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In recent years, the use of resistance training has been promoted as a physical activity for the prevention and treatment of lifestyle related diseases as well as for the prevention of disabilities because of instability and falls in elderly adults[5,8]. It is strongly recommended for implementation in primary and secondary cardiovascular disease-prevention programs[8]. Intense resistance training at loading levels greater than 60% of IRM has attained positive results with respect to general health[9, 10].

As compared to concentric, eccentric training leads to preferential recruitment of type II muscle fibers leading to their selective hypertrophy. The muscle performance at greater velocities of movement depends primarily on fast-twitch motor units and the function of these neuromuscular units is also affected by temperature showing a positive relationship[11,12]. Smith RC and Rutherford OM. have demonstrated that, the changes in dynamic force tend to be greater following eccentric training and greater mechanical efficiency and energy dissipation can be achieved with eccentric contractions.

As the acute elevation in BP during exercise is known to become accentuated with aging[13], it would be dangerous to prescribe resistance loads nearer to the voluntary maximum in the elderly[5]. Therefore, this study is important to clarify the cardiovascular response to concentric and eccentric muscle contraction in younger subjects. So that findings may be extrapolated to middle age and elderly individuals in order to better prescribe resistance training for the prevention of falls during instability.

METHODS

Participants

A total of 60 subjects were selected for this study from the University campus. All the participants were recruited based on predefined selection criteria after taking an informed consent. Both males and females in the age group of 20-30 years, having a normal BMI and resting heart rate between 60 – 100 beats / min. were selected. Subjects with any medical condition, present or past, which may have affected the results of the study, were excluded.

Modalities used

Biodex multi joint exercise system 4 pro (also known as isokinetic dynamometer), treadmill, weighing scale, height scale, and BP apparatus.

Procedure

The study was conducted in the Rehabilitation Center of Jamia Hamdard. First of all, the leg dominancy was tested by ball kicking test. A maximum of two subjects were tested in a single given day. On day 1, the subject was familiarized with the multi joint biodex system 4 pro.

On day 2, he/she took rest for 15 minutes in supine lying position and then baseline BP and HR measurements were taken. After that the subject did warm up for 5 minutes on treadmill at speed of 3.2kph[14,15] following which HR and BP measurements were taken. After warm up, the standard positioning guidelines for knee exercises on the Isokinetic Dynamometer were followed. Any discomfort or subjects reporting 9 or above on the RPE scale would have led to immediate termination of the session.

Each subject was asked to perform the maximum number of repetitions which he/she can perform till the fatigue level with 35 Kgs of resistance on isokinetic machine and according to that,1RM was calculated by using equation {RepWt/(1-0.02RTF)}[16] and according to the 1RM, 75% of 1RM and 85% of 1RM were calculated for each subject. After this a 15 min rest was given to the subject.

The pre- exercise BP and HR measurements were recorded. The subject was asked to perform the concentric resistive knee extension on isokinetic dynamometer at 85% of 1RM intensity. They did repetitions till the voluntary failure to do contractions was achieved. Then the post- exercise BP and HR were recorded, and the maximum number of repetitions performed were recorded. After this 5 min rest was given to subject.

Then again the pre-exercise BP and HR measurements were recorded. The subject was asked to perform concentric resistive knee extension exercise on isokinetic dynamometer at 75% of 1RM intensity. They did the repetitions till the voluntary failure to do the contractions was achieved. The post-exercise BP and HR measurements were recorded along with the maximum number of repetitions.

On day 3, subjects took rest for 15 minutes in supine lying position then baseline BP and HR measurements were taken. Then subject did warm up exercise for 5 minutes on treadmill at a speed of 3.2 kph[14,15] and HR and BP measurements were taken after the warm up. After that the subject was asked to perform eccentric resistive knee extension on isokinetic dynamometer at 85% + 30% of concentric RM intensity[17]. Subject performed the same number of repetitions as in 85% of 1RM of concentric contraction. Then post-exercise BP and HR measurements were taken. After this 5 min rest was given to subject.

Again the pre-exercise BP and HR measurements were taken. Subjects were asked to perform eccentric resistive knee extension exercise on dynamometer at 75% +30% of concentric RM intensity[17]. Subject performed the same number of repetitions as in 75% of 1RM of concentric contraction. Then post- exercise BP and HR measurements were taken.

RESULTS

Statistical analysis was done with the help of IBM SPSS software. Cardiovascular variables were compared between two intensities using the paired t-test. A p-value less then equal to 0.05 was considered as statistically significant.

BETWEEN THE GROUPS COMPARISONS

Comparisons between the concentric and eccentric resistive knee extension

BLOOD PRESSURE

DIASTOLIC BLOOD PRESSURE:

Table 1: Comparison of mean values, standard deviation (SD) and t- value and significance Level (P) of DBP obtained in both groups i.e. concentric and eccentric at different intensities.

DIASTOLIC BLOOD PRESSURE:

INTENSITIES	DIASTOLIC BLOOD PRESSURE	CONCENTRIC		ECCENTRIC		SIGNIFICANCE (p)	T-VAL UE
		MEAN	SD	MEAN	SD		
85%	DBP pre	77.05	8.089	75.40	8.916	0.136	1.510 NS
85%	DBP post	78.43	9.464	77.35	9.940	0.386	0.874 NS
75%	DBP pre	77.25	7.213	76.32	9.912	0.427	0.801 NS
75%	DBP post	80.40	9.788	76.55	9.258	0.010*	2.655 **

*significant at p value < 0.05

TABLE 2: Compassion of mean values, standard deviation (SD) and t- value and significance level (P) of SBP obtained in both groups i.e. concentric and eccentric at different intensities.

INTENSITIES	SYSTOLIC BLOOD PRESSURE	CONCENTRIC		ECCENTRIC		SIGNIFICANCE (p)	T-VALU E
		MEAN	SD	MEAN	SD		
85%	SBP pre	119.05	15.263	116.82	11.803	0.209	1.270 NS
85%	SBP post	127.97	16.590	124.23	13.254	0.017*	2.454**
75%	SBP pre	121.47	15.161	119.42	12.830	0.256	1.146 NS
75%	SBP post	130.82	17.242	123.27	15.121	0.001*	3.567 **

*significant at p value <0.05

HEART RATE:

TABLE 3: Comparison of mean values, standard deviation (SD) and t- value and significance level (P) of HR obtained in both groups i.e. concentric and eccentric at different intensities.

INTENSITIES	HEART RATE	CONCENTRIC		ECCENTRIC		SIGNIFICANCE	T-VAL UE
		MEAN	SD	MEAN	SD		
85%	HR pre	86.02	11.084	86.82	13.230	0.626	0.491 NS
85%	HR post	99.45	13.618	96.10	11.750	0.077	1.800 NS
75%	HR pre	90.28	11.504	87.27	12.025	0.090	1.724 NS
75%	HR post	101.98	13.534	96.32	13.213	0.001*	3.362 **

*significant at p value < 0.05

MEAN ARTERIAL PRESSURE:

TABLE 4: Compassion of mean values, standard deviation (SD) and t- value and significance level (P) of MAP obtained in both groups i.e. concentric and eccentric at different intensities.

INTENSITIES	MEAN ARTRIAL PRESSURE	CONCENTRIC		ECCENTRIC		SIGNIFICANCE	T-VALU E
		MEAN	SD	MEAN	SD		
85%	MAP pre	91.21	9.209	89.17	9.265	0.048*	2.015**
85%	MAP post	95.02	9.856	92.44	9.996	0.010*	2.658**
75%	MAP pre	92.08	8.641	90.87	9.408	0.242	1.181 NS
75%	MAP post	97.66	10.353	92.20	9.345	0.000*	3.774**

**significant at p value < 0.05*

The results shows that there is statically significant difference between posttest readings of DBP at 75% of intensity, SBP at 85% and 75% of intensities, HR at 75% of intensity, MAP at 75% of intensity.

DISCUSSION

Systolic Blood Pressure

In the present study the SBP at both 85% and 75% of 1RM intensities increased more after concentric resistive knee extension exercises than after eccentric resistive knee extension exercises. The possible reason for this difference may be due to the fact that there is increase in peripheral resistance during concentric contraction as compared during eccentric contraction[18].

Diastolic Blood Pressure

Also when comparison was done between concentric and eccentric exercises at an intensity of 75% of 1 RM, the posttest value of DBP after concentric exercises was more than after eccentric exercises. Similar result was found by tom J. Overend in 2000 who concluded that during eccentric contraction cardiac output and stroke volume increase and also there is decrease in peripheral vascular resistance when compared to changes during concentric contraction. Decrease in peripheral resistance during eccentric contraction is associated with

lesser increase in diastolic blood pressure.

The smaller cardiovascular response during eccentric contraction as compared to concentric contraction in this study may be attributable to the difference in active muscle mass utilized in these two modes of muscle contraction i.e. concentric and eccentric contraction as the skeletal muscle recruitment is less during eccentric contraction than concentric contraction as stated by fiatarone et.al, brigand et al [9, 19,20,21].

There are several possible reasons for the difference in energy demands and cardiovascular stress between concentric and eccentric exercise. More motor units are recruited in concentric exercise as compared to eccentric as stated by komie et. al and Okamoto et.al [5,19,21] because eccentric movements require less muscle activation, the intramuscular forces are reduced, resulting in a decrease in BP.

Heart Rate and Mean Arterial Pressure

In present study when posttest value of HR at 75% of 1RM after concentric exercises was compared with that after eccentric exercises it was found out that the HR after concentric exercises increased more than after the eccentric resistive knee extension exercise. The pressor response to exercise includes all of the reflex-induced cardiovascular changes that serve to increase arterial blood pressure during a muscle contraction[22]. Exercise mode, intensity, and duration, and size of the active muscle mass are all factors related to the magnitude of increase in HR and BP[23,24,25]. An increase in the excitation of muscle afferent receptors will cause greater increases in HR and BP during resistance exercise, utilizing either a larger muscle mass[25,26] or a higher relative exercise intensity[27] ·There have been studies which show that even when concentric and eccentric exercise are done against same amount of resistance the RPE rating given by the subjects were higher for concentric contraction as compared to eccentric contraction[18]. The greater increase in cardiovascular stress with greater active muscle mass may explain the increased HR, MAP, associated with concentric exercise in present study.

CONCLUSION

The result of present study concludes that different intensities of concentric and eccentric activity have different effects on cardiovascular variables. Also eccentric activity imposes less stress on cardiovascular variables as compared to concentric activity.

Conflict-of-Interest Statement : The authors declare that there is no conflict of interest

Statement of Informed consent: An informed consent was taken from all the subjects.

Statement of Human and Animal Rights

Ethical Clearance: was taken from Institutional Ethics Committee, Jamia Hamdard

Source of Funding - Self

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Effect of Task-oriented Training with and without Trunk Restraint on Reaching Activity in Adult Hemiparetics

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ABSTRACT

The normal pattern for reaching to a target is not seen in hemiparesis, as patients are seen to use compensatory trunk movements to accomplish the same task. As much as this compensatory behavior allows them to accomplish the task regardless of the motor deficit, it however, may not be desirable for skill requisition. Past studies have shown that limiting these compensatory movements effectively improves reaching activity in adult hemiparetics. However in those studies, the investigators analyzed the effects of training for a very brief period. Thus in this study we are aiming to determine the effect of task-oriented training with trunk restraint on reaching activity in adult hemiparetics, where 20 adult hemiparetics over the age of 40 years were recruited and were randomly allocated to control (n=10) and experimental (n=10) groups. Participants of both groups were assigned a reaching task for 60 repetitions in a single session in 3 directions for 10 sessions within 2 weeks period. Trunk restraint was introduced to the experimental group while performing the reaching task. Pre and post –intervention scores of the Reaching Performance Scale (RPS) were analyzed. Participants of both the groups show significant ($p< 0.05$) change in RPS scores. Inter group post intervention RPS scores show a significant ($p<0.05$) differences. Additionally, when the mean values between the groups were compared, the post intervention RPS scores of the experimental groups were higher than the control group, implying better performance in the former.

Keywords: *Hemiparesis, Upper Extremity, Reaching Activity, Task Oriented Training, Trunk Restraint*

INTRODUCTION

The ability to reach is critical for virtually all activities of daily living (ADL) such as grooming, toileting, feeding and dressing.[1] A necessary requisite for controlled reaching is the coordination of the action of transporting the arm away from the body while activating appropriate muscles to stabilize trunk and scapula. The trunk is recruited before arm such that the trunk begins moving before the hand movement and can continue moving even after the hand has stopped.[2]

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Previous studies in hemiparetic patients have described excessive trunk or shoulder girdle movement in pointing and in reach to grasp movements for target placed close to the body.[3] Wanger et al (2006) showed that deficits in strength appear to be the most influential sensorimotor impairment associated with limiting reaching performance in subjects with acute hemiparesis.[4] Additionally elbow shoulder inter joint coordination is disrupted in hemiparetic patients. In contrast to healthy individuals, reaching in hemiparetic patients is characterized by a lack of smoothness as evidenced by both temporal and spatial segmentation.[5]

Therapist may approach the rehabilitation of reaching in several ways, eg. reflex based neurofacilitation approaches, that is acquisition of trunk and shoulder girdle stability must precede the retraining of arm movement. Unwanted movements and spasticity are inhibited and normal patterns are facilitated under

the assumption that regaining voluntary control over key movements will transfer to functional improvements. However empirical evidences for this assumption are lacking.[6]

A recent meta-analysis also showed that more intensive therapy may at least improve the rate of ADL recovery, particularly if a direct functional approach is adopted.[7]

The rehabilitation of reaching has been based on a task-oriented approach in which movement is behaviorally driven and the interaction of the individual with the environment is stressed. It is seen, that excessive trunk movement in hemiparetics while reaching, limits the potential recovery of normal arm movement patterns. Reducing compensatory mechanisms by trunk restraint may encourage the return of the movement patterns typically seen in healthy individuals.[6]

Peurala et al showed various constraint induced movement therapy (CIT) doses which improved mobility of the affected upper extremity.[8] The Task related training (TRT) involved reaching to objects placed across the work –space. Progressive resistive exercises (PRE) involved whole- arm pulling against resistive therapeutic tubing in planes and distances similar to that in TRT.[5] Jeyaraman et al also demonstrated trunk restraint as a effective treatment for decreasing compensatory strategies.[9]

Post stroke therapeutic interventions leading to functional improvement emphasize intensive task –specific practice reported to facilitate training –induced plasticity and active –induced neuroplasticity where it is necessary to determine whether interventions result in the reappearance of premorbid movement patterns (recovery) or in substitution by novel movement patterns (compensations).[10]

This study aims to show short duration training on reaching activity with trunk restraint for Indian Population.

MATERIALS AND METHOD

After receiving clearance from the Institutional Human Research Ethics Committee for this randomized control trial, 20 subjects from both genders, over age of 40 years were taken.[11] Inclusion criteria for selecting subjects were non traumatic single unilateral stroke (not less than 1 month and not more than 6 months),[12] patients who have the ability to perform reach-to-grasp activity with the hemiparetic upper extremity (Brunstrom recovery stage 3 and above) and those who understand simple commands in English. Those who have severe cognitive impairment (Mini Mental State Exam score < 18), contractures/ deformities on the affected arm, shoulder- hand syndrome were excluded from this study.

Informed written consent was taken from all the subjects. Then all the subjects were randomly allocated into two groups, Group A (Control group, n=20) and Group B (Experimental group, n=20).

All the subjects in both groups were assessed using the Reaching Performance Scale (RPS) for pre and post intervention scoring. The subjects were seated in a chair with their feet in full floor contact. The length of the fully extended arm from medial aspect of the axilla to the distal crease of the wrist medially was measured. Then a target (A conical object with base of 7 cm diameter and height 17.5 cm, made from cardboard with a rough surface) was placed on the mid-sternal height at subject's full arm length. The subjects were asked to reach forward, grasp and return the cone to the mid chest region at a comfortable self paced speed and asked to repeat the same action through 20 repetitions, taking 2-3 minutes rest after the first 10 repetitions. A single session consisted of 60 repetitions of the reach-to-grasp task, where 20 repetitions done in each of the three directions; contralateral, ipsilateral and midline. The experimental group performed the same protocol with trunk restrained to the chair with a trunk restraint belt. The duration of the training was an overall of 10 sessions spread over a 2 week period, after which RPS assessment was done to get the post intervention scoring.

RESULT/ FINDINGS

Statistical analysis using paired t-test showed significant ($p< 0.05$) change in reaching activity of the subjects in both the groups (n=10) (Table 1 & 2). Unpaired t-test showed a significant ($p<0.05$) difference between the post intervention mean scores of the control group and the experimental group (Figure 1). Comparing means before and after intervention showed that participants from both groups improved their reaching activity after intervention. However, better improvement was seen in the experimental group.

DISCUSSION

Task-oriented training is effective in improving reaching activity of adult hemiparetics. Reaching activity is an important component for independent living. However, survivors of stroke often rely on compensatory movement strategies to accomplish reaching tasks.[9] Carr and Shepherd[13] suggest that compensatory strategies are the result of using available movements given the post stroke state of central nervous system, which leads to long term functional limitations. Without intervention, stroke survivors often use the uninvolved limb to accomplish functional goals, which results in learned disuse. In addition, failure to use the paretic limb can produce secondary changes in the effecter apparatus (muscle, connective tissue shortening) and lead to a stiff, immobile and sometimes painful upper limb.[5] To minimize these changes and as well to limit compensatory behavior in order to promote recovery, specific practice requiring the patient's active participation is suggested as being necessary.[14] This may therefore be the reason behind the improvement in reaching activity seen in this group of patients after training.

Quite a number of randomized control trials have shown that task oriented training improves upper extremity functions in hemiparetic patients.[15, 16] The mechanism behind this is the concept of specificity of training, which has been discussed in relation to able-bodied subjects and proposed as a means of rehabilitating the movement disabled.[14, 17, 18, 19] In this concept, it is emphasized that subjects improve on the actions which they practice.

The study also shows that task- oriented training with trunk restraint is effective in improving reaching activity in adult hemiparetics. The effects of trunk restraint indicate that hemiparetic patients did not use their potential joint range for free arm movements.[9] Hemiparetic patients could make isolated elbow flexion and extension movements by using reciprocal muscle activation pattern within available articular ranges. The increase in joint ranges with trunk restraint is partly due to an adaption involving anticipation of changed external load conditions.

Patients are forced to make movement out of synergy which probably involves a focused and greater effort on their part.[9] The adaptation of arm activity was triggered by somatosensory input from the trunk or shoulder caused by the trunk restraint. The strategy of constraining the unaffected arm to force the patient to make more use of the affected arm with the additional feature that reduction of compensatory movement patterns is also targeted. Physical trunk restraint can be considered similar to Manual Guidance in which spatial constraints are used to promote use of more optimal movement patterns.[20]

Comparison of post training RPS scores of the control group and the experimental group signifies that task oriented training with trunk restraint is better than task oriented training without trunk restraint on reaching activity in adult hemiparetics.

The reason behind this may be backed up by the study of Michaelson et al 2004,[20] in which a single session of repetitive reach to grasp training to objects within arm's reach during physical restriction of trunk compensatory movements led to greater gains in elbow extension, greater decreases in trunk involvement, and improved temporal inter joint coordination compared with instructed practice alone. It has been recognized by clinicians[14, 21] that once compensation has been learned, it is very difficult to modify. Indeed, prolonged use of compensatory trunk movements to reach targets placed with in arms length may result in the system learning not to use arm joints for reaching and grasping (learned nonuse) so that recovery of independent use of these joints would be discouraged. Physical trunk restraint can be considered similar to manual guidance in which spatial constraints are used to promote use of more optimal movement patterns justifying training induced plasticity, and activity induced neuro plasticity.[6, 20] In a study by Michaelson et al (2006) to determine how trunk restraint improves reaching ability in stroke patients , kinematic analysis revealed that decreased mean trunk displacement by 32.8 mm at post –test and 14.2 mm at follow-up , where as training without TR increased trunk displacement by 3.6 mm and 22.0 mm respectively.[10] This may further explain why more improvement was seen with trunk restrain as compared to training without trunk restraint.

Kwakkel G et al (2016) reviewed strong evidence that constraint-induced movement therapy has greater effects on motor function only when applied in the earlier stages post stroke, in which it is assumed that restitution of neurological functions is still possible, but that in

the later phases constraint-induced movement therapy solely influences arm-hand activities by learning to use adaptation strategies (i.e., compensation) to improve upper limb performance in Activities of daily living.[22] In this study patients were selected not less than 1 month and not more than 6 months, and similarly also showed better movement pattern development in task oriented training with trunk restraint on reaching activity.

Results of this study have great implications for rehabilitation, demonstrating that stroke patients can improve their performance on seated reaching tasks with a task oriented training program that takes into account normative biomechanics of the upper extremity while minimizing unwanted compensatory movements. The findings directly challenge the assumption that improvement in function after stroke is due to spontaneous recovery only. In addition, the outcome is consistent with the increasing evidence that stroke patients can improve their performance of specific tasks if those tasks are included in training and practiced.

Trunk restraint may also be a useful technique to promote maximal arm motor recovery in the acute stage of stroke, when the potential for neuro plasticity may be greatest. Exercise is known to induce a cascade of molecular and cellular processes that support brain plasticity. Brain-derived neurotrophic factor (BDNF) is an essential neurotrophin that is also intimately connected with central and peripheral molecular processes of energy metabolism and homeostasis, and could play a crucial role in these induced mechanisms. An acute aerobic exercise unmistakably influences circulating BDNF concentration, although the effect is transient.[23]

So it is evident that the benefits of the simple reach training with physical trunk restraint employed in this study provide a strong argument for applying this training in clinical settings. The implication for therapy is that restriction of trunk use should be used even in patients with chronic hemiparetic to encourage maximal use of available degrees of freedom.

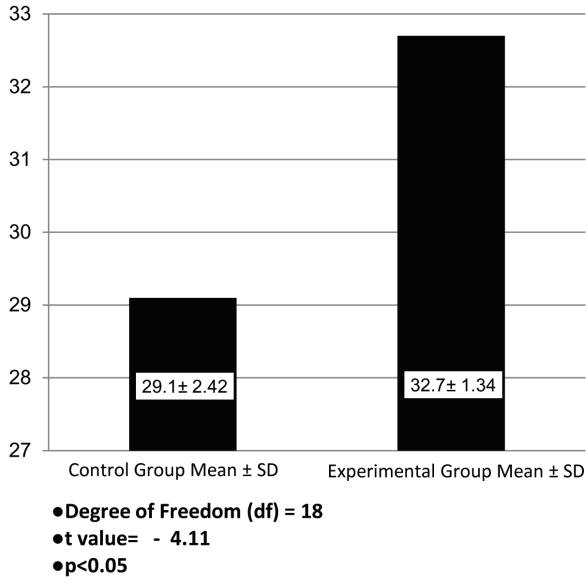

Figure 1: Comparison of post intervention RPS scores of Control and Experimental groups

Table 1: Comparison between the Pre and Post Intervention performance in the Control group (GroupA)

	Pre- Score Mean±SD	Post- Score Mean±SD	t	Sig. (2-tailed)
RPS score	23.1±4.01	29.1±2.42	-8.78	<0.05

Degree of freedom (df) = 9

Table 2: Comparison between the Pre and Post Intervention performance in the Control group (GroupA)

	Pre- Score Mean±SD	Post- Score Mean±SD	t	Sig. (2-tailed)
RPS score	22.6±3.95	32.7±1.34	-10.65	<0.05

Degree of Freedom (df) = 9

CONCLUSION

Task oriented training is an effective means of improving reaching activity in adult hemiparetics. However, task oriented training together with trunk restraint is a better method to improve reaching activity in adult hemiparetics.

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A Study of High Fatigue and Low Fatigue Resistance Training on Quadriceps Muscle Strength and Hypertrophy in Normal Individuals

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ABSTRACT

Background: Resistance training is now accepted as an integral and crucial part of any athlete's training plan. Early pre-season or off-season training is reserved for maximum strength and hypertrophy. The prescriptive variables are numerous such as exercise order, rest intervals between sets and exercises, frequency, velocity of movement, number of sets and repetitions, and load or intensity. All of these variables can be manipulated to meet specific training goals and address individual needs. Strengthening exercise of the quadriceps muscle seems to be important for the prevention and rehabilitation of knee injury. High resistance training enhances muscular strength and hypertrophy; and some studies suggest an important role of metabolite accumulation in this process. In this study the two training protocols were designed to differentiate as much as possible for fatigue and metabolite accumulation by manipulating rest intervals between sets and exercise.

Aims and Objectives: To study effectiveness of high fatigue and low fatigue resistance training on quadriceps muscle strength and hypertrophy and to study the comparative effect of high fatigue and low fatigue resistance training on quadriceps muscle strength and hypertrophy.

Methodology: Study included 30 college students with age between 18-24 years after getting written consent. Training sessions were conducted 3 days per week for 9 weeks. Subjects were divided into two groups. Group A (n=15) trained with high fatigue resistance training and Group B trained with low fatigue resistance training on quadriceps table. 1 RM was used as the criterion measurement for strength and thigh girth at 9" above knee joint line for hypertrophy.

Results: Results showed a significant improvement in outcome measures of strength ($t=5.68$, $p<0.0001$) and hypertrophy ($t=5.82$, $p<0.0001$) in both the groups. But when comparing two groups, more improvement in strength seen in high fatigue resistance training group; this group also showed more significant increase in thigh girth as compared to low fatigue resistance training group.

Conclusion: High fatigue resistance training for knee extension is more effective than low fatigue resistance training in terms of strength and hypertrophy of quadriceps muscle. Training the quadriceps muscles is an integral part of most sports strength programs. So high fatigue resistance training can be used for gaining better results

Keywords: *Fatigue, Resistance training, Rest, Pause, Quadriceps muscle, Hypertrophy, Muscle strength.*

INTRODUCTION

Resistance training is now accepted as an integral and crucial part of any athlete's training plan [1]. Early pre-season or off-season training is reserved for maximum strength and hypertrophy[1]. For athletes new to resistance training an extended period of time may be required for functional or anatomical training to prepare the body for a more strenuous program.[1] The dynamic strength of the quadriceps muscle is important

for the stability and movement of the human body and thus for sports activity[2,3]. Strengthening exercise of the quadriceps muscle seems to be important for the prevention and rehabilitation of knee injury[4, 5, 6]. High resistance training enhances muscular strength and hypertrophy; and some studies suggest an important role of metabolite accumulation in this process while at same other study said that fatigue and metabolite accumulation do not appear to be critical stimuli for strength gain, and resistance training can be effective without the severe discomfort and acute physical effort associated with fatiguing contractions[7]. There is controversy regarding effectiveness of high fatigue resistance training and low fatigue resistance training on muscle strength and hypertrophy and lack of research in this era. So, purpose of the study is to see the individual effects of high fatigue resistance training and low fatigue resistance training on quadriceps muscle strength and hypertrophy and also to compare the effects of high fatigue resistance training and low fatigue resistance training on quadriceps muscle strength and hypertrophy.

MATERIALS AND METHOD

For the study a random sample of 30 students volunteer to participate were taken from our college after getting informed written consent giving due consideration to inclusion and exclusion criteria. Inclusion criteria for this study is normal male individuals with BMI range between 18.5 to 24.9 kg/m^2 having age between 18 to 24 years. Exclusion criteria includes any hip or knee pathology, any hip or knee injury within last one year, history of resistance training in lower limbs, those who reported performance enhancing drugs, pain, any medical illness, those who have reported an active participation in aerobic exercise program or doing aerobic exercise regularly. Materials used in study were consent form, quadriceps table, various free weight plates (lb), locks, measure tape, pillow, plinth, watch, weighing machine, height scale, and digital camera. Outcome measures taken were 1 RM knee extension for measuring strength on quadriceps table and thigh girth measurement 9" above right medial knee joint line with measure tape.

1.1 starting position for right knee joint

1.2 End position for right knee joint

2.1 Thigh girth measurement taken 9" above medial knee joint line

2.2 Thigh girth measurement taken 9" above medial knee joint line

Training sessions were conducted 3 days per week and with at least 48 hours between sessions for nine weeks, and was conducted under supervision. Subjects were randomly divided into two groups. The procedure was explained to all subjects. Subjects trained the right quadriceps femoris muscle group on a quadriceps table. Knee is extended from flexed positioning in a smooth controlled manner. Subjects were asked to maintain their habitual levels of activity throughout the study period. The maximum load that could be lifted just once (1 RM) was measured to the nearest 5 lb. and thigh girth was measured with measure tape to the nearest 0.1 cm at 9" above the right knee joint line in lying position. Average of the three thigh girth measurements was taken as final reading.

The 1RM and thigh girth were measured before the start of study and again after 9 weeks of training. Tests were preceded by warm up that included active movement of knee followed by flexibility exercises for knee musculatures for about 5 minutes. The training load for both protocols was specified as 75% of 1 RM, and the total numbers of repetitions were same for both protocols. The two training protocols were designed to differentiate as much as possible for fatigue and metabolite accumulation. After the completion of training session cool down exercises were given which include active movement of knee and gentle stretching exercise for about 5 minutes.

Group A trained with high fatigue resistance training and Group B trained with low fatigue resistance training on quadriceps table. In high fatigue (HF) resistance training, Group A performed extension of right knee joint for 4 sets of 10 repetitions with 30 seconds of rest between sets. Training load was 75% of 1 RM. They were instructed to perform the contractions in each set continuously in a smooth controlled manner, lowering the weight fully and lifting it through the full range. The training load was typically reduced by 5 lb one to two times in initial training sessions in two subjects because it was impossible for the subjects to complete all the contractions at the prescribed load (75% 1 RM) due to fatigue.

In Low fatigue (LF) resistance training, Group B performed total 40 repetitions of right knee joint extension with 30 seconds rest between each repetition to minimize fatigue and metabolite accumulation. Training load was 75% of 1 RM. It was never needed to reduce the training load for any subject following this protocol. Again, the subjects were instructed to perform each repetition in a smooth controlled manner lifting the weight through the whole range. The subjects were observed for any change or any symptoms and asked to report if there is any discomfort. All the subjects completed the whole treatment program of 9 weeks. Total duration of study was one year.

FINDINGS

Total 30 subjects were randomly divided into two groups: Group A (High fatigue resistance training) and Group B (Low fatigue resistance training). 15 subjects were taken in each group. Table 1 displays the group statistics of age distribution among the 30 subjects. No significant difference was seen across the two groups.

TABLE 1. AGE (IN YEARS) DISTRIBUTION OF THE SUBJECTS

GROUP	N	MEAN	±SD
GROUP A	15	21.20	1.47
GROUP B	15	21.07	1.53

Table 2 displays the group statistics of BMI distribution among the 30 subjects. No significant difference was seen across the two groups.

TABLE 2. BMI (kg/m^2) DISTRIBUTION OF THE SUBJECTS

GROUP	N	MEAN	±SD
`1GROUP A	15	21.63	1.57
GROUP B	15	22.62	1.21

Paired t-Test was applied in Group A and in Group B for with-in group analysis. Unpaired t-Test was applied for between-group comparison of Group A and Group B. In the group A results showed highly significant improvement in 1 RM and thigh girth measurement after 9 weeks of High Fatigue Resistance Training of right Quadriceps muscle at 5% level of significance (Table 3).

TABLE 3 MEANS OF PRE EXERCISE AND POST EXERCISE 1 RM AND THIGH GIRTH OF GROUP A

OUTCOME MEASURE	PRE MEAN±SD	POST MEAN±SD	t VALUE	p VALUE
1 RM (lb)	37.00±11.62	60.67±13.35	16.67	<0.0001
THIGH GIRTH(cm)	41.35±3.03	43.47±3.08	20.07	<0.0001

In the group B results showed highly significant improvement in 1 RM and thigh girth measurement after 9 weeks of Low Fatigue Resistance Training of right Quadriceps muscle at 5% level of significance (Table 4).

TABLE 4. MEANS OF PRE EXERCISE AND POST EXERCISE 1 RM AND THIGH GIRTH OF GROUP B

OUTCOME MEASURE	PRE MEAN±SD	POST MEAN±SD	t VALUE	p VALUE
1 RM (lb)	39.33±14.00	53.67±14.07	17.35	<0.0001
THIGH GIRTH(cm)	42.27±3.05	43.57±3.04	13.96	<0.0001

Student t-test (unpaired t-test) was applied between group comparison for Group A and Group B. On comparing group A and Group B the results showed highly significant improvement in strength (t=5.68, p<0.0001) and hypertrophy (t=5.82, p<0.0001) (Table 5).

TABLE 5. ON COMPARING GROUP A AND GROUP B

OUTCOME MEASURE	GROUP A MEAN±SD	GROUP B MEAN±SD	t VALUE	p VALUE
1 RM(lb)	23.67±5.50	14.33±3.20	5.68	<0.0001
THIGH GIRTH(cm)	2.12±0.41	1.30±0.36	5.82	<0.0001

After 9 weeks of training, group A showed more significant improvement in 1RM knee extension test and thigh girth based upon girth measurement with tape in comparison to group B.

DISCUSSION

The present study was conducted to see the individual effect of high fatigue resistance training and low fatigue resistance training and also to compare the effectiveness of high fatigue resistance training versus low fatigue resistance training on quadriceps muscle strength and hypertrophy in normal individuals. Results showed a significant improvement in outcome measures of strength and hypertrophy in both the groups. But when comparing two groups there was more improvement in strength seen in high fatigue training group; High fatigue training group also showed more significant increase in thigh girth as compared to low fatigue training group. The probable reason for this result was local accumulation of metabolic sub products such as lactate and hydrogen ions which stimulate exercise-induced adrenaline secretion[9]. The increase in metabolic stress with increased lactate and adrenaline has recently been shown to play an important role in the regulation of anabolic hormone secretions from the hypothalamus-pituitary gland[10, 11]. Metabolite accumulation within the muscle causes concomitant growth hormone secretion and transient increase of growth hormone can produce an interaction with muscle cell receptors, aiding recovery and stimulation of hypertrophy [10, 11]. Along with the mechanical stimuli (time under tension, load) the interaction of hormonal (testosterone, growth hormone etc.) and metabolic (e.g. lactate, glycogen, etc.) stimuli are important for development of maximal strength. These findings are in agreement with observations by Rooney K J et al. 1994 who investigated the role of fatigue in strength training. Increase in strength produced by a training protocol in which subjects rested between contractions were compared with those produced when subjects did not rest. Both training groups performed the same number of lifts at the same relative intensity. They concluded that improvement in strength of the elbow flexors following six weeks of dynamic resistance training was significantly greater in the regimen without rest, compared to a regimen with a 30 second rest period between each repetition although the magnitude of muscular hypertrophy was not evaluated . These findings suggest that processes associated with fatigue contribute to the strength training stimulus[12].

In the present study during the first week of training, the high fatigue group (Group A) experienced severe muscle soreness, which is indicative of muscle damage, but this was not the case for the low fatigue group. Muscle damage can cause a strength decrement for days and even weeks[13, 14] and, in theory; this could have attenuated the strength gains and any advantage

of high fatigue training. However, Folland JP et al 2002 had previously investigated the influence of a more acute bout of muscle damage during the initial stages of a strength training programme and found that this did not influence strength gains for more than two weeks[15]. Our observations suggest that high fatigue is an essential or primary stimulus for gain in strength as well in improving girth. Low fatigue strength training designed to minimise stress and metabolite accumulation produced significant increases in quadriceps muscle strength and hypertrophy but that were not of similar magnitude to training designed to maximise fatigue or metabolite accumulation. This suggests that significant and comparable strength gains and hypertrophy can be achieved with high fatigue training. This finding is supportive to two longer studies by Rutherford and colleagues, who found metabolite accumulation to be of significant benefit to strength gains[16, 17], although a six month study by the same group, using a protocol identical with that of the previous investigations, found no advantage to high metabolite accumulation[18]. So, lactic acid may not be the 'bad by product' although it may contribute to fatigue; it can be used as a source of energy. Studies have shown that lactic acid may be important for increase in muscle hypertrophy and strength[16, 19].

CONCLUSION

High fatigue resistance training for knee extension is more effective than low fatigue resistance training in terms of strength and hypertrophy of quadriceps muscle. Therefore, increasing the metabolic stress (lactate) may be an additional stimulatory mechanism for muscle growth and strength.Training the quadriceps muscles is an integral part of most sports strength programs. So high fatigue resistance training can be used for gaining better results. Future studies should be done by taking larger sample size and by taking a female population to the see the effects.

Conflict of Interest: None Declared.

Source of Funding: Nil.

Ethical Clearance: Informed written consents were taken from all volunteer participants of the study.

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To Find Out the Correlation between Pain Disability and Quality of Life with Low Back Pain in Housewives of Age Group 40-50 Years

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ABSTRACT

Background: The level of Quality of Life (QOL) and disability among women with low back pain is an important health issue at global level. **Objective:** To find out the correlation between pain disability and QOL among women. **Materials And Methods**: A community-based correlational study was conducted among 200 women aged 40-50 years who have Low back pain were interviewed, out of which 39 excluded because they did not need meet our inclusion criteria. Severity of pain was assessed using Visual Analogue Scale, Oswestry Disability Low Back Pain questionnaire was used to measure the disability level and WHOQOL-BREF scale was used to assess the quality of life. **Results:** The findings of present study show that 74.19% of the subjects have episodes of low back pain. The present study findings found that the most of the women (74.19%) with low back pain experienced moderate disability (83/161) 51%, followed by severe disability (24/161) 14% and minimal disability (51/161) 31.67%. And crippled (3/161) 1.86%.It has a negative correlation with a value of (-0.11) that means very little effect on Disability. The intensity of pain i.e. moderate or severe has affected the physical domain most having a negative correlation with a value of -0.22 as compared to environment (-0.12), psychological (-0.08), social relation (-0.09).In this study we found that when BMI increases or if a person is overweight the level of pain also increases showing a positive correlation with a value of 0.14

Conclusion: It is concluded that most of the housewives suffer from Low Back Ache. The physical quality of life is inversely/ negatively correlated and BMI is directly/positively correlated with intensity of pain.

Keywords- *BMI,Disability,LBP,QOL,VAS.*

INTRODUCTION

Low back pain (LBP) is a common disorder involving the muscles, nerves, and bones of the back. Pain can vary from a dull constant ache to a sudden sharp feeling. Low back pain may be classified by duration as acute (pain lasting less than 6 weeks), sub-chronic (6 to 12 weeks), or chronic (more than 12 weeks). The condition may be further classified by the underlying cause as either mechanical, non-mechanical, or referred pain the symptoms of low back pain usually improve within a few weeks from the time they start, with 40-90% of people completely better by six weeks.

A woman is the nucleus of the family, especially in India. The daily work schedule of women is very arduous and demanding in nature. The non-neutral posture of the trunk frequently adopted by women is risk for developing a low back pain.[1]

Low back pain is a massive problem in modern population, both in social and economic terms. It affects large numbers of women, especially those aged 40-50. Going through a premenopausal period is associated with many symptoms, including low back pain [2].

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As their life expectancy increases, contemporary women live a third of their life in menopause chronic pain in **is** more prevalent women than in men, and it increases with age. According to Whelan *et al*., even 80% of women suffer from various symptoms (including pain) in the premenopausal period [2].

International surveys of low back pain reported that 1month prevalence was 19-43% and point prevalence was 15-30%.The estimated worldwide lifetime prevalence of low back pain varies from 50%-30%.The estimated worldwide lifetime prevalence of low back pain varies from 50%to 84%.Studies in developed countries have shown that the low back pain point prevalence was 6.8% in North America,13.7%in Denmark,12% in Sweden,14%in the United Kingdom,33% in Belgium and 28.4% in Canada. Similarly, some studies in developing countries have revealed much higher incidence of 72.4% in Nigeria, 64% in China, and 56.2% in Thailand. The occurrence of low back pain in India has suffered from low back pain at some time during their lifespan [1].

Low back pain also restricts mobility, interferes with normal functioning and results in lifelong pain and permanent disability. In India, most of the people are engaged in physically demanding jobs which may increase the risk of low back pain and disability. Low back pain also affects the quality of life [QOL] of not only women themselves, but their families as well .In India very few studies have been done with regard to this [1].

With this background, the present study aimed – To find the correlation between pain, disability and quality of life with LBP in house wives of age[40-50yrs].We want to this study because women usually housewives neglect their health and it affects others family members too because the all of them are depended on her.

More than 85% of Indian women neglect their health and consult the doctor when they have reached at their worst stage of the disease. This study is also rarely done in South Delhi.

METHODOLOGY

- TYPE OF STUDY- Survey, Prospective community based correlational study.
- Tools Used-
- VAS - It is a measure of the intensity of pain. It is usually a 10 cm line with anchors of 'no pain' and 'worst pain possible' with a score of zero and ten respectively. The VAS is a simple, widely used self report measure that has excellent reliability and validity. [17]
- WHOQOL-BREF- It comprises 26 items, which measure the following broad domains; physical health, psychological health, social relationships, environment. It assesses the individual's perceptions in the context of their culture and value system, and their personal goals and standards.[21]
- OSWESTRY DISABILITY LOW BACK PAIN QUESTIONNAIRE- It is an index used by clinicians and researchers to quantify disability for low back pain.[22]
- Sample Size- 217
- Excluded -56
- Source of data collection –Community
- Inclusion criteria- House wife with Low Back Pain Age group 40-50years)
- Exclusion criteria

Working women

Housewives with any trauma, infection, or any major trauma to spine fracture.

Procedure

This study was a correlational. By using quota sampling method, 217 women aged 40-50 years who have LOW BACK PAIN were interviewed, out of whom 56 were excluded because they did not meet our inclusion criteria. The remaining 161 housewives took part in the study.

The language we choose is English and we also make people understand the questions in Hindi so that the questions must not be ignored or answered incorrectly. We excluded the housewives who were engaged in any sort of occupational activity other than household work, and also those who were pregnant or diagnosed with any neurological, cardiovascular or psychiatric conditions. Housewives with tumor, infection, or any other major trauma to the spine fracture was excluded from the study. After selecting the housewives for the sampling,

the interviewer conducted door to door survey .Before proceeding to the inclusion-exclusion criteria and were willing to participate in the study they were then asked to provide their demographical details any present or past medical history, surgery history, gynecological history and information for BMI. After explaining the need and purpose of the study a written consent was obtained from each women. All the three scales were administered to all of them. The language of the WHOQOL-BREF scale is both in English & Hindi & Oswestry Low Back Pain Disability Questionnaire was in English so each question was explained by the researcher in Hindi. Data is recorded on assessment sheets.

DATA ANALYSIS

Analysis of the data was done by using **Formula:**

Correlation Co-Efficient: Correlation(r) = [NΣXY - (ΣX) (ΣY) / Sqrt ([NΣX² - (ΣX)²][NΣY² - (ΣY)²])] N = Number of values or elements X = First Score Y = Second Score ΣXY = Sum of the product of first and Second Scores ΣX = Sum of First Scores ΣY = Sum of Second Scores ΣX^2 = Sum of square First Scores ΣY^2 = Sum of square Second Scores

RESULTS

Out of 217 subjects 161 has LOW BACK PAIN in the age group of 40-50 yrs.85% (n=136) of women had education up to secondary level and 15% (n=24) of them were illiterate. None of the women is at menopausal level. The Parity (no. of children) having subjects has no correlation with each low back pain with a value of 0.03. Regarding Body mass index (BMI), (6/161) 3.7% of subjects are underweight, (69/161) 42.85% of subjects are normal, (85/161) 52.79% of subjects are overweight. As BMI increases the level of pain also increases showing a positive correlation with a value of 0.14. Majority of women (98/161) 60.86% who has moderate pain followed by severe (61/161) 37.88% and mild (3/161) 1.86% pain. The intensity of pain i.e. moderate or severe has affected the physical domain having a negative correlation with a value of -0.22 more as compared to environment (-0.12), psychological(-0.08), social relation(-0.09). Subjects with Low back pain experienced moderate disability (83/161) 51%, followed by severe disability (24/161) 14% and minimal disability (51/161) 31.67%. And crippled (3/161) 1.86%.It has a negative correlation with a value of (-0.11) that means very little effect on Disability.

We found the correlation between:

- VAS And Parity
- BMI And VAS
- VAS and physical ,psychological, social relation ,environment & disability

We found the relation using:

Formula:

Correlation Co-Efficient: Correlation(r) = [NΣXY - (ΣX) (ΣY) / Sqrt ([NΣX² - (ΣX)²][NΣY² - (ΣY)²])] N = Number of values or elements X = First Score Y = Second Score ΣXY = Sum of the product of first and Second Scores ΣX = Sum of First Scores ΣY = Sum of Second Scores ΣX^2 = Sum of square First Scores ΣY^2 = Sum of square Second Scores

You calculate the above formula in excel utility

Formula for excel =Corel (X:XN, Y: YN)

SPECIFIC CORELATION

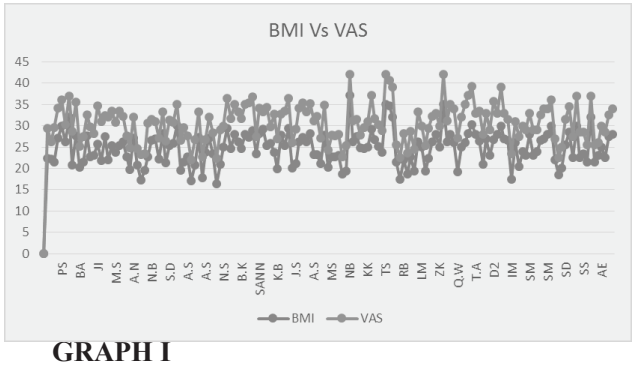
PARITY vs. VAS	0.03
BMI vs VAS	0.14
VAS vs PHYSICAL	-0.22
VAS vs PSYCHOLOGICAL	-0.09
VAS vs SOCIAL RELATION	-0.08
VAS vs ENVIRONMENT	-0.12
VAS vs DISABILITY	-0.11

NOTE:

Correlation coefficient of –ve value indicates a perfect negative correlation. As variable VAS increases, Variable of Physical, Environment, & Disability decreas es.

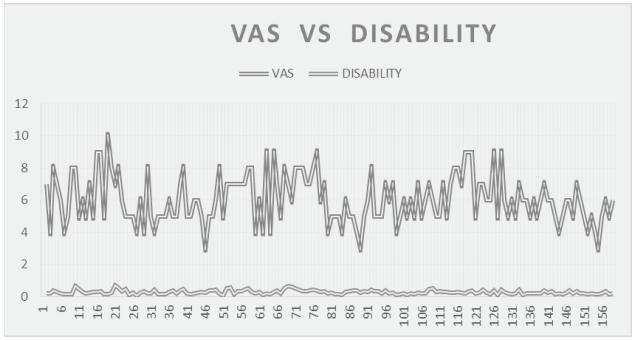
Correlation coefficient of +ve indicates a perfect positive correlation. As BMI variable increases, variable of VAS level will increase.

A correlation coefficient near 0 indicates no correlation: As in case of Parity vs. Psychological & Social Relations.



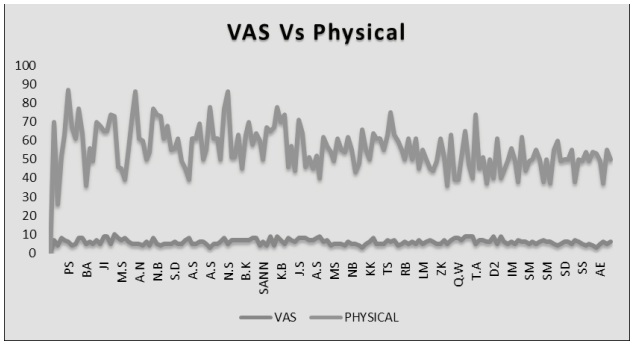
GRAPH I

INTERPRETATION: It shows relation between BMI and VAS & indicates positive correlation with a value of 0.14which means that when BMI of a person increases i.e. the person is overweight the level of pain i.e.(mild, moderate, or severe)also increases.



GRAPH II

INTERPRETATION: It shows the relation between VAS and Disability. It indicates negative correlation with a value of -0.11 which means the level of pain i.e. moderate or severe leads to minimal disability among subjects.



GRAPH III

INTERPRETATION: It shows the relation between the VAS and Physical domain of Quality of life. It indicates a perfect negative correlation with a value of -0.22 which shows that when person has increased level of pain i.e. moderate or severe level so ultimately their physical quality of life hampers or decreases

DISCUSSION

Women are also biologically prone to develop low back pain especially when they are at the age of attaining menopause. In our study 97.51% is at premenopausal and 2.48% attained menopause which result in hormonal changes responsible for global laxity in the muscles and ligaments of the back, and ultimately leads to dysfunctions of spine. [11, 12]Our study reported that 75%of subjects have localized back pain and 25% subjects have radiating pain to legs by using digrmmating view of body also supported by Antje Spijker-Huiges,Feikje Groenhof et.al study.[20]

The housewives who participated in our study were mainly at the age 40-50 years. They actively participated in household activities which are common in daily chores and could be listed as maintaining their home, sweeping floor, washing clothes, lifting loads, taking care of livelihood .These all activities require repeated bending, twisting movements, lifting and pulling movements of the spine. [13] Koley et al. (2008) reported that manual handling and improper style of lifting objects harm the spine due to abnormal stress and strain imposed on spine during activities [14].

The Parity (no. of children) having subjects has no correlation with low back pain with a value of 0.03.But we must have this result because of small population, but some studies like Alan. JSilman, Susan Ferry ANN etal did a study to estimate the influence of the number of live born children on the risk of Low back pain. ([16]The present study findings found that the most of the women (74.19%) with low back pain experienced moderate disability (83/161) 51%, followed by severe disability (24/161) 14% and minimal disability (51/161) 31.67%. And crippled (3/161) 1.86%.It has a negative correlation with a value of (-0.11) that means very little effect on Disability. These findings are consistent with the study conducted by Koley S and Sandhu NS (2009)[15]

The intensity of pain i.e. moderate or severe has affected the physical domain most having a negative correlation with a value of -0.22 as compared to environment (-0.12), psychological (-0.08), social relation (-0.09) which was supported by ThiasStefane Amanda Munaridos Santos et.al. 2013 reported physical quality of life is most impaired. [21]Out of lifestyle factors obesity can be a factor associated with LBP. In

this study we found that (6/161) 3.7% of subjects are underweight, (69/161) 42.85% of subjects are normal, (85/161) 52.79% of subjects are overweight. As BMI increases or if a person is overweight the level of pain also increases showing a positive correlation with a value of 0.14.Lowisachom Sharmayne R.E Brady et.al. 2016 supported this by saying LBP was associated with higher body mass index. [9]Regarding utilization of health services for LBP, it has been observed that a large number of subjects with LBP took no consultation, followed by any kind of rehabilitation treatment. Majority of subjects preferred traditional methods or took allopathic medications or took no care. Better health care measures to enhance housewives education about good posture, ergonomic measures, health awareness and activity pacing could help the housewives. We gave health booklet to each subjects and make them understand some basic exercises such as bridging ,back isometrics and straight leg rising and it also contain the basic ergonomics regarding LBP. It is in English language and each sentences and exercises/techniques was explained in Hindi by the researcher.

CONCLUSION

It is concluded that most of the housewives suffer from Low Back Pain. The physical quality of life is negatively correlated and BMI is positively correlated with intensity of pain.

Ethical Clearance- Nil

Source of Funding- Nil

Conflict of Interest - Nil

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A Comparison of the Immediate and Lasting Effects between Passive Stretch and Muscle Energy Technique on Hamstring Muscle Extensibility

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ABSTRACT

Background: A surprising number of problems arise from inadequate hamstrings extensibility and, gives the frequency of knee injuries among athletes, non-athletic individuals and dancers; so treatment should be focused to reduce tightness. One of the most important aspects of performance enhancement other than skill is to maintain flexibility so there by injury can be prevented. In order to assist the athlete in training for flexibility event and for general population to relieve the symptoms due to inadequate muscle extensibility, stretching techniques are commonly used and the concept of muscle energy technique (MET) evolved out of osteopathic procedures developed by pioneer practitioners such as T. J. Ruddy, Fred Mitchell and Philip Greenman should be incorporated. This article presents a more effective way to free the hamstrings and improve the performance.

Aims & Objectives: To study the immediate and lasting effects of MET and passive stretching on hamstring muscle extensibility and to compare the immediate and lasting effects of MET and passive stretching on hamstring muscle extensibility.

Materials and Method: Study included 40 college students with age group between 18-25 years. Subjects were randomly divided in to 2 groups after getting written consent. Single session of intervention was given to right lower extremity in the afternoon. The active knee extension (AKE) and back saver sit and reach test (BSSR) were used as a criterion measurement for hamstring muscle extensibility. Before intervention measurements were taken then Group A (n-20) was given MET, Group B (n-20) was given passive stretching. Both MET and passive stretching were matched for repetitions, duration and rest interval. Immediate and lasting effects of interventions in both groups were measured again by above mentioned tests immediately and one hour after an intervention.

Result: 'Students t Test' (paired t-test) was applied for within group comparison, both groups individually showed highly significant improvement in range of AKE and distance of BSSR test at immediate and after one hour of intervention. Student's t test (unpaired t test) was applied for between group showed no significant difference in improvement of AKE and distance from middle finger of hands to great toe at 5% level of significance, although improvement was more in Group A as compared to Group B.

Conclusion: MET is superior to passive stretching in terms of hamstring extensibility. Hamstring extensibility is obviously valuable for athletes and also for general population to avoid deleterious effects of hamstring tightness. Therefore those involved in flexibility training can confidently include MET as adjuvant to their normal training protocol than using passive muscle stretching.

Keywords: *Passive stretch, Muscle energy technique, Hamstring muscle extensibility.*

INTRODUCTION

Hamstring muscle injuries are one of the most common musculotendinous injuries in the lower extremity[1]. They occur primarily during high speed or high intensity exercises and have a high rate of recurrence due to hamstring tightness[2]. Most medical professionals, coaches and athletes consider aerobic

conditioning, strength training and flexibility, the integral components in any conditioning program[3]. Lack of hamstring extensibility was the single most important characteristics of hamstring injuries in athletes[1]. Decreased hamstring extensibility is a risk factor for hamstring strain injury[4], and symptoms of muscle damage following eccentric exercise. Passive stretching and isometric contract-relax stretching (muscle energy technique "MET") are commonly used in manual therapy professions, such as osteopathy and physiotherapy, to improve joint and muscle extensibility. Passive stretching consists of a passive elongation of the desired muscle group, commonly with duration of 10 to 30 seconds[5]. MET is an osteopathic treatment procedure that involves the voluntary contraction of the muscle in a precisely controlled direction, at varying levels of intensity, against a distinctly executed counterforce applied by the operator [6]. Greenman stated that MET can be used to lengthen a shortened, contracted, or spastic muscle; to strengthen a physiologically weakened muscle or group of muscles; and to mobilize an articulation with restricted mobility[6]. MET and passive stretching has been demonstrated to improve extensibility and joint range of motion (ROM), particularly when measured by active knee extension (AKE) test and back saver sit and reach (BSSR) test, although the mechanism and duration of effect remains controversial. Several studies have shown varying results as to the most effective technique [7]. It is therefore important to examine whether passive stretching or MET produce either a greater or longer lasting effect on physiological range of motion. So the objective of this study is to investigate whether the single session of MET is more effective, and has a longer lasting effect, than a single session of passive stretching on the extensibility of the hamstring muscles measured.

MATERIALS AND METHOD

Study included 40 college students volunteer to participate for the intervention. Subjects were randomly divided in to two groups after getting written consents giving due consideration to inclusion and exclusion criteria. Inclusion criteria for this study is normal male and female individuals with BMI range between 18.5 to 24.9 kg/m^2 having age between 18 to 25 years having right side tight hamstring (Inability to achieve last than 20 degree of knee extension actively with hip at 90° of flexion). Exclusion criteria include acute or chronic low back pain, acute or chronic hamstring injury, any hip or knee pathology and sciatica. Materials used in study were consent form, plinth, measure tape, cross bar, straps, wrist watch, weighing machine, height scale, universal goniometer, stool and marker pen. Single session of intervention was given to right lower extremity to subjects of both the groups in the afternoon. The active knee extension and back saver sit and reach test were used as an outcome measure for hamstring muscle extensibility taken before and after intervention in both groups.

Fig 1: Measurement of AKE

Fig 2: Measurement of BSSR

In group A (MET) the subject's knee was extended with 90º hip flexion actively by himself or herself to the position where the subject first reported of any hamstring discomfort and moderate isometric contraction (approx 30% of maximal) of the hamstring muscle was given at that barrier and maintained for 7-10 seconds followed by 5 seconds relaxation. The knee was then extended with flexed hip, taken to its new restriction barrier and a small degree beyond, passively by therapist, and held in this position for at least 30 seconds. This completes one repetition. Total five repetitions were given with 20 seconds rest between each repetition. During subsequent repetitions, each isometric contraction commencing from a position short of the barrier and isometric contraction

holding time was increased from 7-10 seconds up to 20 seconds. In group B subjects were lying supine and asked to relax the leg while the therapist extended the knee with hip flexed to the point of first onset of pain. The stretch was held for 30 seconds where the force of stretch was increased as subject tolerance changed or the muscle was felt to "give" during the stretch. The technique was repeated five times. 20 seconds rest was given between repetitions.

Fig 3: MET/Passive stretching from a position short of the barrier

Subjects were asked not to participate in any exerting physical activity during 1 hour interval. After one hour AKE and BSSR test were performed and measurements were taken. The subjects were also observed for any change or any symptoms and asked to report if there is any discomfort during treatments session. All subjects completed the whole treatment programme without any discomfort. Total duration of the study was 3 months.

RESULT

Total 40 subjects, were randomly divided in to 2 groups: Group A (MET group) Group B (Passive stretching group). The table 1 shows the Gender Distribution of the 40 subjects participated in the study. There were 9 males and 11 females in Group A and 8 males and 12 females in Group B.

Table 1: Gender distribution of the patients

GENDER	GROUP A	GROUP B
MALE	9(45%)	8(40%)
FEMALE	11(55%)	12(60%)

Table 2 displays the group statistics of age distribution among 40 subjects. No significant difference was seen across the two groups.

Table 2: Age (in years) distribution of the subjects

GROUP	N	MEAN	±SD
GROUP A	20	23.15	1.53
GROUP B	20	23	1.3

All the statistical analysis was done with the help of Microsoft Excel 2007 version. Student t-test (Paired t -test) was applied for within group comparison of group A and group B. In the group A and Group B results showed significant improvement in AKE range of motion (ROM) on immediate and one hour (Lasting) after an intervention at 5% level of significance (Table 3 and Table 4).

Table 3: Means of pre exercise and immediate AKE ROM (flexion angle) of Group A and Group B

GROUP	PRE MEAN(°)±SD	IMMEDIATE MEAN(°) ±SD	t VALUE	p VALUE
GROUP A	40.1±8.9	34.7±7.9	12.8	p<0.001
GROUP B	39.9±7.9	35.7±8.3	9.9	p<0.001

Table 4: Means of pre exercise and Lasting AKE ROM (flexion angle) of Group A and Group B

GROUP	PRE MEAN(°)±SD	LASTING MEAN(°) ±SD	t VALUE	p VALUE
GROUP A	40.1±8.9	36.2±2	10.3	p<0.001
GROUP B	39.9±7.9	37.1±8.6	6.5	p<0.001

In the Group A and B results showed significant improvement in distance in BSSR test on immediate and one hour (lasting) after an intervention at 5% level of significance. (Table 5 and table 6).

Table 5: Means of pre exercise and immediate effect distance of BSSR test of Group A and Group B

GROUP	PRE MEAN(cm)±SD	IMMEDIATE MEAN(cm) ±SD	t VALUE	p VALUE
GROUP A	17.0±4.3	12.5±3.6	7.8	p<0.001
GROUP B	16.9±5.5	13.5±4.8	12.8	p<0.001

Table 6: Means of pre exercise and lasting effect distance of BSSR test of Group A and Group B

GROUP	PRE MEAN(cm)±SD	IMMEDIATE MEAN(cm) ±SD	t VALUE	p VALUE
GROUP A	17.0±4.3	13.7±3.6	6.5	p<0.001
GROUP B	16.9±5.6	14.4±4.8	11.8	p<0.001

Student's t test (unpaired t test) was applied between group comparison for Group A and Group B. On comparing immediate and lasting effect of intervention between Group A and Group B the result showed no significant difference in improvement of AKE ROM (flexion angle) and distance (from middle finger of hands to great toe of right foot) of BSSR test at 5% level of significance, although improvement was more in Group A as compared to Group B. (Table 7 and table 8).

Table 7: Means of differences of AKE ROM (flexion angle) of immediate effect and lasting effect for Group A and Group B

EFFECTS	GROUP A (MEAN±SD)	GROUP B (MEAN±SD)	t VALUE	p VALUE
Immediate	5.4±1.9	4.4±2.0	1.6	p=0.11
Lasting	3.9±1.7	2.9±2.0	1.6	p=0.11

Table 8: Means of differences of distance of BSSR test of immediate effect and lasting effect for Group A and Group B

EFFECTS	GROUP A (MEAN±SD)	GROUP B (MEAN±SD)	t VALUE	p VALUE
Immediate	4.5±2.6	3.4±1.2	1.6	p=0.10
Lasting	3.3±2.3	2.5±1.3	1.4	p=0.18

In this intervention, both Group A and B showed highly significant improvement in hamstring extensibility at immediate and one hour after an intervention based upon AKE ROM and distance of BSSR tests. While comparing Group A and Group B improvement in hamstring extensibility at immediate and after one hour is more in Group A as compared to Group B though difference was not significant.

DISCUSSION

MET and passive stretching has been demonstrated to improve hamstring muscle extensibility and thereby increase joint ROM, particularly when measured by AKE and BSSR, although the mechanism and duration of effect remains controversial. The result of this study has shown that MET appeared to be more effective than

passive stretching for increasing hamstring extensibility immediately post-treatment and still at one hour later which can be explained by no. of possible mechanism. In stretching there will be increase in passive tension of the muscle which creates resistance against subsequent stretching and also due to stretching pain, patient will have decreased tolerance to stretch[8]. The application of MET would appear to decrease an individual's perception of muscle pain, and is greater than that which occurs with passive stretching[9]. Stretching and isometric contraction in MET stimulate muscle and joint mechanoreceptors and proprioceptors, and it is possible that this may attenuate the sensation of pain and thereby increase tolerance to stretch[9]. In MET the neurological effects of the loading of the golgi tendon organs of a skeletal muscle by means of an isometric contraction, produces a postisometric relaxation effect in that muscle[10]. Moreover, post isometric relaxation-biomechanical event: combination of viscoelastic creep and plastic changes in the parallel and series connective tissue elements of muscle occur above and beyond that obtained by passive stretching[11]. In addition, voluntary contraction during a stretch increases tension on the muscle, activating the golgi tendon organs more than the stretch alone[12]. When the muscle performing the isometric contraction is relaxed, it retains its ability to stretch beyond its initial maximum length[12], MET tries to take immediate advantage of this increased range of motion by immediately subjecting the contracted muscle to a passive stretch and helps to train the stretch receptors of the muscle spindle to immediately accommodate this greater muscle length[12]. Ballantyne F et al 2003 concluded that Muscle Energy Technique produced an immediate increase in passive knee extension[7]. This observed change in range of motion is possibly due to an increased tolerance to stretch as there was no evidence of viscoelastic change.

CONCLUSION

It can be concluded from present study that following a single application, MET and passive stretching groups individually showed highly significant improvement in hamstring extensibility immediately and still one hour after an intervention based upon AKE and BSSR tests. While comparing both groups, improvement in hamstring extensibility immediately and one hour after an intervention is more in MET group as compared to passive stretching group although difference was not significant. So MET is superior to passive stretching in terms of hamstring extensibility and perception of stretching pain seems to be less in MET than passive stretching hence more comfortable. Those involved in flexibility programme like before going for any sports to get immediate and sustained effect at least up to 1 hour and in clinical situation to choose more effective and more comfortable intervention even by only single session, MET can be used as an adjuvant to their normal training protocol rather than using passive stretching.

Conflict of Interest: None Declared.

Source of Funding: Nil.

Ethical Clearance: Informed written consents were taken from all volunteer participants of the study.

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Influence of Early Physiotherapy Intervention on Pain, Joint Range of Motion and Quality of Life in Unilateral Hip Joint Replacement Surgery

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ABSTRACT

Background: Joint replacement surgery is procedure that has increasingly been performed intending to improve quality of life for the population living with orthopaedics condition. In the joints of the lower limb, the knee joint is mostly replaced and next is the hip joint. Recently the hip joint replacement is commonly replacing with internal prosthesis in elderly individuals, to prevent the complication. Now a day's THR Is the most common surgery in the general population. According to previous rehabilitation program of THR, ambulation starts 6th or 7th day of surgery, which could not able to prevent the post-operative complications such as pulmonary embolism, urinary retention, blood clotting, DVT after THR. For reducing the post-operative complications and to improve the functional activity and QOL, we will ambulate the patients on 3rd post-operative day

Methodology: 32 subjects with the unilateral THR were taking for the study and divided into two groups. Group 1 were ambulating within the 3rd day of the surgery and Group 2 were ambulating on 7th day of surgery. Pain was measured with VAS, ROM is measured from goniometer and QOL is measured with the WOMAC score.

Results: Results of the early ambulation on 3rd day is showing the significant improvement ($p<0.05$) of post-operative pain and QOL of the unilateral THR subjects.

Conclusion: On the basis of above study we concluded that early ambulation within 3rd day of surgery will make difference in QOL and functional stability following unilateral THR subjects.

Keywords: *Total hip replacement, avascular necrosis, Quality of life.*

INTRODUCTION

The hip joint is a ball and socket verity of synovial joint; it is composed of two large bones, the innominate bone of the pelvis and the femur.

Hip motion is essential to many daily activities, including rising from a chair or toilet, picking up something from the floor, walking, and climbing stairs. Normal walking utilizes approximately 20"–30" of flexion, reaching a maximum at about initial contact. Stair climbing utilizes more, approximately 45"–65" and slightly less for stair descent. Rising from a chair typically requires more than 100" of hip flexion, usually more amount of flexion used when bending to tie a shoe or squatting to pick up something from the floor.[4]

The articular cartilage of the femoral head and of the acetabulum is among the thickest in the body. Reported thicknesses range from 0.7 to 3.6 mm, with the greatest thicknesses usually found in the anterosuperior aspect of the acetabulum.[4] The acetabular and femoral articular cartilage surfaces exhibit small incongruities in shape, thickness, and stiffness, which may facilitate cartilage lubrication and chondrogenesis. They may also contribute to degenerative changes of the articular

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cartilage.[4]

As a synovial joint, the hip is supported by a synovial capsule that is attached to the bony rim of the acetabulum proximally and to the intertrochanteric crest and line of the femur distally. The capsule of the hip joint is composed primarily of fibres running parallel to its length, the longitudinal fibres. It also possesses a band of fibres oriented circumferentially around the canter of the femoral neck. This bundle is known as the zona orbicularis, or femoral arcuate ligament. The capsule encloses most of the femoral neck and the entire femoral head. The blood supply to synovial joints is generally provided by a network of blood vessels, or anastomoses, at the attachment of the capsule and bone. The primary blood supply to the femoral head and neck arises from the medial and lateral circumflex femoral arteries at the base of the femoral neck that then travel proximally within synovial folds of the capsule reflected onto the femoral neck.

Disruption of the hip joint capsule at the base of the femoral neck or injury to the neck itself may disrupt the blood supply of the femoral head and endanger the integrity of the head itself. A serious potential sequel of a femoral neck fracture is avascular necrosis of the femoral head, which can result when the femoral head is separated from its blood supply in the femoral neck. When the displacement of the femoral neck is severe or when the time between injury and intervention is several hours or more, the risk of avascular necrosis increases. In such cases, the orthopaedic surgeon may choose to perform a partial or total joint replacement (arthroplasty) rather than try to repair the fracture with pins or screws Arthroplasty is particularly advantageous when the fracture cannot be reduced readily or when it occurs in afrail patient. In contrast, intertrochanteric and subtrochanteric fractures present considerably less risk to the vascular supply because the capsule and femoral neck and, consequently, the blood supply to the femoral head are usually spared. Therefore, these fractures are more amenable to treatment by internal fixation.[12]

There are different approaches for the total hip replacement surgery that is anterior approach, lateral approach, posterior approach, anterolateral approach, posterolateral approach and medial approach. Conventional THR surgery already provides excellent pain relief, functional improvement that minimally invasive. Total hip replacement will result in reduce soft tissue trauma, reduce post-operative blood loss, decrease pain, shorter hospital stay, speeder recovery and improved cosmetic approach.

The most frequent complication after THR is thromboembolic disease including deep vein thrombosis and pulmonary embolism. Early in the history of THR the rate of total pulmonary embolism was 15% to 22 %. However at that time patient were kept at bed rest for as long as 2 to 3 weeks and kept as long as 6 weeks in the hospital. Early mobilization of the patient has undoubtedly contributed to the significant reduction in the rate of fatal pulmonary embolism.

Total hip replacement is the common operation today. Approximately 250000 replacements are performed each year in India. The primary goal of hip replacement surgery is to relive pain which can be accomplished in more than 95% of patients. The result of THR can last approximately 15 year or more. In fact one study found that more than 90% of THR survived a minimum of 30 year. In THR both the socket & the ball are replaced with metal & plastic part cup cemented onto the bone or by a mental shell impacted into the prepared acetabular space with a removable liner. The ball is replaced by a metal ball attached to stem that goes inside the shaft of the femur.[3]

In this present study physiotherapy management goal of the THR patient is 1) To decrease pain, 2) To restore hip and knee ROM, 3) To regain strength of hip muscular. Physiotherapy management did with three stages: Stage I include day 1 to 3, Stage II includes day 4 to 9, Stage III include day 10 to 15. After the 15 days protocol, patient discharged from the hospital & home program taught patients.

Patient can start ambulation within the 3rd day of the surgery, which is beneficial for preventing the complicated after the surgery & also beneficial for the less hospital stay & good quality of life.

The main objectives of this study are to evaluate the effectiveness of early physiotherapy intervention on pain (VAS) in unilateral THR subjects, to evaluate the

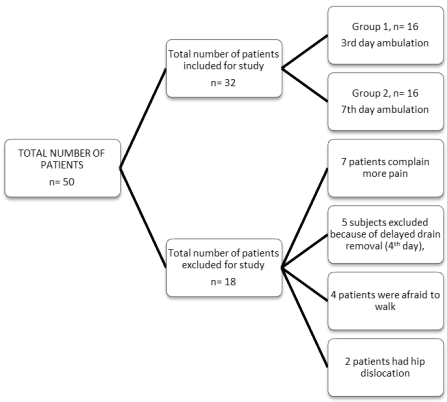
Effectiveness of early physiotherapy intervention on active ROM of hip in unilateral THR subjects, to evaluate the effectiveness of early physiotherapy intervention on functional activity in unilateral THR subjects, to evaluate the effectiveness of early physiotherapy intervention on

QOL in unilateral THR subjects.

MATERIALS AND MATHOD

In our study we used inch tape to measure the leg length and 180" goniometer to measure the range of motion of hip. This is the experimental study to determine the quality of life. Simple random sampling is use for preventing the bias in selecting which subjects underwent for THR surgery. Subjects provided signed informed consent and either approval was received from BIRRD (Balaji institute of surgery, research and rehabilitation for disabled). Total 50 subjects were selected for the study, 7 subjects complained more pain, 5 subjects excluded because of delayed drain removal (4th day), 4 subjects were afraid to walk and 2 subjects had hip dislocation, so total 32 patients have been taken for rehabilitation, which was divided into two groups (n= 16). Subjects were age between 40-65 years of age; both males and females were included for the study. 32 subjects have been taken for this experimental study. Subjects who were 1st diagnosed AVN; after the fracture, any metabolic disorder, inflammatory arthritis and Osteonecrosis were included. Post traumatic arthritis, Infection of hip, Significant neuromuscular disease, Malignancy, Revision total hip replacement surgery and History of contralateral THR were excluded.

Algorithm showed consent study population:



Intervention: All subjects assessed pre-operatively and post-operatively in the hospital. They received post-operative rehabilitation program and discharged with home exercises program following 8 to 15 days of hospital stay. All the subjects were divided into 2 groups. Group 1 ambulated on 3rd day of surgery and Group 2 ambulated on 7th day of surgery. This rehabilitation program involves ROM exercise & isometric strengthening exercises for the hip musculature as well as encouraging walking with appropriate gait aids. Patient attended preoperative sessions and postoperative 6 days/week for 12 days then encouraged to perform home exercise daily. Patient instructed 1) at the day of surgery to avoid hip flexion 90º, avoid internal rotation of lower extremity, avoid crossing the leg, avoid sitting on low chair, perform only bed mobility. 2) On day 1st to 3rd all hip and knee muscles isometrics, ankle pump, abduction & adduction isometrics, Thomas stretch lonely for 1-2 day. 3) From 3 to 7 days all isometrics & ambulation with walker supports stationary bicycling exercises with a high seats. 4) From 2-6 week's action hip flexion. 5) From 6-12 weeks home exercises program started. Subjects were evaluated preoperatively and post-operatively. We assessed pain with VAS score, range of motion with goniometer and QOL with WOMEC score.

STATISTICAL ANALYSIS AND RESULTS

Statistical analysis was done by the use of IBN SPSS statistics 22.0 software. Analysis was done by paired sample t test to find out the analysis of pain and QOL post-operatively. All the 32 subjects were received 6 weeks rehabilitation program. Pain and QOL were analysed.

TABLE 1: Comparison of pain in Group 1 and Group 2 on 3rd pop day and 7th pop day

Pain	N	Mean	SD	Std. Error	df	**t value**	**p value**
3rd day (Group 1)	16	5.188	.6551	.1638	15	18.013	.000
3rd day (Group 2)	16	8.250	.6831	.1708			
7th day (Group 1)	16	2.313	.8732	.2183	15	6.343	.000
7th day (Group 2)	16	3.938	.7719	.1930			

For group 1 shows there is significant reduction in pain on 3rd and 7th pop day that is 5.188 ± 0.65 and 2.313 ± 0.87. For group 2 shows there is significant reduction in pain on 3rd and 7th pop day that is 8.250 ± 0.68 and 3.938 ± 0.77. On 3rd day group 2 shows more pain than group 1 that is 8.250 ± 0.68 and on 7th day group 2 shows more pain than group 1 that is 3.938 ± 0.77.

TABLE 2: Comparison of QOL of Group 1 and Group 2

QOL	N	Mean	SD	Std. Error	df	t value	p value
Group 1	16	32.875	0.8062	0.2016	15	35.825	.000
Group 2	16	41.813	0.9106	0.2276			

Analysis shows significant improvement of QOL (Quality of life) in group 1 than group 2 that is 32.875 ± 0.80 and 41.813 ± 0.91.

Hence we found that, we ambulated patient within 3rd day, so functional activity of the patient improved which improved the QOL of unilateral THR subjects.

DISCUSSION

The prescribed exercise program was effective for the THR patients in this study. All outcome measures improved with the majority showing significant improvement by the end. According to Jackson E et al (2004) an 8-week, hip-exercise intervention, during which the control group received basic isometric and active range of motion exercises; the experimental group received strength and postural stability exercises. An exercise program emphasizing weight bearing and postural stability significantly improved muscle strength, postural stability, and self-perceived function in patients 4 to 12 months after THA. Helen J. Gilbey et al (2001) said that randomized study was to apply an 8-week customized exercise program to patients (Group E) scheduled for total hip arthroplasty, followed by a post-surgery exercise program, and show the effect on functional recovery compared with control subjects (Group C) who received no additional exercise apart from routine in-hospital physical therapy. Strength, range of motion, and physical function tests were completed by 57 patients at Week 8 and Week 1 before surgery and at Weeks 3, 12, and 24 postoperatively. No differences between the exercise and control groups were observed at baseline.

Present study is carried out using unilateral THR subjects. Total number of subjects is 32; age group is 40 years to 65 years which divided into 2 groups. Group 1 ambulated within 3rd day and Group 2 ambulated on 7th day of surgery. It showed that there is significant difference between group 1 and group 2 on 3rd and 7th pop day in pain and quality of life of the patient who underwent unilateral THR surgery. In this study preoperative assessments (pain, limb length and QOL) of the patients have been done and post operatively assessment (pain, limb length, ROM and QOL) and rehabilitation program have been started 1st post-oerative day of surgery. Exercises helped to reduce pain by increasing the local blood circulation, which help to remove the west products and reducing pain, which measured by VAS scale. In present study prescribed isometric exercises of quadriceps, hamstrings, abductors and adductors helped to reduce pain and increase ROM of hip joint. Active assisted ROM exercises for hip and knee performed in both supine and sitting position. Gait training program started for group 1 within 3rd day of surgery and for group 2 on 7th day of surgery. When we ambulated patents on 3rd day of surgery then it improved the functional activity and quality of life of patients and it reduced hospital stay. Statistical analysis showed there is significant improvement in QOL of group 1. All the exercise programs have been started within the day of surgery and have been progressed till the discharged day. 6 weeks protocol has been followed for all patients. At the time of follow-up all patients have been advised for home based exercise program.

CONCLUSION

On the basis of above study we concluded that early ambulation following surgery will make difference in QOL and functional stability following unilateral THR subjects. Therefore for the improvement of functional activity and QOL, early ambulation within 3rd post-operative day would be the choice of treatment, which reduced the hospital stay.

LIMITATION:

- Study is heterogeneous.
- Small sample size.
- Study duration was short.

Conflict of Interest – Nil

Source of Funding- Self

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Gender Difference in Physical Performance Tests with in the Individual with Normal Body Mass Index

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ABSTRACT

Background: Health-related physical fitness (HRPF) is considered to be an indirect marker of a person's health and wellbeing reflecting the interplay and integration of many persons' systems and body functions (musculoskeletal, cardio respiratory, hemato-circulatory, psycho neurological and body composition).Und erstanding the relationship between BMI and HRPF, measured by valid and reliable tests, will provide key information to aid the design of strategies to reduce the prevalence of cardio metabolic risk factors among children and adolescents.

Purpose: The purpose of the study is to compare the gender difference in physical performance tests within the individuals with normal body mass index.

Method: The data needed for study is collected from Acharya college students and the research approach adopted is one time study. The research approach includes collection of data from 80 students on the basis of inclusion and exclusion criteria.

Results: Results show a significant difference in the physical performance test performed by male and female students. Male students performed better than female students on the basis of time with normal BMI.

Conclusion: The present study shows that males took less time to perform the physical fitness test when compared to female irrespective of normal BMI.

Keywords: *Health related physical fitness (HRPF), Body composition, physical fitness, physical performance, BMI.*

INTRODUCTION

Body Mass Index (BMI) is a simple index of weight-for-height that is commonly used to classify underweight, overweight and obesity in adults. It is defined as the weight in kilograms divided by the square of the height in meters (kg/m^2)[1]

Physical activity is defined as any bodily movement produced by skeletal muscles that result in energy expenditure. Physical activity in daily life can be categorized into occupational, sports, conditioning, household, or other activities. Physical fitness is a set of attributes that are either health- or skill-related. The degree to which people have these attributes can be measured with specific test.[2]

Understanding the trends of overweight or obesity and underweight in adolescents is important, because it is associated with adverse effects on health and social repercussion in both adolescence and adulthood. It is suggested that adolescence is a crucial period of life, since dramatic physiological and psychological changes take place at these ages as it may constitute the last possible growth spurt [3]. During this stage of life the development of physiological health risk factors depends largely on the initiation of health-compromising

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behavior such as poor eating and inactivity [4]. Studies during adolescence would add support to the primary assumptions given for early interventions to prevent risk factors of non-communicable diseases before behavioral patterns are fully established and resistant to change [5]. The consequences of the adverse health effects of underweight and obesity are likely to be the development of hypo kinetic diseases such as hypertension, cancer and Type II diabetes as well as reduced health-related physical fitness [6].

Excessive fatness (determined by body mass index (BMI) - a useful surrogate of percentage body fat) is found to be negatively associated with performance tasks in which the body is projected through space, as in standing broad jump, and on tasks in which the body must be lifted in space, as in bent arm hang [7]. Consequently, hypokinetic diseases as well as poor physical fitness have the potential to place considerable future burden on spiraling health costs and services [8]. As such, early identification of adolescents at risk is essential for prevention of adulthood obesity [9].

Several health conditions and disorders have been attributed to being overweight in children and adolescents. For instance, overweight children and adolescents are more likely to suffer from cardiovascular, metabolic, pulmonary, skeletal or psychosocial disorders. Even if these conditions or disorders are not manifested during childhood, being overweight in childhood increases the risk of illness in adulthood. Hence, it is critical to identify risk factors for overweight in children and adolescents and to address overweight during childhood and adolescence.[10]

According to Bouchard et al. [11], both the family environment and genetic predisposition influence the development of body fat content and distribution. Other important factors include lifestyle factors such as physical activity (PA), nonsmoking, high-quality diet, sedentary activities and normal weight. Lifestyle factors are also important in the description of the obesogenic environment that is based on the four pillars family, sport and leisure time, eating behavior and social education [12].

A flight of stair climbing also called a stairway, stair case, stairwell or just stair-does the simple job of dividing large vertical gaps into smaller vertical gaps called steps. Maximum cardio pulmonary exercise test are increasingly used to assess the aerobic capacity of an individual like the stair climbing test.[13]

Hexagon agility test is a test of the ability to move quickly while maintaining balance. This test is suitable for active athletes but not for individuals where the test would be contraindicated. Reliability will depend upon how strict the test is conducted and the individual's level of motivation to perform the test.[14]

50 feet Walk Test is widely used and well-defined measuring method to measure physical function in many diseases. They are recommended for use prospectively as outcome measures in research, and also in clinical practice to make treatment decisions based on the results and to monitor physical function of individual patients over time. [15]

METHODOLOGY

Population : 80 students aged between 18 – 25 years

Sample size : 80 students (40 boys and 40 girls)

Sampling method : convenient sampling

Research design: one time study

Study duration : one month

Study Setting : From Acharya Institute of Health Sciences

Tools used in this stud : Chalk piece
Inch tape, Stairs
Stationary (pen, paper, eraser etc.).
Stop watch/ Timer.
Weighing machine
Stature meter

Inclusion criteria : Age group between and 18-25 years.
Regardless of normal BMI
Gender-both (boys and girls)
Those who are willing to do

Exclusion criteria: Athletes.
Any fracture cases.
Cardiopulmonary disease
Those who are not willing to do
Obese persons

Outcome measures: Body mass index

Procedure

80 subjects were selected on the basis of inclusion

and exclusion criteria from Acharya College of physiotherapy.

The study population consisted of age group 18 to 25 years. Among the 80 subjects 40 were male students and 40 were female students.

Height (meter) and weight (kilogram) of each individual student was noted to calculate the BMI (18-25kg/ m^2) .The individuals with normal BMI (40 males and 40 females) were selected for the study depending upon inclusion and exclusion criteria and were explained about the procedure of the study. After explaining the subject about the physical performance test , written consent was taken from subject .Subjects were divided into 4 groups viz. Group A, Group B, Group C and Group D. Each group consists of 20 students (10 males and 10 females). In the first week, data was collected from Group A, respectively second, third and fourth week data was collected from Group B, Group C and Group D. Subjects were demonstrated the physical performance test to be performed and time taken to perform each test was noted in seconds.

PHYSICAL TESTS

1. 50 FEET walk test

- A distance of 50 feet has to be marked on a straight and plane ground.
- Ask the subject to walk as fast as he/she can but do not run.
- Time is noted by using a stop watch.

2. One flight stair climbing test

- One flight of stairs (10 steps) was selected inside the college campus.
- Subjects were instructed to climb up the stairs and come down without any stop in between.
- Clear instruction to the subject were given regarding not to touch the hand rails or take any support.
- Time is noted using a stop watch.
- Stair measurement – 1. Treed: 26 cm

  2. Raiser: 14.5 cm

3. Hexagon test

- A hexagon is made on the plane surface with a length of 2 feet each side.
- The subject was instructed to stand inside the hexagon.
- Jump out and in till all the six side of the hexagon are covered in a clockwise fashion.
- Time is noted using a stop watch

RESULTS

The study included 80 subjects with both the sexes (male and female) to compare the physical fitness in young adults within normal BMI.

No adverse effects were observed .All the participants completed the physical tests and showed significant difference.

DATA ANALYSIS

SPSS V. 16.0 Software

Excel has been used to generate bar diagram and tables

Paired t- table

TABLE 1: Analysis of 50 feet walk test

Pair 1	Mean	N	Std. Deviation	Std. Error Mean
Male	7.3725	40	.75277	.11902
Female	7.8550	40	1.01121	.15989

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Male Female	-.48250	1.17034	.18505	-.85679	-.10821	-2.607	39	.013

T- Test value is -2.607 and p value is 0.013 which is less than 0.05.

The p is less than 0.05 which is statistically significant and indicates better physical performance among males when compared to females.

Table 2: Analysis of one flight stair climbing test

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	male	7.2200	40	.68433	.10820
	female	8.1550	40	1.29812	.20525

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Male Female	-1.03000	1.25498	.19843	-1.43136	-.62864	-5.191	39	.000

T- Test value is -5.191 and p value is 0.00 which is less than 0.05.

The p is less than 0.05 which is statistically significant and indicates better physical performance among males when compared to females

TABLE 3: Analysis of hexagon test

Paired Samples Statistics					
		Mean	**N**	**Std. Deviation**	**Std. Error Mean**
Pair 1	Male Female	6.7150	40	.76109	.12034
		7.7450	40	1.25493	.19842

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	male female	-1.03000	1.25498	.19843	-1.43136	-.62864	-5.191	39	.000

T- Test value is -5.191 and p value is 0.00 which is less than 0.05.

The p is less than 0.05 which is statistically significant and indicates better physical performance among males when compared to females.

50 feet walk test:

One flight stair climbing test

Hexagon test

DISCUSSION

The purpose of the study is to compare the gender difference in physical performance tests within the individuals with normal body mass index.

80 students were randomly selected among which 40 are male and 40 are female. Each individual performed three physical tests and time was noted down in seconds along with their height and weight in order to calculate the BMI.

F. Gashi , R. Ahmetxhekaj , E.Gara, B. Hoxie, Z. Durguti, I.Shalaj studied the gender difference of physical performance test and its relation to body composition in adolescents and observed that physical performance was higher in boys than in girls.[16] In my study also physical performance test is performed better by boys when compared to girls.

Beekhuizen KS, David MD, Colbar MJ, Cheng MS studied test re-test reliability and minimal detectable change of the hexagon agility test concluded that the evidence of reliability and ease of administration makes the hexagon test a practical and effective method to measure agility[17]. In my study also I used hexagon test as one of the physical performance test as in this test within the normal BMI male students were doing better than the females students and it is highly reliable .

BayramUnver, SerpilKalkan, ErtugrulYuksel, TurhanKahraman and VasfiKaratosun studied Reliability of the 50-foot walk test and 30-sec chair stand test in total knee arthroplasty. According to results of this study; both 50 FWT and 30 CST have excellent reliability in patients with TKA[18]. In my study also I used 50 feet walk test as one of the physical performance test where male students were taking less time compare to female students within the normal BMI as it is highly reliable and easy to administer.

Alesssandro Brunelli, MD, Marco Monteverde, Majed AL Refai studied Stair climbing test in prediction of postoperative complications after lung surgery. It was noticed that duration of postoperative period has an inverse proportion to a number of the climbed up footsteps and informative enough for prediction of postoperative cardiopulmonary complications after lung surgery[19]. In my study I also used stair climbing test as one of the physical performance test as I have taken 10 steps as one flight of stairs and male students have performed better than the female students within the normal BMI. It is highly reliable method and easy to administer.

The study is showing significant difference in the time taken by males and females to perform the physical fitness test. Females are taking more time to perform the physical test when compared to males irrespective of normal BMI.

CONCLUSION

The present study shows that males took less time to perform the physical fitness test when compared to female irrespective of normal BMI.

Limitations

- Sample size taken was small.
- Practice before the final test was not done.
- Within the age of 18 to25 many are obese.
- Many students are sport players.

Recommendation

- Further study can be done on larger samples.
- Similar studies can be carried out with different age group.
- A similar study can be done among the individuals suffering from pulmonary complications.

• Further study must establish the relationship between the individuals with normal and abnormal BMI on the basis of physical fitness test.

Conflict of Interest: Nil

Source of Funding: Self

Ethical Clearance: Taken from college ethical committee

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Effect of Asymptomatic Arm Neural Mobilization in Patients with Cervicobrachial Pain Syndrome

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ABSTRACT

Cervicobrachial pain syndrome (CBPS) can be characterized by enhanced mechanosensitivity of the neural tissues that can be tested and treated using asymptomatic arm in patients with irritable symptom. The study aimed at examining the effect of asymptomatic arm neural mobilization on elbow extension, pain intensity and disability in patients with unilateral CBPS. Ten patients with mean age of 30.40±10.07 met the eligibility criteria. NPRS and DASH questionnaire were administered at baseline. ULNT1 was performed on symptomatic arm and elbow extension to the point of first pain was noted (P1). Holding symptomatic arm position, ULNT1 was performed on asymptomatic arm and change in symptomatic arm elbow extension was measured ($P1^{c}$). Six sessions of neural mobilization were administered on asymptomatic arm for six consecutive days and change in symptomatic arm elbow extension was measured everyday ($P1^{m}$). NPRS and DASH questionnaire re-administered at the end of sixth session. All the patients showed a significant improvement in elbow extension (P1- $P1^{c}$ $p<0.001$ and P1- $P1^{m}$ $p<0.001$) and a significant decrease in pain (NPRS $p=0.005$) and disability (DASH $p=0.012$). The findings of the study can be used to form the basis of future studies.

Keywords: *Cervicobrachial pain syndrome, ULNT, Mechanosensitivity, Neural Mobilization*

INTRODUCTION

Cervicobrachial pain syndrome (CBPS) is a significant problem affecting many individuals[1]. CBPS is described as upper quarter pain, though unaccompanied by neurological deficit, enhanced mechanosensitivity of the upper limb peripheral nerves may have a role in its pathology[2]. Upper limb neurodynamic tests (ULNT) are used to identify the involvement of neural tissue in CBPS[3,4]. While performing these tests, various sensitizing maneuvers near to or remote from the affected area can be employed to alter the tension in the nerves[4,5,6,7]. A multitude of manual physical therapy treatment techniques have been studied in patients with CBPS ranging from neural tissue mobilization[1,9,10,11,12,13]. A specific form of treatment technique has been proposed by Elvey and Hall for patients with CBPS which focuses on passive mobilization of the neural tissues and surrounding structures using gentle controlled oscillatory movements[2].

According to the basic principles of mobilization, one of the criteria on which the choice of treatment technique depends is symptom irritability[14]. Irritability can be commented on by vigor of activity, severity of symptoms and the time taken for the symptoms to return to the baseline[14,15]. Symptoms in irritable conditions are usually pain dominant and are of severe continuous quality; hence assessment and treatment of the affected area should be carried out with caution[16]. Since remote components can alter tension in the nerves[4,5,6,7], in irritable disorder the concept of remote area movement is advisable to confirm the involvement of neural

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tissue[14]. In unilateral CBPS with irritable symptoms, the choice of treatment technique can be as remote as the asymptomatic or contralateral limb or towards the lower quarter and legs.

Rubenach studied the alteration in ULNT1 response when ULNT1 was performed on contralateral arm and found reduction in the test response. He explained that this reduction of test response could be due the movement of spinal cord back towards the center of the canal thereby releasing the stress on the spinal nerve[17]. Shacklock proposed a different concept which says that the reduction of ULNT1 response in the held arm can be due to downward descent of the spinal cord in the spinal canal[6]. Despite the widespread use of movement based approaches for the treatment of neural mechanosensitivity in CBPS, literature lacks the use of asymptomatic arm neural mobilization for CBPS with irritable symptoms. Therefore, the purpose of this study is to examine the effect of asymptomatic arm neural mobilization on elbow extension, pain intensity and disability in patients with unilateral cervicobrachial pain syndrome.

MATERIALS AND METHODOLOGY

The research design was single group pretest posttest experimental study design. Ethical approval for the study was taken from the research committee of Manipal College of Allied Health Sciences, Manipal, Karnataka, India. Consecutive patients with unilateral cervical radicular pain referred to physiotherapy department of Kasturba Hospital, Manipal, between August 2008 and March 2009 were screened for inclusion and exclusion criteria. Inclusion criteria were: unilateral CBPS patients of both genders with elbow extension restricted to minimum of 50º in ULNT1 position. Exclusion criteria were cervical radiculopathy, history of cervical myelopathy, fracture of spine and upper limb, deformities of upper limb affecting range of motion of the joints and other soft tissue injuries of upper limb. A convenience sample of ten patients, three males and seven females with mean age of 37.33±9.29 and 27.43±9.43 years respectively, met the eligibility criteria and gave their consent to participate in the study. Two self-reported measures Numeric Pain Rating Scale (NPRS)[18] and Disability of Arm, Shoulder and Hand (DASH) including work DASH (DASH_W) questionnaire[19] were collected at baseline for measuring pain and disability of the subjects.

Procedure:

Three qualified physiotherapists were involved in the study: first therapist performed ULNT1 and maintained the symptomatic upper limb in the desired position, second therapist performed the asymptomatic arm neural mobilization and the third therapist measured the elbow extension range of the symptomatic limb.

Positioning of the patient (Figure1):

Each subject was positioned in supine lying with the head in neutral position. ULNT1 of the symptomatic arm was performed by first therapist in the following sequence: (1) shoulder girdle depression, maintained at 60 mm Hg using Pressure Biofeedback (Stabilizer, Pressure Biofeedback Chattanooga Group, Inc) (2) abduction of glenohumeral joint to 110º (3) forearm supination (4) wrist and finger extension (5) external rotation of glenohumeral joint (6) elbow extension to the point of first pain as reported by the patient. Amount of elbow extension attained was measured by the third therapist using universal gonimeter (stationary arm of the instrument was held along the medial border of humerus and movable arm was aligned along the medial border of ulna, medial epicondyle was marked to act as fulcrum) and recorded as P1.

Figure1: Positioning of the patient

Asymptomatic arm ULNT1 (Figure1):

The test components of the ULNT1 performed on symptomatic side were maintained in the same position, while ULNT1 was performed on the asymptomatic arm by the second therapist in the sequence stated above. Elbow of the asymptomatic arm was extended up to the point of first pain as reported by the patient or first resistance felt by the therapist. As soon as ULNT1 was

performed on asymptomatic arm, patient was asked to report whether the initial P1 on the symptomatic arm disappeared. On the disappearance of initial P1 of symptomatic arm, elbow of the same arm was extended further till the first pain reported by the patient and change in elbow extension was recorded ($P1^c$). Procedure was not to be continued if patients reported increase in pain or P1 did not disappear. Incidentally all the patients experienced disappearance of P1 on symptomatic arm when asymptomatic arm ULNT1 was performed.

Neural mobilization of asymptomatic arm:

Before starting neural mobilization elbow of symptomatic arm was flexed to a point where subjects' symptoms were at a tolerable level. A single session of Maitland's grade IV mobilization using elbow component of ULNT1 was performed on the asymptomatic arm by the second therapist. Three sets of 10 repetitions each was carried out with a rest period of 10 seconds between the sets. Following mobilization, elbow of asymptomatic arm was extended till first pain and held in same position. The first therapist then extended the symptomatic arm elbow till the first pain as reported by the patient and elbow extension value noted ($P1^m$). Six sessions of same treatment was given for six consecutive days and respective values of P1, $P1^c$ and $P1^m$ were noted. At the end of the sixth session, NPRS and DASH were re-administered.

DATA ANALYSIS

Area under curve (AUC) was calculated for elbow extension in Microsoft Excel 2003 using formula[20]:

$$AUC = \tfrac{1}{2} \sum_{i=0}^{n-1} (t_{i+1} - t_i)(y_i + y_{i+1})^*$$

*n = no. of times elbow extension range was measured

t = time interval

y = elbow extension range

i = time (in this study 'one day')

AUC is a two staged analysis method. Firstly summary of the responses is obtained by calculating area under the curve and then summary is analyzed using simple statistical methods[21]. In the current study, after calculating AUC for all the values of elbow extension, data obtained (AUCP1, $AUCP1^c$ and $AUCP1^m$) were analyzed in SPSS (version 11.5) using paired *t* test. Comparison was done between:

1. AUCP1 and $AUCP1^c$
2. $AUCP1^c$ and $AUCP1^m$

NPRS and DASH were analyzed using Wilcoxon Signed Rank Test in SPSS (version 11.5). A significance level of ≤0.05 was set for all analyses[18].

RESULTS

A total of 10 subjects met inclusion and exclusion criteria and participated in the study. Age, gender, occupation, symptomatic side and irritability of all the subjects are shown in Table1.

Table1: Demographic characteristics of participants

Subjects	Age	Gender	Occupation	Symptomatic side	Irritability
1	21	F	Student	Right	Mild
2	20	F	Student	Right	Mild
3	25	F	Physiotherapist	Right	Moderate
4	22	F	Student	Right	Mild
5	23	F	Physiotherapist	Left	Moderate
6	45	F	Beedi Worker	Left	Moderate
7	33	M	Farmer	Left	Moderate
8	48	M	Businessman	Right	Moderate
9	36	F	Housewife	Right	Moderate
10	31	M	Doctor	Right	Moderate

Elbow extension range:

Area under curve was calculated to create a summary of P1, $P1^c$ and $P1^m$ values for all the subjects who participated in the study. Paired *t* test analysis of these values revealed that there is a significant difference in elbow extension before and after introduction of asymptomatic arm ULNT1 ($p< 0.001$) as well as significant difference is noted after asymptomatic arm neural mobilization ($p < 0.001$) (Table 2).

Table2: Comparison of AUC for elbow extension:

AUC	Mean±SD	95% confidence interval		*t*	*p*
		Lower	Upper		
AUCP1-AUCP1^c	41.75±8.25	35.85	47.65	16.00	<0.001
AUCP1^c-AUCP1^m	39.50±17.90	26.69	52.31	6.98	<0.001

Figure2 was constructed to illustrate daily changes of P1 revealing an improvement in elbow extension in all the subjects by sixth day.

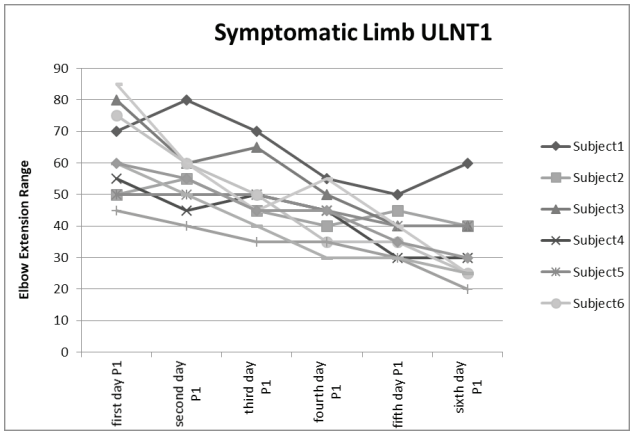

Figure2: Daily changes in P1

Pain and disability scores:

Two out of ten subjects were admitted, hence post treatment DASH was not calculated for the two subjects as they were not able to perform few tasks mentioned in DASH [According to the criteria of DASH if more than three items are not answered DASH is not reliable[17]]. DASH scores from remaining eight subjects were analyzed. The median, IQR and *p* value of pre and post treatment NPRS and DASH are outlined in Table3. Statistically significant decrease in NPRS and DASH was seen post treatment (NPRS p=0.005, DASH p=0.012, DASH_W p=0.011)

Table3: NPRS and DASH

	Pre Treatment		Post Treatment		p
	Median	IQR	Median	IQR	
NPRS	7.50	5.00-9.00	2.50	1.75-4.00	0.005
DASH	21.53	13.12-41.14	10.78	5.26-15.95	0.012
DASH_W	31.25	14.06-48.43	9.36	1.56-21.88	0.011

The figures 3, 4 & 5 depict the pre-treatment and post-treatment NPRS and DASH scores of each subject. Magnitude of reduction in pain differed in different subjects. Patients with moderate irritability reported better reduction in pain than mildly irritable cases.

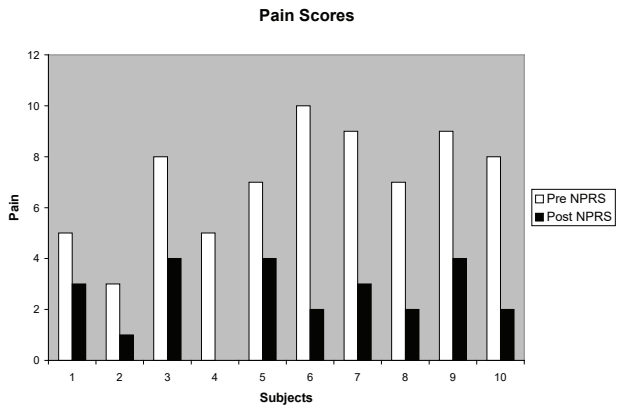

Figure3: Pain changes pre and post treatment

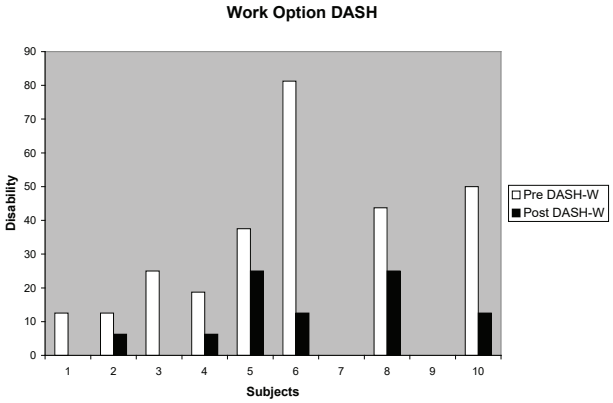

Figure4: DASH changes pre and post treatment

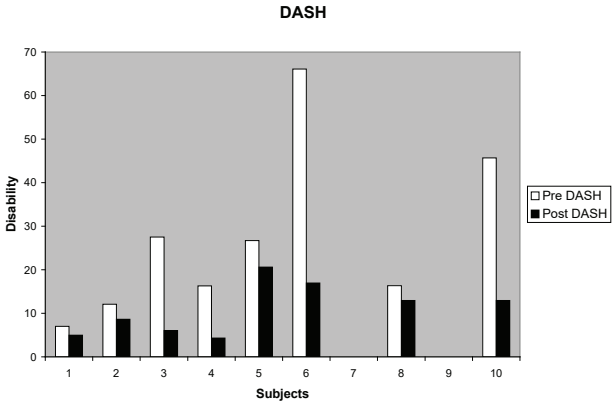

Figure5: DASH-W changes pre and post treatment

DISCUSSION

Although there are numerous studies that have addressed the treatment of CBPS, few studies utilized neural tissue mobilization techniques as an intervention in the treatment of CBPS. Previous researches investigated the effect of either mobilization of structures surrounding the neural tissues or symptomatic arm neural mobilization[1,13,22]. This study attempted to observe the effect of asymptomatic arm neural mobilization in patients with unilateral CBPS and reported significant improvement in elbow extension, pain and disability. This is consistent with the findings of the previous studies that have demonstrated positive effects of mobilization techniques addressing neural tissue in CBPS patients[1,13,23].

Previous authors discussed that contralateral ULNT1 reduces the test response in the ipsilateral arm held in ULNT1[6,17]. In our study inspite of pre-stressing the nerves of symptomatic arm, all the subjects reported disappearance of P1 and showed statistically significant improvement in elbow extension after ULNT1 was performed on asymptomatic arm. Following asymptomatic arm neural mobilization the result of this study showed significant improvement in elbow extension, pain and disability. This can be attributed to neurophysiological effects of mobilization[24,25]. Pain also has cognitive-behavioral aspect which means that reduction of pain leads to overall wellbeing of an individual[26]. In the current study patients reported decrease in disability and increased efficiency while performing their daily work due to reduction in pain levels.

It was not possible to control the use of analgesics and electrical modalities due to ethical considerations and we acknowledge lack of controlling this as a limitation of the study. Small sample size, stringent inclusion criteria (restricted elbow extension range of more than 50^0), lack of control group, single trial to find P1 and no follow up are also acknowledged as limitations of the study. The clinical importance from the findings of this study would suggest that in irritable cases of CBPS asymptomatic arm can be a starting point for the treatment. The results of the study cannot be generalized since the sample size was less and no randomization was done. Further research in the form of randomized control trials should be done to compare ipsilateral vs. contralateral neural mobilization with a larger sample size and patients with different irritability levels.

CONCLUSION

In this preliminary study all the patients having unilateral CBPS demonstrated improvement in elbow extension and reduction in pain and disability with asymptomatic arm neural mobilization. Although definite conclusion cannot be drawn, the current study can form a basis for future studies. Further studies in the form of well-designed randomized control trials with higher sample size can be performed to evaluate the effectiveness of this treatment technique in CBPS with irritable symptoms.

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Conflict of Interest – Nil

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Correlation between Balance and Functional Ability in Elderly: A Pilot Study

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ABSTRACT

Background & Objectives: Higher-functioning older adults refer to older adults aged 65 years and older who are active, ambulatory, and living independently in the community (eg, residential homes, independent living facilities, and retirement facilities). Aging progressively impairs sight, vestibular input, and somato-sensory information, which results in a reduction of environmental perception and precision of movements. The objective of the study was to find the relationship between balance and activities of daily living in elderly individuals.

Methods: The study involved 30 subjects (community living and those identified from old age homes), aged 65 and above. Balance was assessed using Berg Balance Scale (BBS) and Physical independence in daily activities was evaluated using the Barthel Index (BI). The Pearson's correlation coefficient was used to examine the relationship between the parameters evaluated. Significance was set at the level of 5% ($p< 0.05$).

Results: The population's mean age was 78.37 ± 6.68 years. The mean BBS score was 51.87 ± 4.21, whereas the mean BI score was 94.67 ± 7.76. Statistically significant relationships were found between the BBS and BI ($r =0.678$; $p=0.000$).

Conclusion: The results showed a strong positive correlation ($r =0.678$) between balance and independence level. Results from a larger sample may be necessary to corroborate the findings of the present study.

Keywords: *balance, functional ability, elderly.*

INTRODUCTION

The growing population of the elderly (over 65 years of age) has made the understanding of aging process to become a necessity. The increase in life span has led to the prevalence of chronic diseases which in turn have a substantial impact on the functional ability of the elderly people of the society. Functional ability is the competence of an individual to have the physiological capacity to perform normal everyday activities safely and independently without under fatigue[1]. Due to the decline of sensory and motor resources required for postural stability the ability to maintain balance is compromised. Age related proprioceptive and vestibular losses associated with reliance on visual inputs worsen the situation. Musculoskeletal impairment along with sensorimotor deterioration contribute to poor postural control[2,3]. As the overall number of elderly people increase, there is a corresponding rise in the number of older persons with disabilities. Such disabilities may be social, physical, mental or psychological[4].

The potential of the elderly for deciding and acting independently in their daily activities is called functional ability[5]. To be physically active , it is necessary to maintain balance function[6]. Reduction or loss of balance

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function leads to dependence of activities of daily living[7,8,9]. The reduction in the aerobic capacity and muscle strength lead to decrease the functional ability which ultimately cause loss of socioeconomic balance[1]. There is greater dependence on the friends and family in order to perform daily tasks such as standing up and sitting down, crossing the road[10,11].

According to Jonsson, age-related deterioration of balance or postural control has a negative impact on the ability to safely carry out day-to-day activities[12]. The elderly segment of the society is more likely to sustain fractures, develop respiratory complications and other associated co-morbidities. Therefore it is necessary to know the etiology of the functional decline. Sarcopenia-the age related loss of muscle mass, the reduced ability to interpret sensory information leading to impaired balance, reduced proprioception all these factors contribute to reduced maintenance of balance[13,14]. The aim of the present study was to determine the correlation between balance and functional ability in elderly individuals.

METHOD

This cross-sectional study was conducted in old age homes and out patient clinics of selected tertiary hospitals. Study protocol was approved by Institutional Ethics Committee. The study was conducted over a period of 1 year. The study population was selected by purposive sampling method which included 30 Community-dwelling elderly individuals with age of 65 and above, from both genders (18 men & 12 women). Inclusion criteria were: subjects referred for balance dysfunction, BMI ≤ 35, ability to walk 20 feet(with or without assistive device), ability to follow instructions and be independent in daily living activities. They were excluded if they had any history of neurological disease (e.g., Stroke, Parkinson disease) with residual impairment, unstable or limiting cardiac disease (e.g., angina), history of myocardial infarction, coronary artery bypass or other cardiac surgery within the previous 6 months, scored less than 24 in the Mini-Mental State Examination (MMSE). The study procedure was explained and informed consent was taken from all the patients. Berg Balance Scale (BBS) and Barthel index (BI) scales were administered and response noted down.

STATISTICAL ANALYSIS

Results were tabulated in Microsoft office excel and analysed by Statistical Package for Social Sciences (SPSS) version 17. Values were recorded as frequency, percentage, mean and standard deviation. Pearson's correlation coefficient was used to determine the relationship between the evaluated parameters. Significance was set at the level of 5% ($p < 0.05$).

RESULTS

Out of the 30 elderly individuals studied, 18 were men and 12 were women with a mean age of 78.4±6.7 years and mean BMI of 24.13±2.7. Every participant had MMSE scores greater than 25(28.3±1.8). The participants' balance was evaluated using the Berg Balance Scale (BBS), and functional independence in daily activities was evaluated using the Barthel Index (BI). The mean BBS score obtained on this study was 51.9±4.2. The mean BI score obtained on this study was 94.7±7.8.

Table 1 : Characteristics of measurement

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
AGE	30	65	93	78.37	6.688
BMI	30	20	32	24.13	2.360
MMSE	30	25	30	28.33	1.788
Berg Balance Scale	30	42	56	51.87	4.216
Barthel Index	30	75	100	94.67	7.761

Correlation analysis on data gathered from the community dwelling elderly people, showed that there was a statistically significant relationship between BBS and BI scores ($r = 0.67$; $p = 0.000$), which was found to be a strong positive correlation.

Table 2 : Correlation between BBS and BI

Correlations				
		L' TEST	**Berg balance scale**	**Barthel Index**
MMSE	r	-0.117	0.180	0.058
	p	0.539	0.341	0.761
	N	30	30	30
Berg balance scale	r			0.678
	p			0.000
	N			30

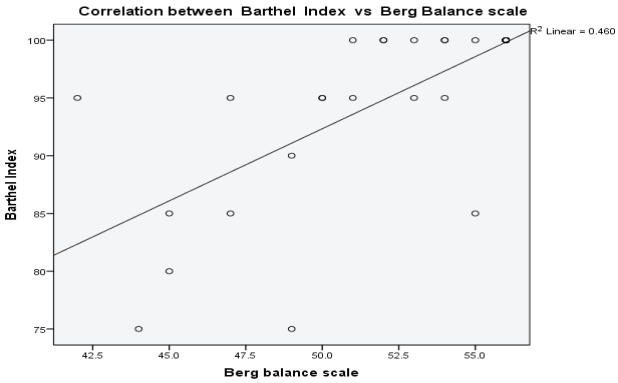

Figure 1 : Correlation between BBS and BI

DISCUSSION

The present study was conducted as a pilot study towards examining the relationship between balance and functional ability. In the study only those subjects who are able to comprehend and communicate in English were included. The study was conducted among subjects who had only mild balance deficits (BBS≥41). This population with relatively good balance may be vulnerable to falls due to their limited perception or balance deficits.

The Barthel index (BI)was developed in 1965 and later modified by Granger and co-workers, as a scoring technique that measures the patient's performance in 10 activities of daily life: feeding, bathing, grooming, dressing, bowel motion, bladder motion, toilet use, transfers to bed and chair and back, mobility and use of stairs[20]. The score corresponds to the sum of all the points obtained, and can range from 0 to 100 points. Elderly people with scores from 0 to 20 are considered to be totally dependent; from 21 to 60, seriously dependent; from 61 to 90, moderately dependent; from 91 to 99, slightly dependent; and of 100, independent[21].

The BBS is a 14-item scale that quantitatively assesses balance and risk for falls in older community-dwelling adults through direct observation of their performance. The scale requires 10 to 20 minutes to complete and measures the patient's ability to maintain balance—either statically or while performing various functional movements—for a specified duration of time. The items are scored from 0 to 4, with a score of 0 representing an inability to complete the task and a score of 4 representing independent item completion. A global score is calculated out of 56 possible points. Scores of 0 to 20 represent balance impairment, 21 to 40 represent acceptable balance, and 41 to 56 represent good balance. The BBS measures both static and dynamic aspects of balance. The ease with which the BBS can be administered makes it an attractive measure for clinicians; it involves minimal equipment (chair, stopwatch, ruler, step) and space and requires no specialized training [19].

Dependence, by itself, does not constitute a negative event. At different stages of life, individuals may or may not be dependent, on either a temporary or a definitive basis. Dependence takes on greater importance when this appears because of events that occur during the final stage of life, and daily activities are affected by this dependence.

Results of the present study further indicated that BI may be a good outcome measure to analyse the functional ability among community living elderly individuals. Ferrucci et al. did a study on stroke patients, compared the Level of functional performance versus motor impairment using Functional Measures with Barthel Index[15]. They reported that their study found considerable statistical significance when the FM scale was correlated with the Barthel Index.

Some researchers have been demonstrating a significant relationship between the measures of balance obtained by means of ordinal scales with the performance of functional tasks, such as the ability to transfer , walk and climb stairs[15,16,17]. Roberta de Oliveira et al. did a study on post-stroke motor and functional evaluations using Berg Balance Scale and the Barthel Index, they could not find any relationship between balance and functional ability, which contradicts the findings from Berg et al., which reported an intense correlation between the scores obtained in both scales for individuals with stroke[18,19].

The aging process is related to decreasing balance and ability to perform daily activities, and this situation may lead to falls, fear of falling, dependence, institutionalization and death. Specifically with regard to daily activities, the need for help to perform simple daily tasks such as eating, bathing and walking is associated with a large number of negative health indicators, such as hospitalization, treatment costs, quality of life and, finally, death[22]. BBS is a functional way of measuring an individual's balance and can provide valuable information for clinicians designing individual exercise programs. It also is easy to administer because it does not require much time or equipment. However, it seems important for clinicians to be careful when using single assessments of the BBS to draw conclusions concerning a change in balance function in the studied population. It has been indicated that the use of the mean of repeated measurements increases the reliability for tests of walking ability[23].

Older adults' confidence in their walking ability during everyday activities may be as important for their social participation as their actual ability.This present study results also showed that, among the elderly appraised here, there was an association between balance and daily activities, thus indicating that elderly individuals who had better balance kept a good level of independence. The validity of the BBS was investigated by Steffen et al. among elderly adults with disability[24]. BBS scores were moderately to highly correlated with scores in numerous functional measurements (Barthel Index, Fugl Meyer Test motor and balance subscales, Timed up and go, Performance-oriented assessment of mobility balance subscale and the Emory Functional Ambulation Profile). The BBS scores also correlated moderately with data obtained from the Dynamic Gait Index, gait speed, caregiver ratings of balance and centre of pressure measures of body sway during still and perturbed standing. It has been suggested that a BBS score of less than 45 is predictive of multiple falls in elderly adults[25].

LIMITATION

Even though the result of the present study indicated a strong correlation between balance and functional ability, the findings may be viewed with caution. A possible limitation of the present study may be that BI may not be sensitive in ambulant elderly with minimal functional limitations. Hence future studies may explore measures for the evaluation of functional ability that may be more suitable for this population.

CONCLUSION

There was a strong positive correlation between balance assessed by Berg Balance Scale (BBS) and functional ability (represented as Physical independence in daily activities) - evaluated using the Barthel Index (BI) in community dwelling elderly individuals.

Abbreviations

BBS:- Berg Balance Scale

BI:- Barthel Index

Conflict of Interest - Nil

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Immediate Effects of Unilateral Thoracic Postero- Anterior Pressure Versus Transverse Pressure in Chronic Mechanical Neck Pain: A Comparative Study

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ABSTRACT

Background: - The prevalence of neck pain has generally been reported to be 45–54% and approximately 50% for workers of any kind. Related to this, approximately 25% of out-patient physical therapy visits concern presentations of pain in the neck region

Objective: - The main objective of this study was to compare two different manual techniques for thoracic spine in patients with chronic mechanical neck pain and study its impact on pain and range of motion in the cervical spine in lateral flexion and rotation after a single intervention

Method: - Patients with Chronic Mechanical neck pain were included according to the criteria. They were divided into two groups randomly. One group received Unilateral thoracic postero- anterior pressure(Group A) while the other received Transverse thoracic pressure(Group B) to the thoracic spine. Data was collected at baseline and ten minutes after a single session was given.

Results: - Both the groups reported significant improvement in pain and range. In Group A the NPRS went down from 6.2±1.28 to 3.25±1.16 whereas in B it went down from 5.75±1.44 to 2.45±1.39. The lateral flexion to right nd left in group A increased from 25.78 to 36.45 and 27.56 to 37 whereas in group B it increased from 27.31 to 35.71 and 28.3 to 35.85 respectively. The rotation range of motion to the right and left in group A increased from 61.26 to 75.28 and 62.55 to 74.2 whereas in group B it increased from 64.56 to 73.73 and 62.88 to 73.41 respectively. There was mild to moderate better improvement in group A and group B in terms of pain and range. There was no significant difference in range of lateral flexion to left between both the groups.

Conclusion: - Patients with Chronic Mechanical Neck Pain showed reduction in pain with Unilateral Thoracic Postero-anterior Pressure. Which can be considered a better form of treatment based on the results found in the present study.

Keywords: *- Chronic Mechanical Neck Pain, Mobilisation, Manual Therapy, Thoracic Spine*

INTRODUCTION

Neck pain is one of the commonest health problems in the general population, particularly among people of working age. The prevalence of neck pain has generally been reported to be 45–54% and approximately 50% for workers of any kind.[1,2]

Neck pain is defined as of mechanical origin when symptoms will vary with time and activities and is often accompanied by a limited range of movement (upto 15^0) in the cervical spine, mostly in lateral flexion and rotation.

Most neck pain of mechanical origin is associated with poor posture, anxiety and depression, neck strain,

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occupational injuries, or sporting injuries, static posturing and various other confounding physical, psychosocial and individual factors.[11]

Manual therapeutic techniques are used to relieve pain and to increase the mobility of joints.

Cervical spine mobilisation includes several risk factors like exacerbation of symptoms, muscle spasm, the most common one being vertebrobasilar insufficiency.[15] In a systematic review on the adverse effects of spinal manipulation, adverse effects were found to be consistent with cervical spine mobilization.

The cervical and thoracic spines, while anatomically distinct regions, are not clinically independent of each other.[1] Studies have shown that dysfunctions in the thoracic spine may result in pain and altered movement patterns in the cervical spine.[2]

As to why, it is widely thought that the conceptual model of regional interdependence is involved.[16] Cleland et al. suggested that multiple thoracic mobilization Grade III could reduce pain and disability in the neck, It was claimed that the T6 vertebral level was the most rigid in terms of nervous system mobility.[17]

Another neurophysiological effect that the mobilization might have is the stimulation of the sympathetic trunk of the autonomic nervous system, lowering the pain-pressure threshold and vasodilation which increases blood supply to the tissue at fault and hence enhances healing while decreasing pain.[18]

There continues to be lack of evidence supporting which mobilization technique out of the two commonly used, that is unilateral postero-anterior pressure to the thoracic spine and transverse pressure to the thoracic spine, will be most suited clinically.

The purpose of this study was to explore which technique of thoracic mobilization is best suited and produces maximum benefit in patients with chronic mechanical neck pain

MATERIAL AND METHOD

40 patients were included in the study and the sample was collected from the National Institute for Locomotor Disabilities(Divyangjan), Kolkata.

The inclusion criteria were

1. Age 18–45 years. [17]

2. Duration of pain at least 3 months or more than that.[27]

3. Numeric pain rating scale score more than 3 points and ≤ 8 on activity.[8]

4. Dull aching pain increased by sustained postures, neck movements (lateral flexion and rotation) and palpation of cervical musculature.[27,28]

The patients were excluded if Symptoms were present inferior to the suprascapular area, if there was Red flags of Mobilization such as metastasis, burns, bony anomaly (Congenital or Acquired), etc.[10,6] and Physiotherapy Treatment for this condition in the past three months.

Demographic data was collected and the Patients were further evaluated thoroughly. Patients were asked about their pain intensity on NPRS during activity. Range of motion in lateral flexion bilaterally and rotation bilaterally was measured using a standard universal goniometer in accordance to Norkins C guidelines and documented.

Then they were allotted to one of the two groups via simple random sampling and intervention was given.

GROUP A – UNILATERAL THORACIC MOBILISATION GROUP

Patients were asked to lie in a prone position on the examination table and they were marked on both sides of the zygapophyseal joint.

The therapist stood beside the patient in stride standing position and placed the thumbs on the zygoapophyseal joints by palpating the spinous process and moving one finger laterally to the affected side. [10]

The therapist then performed unilateral postero-anterior mobilization at the zygapophyseal joint in the upper thoracic level (T1 to T6) on both the left and right, 1 minute on each side. [18]

GROUP B – TRANSVERSE THORACIC PRESSURE GROUP

The physiotherapist stood at the patient's right side at the level of the vertebrae to be mobilized, and placed the hands on the patient's back so that the pads

of the thumbs were adjacent to the right side of the spinous processes while the fingers were spread over the patient's left ribs. The left thumb acted as the point of contact and was fitted down into the groove between the spinous process and the paravertebral muscles, so that part of the pad of the Thumb was pressed against the lateral aspect of the spinous process on its right-hand side. It was essential to have as much of it, pad in contact with the spinous process as was possible. [10]

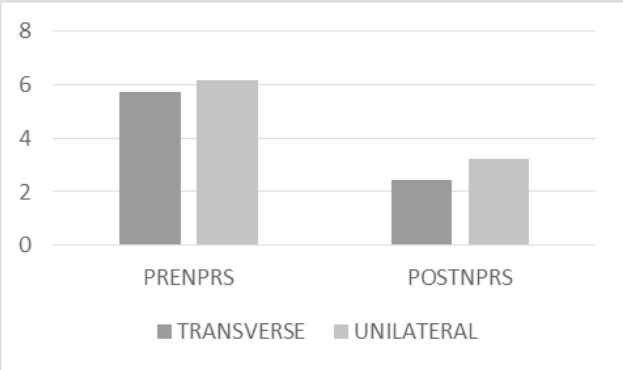
The pressure is applied to the spinous process through the thumbs by the movement of the trunk; alternate pressure and relaxation is repeated continuously to produce an oscillating type of movement of the intervertebral Joint. The procedure was performed on both sides, 1 minute on each side starting from T1 up to T6. [15]

DATA ANALYSIS

The sample size was obtained by using the previous studies where the power analysis has already been done and was found out to be 40 for the effect sizes(d=0.5). The Confidence Interval was kept at the standard level of 95% and the data was analysed using IBM SPSS Version 23 (SPSS, Inc, Chicago IL, USA).

FINDINGS

It was found that the data between the two groups that is group A and group B when compared, by independent t-test the significance crossed 0.05 indicating that the nature of the data was homogenous as there was no statistically significant change in the baseline.



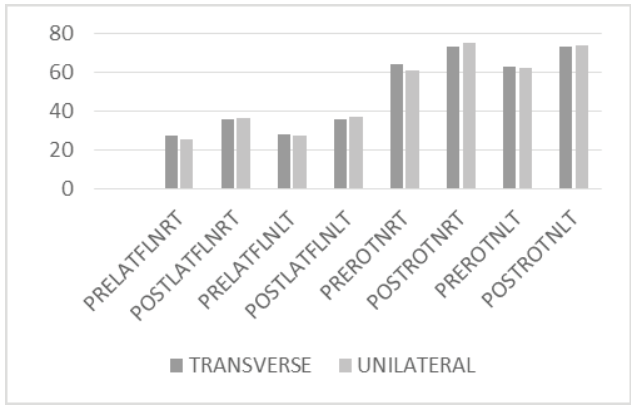
Graph 1 – Showing the pre-test post-test comparison of means on Numeric Pain Rating Scale.

PRENPRS= Pre-test Numeric Pain Rating Scale Mean Score

POSTNPRS= Post-test Numeric Pain Rating Scale Mean Score

Within group analysis was done using a paired sample t test for pre and post test measurements for the five variables in SPSS for both the groups where the level of significance α=0.05. Post hoc analysis was done between groups using G*Power version 3.1.7 where the effect size between the two groups were calculated.

Graph 2 - Showing the pre-test post-test comparison of means



in lateral flexion and rotation movements of the cervical spine.

Legend to the Graph: -

PRELATFLNRT= Pre-test Lateral Flexion to Right Mean Score

POSTLATFLNRT= Post-test Lateral Flexion to Right Mean Score

PRELATFLNLT= Pre-test Lateral Flexion to Left Mean Score

POSTLATFLNLT= Post-test Lateral Flexion to Left Mean Score

PREROTNRT= Pre-test Rotation to Right Mean Score

POSTROTNRT= Post-test Rotation to Right Mean Score

PREROTNLT= Pre-test Rotation to Left Mean Score

POSTROTNLT= Post-test Rotation to Left Mean Score

DISCUSSION

Although there are various treatment techniques for treatment of chronic mechanical neck pain, manual therapy is a well-established alternative for treating such types of pain.

The neurophysiologic response of pain reduction through thoracic mobilization may be explained in terms of several mechanisms. One possible mechanism is that the mobilization induces a reflex inhibition of pain or muscle relaxation reflex by modifying the discharge of proprioceptive Group I and II afferents. This may also improve spine mobility.[26] A second mechanism is that the spinal mobilization activates descending inhibitory mechanisms resulting in pain reduction in distant areas from the mobilization.[21,]

The sympathetic trunks are two ganglionated nerve trunks that extend the whole length of the vertebral column. Therefore, when applying unilateral thoracic postero-anterior pressure the activation of the sympathetic trunk by direct pressure was more pronounced. This might be the reason why the improvement in NPRS and range in lateral flexion in both directions and rotation to right was mildly better in the Unilateral thoracic postero-anterior pressure than the transverse thoracic pressure group. The biomechanical alteration that these two techniques have are relatively the same which is to improve the mobility of the facet joints of the vertral column but in the transverse pressure group, pressure was applied on the lateral aspect of the spinous process and there was no pressure of the sympathetic trunk. Hence the reduction in pain in the unilateral group was more as compared to the transverse group since in the latter group, the autonomic nervous system couldnot be activated.[17]

This is attributed to the Fryette's 3 laws that is based on the interdependence of the spinal column.[21,23,25]

The first law states that *when the spine is in neutral, sidebending to one side will be accompanied by horizontal rotation to the opposite side.* In both the techniques the mobilization force that was introduced to the thoracic spine only had a rotational component. There was no lateral gliding of the segments while the intervention was being given as it was not possible in this region of the spinal cord. There exists a causal relationship in terms of biomechanics between the cervical and thoracic regions, therefore, pain and stiffness in the cervical spine will lead to decreased range of motion in thoracic spine as well. [21,30]

The second law of Fryette's states that *When the spine is in a flexed or extended position, side-bending to one side will be accompanied by rotation to the same side.* In a pathological scenario, if one vertebra is out of place (in flexion or extension), there will be worsening of symptoms if movement in other planes are performed. Since the region of the spine was already placed in flexion or extension (flexion in upper thoracic and lower cervical regions, extension in upper cervical regions) therefore, movement in side flexion or rotation worsened the symptoms. The fault in posture might be attributed to pain and decreased mobility, hence altreing the normal biomechanics of the spine.[5,6,11,17]

The third law of Fryette's states that *When motion is introduced in one plane it will reduce motion in the other two planes.* Hence if there was a dysfunction of range in one plane, all the movements of the segment will be reduced. This was also true in our study where there was a mobilising force being given to bring about rotation of the spinal segment but there was an overall improvement in all other ranges as well that is side flexion to both sides. This might again be attributed to the bio-mechanical correction that could have been brought once the mobility was made better and movements in rotation and side flexion improved significantly in both the groups when compared with the baseline.[26,24]

CONCLUSION

When a patient approaches with a chronic mechanical neck pain to a manual therapist, it would be better to start with the unilateral thoracic postero-anterior technique descibed by Maitland first since it would produce better improvement in pain and there will be better improvement in range of motion in the lateral flexion to both sides and rotation to right.

Conflict of Interest: The authors certify that they have NO affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

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Ethical Clearance: Institutional Ethical Clearance was obtained before performing the study from the Institutional Ethical Board of National Institute for Locomotor Disabilities(Divyangjan).

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A Comparative Study on Alteration of Blood Pressure During Mechanical Intermittent and Continuous Cervical Traction

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ABSTRACT

Objective: To determine the alteration in systolic blood pressure during intermittent and continuous cervical traction in normal healthy individuals. **Study Design:** Comparative Study. **Method:** 60 healthy participants aged between 18-25 years were included in the study. They were then randomized by lottery method using convenient sampling method into intermittent cervical traction group A (n=30) and Continuous cervical traction group B (n=30). Each group the blood pressure was measured before, during and after the application of cervical traction. The repeated ANOVA test was used to compare the variations in systolic blood pressure within groups while two sample independent't' test was used for between group differences. Level of significance was set at $p<0.05$. **Results:** There was no statistically significant difference in mean BP between group A and group B ($p=0.137$) **Conclusion:** Based on the results, conducting a comparative study using the same traction weight and with a small sample size might have led to weak negative correlation. Hence, we strongly feel that further research needs to be done considering gender differences independently and also with a larger sample.

Keywords: *cervical traction, systolic blood pressure, repeated measurement.*

INTRODUCTION

Cervical traction (CT) is applied for neck or upper limb pain caused by conditions such as, degenerative disc disease (with or without cervical root compression), hypo mobile facet joints, and cervical muscular dysfunction[1]. A cervical traction unit delivers mechanical traction force to the cervical spine. The traction can be given steadily for a certain period of time (continuous) or on and off cycle (intermittent), therefore, relieves compression on the nerve root by stretching the spine and widening the intervertebral foramina, decreased spasm in paraspinal muscles, increased intervertebral disc space, improved vertebral alignment and improved disc hydration[2]. From an anatomical and mechanical viewpoint, Cervical traction can separate zygapophyseal joints with intervertebral foramina enlargement, increase intervertebral space, tighten the posterior longitudinal ligament to adjust the adjacent annulus fibrous and stretch muscles and ligaments[3].However, it has been reported that adverse events related to increased blood pressure, such as headache, dizziness, and nausea, could develop after cervical traction. The traction weight may be an important factor in such side effects[4].

Few studies reported changes in blood pressure during cervical traction (CT) and suggested that clinical physicians and therapists notice hemodynamic changes during its use. However, the relationship between side-effects and hemodynamic alternation is still unclear. Since cardiovascular homeostasis is controlled mainly by the autonomic system[5]. The reversible changes in blood pressure may be related to various factors, including direct stretching to baroreceptors in the carotid sinus during traction to elicit a baroreflex, direct stretching to spinal muscles, tendons, and ligaments to cause a

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stress-related sympathetic reflex (physical stress); and psychological irritability[6]. Few studies have addressed the physiological effects of CT on the cardiovascular system[4].

Many studies have found the significant increase in autonomic functions and blood pressure associated with different cervical traction weight. Studies conducted on intermittent cervical traction shows that 15 percent of body weight has significant increase in blood pressure. Hence, the purpose of this study was to compare the alteration of systolic blood pressure during mechanical intermittent and continuous cervical traction by using 15% of the body weight. The results can then be analyzed to lay out comparison between the mechanical intermittent and continuous cervical traction, and also to validate the significance of the alteration. Application of these outcomes may be extended to clinical decision making process for giving tractions to patients with altered blood pressure.

MATERIALS AND METHOD

This study was conducted among the healthy participants aged between 18 to 25 years with a sample size of 60. Prior to participation, the participants were explained about the study and an informed consent was obtained from them. Ethical clearance was obtained from University ethics committee. Participants were screened based on the inclusion and exclusion criteria. Inclusion criteria were: Healthy volunteers of both genders aged from 18-25. Participants with normal neck ROM. Exclusion criteria were: Presence of any musculoskeletal, neurological and cardiovascular condition or any other pathological condition contraindicating to cervical traction. Eligible participants were then randomized by lottery method to either intermittent cervical traction Group A (n=30) and Continuous cervical traction Group B (n=30).

METHOD

For the participants in both the groups weight was measured using a weighing machine and 15% of the body weight of each participant was calculated and noted. The first BP measurement was taken just prior to giving continuous or intermittent traction. The Participants were laid on the traction bed with the neck flexed at 20 to 30 degrees, and secured with the cervical traction belt with their forearms placed by their side. The systolic value of BP was recorded from which the mean of three measurements were calculated and noted. The BP cuff was placed throughout the procedure and it was deflated when not in use.

Group A received mechanical intermittent traction using 15% of the body weight with hold/relax set at 40 sec hold and 20 sec relax. The second BP measurement was started at the 10th minute of the intermittent traction and the measurement was recorded during hold time of intermittent traction. The third BP measurement was conducted after the 15 minutes of intermittent traction with each measurement being repeated three times for calculating the mean.

Group B received mechanical continuous traction with 15% of the body weight. The second BP measurement was started at the 10th minute of continuous traction. The third BP measurement was conducted after 15 minutes of continuous traction. Each measurement was repeated three times and the mean was calculated.

In this study, we compared the alteration of systolic blood pressure in continuous versus intermittent traction among healthy participants.

STATISTICAL ANALYSIS

Statistical analysis was done using IBM SPSS statistics version 22. Descriptive statistics was reported as mean (standard deviation) for continuous variables and frequency (percentage) for categorical variations. Variation in systolic blood pressure was compared within each group using repeated measures ANOVA or Friedman's test based on normality. Between groups, the systolic BP comparison was done using two sample independent T-Test Mann Whitney U Test based on normality. A $p<0.05$ was considered statistically significant.

RESULTS

Results showed a weak negative correlation (R=-0.094) between Continuous traction group and intermittent traction group and this difference was found to be not statistically significant (Refer Table 1). A difference in average number between intermittent and continuous group at 3 end points. i.e., pre traction, during traction and post traction was found to be statistically significant using two sample independent T-test ($p<0.05$) (Refer Table 2). There was no statistically significant difference in the base line

characteristics between two groups (p>0.05) using an independent sample T- test (Refer Table 3). There by proving the fact that intermittent and continuous groups are comparable. A statistically significant difference was found across the repeated measurements using a repeated ANOVA i.e. pre, during and post traction average for the intermittent group f value was found to be 16.591 with a p value<0.001. From the pair wise comparison, we find that there was a significant difference between pre traction and during traction average (p<0.001) and also a significant difference between during traction and post traction average (p<0.001) (Refer Table 4). For the continuous group, f- value was found to be 38.72 with a p value<0.001 which was also statistically significant. P value clearly implies that there was a statistically significant difference between the three repeated measurements within the group i.e. pre, during and post traction average (Refer Table 5). There was no statistically significant difference in mean BP between group A and group B (p=0.137) (Refer Table 6).

DISCUSSION

This study was conducted to compare the alteration of systolic blood pressure during continuous cervical traction and intermittent cervical traction in healthy individuals. Sixty participants were included in this study in an age group of 18 to 24. They were randomly divided into two groups. Intermittent traction group (Group A) and continuous traction group (Group B).

The intermittent group showed an average increase of 6.93mmhg in systolic blood pressure during traction compared to pre traction. Immediately after the traction was removed, the blood pressure returned almost to the pre traction BP level, whereas in continuous group, the blood pressure decreased by an average of 7.62mmhg during traction compared to pre traction measurement. The post traction blood pressure came back to near-normal level as well. Many studies investigated the alteration in BP related to different traction forces such as 5%, 15% and 25% out of which 15% and 25% of the traction force caused significant alteration of blood pressure.

A study done on Autonomic functions and blood pressure changes linked with different cervical traction weights found that there is a relationship between cervical traction and autonomic functions. Results showed that systolic and diastolic BP was increased but heart rate and heart rate variability were decreased when traction was given with 30% of body weight[7]. Another study on Clinical response and autonomic modulation as seen in heart rate variability in mechanical intermittent cervical traction found that intermittent CT in a sitting position using 10% body weight traction force is more comfortable than using 20% body weight traction force. Using 20% body weight traction force causes more subtle perturbation in the autonomic system and is accompanied by a higher incidence of discomfort[1]. Comparison of Blood Pressure and Heart Rate Variability in (Saunders Cervical Traction) at three different forces in healthy volunteers found that Heart rate variability (HRV), which is induced by changes in blood pressure, reduced with increasing cervical traction force, and results suggest that traction forces of 25% body weight should be used carefully for patients whereas 15% of body weight can be safely used[8].

In this study the traction weight 15% of the body weight for both continuous traction group and intermittent traction group was used, there were no complaints of discomfort or side effects of cervical traction like dizziness, vertigo or nausea. Hence, 15% of traction force can be considered safe in healthy individuals. Although the findings in this study are in contrast with many other studies in the literature, Hence, we strongly feel that further research needs to be done considering gender differences independently and also with a larger sample size and with painful cervical conditions.

LIMITATION

Conducting a comparative study using the same traction weight and with a small sample size might have led to weak negative correlation. Hence, we strongly feel that further research needs to be done considering gender differences independently and also with a larger sample size.

Table: 1: Pearson's correlation was used to find whether there was a statistically significant correlation between (method A and B). Descriptive statistics

Descriptive Statistics				Correlation coefficient "r"/p value
	Mean	Std. Deviation	N	
INTER	113.36	7.85	30	
CONT	116.20	6.66	30	-0.094/0.620

There was a weak negative correlation (r=-0.094) between Continuous traction group and intermittent traction group and was not statistically significant.

Table :2	**T-Test**			
	Group	**N**	**Mean**	**Std. Deviation**
pre traction average	Intermittent group	30	114.400	7.4027
	Continuous group	30	118.133	7.5737
during traction average	Intermittent group	30	119.333	6.7535
	Continuous group	30	112.400	7.6230
post traction average	Intermittent group	30	113.367	7.8586
	Continuous group	30	116.200	6.6613

A statistically significant difference in average BP between intermittent and continuous groups at pre traction and during traction ($p<0.05$)

Table: 3: Independent Samples Test

		t-test for Equality of Means				
		T	**P**	**Mean Difference**	**95% Confidence Interval of the Difference**	
					Lower	**Upper**
AGE		.306	.761	.1000	-.5539	.7539
GENDER		1.433	.157	.1667	-.0661	.3995

There was no statistically significant difference in the base line characteristics between two groups ($p>0.05$)

Table: 4: Intermittent group

	Mean	**Std. Deviation**	**N**
pre traction average	114.400	7.4027	30
during traction average	119.333	6.7535	30
post traction average	113.367	7.8586	30

F=68.591 P<0.001

Pair wise Comparison of intermittent group

Measure: MEASURE_1

(I) factor1	**(J) factor1**	**Mean Difference (I-J)**	**P**	**95% Confidence Interval for Difference[b]**	
				Lower Bound	**Upper Bound**
1	2	-4.933*	<0.001	-5.836	-4.030
	3	1.033	.356	-.599	2.665
2	3	5.967*	<0.001	4.462	7.471

Based on estimated marginal means(The mean difference is significant at the .05 level)

Table : 5 Continuous traction

	Mean	**Std. Deviation**	**N**
pre traction average	118.133	7.5737	30
during traction average	112.400	7.6230	30
post traction average	116.200	6.6613	30

F=38.872 P=0.001

Pair wise Comparison of Continuous group					
Measure: MEASURE_1					
(I) factor1	(J) factor1	Mean Difference (I-J)	Sig.[b]	95% Confidence Interval for Difference[b]	
				Lower Bound	Upper Bound
1	2	5.733*	<0.001	4.108	7.358
	3	1.933*	.038	.086	3.781
2	3	-3.800*	<0.001	-5.357	-2.243

Based on estimated marginal means(The mean difference is significant at the .05 level)

Table 6: Independent sample t test

GROUP	N	Mean	Std. Deviation	t/pvalue	
INTER	30	113.3667	7.85859	1.506/ 0.137	
CONT	30	116.2000	6.66126		

There was no statistically significant difference in mean BP between group A and group B (p=0.137)

CONCLUSION

The present study acknowledges that there was no statistically significant difference in mean (systolic) BP between group A and group B (p=0.137)

Conflict of Interest: There is no conflict of interest.

Source of Funding- Self

Ethical Clearance- Yenepoya University Ethics Committee

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Effect of Strengthening of Inspiratory Muscles using Inspiratory Muscle Trainer on Pulmonary Function among Patients with Spinal Cord Injury -A Quasi-experimental Study

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ABSTRACT

Background. Respiratory complications are the major causes of mortality and morbidity in patients with spinal cord injury. Thus there is a need to prevent the respiratory complications. In these patients respiratory problems may result from a loss of control of the abdominal muscles, intercostals and in some cases, a partial or total loss of the diaphragmatic function.

Objective. To determine the effect of strengthening of inspiratory muscles using inspiratory muscle trainer on pulmonary function among patients with spinal cord injury.

Study design. The study was a Quasi-Experimental study design. The sampling technique used was Purposive Sampling Technique. The study was conducted at Coimbatore, Tamil Nadu, India. A sample of 20 male patients with traumatic spinal cord injury with level ranging from C_5 to T_{12} were selected and assigned into 2 groups.

Intervention. Group I was intervened with conventional chest physiotherapy. Group II was intervened with strengthening of inspiratory muscles using IMT Threshold device along with conventional chest physiotherapy. The study was conducted for a period of 8 weeks. The outcome measures include rate of perceived exertion assessed by modified Borg's scale, maximal inspiratory and expiratory pressure was assessed by modified sphygmomanometer, peak expiratory flow rate was assessed by mini peak flow meter.

Results. Statistical analysis were made using student't' test and paired 't' test at 5% level of significance. Pre test values showed that there is no significant difference between two groups. There is improvement in both groups and the experimental group showed a greater level of improvement in MIP, MEP and PEFR than the control group.

Conclusion. From this study it is concluded that the inspiratory muscle training is effective to improve pulmonary function among patients with spinal cord injury.

Keywords. *Spinal cord injury, inspiratory muscle training, IMT Threshold device, maximal inspiratory pressure, maximal expiratory pressure*

INTRODUCTION

A spinal cord injury (SCI) refers to any injury to the spinal cord that is caused by trauma instead of disease. Depending on where the nerve root and spinal cord are damaged, the symptoms can vary widely, from pain to paralysis to incontinence.

Injury to the spinal cord, can cause severe respiratory impairment depending on the level at which the lesion occurs. Lesions above C3 are life threatening, causing paralysis of the diaphragm, intercostals, scaleni and abdominal muscles, thereby leading to a lack of ventilatory support and the need for mechanical ventilation. If the injury occurs below C3, the diaphragm

remains totally or partially innervated. However, diaphragmatic function is impaired due to paralysis of other respiratory muscles, including the abdominal muscles.

Spinal cord injury with the neurological level through C3 generally results in a weakened diaphragm, paralysis of the external (parasternals) and internal intercostals, abdominal musculature resulting in significant impairment of respiratory function.

After spinal cord injury, there will be an alteration in the mechanical properties of the lungs and chest wall result in paradoxical (out of phase) movement of the chest wall, and reduced lung and chest wall compliance (flexibility). This, in turn, leads to reduced breathing efficiency, reduced maximal static respiratory pressures, and reduced lung volumes. Impairment of the muscles of inspiration reduces vital capacity (VC), prevents deep breath, and may lead to dyspnoea with exertion and collapse of the lungs[1].

Due to impaired cough and difficulty in mobilizing the lung secretions, patients after spinal cord injury are at increased risk of pneumonia. The pulmonary complications of SCI include increased risk of pulmonary infection and death, and higher rates of symptoms of respiratory dysfunction. The inspiratory capacity is diminished in individuals with higher level lesions, contributing to microatelectasis, dyspnea with exertion and in those with more severe impairments, respiratory insufficiency[2].

Moreover, reduced lung volumes and the associated inadequate stretch of airway smooth muscle with deep breathing may contribute to dyspnea, further limiting an individual from progressing in vocational and avocational independent activities.

These patients have restrictive ventilator impairment and endurance time, as well as inability to cough, especially in a sitting position. Therefore, these patients are highly susceptible to inspiratory muscle fatigue and pulmonary complications.

The measurement of Maximal Respiratory pressure (MRP) by manometers is a useful procedure in evaluating respiratory muscle strength[3]. American physiological society, (2003) stated that the Inspiratory muscle strength was measured at the mouth by an electronic pressure manometer. PImax indirectly reflect the inspiratory muscle strength and sustained atleast for 1 second while performing a maximal inspiratory effort.

The strength and endurance of respiratory muscles in individuals with acute and chronic SCI may be further increased with specific resistive inspiratory muscle training (IMT), suggesting this may help to protect against respiratory infections, which in severe instances can evolve into respiratory failure. Improved inspiratory muscle strength and endurance could potentially improve cough and maximal exercise ventilation in addition with decreased dyspnea. The inspiratory muscles can be trained similar to the limb muscles with inexpensive devices that increase the resistive or threshold inspiratory load on the inspiratory muscles[4].

Hence, this study was carried out to evaluate the effect the strengthening of inspiratory muscles, using the inspiratory muscle trainer (IMT) in individuals with chronic spinal cord injury that prevent the pulmonary complications and respiratory failure.

METHOD

Design and participation selection

The study was a Quasi-Experimental study, with Purposive sampling technique. Twenty males with chronic spinal cord injury were recruited for the study. Inclusion criteria for participation in the study were: Chronic cervical and thoracic level spinal cord injury (C5-T12), strength of the diaphragm- grade “fair”, Patients with good consciousness and cooperation, Patients who are medically stable. Unstable and non cooperative patients and patients with respiratory complications were excluded from the study.

Ethical considerations

Approval of the proposal was obtained by ethical committee of KMCH College of Physiotherapy, Coimbatore, Tamil Nadu, India. The study was explained to the patients and their care takers. A written informed consent was taken.

Intervention

The 20 patients were divided into two, 10 in each group. Pre-test was taken using modified sphygmomanometer to measure Maximal inspiratory

pressure and Maximal expiratory pressure, Mini peak flow meter to measure peak expiratory flow rate and Modified Borg scale to measure rate of perceived exertion. Group I with 10 subjects was provided with conventional chest physiotherapy, that included diaphragmatic breathing exercise, air shift maneuver, assisted coughing and active cycle of breathing technique. Group II with 10 subjects received both inspiratory muscle training and the conventional chest physiotherapy. For the patients undergoing inspiratory muscle training 30% of Maximal inspiratory pressure was set as the resistance according to the patient's MIP value[5]. Nose clip was used to close the nasal orifice. The patient was asked to inhale against the resistance. Frequent rest period was given in between the session. The progression was made according to the increase in the MIP value. Two sessions per day and each session lasted 15 minutes. The training was given for 4 days per week, for a period of 8 weeks. Post test was taken after 8 weeks.

DATA ANALYSIS

Data analysis was made using independent't' test and paired't' test at 5% level of significance (p = 0.05).

Rate of Perceived Exertion

When the values of Group I and II are analysed by Independent't' test, the calculated value of pre test was 0.84 and post test was 0.31. The calculated't' value between pre test and post test of group I was 3.142 and group II was 3.493. Patients in group II who received IMT with conventional chest physiotherapy showed a greater improvement than group I who received only the conventional chest physiotherapy. But, the improvement was not statistically significant as the RPE values became zero and there was no further improvement to be noted.

Maximal Inspiratory Pressure

When the values of Group I and II are analysed by Independent't' test, the calculated value of pre test was 0.73 and post test was 2.55. The calculated't' value between pre test and post test of group I was 6.125 and group II was 6.181. It is proved that there is a statistically significant improvement in Group II than the group I.

Maximal Expiratory Pressure

When the values of Group I and II are analysed by Independent't' test, the calculated value of pre test was 0.268 and post test was 2.772. The calculated't' value between pre test and post test of group I was2.45 and group II was 6.082. It is proved that there is a greater statistically significant improvement in Group II than the group I.

Peak Expiratory Flow Rate

When the values of Group I and II are analysed by Independent't' test, the calculated value of pre test was 0.586 and post test was 4.488. The calculated't' value between pre test and post test of group I was 6.524 and group II was 8.21. It is proved that there is a greater statistically significant improvement in Group II than the group I.

GRAPHICAL REPRESENTATION

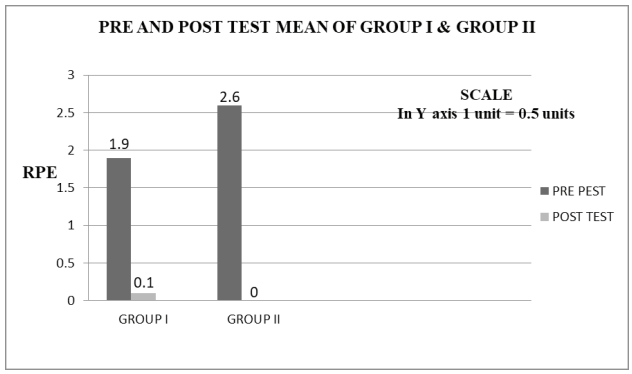

FIGURE 1 - RATE OF PERCEIVED EXERTION

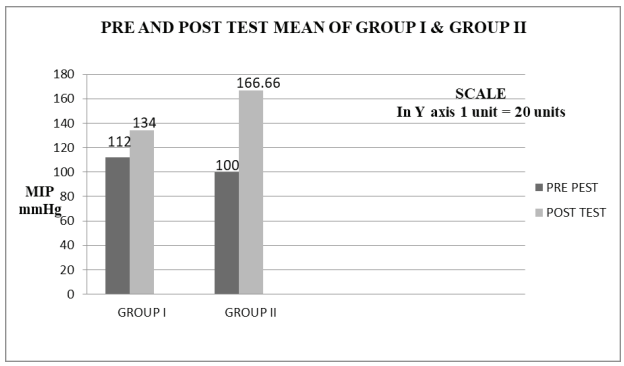

FIGURE 2 - MAXIMAL INSPIRATORY PRESSURE

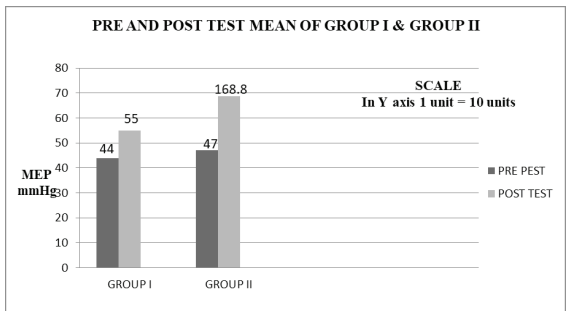

FIGURE 3 - MAXIMAL EXPIRATORY PRESSURE

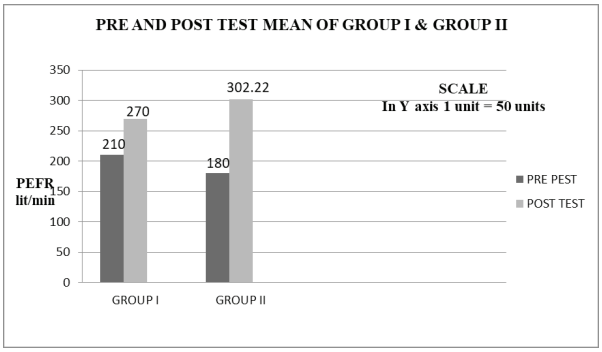

FIGURE 4 - PEAK EXPIRATORY FLOW RATE

DISCUSSION

It is estimated that in the United States each year there are about 11,000 new cases of spinal cord injury (SCI) and that there are currently about 250,000 persons alive with SCI. Because of improvements in medical care and survival, the prevalence of people living with SCI has increased, and it is predicted that there will be greater and greater numbers of older patients with SCI. Currently the average age at injury is 37.6 years, and about 80% of those affected are male.Because of the changes in pulmonary compliance, chest-wall distortion, and impairment in both muscles of inhalation and exhalation following spinal cord injury, there occurs a reduction in vital capacity (VC), inefficiency in ventilation, and markedly impaired cough.

This study was done to find the effect of strengthening of inspiratory muscles using inspiratory muscle trainer on pulmonary function among patients with spinal cord injury for a period of 8 weeks.

William et.al (2000) stated that the pulmonary function is compromised by most of the lesions of the spinal cord, even in those with paraplegia, and is affected relative to the level of lesion[6]. Jackson et.al found that the complications overall occurred significantly sooner in the T1-12 group[7]. Hence, in this study both the cervical and thoracic level of spinal cord injury patients were taken.

Haas et.al described that there is a marked reduction in the ability of tetraplegics to achieve full lung inflation, which predispose to the development of alveolar hypoventilation, as a result of paralysis of inspiratory muscles.

Hence, Group I with 10 samples was provided with the conventional chest physiotherapy, including Simple Relaxed Diaphragmatic Breathing Exercise, Air Shift Maneuver, Assisted Coughing, and Active Cycle of Breathing. Group I showed a significant improvement in MIP, MEP, RPE and PEFR.

Group II with 10 samples were provided with Inspiratory Muscle Training along with the conventional chest physiotherapy. One patient discontinued the study because of urinary tract infection and post test was taken only to 9 patients. The result showed a greater improvement in maximal inspiratory pressure, maximal expiratory pressure and in peak expiratory flow rate and rate of perceived exertion.

Rutchick et.al concluded that the strengthening the muscles of respiration is responsible for the improved maximal inspiratory pressure, which resulted in increase in both spirometric and lung volume parameters. The amount of work performed by a muscle is reflected in changes in the muscle itself. Several recognizable alterations occur in all muscle fiber types due to training. There is an increase in capillary density of the trained muscles, as well as in mitochondria within the cells, and the fibers synthesize more myoglobin. Strength training of the respiratory muscles has been studied in several different populations, including patients with COPD, asthma, muscular dystrophy and in both acute and chronic spinal cord injury[6,8,9,11].

The most successful findings have been attained using a resistive IMT device in the SCI population, in which several investigators have demonstrated significant and progressive increase in respiratory muscle strength and endurance while improving lung volumes[2,3,7,10].

In this study, both the groups showed a reduction in the rate of perceived exertion but that was not statistically significant. This was because, the post test mean values were 0.1 and 0 and hence the further improvement was unable to be noted. All the patients gave a subjective feedback that there is no dyspnea on exertion when compared before starting the treatment program.

As Group II showed greater significant improvement when compared to Group I, inspiratory muscle training can be effective in treating patients with spinal cord injury on pulmonary function.

LIMITATIONS AND SUGESSIONS

In this study, only a small sample size was included and large number of samples can be included in further

studies. Both cervical and thoracic level of spinal cord injury patients were included and studies can be done concentrating a single level. Both complete and the incomplete injury were taken. In future, studies can be done preferably on incomplete injury for better results. Modified sphygmomanometer was used in this study and digital pressure manometer can be used for better accuracy. Quality of life questionnaires can be used to document the level of improvement.

CONCLUSION

The results showed a significant improvement in both the groups. The data was collected and analysed by using student 't' test and paired 't' test. On comparison, the group II showed a greater improvement than Group I.

With this study, it is concluded that the Inspiratory Muscle Training along with conventional chest physiotherapy will help to improve pulmonary function in patients with chronic spinal cord injury.

Conflict of Interest: There was no personal or institutional conflict of interest for this study

Source of Funding: Self

Ethical Clearance: From the institute

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Invasive vs Non Invasive Treatment in Stenosing Tenosynovitis

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ABSTRACT

Background: de Quervain's tenosynovitis is an inflammation of abductor pollicis longus (APL) and extensor pollicis brevis (EPB) muscle tendon sheaths at the level of radial styloid process. Its conservative management includes nonsteroidal anti-inflammatorydrugs, wrist and thumb immobilization, ultrasonic therapy (US Th.) and low level laser therapy (LLLT). Invasive methods include local injection of steroid in tendon sheath (inj. LHC) and surgery involving release of tendon sheath.

Materials and Method: Sixty patients clinically diagnosed de Quervains tenosynovitis were included in the study and randomly assigned to two groups.The average age was 36 years (range: 21-45 years). One group was given LLLT + US Th. And other was injection LHC. The clinical criteria used were Finkelstein's test, tenderness over radial styloid (Ritchie's tenderness scale), grip strength, pain (visual analog scale [VAS]) and radiological criteria was ultrasonographic assessment of change in thickness of APL and EPB tendon sheath. They were measured before commencement and at the end of seven sessions of therapy, as per standard procedure.

Results: Improvement was seen within both groups in the following outcome measures assessed: Ritchie's tenderness scale, grip strength and VAS. Finkelstein's test was significantly improved in inj. LHC group. Ultrasonographic measurement of tendon sheath diameters, the mediolateral (ML), and anteroposterior (AP) diameters was not found to be significantly different in between the groups after treatment. On comparing both the groups, statistically significant difference was found. However, looking at the mean values, the grip strength and VAS showed better improvement in the inj LHC group as compared to the US+laser therapy group.

Keywords: *de Quervains tenosynovitis, low level lasers, ultrasonic therapy,inj LHC*

INTRODUCTION

Dequervains disease named after the Swiss surgeon Fritz de quervain,who identified first in 1895[3].It is an inflammation of the sheath or tunnel that surrounds two tendons that controls thumb.It is caused by repetitive use of the thumb in combination with radial deviation of the wrist.(pinching,wringing,lifting,grasping,gardening, knitting).

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Dequervains'tenosynovitis (inflammation of abductor pollicis longus[APL] and extensor pollicis brevis[EPB] muscle tendon sheath) is a repetitive strain injury or a cumulative trauma disorder[1].

Patient usually presents complaining of radial wrist pain with thumb movement and tenderness over the first dorsal compartment.Diagnosis is usually concluded by a positive Finkelstein's test ,as well as the presense of tender nodule over radial styloid. Finkelstien's test was first described in 1930 and has recently been described as being performed in four stages:first with the application of gravity assisted gentle active ulnar deviation at a wrist,then the patient actively deviates the wrist in an ulnar direction,then further passive ulnar deviation by the examiner and in the final stage the examiner

passively flexes the thumb into the palm.The reliability ,specificity,sensitivity has not being reported,but it was claimed that staged method of testing may be more accurate with higher sensitivity and specificity.Other tests are indicative of this condition including a decrease in pinch and thumb strength measurenments on the symptomatic site.

It is commonly managed nonoperatively by non–steroidal anti-inflammatory drugs,wrist and thumb immobilization,ultrasonic therapy and low level laser thearapy(LLLT)[2-4].

Ultrasound therapy is a therapeutic modality widely used for management of various soft tissue and musculoskeletal disorders. Although its mechanism of action is not clearly understood.[5-8].

Its efficacy has been questioned in the past[9].Most of the reviews and metaanalysis conducted on ultrasound therapy are lacking in specific information regarding the description of randomization methods,an ultrasound apparatus,mode of delivery,size of ultrasound head,treatment time and dropouts[9-12].

Well-designed research studies are required to justify the use of ulstrasound,especially in vivo.

Lasers have been used for photobiomodulation[13].

The available literature gives conflicting results regarding the efficacy of the modality in management of soft tissue disorders[14-17]] and lack of descriptive information,further makes analysis difficult. Although there are some recent reports on the efficacy of the intra-sheath injection of triamcinolone acetonide (TC), which is a long-acting and lyophobic steroid, for patients with snapping fingers (34).There are no comprehensive reports describing the clinical outcomes of intra-sheath injection in the treatment of de Quervain's disease. We describe the intra-sheath injection of triamcinolone in the treatment of de Quervain's disease and report on its clinical outcomes and complications. Low level laser therapy is effective in the management of the Dequervains'tenosynovitis(2). As demonstrated ultraso nographically,however,studies on comperative efficacy of Low Level laser therapy and ultrasound therapy in management of soft tissue disorders are not many[18]. This study assessed and compared the efficacy of inj LHC and ultrasound therapy + low level laser therapy in Dequervains'tenosynovitis.

MATERIAL AND METHOD

Aims and Objectives

To compare the two different modality of management i.e invasive (inj LHC i.e triamcinolone acetonide) and non invasive ultrasound therapy + low level laser therapy for De quervains' tenosynovitis.

Study designs:

60 consecutive patients attending the orthopaedics out patient department having clinically diagnosed De quervains' tenosynovitis on the basis of positive Finkels tein'stest[23],were included in this prospective study.

There were 54 females and 6 males patients.The average age was 36.6 years (range 21-45 years).

Inclusion criteria: females and males ages between 21-45 years

Exclusion criteria: cervical spondylosis with or without radiating pain,hypertension,diabetes mellitus, Carpel tunel syndrome,first CMC joint arthritis, Superficial radial neuritis ,fracture of upper extremity or any other chronic condition like rheumatoid arthritis.

An informal consent for participation in the study was taken.The study was approved by the institutional ethical committee.

Level of study:

Prospective comparative study [therapeutic];

A study in which patient group are separated non randomaly by exposure or treatment with exposure occurring after the initiation of study.

The patients included in the study were randomly divided in two groups,one group (n=30) received inj.LHC therapy and the other group(n=30) received ultrasound + low level laser therapy.

The clinical diagnosis was done by the orthopedician. A mixture of 1 ml (10mg) of triamcinilone acetonide and 1 ml of 2% lignocaine hydrochloride was injected in first dorsal compartment of involved wrist. Patients were followed for 16 weeks on monthly basis. The area of tenderness was confirmed before injection. The needle was passed in the first extensor compartment of wrist, directing proximally towards the styloid process of radius and parallel to the abductor polices longus

and extensor polices bravis tendons. Stretching of the synovial sheath by volume effect was observed. For early clinical response each patient examined two weeks after the injection, and then followed monthly for 28 weeks .Injection was given by orthopedician . Application of ultrasound and laser therapy was done by the physiotherapist. Finkelstein's test which involves grasping the patients's thumb and quickly moving the hand ulnar ward was performed.Tenderness elicited over the tip of the radial styloid process was taken as a positive test.

Tenderness or pressure over the radial styloid was graded by Ritchie's tenderness scale[25].The grades were grade-1 -tolerable pain,grade-2- patient winces on pressure and grade-3-patient winces and withdraws hand.

Grip strength[24] was measured by a standard mercury sphygmomanometer.The elbow and arm were supported on a table and the elbow flexed to 900.The cuff was then pressed in the cylindrical grasp.The elevation of the mercury column was recorded 3 times.The average of three readings was taken.

An endolaser 476 with a pencil probe (wave length 830nm,power 30-40 mw,beam diameter 40mm at 10mm from the probe,angle of divergence 2.50 . Exposure time for 2 min.Energy in joules 37/cm2 was used for treatment. The low level laser therapy was applied twice per session.Once the probe was held stationary in contact with skin at radial styloid and second time along tendon sheath. The laser probe and the part to be treated were cleaned with 70% alcohol to remove any oil and dirt from the skin surface for better penetration. Protective goggles were worn by patients and therapist. 3Mhz ultrasound generation was used for ultrasound therapy.An aqua sonic gel was used as a coupling medium. For ultrasound therapy,the pulsed mode to expose the area over radial styloid by 5ms and 5ms off. A space average intensity of 0.8w/cm2(depth of lesion 0.5 cm approximately)for a period of 3 min was delivered.

The following outcome measure were used namely Finkelstein's test,tenderness over radial styloid (Ritchie's tenderness scale),grip strength ,pain as assessed by visual analogue scale(VAS).

All the outcome measure were done before commencement and after the end of therapy.

Clinically, the improvement was assessed subjectively by the patient,using VAS(26) (0=no pain,10=severe pain).

The clinical tests were repeated after one dose of inj. LHC and after 21 days for laser+ultrasound therapy. The patients were given ultrasound therapy + low level laser therapy for 21 days.

Testing of optical output was performed regularly before and the end of treatment.

Precautions regarding avoidance of forceful movements of the thumb were explained to the patients.

DISCUSSION

30 cases of De Quervains tenosynovitis were treated by inj LHC and 30 cases with ultrasound + low level laser therapy.The purpose of the our study was to compare the effectiveness between invasive procedure and the non invasive ultrasound + low level laser therapy in De quervains tenosynovitis.

De quervains tenosynovitis is more commonly seen in perimenopausal women and women of childbearing age and hence the age range taken that is 20–45 years. Women are seen to have a significantly higher rate of occurance of De quervains tenosynovitis as compared to men.There were only 6 male patients in this study.

Faithful and Lamb observed that the nondominant hand is generally more affected.

Mardiman S, Wessel J, Fisher B observed that ultrasound therapy and Low level laser therapy cause a decrease in pain,decrease in Ritchie's tenderness scale and VAS scale improvement in all the patients and was found to be statistically significant.

Finkelstein's test is the classic diagnostic test for De quervain's disease. Finkelstein hypothesized that entrapment of the extensor pollicis brevis (EPB) and abductor pollicis longus (APL) tendons into the first extensor compartment was responsible for the pain over the radial styloid.we had also used this test as a clinical parameter for diagnosing the De quervains' tenosynovitis.

In our study, both inj LHC group and Low level laser therapy + ultrasound therapy showed an improvement in De quervains tenosynovitis. The inj LHC therapy group showed marked better improvement as compared to

ultrasound + Low level laser therapy but with more complications like local cellulitis occurring in 3 patients ,2 patients developed hypopigmentation at injection site, 1 patient had tendon rupture and required surgical intervention and 6 patients required repeated dose of local injection.

RESULTS

Of the sixty patients taken up for the study, the left side was involved in 34 (59%), and the right side (dominant extremity) was involved only in 26 patients. Bilateral involvement was seen in two patients. However only the more affected extremity was included in the study.

Finkelstein's test conducted before and after treatment was statistically significant in both the groups, that is, Inj LHC and ultrasound+low level laser therapy .

Grip strength was found significantly improved in the inj LHC (P = 0.003) and low level laser therapy group (P = 0.005). Grip strength for both the groups, before and after the treatment values were significantly different from each other and between the groups.

Visual analog scale when compared between groups, the change was found statistically significant between the groups and was found insignificant within the group.

Looking at the mean values, the grip strength and VAS showed marked better improvement in the injection LHC group as compared to the ultrasound+low level laser therapy group. The results imply that inj LHC therapy is more effective than low level laser therapy but has a more complications rate as well. In our study, 65% of patients were symptom free two weeks after intervention, 80% after four weeks and 95% were free of symptoms at six weeks after intervention and 99% by the end of 12 weeks. There were no recurrences at 24 weeks. This shows that the effect of local steroid may persist for 4 to 6 weeks. It is believed that anti-inflammatory effects of this drug persist for two to four weeks.[4]The adverse events in our study were seen in 10 out of thirty (33%) of patients. out of these 8 patients recovered from transient pain at injection site within 10 days. In Remaining 3 patients with skin de pigmentation (2 patients) and atrophy of subcutaneous fat (1 patients) .The changes reversed in 20 weeks' time. Steroid injections may have adverse side effects e.g. pain at the injection site and skin hypo pigmentation. These effects are transient. It is recommended that before starting the treatment the patients should be informed about these side effects.[5,6]

Table 1: Age, Distribution of sex and extremity involved

Demographic data	**Inj LHC(n=30)**	**Ultrasound + Low level laser therapy (n=30)**		
Extremity involved(right/ left)	14/16	10/20		
Sex(female/male)	28/2	26/4		
	Mean SD	Mean SD	P(Mann-whitney U-test)	Significance
Age	34.4 6.20	36.4 7.5	0.521	Not significant

Table 2: Grip strength

Grip strength	**Inj LHC(n=30)**	**USG+Low level laser (n=30)**	**P(Mann-whitney U-test)**	**Significance**
	Mean SD	Mean SD		
Before treatment	113.60 49.58	111.15 42.40	0.830	Not significant
After treatment	196.32 69.78	136.40 49.45	0.384	Significant
P(sign-test)	0.006	0.002		
Significance	Significant	Significant		

Table 3: VAS for pain

VAS Scale	Inj LHC(n=30)		Ultrasound+Low level laser therapy (n=30)		P(Mann-whitney U-test)	Significance
	Mean	SD	Mean	SD		
Before treatment	9.10	1.35	8.75	1.55	0.560	Not significant
After treatment	4.41	3.00	4.20	3.44	0.324	Significant
P(sign-test)	0.001		0.0015			
Significance	Significant		Significant			

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Comparison of Cardio Respiratory Responses and Level of Exertion Following Two Common Tests for Arm Exercise Capacity in Patients with COPD

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ABSTRACT

Unsupported arm exercise capacity has been measured in various ways. Commonly used unsupported arm exercise tests include the 'six minute peg board ring test' (PBRT) and 'unsupported upper limb exercise test' (UULEX). It is unknown whether these tests elicit comparable cardio-respiratory responses and level of exertion in patients with chronic obstructive pulmonary disease (COPD).The study aimed to evaluate whether the tests result in comparable or different cardio-respiratory responses and arm fatigue in patients with COPD. Twenty-five patients with COPD randomly performed the PBRT and UULEX with a rest of thirty minutes between two tests. Systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate (HR) and respiratory rate (RR) were measured before and after each test. Immediately after each test, participants rated their perceived rate of exertion for arm fatigue and sensation of dyspnoea using modified Borg scale. Statistical analysis included repeated-measures analysis of variance and post-hoc Duncan tests. The increase in cardiac variables was not different between the two tests (SBP: p=0.917; DBP: p=0.588 and HR: p=0.764). Dyspnoea ratings and level of exertion were larger following UULEX compared to PBRT (p=0.006 and p=0.026, respectively). The cardiac responses after both tests were comparable, but respiratory responses (RR and dyspnoea) and arm fatigue were triggered more easily with UULEX. Although future studies on larger samples are recommended, findings of this study should be taken into consideration when selecting tests for arm capacity in patients with COPD.PBRT and UULEX result comparable cardiac responses, but different respiratory responses and arm fatigue.

Keywords: *Chronic obstructive pulmonary disease, upper limb fatigue, unsupported arm exercise test*

INTRODUCTION

Patients with moderate to severe COPD often develop dyspnoea when using their arms during activities of daily living (ADL)[1]. The progressive deconditioning associated with inactivity initiates a vicious cycle in which dyspnoea occurs at progressively lower physical demands[2]. With time, patients adopt irregular, shallow and rapid breathing patterns while performing simple low-intensity tasks [3].

Common unsupported arm exercise tests include: maximum number of dowels arm lifts in 1 minute [4], incremental unsupported upper limb exercise [5], number of rings moved vertically in 6 minutes [6], PBRT (Six minute peg board ring test), UULEX (Unsupported upper limb exercise test) or with a upper arm exercise electromechanical device[7, 8].

A study done by Janaudis-Ferreira *et al* , revealed that arm ergometry may be best for measuring peak arm exercise capacity and endurance during supported

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exercises, while the UULEX, 6PBRT, and GST may better reflect ADLs and should be the tests of choice to measure peak unsupported arm exercise capacity and arm function[9].

UULEX is reproducible, inexpensive, and acceptable to patients with COPD and does not require a large amount of space. UULEX mimics unsupported movement of upper limbs required in ADL and is simple to administer[5]. PBRT is a valid and reliable test to measure arm functional capacity in patients with COPD. It is cost effective and simple to perform[4].

Both tests measure arm function in patients with COPD. Although the responsiveness and interpretability of the UULEX or 6PBRT have not been specifically studied, both tests demonstrate aspects of validity and reliability, require simple equipment, and reflect ADLs that involve arm elevations [9].As UULEX and 6PBRT both are tests, which require unsupported upper limb activity; it will be taxing on the cardio-respiratory system. There is a paucity of studies until now which determines and compares cardio-respiratory responses during UULEX and PBRT. In addition, there are no studies which determine which of the above tests induce more arm fatigue.

The aim of the study was to determine which test induces more arm fatigue and evokes more cardio-respiratory responses among patients with COPD.

METHOD

Participants

The study included 30 male subjects with COPD volunteered to participate in this study. However, two subjects withdrew from the study as they could not perform the second test due to fatigue, and three were excluded from the study after performing the first test as they developed clinically significant dyspnea during the test. The remaining 25 subjects performed both the test and they terminated the test due to fatigue.

Twenty-fivepatients with COPD, mean age (SD): 59.6 **(**9.1**)** and FEV_1 % of predicted value (SD): 62.52 (8.2) were recruited from two government hospitals and one private clinics. Patients were clinically stable at time of their participation in the study. Each patient underwent a formal evaluation including Pulmonary Function Test (PFT) prior to the study. PFT was performed as per the standards outlined by the American Thoracic Society[10].

The patients aged between 45- 75 years of age and diagnosed with COPD (with FEV1 45-75% of predicted value) were selected. The patients were excluded if they had performed either UULEX or PBRT previously or performed any upper limb exercise in preceding one month. Patients with unstable cardiac conditions, upper limb musculoskeletal disability preventing exercises, cor-pulmonale, respiratory muscle fatigue, hearing and visual impairments, acute illness and acute exacerbation during the period of study were excluded from the study. The institution's ethics committee approved the study and all participants provided informed consent prior to participating in the study.

Before the tests, heart rate (HR)[11], blood pressure (BP)[11], respiratory rate RR[11], Borg scale for rate of perceived exertion for fatigue and breathlessness[12] was measured. Patients performed the PBRT and UULEX in random order with a rest of thirty minutes between the two tests. A 30-minute resting interval was given between the PBRT and UULEX to avoid potential fatigue. Test was terminated if patients reported severe fatigue or breathlessness.

For PBRT, the participants sat in front of a board with two lower (positioned at shoulder level) and two higher pegs (at 20 cm above shoulders) and asked to move as many rings as possible in 6 min. Ten rings (0.34 kg per ring) were put on each of the two lower pegs. Patients were instructed to use both hands simultaneously to move one ring at a time from each of the lower pegs to upper pegs, and vice versa. Patients were permitted to stop and rest during the test if they feel severe dyspnoea, fatigue, or other discomfort, and continue moving the pegs as soon as they can.

For UULEX, participants sat in front of an eight-level chart and raised a 0.2kg bar at a constant cadence (30beats/min). The test begins with a 2-minute warm-up, during which the patients extends their arms simultaneously, lifting bar from a neutral position to the first level. After the warm-up, the vertical amplitude of the lift increases by 0.15 m every minute as the patient progresses through the stages of the test. Once the participant reached the highest level, the weight of the bar was increased by 0.5 kg each minute to a maximum of 2 kg. The patient continued the test as long as possible until the subject feels breathless [5].

After both the tests, HR[12], BP[11] and RR[11] were

measured and the patient rated the local muscle fatigue according to perceived exertion for local (arm) muscle using the modified Borg 0-10 scale[12]. In addition, the patients were asked to rate their sensation of dyspnoea using the Borg 0-10 scale[12].

Data analysis

Repeated measures analysis of variance was used to evaluate pre-test and post-test outcome variables. Post-Hoc Duncan test was used to find out the significant difference among variables. Pearson's correlation test was used to find out relationship of variables (HR, BP and RR). Spearman rank order correlation test was done to find out the relationship of variables (Modified Borg Scale 0-10 for dyspnoea and fatigue). Statistical analysis was performed by using Stastistica 64, version 10. Alpha value was set as 0.05.

RESULTS

The mean age was 59.6 years (9.1) and mean forced expiratory volume in one second (FEV1) was 62.5 (8.2). The outcome variables are summarized in Table 1.

Cardiac responses:

Both the PBRT and UULEX resulted in a significant increase in cardiac variables (HR:p≤0.001; SBP: p≤0.001; DBP: p≤0.001). The increase in cardiac variables was not different between the two tests (SBP: p=0.917, DBP: p=0.588and HR: p=0.764). There was significant correlation between the two tests for all cardiac variables (SBP: r = 0.802, p≤ 0.01, DBP: r = 0.701, p≤ 0.01; and HR: r = 0.651, p≤ 0.01). (Figure 1 and Figure 2)

Dyspnoea rating and respiratory rate:

There was a significant increase in respiratory variables (RR: p ≤0.001) and dyspnoea ratings (p≤ 0.001) after both tests. Compared with the changes observed after PBRT, the magnitude of change was greater after UULEX, RR: p ≤0.002 and dyspnoea ratings: p≤0.0006. There was a strong and significant correlation between the two tests for both respiratory variables (RR: r = 0.772, p≤ 0.01, dyspnoea ratings : r = 0.794, p≤ 0.01). (Figure 1 and Figure 2)

Perceived rate of exertion ratings:

A significant increase in Perceived rate of exertion ratings (p ≤0.001) was observed after each test. PRE ratings for exertion showed greater changes after UULEX than PBRT (p≤0.026). Significant correlation was found between the two tests for PRE ratings(r = 0.599, p≤ 0.02) was found. (Figure 1 and Figure 2)

DISCUSSION

There is no significant difference in increase in heart rate and blood pressure after UULEX and PBRT. Both UULEX and PBRT require the patient to elevate the arms in similar manner repetitively. But UULEX requires arm elevation to different heights while PBRT requires arm elevation at two different levels. The blood pressure responses after 3 different arm positions were not varying in patients with COPD [13].

UULEX test had showed significantly higher respiratory responses, which may be due to the factors such as increasing weights in UULEX, more concentration required by the patients, wider amplitude of shoulder movements and warm up time in UULEX as compared to PBRT. Some studies have demonstrated that the activities that maintain the arms elevated and unsupported produce a sensation of dyspnoea and thoraco-abdominal dyssynchrony[14], an increase in oxygen consumption (VO_2)and minute ventilation(VE)[15] and an increase in carbon di-oxide elimination(VCO_2), respiratory rate, and HR[16].

At rest, the diaphragm is dominant active inspiratory muscle[14]. But during unsupported arm elevation, some of the upper torso muscles become involved in arm positioning and their participation in ventilation is decreased, there is a shift of ventilatory work to diaphragm. Also, arm elevation results in increased diaphragmatic work to meet ventilatory demand[15].

Velloso *et al* observed that there was significantly higher respiratory response in activities such as lifting the pots of various weights to above the head using both the arms in comparison to activities like erasing blackboard and fixing the bulb[17]. Similarly, UULEX also requires a person to lift PVC pipes of increasing weights, which is similar to the activity, studied by Velloso *et al*. Whereas during PBRT, the subject is only required to lift light weighted rings for a number of times.

In this study, the dyspnea ratings after UULEX are also significantly higher as compared to after PBRT. UULEX requires a great deal of physical effort by the patients as the patient has to lift the PVC pipes

for a number of times at different levels at the beat of metronome. Velloso *et al* had found that any activity such as lifting pots which requires a great deal of physical effort by the patients and also involve the wide amplitude of upper limb movement particularly shoulders, induce a higher perception of breathlessness[17].

Tangri and Wolff concluded that activities requiring a higher level of concentration lead patients with COPD to engage in short periods of apnea during these activities and produces a sense of dyspnea[2]. As compared to PBRT, which only requires the subject to place the rings at his own pace, the UULEX test is cumbersome for the patient and requires more concentration to lift pipes to beat of metronome.

The patients were given a warm up period of 2 minutes before the UULEX test. But, in PBRT, they were not given any warm up period. Only a practice movement was given. Thus, the patients may have been more stressed before the commencement of UULEX as compared to PBRT. This may have led to higher respiratory responses and perceived inpatients after UULEX.

The Perceived rate of exertion rated by the patients after PBRT and UULEX showed significant differences. In UULEX, the person was required to perform the task according to the beat of metronome, which allowed no rest in between. But in PBRT test, the person can perform the task at his own pace and is allowed to take rest within the 6 minute time period. Hence, UULEX induced higher PRE for arm fatigue.

The limitation of the study was that participants were only males. But, patients with all severity of COPD were included, so there is no reason to assume that it might have affected the result of the study.

CONCLUSION

The cardiac responses after both tests were comparable, but respiratory responses (RR and dyspnae) and arm fatigue were triggered more easily with UULEX. The findings of this study should be taken into consideration when selecting tests for arm capacity in patients with COPD. PBRT and UULEX result in comparable cardiac responses, but different respiratory responses and arm fatigue.

Table 1. Baseline data, pre and post outcome variables

Variables	Baseline Mean (SD)	Post PBRT Mean (SD)	Post UULEX Mean (SD)
SBP	137.8 (4.6)	156.7 (6.2)	156.8 (6.5)
DBP	83.7 (2.8)	86.5 (3.7)	86.8 (3.9)
HR	81.8 (7.5)	98.1 (6.3)	97.7 (7.1)
RR	15.9 (1.3)	21.2 (2.0)	22.5 (2.1)
PRE	0	6.3 (1.2)	6.8 (1.1)
Dyspnea	0	6.4(1.5)	7.2 (1.2)

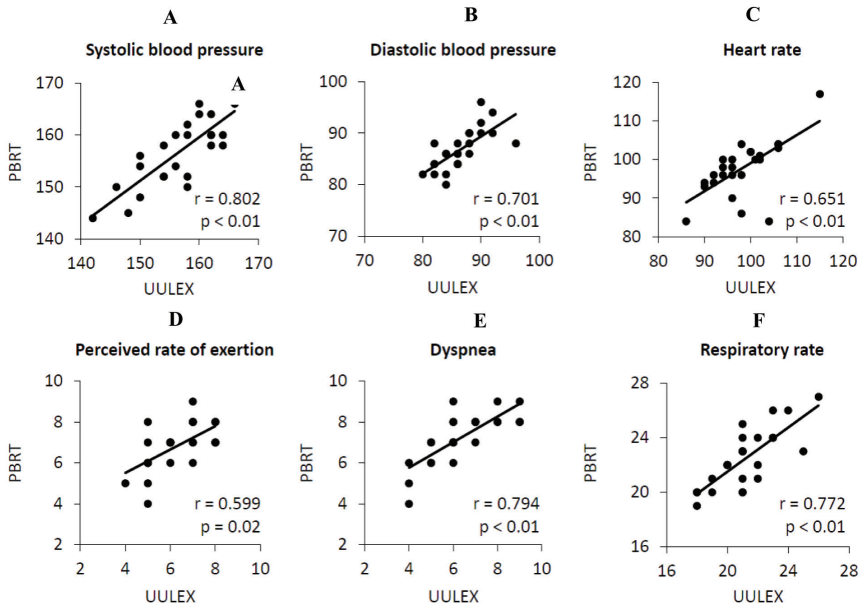

Figure 1: There was significant correlation between the two tests for all cardiac variables (SBP: r = 0.802, p≤ 0.01, DBP: r = 0.701, p≤ 0.01; and HR: r = 0.651, p≤ 0.01) (see fig 1 (A, B, C)), using Pearson's correlation test. There was significant correlation between the two tests for both respiratory variables (RR: r = 0.772, p≤ 0.01, dyspnea ratings : r = 0.794, p≤ 0.01) and PRE ratings(r = 0.599, p≤ 0.02) (see fig 1 (D, E, F)).

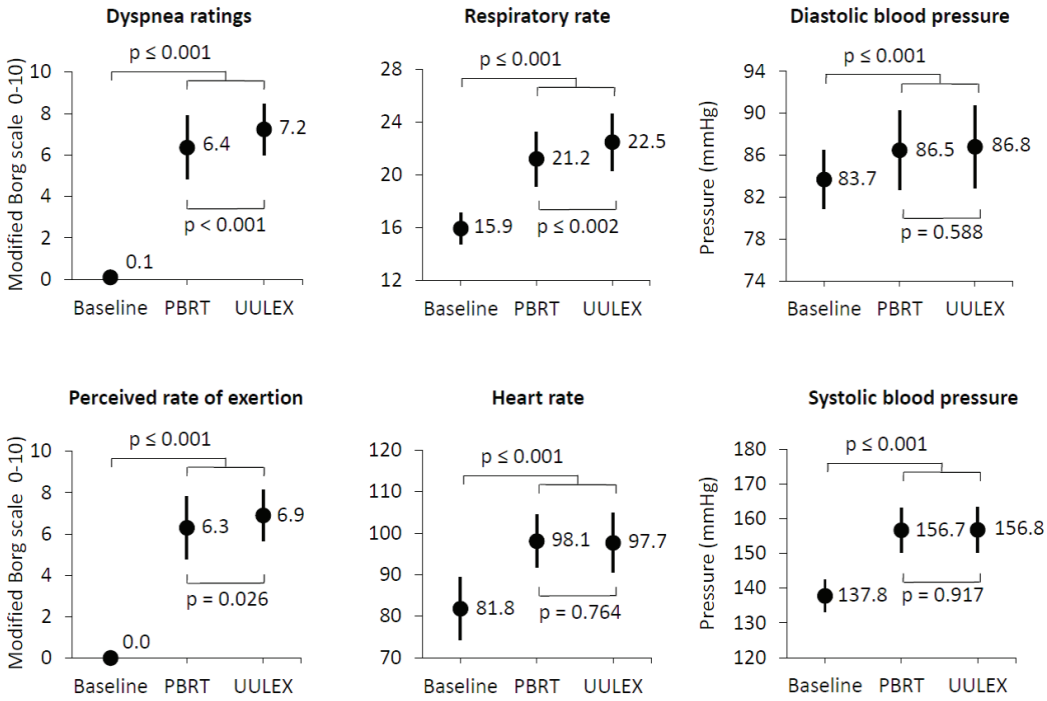

Figure 2: Difference between baseline, pre-test and post- test outcome variables by using repeated measures analysis andPost-Hoc Duncan test.Both the tests resulted in a significant increase in cardiac variables from baseline (HR:p≤0.001; SBP: p≤0.001; DBP: p≤0.001), but between UULEX and PBRT, the post- test variables were not significantly different,(SBP: p=0.917, DBP: p=0.588and HR: p=0.764)(see fig 2 (C,E,F)).There was a significant increase in respiratory variables (RR: p ≤0.001) and dyspnoea ratings (p≤ 0.001) after both tests and significant difference between post-test respiratory variables (RR: p ≤0.002 and dyspnea ratings: p≤0.0006)(see fig 2(A,B)).A significant increase in Perceived rate of exertion ratings (p ≤0.001) was observed after each test. PRE ratings for exertion showed significant changes after UULEX than PBRT (p≤0.026) (see fig 2(D)).

Source of Funding- Self

Conflict of Interest - Nil

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Prevalence of Anterior Knee Pain in Marathon Runners

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ABSTRACT

Background/purpose: Anterior knee pain (AKP) is a pain arising from the patellofemoral joint itself specifically called Patellofemoral Pain Syndrome (PFPS), it is a common problem among runners.[5] Therefore, the name implies, runner's knee. Running was, and continues to be, the sport of choice for many, because of its convenience, health benefits & economical nature.[5] Over the last 10–15 years, there has been a dramatic increase in popularity of running marathons.[4] However, the potential for running injuries has increased. Many believe that running injuries result from a combination of extrinsic factors (training errors, old shoes, running surface) & intrinsic factors (poor flexibility, malalignment, previous injury, running experience).[5] Thus the most affected joint is the knee joint & the most common overuse injury is the Patellofemoral Pain Syndrome (PFPS).[5] Medical diagnosis of AKP has historically included many different conditions. Perhaps a functional diagnosis as offered by the AKPQ would be better than a medical diagnosis when treating patients with AKP.[1] Therefore, outcome tools such as the AKPQ, reported validity (v=0.92) & reliability (r=0.92) [1, 2] may be better suited to document symptoms & chart progress in patients during their rehabilitation.[1] The purpose of this study is, to estimate the prevalence of Anterior Knee Pain (AKP) in Marathon runners. And other objectives were, to review the most affected component of the questionnaire and to estimate age wise prevalence of Anterior Knee Pain (AKP).

Method: Total 100, male (n=48) and female (n=52) Marathon runners within the age group of 15-30 years old participated in this study, they were surveyed for Anterior Knee Pain & functional disability using Anterior Knee Pain Questionnaire (AKPS) called Kujala scale. After that a total score was calculated of each subject. A cut-off of 83 on the Kujala scale was chosen to identify those individuals with Anterior Knee Pain (AKP).[1]

Result: 68% in the given population were positive for AKPQ and 32% were negative. Most affected component of the questionnaire was Pain on Prolonged Sitting affecting 51%. 46% had painful walking for > 2 km. 29% had pain on running for > 2 km, 22% had severe pain & 14% were unable to run. And the least affected component were Atrophy of Thigh muscles & Flexion Deformity where 82% had no flexion deformity. In addition, injuries occurred with a higher frequency in age group of 23 to 25 years with (mean age=23 years old).

Conclusion: There is 68% Prevalence of Anterior Knee Pain (AKP) in Marathon runners in the age group of 15 to 30 years.

Keywords: *anterior knee pain, marathon runners, anterior knee pain questionnaire, kujala scale, prevalence.*

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INTRODUCTION

Anterior knee pain (AKP) is a pain arising from the patellofemoral joint itself specifically called Patellofemoral Pain Syndrome (PFPS). AKP or PFPS has been described as a common diagnosis among

young, active individuals.[1] The terms AKP and PFPS are often used synonymously to describe this syndrome, characterized by knee pain ranging from severe to mild discomfort seemingly originating from the contact of the posterior surface of the patella with the femur, that includes pain in the anterior part of the knee. PFPS is a common problem among runners.[5] Therefore, the name implies, runner's knee. However, it may take place in athletes that are involved in activities requiring frequent knee bending, such as jumping, biking and even walking.

Running was, and continues to be, the sport of choice for many, because of its convenience, health benefits & economical nature.[5] Over the last 10–15 years, there has been a dramatic increase in popularity of running marathons.[4] However, the potential for running injuries has increased. Many believe that running injuries result from a combination of extrinsic (training errors, old shoes, running surface) & intrinsic factors (poor flexibility, malalignment, previous injury, running experience).[5] Thus the most affected joint is the knee joint & the most common overuse injury is the PFPS.[5] Many etiological factors have been linked to AKP. These factors can be broadly grouped under the following: Muscular, Structural & Training Faults. Amongst these faults, researches have shown that the combination of these factors have the highest co-relation in predicting the development of AKP.

Diagnosis of AKP is usually determined by the patient's report of symptoms, rather than any combination of clinical or functional tests.[1]

Therefore, Signs & symptoms are as follows, onset of this condition is usually gradual. Most common symptom is diffuse peripatellar pain (vague pain around the kneecap) & localized retropatellar pain (pain focused behind the kneecap). Affected individuals typically have difficulty describing the location of the pain, & may place their hands over anterior patella or describe a circle around the patella (the "circle sign"). Pain is usually initiated when load is put on knee extensor mechanism, e.g. ascending or descending stairs or slopes, squatting, kneeling, cycling, running or prolonged sitting with flexed knees. Latter feature is sometimes termed the "movie sign" or "theatre sign" because individuals might experience pain while sitting to watch a film or similar activity. Pain is typically aching with occasional sharp pains. You may also experience occasional knee buckling, in which the knee suddenly & unexpectedly gives way & does not support your body weight. It is also common to have a catching, or grinding sensation & some cracking sounds when you are walking or when you are moving your knee especially bending. Presence of tenderness in the inner border of the patella. In some cases, any sort of activity leads to development of swelling. In chronic cases of PFPS, there is presence of quadriceps muscle atrophy.

Medical diagnosis of AKP has historically included many different conditions. Perhaps a functional diagnosis as offered by the AKPQ would be better than a medical diagnosis when treating patients with AKP.[1] Several authors have found little to no validity for the common clinical tools used to assess individuals with AKP.[1] Furthermore, the diagnosis is usually made by ruling out other conditions.[1] Therefore, outcome tools such as the AKPQ may be better suited to document symptoms & chart progress in patients during their rehabilitation.[1]

AKPQ was used as the functional outcome tool & it was chosen because the reported validity (v=0.92) & reliability (r=0.92) for the test were deemed adequate.[1, 2] However, it is easy to administer & subjects have reported that it was easy to complete.[1]

And as a greater percentage of the population now participates in running in Marathons. It is better to understand the current scope of the most common knee injuries that is PFPS that runners encounter.

MATERIAL AND METHOD

1. STUDY DESIGN

TYPE OF STUDY: Observational study.

MATERIAL USED FOR STUDY: AKP questionnaire (Kujala scale).

DURATION OF STUDY: 6 Months.

LOCATION: Parks and jogging tracks of metropolitan city.

2. SAMPLING DESIGN

SAMPLING METHOD: Convenient sampling.

SAMPLE POPULATION: Marathon runners.

SAMPLE SIZE: 100.

3. SELECTION CRITERIA

INCLUSION CRITERIA:

- Runners willing to participate in the study.
- Individuals participating in Marathon running on regular bases for past 6 months & more.
- Age group of 15-30 years.[1, 5]
- Both males and females.
- Running a minimum of 40 miles/week that comes to 9 km/day.[4]

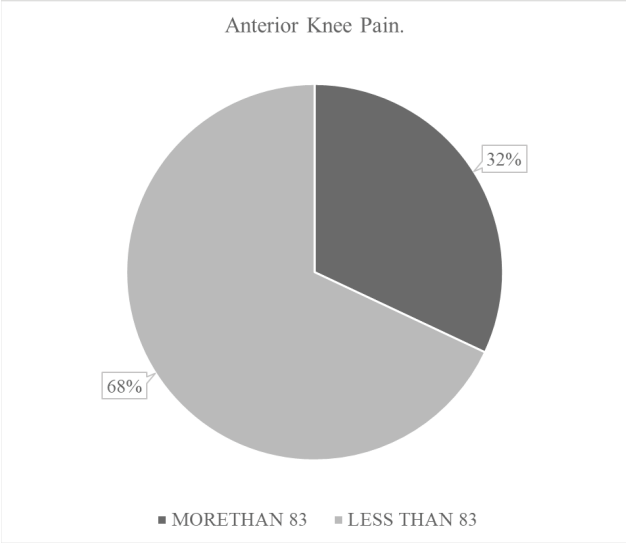
EXCLUSION CRITERIA:

- Ligament injury.
- Meniscal tear.
- Bursitis.
- Any past Fractures.
- Any past knee surgery.
- Iliotibial band friction syndrome.
- Patellar tendinitis/ Jumpers knee.
- Osteoarthritis in the knee.
- Rheumatoid arthritis.
- Popliteal Cyst (Baker's Cyst).
- Referred pain from the hip joint & from lumbar spine.

PROCEDURE

Total of 100, males (n=48) & females (n=52) Marathon runners within the age group of 15-30 years were surveyed for Anterior Knee Pain using Anterior Knee Pain Questionnaire (AKPS) called Kujala scale. Before handling the questionnaire, each subject had been given detailed information about the purpose of study. Consent was taken in the language best understood by them. Various sections and optional answers given in the questionnaire will be translated in the language understood by subjects, they have to mark one box in each section in which the score is rated. They then completed the AKPQ called Kujala scale, based on their current symptoms & functional abilities. After that a total score was calculated of each subject. A cut-off of 83 on the Kujala scale was chosen to identify those individuals with AKP.[1] Number of subjects who were considered to be positive for AKP as determined by the Kujala scale were counted.

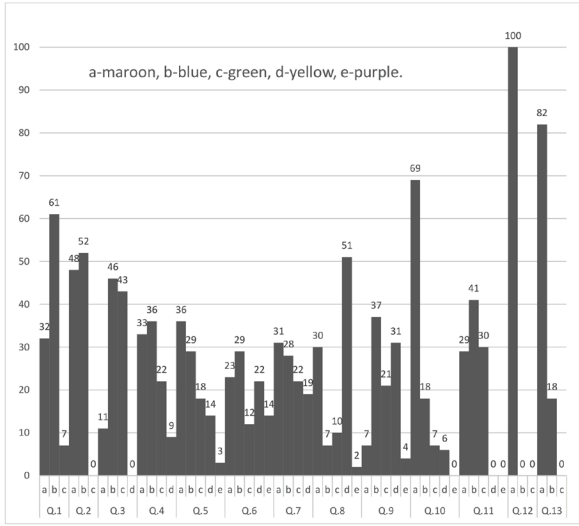
FINDINGS



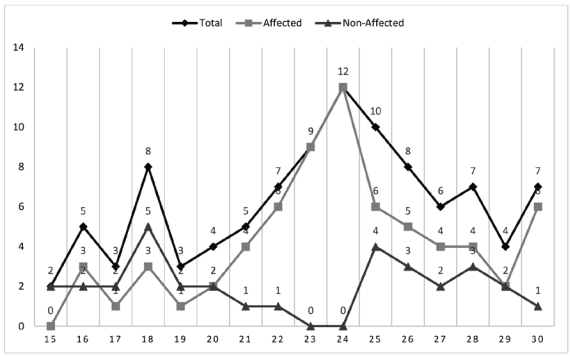
GRAPH-1 Shows Prevalence of Anterior Knee Pain (AKP) in the given population.

RESULTS: Pie diagram shows that 68% of individuals have Anterior Knee Pain & 32% of individuals do not have Anterior Knee Pain.

GRAPH-2 Shows number of individuals in the given population, affected by each component in the questionnaire.



RESULTS: Above data states that the most affected component of the questionnaire is Pain on Prolonged Sitting and the least affected component are Atrophy of the Thigh muscles and Flexion Deformity.



GRAPH-3 Age wise Prevalence of Anterior Knee Pain (AKP) from the total sample size into Affected and Non-Affected ones.

RESULTS: Above data states that, there is highest Prevalence of AKP in the age group of 22-25 years.

DISSCUSION

Graph 1 showed 68% in the given population had AKP among Marathon runners. Factors that have been linked to AKP are Muscular, Structural & Training Faults. Running injuries results from a combination of these extrinsic (training errors–training on hard surfaces, old shoes or premature change of footwear) & intrinsic factors (poor flexibility, malalignment, patellar disorientation, previous injury, running experience).[5] One of the main causes of PFPS is the patellar orientation & alignment. When the patella has a different orientation, it may glide more to one side of the femur & thus can cause overuse/overload (overpressure) on that part of the femur which can result in pain, discomfort or irritation. A study has shown that patients with PFPS displayed weaker hip abductor muscles that were associated with an increase in hip adduction during running (muscular imbalance). This alters the pressures under the surface of the patella, causing a premature wearing out of the cartilage & increasing the risk of degeneration & pain.

Graph 2 shows, the most affected component of all was Q.8 Pain on Prolonged Sitting option d, which states, Pain forces them to extend their knees temporarily, affecting 51% of the given population showcasing classical "movie theatre sign". Sitting for prolonged period of time, increases compressive forces on the knee joint, by extending knees, it minimizes the forces acting on knee joint providing relief.[10]

2nd most affected component was Q.9 Pain, with 37% had slight pain occasionally, 31% states their pain gets occasionally severe & 21% had pain interfering their sleep, abnormal position of the patella increases undue stresses on the cartilage & irritates the surrounding structures leading to pain & discomfort.

61% were with slight limping, it is usually initiated when load is put on the knee extensor mechanism causing forces on knee joint to increase, it suddenly & unexpectedly gives way & does not support your body weight.[10]

52% had painful weight bearing support, a study says gliding of the patella in PFPS in standing position had significantly increased lateral translation (maltracking), lateral patellar spin & a tendency towards increased lateral tilt compared to healthy subjects,[7] causing instability of knee joint.[10]

46% had painful walking for > 2 km, patellofemoral joint reaction forces can become very high during routine daily activities. During the stance phase of walking, when peak knee flexion is only approximately 20 degrees, the patellofemoral compressive force is approximately 25%-50% of body weight.[10] Also, due to lack of pronation of rear foot on heel strike increasing the strain that the knee undergoes due to lack of absorption of the ground reaction force.[7] Also athletes with pes cavus or high arch foot type have a smaller surface area of contact thus increasing the ground reaction force.

41% had abnormal painful kneecap patellar movements occasionally in sports activities & 30% had in daily activities, due to the damaged cartilage beneath the kneecap causing friction & pain.

36% were suffering from slight pain when descending stairs & 22% had pain on both ascending & descending, as load is put on knee extensor mechanism on stair climbing causing pain. Also, an imbalance in the activation of the muscles where vastus lateralis was earlier activated than vastus medialis obliquus when patients climbed downstairs & upstairs.[7]

29% had pain on running for > 2 km, 22% had severe pain & 14% were unable to run due to lack of strength, muscular imbalance of quadriceps correlates with an increased impact on the knee during a run causing biomechanical abnormality that may lead to patellar deviation & also provoke PFPS. With greater knee flexion & greater quadriceps activity, as during running, patellofemoral compressive forces have been estimated, to reach between 5-6 times body weight.[10]

Least affected component was Q.12 Atrophy of thigh muscles, where no individuals had atrophy of thigh muscles as its present only in severe & chronic cases of AKP, where severe weakness of quadriceps is present & is the causative factor for PFPS, & in the population of this study there were no chronic cases.

2nd least affected component was Q.13 Flexion deformity where 82% had no flexion deformity, but 18% had a slight flexion deformity that is due to tight hamstrings because of lack of stretching or passive insufficiency.[7]

69% had no swelling & 18% had swelling on severe exertion, this sign may or may not be present due to inflammatory reactions.[10]

36% had no difficulty in squatting whereas 29% had repeated squat painful, maltracking of the patella plays a key role for e.g. patients with a PFPS squat with increased lateralization & increased lateral tilt of the patella & also a hypermobile patella had a significant correlation with the incidence of patellofemoral pain.[7]

31% had no difficulty in jumping whereas 28% had difficulty in jumping, pain on jumping is mainly caused due patellar tendonitis (Jumpers knee) because the forces acting on quadriceps extensor mechanism which causes the stress on patellar tendon. In PFPS there is decreased strength of hip abduction, external rotation & extension muscles. It is found that decreased strength of muscles gluteus medius & gluteus maximus is related to increased knee valgus after landing a drop jump.[7]

Graph 3, showed Age wise Prevalence of AKP in the age group of 15-30 years (Mean age=23 years) stating, with increasing age there is increase in the prevalence of AKP up to the age of 25 years, maximum at 24 years old, after the age of 25, the rate of prevalence of AKP gradually declines. As, runners of higher calibre have more running experience & a greater ability to "listen to the language of their body", which are thought to contribute negatively to the incidence of running related injuries.[5] In addition, certain people may have developed an anatomical adaptation to running & thus may be able to avoid overuse injuries to a larger extent.

The most common overuse running injury 20 years ago was patellofemoral pain & this is still the case today.[5]

CONCLUSION

This study concluded that there is 68% Prevalence of Anterior Knee Pain (AKP) in Marathon runners in the age group of 15 to 30 years in 100 samples. The most affected component of the questionnaire was Pain on Prolonged Sitting and the least affected component were Atrophy of the Thigh muscles and Flexion Deformity. In addition, injuries occurred with a higher frequency in age group of 22 to 25 years.

Conflict of Interest: None.

Source of Funding: Self.

Ethical Clearance: Obtained by DPO'S NETT college of Physiotherapy.

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To Compare the Effectiveness of Tendo-achilles and Plantar Fascia Stretching with Ultrasound with Planta Fascia Stretching and Ultrasound in Plantar Fasciitis

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ABSTRACT

Objectives: This study was done to compare the effectiveness of group receiving combination of plantar fascia stretching, tendoAchilles stretching and ultrasound with group receiving plantar fascia stretching and ultrasound alone in plantar fasciitis.

Design: An Experimental study.

Method: Thirty participants with the clinical diagnosis of plantar fasciitis were randomly allocated in two groups. Group 'A' received plantar fascia stretching, tendoAchilles stretching and ultrasound and Group 'B' plantar fascia stretching and ultrasound. The outcome was assessed in terms of Visual Analogue Scale, Foot Function Index and Range of Motion of Ankle.

Results: When VAS, FFI and Dorsiflexion ROM mean scores for within the groups and between the groups was analyzed, there was statistical significant difference for within the groups and there was no statistical significant difference between the groups.

Conclusion: There was no significant difference in comparison of the effectiveness of group receiving combination of plantar fascia stretching, tendoachilles stretching and ultrasound with group receiving plantar fascia stretching and ultrasound alone in plantar fasciitis on Outcome measures.

Keywords: *Plantar fasciitis, Stretching, Ultrasound therapy.*

INTRODUCTION

Plantar fasciitis is an inflammation of the plantar fascia and the perifascial structures. It is classified as a syndrome resulting from repeated trauma to the plantar fascia at its origin on the medial tubercle of the calcaneus.[1]Plantar fasciitis is estimated to account for 11 to 15 % of all foot symptoms requiring professional care among adults.[2,3] The incidence reportedly peaks in people between the ages of 40 and 60 years in general population and in younger people among runners. [3]The condition is thought to be multifactorial in origin with factors such as increased age, decreased ankle dorsiflexion due to tightness of the Achilles tendon and first metatarsophalangeal joint range of motion, obesity and excessive periods of weight-bearing activity commonly suggested to be involved. The literature attributes plantar fasciitis to faulty biomechanics such as excessive pronation. Structural deformities such as forefoot Varus may result in excessive pronation during gait. Over pronation contributes to excessive foot mobility, which can increase the level of stresses applied to the musculofascial and soft tissue elongation and increased tissue stress. [2,3,4,5]

The classic presentation of plantar fasciitis is pain on the sole of foot at the inferior region of the heel. Patient reports the pain to be particularly bad with the first step taken on rising in the morning or after an extended refrain from weight bearing activity. After few

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steps and through the course of the day, the heel pain diminishes, but returns if intense or prolonged weight bearing activity is undertaken. Initial reports of heel pain may be diffuse or migratory; with time usually focuses around the area of the medial calcaneal tuberosity. Generally, pain is most significant when weight bearing activities are involved.[6]

A wide variety of management strategies have been developed to treat the disorder. The conservative treatment approaches used in plantar fasciitis are use of heel pads, orthoses, steroid injections, night splints and extracorporeal shock wave therapy.

Various physiotherapy treatment protocols have also been advocated in the past in which Iontophoresis, Ice, Ultrasound were commonly used in the treatment of plantar fasciitis.[7] Ultrasound is a high frequency sound wave and mostly used treatment of choice with an affinity for tendons and ligaments (highly organized, without high water content).[8,9]

Stretching and strengthening programs play an important role in treatment of plantar fasciitis and can correct functional risk factors such as tightness of the gastrosoleus complex and weakness of intrinsic foot muscles. Stretching includes gastrosoleus stretching and plantar fascia stretching.[9,10]

Many studies concluded on stretching of plantar fascia and stretching of tendoAchilles alone are effective in treating plantar fasciitis**.** [8,10, 11,15,18]Although ultrasound is also proved to be effective in treating pain in plantar fasciitis**.** [8,10, 11,12,20,21] But not many studies have compared and assessed effectiveness by combination of ultrasound, tendoAchilles stretching and plantar fascia stretching on outcome measures. We conducted a study based on combination of all three treatment procedures in plantar fasciitis population to know their effectiveness.

HYPOTHESIS

NULL HYPOTHESIS (H0) – There will be no significant difference in comparison of the effectiveness of group receiving combination of plantar fascia stretching, tendo Achilles stretching and ultrasound with group receiving plantar fascia stretching and ultrasound alone in plantar fasciitis on Outcome measures.

ALTERNATE HYPOTHESIS (H1) - There will be significant difference in comparison of the effectiveness of group receiving combination of plantar fascia stretching, tendo Achilles stretching and ultrasound with group receiving plantar fascia stretching and ultrasound alone in plantar fasciitis on Outcome measures.

METHODOLOGY

Source of Data- All the subjects with plantar fasciitis, reported to Orthopedic Department who were directed to physiotherapy OPD, SDM medical college and hospital Dharwad.

Study Design- Experimental study

Sample Size- 30 subject

Duration of Studty-one year

CRITERIA FOR SAMPLING

Inclusion Criteria:

1. Subjects Age range is from 18-60 yrs.

2. Subjects with clinical diagnosis of plantar fasciitis for 4 weeks or longer.

Exclusion Criteria:

1. Subjects with clinical disorders where therapeutic ultrasound is

contraindicated.

2. Subjects with referred pain due to sciatica and other neurological disorders.

3. Subjects who received corticosteroid injection in the heel in past 3 months.

4. Old fractures, Deformities and instabilities at foot and ankle, Arthritis of ankle, Metatarsalgia.

MATERIALS

1) Ultrasound Equipment (electro son 709).

2) Universal Goniometer.

3) Ultrasonic Gel.

4) Towel.

MAIN OUTCOME MEASURES

1) Visual analog scale (VAS).

2) Foot function index (FFI) and

3) Range of motion on Goniometer.

PROCEDURE

Ethical approval for the trial was obtained from the institutional ethical Committee.

A convenient sample of 30 subjects who were diagnosed for plantar fasciitis, were selected in the study. In each group 15 subjects were allocated by concealed envelope method. Subjects who provided informed consent were randomly allocated to one of two groups: **Group A:** an intervention group receiving plantar fascia stretching and tendoAchilles stretching, with ultrasound **Group B:** a control group receiving plantar fascia stretching with ultrasound.

Both the groups received ultrasound**.** Ultrasound with output of 1W/cm^2 for 5 minutes using a pulsed mode 1:4 ratio with frequency of 1 MHZ for 10 sittings for 10 sessions were given for the both the groups.[9,20,21]

Plantar fascia stretching was given by therapist, subjects in sitting with foot placed across the opposite knee. Then therapist held one hand at the heel and one at metatarsal region and applied a stretch. [19]

TendoAchilles stretching was also carried out by the therapist, subjects in supine position. The therapist grasped the patient's heel and stretched the heel. TendoAchilles stretching was given only to Group 'A'.[19]

All subjects were given therapy for maximum ten sessions. Both the stretching exercises were given to both the groups for 10 times per session and the stretch was sustained for 30 seconds.

Self-stretching exercises for plantar fascia and tendoAchilles were given to the both the groups during their discharge to do at home.[19]

Outcome measures VAS, FFI and ROM were measured pre-and post-interventions and data thus obtained was used for statistical analysis.

DATA ANALYSIS

Statistical analysis was done by using SPSS version 16 software. The descriptive statistics were analyzed using Mean and Standard deviation for the baseline characteristics. The Wilcoxon matched paired test by rank was used to analyze the difference in visual analogue scale scoring from baseline to 10th day of treatment for both the groups. The differences in visual analogue scale scoring between the two groups were analyzed by using Mann – Whitney U test. Range of motion and foot function index values between and within the groups were analyzed using paired t test and Independent t test.

RESULTS

The mean age of Group 'A' was 52.3(8.4) and the mean age of Group 'B' was 47.6(13.7). The total Mean age between the groups was 49(11.4). The mean age of Males was 50.7(11.5) and Females was 48.1(11.6).

Table 1: Comparison of pre and post treatment VAS scores in Group 'A' and Group 'B' by Wilcoxon matched paired test by ranks

Group	Treatment	Mean	SD	Mean diff	SD diff.	% of change	Z-value	p-value
A	Pre	8.0	0.7					
	Post	3.0	0.8	5.0	1.1	62.8	3.4	0.0007*
B	Pre	8.2	0.8					
	Post	3.1	0.7	5.0	0.6	61.3	3.4	0.0007*

*Significant at 5% level of significance ($p<0.05$), SD: standard deviation

When the VAS scores were compared for within and between the groups, there was a significant difference within the groups ($p=0.0007$) and no significant difference between the groups.

Table 2: Comparison of pre and post treatment Foot Function index scores in Group 'A' and Group 'B' by paired t-test

Group	Treatment	Mean	SD	Mean diff	SD diff.	% of change	Paired t-value	p-value
A	Pre	365.8	48.4					
	Post	66.2	14.6	299.6	40.8	81.8	28.3	0.0000*
B	Pre	374.5	51.3					
	Post	59.9	15.1	314.6	47.3	84.0	25.7	0.0000*

*Significant at 5% level of significance ($p<0.05$)

When the Foot Function Index scores were compared for within and between the groups, there was a significant difference within the groups ($p=0.0000$) and no significant difference between the groups.

Table 3: Comparison of pre and post treatment Dorsiflexion scores in Group 'A' and Group 'B' by paired t-test

Group	Treatment	Mean	SD	Mean diff	SD diff.	% of change	Paired t-value	p-value
A	Pre	9.4000	1.5491					
	Post	16.1333	2.0999	-6.733	2.1865	-84.7328	-11.9272	0.0000*
B	Pre	9.4000	1.5491					
	Post	15.466	2.6690	-6.066	2.8900	-80.7416	-8.130	0.0000*

*Significant at 5% level of significance ($p<0.05$)

When the dorsiflexion range scores were compared for within and between the groups, there was a significant difference within the groups ($p=0.0000$) and no significant difference between the groups.

DISCUSSION

The purpose of this study was to evaluate the effectiveness of ultrasound, plantar fascia stretching and tendoAchilles stretching in combination as compared to ultrasound and plantar fascia stretching alone in subjects with plantar fasciitis.

Our results revealed that, there was no significant difference in comparison of the effectiveness of group receiving combination of plantar fascia stretching, tendoAchilles stretching and ultrasound with group receiving plantar fascia stretching and ultrasound alone in plantar fasciitis on outcome measures.

When the analysis was done within the groups for pre and post treatment using VAS for assessment of pain, the mean difference for Group 'A' was 5 with 62% and the Mean difference for Group 'B' was also 5 with 61%. Both the groups showed a statistical significance with a $p = 0.0007$.

The significant decrease in pain in terms of VAS for both the groups may be with the usage of therapeutic ultrasound in addition to other treatment. In a similar study performed by Hana Hronkova in 2000 the group which received therapeutic ultrasound for plantar fasciitis showed significant difference in terms of pain. Pain relief occurs due to non-thermal effects of pulsed ultrasound in the form of stimulation of histamine release from mast cells and factors related from macrophages that accelerates the normal resolution of inflammation. Therapeutic ultrasound has the potential to accelerate normal resolution of inflammation provided that the inflammatory stimulus is removed. [9,20,21] Therefore we can assume that this the mechanism behind pain relief in both the groups. When between the groups analysis was done, there was no statistical significance. This may be due to the similar values at baseline and post treatment in both the groups.

Our study analyzed Foot Function Index as a whole and the three different subscales of FFI separately between and within the groups. When the subscales

were individually analyzed between both the groups for pre and post treatment there was no significant change. When the whole of Foot Function Index scores was taken into consideration there was a significant difference within the groups but no statistical significance was found between the groups.

Previously also there were similar findings with the author DiGiovanni. He had used only the first few items of the pain subscale of the FFI as primary outcome measure. He mentioned in his study that routinely in the clinical practice, subjects with plantar fasciitis routinely complained about the severe pain with the first few steps in the morning and focus on the pain when it is at its worst. At the start of the study the authors chose to independently analyze items, since these were thought to be most clinically relevant to the subject's complaints. When the scores were combined for all the items along with the inclusion of the effects of walking barefoot and walking with use of shoes, no significant differences were detected between the groups. Many subjects reported that they never stood or walked barefoot because of pain.[15] Hence we can attribute the activity limitation and disability were mainly due to the pain. As pain was better activities were better and disability was less. Therefore, overall FFI when analyzed was significant within the groups.

When the dorsiflexion scores were analyzed within group showed significant difference. Improvement in dorsiflexion range may be attributed to stretching effects as when a muscle is stretched there is elongation, a tension is created in the muscle and when the stretch is held there is disruption of the cross-bridges leading to abrupt lengthening of muscle.36

Since the treatment was given with combination of ultrasound and stretching has led to reduction in pain in both the groups. According to DiGiovanni, plantar fascia stretching will help in recreating the windlass mechanism and to limit repetitive micro trauma and associated inflammation. [15]

Although the previous studies have documented that risk factors of plantar fasciitis increase as range of ankle dorsiflexion reduces. [2,3,15,16] Our study showed a positive correlation between reduced ankle dorsiflexion range and symptoms of plantar fasciitis, but specific stretching of tendoAchilles to improve dorsiflexion range did not show any effect on outcome measures. Hence the improvement in dorsiflexion range may be attributed to reduced inflammation of plantar fascia or reduced pain. [14,15,17]

CONCLUSION

Based on the results of our study, there was no significant difference in comparison of the effectiveness of group receiving combination of plantar fascia stretching, tendoachilles stretching and ultrasound with group receiving plantar fascia stretching and ultrasound alone in plantar fasciitis on Outcome measures. Although the previous studies have documented that risk factors of plantar fasciitis increase as range of ankle dorsiflexion reduces. [2,3,15,16] Our study showed a positive correlation between reduced ankle dorsiflexion range and symptoms of plantar fasciitis, however specific stretching of tendoAchilles to improve dorsiflexion range did not show any effect on outcome measures.

LIMITATION OF THE STUDY

- Sample size – small
- Study has no long term follow up and it was conducted in short duration.

FUTURE SCOPE OF STUDY

- Long term effect and follow up studies with large sample size can be conducted.
- Studies with combination of different treatments combined with our treatment approaches can be done.
- Different duration of stretching and ultrasound can be used and studied further in treatment of plantar fasciitis.

Source of Funding: Self

Conflict of Interest: Nil

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Foot Posture and Frontal Plane Knee Alignment in Obese Individuals with and without Osteoarthritis Knee

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ABSTRACT

Background: To find the correlation of foot posture and frontal plane knee alignment in obese individuals with and without osteoarthritis knee.

Methodology: 218 obese individuals (109 individuals each with and without OA knee) were selected according to inclusion and exclusion criteria. Foot posture and frontal plane knee alignment was assessed using Foot Posture Index (FPI) and non-radiographic measure (Umbilical Method) of frontal plane knee alignment respectively.

Result & Conclusion: Presence of pronated feet in both obese individuals with and without OA knee while no predominance of a single malalignment at knee in obese individuals with and without OA knee was seen. Also no correlation was found between foot posture and frontal plane knee alignment in obese individuals with and without OA knee.

Keywords: *BMI ≥ 25 / Obesity, Foot Posture Index, Frontal Plane Knee Alignment, Osteoarthritis knee.*

INTRODUCTION

Obesity is affecting men, women & children and prevalence rates are increasing all over the world.[1] Obesity is potentially a modifiable risk factor, in the onset and progression of musculoskeletal conditions of the knee and foot.[2] Osteoarthritis (OA) is the second most common rheumatological problem with prevalence rates 22% to 39% in India.[3] Obesity is a risk factor for both development and progression of osteoarthritis knee.[4,5] In comparison with underweight/normal weight individuals OA was upto 7 times higher in obese individuals.[6] Although, elevated BMI increases risk of knee OA progression, effect of BMI is limited to knees in which moderate mal-alignment exists, because of the combined effect of load from mal-alignment and excess load from increased weight.[7] There is increase in medial and lateral tibio-femoral loading varus and valgus mal-alignment respectively. Risk of incident tibio-femoral osteoarthritis is increased with varus but not valgus alignment. In individuals with OA knee risk of OA progression is increased with varus and valgus alignment.[8] Due to the anatomically, biomechanically, and functionally inter-relation of the knee and foot in closed kinematic chain, any impairment or disease of knee joint can affect foot posture and vice-versa.[9,10,11] According to the established biomechanical principles, varus alignment at the knee is accompanied by external rotation and abduction of tibia which, in turn, leads to supination at foot.[12] However, literature suggests that patients with medial osteoarthritis knee tend to have pronated foot in order to compensate for the mal-alignment at knee joint.[13,14,15]

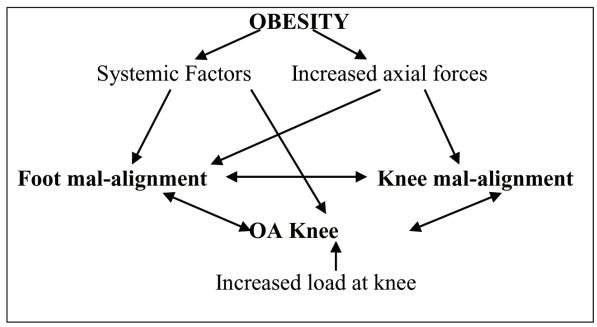

Figure 1: Relationship of obesity and foot and knee mal-alignment with knee osteoarthritis.

The literature indicates that foot posture and frontal plane knee alignment is affected in obese individuals. Also it is known that obesity is a risk factor for both

the development and progression of knee osteoarthritis. Literature also gives that foot posture and knee alignment are affected in individuals with OA knee and obese individuals with OA knee. However it is not clear whether there is any correlation of foot posture and frontal plane knee alignment in obese individuals with and without OA knee.

MATERIAL & METHOD

Subjects were selected according to inclusion criteria i.e. BMI ≥ 25, age above 40 years, individual with OA knee were selected using American College of Rheumatology clinical classification criteria for osteoarthritis knee; and exclusion criteria followed was individuals with significant trauma, surgery of lower extremities or back, any severe orthopedic condition other than OA knee, affecting knee or foot. Each participant was informed prior about the purpose and nature of the study and an informed consent was taken in the language they understood. BMI, FPI and frontal plane knee alignment were then taken.

I. Body mass index:[16,17,18,19]

BMI = Weight (kg)/Height^2 (meter^2)

Table A: Indian cut-off for BMI was used to define obesity in this study.

BMI	CLASSIFICATION
< 18.5	Underweight
18.5–22.9	normal weight
23.0–24.9	Overweight
≥ 25.0	OBESE

II. Foot Posture Index:[20]

All the components of FPI using six item version FPI-6 were viewed.

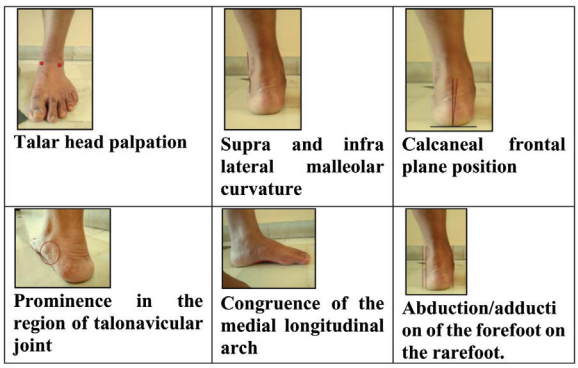

Figure 1: Components of FPI-6.

Each components of test was graded as 0 for neutral, -2 for clear signs of supination and +2 for clear signs of pronation. The reference values for FPI used were:

Normal = 0 to +5

Pronated = +6 to +9, highly pronated 10+

Supinated = -1 to -4, highly supinated -5 to -12.

III. Non-radiographic measure (umbilical method) of frontal plane knee alignment: [21]

Subjects were instructed to take three marching steps in place and then maintain natural foot position. Subjects were then instructed to adduct their legs until contact between the legs occurred (e.g. secondary to soft tissue around the knee, lower leg, or medial malleoli). Proximal landmark consists of umbilicus. Distal landmark consists of a point equidistant between the medial and lateral malleoli and the middle landmark consists of a point in the center of the knee at the joint line. Both distal and middle landmarks were located with a vernier caliper. Measures were obtained using an extendable goniometer (4.5 to 18 inches). Values were recorded to the nearest degree.

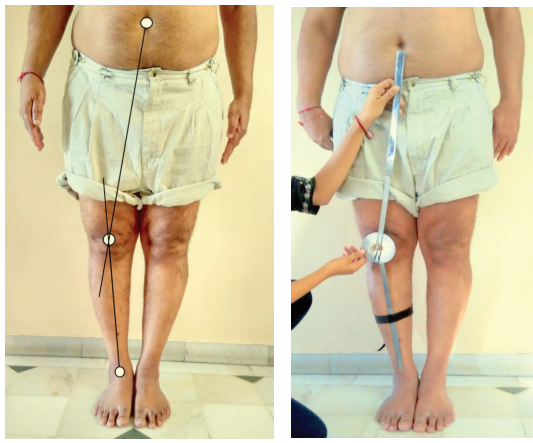

Figure 2: Non-radiographic measure (umbilical method) of frontal plane knee alignment

Use of the raw umbilical method values would not represent the "true" radiographic angle and would make interpretation of the values problematic. To account for this, following regression equation was used:

Predicted radiographic value = 0.746(umbilical method) – 5.22.

Using this model, the umbilical method value was denoted as a positive number if varus, and negative if valgus and "0" as neutral.

FINDINGS

The data was analyzed using SPSS 16.0. Data did not pass the test for normality; hence non parametric tests were used. 59.6% were females while 40.4% were males (65 females and 44 males in each group). The mean age of the population was 53.09 ± 7.79 (95% CI) and 52.05 ± 7.02 (95% CI) years respectively for obese individuals with and without osteoarthritis knee and the mean BMI of the population was 28.49 ± 2.45 (95% CI) and 27.75 ± 2.02 (95% CI) respectively. The data was homogenous with respect to age and BMI as p value was > 0.05 using unpaired t-test.

Table 1: Frequency distribution of right foot posture of obese individuals with and without osteoarthritis knee.

Right FPI	**Obese individuals with Osteoarthritis knee**		**Obese individuals without Osteoarthritis knee**	
	Frequency	**Percent**	**Frequency**	**Percent**
Highly pronated	35	32.1	**41**	**37.6**
Pronated	49	45.0	37	33.9
Normal	10	9.2	11	10.1
Supinated	8	7.3	10	9.2
Highly supinated	7	6.4	10	9.2
Total	109	100.0	109	100.0

Table 2: Frequency distribution of left foot posture of obese individuals with and without osteoarthritis knee.

Left FPI	**Obese individuals with Osteoarthritis knee**		**Obese individuals without Osteoarthritis knee**	
	Frequency	Percent	Frequency	Percent
Highly pronated	34	31.2	**40**	**36.7**
Pronated	**47**	**43.1**	37	33.9
Normal	12	11.0	12	11.0
Supinated	9	8.3	11	10.1
Highly supinated	7	6.4	9	8.3
Total	109	100.0	109	100.0

It shows that obese individuals with and without osteoarthritis knee both predominantly had pes planus i.e. flat or pronated feet. These findings are similar to the studies done by Butterworth P. et al; Aurichio T. et al; Fabris S. et al who found presence of pronated feet in obese individuals. In obese individuals increased axial forces cause the arches of the foot to lower so as to accommodate for excess load and weight. Also Levinger et al (2010), Reilly K et al (2006), Reilly K et al (2009) stated presence of pronated feet in individuals with osteoarthritis knee. Osteoarthritis knee frequently have medial compartment affection of the knee; pronated foot causes the centre of pressure to shift laterally thus possibly reducing load on the medial compartment. [24,25] Thus, obesity may be the main contributing factor for presence of pronated feet in obese individuals with and without osteoarthritis knee.

Table 3: Frequency distribution of right frontal plane knee alignment of obese individuals with and without osteoarthritis knee.

Right Knee Alignment	Obese individuals with Osteoarthritis		Obese individuals without Osteoarthritis	
	Frequency	Percent	Frequency	Percent
Varum	42	38.5	17	15.6
Normal	18	16.5	**46**	**42.2**
Valgum	49	45.0	46	42.2
Total	109	100.0	109	100.0

Table 4: Frequency distribution of left frontal plane knee alignment of obese individuals with and without osteoarthritis knee.

Left Knee Alignment	Obese individuals with Osteoarthritis knee		Obese individuals without Osteoarthritis knee	
	Frequency	Percent	Frequency	Percent
Varum	37	33.9	21	19.3
Normal	21	19.3	41	37.6
Valgum	51	46.8	47	43.1
Total	109	100.0	109	100.0

There was almost equal distribution of varus and valgus knee alignment in obese individuals with osteoarthritis knee and normal and valgus knee alignment in obese individuals without osteoarthritis knee. Gibson et al, Sharma et al(2000), had found more frequency of varus knee alignment in obese individual with osteoarthritis knee. Lavinger et al (2010), Lavinger et al (2013) had found more frequency of varus knee alignment in individuals with osteoarthritis. Bout et al had found presence of valgus knee alignment in obese children. While Wise et al found presence of lateral tibiofemoral joint space narrowing and valgus knee alignment in elderly women.

During bilateral stance weight bearing stresses are equally distributed between medial and lateral compartments of knee joint. However during unilateral stance as while walking the weight bearing line shifts medially thus causing increased compressive forces on medial compartment. Due to any abnormal compartmental loading the frontal plane alignment is affected thus causing either genu varum or genu valgum. [29-31]

Biomechanically it is seen that individuals with medial compartment OA knee have varus knee alignment while individuals with lateral compartment OA knee have valgus knee alignment.[32] Literature gives that medial compartment is more affected in osteoarthritis knee. [24,25] In our study we found more frequency of valgus knee alignment in individuals with and without osteoarthritis. However we did not consider which compartment of knee was affected.

Table 5: Shows that there was no significant difference found for foot posture and frontal plane knee alignment respectively in both obese individuals with and without OA knee as Mann-Whitney U test as p > 0.05 and no difference in mean ranks for foot posture and frontal plane knee alignment respectively.

	Comparison of foot posture of obese individuals with and without OA knee		Comparison of frontal plane knee alignment of obese individuals with and without OA knee	
	RIGHT FOOT	LEFT FOOT	RIGHT	LEFT
Mann-Whitney U	5.933E3	5.874E3	5.291E3	5.620E3
z	-.017	-.152	-1.494	-.738
p- value	**.986**	**.880**	**.135**	**.461**
Mean Rank	109.57	110.11	103.54	106.56
	109.43	108.89	115.46	112.44

This is because there was more frequency of pronated feet in both the groups. Also there was frontal plane mal-alignment present in both the groups irrespective of presence of osteoarthritis knee.

Spearman co-relation coefficient was used to check correlation of foot posture and frontal plane knee alignment in obese individuals with and without OA knee respectively. There was no statistically significant correlation seen as p> 0.05 as seen in **table 6.**

Table 6: Spearman co-relation coefficient of obese individuals with and without osteoarthritis knee.

Spearman's rho Coefficient Correlation	**Obese individuals with OA knee**		**Obese individuals without OA knee**	
	Right	Left	Right	Left
	0.030	0.22	-0.140	-0.086
p-value	0.759	0.822	0.148	0.372
Significant	NO	NO	NO	NO

Our study showed preponderance of pronated feet in both obese individuals with and without osteoarthritis knee and no predominance of a single malalignment at knee in obese individuals without osteoarthritis knee. This could be a reason for no correlation of foot posture and frontal plane knee alignment in obese individuals with and without osteoarthritis knee. Hence, proving the null hypothesis.

CONCLUSION

- Obese individuals with and without osteoarthritis knee both had pronated foot posture.
- Obese individuals with osteoarthritis knee showed almost equal distribution of varus and valgus knee alignment.
- Obese individuals without osteoarthritis knee showed almost equal distribution of normal and valgus knee alignment.
- Frequency of valgus knee alignment was slightly more in both obese individuals with and without osteoarthritis knee.
- There was no significant difference found for foot posture and frontal plane knee alignment respectively in both obese individuals with and without osteoarthritis knee.
- There was no statistically significant correlation between foot posture and frontal plane knee alignment in obese individuals with osteoarthritis knee without osteoarthritis knee respectively.

LIMITATIONS

- Compartment of knee affected in osteoarthritis knee was not considered due to lack of availability of radiographs.
- Severity of osteoarthritis knee was not taken into consideration.

Conflict of Interest: None

Source of Fundng: Self.

Ethical Clearance: Taken from Ethics Committee for Academic Research Projects (ECARP), PG Academic Committee, T.N. Medical College & BYL Nair Ch. Hospital.

ECARP Reference No: ECARP/2014/23.

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Effect of Scapula Stabilizing Muscles Strengthening to Improve Throw-in Distance among College Level Male Soccer Players

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ABSTRACT

Objective: To investigate the relationship between the strength of scapula stabilizing muscles and the throw-in distance among college level male soccer players. **Study Design:** Randomized control trial. **Methods:** 32 college level soccer players aged between16 and 26 years, who had participated in at least one college level tournament were included in the study. The participants were then randomized by lottery method to control group (n=16) and interventional group (n=16). Control group underwent regular coaching program and interventional group had specific scapula stabilizing muscle strength training in addition to regular coaching program for 6 weeks. Their pre and post training strength and throw-in distance measures were documented. Data was analyzed using paired't' test and independent't' test. Level of significance was set at $p<0.05$. **Results:** There was significant within group improvement in strength and throw-in distance in both groups. The intervention group showed greater improvement in both strength and throw-in distance compared to the control group. However, the between group comparison did not show any statistical significance. **Conclusion:** This study showed a clinically significant improvement in strength and throw-in distance post specific scapula stabilizing muscle strengthening. Thus, including scapula stabilizing muscle strengthening in the regular coaching program could provide an added gain to the player and his performance in the sport.

Keywords: *scapula stabilizers, soccer throw-in, resistance training*

INTRODUCTION

Soccer is the most played team game which has participation from around 150 countries and 250 million players.[1]. A throw-in comes into play when the ball crosses over the touchline.[2] A longer throw-in distance can create a better opportunities to score a goal, as the ball can reach the farther player nearer to the opponent's goal post more quickly.[3] Longer throw-ins can be achieved by generating maximum forces in the kinetic chain.[4] Kinetic chain refers to continuous transfer of energy and momentum in a series of segments in a rigid body while a coordinated motion occurs.[5, 6] This sequence of kinetic chain originates from the ankle, then progresses to the knee, hip, pelvis, trunk, shoulder girdle, elbow, hand, and finally to the ball.[7] Dysfunction in any of the components of this kinetic chain will lead to reduction of throw-in performance.[7] In literature, the scapulo-thoracic joint is quoted as a "functional joint" rather than a true joint due to the absence of the joint capsule and ligamentous network.[8] In true sense, the upper limb and thorax are structurally attached by the sterno-clavicular joint and the acromio-clavicular joint that forms a bridge between the overhead throw and the muscular architecture by transferring the energy from the trunk to the upper extremity.[7, 8] For efficient gleno-humeral movement, the scapula as well as the muscles controlling it must act as a stable base and move the glenoid dynamically into various positions.[9] Understanding of the force couple within the shoulder complex is important as it has its own contributions in the overhead throw-in.[8] For a throw-in, the force couple is generated during elevation of gleno-humeral joint

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occurring by the action of deltoid/ rotator cuff muscles and the rotation at scapula-thoracic articulation by the action of trapezius and serratus anterior.[10] The Upper portions of trapezius and serratus anterior muscle work together to produce upward rotation force of the scapula and forms the first part of the force couple. And the lower portions of trapezius and serratus anterior also assist in the upward rotation and form the second part of the force couple. These muscles are the main synergists that stabilize the scapula when the deltoid exerts force at gleno- humeral joint[8]

During coaching more importance is given to the strengthening of muscles of lower limbs, abdomen and shoulder but strengthening of scapula stabilizer is often neglected in spite of its important role. Various studies on throw-in distance in soccer have been done to determine the best projectile angle of throw-in, strengthening the rotator cuff and triceps muscles and run up throw-in but the relationship of scapula stabilizing muscle strength and throw-in distance in soccer players still remains unexplored. Hence, this study aimed to investigate the relationship between strengthening of scapula stabilizing muscles and the throw-in distance among male soccer players.

MATERIALS AND METHOD

This study was conducted among 32 college level male soccer players aged 17–26 years. Prior to participation, a written informed consent was obtained. Ethical clearance was obtained from university's ethics committee. Participants were screened and included if they were college level male soccer players, aged between 17-26 years, should have participated in at least 1college level tournament. Participants with presence of any musculoskeletal conditions, neurological conditions, cardiovascular conditions, undergoing intense bodybuilding workouts and any other conditions contraindicating exercise participation were excluded. Participants were then screened using the ACSM's pre-participation screening questionnaire.[11] Eligible participants were then randomized by lottery method into interventional group and control group equally. Both groups received their regular soccer coaching 3times a week for 6 weeks. The interventional group received additional strength training for the scapular stabilizing muscles namely serratus anterior, trapezius, rhomboids and levator scapulae. It included a training session of 3 sets with 12, 10, 8 repetitions respectively with training load of 70% of 1RM and a 2- 10 % of load progression was given if the participant was able to do 2-3 repetitions more than the desired set repetition based on the recommendations given by the American college of sports medicine.[12] The exercises were

- Warm-up
- Serratus anterior punch[9,13]
- Seated cable rows [9]
- Dumbbell shrugs[9,14,15]
- Prone lying arm rise over the head[16, 17]
- Cool down

The interventional group was trained thrice a week for 6 weeks.[18] Each training session lasted around 40 minutes and were supervised by one physiotherapist and an assistant. Pre and post evaluation of strength of scapula stabilizers and throw-in distance of both the groups were documented before and after 6 weeks. Strength was assessed by the following formula:1 RM = 100× W/ [102.78- (2.78× R)] Where, RM: repetition maximum, W: weight, R: Repetition.[19] The warm up session consisted of general as well as specific warm up.[20, 21] The pre and post throw-in distance was measured by asking the participants to stand close to the touchline by holding the ball (dusted with chalk powder for marking) as in usual soccer throw-in, in a staggered stance. They were then asked to deliver a legal throw-in in a forward direction as distant as possible. The maximum horizontal distance was recorded using a Freemans standard measuring tape positioned at a right angle. The distance between the upper border of the touchline and the point perpendicular to the lower border of the chalk mark left by the thrown ball was measured.[22] The termination criteria adopted was: any participants of the control group absent from regular coaching for more than 3 days for 2 weeks and participants from the experimental group absent for more than 2 weeks of training session due to any reason including injury or illness.

STATISTICAL ANALYSIS

Statistical analysis was done using SPSS version 22 IBM. Shapiro wilk test was used to check the normality of the data. Paired 't' test was used to compare pre and post measurements as the data followed normality. Independent t test was used to compare the data of control and experimental groups. P value < 0.05 was

considered statistically significant.

RESULTS

Within group improvement in strength and throw-in distance was seen in both groups. However, the pre to post strength as well as the throw-in distance difference in the interventional group outweighs the difference seen in control group ($p<0.05$) (Refer Table. 1). There was a statistically significant improvement in strength gain in the interventional group compared to control group when post training comparison was done ($p<0.05$). However, there was no statistically significant improvement seen in the throw-in distance between the control and the interventional group. (Refer Table. 2)

Table 1: Pre-training to post-training differences within the groups

Pair no :	Outcomes	Control group			Interventional group		
		Mean	SD	P value	Mean	SD	P value
1	pre-dumbell shrugs	47.44	7.728	.001	50.63	7.535	.000
	post-dumbell shrugs	52.31	9.471		71.00	9.771	
2	pre-seated row	75.63	8.921	.002	79.31	12.574	.000
	post-seated row	80.56	7.580		104.38	12.585	
3	pre-prone lying dumbbell raise	7.88	1.857	.038	9.00	2.191	.000
	post-prone lying dumbbell raise	8.69	1.740		15.38	3.096	
4	pre-serratus punch	34.06	7.844	.000	33.50	8.140	.000
	post-serratus punch	38.19	6.565		48.44	8.571	
5	Pre-average throw in distance(meters)	16.5373	2.05017	.015	16.4713	1.63756	.000
	Post-average throw in distance(meters)	16.9065	1.98258		18.0363	1.79365	

Table 2: Post-training difference between interventional and control groups

No :	Outcome	Group	N	Mean	Mean difference	SD	P value
1	post-dumbbell shrugs	Control	16	52.31	-18.688	9.471	.000*
		Intervention	16	71.00		9.771	

Cont... **Table 2: Post-training difference between interventional and control groups**

2	post-seated row	Control	16	80.56	-23.813	7.580	.000*
		Intervention	16	104.38		12.585	
3	post-prone lying dumbbell raise	Control	16	8.69	-6.688	1.740	.000*
		Intervention	16	15.38		3.096	
4	post-serratus punch	Control	16	38.19	-10.250	6.565	.001*
		Intervention	16	48.44		8.571	
5	Post-average throw in distance(meters)	Control	16	16.9065	-1.12979	1.98258	.101
		Intervention	16	18.0363		1.79365	

DISCUSSION

This study aimed to investigate the relationship of the strength of scapula stabilizing muscles and the throw-in distance among college level male soccer players. The targeted scapula stabilizer muscles strength improved significantly using the four exercises. This gain in strength might have been due to the training load, set configuration, progression of loads, frequency designed specifically to increase the strength in accordance to guidelines put forth by Ratames. A et al in their study named "Progression models in resistance training for healthy adults".[12]

The improvement in post training strength found in control group might be attributed to the type of regular coaching exercises done, which included push-ups, military press, pull-ups, bench press etc. which indirectly requires and recruit the scapular stabilizer muscles as these are compound exercises. Lear l. J. and Gross M. T documented the electromyographic analysis of scapular stabilizer muscles and push-up progressions in which they stress the use of push-up progression to facilitate activations of serratus anterior and upper trapezius muscles.[25] Another EMG analysis of scapular muscles during a scapular rehabilitation program done by Moscley J. B. et al. found effective activation of trapezius, serratus anterior with military press and push-ups.[22]

Along with the significant improvement in strength, improvement in pre to post throw-in distance was also reflected within the interventional group (Pre 16.4713 meters & Post 18.0363 meters). The control group pre-post scores also showed some improvement in throw-in distance (Pre 16.5373 meters & Post 16.9065 meters). The improvement in the throw-in distance was more statistically inclined towards the intervention group. When within group differences were evaluated. The control group also showed a within group increase in throw-in distance as there was significant increase in strength of the scapular stabilizer muscles. This is in accordance with a study conducted by Tillar R. V. D. who found a significant increase in throw-in velocity among resistance training group .[23] When strength difference between group was evaluated; statistically significant improvement was seen in the interventional group ($p<0.05$) compared to the control group in all the 4 exercises. However, no significant difference in improvement between groups was found in post throw-in distance when compared between the groups (control group mean 16.9065 & interventional group mean 18.0363), this might be due to the significant strength gain exhibited by the control group as they were in their off-season period training and had received more strength training sessions as a part of their routine training program.

Although this present study aimed for maximum throw-in distance, the importance of the influence of the releasing angle and fast back spin for soccer throw-in is inevitable. This could not be considered due to lack of advanced resources. Linthorne. N. P. and Everet D. J. highlights the importance of release angle for attaining maximum distance from the soccer throw- in, they found that using low release angles as close as 30 degrees as well as using a fast backspin resulted in greater release speed and distance covered.[3] The throw-in performed in standing and running have their own differences thus Cerrah. A. O et al. documented that higher values of vertical ground reaction and longer throw-ins were obtained for a running throw-in when compared to standing throw-in.[24]

However, the result of the study strongly recommends the strengthening of scapula stabilizing muscles as a part of the coaching program, thus, not only improving the throw-in distance but providing an overall gain to the player and his sport. There is scarce literature available on this topic and this was the first study of its kind to establish a direct relationship between specific scapula stabilizing muscles strengthening & its influence on the throw-in distance for soccer players. Further research is needed to generalize the findings of this study to the male soccer population

CONCLUSION

The improved strength values of the scapula stabilizing muscles found in this study are a strong factor that describes standing throw-in performance among male soccer players. Soccer coaches can thus include the strengthening of scapula stabilizing muscles as part of their regular coaching program.

Conflict of Interest: Nil.

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Stigmatizing Attitudes in Community towards People Living with HIV/AIDS: A Cross-Sectional Study

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ABSTRACT

Background: Stigma related to AIDS was one of the real purposes behind its uncontained obliteration of millions in India. Individuals were hesitant to interface with HIV/AIDS people since it was thought to be infectious, executing malady which had no cure.

Purpose: To measure the level of community stigma towards people living with HIV/AIDS (PLWHA) and to find out the associated demographic factors for stigma.

Method: A community-based, cross-sectional analytic study was conducted in Surat among 350 participants over a period of three months. The surveys included several aspects of stigma, such as: negative attitudes and blame towards PLWHA due to their diagnosis and their perceived HIV/AIDS risk behaviour; perceived risk of HIV infection due to casual contact with PLWHA; social distancing from PLWHA and groups at higher risk of HIV/AIDS. These questions were read as uniform statements with responses in the form of a 4-point Likert scale ranging from strongly agree to strongly disagree. A Logistic regression analysis was done between no stigma and mild to moderate stigma for the demographic variables

Results: Mean stigma score was 49.55 with standard deviation 12.16. Minimum stigma score was 24 and maximum 84 shows the range of 60. Males and persons with only primary education level had mild to moderate level of stigma (B=1.084&1.246); people who were doing job, studying, or in business (B= -0.39, -0.326, -1.701 respectively) had less stigma compared to those who were unemployed, retired or housewives.

Conclusion: There were up to the moderate level of stigma towards PLWHA in the community. Male and people with less education had mild to moderate stigma compared to female and people with higher education. Those who were studying, doing job and were doing business had less stigma, than unemployed, housewife or retired population.

Keywords: *Stigma, Community, People Living with HIV/AIDS.*

INTRODUCTION

The epidemics of the Acquired Immune Deficiency Syndrome (AIDS) have become one of the most common threats to human survival, development, and prosperity in all parts of the world. The Human Immunodeficiency Virus (HIV) was survived in human over three decades, and the case was found in a group of homosexual men in 1981 in U.S.A. has ruined a large number of individuals whereby the kids have lost their folks; families have encountered serious monetary challenges; countries have lost their additions and ventures of numerous decades; and societies have lost huge potential contributions to the different spheres of life from its afflicted members[(1)].

The HIV/AIDS pandemic has not exclusively been the most noticeably awful disaster in contemporary

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history, however, has additionally postured genuine statistic, helpful, monetary and formative crisis. Right from the earliest starting point, the HIV/AIDS plague has been joined by a scourge of dread, numbness, and foreswearing, prompting slander of and oppression individuals with HIV/AIDS [2].

HIV/AIDS stigmatization poses a major challenge to preventive public health efforts by contributing to under-reporting of cases [3] [4] [5] [6]. Early recognition is subsequently key to keeping the spread of HIV since it urges people to embrace more secure practice [7] [8] [9]and results in more successful and proficient therapeutic care by diminishing the infectivity of people with HIV [10] [11], and in this way the danger of spreading the virus. Sometimes many people under risk of infection, then also they are avoided for a screening test because of fear that the result will be positive and they will have to face the stigma because of HIV [3] [4] [12] [13]. So stigma and discrimination towards AIDS become a global phenomenon and for that people living with HIV are more prone to rejection, social ostracism, discrimination, and violence. Stigma only is one of the most common barriers to public action. AIDS-related shame alludes to the bias and separation coordinated at individuals living with HIV and AIDS. It causes individuals living with HIV and AIDS to be rejected from their group, avoided, victimized or even get physically hurt. Researches confirm demonstrates that some HIV and AIDS patients confront some sort of shame and discrimination. Stigma when coordinated at individuals living with HIV/AIDS (PLWHA), muddles the battle against HIV and AIDS since when vilified the PLWHA experience issues to adapt to the disease at an individual level. In an expansion, disgrace additionally meddles with endeavours to battle the AIDS pestilence all in all [14]. An investigation in Botswana and Zambia found that shame against HIV-constructive individuals and dread of abuse kept individuals from taking part in wilful advising and testing and projects to counteract mother to kid transmission [15].

Demoralization would make individuals reluctant to complete the test, in this manner, more PLWHA are uninformed that they are experiencing HIV/AIDS, and are along these lines putting his/her sexual accomplices as well as the needle [16]. There are a few explanations behind the shame toward PLWHA among the overall public, one of them could be incorrect data about the transmission of HIV; creating irrational behaviour and misperceptions of personal risks [16].

Stigma related to AIDS was one of the real purposes behind its uncontained obliteration of millions in India. Individuals were hesitant to interface with HIV/AIDS people since it was thought to be infectious, executing malady which had no cure. The nature of discrimination associated with HIV/AIDS was closely related to sexual stigma in India [17] . The primary objective of this study is to look at and decide the level of the stigma of people towards PLWA with a view to proposing how such disgrace and segregation can be relieved.

METHOD

A community-based, cross-sectional analytic study was conducted in Surat among 350 participants over a period of three months (August to September 2016). Participants were selected by non-probability sampling. Inclusion criteria were participants' willingness, between the ages of 20 to 60, eligible to answer all the questions, and minimum education of primary level. Exclusion criteria were individuals with HIV positive, health professionals, and mentally unstable individuals. The study was approved by the institutional ethical committee and written permission from NACO (National AIDS Control Organization) was taken. Informed consent of all the respondents enrolled in the study was taken before starting the interview. The instrument that we use to evaluate stigma was HIV Stigma scale which has 22 items [18].The survey included several aspects of stigma, such as: negative attitudes and blame towards PLWHA due to their diagnosis and their perceived HIV/AIDS risk behaviour; perceived risk of HIV infection due to casual contact with PLWHA; social distancing from PLWHA and groups at higher risk of HIV/AIDS; and endorsement of restrictive policies for PLWHA These questions were read as uniform statements with responses in the form of a 4-point Likert scale ranging from strongly agree (coded as 4) to strongly disagree (coded as 1). Endorsement of stigmatizing views yielded a higher score on the 4-point scale. If the respondent refused to provide an answer to any question, the interviewers coded the response as a refusal.

DATA ANALYSIS

Data were analyzed using SPSS version 20.0 for windows at 95% confidence interval and p-value <0.05.The data were summarized in frequencies for

categorical variables, and linear regression analysis was done to find out the variance of demographical variables on stigma. A logistic regression analysis was also carried out to find out the categories of demographical variables on stigma.

Results: Descriptive data analysis was conducted first in order to understand frequencies of the socio-demographic variables, HIV risk variables, and the stigma statements

Table 1: Demographic profile of study population (n = 300)

	Demographic Variable	Frequency	Percent
Age (years)	20-30	76	25.3
	31-40	74	24.7
	41-50	77	25.7
	51-60	73	24.3
Gender	Male	142	47.3
	Female	158	52.7
Education	Primary	57	19.0
	Secondary	95	31.7
	Higher secondary	47	15.7
	Graduate and above	101	33.7
Occupation	Study	31	10.3
	Business	67	22.3
	Job	66	22.0
	Retire/HW/ Unemployed	136	45.3
Stigma	No Stigma	96	32
	Mild to Moderate Stigma	204	68
	Severe Stigma	-	-

Out of 350 participants, 300 were correctly filled and returned giving 85.7% retrieval. Both male and female participants were almost same. The highest age group was within the range 41-50 years (25.7%) while the least age group was 51-60 years (73%). Mean stigma score was 49.55 (score range from 22 to 110) with standard deviation 12.16. Minimum stigma score was 24 and maximum 84 shows the range of 60.

Table 2: Logistic Regression Analysis of demographic variables and stigma for HIV people

Demographic variable		B	Sig.	Exp(B)	95% coefficient interval for exp (B)	
					Lower Bound	Upper Bound
Mild to moderate stigma intercept		15.816	.000			
Age	20-30	.426	.356	1.532	.620	3.787
	30-40	.190	.641	1.209	.544	2.683
	40-50	.337	.388	1.401	.651	3.017
	50-60	0	.	.	.	.
Gender	Male	1.084	.004	2.955	1.415	6.171
	Female	0			.	
Education	Primary	1.246	.008	3.476	1.394	8.668
	Secondary	.668	.068	1.951	.952	4.000
	Higher secondary	.489	.264	1.630	.691	3.844
	Graduate and above	0	.	.	.	.
Occupation	Study	-.326	.586	.722	.244	2.329
	Business	-1.701	.000	.182	.075	.441
	Job	-.039	.927	.961	.414	2.235
	Unemployed/Retired/ Housewife	0	.	.	.	.

DISCUSSION

Study examines the patterns of stigmatizing attitudes towards PLWHA within a population-based sample. We classify stigma into three classes like no stigma, mild to moderate stigma and severe stigma. Within these three class groups, the first (no stigma), comprised of about 32% of the population, while rest of the population (68%) having mild to moderate stigma towards HIV individuals and not a single individuals show severe stigma towards PLWHA. From all study participants who knew an individual with HIV/AIDS reported less stigmatizing attitudes and lower perceived discrimination than those who did not know someone, perhaps reflective of personal experience with accessing the support and care that is available for PLWHA. Anastasia [19] in their study reported that knowing someone with HIV or feeling personally at-risk for HIV were significantly more likely to belong to the least stigmatizing group.

Participants who were in business had significantly less stigma towards HIV individuals when compared to housewives, retire or unemployed. And those who were studying or doing job also showed less stigma. Compared to male population female population shows less stigma towards HIV/AIDS individuals. Higher the level of education there was less stigma towards PLWHA, compare to graduate and above level of education; people with the primary level of education had 3.48 times; those who studied secondary level had 1.95 times, and higher secondary level of education people having 1.63 times more stigma.

The questionnaire focused on personal beliefs that the respondent holds in relation to PLWHA as well as their beliefs regarding the origins of stigmatizing attitudes and discrimination practices within their communities. Community respondents are less frequently exposed to PLWHA, as today HIV is concentrated in stigmatized groups. The scale relates to respondent perceptions about the manifestations of stigmatizing attitudes existing within their community. Specifically, the questions in the scale ask the participant to react to statements that reflect a number of discriminatory practices that occur in their community. Previous research has demonstrated the inverse relationship between access to therapies and HIV/ AIDS-related stigma [20]. We didn't found stigma in population comparing with different age group. Gobopamang Letamo [21] in their study found discriminating attitudes among adolescents of bostanwa. The study says that adolescents who lack understanding of modes of transmission were more likely to stigmatize and discriminate against people living with HIV/AIDS. Those who have misconceptions (those who believe that HIV/AIDS can be transmitted by sharing a meal with PLWA or can be contracted through witchcraft or mosquito) were more likely to express negative attitudes toward an HIV-positive teacher than those who had correct knowledge of HIV transmission.

It appears again that lack of knowledge of how HIV/AIDS can be transmitted is an important predictor of discriminatory attitude among adolescents towards people living with HIV/AIDS.

Self-reported measures of stigma are subject to reporting bias since some survey questions are framed around hypothetical scenarios and may provoke socially desirable answers from respondents. In addition, studies are needed that continue to examine HIV/AIDS-related stigma and discrimination across multiple cultural contexts and to determine whether the factor structure presented here is stable across other diverse research settings in various stages of the HIV epidemic.

Limitation: studies are needed that continue to examine HIV/AIDS-related stigma and discrimination across multiple cultural contexts and to determine whether the factor structure presented here is stable across other diverse research settings in various stages of the HIV epidemic.

CONCLUSION

According to the results of the study we can conclude that male and people with less education had mild to moderate stigma compared to female and people with higher education. Business people had very less stigma than unemployed, housewife or retired people. Similarly those who were doing job or studying also had less stigma next to business people.

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Level of Stress among Doctor of Physical Therapy Students in Karachi, Pakistan

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ABSTRACT

Background: Stress is something that disrupts one's bodily or intellectual wellbeing. Mental stress comprises of anxiety, hopelessness and signs such as insomnia, pain in head and back. Presently mental stress is a foremost root of disability wide-reaching, accounting for 1/3rd of disability adjusted life years (DALYs). The purpose of our study was to assess the level of stress amongst DPT students in Dow University of Health Sciences, Karachi, Pakistan.

Methodology: A cross-sectional Study was conducted among undergraduate DPT students studying in Dow University of Health Sciences, with the help of Non-probability purposive sampling technique. Estimated sample size was 382. The study duration was 3 months. Data was analyzed through SPSS Version 23. Pearson Chi Square Test was used to determine the degree of import between two variables.

P-Value was less than 0.5

Results: Results of the studied showed that, out of 382 selected students, 40.1% students were found with severe stress, 38.2% students had Moderate Stress, 19.6% students had mild stress and only 2.1% students were found without any stress.

Conclusion: This study demonstrates a significant increase in the proportion of students with stress. Overall study showed that majority of the students had severe stress due to academic and personal reasons which they couldn't cope up.

Keywords: *Stress, Headache, Physical therapy students*

INTRODUCTION

Stress is something that disrupts one's bodily or intellectual wellbeing. Educational stress amongst the university students is a great challenge for the institutions currently[1] Stress is a bodily or psychosomatic incident documented during self-cognition of aggravating factors, when interacting with one's environment[2] Presently mental stress is a significant communal health crisis and it is a foremost root of disability wide-reaching, accounting for 1/3rd of disability adjusted life years (DALYs).[3] Stress is ''numerous usual responses of the body (psychological, emotional, and physiological) intended for self-preservation'' and as well as ''a condition of psychological or emotional strain or dormancy''.[5] Psychological stress, nervousness and bad temper are also experience by students which are too associated with stress.[12] Headache, back pain, pain in torso, arms, legs or joint is highly predominant in individuals with Post Traumatic Stress Disorder (PTSD).[15]

Physical Therapy is a difficult field and students are exposed to numerous types of pressure as educational stress, trying to achieve enhanced outcomes, alterations in environment, personal or family concern, lack of confidence about future, not sufficient spare time, handling extremely inspiring atmosphere of university, examinations, increased work burden and financial concerns.[19]

The bio-psycho-social approach is the most extensive in presenting stress as a solitary and/or mutual load.[24] The five commonly used coping strategies by

the undergraduates all through the events of stress were: Positive Reframing, Planning, Acceptance, Active Coping and Self-distraction.[8]

Favourable stress and unfavourable stress are two types of stress. Favourable stress is the type of stress which encourages and helps achieving knowledge and wisdom and unfavourable stress is the one which prevents and suppresses achieving knowledge [4] Another type of stress which is negative is distress that can harmfully affect physical and emotional life on an individual [1].

High occurrence of stress has been reported amongst medical undergraduates i.e. from 25-90% [23]. A study conducted amongst medical students of USA reported 23% students had clinical depression while 57% were under psychological stress.[10]63.8% in Saudi Arabia and 90% in Pakistan was the reported prevalence of stress.[14] Examinations, family and relationship issues were the most common stressors reported by girls than boys.[5]

Poor educational performance, dropout amounts greater than before from medical university, damaged relationships, substance misuse and suicide might be caused by distress. Low self-esteem, low quality of patient care, exhaustion, and, eventually an alteration in the values of the medical career might also be caused by distress [11]

Unsuccessful stress managing mechanism such as avoiding problem, suspicious thinking, public withdrawal, and self-criticism has harmful consequences and might lead to despair, anxiety and reduced psychological well-being [22] Psychotherapy facilities are essential and it should be accessible to undergraduates in medical university to control this morbidity [25]

Stress can be best coped by exercising every day, meditation or other relaxation methods, planned intervals and learning innovative coping strategies to produce predictability in our lives. Almost 75% of the medical undergraduates were satisfied with their specific coping mechanisms[5]

The rationale of our study was to determine the level of stress amongst Doctor of Physical Therapy (DPT) students studying in Dow University of Health Sciences, Karachi, Pakistan.

METHOD AND MATERIALS

RESEARCH DESIGN

A cross-sectional (self-reported) questionnaire survey design was used for data collection.

SETTINGS

DPT students Dow University of Health Sciences (IPM&R and OJHA)

INCLUSION CRITERION

- Undergraduate DPT students of DUHS [(both male and female) (1st year – 5th year)]

EXCLUSION CRITERION

- DPT students of universities other than DUHS
- Post graduate physiotherapists
- Technician physiotherapists
- BSPT and Diploma holders in physiotherapy

DURATION OF THE STUDY

3 months after the approval of synopsis from IPM&R Scientific meeting.

SIZE OF SAMPLE

382 was the sample size calculated through WHO software Open Epi Version 3.0 with 54% of the frequency hypothesized, with 5% confidence limit, 1% of design effect and 95% confidence level[22]

SAMPLING TECHNIQUE

Non-probability Purposive Sampling Technique was used.

METHODOLOGY

SUBJECTS

All participants were given questionnaires after explanation of aim of study and taking consent. The research was carried out from August 2016 to October 2016. Our study setting was IPMR and OJHA School of physiotherapy. Permission was taken from the Head of Departments.

The Questionnaire had 2 parts, one contained the demographic details of the participant and while

other one comprised of 32 potential stress producers, through which you could determine whether you have experienced low, moderate, or high stress in the past year.

METHOD

In the beginning of our data collection we took permission from the HOD to approach the students and get our forms filled. Questionnaire was distributed amongst them after telling them the aim of our study and after taking their consent We divided the sample size equally per class and further divided the data per class into OJHA and IPMR. Then we grouped the selected number of students of IPMR in the class who gave their consent (1 class per day) and after explaining to them the purpose of our study and the questions included in the questionnaire, questionnaire was distributed. After our data was completed from IPMR, we went to OJHA. We took permission from their HOD as well and the same process was repeated. 2nd year was on their examination leave so we couldn't get data from there therefore we had to wait for their semester classes to start. After they came back we had to go to OJHA once again and get our forms filled from them.

STATISTICAL ANALYSIS

Data were stored and analyzed using IBM-SPSS version 23.0, count and percentages were reported for gender, age group and years of study, and level of stress among doctor of physical therapy students of studied sample, Pearson chi square test was used to see the association of stress with baseline factors, pie chart reported to give the prevalence of stress and bar chart used to give graphical summary of results. P-value less than 0.05 were considered significant.

RESULTS/ FINDINGS

In the present study 382 DPT students participated out of which 84.8% of the sample was female while males only made 15.2% of the total. 44% of students were below 20 years of age and 56% were above 20 years. As per the division students participated in the study were; 84 students from 1st year (22%), 86 students from 2nd year (22.5%), 82 students from 3rd year (21.5%), 85 students from 4th year (22.3%) and 45 students from 5th year (11.8%). (Table 1)

Results of the studied showed that, 40.1% students found with severe stress, 38.2% students had Moderate Stress, 19.6% students declared as mild stress and only 2.1% students were found without any stress. (Table 2) The graphical presentation of stress level is given using pie chart.

Pearson Chi Square test was used to see the association of age, gender and years of study with level of stress, study showed that, only eight females, were found without any stress, and 89% females found with moderate level of stress, 60.1% sample of age more than twenty-years old found with severe stress, 37.3% student of 2nd year found with mild stress level and 26.8% student of 4th year found with severe stress level, results of chi square test showed that there was no significant association of stress levels with age group and gender, but there was significant association with year of study, (Table 3) , bar chart is reported to give the graphical representation of stress levels with age group, gender and year of study.

Table 1: Baseline Characteristics of Studied Sample (n=382)

Variables		**n**	**%**
Gender	Male	58	15.2
	Female	324	84.8
Age (years)	< 20 Years	168	44
	> 20 Years	214	56
Year of Study	1st Year	84	22
	2nd Year	86	22.5
	3rd Year	82	21.5
	4th Year	85	22.3
	5th Year	45	11.8

Table 2: Level of Stress

Level of Stress	N	%
No Stress	8	2.1
Mild Stress	75	19.6
Moderate Stress	146	38.2
Severe Stress	153	40.1

Table 3: Association of Stress Levels with Baseline Parameters using Pearson Chi Square test

Variables		No Stress		Mild Stress		Moderate Stress		Severe Stress		p-value
		n	%	n	%	n	%	n	%	
Gender	Male	-	-	12	16.0	16	11.0	30	19.6	0.12
	Female	8	100	63	84.0	130	89.0	123	80.4	
Age (years)	<= 20 Years	3	37.5	40	53.3	64	43.8	61	39.9	0.27
	> 20 Years	5	62.5	35	46.7	82	56.2	92	60.1	
Year of Study	1st Year	-	-	10	13.3	33	22.6	41	26.8	0.01*
	2nd Year	3	37.5	28	37.3	31	21.2	24	15.7	
	3rd Year	3	37.5	16	21.3	31	21.2	32	20.9	
	4th Year	-	-	14	18.7	30	20.5	41	26.8	
	5th Year	2	25.0	7	9.3	21	14.4	15	9.8	

*p<0.05 was considered significant using Pearson Chi Square test

DISCUSSION

Out of the whole sample only 2.1% of the students reported no stress while the greatest ratio of the students 40.1% reported severe stress with a little difference from moderate stress that was 38.2%. 19.6% of students showed mild stress levels.

The main results of this study suggest that among Doctor of Physical Therapy students at Dow University of Health Sciences only eight females, were found without any stress, and 89% females were found with moderate level of stress, 60.1% sample of age more than twenty-years old found with severe stress, 37.3% student of 2nd year found with mild stress level and 26.8% student of 4th year found with severe stress level. Our study showed that there was no significant association of stress level with gender. No significant association between stress levels and gender in a sample of college students this result is correspondent with a report by Cohen and colleagues (*Cohen, Kamarck &Mermelstein, 1983*).

The result is not parallel to the studies which found that both male and female students were likely to experience stress [14]. But females perceive high levels of stress as related to males suggested by many studies. As they perceive additional burden over themselves, they're not merely different in their perception of stressors, but their responses to stressors are also changed. [2]

The results of our study showed that there was no significant association of stress levels with age group and gender, but there was significant association with year of study and it is an important factor in perceived stress in DPT students,

The results showed that 37.3% student of 2nd year found with mild stress and 26.8% student of 1st and 4th year found with severe stress. Studies done in Australia, Saudi Arabia, Norway and Ethiopia recognised that first year students were more likely to have mental distress than second year and above Although, any significant association between year of study and mental distress does not show by other studies. This may be since, trouble in adjusting to University training face by first year students [3]. Studies show that each year of medical training is stressful, with the fourth year no worse than others[26].

Our study showed death of a relative as a major stressor which was not reported in any other studies on stress. Increased workload at school was also a major stressor which was like studies on stress by Yusoff et al. (2011) and Sheikh et al. (2004). [4,5] Another significant stressor was change in sleeping habits which was also reported by a study by Waqas et al. (2015) [14]. Change in lifestyle for financial reason was also a stressor amongst

many undergraduates which was contradictory to the study by Waqas et al. (2015) because that study was done in a private institution where most of the undergraduates were from a higher socio-economic class [14]. Change in social habits and too many missed classes also lead to distress amongst students and were not mentioned in any other studies reported on stress.

CONCLUSION

According to the study a very little proportion of the students reported no stress while the greatest fraction of the students reported severe stress with a modest variation from moderate stress that that the students reported. Mild stress levels were reported by less than half of the sample.

Conflict of Interest: Nil.

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Ethical Clearance: Taken from the committee of Dow University of Health Sciences.

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Immediate Effect of Virtual Reality on Balance, Gait and Posture in Stroke Patients- An Experimental Study

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ABSTRACT

Background and purpose – Balance, gait and posture is affected in the stroke patients and also has adverse effect on truncal stability along with the gait. Extensive research has been done in the field of physiotherapy in stroke rehabilitation; no evidence is available for immediate effect of virtual reality on balance, gait and posture in stroke patients.

Objective – To evaluate the immediate effect of virtual reality on balance, gait and posture in stroke patients using Timed Up and Go (TUG), Tinetti Performance-Oriented Mobility Assessment (POMA) and Postural Assessment Scale for Stroke Patients (PASS).

Methods and materials- The present experimental study was conducted on 13 participants which included both male and female participants between 40 to 65 years with chronic stroke. The participants were given virtual reality for 45minutes. Pre-interventional and Post-interventional outcome measurements were assessed using Timed Up and Go (TUG), Tinetti Performance-Oriented Mobility Assessment (POMA) and Postural assessment Scale for Stroke Patients (PASS).

Result- The difference between pretest and posttest of TUG, POMA and PASS was statistically found significant.

Conclusion – The study concludes that there is immediate effect of virtual reality on balance, gait and posture in stroke patients. Virtual reality can be used as adjunct therapy to tackle balance, gait and posture issue in association with conventional therapy.

Keywords: *virtual reality, stroke patients, balance, gait and posture.*

INTRODUCTION

Stroke is the 2nd commonest cause of death[1]. WHO clinically defines stroke as 'the rapid development of clinical signs and symptoms of a focal neurological disturbance lasting more than 24 hours or leading to death with no apparent cause other than vascular origin[2]. The global incidence of stroke is 258/100,000/year and 1.5 times higher in men than in women[3].

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Stroke related hemiparesis shows asymmetry in standing posture and walking,[4-6]due to motor weakness,[7] asymmetric muscle tone,[8,9] and somatosensory deficits in lower extremities which leads to balance impairment, postural sway[9] , disordered gait and increased probability of falls.[10] Disuse of paretic leg can be a consequence for weight bearing asymmetry and impaired balance function.[11]Various physiotherapy approaches including Virtual reality (VR) are available for stroke rehabilitation. These are introduced to the patients from hospital admission, based on the stage of recovery in hemiplegics.

Virtual reality involves interactive stimulation designed to give users an experience similar to the real world through computer hardware and software[12]. It

provides patients with consistent practice, biofeedback and further encourages endurance practice. It has numerous benefits in gait, balance retraining, upper and lower limb rehabilitation etc. In advancement of visual, auditory, tactile input and motivation, virtual reality also proves to be beneficial.[13]Moreover, programs in VR are more interesting and enjoyable than the conventional therapy task thereby encouraging the patients to increase the frequency of activity[14]with minimal assistance from therapist.

Virtual reality games are feasible and beneficial when introduced to elderly patients who experience recurrent fall.[15]Plenty of work is done using virtual reality to assess balance and gait in stroke patients. Many studies showed positive effect on balance and gait among stroke patients who underwent long periods of intervention using virtual reality. Studies are done which state that there is improvement in postural sway, postural stability and postural control but not many studies are done on posture assessment using virtual reality. After extensive literature search, we could not find any conclusive evidence regarding an immediate effect of virtual reality on balance, gait and posture in stroke patients. Hence, there is need to conduct a further study which would state immediate effect of virtual reality on balance, gait and posture in stroke patients.

MATERIALS AND METHOD

MethodsThe study was conducted over a period of 6 months at a tertiary care hospital after taking required ethical clearance from the institutional ethical committee. Written informed consent was taken from each participant. A total of 18participants were screened and 13 participants were recruited on the basis of inclusion and exclusion criteria. **Inclusion criteria:** Subjects diagnosed with 1st ever attack of stroke, willing to participate in the study, both males and females of age group 41-65 years, able to stand without support with Mini mental state examination (MMSE) score more than 24 out of 30 were included. **Exclusion criteria:** Subjects with other neurological conditions except stroke, individuals with vertigo, individuals with peripheral neuropathy, individuals with postural hypotension and individuals with visual problems. A pre and post assessment of balance, gait and posture was done using Timed Up and Go test (TUG), Performance Oriented Mobility Assessment (POMA) and Postural Assessment Scale for Stroke Patients (PASS).

Procedure

Virtual reality therapy was given for 45minutes to all the subjects where subjects were asked to stand on the sensor platform. A walking task was given in which the subjects had to march on the sensor platform with the virtual image of the person moving in a street environment. The walking task was planned through obstacles which had to be avoided by swaying and weight bearing either on the left or right leg. The subjects were asked to walk on the virtual reality platform viewing the visuals in front of them.

DATA ANALYSIS

Nominal data from patient's demographic data i.e. age, gender were analyzed using t-test. Percentage of distribution of males and females with stroke was done. Comparison of pre intervention and post intervention scores of TUG, POMA and PASS were compared using paired t-test. Probability values less than 0.05 were considered statistically significant.

RESULT

The prevalence of stroke was more in the age of 40-65 years with the mean age 55. There were more number of males (76.92%) than females (23.08%) in the present study. Results of TUG score, POMA and PASS is listed in Table 1. There was a significant change from pre value to post value after virtual reality therapy.

Table 1: Comparison of pre-test and post-test TUG scores, POMA scores, PASS scores.

Outcome Measure	Pre Test (Mean±SD)	Post Test (Mean±SD)	P-value
TUG	36.96±26.92	28.65±19.42	0.0071*
POMA	20.08±5.87	22.38±3.38	0.0250*
PASS	28.62±5.58	30.38±5.36	0.0005*

*$p<0.05$

DISCUSSION

The present pilot study identified some beneficial effects of virtual reality on balance, gait and posture. As expected from previous work on stroke rehabilitation, subjects showed improvement.

Post intervention assessment done by POMA, BBS and PASS scores showed significant improvement in neurological symptoms like muscle weakness, abnormal muscle tone, sensory dysfunction, asymmetrical gait pattern, slow gait speed, reduced balance ability and impaired postural control which may have resulted in reduced risk of fall in stroke patients.[16]

Normal functional tasks require input from visual, sensory, somato sensory systems for normal postural control. Virtual reality exercises included were, avoiding obstacles, weight shifting and stepping. These exercises were mainly included as it stimulates the dynamic part of postural stability. Loss of postural control can cause disturbances in balance , gait and posture, thus hampering activities of daily living.These exercises also improve weight symmetry with the increased use of paretic leg. This provides realistic visual and proprioceptive input thus improving patient's reaction time and postural stability improving the ADL's of the patient.[17]

These exercises are also essential components of locomotion. Gait and balance abilities of an individual greatly depend upon the motor function of the ankle joint. Muscle tone helps the structures to be in continuous and passive partial contraction which helps to maintain body's posture. In the later stages of stroke, spasticity develops. Increased tone in the ankle plantarflexors hinders static as well as dynamic balanace and gait. Exercise involved in the present virtual reality programme involved the ankle joint which increased the cordination between agonist and antagonist muscles. Thus reducing the spasticity [18], and improving the function. Side stepping exercises that were performed helped in activation the hip abduction. Thereby try reducing the pelvic drop during the single stance phase of gait cycle. [19]

Physiologically, VR therapy helps to promote neural plasticity. The reorganisation occurs by activation from the same side of the brain to the opposite sensory motor cortex thereby improving locomotion in chronic stroke survivors. This mechanism could also denote the changes in the gait cycle improving the time.[19]

In the present study virtual reality helped the participants to concentrate on games which improved their balance and postural abilities on affected extremity. Participants felt difficulty in performing the VR tasks at the beginning of balance training sessions and felt more confident at the end of the session. Also after the virtual reality the participants walking speed was improved.

Similar study was done in stroke patients and showed significant improvement in balance. Due to visual and auditory feedback and influence of motivational aspects on motor performance provided by virtual reality system these results were obtained. This sensory information provided by virtual reality system allows the central nervous system for better control position and orientation of body segment to adapt the external environment.[20]

These positive improvements occurred in these subjects of already higher functioning stroke patients who were ambulatory and also received alternative rehabilitation protocol. Therefore results cannot be attributed to virtual reality alone.[21]

The limitations of the present study are Study was conducted to assess the effect of virtual reality for its immediate effect which grossly restricts information about the long term effect. Total number of sample size was very small; hence it will have negative impact on generalization of result. The study assessed immediate effect, hence the effect of long term therapy not taken. Future research with a Long term effects can be assessed in large sample size. Similar study can be taken up for assessing effect of long term therapy among stroke patients.

CONCLUSION

The effect of virtual reality was found significant on parameter of TUG score. POMA score was also found significantly improved immediately after the therapy. The PASS score showed significant improvement among the stroke patients. Static as well as dynamic balance and mobility skills found improved among the patients. There was improvement in balance and gait parameters as well as ability to stand on paretic limb. Hence, Virtual reality can be used as adjunct therapy to tackle balance, gait and posture issue in association with conventional therapy.

Source of Funding- Self funding

Conflict of Interest- Nil

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Effect of Cluster Training Versus Traditional Training on Muscular Strength among Recreationally Active Males- A Comparative Study

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ABSTRACT

Objective: To compare the effect of cluster training and traditional training on muscular strength outcome in recreational males. **Study Design:** Comparative Study. **Methods:** 32 male participants aged between 18-30 years who were already exposed to 6 months of resistance training were included in the study. They were then randomized by lottery method to cluster group (n=16) and traditional group (n=16). Each group underwent training for 7 weeks and their pre and post training strength measure was documented. The Paired 't' test was used to analyze within group difference while independent 't' test was used for between group differences. Level of significance was set at $p<0.05$. **Results:** Significant improvement in strength ($p<0.05$) was found post training compared to pre training in both the groups. However greater improvement in strength was seen in CT group when compared to TT group. **Conclusion:** Based on the results, Cluster training outperformed traditional training in improving strength development. Cluster training may be an alternate for Traditional training in strength development training programs.

Keywords: *cluster training, traditional training, Repetition maximum, intraset rest.*

INTRODUCTION

"Resistance training is a form of physical activity that is designed to improve muscular fitness by exercising a muscle or a muscle group against external resistance".[1]Structured variation is the cornerstone of an appropriately designed periodized strength and conditioning program.[2]

Evidence suggests that there are two main set structures, the traditional (continuous repetition) and cluster set (intraset rest), that can be utilized in a resistance training program. Variation in a resistance training program can be done by varying training load, number of sets and repetitions, order of exercise, exercise density (i.e., number of exercises in a session, period of training, cycling of exercises), training focus or priority, and by providing rest intervals between sets.[2]

Most commonly used set configuration is traditional set. This involves a series of repetitions that are performed with the varying load in a continuous fashion. Traditional set structures are generally better suited for inducing hypertrophy, but they may not be the best for improving movement velocity, strength or power output.[2] Traditional sets consist of the following types, a) Straight sets, b) Pyramid sets, c) Reverse pyramid sets.[3] Cluster set involves varying the intraset rest (or inter-repetition rest) interval and/or training load. Typically, the cluster set structure includes a 5 - 45 seconds rest interval between each individual or series of repetitions, which has shown improvement in power output, barbell velocity, and barbell displacement when compared to traditional set configurations.[2, 4] There are generally four basic variants for cluster set training, a) Standard cluster set, b) Undulating cluster, c) Wave loading, d) Ascending cluster.[2, 4]

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Traditional resistance training affects the quality of repetitions due to fatigue caused by the accumulation of lactic acid. A greater reduction of phosphocreatine (PCr) stores will occur as a result of performing continuous repetitions during a set which will result in an increased usage of muscle glycogen and thus, a greater increase in lactic acid concentration. The lactic acid produced will decrease the performance during traditional set training and also the force generating capacity which occurs as a result of the hydrogen ion stimulating a reduction of the number of high force cross-bridge attachments in fast twitch fibers.[4] Literature suggest that 15s of recovery effectively return force generating capacity to approximately 79.7% of the pre-fatigue capacity as a result of the partial replenishment of fuel substrates.[4] Cluster training might have has the ability to produce higher power outputs to perform each repetition owing to partial replenishment of Phosphocreatine during the intraset rest interval.[4] However, some studies have reported that traditional training has better strength outputs whereas some studies have supported cluster set training to be more effective for power outputs.[5-8] Also, there exists conflicting results regarding which of the two have a better effect on muscular strength. Also, very few studies have been done to find the effects of traditional versus cluster training specifically on strength output. Therefore, the present study aimed to compare the effect of cluster versus traditional set training on muscular strength.

MATERIALS AND METHOD

This study was conducted among males aged between 18 to 25 years with a sample size of 32. Prior to participation, the participants were explained about the study and an informed consent was obtained from them. Ethical clearance was obtained from University ethics committee. Participants were screened based on the inclusion and exclusion criteria. Inclusion criteria were: Recreationally active male engaged in sports, aged between 18 - 26 years, Participants experienced in resistance training for at least 6 months. Exclusion criteria were: Presence of any musculoskeletal, neurological and cardiovascular condition or any other pathological condition contraindicating exercise participation, Individuals already undergoing high-intensity strength training. Included participants were screened using the ACSM's pre-participation screening questionnaire. Eligible participants were then randomized by lottery method to either TT group (16) or CT group (16).

METHOD

Participants in both the groups trained thrice a week for 7 weeks with each session lasting for up to 1 hour and their pre and post evaluation of strength was documented by the formula: One repetition maximum (1 RM) = 100× W/ [102.78- (2.78× R)] Where, RM: repetition maximum, W: weight, R: Repetition.[5] Training load was set at participant's 75% of 1 RM for both the groups. Both the groups were given 3 upper body exercises, viz., Bench press (Figure.3), Bent over row (Figure. 1), Shoulder press (Figure. 4) and three lower body exercises, viz., Back squat (Figure. 5), sumo squat (Figure. 6), Calf raises (Figure. 2) according to the guidelines prescribed in Essentials of Strength Training and Conditioning manual.[9] Before performing the above exercises the participants went through warm up and cool down sessions. The warm up session consisted of general as well as specific warm up each lasting up to 5 minutes. The cool down period was 10 minutes comprising of static stretching of the muscles of the upper limb and lower limb performed after the cessation of the exercises. [9] The traditional training group used the Pyramid set configuration.1st set of10 repetitions with 75% of 1RM, 2nd set of 8 repetitions with 75% of 1RM adding additional weight than previously attempted and 3rd set of 6 repetitions with 75% of 1RM adding additional weight than attempted in set 2. [10]

The rest period between sets in traditional sets was 2 minutes. The cluster training group used the standard cluster set protocol. A series of 24 repetitions were performed with 3 repetitions in one cluster leading to an overall of 8 clusters.[4] The rest period between each cluster was 15 seconds.

STATISTICAL ANALYSIS

Statistical analysis was done using SPSS version 22 IBM. Data was extracted and analyzed by Shapiro Wilk test of normality. Paired t test was used to analyze pre-training to post-training difference within the groups. A two sample independent t test was applied to analyze post-training difference between traditional and cluster groups. $P<0.05$ is considered to be significant

RESULTS

Results showed an increase in the post mean for all the pairs within the traditional group and this difference was found to be statistically significant ($p<0.001$)

(Refer Table 1). Increase in the post mean was also seen within the cluster group for all the pairs and this difference was found to be statistically significant ($p<0.001$) (Refer Table 2). Post-training difference between traditional and cluster group showed significant improvement in strength in the cluster group compared to traditional group ($p<0.05$) (Refer Table 3).

DISCUSSION

This study was conducted with an aim to compare the effect of cluster training and traditional training on muscular strength outcome in recreational males. Thirty-two recreational males were recruited in the study who completed the exercise protocol for 7 weeks.

The cluster group showed significant improvement in strength (P value<0.05), post exercise. The pre and post training mean score (in Kgs) of findings were as follows; bench press 77.38 &99.75, shoulder press 57.50 & 83.00, bent over row 76.50 &102.69, sumo squat 91.00 and 116.25, back squat 86.19 & 113.94 and calf raises 97.75 & 125.63. This was because 15 -30 seconds of rest between the repetitions helped re-synthesizing some of the depleted phosphocreatine (PCr) in the muscle cell, and thus caused a reduction in fatigue. Decreases in both ATP and PCr are associated with significant elevations in lactate concentrations, which leads to substantial decreases in the amount of force that can be generated by the muscle. Haff et al found that Inclusion of 15 seconds of recovery results in 79.7± 2.3% increase in maximal force– generating capacity that corresponded to of initial capacity. Increased lactate level resulting from short rest intervals is generally associated with negative effects on muscle contraction leading to impaired ATP production caused by changes in contractility, lactate accumulation ultimately altering function.[11]The present study showed improvement in strength post training in the traditional group as well. The findings were significant (P value<0.05) in all the 6 exercises. The pre and post training mean score of findings were as follows; bench press 72.44 & 85.63, shoulder press 46.63 & 59.38, bent over row 67.50 & 83.31, sumo squat 73.19 & 89.06, back squat 74.00 & 90.69 and calf raises 79.38 & 97.69. This improvement might have occurred because the set configuration was designed specifically to target strength with the use of lower repetition and higher weights.[12] Similar results were seen in the study done by Mehrizi A Z et al who found that traditional training had an upper hand in developing strength when compared to cluster training.[5]

Moreover, the continuous repetitions might have activated the higher threshold motor units inactivating the lower threshold motor units. This was put forward in the work done by Lawton T et al who compared the effect of continuous repetition and intraset rest interval on bench press strength and power. They found that no regimen was superior in promoting power, however, bench press training with continuous repetitions resulted in greater strength than with intra-set rest training.[8] This increment in strength can also be attributed to the build-up of metabolites that might have occurred during the continuous repetitions that triggered the strength adaptation. This was reflected in the work done by Karabulut M et al who investigated effects of low-intensity resistance training with vascular restriction on leg muscle strength in older men. They found greater increment in strength with low-load vascular restriction training.[13] However, this relation of metabolites to the strength adaptation is unclear and demands further research to reach into deep insights. The nature of traditional resistance training had put the muscles under greater time under tension which is in accordance with the study done by Lawton T et al who found greater time under tension with continuous repetition training than intra set rest training. But this is in contrast with the study done by Gavin L et al who found greater time under tension for muscles with cluster training.[7] However, when the between group analysis was done the CT group exhibited greater significant strength post training (P value<0.05) when compared to TT in all the 6 exercises. The post training CT and TT mean scores for the exercises were as follows; Bench press 99.75 & 85.63, Shoulder press 83.00 & 59.38, Bent over row 102.69 & 83.31, Sumo squat 116.25 & 89.06, back squat 113.94 & 90.69 and calf raises 123.63 & 97.69. The intra-repetition rest in the cluster training has shown to reduce the central and peripheral fatigue which might be the reason for better strength output exhibited by the cluster training participants. Rio-Rodriguez, Iglesias-soler E and Olmo MF investigated central and peripheral fatigue induced by Traditional set (TS) and intraset rest configurations (ISR), with an equal work-to-rest ratio, and their relationship with cardiovascular changes. They found that ISR induced lower central and peripheral fatigue as well as lower cardiovascular stress in comparison with TS configuration.[14] Also, as the exercise protocol in the cluster training was very novel

to the participants in this study, it might have had some psychological boost for the participants to workout with more enthusiasm and reflect this big difference. Although the findings in this study are in contrast with many other works in the literature, cluster training can be utilized by the beginners to build their strength.

LIMITATION

There was no follow up done for this study. Hence the long term effects of strength gains with cluster set training is not clear.

Table 1: Pre-training to post-training difference within the traditional group.

Exercises		Mean	N	Std. Deviation	t value/p value
Pair 1	Pre-bench press	72.44	16	12.431	**6.933/<0.001**
Post-bench press	85.63	16	10.745		
Pair 2	Pre-shoulder press	46.63	16	10.372	**5.447/<0.001**
Post-shoulder press	59.38	16	9.273		
Pair 3	Pre-bent over row	67.50	16	18.615	**8.758/<0.001**
Post-bent over row	83.31	16	17.910		
Pair 4	Pre-sumo squat	73.19	16	21.772	**7.657<0.001**
Post-sumo squat	89.06	16	19.437		
Pair 5	Pre-back squat	74.00	16	18.694	**8.535/<0.001**
Post-back squat	90.69	16	14.160		
Pair 6	Pre-calf raise	79.38	16	17.723	**8.442/<0.001**

Table 2: Pre-training to post-training difference within the cluster group.

Exercises		Mean	N	Std. Deviation	t value/p value
Pair 1	Pre-bench press	77.38	16	9.301	**10.791 /p<0.001**
	Post-bench press	99.75	16	14.599	
Pair 2	Pre-shoulder press	57.50	16	9.987	**11.731 /p<0.001**
	Post-shoulder press	83.00	16	14.024	
Pair 3	Pre-bent over row	76.50	16	14.922	**9.472 /p<0.001**
	Post-bent over row	102.69	16	17.951	
Pair 4	Pre-sumo squat	91.00	16	19.664	**11.086/ p<0.001**
	Post-sumo squat	116.25	16	19.018	
Pair 5	Pre-back squat	86.19	16	20.782	**7.986/ p<0.001**
	Post-back squat	113.94	16	19.478	
Pair 6	Pre-calf raise	97.75	16	11.807	**11.887/p<0.001**
	Post-calf raise	125.63	16	15.903	

Table 3: Post-training difference between traditional and cluster groups.

Exercises	Group	N	Mean	Std. Deviation	t value/p value
	Cluster	16	99.75	14.599	
Post-bench press	Traditional	16	85.63	10.745	**3.117/0.004**
	Cluster	16	83.00	14.024	
Post-shoulder press	Traditional	16	59.38	9.273	**5.621<0.01**
	Cluster	16	102.69	17.951	
Post-bent over row	Traditional	16	83.31	17.910	**3.056/0.005**
	Cluster	16	116.25	19.018	
Post-sumo squat	Traditional	16	89.06	19.437	**3.999/<0.001**
	Cluster	16	113.94	19.478	
Post-back squat	Traditional	16	90.69	14.160	**3.862/0.001**
	Cluster	16	125.63	15.903	
Post-calf raise	Traditional	16	97.69	20.480	**4.310/<0.001**

FIGURES

Figure: 1 starting & ending position of Bent over rows

Figure: 2 Starting &ending position of Calf raise

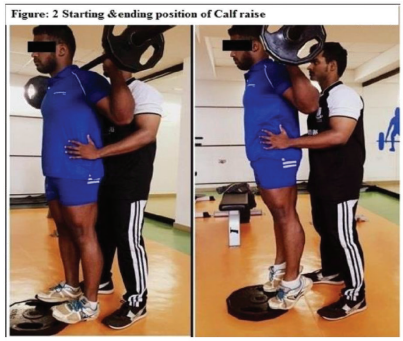

Figure: 3 starting & ending position of Bench press

Figure: 4 Starting & ending postion of Shoulder Press

Figure: 5 Starting & ending position of Back squat

Figure: 6 Starting & ending position of Sumo squat

CONCLUSION

The present study accepts the alternate hypothesis. Cluster training has an upper hand in developing strength in recreational males compared to traditional training.

Conflict of Interest : Nil.

Source of Funding : Self

Ethical Clearance: Yenepoya University Ethics Committee

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Effectiveness of Kleinert's Controlled Motion Protocol on Tendon Gliding Following Zone 5 Flexor Tendon Repair

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ABSTRACT

Introduction: Hand is the most active part of our body and used extensively in day to day activities. The flexor aspect of our hand is divided into 5 Zones. The 5th Zone or Zone 5 starts from the proximal palmar crease to the distal forearm. Flexor tendon injury at the Zone 5 includes loss of both finger and wrist movements. Post-operative rehabilitation is of utmost importance in recovering function of the hand.

Purpose: To study the effect of Kleinert's Controlled Motion (KCM) Protocol compared to the Conventional Accelerated Motion (CAM) Protocol followed in the hospital, in post operative Zone 5 flexor tendon injuries.

Methods: The study was conducted on 30 subjects, whose flexor tendons were repaired at the Zone 5. They were randomly divided into the Kleinert's Controlled Motion (KCM) group and the Conventional Accelerated Motion (CAM) group and were assessed for active range of motion at the metacarpophalangeal, proximal and distal interphalangeal joints by Finger Tip to Distal Palmar Crease (FTDPC) measure and Total Active Motion (TAM) score; active range of motion (AROM) at wrist and power grip (PG). The study was conducted for 12 weeks.

Results: Both the groups showed statistically significant improvement, but the subjects in the Kleinert's group showed better clinical improvement.

Conclusion: Better improvement in Kleinert's group may be attributed to the low tensile load put on the flexor tendons during the first weeks of rehabilitation leading to minimal adhesion formation and better outcome.

Keywords: *Kleinert's controlled motion, Safe zone, Tendon Gliding and Power Grip.*

BACKGROUND

Hand is the most active part of our body. While the eye is only a sensory organ and the foot mainly a motor organ, the hand plays a dual role. Injury to the hand or a loss of its function can hinder daily activities and this has severe physiological, psychological and social repercussions. To preserve them is the primary objective of hand surgery and to restore them, of rehabilitation[1].

Injury to flexor tendons either by trauma or surgical repair result in adhesion formation. In 1960, Lindsay and Thomson showed immobilization was the key to adhesion formation, though good tissue healing occurs, restricting tendon glide within a narrow tendon sheath[2, 3]. In 1963, Potenza hypothesized that adhesion formation was necessary for blood vessel in-growth into the tendon and healing occurs by fibroblastic response of the sheath and surrounding tissues (extrinsic healing)[4, 5]. Later Mathews and Richards showed that flexor tendon healing can occur in the absence of adhesion formation, by nutrition supplied by diffusion from the synovial fluid (intrinsic healing). These two concepts of tendon healing have guided strategies to improve the flexor tendon repair outcomes over the years[6-9].

Recent advances in surgical technique, centers on stronger repairs (more suture strands, more strong the repair) that can tolerate active motion, to ensure

early gliding[10-14]. Research shows that tendons that move as they heal have a better final outcome[15], but an early normal motion can result in tendon rupture. Therefore protected movements should be encouraged allowing sound healing while permitting tendon gliding. The strength of such tendons is better than which are immobilized[16-20].

There are many studies done on Zone 2 as this zone has more chances of adhesion formation than other zones[30]. Movement at wrist usually affects movement at fingers. Therefore quality of function at wrist directly or indirectly affects prehension and power at the hand. Thus there is a need to address Zone 5 with an intensive rehabilitation protocol. However there is less literature available on the same. Kleinert's Controlled Motion (KCM) Protocol has shown early recovery in Zone 2[30], but has not been addressed much in Zone 5 and thus there is a need to provide evidence and compare the same with other therapeutic regimens.

The purpose of this study was to determine the effect of Kleinert's Controlled Motion protocol when compared to the Conventional Accelerated Motion protocol followed at the hospital in post-operative Zone 5 flexor tendon repair.

METHODOLOGY

Forty six subjects from the Department of Plastic and Reconstructive Surgery (PS) of Nizam's Institute of Medical Sciences were screened according to the inclusion and exclusion criteria, after obtaining ethical clearance from IEC NIMS. Subjects with atleast one tendon repair between the ages 18 and 40 years were included and those with nerve injuries, extensor tendon injuries, degenerative/rheumatoid arthritis, fractures, compression neuropathies, neurological diseases involving the hand were excluded. Thirty subjects who fit the criteria were selected and randomly divided into two groups of 15 each by lottery method and informed consent was obtained from both the groups prior to the intervention. Patients were blinded for being in either of the groups. The Kleinert's Controlled Motion protocol was followed in the experimental (KCM) group while Conventional Accelerated Motion protocol followed at the hospital was given to the control (CAM) group.

Week	**Kleinert's Controlled Motion Group[1]**	**Conventional Accelerated Motion Group**
Splint	• Dorsal block splint (DBS) with wrist in 20°-30°, MCP in 50°-70°, IPJs in extension	• Dorsal block splint (DBS) with wrist 40°-50°, MCP in 50°-70°, IPJs in extension
I – III Hourly exercise within the Dorsal Block Splint (DBS)	1. 50 repetitions of active PIPJ and DIPJ extension 2. 5-10 repetitions of isolated passive PIPJ and DIPJ flexion, followed by composite passive flexion to each digit. 3. 2-5 repetitions of place and hold exercise. 4. Shoulder and elbow (no forearm) exercises in all planes, edema reduction by elevation, TENS for pain relief.	1. Passive movements to all IPJs 2. Shoulder and elbow (no forearm) exercises in all planes, edema reduction by elevation, TENS for pain relief.
End of IIIrd week	Scar care – massage of the scar during therapy without removal of the DBS.	

<table>
<tr><td>IV</td><td>• If good to excellent motion, it indicates weak or minimal scarring of the tendon and the DBS must be worn for another 1-2 weeks
• If contracture is setting in, DBS can be removed.
1. Patient is instructed to use the other hand to block MCP in flexion during active and gentle protected passive IPJ extension.
2. Gentle wrist active movement exercises.
3. FDS / FDP tendon gliding exercises.
4. Continue scar care</td><td rowspan="3">1. Active movements to all MCPs and IPs
2. Gentle wrist active movements and movement is progressed gradually
3. Continue scar care
4. Electric stimulation is started at 6th week for improving FDS/FDP glide
5. DBS is continued till 6th week</td></tr>
<tr><td>V</td><td>• Continue DBS if excellent motion is seen or discontinue in case of limited motion
• Continue week 4 exercises
1. Gentle non-resistive blocking exercise to facilitate FDS/FDP glide</td></tr>
<tr><td>VI</td><td>• Discontinue DBS
1. Isolated FDS/FDP muscle gliding
2. Gentle passive stretching to control contractures
3. Complete wrist AROM exercises
4. Electric stimulation for improving FDS/FDP glide
5. Light functional activities</td></tr>
<tr><td>VII</td><td>• Exercises as in 6th week
1. Full active finger and wrist movements
2. Light grip and wrist strengthening
3. Light functional activities</td><td>1. Full active finger and wrist movements
2. Light grip and wrist strengthening
3. Light functional activities</td></tr>
<tr><td>VIII - XII</td><td>• Progressive strengthening with progression to work conditioning
• Progress to normal functional activities</td><td>• Progressive strengthening with progression to work conditioning
• Progress to normal functional activities</td></tr>
<tr><td colspan="3">• NO ADDITIONAL CHANGES WERE MADE IN THE PROTOCOL</td></tr>
</table>

Subjects were assessed for active range of motion (AROM) at interphalangeal joints (IPJs) by Finger Tip to Distal Palmar Crease (FTDPC) measure using a ruler, Strickland's Total Active Motion (TAM) score using finger Goniometer; AROM at wrist using Goniometer and power grip strength (PG) using Jamar's hand-held dynamometer (JD)[27,29].

OBSERVATION AND RESULTS

During the 12 weeks of study, data collected was as follows: baseline values at 0 week for FTDPC, 4th week for TAM and Wrist AROM (as AROM exercises were started at 4th week). At the end, the baseline values were compared with the 12th week values. Power grip of the normal and affected hands were assessed and compared in the 12th week only, at the 2nd position of JD (as testing before 12th week can load the tendons causing ruptures). No tendon ruptures or subject drop-outs were recorded.

Table 1: Mean %ge and SD of each finger for FTDPC and TAM of Kleinert's group and Conventional group.

	FTDPC Difference between means 1st – 12th week mean%(SD)		**TAM score Difference between means 4th – 12th week mean%(SD)**	
	KCM	**CAM**	**KCM**	**CAM**
Index	6 (0.6)*	5.5 (0.5)*	-67.8 (9.2)*	-52.8 (17.1)*
Middle	5.7(0.9)*	4.5 (0.5)*	-66.2 (10)*	-52 (17.9)*
Ring	4.8 (0.9)*	3.9 (0.6)*	-57.7 (13.8)*	-48.5 (15.2)*
Little	3.8 (0.7)*	3.8 (0.5)*	-57 (14.8)*	-48.5 (14.4)*
*- p significant at <0.5				

Table 2: Mean %ge and SD of each finger for FTDPCand TAM of Kleinert's group and Conventional group

	Wrist AROM Difference between means 4th – 12th week mean%(SD)	
	Experimental	**Control**
Flexion	36 (9.1)*	22.6 (11.6)*
Extension	44 (12.4)*	34.6 (7.8)*
Ulnar Deviation	21.6 (8.1)*	17 (4.9)*
Radial Deviation	10.6 (3.7)*	7.6 (3.1)*
*- p significant at <0.5		

Table 3: Mean %ge and SD of Power grip of Kleinert's group and Conventional group.

Power Grip Difference between means At 12th week mean%(SD)	
KCM	CAM
13.8 (3.5)*	6.9 (2)*
*- p significant at <0.5	

DISCUSSION

Hand injuries are usually complicated with restriction of movement. Achieving maximum function is a therapeutic challenge. The concept of early controlled motion was designed to minimize adhesion formation and maximize tendon gliding, reducing frequency of tendon ruptures[8, 9, 21-23]. An understanding of tendon gliding and rupture paved the concept of SAFE ZONE i.e., *'the range of applied tendon loads should be large enough to induce tendon motion, yet small enough to avoid creation of a repair site gap or a tendon rupture'* [24]. Recent studies suggest that tendon motion rather than loading, gives a beneficial outcome. Thus tendon should glide, but with minimum force.

Evidence shows that during the first few days of surgery, resistance to tendon gliding is high and a tendon's tensile strength decreases initially after surgery, so the surgical repair alone must keep the tendon's ends approximated[25]. Thus very early active IPJ flexion; provokes fresh bleed and in contrast, if immobilized longer, joint stiffness and friction between the tendon and its sheath increases, thereby raising gliding resistance and promoting adhesion formation[26]. Hence it is better to wait three to five days, but not as long as a week, for the postoperative thrombus to mature and for the gliding environment to improve before starting rehabilitation[24].

In KCM group, passive flexion and active extension of IPJs was initially given, causing active tendon gliding and less stress on the tendon and in CAM group, passive IPJ motion was initially given, causing passive tendon gliding, which can either stress the tendons (with over passive motion) or lead to contracture (with less passive motion). So in KCM group there is a decreased chance of adhesion formation leading to better motion. Thus initial weeks of treatment are important for a better final outcome.

FTDPC measure and TAM score: At the end of the 12th week there was a significant difference ($p<0.05$) seen between the groups, with KCM group showing better results. The results agree with the conclusions drawn from literature that by imparting low load on the tendon, friction between the tendon and its sheath is reduced. Passive flexion and active extension, causes a tendon to glide, without putting much load on it. This movement is useful not only in reducing stiffness but also in decreasing the risks of gaping[24, 26].

Wrist AROM: At the end of 12th week, a significant difference ($p<0.5$) was seen between the groups but suggesting better improvement in KCM group. These results agree that, careful tissue handling reduces the load for tendon gliding during the first weeks of rehabilitation and the proximally directed tendon force applied with simple passive finger flexion with the wrist flexed is minimal, thereby reducing the tendon gliding resistance[24]. Subjects in the KCM group benefited better final active range of wrist motion as the wrists were immobilized in 20^0-30^0 of flexion when compared with CAM group where the operated wrists were immobilized in 40°-50^0 flexion agreeing with Bengi Oz et al[27] that, too much wrist flexion during immobilization can make it difficult to regain wrist extension.

Power grip: There is a significant difference ($p<0.05$) in the means of the grip strength of the affected hands between the groups with better improvement in KCM group. The results obtained in this study coincide with a systematic review in which there was 79% improvement in grip strength[28]. These findings agree with Groth[25] who considered that progressive strengthening of the repaired tendons over time i.e., raising of the upper limit of the 'SAFE ZONE'. This allows safe healing of the tendon, while improving the strength of the tendon and avoids the risk of tendon rupture and gapping.

CONCLUSION

The present study was designed to determine the efficiency of the KCM protocol on tendon gliding in post-operative Zone 5 flexor tendons when compared with the conventional protocol. A twelve week intervention with the KCM protocol has improved the tensile strength of the repaired flexor tendons when compared with the conventional protocol which was attributed to the progressive strengthening of the flexor tendons, showing minimum adhesion formation and better hand function.

Source of Funding: SELF

Conflict of Interest: NIL

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Comparison between Immediate Effect Land based and Water based Squatting Activity on Pain in Osteoarthritis Knee Patients

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ABSTRACT

Aim: To compare immediate effect of land-based and water based squatting activity on pain in OA knee patients.

Objectives: To assess the pain using VAS (visual analogue scale) after performing land based squatting activity in OA knee patients

- To assess the pain using VAS after performing water based squatting activity in OA knee patients.
- To compare between immediate effect of land based and water based squatting activity, on pain in OA knee patients.

Results: The study showed that subjects of osteoarthritis knee showed statistically significant difference between immediate effect of land based and water based squatting activity($p<0.05$)

Keywords-*OA,osteoarthrithis,squatting,knee pain,elderly*

INTRODUCTION

OA is a nearly universal, slowly progressive degenerative condition affecting men and women as they age.OA of knee is most common type of degenerative disease affecting thousands of Indian citizens. It is the second most common form of disability and although it affects both men and women, women are more likely to be symptomatic[1]. OA is a condition in which the cartilage that acts as a cushion between bones in joints begins to wear out, causing pain and inflammation in joints, thereby restricting movement[2].

Hydrotherapy is the use of water to heal and ease a variety of ailments. Hydrotherapy is the most beneficial system of restoring normal functions in the body. It is employed to help balance metabolism[3].Use of water in various forms and in various temperatures can produce different effects on different system of the body. The principle effects of water include buoyancy, resistance (viscosity), hydrostatic pressure and surface tension. Understanding these basic[5]

Principle helps us utilize them to their fullest potential on individual cases. Buoyancy and resistance are the most commonly known principles upward thrust placed on a body when the body part is submerged. When the body is submerge in a bath, a pool, or a whirlpool, it feels weightless[6].

The squat is one of the most frequently use activity in the day to day life. Benefits associated with squat performance are not limited to the athletic population[8]. Given that most ADL'S necessitate the simultaneous coordinated interaction of numerous muscle groups. Squats can be performed at a variety of depths, generally measured by degree of flexion at the knee. Squats can be performed using just one's body weight or with an external load[9,10]. Effect of squatting depends upon the loads. Squat depth should be consistent with the goals and abilities of the individual. Because peak patellofemoral compressive forces occurs at or near maximum knee flexion[11,12]. Squat decent should always be execute in a controlled fashion, with a 2 to 3 second eccentric tempo considered a general guideline. Front squat tend to produce less knee extensor torque compare to back squats[14].

NEED OF STUDY

Osteoarthritis of knee is the fourth most important cause of disability in women according to World Health Organization report on Global Burden of disease. In subjects with OA it seems necessary to perform ADL and aquatic therapy has been shown to capable of improving physical functions in the subjects. However not much research has been done regarding the "comparison between land-based and water based squatting activity on pain in OA knee patients ". There are many studies done on "effectiveness of exercise performed in the aquatic pool and out of the pool in subjects with OA knee".

Hence, the present study has been undertaken to find out the immediate impact of hydrotherapy on OA knee patients after performing squatting.

AIMS AND OBJECTIVES

AIM

To compare immediate effect of land-based and water based squatting activity on pain in OA knee patients.

OBJECTIVES

- To assess the pain using VAS (visual analogue scale) after performing land based squatting activity in OA knee patients
- To assess the pain using VAS after performing water based squatting activity in OA knee patients.
- To compare between immediate effect of land based and water based squatting activity, on pain in OA knee patients.

HYPOTHESIS

NULL HYPOTHESIS:

There will be no significant difference between immediate effect of land based and water based squatting activity on pain in OA knee patients.

EXPERIMENTAL HYPOTHESIS:

There will be significant difference between immediate effect of land based andwater based squatting activity on pain in OA knee patients.

MATERIALS AND METHODOLOGY

1. STUDY DESIGN

Type of study: comparative study.

Population: Diagnosed case of knee osteoarthritis.

Duration of study: 6 months

Location: metropolitan city.

2. SAMPLE DESIGN

Type of sampling: convenient sampling.

Sample size: 60

Location: metropolitan city.

MATERIALS

Visual analogue scale

Paper and markers

Swimming costume

Swimming pool

SELECTION CRITERIA

INCLUSION CRITERIA:

1. Diagnosed case of knee Osteoarthritis.
2. Patients willing to participate.
3. Patients with age group of 50 to 60 years.
4. Patient with bilateral knee osteoarthritis.

EXCLUSION CRITERIA:

1. CN disease, especially epilepsy.
2. Any recent lower limb fractures.
3. Severe lung disease such as e.g. COPD
4. Patient with Hydrophobia.
5. Large skin wounds or inflammatory and ulcerated dermatosis of the legs.
6. Severe febrile infectious disease
7. Inflammatory arthropathy of knee joint
8. Acute, hot, red, swollen knee joint

PROCEDURES

Subjects with OA knee and are having knee pain who fulfill the inclusion criteria will be included in the study. A written informed consent will be taken from all subjects prior to participation. Purpose and procedure will be explained prior to participation in the study.

The subject is asked to perform 10 repetitions (as much as he/she can perform) of squatting activity outside

the pool. He /she can take the help of support (wall bar) if required. After the activity has been performed, pain will be measured using VAS (visual analogue scale).

Now, the patient is given rest for some time. As the pain subsides, if pain does not subside, intervention will be done for the same. Now activity will then be performed in the waist level aquatic pool. Here patient can take support of the pool bar for squatting, after performing activity; pain will then be noted on VAS.

If pain will not subside then intervention will be done to reduce the pain.

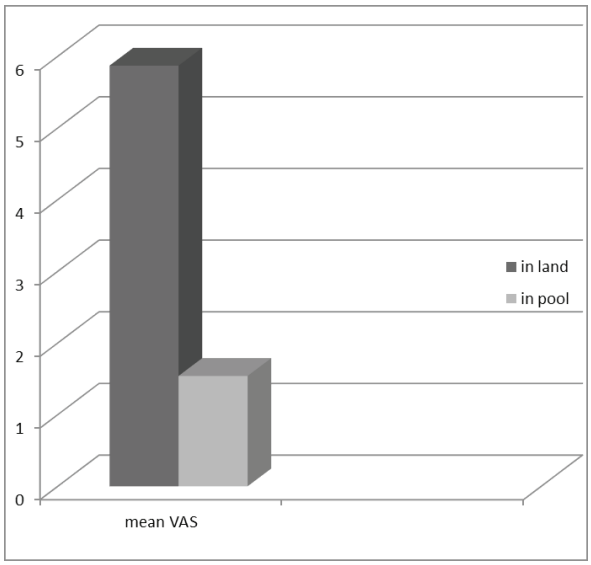
The reading of the pain which was noted using VAS (visual analogue scale), would be statistically analyzed to conclude the study.

DATA ANALYSIS

100 subjects of diagnosed case of bilateral knee osteoarthritis were taken in the study and 10 repetitions of squatting were performed inside and outside the aquatic pool. Pain was measured using VAS inside and outside the aquatic pool and data was collected, statistical analysis was performed using unpaired T test.

A bar graph shows comparison ofpain (VAS score)in osteoarthritis knee patients between in the pool and out of the pool.

RESULTS



Graph 1: Comparison vas score between land and pool

RESULTS

The study showed that subjects of osteoarthritis knee showed statistically significant difference between immediate effect of land based and water based squatting activity($p<0.05$)

DISSCUSION

Osteoarthritis, commonly known as wear-and-tear arthritis, is a condition in which the natural cushioning between joints -- cartilage -- wears away. When this happens, the bones of the joints rub more closely against one another with less of the shock-absorbing benefits of cartilage. The rubbing results in pain, swelling, stiffness, decreased ability to move and, sometimes, the formation of bone spurs. Previous studies says that exercises performed in the aquatic pool in the OA knee patients reduces pain as principle effects of water like buoyancy, surface tension, viscosity acts on the joint and thereby improving range of motion of the joint. It has been recognized that exercising in water can be an effective and useful mode of therapeutic exercise, especially for the individuals who have difficulties with the weight-bearing components while performing land exercises. It seems that it may be more suitable for water based exercise programs than the land-based exercise. A new study shows that both water-based (hydrotherapy) and traditional gym exercise programs can increase muscle strength and help people with osteoarthritis of the knee or hip walk faster and longer, which may reduce the risk of falls and disability.

There is a moderate quality level of evidence supporting the notion that water-based exercise can improve pain, function, self-efficacy, joint mobility, strength and balance outcomes for people with osteoarthritis knee. Hydrotherapy provides favorable environment and it can be beneficial for patients with osteoarthritis knee. Hydrotherapy was superior to land-based exercise in relieving pain before and after walking during the last follow-up.

Water-based exercises are a suitable and effective alternative for the management of OA of the knee.

Our study showed that water based squatting activity shows immediate effect on pain relief than land based squatting activity.

CLINICAL IMPLICATION

With the use of an aquatic therapy training of squatting activity can be started earlier in the Osteoarthritis knee patients.

Aquatic therapy can be used for reduction of pain

SUGGESTIONS

Further study can be undertaken using,

Comparison of VAS scores of male and female in the pool and out of the pool. Pre and post values of VAS scores c

CONCLUSION

Our study concludes that water based squatting activity shows immediate effect on pain relief than land based squatting activity.

Ethical Clearance- Taken from college committee

Source of Funding- Self

Conflict of Interest - Nil

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Co-relation between VC & 6 Minute Walk Test in Patients with Impaired Lung Functions

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ABSTRACT

Like everywhere else in the world and especially in the developing world; India is changing - not only in terms of its demographics, urbanization, economic profile, pollution but also in terms of its health burden, disease pattern, dominant-disease-composition, morbidity and mortality determinants.The VC of the lungs is a critical component of good health. It is an indispensable measure for the diagnosis of pulmonary mechanical limitation as well as for adequationof pulmonary re-expansion therapy applied to patients after cardiac surgery. The evaluation of pulmonary volumes and capacities is essential to characterize pulmonary mechanical limitations in postoperative cardiac surgery patients and in obstructive disorders. Measurement of exercise capacity is an integral element in assessment of patients with cardiopulmonary disease. The 6MWT provides information regarding functional capacity, response to therapy and prognosis across a range of chronic cardiopulmonary conditions. This study was approved by the Research Ethics Committee.Patient s & written informed consent was signed.Subjects were evaluated.Pulmonary function(VC) was assesed by spirometry, at the PFT lab..6-MWT was performed on the 5th postoperative day CABG; 1st post-operative day PTCA and OPD basis for Obstructive disorder. The study showed that the VC and the 6 MWT was also reduced in post cardiac surgery and obstructive group of subjects.There is NO statistical significant correlation between VC and 6 MWT in post cardiac surgery and obstructive group of subjects.Though the pattern showed most of subjects with a better VC covered more distance in 6 MWT.

Keywords:- *VC, 6 MINUTE WALK TEST, LUNG FUNCTIONS, CABG, PTCA, COPD,*

INTRODUCTION

Like everywhere else in the world and especially in the developing world; India is changing - not only in terms of its demographics, urbanization, economic profile, pollution but also in terms of its health burden, disease pattern, dominant-disease-composition, morbidity and mortality determinants.

The VC of the lungs is a critical component of good health.Itis defined as the maximum amount of air that can be exhaled after a maximum inhalation, it is an indispensable measure for the diagnosis of pulmonary mechanical limitation as well as for adequation of pulmonary re-expansion therapy applied to patients after cardiac surgery. The normal value of the VC is from 3 to 5L/min, however, there may be variations regarding ethnicity, age, gender, height and weight [1-5].A study showed the mean VC of Indian male is 3.53L/min and that of Indian women is 2.37L/min[3].

The evaluation of pulmonary volumes and capacities is essential to characterize pulmonary mechanical limitation, especially in postoperative cardiac surgery patients [6,7]and in obstructive disorde rs.It has been described that VC lower than 25 ml/Kg can predispose atelectasis, hypoxemia and inefficient cough [6,7]. After cardiac surgery, the impairment of VC has a multifactorial meaning and the restrictive pattern can last for more than 116 days, predisposing atelecta sis and post operatorycomplications[8,9]. Similar changes are seen in obstructive lung disorders like COPD, Bronc hiectasis, Bronchial asthma.due to pathological process leading to deterioration of the VC.

Coronary heart disease is the most prevalent heart disease in India, contributing more than 95% of the total CVD prevalence, and more than 85% of all CVD related deaths in 2004[10]. India also contributes a significant and growing percentage of COPD mortality estimated to be amongst the highest in the world; i.e.

more than 64.7 estimated age standardized death rate per 100,000 amongst both sexes as mentioned in the WHO Global Infobase Updated on 20th January 2011 (India 102.3 and China 131.5)[19]. This would translate into approximately 556,000 in case of India (>20%) and 1,354,000 cases in China (about 50%) out of a world total of 2,748,000 annually [20].

Cardiac surgery causes a series of clinical and functional complications, among them, the postoperative complications are the most common, with incidence ranging from 6% to 88%, and directly contributes to increased morbidity and mortality, duration of hospital stay, use of resources and time to return to productive life[11,12]. This is due to changes induced by cardiac surgery on pulmonary and cardiac mechanics when using general anesthesia, median sternotomy, thoracic manipulation and cardiopulmonary bypass (CPB), causing depression of cardiorespiratory function and postoperative pain[13-15]. These dysfunctions affect the breathing pattern, reducing lung volume and capacity, contributing to the appearance of atelectasis and changes in the ventilation/ perfusion relationship [14,15,17,18]. This presentation reduces the cardiorespiratory cap acity, which is also negatively influenced by physical postoperative inactivity, due to bed rest, which also produces loss of muscle strength and deconditioning, which is a risk factor for pulmonary complications and thromboembolism [15-17]. Similarly, changes due to pathophysiological processes leading to reduction in pulmonary mechanics, predisposing to various sign & symptoms like Dyspnoea, Cough, Expectorations etc.

The positioning of the patient to rest in the dorsal decubitus causes a reduction in volume and lung capacity and increased work of breathing and heartbeat. This is because the positioning promotes the accumulation of central blood volume that promotes the formation of congestion, oedema and decreased lung compliance, as well as reduced cardiac output by 30%, which can lead to orthostatic intolerance[16,18].

Measurement of exercise capacity is an integral element in assessment of patients with cardiopulmonary disease. The 6-min walk test (6MWT) provides information regarding functional capacity, response to therapy and prognosis across a range of chronic cardiopulmonary conditions. A distance less than 350 m is associated with increased mortality in chronic obstructive pulmonary disease, chronic heart failure and pulmonary arterial hypertension. Desaturation during a 6 MWT is an important prognostic indicator for patients with interstitial lung disease. A change in walking distance of more than 50 m is clinically significant in most disease states[21].

In light of the foregoing, the aim of this study was to evaluate lung functions (VC) and distance of the six-minute walk test (6-MWT) in patients undergoing CABG,PTCA & those with Obstructive lung disorders. To assess the influence of both variables on the lung function and overall functional capacity of the patients.

No study has evaluated the relation of VC to other health parameters like Blood pressure, Heart rate,SPO_2 and functional capacity(6 Minute walk distance).Thus this study was designed to find an association(if any) between these above mentioned parameters.

METHOD

To asses the lung VC & 6 minute walk test in post cardiac surgery and obstructive respiratory condition. Also to find Co-relation between lung VC & 6minute walk distance in post cardiac surgery and obstructive respiratory conditions

Study design – Experimental

Sample size – 215 Patients in experimental group

Type of sampling – Convenience sampling

Sample source – Tertiary health centre

Materials used- Spirometry (PFT), 30m hallway ,S topwatch, Sphygmomanometer, Pulse oximeter.

Subjects-Post CABG, Post PTCA, Obstructive lung conditionS

INCLUSION CRITERIA

1) Age:-20-60yrs.

2) Patients with Chronic obstructive airway diseases: COPD, Bronchiectasis, Bronchial asthma.

3) Patients who had undergone cardiac surgery: Coronary artery bypass grafting (CABG), Percutaneou s transluminalcoronaryangioplasty (PTCA).

EXCLUSION CRITERIA

1) Trauma

2) Acute exacerbation

3) Malignancy

4) Hyperpyrexia

5) Any musculoskeletal injuries or neurological involvement or any surgeries in lower limbs in past 6 months

6) Patients with any associated psychiatric conditions.

PROCEDURE:-

I. This study was approved by the Research Ethics Committee.

II. Patients were informed about the procedures to be performed and written informed consent to participate in this study was signed.

III. Subjects from both genders (male and female), aged between 20-60 years were evaluated in the time period of January 2014 to February 2015.

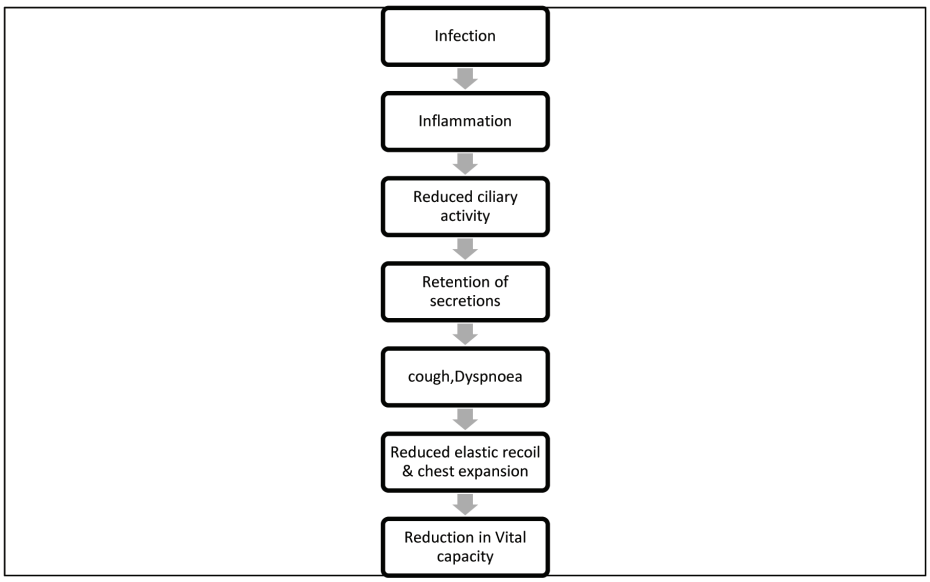
IIII. Pulmonary function was assesed by spirometry, using the portable spirometer manufactured by Micro Medical model Microlab 3500 (Rochester, England) by the PFT lab. The variables of the test used in the study is the VC (VC).

V. 6-MWT was performed on the 5th postoperative day CABG; 1st post-operative day PTCA and OPD basis for Obstructive disorders. All the vital parameters were assessed at the beginning and at the end of the test. The patient was guided to walk as far as possible without running, as recommended by the American Thoracic Society[13] in a course of 30 meters, marked every 3 meters, with the turning point marked by a cone. After completing the six minutes, the patient was asked to immediately stop and sit in a chair. The total distance walked by the patient was recorded.

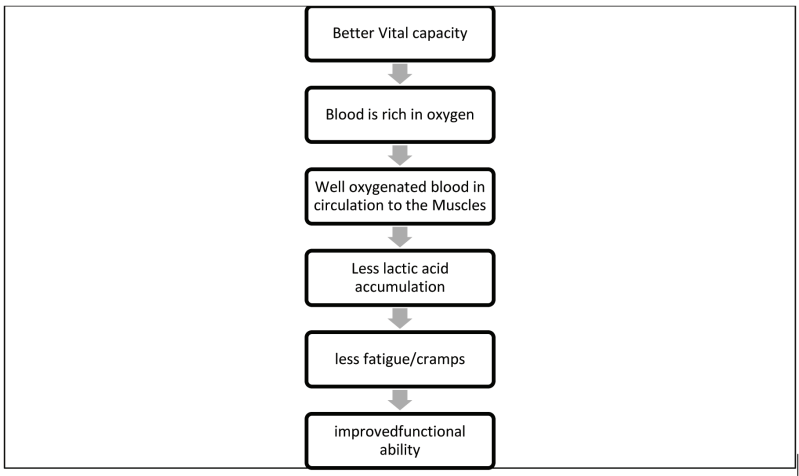
RESULTS

213 patients were assessed.63 underwent CABG [Group I]40underwent PTCA [Group II] and 103 had Obstructive lung conditions [Group III](COPD, Bronchiectasis, Bronchial asthma).They were evaluated for VC and 6 MWT & results showed reduction in VC more pronounced in patients with obstructive conditions with an average VC of 2L/min followed by CABG 2.5L/min lastly PTCA group showed 3L/min. There was reduction of 6 MWT distance in all 3 groups Maximally reduced in CABG group 483m followed by PTCA 487m lastly Obstructive group 488m.Based on spearman correlation test the p value for CABG IS 0.3883;PTCA Is 0.3433 & obstructive is 0.9551.Hence concluded there is no Statistical Correlation between 6 MWT distance and VC in all the 3 groups .

Pathophysiology-Obstructiveconditions(Figure1)



Pathophysiology-VC(Figure2)



DISCUSSION & CONCLUSION

213 patients were evaluated for VC and 6MWD. There were 8 droupouts due to lost to followup. All data was analysed on computer by means of the Graphpad Prism(6.0) and Microsoft Excel 2010To check for normality Kolmogorov-smirrnov test was applied. As the data was not following Normal distribution, nonparametric Spearman correlation test was used. Stepwise multiple analysis was used to determine the best predictor for correlation. A p value of less than 0.05 was taken as significant.As seen in VC was reduced in all the patient groups as compared to normal(3-5L/min)[1-5]. Maximum reduction in VC (average 2L/min) was seen in patients with obstructivedisorders(COPD, Bronchial Asthma, Bronchiectasis).This can be attributed to the ongoing pathology of the disease processes[77,83](FIgure 3)In patients who underwent CABG showed an average VC was 2.5L/min. 6 MWT was significantly reduced in patient's with CABG, followed by those who underwent PTCA, lastly in Obstructive group. The average distance walked by CABG patient's was 483m, followed by PTCA was 487m and maximum was walked by obstructive group of patients 488m. There is a major role of sedation during the procedure, length of sedation, ventilation etc. This in turn may lead to weakness and fatigue. Other factors indirectly affecting the functional ability most commonly is pain.On observing the data closely ;it showed that subjects with a higher VC covered relatively more distance in the 6MWT though there was no statistical significance.(FIgure 4)In PTCA group VC is more(average3L/min) then those in CABG group(average 2.5L/min). Also the 6 MWT in the PTCA group is more(average of 487m)as compared to those in CABG group(average 483m).

Pathophysiology-Obstructiveconditions (Figure3)

Pathophysiology-VC(Figure4)

Conflict of Interest- Nil

Source of Funding- Self.

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Intra and Inter-Rater Reliability of Brief Balance Evaluation System Test in Patients with Total Knee Arthroplasty

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ABSTRACT

Background: Following Total Knee Arthroplasty (TKA) surgery the patients may have functional deficits like reduced walking velocity and stride length and during the level walking, balance impairment can lead to falling risk in them. But currently, the balance evaluation system is not addressed in full depth with a more reliable tool in knee arthroplasty patients.

Purpose: The purpose of this study was to evaluate the reliability of Brief Balance Evaluation System Test (Brief-BESTest) scale as an assessment tool for balance on individuals with TKA.

Methods: An observational study design used with 30 individuals as participants who had undergone TKA surgery. Intra-class correlation coefficients (ICC, model two-way random, type absolute agreement) were calculated for examining the test-retest reliability.

Results: The Intra-rater reliability was 0.984(0.967-0.992); Inter-rater reliability was 0.987(0.973-0.994) and the Bland-Altman analysis of limits of agreement showed that the mean difference was -0.266±1.112 for the Brief-BESTest scale.

Conclusion: The Brief-BESTest is a reliable and time-saving tool to assess the balance in TKA patients and is more reliable compared to Mini-BESTest and BESTest.

Keywords: *Total knee arthroplasty, Stability, Balance test.*

INTRODUCTION

Total Knee arthroplasty (TKA) is a common surgical intervention to treat the patients with severe knee osteoarthritis. The incidence rate of TKA has grown over the last 20 years and will continue to grow due to changing population demographics[(1)]. The uses of knee arthroplasty surgery are to correct the deformity, reduce pain, and improve physical function and symptoms of osteoarthritis. However following surgery the patients have functional deficits like reduced walking velocity and stride length during level walking[(2, 3)], altered sensory and motor function, which can lead to impairment in balance function [(4, 5)] and alteration in motor coordination, muscle strength and/or proprioceptive dysfunction[(2, 6, 7)]. Balance impairment can lead to falling risk in patients with TKA[(4, 5)]. A balance test is used to assess different components of balance and provides information regarding individual's functional recovery and to make predictions of falls[(8)]. Falling is a serious public health problem among elderly people because of its frequency, the morbidity associated with falls and cost of the necessary health care [(9, 10).] Approximately 30% of people over 65-years of age who live in the community fall each year. Several potentially modifiable risk factors for falling such as muscle weakness, impairment in balance and use of medication have been identified[(9, 11, 12).]

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Balance involves the interaction of both sensory and motor systems [13]. Previous research in balance assessment among patients with TKA mainly involved advanced technology and sophisticated equipment in laboratory settings such as virtual or real obstacles avoidance[14, 15], stabilogram analysis[16, 17], kinematic and electromyographic analysis[4, 18] and computerized dynamic posturography[19], which might not be available and feasible in real clinical situations. Although Berg Balance Scale (BBS) is a common tool for balance assessment[20, 21] and can be considered as a reference standard for assessing balance in patients with TKA clinically[22, 23]. It mainly assesses static balance and has been shown to have considerable ceiling effects in various patients' population[24, 25]. Balance is an important dynamic task in walking but is not addressed in the BBS [26]. The BESTest was developed which includes 36 items that evaluate the performance of 6 balance systems: biomechanical constraints, stability limits/vertically, anticipatory postural adjustment, postural responses, sensory orientation and stability in gait[27]. Most of the current standardized clinical balance assessment tools are directed at screening for balance problems and predicting fall risk, particularly in elderly people[28, 29]. The BESTest takes about 45 minutes to administer[30]. In addition, equipment such as a ramp, a foam block, a meter stick, a table and a 2.27 Kg weight is necessary for the BESTest and may not be readily available for clinicians. These concerns suggest that BESTest, although measuring balance control systems and possessing reasonable accuracy in predicting falls, may not be practical for regular use in all clinical settings [31]. A condensed version of BESTest named the mini-BESTest was derived with only 16 items, which takes only 15 minutes to complete. However, 2 of the balance system (biomechanical constraints and stability limits/verticality) are omitted in mini-BESTest[30]. To avoid the drawbacks of BESTest and mini-BESTest, the 8-item Brief-BESTest was developed which assess all 6 balance systems. It requires less than 10 minutes to administer and could be more feasible for clinical use[32].

Section-1: Biomechanical constraints: Biomechanical constraints for standing balance include hip/trunk lateral strength (item-1) in a standing position to assess the balance function[33].

Section-2: Stability limits: This system includes items for an internal representation of how far the body can move over its base of support before changing the support or losing balance, as well as an internal perception of postural vertical [42, 43]. Stability limits include functional reach forward (item-2), which measures the ability to lean as far as possible in standing position[36].

Section-3: Transitions –anticipatory postural adjustment: This system includes tasks that require an active movement of the body's center of mass in anticipation of a postural transition from one body position to another [37]. Anticipatory postural adjustment includes standing on one leg-left and right (items-3 and-4) to examine balance function[38].

Section-4: Reactive postural response: Reactive postural responses include both in-place and compensatory stepping responses to an external perturbation induced by the examiner's hands using the unique "push and release" technique [39]. The postural response includes compensatory stepping-lateral, to both the sides left and right (items-5 and -6) [40].

Section-5: Sensory orientation: This system identifies any increase in body sway during stance associated with altering visual or surface somatosensory information for control of standing balance. Sensory orientation includes standing with eyes closed, on foam surface (item-7) [41].

Section-6: Stability in Gait- This system evaluates balance during gait [42]. Stability in gait includes timed "up & go" test (item-8), which evaluates how fast a patient can sequence rising from a chair, walking, turning and sitting back down again [43].

The purpose of this study was to evaluate the reliability of Brief-BESTest scale as an assessment tool for balance on individuals with TKA.

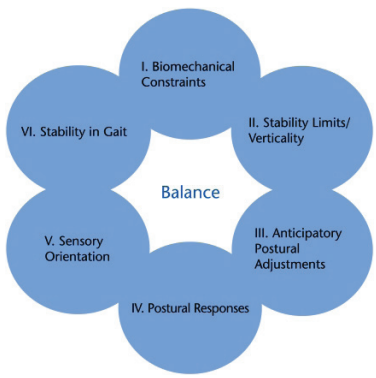

Figure-1: Model summarizing systems underlying postural control corresponding to sections of the BESTest [25]

METHODOLOGY

An observational study design used with 30 individuals as participants who had undergone TKA recruited in the study based on the following criteria: Inclusion criteria: 1. Postoperatively one month after TKA done and able to fully participate in study procedure without fatigue 2. Able to stand and walk without any aids. Exclusion criteria: 1. Any other musculoskeletal injuries and 2. The current use of any medicines, which can cause dizziness and fainting. 3. Any neurological involvement.

Data collection included two assessors assessing all the 30 participants. All the subjects were tested under the same condition. Before the test, demographic information was obtained from medical records and personal interview. First balance evaluation was done using Brief-BESTest by both assessors separately. After a period of one week, the second evaluation was done by the first assessor.

STATISTICAL ANALYSIS

Intra-class correlation coefficients (ICC, model two-way random, type absolute agreement) were calculated for examining the test-retest reliability. The ICC values ranges from 0 to 1; 1= perfect reliability, 0.90 to 0.99 = very high correlation; 0.70 to 0.89 = high correlation; 0.50 to 0.69 = moderate correlation; 0.26 to 0.49 = low correlation and 0.00 to 0.25 =little, if any, reliability[44]. The agreement was determined by the Bland-Altman method in which the individual differences were plotted against the individual mean scores. The significance level was set at 5%[45]. The standard error of measurement (SEM=Average SD x √1-ICC) was used to determine the measurement error. The SEM was then converted into the Minimal Detectable Change (MDC), which expresses the minimal magnitude of change that likely reflects true change rather than measurement error. The MDC95% was estimated from the SEM and calculated as 1.96 √2 × SEM[46].

RESULTS

The present study used 30 TKA patients. From this sample, 21 subjects were females (70%) and 9 subjects were males (30%). The mean age was 62.77± 13.20 years. Their mean height was 1.62±.075 meter and weight 69.60±6.27 Kgs. Among them, 11(36.7%) undergone bi-compartmental and 19(63.3%) tri-compartmental surgery.

Table-1 shows the mean and standard deviation of Brief-BESTest score. The intra-rater, inter rater reliability and internal consistency of Brief-BESTest, are shown in Table-2&-3.

Table-1: Mean and SD of Brief-BESTest (N=30)

	Minimum	Maximum	Mean	SD
Rater 1	8	26	20.7	4.442
Rater 2	7	26	20.97	4.398
Rater 1 Retest	8	27	20.97	4.522

Table-2: Intra-rater & Inter-rater Reliability

Reliability	ICC	95% Confidence Interval
Intra-rater reliability	0.984	0.967-0.992
Inter –rater reliability	0.987	0.973-0.994

Table-3: Component-wise Intra-Rater, Inter–Rater Reliability, and Internal Consistency

Brief BESTest	Inter-rater reliability		Intra–rater reliability		Internal consistency (Cronbach' alpha)
	ICC	95%CI	ICC	95%CI	
Biomechanical Constraint	0.918	0.829-0.961	0.939	0.874-0.971	0.937
Stability Limits/Verticality	0.670	0.314-0.842	0.680	0.374-0.821	0.682
Anticipatory Postural Adjustments	0.940	0.876-0.971	0.888	0.767-0.947	0.939
Postural Responses	0.965	0.928-0.983	0.996	0.991-0.998	0.996
Sensory Orientation	1.00	1.00-1.00	1.00	1.00-1.00	1
Stability in Gait	0.906	0.811-0.957	0.753	0.448-0.883	0.909

For Intra-rater or test-retest reliability, the Bland-Altman analysis of limits of agreement showed that the mean difference was -0.266±1.112 for the Brief-BESTest. The SEM for the Brief-BESTest was 0.566. In our study, calculations revealed an MDC of 1.569 points for Brief-BESTest.

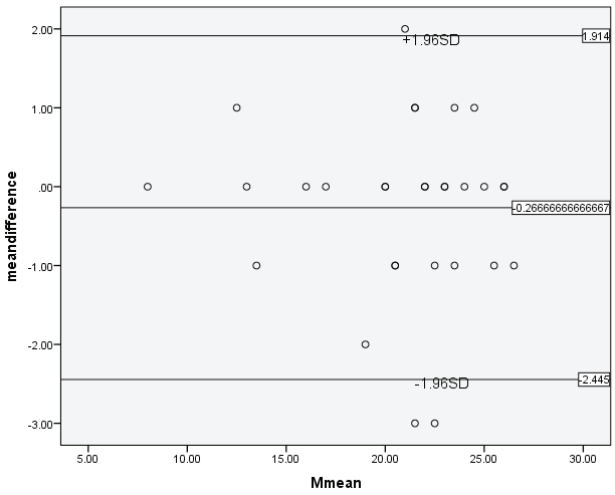

Figure-1: Bland-Altman Plot for measuring the limits of agreement of Brief-BESTest scores

DISCUSSION

The present study is to determine whether Brief-BESTest has good reliability to assess balance in patients with TKA. The study targeted both inter-rater and intra-rater reliability of balance measures for participants in the study using a Brief-BESTest scale. In the intra-rater reliability of Brief-BESTest scale, ICC is 0.984 which is suggestive of high reliability and for inter-rater reliability of Brief-BESTest the ICC is 0.987 which is also suggestive of high inter-rater reliability. Similarly, Horak et al[25] conducted a study that differentiates balance deficits by using Brief-BESTest and he found that the Brief-BESTest is the most comprehensive clinical balance tool available with excellent reliability and very good validity. The Brief-BESTest demonstrated reliability comparable to that of the Mini-BESTest and potentially superior sensitivity while requiring half the items of the Mini-BESTest and representing all theoretically based sections of the original BESTest. The study suggested that Clinicians can reasonably rely on the Brief-BESTest for predicting falls, particularly when time and equipment constraints are of concern[47, 48].

Moreover, a study by Andy et al[49] to assess balance function in patients with TKA results suggested that all the three BESTests demonstrated excellent inter-rater reliability, intra-rater reliability, and internal consistency for evaluation of balance in patients with TKA.

Brief-BESTest is a very reliable tool for assessing balance problems in subjects with TKA. Most of existing clinical balance tests are directed at predicting fall risk or whether balance problems exists, rather than what type of balance problems exists.

CONCLUSION

The Brief-BESTest is a reliable tool to assess balance in patients with TKA. Even Brief-BESTest demonstrated reliability comparable to Mini-BESTest and BESTest and it is very useful for clinicians for assessing balance with less time consumption in assessment.

Ethical Approval: Permission taken from Sarvajanik College of Physiotherapy, Surat.

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Conflict of Interest: None.

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Efficacy of Retro-treadmill Walking Versus Forward-treadmill Walking on Hamstring Flexibility, Strength and Balance in Young Collegiate Students

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ABSTRACT

Objective– Efficacy of retro treadmill walking versus forward treadmill walking in hamstring flexibility, strength and balance in young collegiate student.

Methodology–The duration of the study was one and half year. Minimum of 60 subjects were selected byrandom sampling for the study. They were divided randomly into three groups- Group A, Group B and Group C. Each group had minimum of 20 subjects. In Group A- subjects were instructed to do forward walking. Group B- subjects were instructed to do retro walking and Group C- was kept as control group. 5 sessions per week were given for 2 weeks respectively to each group and reassessment was done on 5th and 11th day.

Result- The result showed that there was statistical significant difference between both the experimental groups- Group A and Group B.it is clear that forward and backward walking improves flexibility, strength and balance.

Conclusion- We conclude that forward walking and backward walking are effective in improving flexibility, strength and balance in healthy subjects. But backward walking proves to be more effective in improving flexibility, strength and balance as compare to forward walking hence, proving research hypothesis.

Keywords- *Forward-treadmill walking, Retro-treadmill walking, hamstring flexibility, strength and balance*

INTRODUCTION

The treadmill is a sensible choice as an alternative to over ground training due to its availability, as well as the ability to maintain a specific speed and slope. Motorized treadmill has a flat running surface with a motor that propels a continuous moving belt in which the runner attempts to match the speed through stride length and stride rate.[1]The ability of an individual to move smoothly depends upon his flexibility. The hamstrings are an example of muscle group that have tendency to shorten.[3] A short hamstring muscle are associated with various problems, including specific disorders of lumbar spine, general dysfunction syndromes of low back and sports related injuries[4.]During forward walking knee joint flexes, extends and then flexes in support phase, whereas knee initially extends, flexes and extends in support phase, prior to flexing and extending during swing. However support swing ratio of backward walk is similar to forward walking with 60% support and 40% swing. Backward walking increases stride rate, decreases stride length and increases support time. Backward walking overall reduces range of motion of knee thereby increase active functional range.[7] During backward walking in the same motor program is used as during forward walking, but possibly running in reverse.[29, 35] It has been suggested that backward walking appears to create more muscle activity in proportion to effort than forward walking. [29, 30] For the performance of walking parameters the steps of walking backward per minute was more than forward and relatively walking forward needed longing moving time of per pace[36,37].

Purpose of study:

The purpose of this study is to determine the efficacy of retro-treadmill walking versus forward-

treadmill walking on hamstring flexibility, balance and strength in young collegiate students.

Objectives:

- To assess the effect of retro-treadmill walking on hamstring flexibility, strength and balance in young collegiate students.
- To assess the effect of forward-treadmill walking on hamstring flexibility, strength and balance in young collegiate students.
- To compare the effect of retro-treadmill walking versus forward-treadmill walking on hamstring flexibility, strength and balance in young collegiate students.

METHODOLOGY

Experimental design (comparative in nature) was used with random sampling. Outcome measures : Standing stork test for static balance,Star excursion balance test for dynamic balance,AKED for flexibility,MVIC(maximum voluntary isometric contraction) for strength 60 subjects were included on the basis of inclusion criteria: both males and females, 18-27 years of age, normal subjects with tight hamstrings (extension lag 25^0 or $>25^0$). Subjects were excluded on the basis of exclusion criteria: any visible deformity of lower limb, ankylosing spondylitis, soft tissue injury of lower limb, cardiopulmonary disease, any neurological condition, recent injury to the hip, knee or ankle, rheumatic disease.

Protocol

A written consent was obtained from all subjects. 60 subjects were randomly divided into three groups minimum of 20 subjects in each group. Pre data was measured such as static and dynamic balance with standing stork test and star excursion balance test, MVIC of hamstring on EMG for strength and hamstring flexibility by AKED (Active knee extension deficiency). All the data was measured in reference to dominant leg.

Procedure on treadmill

Both groups A and B were performed the forward walking and retro walking on a motorized treadmill at a speed of 3mph and uphill inclination of 10^o for 20 minutes for 5 sessions per week for two weeks respective to their group. As a warm up subjects of both the group were required to perform backward and forward walking on a treadmill for two minutes at 0^o of inclination. Group C was control. Data were collected on 1^{st} (pre-intervention), after 5^{th} (pre-intervention) and 11^{th} (post intervention) respectively.

Procedure for static and dynamic balance

Static balance

Standing stork test:

A stopwatch was the only equipment necessary.

- The students lifted their non-dominant leg and place the sole of his foot against the side of the dominant leg's kneecap.
- The test administer gave command "GO", started the stopwatch and the student raised the heel of the foot of their dominant leg to stand on their toes.
- The student was to hold this position for as long as possible.[1]

Dynamic balance:

Star excursion balance test

In test, the length of the stance leg or dominant leg was measured from the anterior-superior iliac spine to the most distal point of the ipsilateral medial malleolus, using a standard tape measure while participants lay supine on a plinth. The participant than performed 3 test trails in each direction for each of the raters, sitting in a chair to rest for 5 minutes between raters. The 3 reach directions tested were anterior, posteromedial and posterolateral.[2]

Performance of the SEBT

Participant performed the SEBT by standing in the middle of a testing grid with strips of tape place 45 degree angles, reaching dominant foot as far as possible along different grid lines, then returning to the starting position. While standing bare foot or in the socks on a single limb and keeping the hands on the hips. The participants will made an effort to reach as far as possible with the reaching limb along each tape measure; touch lightly on the tape measure with most distal portion of the reaching feet, without shifting weight to or coming to rest on the foot of the reaching limb and return the reaching limb to the start position at the apex of the grid.

2

Hamstring flexibility

AKED (Active knee extension test)

The baseline extension was measured using a double-arm goniometer with 0.97 reliability value. Then, the subject performed the active knee extension test procedure in supine on the plinth and the hip of the lower limb being assessed was flexed to 90°. The distal part of their anterior surface of the thigh was placed in contact with cross line of specially constructed of wooden stool. With his ankle in relaxed position, and ensuring that his thigh maintained contact with the crossed line on the wooden frame, the subject was instructed to actively extend the knee to the point where he started feeling a stretch. The active knee extension deficiency (AKED) was measured using the goniometer 0° was considered to be full extension of the knee[3]

ELECTROMYOGRAPHY for hamstring strength

Measurement of EMG activity

Electrode placement: gross electrical activity of hamstring muscle was measured using adhesive surface electrodes and were placed midway between gluteal fold and knee joint which was determined using inch tape with a 3cm interelectrode distance. Active electrode being placed proximally and passive placed distally.[4,5]

Method for measuring MVIC of hamstring:

The subject was laid prone with the knee flexed to 90°. The researcher provided manual resistance in the direction of knee extension while the subject flexed the knee. Before contraction, a strap was placed around the patient's hips to hip extension and other accessory motion.[6]

DATA ANALYSIS AND RESULT

- Repeated measure ANOVA for within group analysis.
- For Between group analysis ONE WAY ANOVA and post hoc analysis by Tukey's method.

Table 1: Post hoc comparison of mean between groups for AKED-RIGHT

GROUPS	DAY 11th MEAN ± SD	p value
GROUP A vs GROUP B	39.70±5.841 34.65±3.884	5.05(S)
GROUP A vs GROUP C	39.70±5.841 44.70±8.151	5(S)
GROUP B vs GROUP C	34.65±3.884 44.70±8.151	10.05(S)

Table 2: Post hoc comparison of mean between groups for AKED-LEFT

GROUPS	DAY 11 MEAN ± SD	p value
GROUP A vs GROUP B	39.60±4.430 33.50±4.525	4.61(S)
GROUP A vs GROUP C	39.60±4.430 44.20±7.871	4.6(S)
GROUP B vs GROUP C	33.50±4.525 44.20±7.871	10.7(S)

Table 3: Post hoc comparison of mean between groups for EMG-MVIC

GROUPS	DAY 11 MEAN ± SD	p value
GROUP A vs GROUP B	1665.18±450.731 2598.90±799.064	933.72(S)
GROUP A vs GROUP C	1665.18±450.731 1032.61±265.843	632.57(S)
GROUP B vs GROUP C	2598.90±799.064 1032.61±265.843	566.29(S)

Table 4: Post hoc comparison of mean between groups for SEBT (ANTERIOR)

GROUPS	DAY 11 MEAN ± SD	p value
GROUP A vs GROUP B	88.83±13.331 98.38±10.345	9.56(S)
GROUP A vs GROUP C	88.83±13.331 75.26±12.978	13.57(S)
GROUP B vs GROUP C	98.38±10.345 75.26±12.978	23.12(S)

Table 5: Post hoc comparison of mean between groups for SEBT (POSTEROMEDIAL)

GROUPS	**DAY 11 MEAN ± SD**	**p value**
GROUP A vs GROUP B	75.55±11.558 86.51±10.899	10.96(S)
GROUP A vs GROUP C	75.55±11.558 63.60±17.202	14.71(S)
GROUP B vs GROUP C	86.51±10.899 63.60±17.202	22.91(S)

Table 6: Post hoc comparison of mean between groups for SEBT (POSTEROLATERAL)

GROUPS	DAY 11 MEAN ± SD	p value
GROUP A vs GROUP B	69.36±11.161 79.79±17.240	10.43(S)
GROUP A vs GROUP C	69.36±11.161 58.34±17.240	11.02(S)
GROUP B vs GROUP C	79.79±11.090 58.34±17.240	21.45(S)

Table 7: Post hoc comparison of mean between groups for SST

GROUPS	DAY 11 MEAN ± SD	p value
GROUP A vs GROUP B	6.47±2.570 9.44±2.475	2.97(S)
GROUP A vs GROUP C	6.47±2.570 3.86±1.096	2.61(S)
GROUP B vs GROUP C	9.44±2.475 3.86±1.096	5.58(S)

DISCUSSION

The study demonstrated that both forward and backward walking showed significant improvement in flexibility, strength and balance. However, Group B showed more significant improvement in variables as compare to group A and Group C.

Within group analysis: Group A and B showed statistically significant improvement in variables whereas Group C didn't show any statically significant improvement in variables in healthy subjects.

Flexibility is an important physiological component of physical fitness and reduced flexibility can cause inefficiency in the work place. Increasing hamstring flexibility was reported to be an effective method for increasing hamstring muscle performance on selective isokinetic conditions.[1]The active knee extension (AKE) test was used to evaluate the hamstring muscle length of the dominant lower limb.[2] These results could explain the gain in hamstring length[5]. Previous study revealed that the treadmill training improves the balance and build muscle strength in lower limbs which are involved in the generation of more independent and mature walking[8]. Treadmill training is believed to improve the lower limbs muscle strength and balance as well as stimulate neuronal connections that are involved in generation of independent balanced walking.[9] The significant improvement in functional strength in BW is in accordance with various earlier studies have been observed the increases in lower limb muscle strength with retro-walking [5.10]. Previous studies indicate that strengths of quadriceps and hamstring muscles are

increased after BW exercises.[12,] The study proving that backward walking group that is Group B showed more significant improvement in muscle strength than Group A which was the forward walking group.

Adaptive mechanisms necessary for coordination patterns, body orientation and balance stability can be improved by treadmill walking.[15] Walking on a treadmill is more effective in activating the central gait pattern generator and enhances motor learning than other type of exercises.[16]Sensory integration can be improved through specific training such as altering the standing surface or its movement in order to enhance postural stability in elderly people[17]. After forward and backward walking, forward and backward inclination occurs[15] that leads to anterior and posterior muscle stretching. This is followed by co-contraction of muscles which maintains balance.[18]

The gain in dynamic balance in the present study could be explained by the reason that there was an increase in static balance and thus, in dynamic balance assessment by SEBT. Which requires stability around ankle on stance limb can be the reason of increase in the reach distance by the other limb.[5]Further, as there was an increase in length of the hamstring muscle found by Whitley, this could also be the possible reason for increase in the reach distance which is a sign of increase in the dynamic balance. However, RW was itself a dynamic activity and stress more dynamic control over the body during RW. The improvement in dynamic balance could be explained as the increase in reach distance because of the reason that as there was increase in hamstring length, it could affect the reach distance and thus increased in the reach directions had been observed.[19]

Conflict of Interest: There was no conflict of interest.

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