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Case report of an ankylosing spondylitis patient & review

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Abstract

Ankylosing Spondylitis (AS) is a chronic inflammatory disorder of the musculoskeletal system with gradually increasing axial stiffness and restriction in movement. It leads to pain, reduced spinal & joint mobility and limitations in physical functioning. Timely identification of disease and a combination of pharmacotherapy as well as rehabilitation helps combat the pain and disability. A case report is presented of an AS patient with all characteristic features.

Key Words

Ankylosing Spondylitis, peripheral arthritis, total hip arthroplasty, physical therapy.

Introduction

Ankylosing Spondylitis a chronic, immune-mediated inflammatory disease that is associated with inflammation in the sacroiliac joints, the axial skeleton, entheses, peripheral joints, uvea, and other structures¹, of unknown aetiology;² predilection for axial skeleton, affecting particularly SI and spinal facet joints³; approximately 0.9% population affected⁴, found worldwide, more often in Caucasians than other races⁵. A strong family history & approximately 90-95% of patients have tissue antigen HLA-B27^{2,6}. Recent identification of two new genes, ARTS1 and IL23R, and confirmation of IL-1A association further substantiate that AS is determined to a large extent by genes outside the major histocompatibility complex⁷. Onset age is 2nd or 3rd decade, with peak age of disease onset around 15-35 years (mean 26years), males affected 2 to 3 times more than females^{2,4,5,6}.

The initial pathological changes are initiated by macrophage infiltration that leads to synovitis and enthesitis. The macrophages are later replaced by lymphocytes, leading to release of large number of inflammatory mediators, most significant of which are TNF, vascular endothelial growth factor, and IL-1. These inflammatory mediators lead to bone erosion, pannus, and granulation tissue formation. The eroded bone heals by osseous ankylosis¹. There are 2 basic pathological lesions: synovitis of the diarthrodial joints & inflammation at the fibro-osseous junctions of the syndesmotic joints & tendons. The preferential involvement of the insertion of tendons and ligaments (entheses) is seen⁸. Pathological changes proceed in 3 stages- inflammatory reaction with ground cell infiltration, granulation tissue formation & erosion of adjacent bone; replacement of granulation tissue by fibrous tissue; and ossification of fibrous tissue leading to ankylosis of joint⁸. Ossification across surface of disc gives rise to small bony ridges-syndesmophytes linking adjacent vertebral bodies. If many vertebrae are

involved spine may become absolutely rigid⁸.

The clinical features are insidious onset; dull pain felt in lower lumbar region, morning stiffness lasting for few hours, asymmetric arthritis of other joints mainly of lower limbs. Neck pain and stiffness present in advanced cases. Physical findings include loss of spinal flexion, extension, lumbar lordosis, diminished chest expansion, and exaggerated thoracic kyphosis³. Modified New York Criteria, 1984 for diagnosis are:

1. Low back pain of at least 3 months' duration improved by exercise and not relieved by rest
2. Limitation of lumbar spine in sagittal and frontal planes
3. Chest expansion decreased relative to normal values for age and sex
4. Bilateral sacroiliitis grade 2 to 4
5. Unilateral sacroiliitis grade 3 or 4

Definite AS diagnosed when: unilateral grade 3 or 4, or bilateral grade 2 to 4 sacroiliitis and atleast one clinical criterion. CT and MRI can detect AS lesions earlier and with greater consistency than plain radiography⁹.

Extraskeletal Manifestation of AS

alternate buttock pain, acute anterior uveitis (25–40%),^{9,10} synovitis, enthesitis (heel, plantar),⁹ peripheral arthritis (25–50%), chronic inflammatory bowel disease (26%), Psoriasis(10%)^{9,10}, aortic incompetence, cardiac conduction defects, and fibrosis of the upper lobes of the lungs, cauda equina syndrome or renal amyloidosis⁹.

In established cases posture is typical: loss of normal lumbar lordosis, increased thoracic kyphosis & forward thrust of neck; and in late cases these may become fixed deformities. Spinal movements restricted in all directions, but loss of extension is always the earliest and the most severe disability. In advanced cases spine may become completely ankylosed from occiput to sacrum, sometimes in position of grotesque deformity³.

AS affects spinal and peripheral joints such as the shoulder, hip, knee, and ankle. The thoracic vertebrae are affected, and inflammation of the costovertebral, costosternal, and manubriosternal joints causes pulmonary restriction and thoracic pain. As a result, people with AS demonstrate inspiratory muscle fatigue during exercise and limited capacity of maximal oxygen. These restrictions lead to decreased daily activity and quality of life¹¹.

Due to the sporadic, progressive nature of AS, and unknown aetiology, management is difficult. More important for the long term management is rehabilitation

approaches which enable the patient to self-manage symptoms⁴. A growing body of research reveals that exercise is as crucial as drug treatment in the management of AS¹¹.

A case report is selected of a patient of AS.

Case Study of an Ankylosing Spondylitis Patient

The case study is of a 53 years old male having AS for the last 33 years.

There is a positive family history of AS, family of four brothers of which two have AS, though symptoms and course of disease is varied in all. One of his grandfather's second cousins had a stooped posture and had back pain during his youth. In retrospect family and the doctors thought he too would be an AS in absence of medical reports. None of his children or his brothers' children, age group 24 to 38, have AS till date or any associated complaints.

He was a young healthy adult till age of 20 years (1977) when he developed colitis. Thereafter he was operated for appendisectomy in January 1978. On the 7th post – op day he developed severe pain in right hip joint, which subsided after strong pain relievers. Subsequently no problem for 11/2yrs. He was easily fatigued during this duration required frequent rest. May 1979 he had jaundice and subsequently had pain and swelling in right acromioclavicular joint. Two months later, movement of shoulder joint gradually reduced. Nearly four months his left acromioclavicular joint started showing similar signs. Pain in the upper region of spine started in early 1980. February 1980, pain appeared in right foot and two - three months later moderate neck pain developed. Within the next few months persistent back ache started. He consulted an orthopaedic surgeon in November 1980 and was diagnosed as an advanced case of AS with HLA B-27 positive and ESR in range of 86. He was put on pain killers and the doctor then advised to refrain from doing exercises.

Onset of acute pain in right hip joint by May 1981. Subsequently, severe pain in right hip occurred every 2 to 3 months, and walking was impossible for 2 to 3 days during each episode. Moderate to severe intensity pain in right hip pain for four years, out of which 15 months were of severe, excruciating pain confining him to bed. A senior world renowned orthopaedic surgeon then advised him for exercises regularly to maintain his joints mobility and flexibility; though by then the right hip joint had considerably deteriorated. Right total hip arthroplasty was done on 23rd June 1983. 3 years later pain in left hip joint started, patient confined to bed for four months and THR done on 24th August 1990. (Figure–1 x-ray B/L THR). Revised THR for right hip done on 1st September 2008 as constant pain and discomfort in the right hip joint and radiologically signs of loosening were noticed. (Figure – 2 x-ray Rt. Revision THR). He has had multiple episodes of acute iritis treated by cortisone therapy.

Post primary THR in Mumbai the importance of regular exercises, precautions and management of his disease was emphasized. He and his family members were well educated about the disease and its outcome.

Figure 1: (X-ray B/L THR)



Figure 2: (X-ray Rt. Revision THR, Lt. Primary THR)



His positive attitude and adherence to the instructions of his medical team gave him favourable results. He followed a regulated daily routine with an exercise schedule under supervision of physiotherapists.

Since the last 6 years he has been undergoing daily physiotherapy of active, active assisted and mild resisted exercises maintaining his range of motion, muscle strength and posture. Off and on episodes of acute pain in the joints, especially at entheses sites noticed. In physiotherapy modalities like ultrasonic waves, laser, hot packs and cold packs have been used as per the indications. The best results have been gained with hot packs and supervised exercises. The things worth mentioning are

1. Daily exercise regime has reduced pain & stiffness and improved range of motion.
2. Ability to maintain a fairly active life style and a positive attitude.
3. Despite early onset of disease stooped posture has not developed as lying down prone daily as a part of exercise regime to counteract the flexed attitude.
4. Pranayamas and regulated food habits.
5. Faith in exercise regime.
6. With proper precautions and care his bilateral THR's have lasted for years, right primary THR - 25 years; left primary THR for 21 years and still doing well.

Discussion

Subject discussed has a positive correlation with HLA-B27 as in other studies. G. Narsimulu et al report that AS is HLA-B27-associated chronic, inflammatory rheumatic disease characterised by sacroiliitis and spondylitis with formation of syndesmophytes leading to ankylosis⁹. G Peh and Bedriye Mermerci Başkan et al show approximately 90-95% of patients have the tissue

antigen HLA-B27^{2,6}.

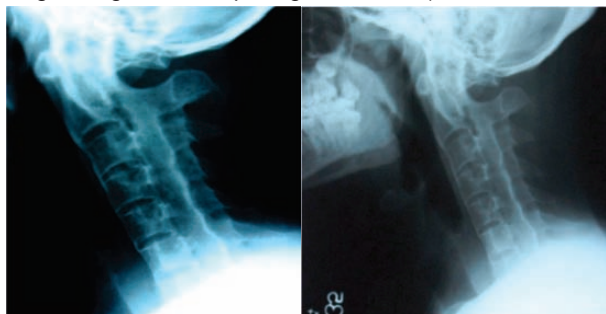
Subject selected disease onset was at 20 years but diagnosed at 22 years when symptoms manifested fully. Study report by A. A. Khalessi peak age of onset was between 20–30 years, with an average 5–6year delay in diagnosis reported in the literature¹⁰. A Ghosh et al also report age of onset in 2nd or 3rd decade of life and males affected two to three times more than females³. Similar findings seen for our subject too.

A. N. Shukla et al have shown that functionally, the patient is most limited by the hip disease. THR offers such patients a new lease of life¹³. Our subject was most affected by hip disease. The hip joint involvement was severe that within the initial few years of disease activity joint deteriorated severely and patient was bed-ridden due to acute, debilitating pain in both hips on different instances. Jaypal Reddy Sangala et al report hip replacement and spinal surgery have to be considered in patients with refractory pain and/or disability¹. G. Narsimulu and K. Suresh reported that THR is indicated in patients with refractory pain or disability and radiographic evidence of structural damage, irrespective of age⁹. It ensures stability and mobility of the joint & most effective ways of improving quality of life particularly in cases of AS¹⁴. Our subject also had marked improvement in quality of life as well as reduction in pain by THR.

In subject selected THR in both hips have a survivorship of more than 20 years, right side primary THR survived for 25 years and left side THR still continuing at 21 years on. Revision THR for right was done 3 years ago. Studies have also shown that survivorship analysis with use of Kaplan-Meier method revealed that probability of survival of femoral component (with 95% confidence intervals) was 91% (83 to 99%) at 20years and 83% (72 to 94%) at 30years. The probability of survival of acetabular components was 73% (61 to 84%) at 20years and 70% (57 to 83%) at 30years. Probability that both components would survive was 91% (82 to 100%) at 10years, 73% (61 to 84%) at 20years, and 70% (57 to 83%) at 30 years. The Charnley low-friction arthroplasty provided consistently good long-term results, with a low rate of complications and revisions, in this group of young patients¹².

Studies show that age at onset in the patients with peripheral arthritis was significantly younger than in patients without peripheral arthritis. Patients with peripheral arthritis had a higher frequency of enthesitis

Fig. 3.1& 3.2: (X-rays cervical spine - syndesmophytes, straightening of neck, squaring of vertebrae)



and trauma history. Distribution of initially-affected joints-axial joints including hip and shoulder(53%), peripheral joints(36%), and entheses(11%), in decreasing order, the axial joints most commonly involved initially sacroiliac joints(37%)⁵. In our case report similar features were seen with initial involvement in hip joints, followed by shoulder joints, ankle joints and wrist joints, disease onset in 2nd decade and peripheral arthritis significantly noticed.

Acute anterior uveitis, most common extra-articular involvement reported to occur in 1.5-30% of patients, and is more common in HLA B27(+) than HLA B27(-)⁵. Our subject has had multiple episodes of iritis, requiring cortisone in most instances.

The management can be considered as involving a multi directional approach. The aims of treatment in A.S are to control pain, to maintain or improve function¹⁵, to improve mobility and strength, to prevent or reduce spinal curve abnormalities³, & thus quality of life¹⁵. Physical treatments and medical treatment are mutually complementary. Physical exercise is impossible until pain and inflammation are medically controlled & stiffness and spinal deformities cannot be prevented by drugs alone³.

Our subject has regularly followed an exercise schedule maintaining his joints flexibility and functional independence and able to prevent a stooped posture. Physiotherapy remains the mainstay of management of AS 9 statement emphasized by our subject too. Studies indicate that regular exercises are of fundamental importance to prevent or minimize deformity.¹⁵ Studies report that physical therapy and exercise are necessary adjuncts to pharmacotherapy¹¹. Band et al discuss influences of age upon treatment and conclude that younger patients, women and those with shorter disease duration respond better to physical therapy¹⁶. Carbon et al and Uhrin et al demonstrated that physical training promotes a beneficial effect in flexibility and wideness of spinal movement due to release of analgesic and anti-inflammatory effect mediators¹⁶. These findings consistent with our patient, that regular exercises have enabled him to improve his functional capacity and reduce fatigue.

Rigid spine typical of an AS patient noticed by our subject also.(Figure 3.,3.2 and 3.3). A variety of changes occur in the spine, starting with small corner

Fig. 3.3: (X-ray Lumbar spine syndesmophytes)



erosions, squaring of the vertebral bodies, progressing to syndesmophyte formation, interspinous ligament ossification, apophyseal joint fusion, and complete vertebral fusion which produces the bamboo spine appearance⁶. The vertebral column transforms from dynamic structure with ligamentous attachments into a rigid column of tubular bone housing the spinal cord and neural elements¹⁰.

Rigidity of thorax occurs in AS with bony ankylosis of thoracic vertebrae, costovertebral, costotransverse, sternoclavicular and sternomanubrial joints leading to a predominant diaphragmatic breathing. Patients with AS who practice some regular physical activity present a preservation of their pulmonary function, measured by minute volume¹⁶. Our subject well informed about limited pulmonary functions and has regularly practised deep breathing exercises and yoga pranayamas to combat the difficulty as much as possible.

Efficacy of rehabilitation in warm climate has been established. Hydrotherapy, immersion of the entire body or parts of it in thermal water coming either from springs (mineral water) or other sources. Thermal water (between 30°C and 40°C) may increase the secretion of cortisol, ACTH, growth hormone and prolactin, thus reducing levels of inflammatory compounds such as prostaglandins and leukotriene¹⁷. Our subject always feels better with warm temperature. Peak rise in temp fatigues him easily and low temperatures he is extremely cold and uncomfortable.

Conclusion

AS is an inflammatory arthritis of unknown etiology with progressive loss of joint mobility and unpredictable in course. Physical therapy directed to improve joint mobility, decrease pain and postural deformity will increase the function, quality of life as well as physiological and psychological well-being.

Interest of conflict- authors reports no conflict of interest.

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Efficacy of enhancement forearm supination on improvement of finger dexterity in hemiplegic cerebral palsy children

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Abstract

Objective

The aim of this work was to show the effect of enhancement forearm supination on improvement of finger dexterity in hemiplegic cerebral palsy children.

Method

Thirty children were enrolled in this study and randomly assigned into two groups; group A (specialized treatment program for enhancement of supination plus traditional physiotherapy program) and group B (traditional physiotherapy program only). Nine peg hole test was used to detect and follow finger dexterity. This measurement were taken before initial treatment and after 12 weeks post treatment. The children parents in group A were instructed to complete 3 hours of specialized treatment program for enhancement of supination plus thumb abduction supination splint at home as routine program.

Results

Data analysis were available on 30 spastic hemiplegic CP children and it was insignificant in the variable related to age ($p > 0.05$). Mean value of the time required to perform task in study group pre and post treatment was highly statistical significant differences $p < .0001$ while The mean value of time required to perform task in the control group pre and post treatment was statistical significant difference $p < .05$.

Conclusion

The use of specialized treatment program for enhancement of supination plus traditional physiotherapy program are superior to traditional treatment program only for finger dexterity improvement after 12 weeks follow up.

Key Words

Finger dexterity, pronation deformity, spasticity, cerebral palsy.

Introduction

Cerebral palsy (C.P) is a non-progressive clinical syndrome that occurs as a result of damage to the motor areas of the immature brain, resulting in a variety of motor deficits⁷.

The spastic type is the most common form of C.P, and considered to be a main contributor to both the impairment of function and decreased longitudinal muscle growth, leading to deformities^{1,5}.

Pronation deformity is commonly associated with elbow spasticity, wrist spasticity or both. These deformities are most often treated together with the associated deformities. They seldom require treatment individually. Pronation deformity of the forearm in hemiplegic cerebral palsy is more common. Pronation bias makes it difficult for a person to reach for a target under hand^{4,7}.

Pronation deformity of the forearm is the result of over-activity of the pronator teres and pronator quadrates and weakness of the supinator. When combined with

flexion contracture in young children, dislocation of the radial head may occur^{12,14}.

Spasticity and excessive neuro-muscular tone in the upper extremities often impair motor neuron functional abilities. This is due to complex agonist and antagonist hyperactivity, particularly in the pronator teres and/or quadrates muscles^{3,7}.

The incidence rate of shortening was twice as high when associated with spasticity compared with patients without spasticity. The standard of care in treating shortening includes physiotherapy and occupational therapy for shortening reduction and tone management. Stretching is considered one of the most integral treatments in the reduction of shortening and this often requires the greatest amount of time from the therapist. Passive stretching is commonly used for patients with excessive pronation specially at home. Prolonged stretch may have also contributed to the decreased spasticity. Prolonged, passive stretching decreased reflex sensitivity, and the amplitude of peak-to-peak reflex decreased by 84.8%. The consistent stretching employed in this case was for 45 minutes, twice per day, for excessive forearm pronation^{2,8}.

Methods

Subject

Thirty children from both sexes with hemiplegic CP were enrolled for this study, aged 5 to 8 years at the time of recruitment. The degree of spasticity ranged from 1 to +1 according to the modified Ashworth scale. Assessment was performed to anti-gravity muscle groups. They were able to follow simple verbal commands and instructions during both evaluation and treatment. Exclusion criteria for all children were: (1) botulinum injections in the upper limb in the past 12 months, (2) Prior surgery (i.e. tendon transfer/tendon lengthening), (3) auditory or perceptual problems, or uncontrolled seizure disorder.

Children were randomized into two groups. The experimental group (group A) received a traditional physiotherapy program plus specialized treatment program to enhance supination in addition to thumb abduction supination splint. Control group (group B) received a traditional physiotherapy program only.

Outcome Measurements

The clinical evaluation included history, and degree of spasticity. All children were assessed for hand function

using the nine hole peg test. All measurements were taken at baseline (Pre) and after 12-week of intervention (Post).

Assessment of Hand Function

The nine hole pegs test used for data collection in this study consists of a plastic console with a shallow round dish to contain the pegs on one end of the console and the nine-hole peg-board on the opposite end. The therapist centered the pegboard on the table to be in front of children. The shallow dish was oriented on the participant's affected hand and the peg holes on the non affected side. Children were given the opportunity for a brief practice test prior to the actual test. Then the children were tested using their affected hand. The tests were timed, with a stopwatch, from the moment the child touched the first peg until the moment the last peg hit the dish. The recorded score was the number of seconds required to complete the test. If the children dropped a peg or the trial was interrupted in any way, the evaluator cued the child to stop and a new trial was initiated. The average of three trials produced higher test-retest reliability than a single trial considered three trials for increased validity¹⁰.

The size, shape, weight, texture, and slipperiness of the objects must be given careful consideration. Children can handle blocks and other objects with straight sides more effectively than round objects. Grasp of small tiny object should not be the priority for children, People use an opposed pattern to grasp items as a cup(cylindrical grasp, a ball (aspheric grasp), a telephone receiver and a large block. Children with disability be assisted in developing skills of all types of opposed grasp pattern, power grasp, and lateral pinch to evaluate the skill acquisition^{3,5}.

Time, speed, accuracy and numbers of trials they are movement parameters have to be evaluated in fine motor skills. A small object required longer reaction time than the larger object. The first part of the movement seems to be unaffected by object size but for smaller objects extra movement, time is spent in the last part of movement when we increase the speed of a movement the accuracy will decrease.

We used the following graduation to follow the improvement in skill acquisition

- a-Big object, rectangular shape, rough, heavy
- b-Big object, rectangular, rough, light
- c-Big object, rectangular, Smooth, heavy
- d-Big object, circular, rough, heavy
- e-Big object, rectangular, smooth light
- f-Big object, circular, smooth, heavy
- g-Big object circular, smooth, light
- h-Big object, rectangular, rough, light
- i-Small, rectangular, rough, heavy
- j-Small, circular, rough, heavy
- k-Small, rectangular, smooth, heavy
- l-Small, rectangular, rough, light
- m-Small, rectangular, smooth, light
- n-Small, circular, smooth, heavy
- o-Small, circular, rough, light
- p-Small, circular, smooth, light.

Timing places high demands on the motor system for speed and efficiency with high demands for attention and perception. Reaction time provided an indication of an individual speed in preparing a response production of fast arm movement may be affected by poor attention as clumsy children. Increased numbers of trials indicate to increased reaction time and decrease of speed and accuracy^{1,2}.

Intervention

For all children, the programs were conducted three times weekly, for 12 weeks. Each session lasted of 45 to 60 minutes in an occupational therapy room, in addition to 3 hours of home program, 7 days a week during the treatment period.

Both groups (A and B) received a traditional physiotherapy program, as the following;

1. Hot packs to improve circulation and relax muscle tension applied on the forearm for 20 minutes.
2. Facilitation of anti-spastic muscles of the wrist extensors, elbow extensors, supinator: tapping followed by movement, quick stretch, triggering mass flexion, biofeedback, weight bearing, clenching to toes, compression on bony prominence, rapping the muscle, approximation, vibration, irradiation to weak muscles by strong muscles, ice application for brief time [8]
3. Prolonged stretch for 20 minutes to pronator teres, wrist and elbow flexors to gain relaxation⁶.
4. Passive, gentle and gradual stretching to tight muscles (i.e. pronators, wrist flexors, elbow flexors, shoulder adductor³.
5. Graduated active exercise for upper limb muscles.
6. Gait training using aids in closed environment using obstacles, side walking then by pass walking to stimulate protective reaction for the hand.
7. Balance training program which include static and dynamic training

The experimental group (group A) received specialized treatment program to enhance supination in addition to thumb abduction supination splint as following;

1. Facilitate supination with the forearm on a surface as in weight bearing on floor, or on mat, while seated at a table the therapist place an object in the child hand, the child attempt to compensate for difficulty with supination by using wrist extension.
2. Encourage the use of 45 to 90 degrees of supination followed by grasp of an object with elbow in 90 degrees of flexion, the child encouraged to keep the thumb up as reaching and grasping large birthday candles then put them into cake that require supination.
3. Encourage lateral reach followed by grasp most of the children with a limited use of supination find it easier to combine humeral abduction with external rotation and supination than to use humeral flexion with external rotation and supination.
4. Encourage reaching by using shoulder flexion and external rotation by placing the object between leg

and shoulder in sitting position depending on the child ability to control external rotation and supination while completing the reach.

5. Encourage reaching across midline following strategies suggested for reaching in front of the shoulder.
6. Supination Ideas (Turning the hand over, palm up) Children were ringing water out of a towel by twisting it, turning pages of a book. "Guess which hand" games, where something is hidden in one hand, the partner guesses which by tapping the guest hand, A simple slinky is a great toy to encourage supination, Build with cones, grasping a magnet (adapt type and size to the child's needs), The path is held with the non-affected hand and the child holds the magnet in the affected hand, under the path to guide the car⁵.
7. Thumb abduction supination splint: it is supplied in rolls of various lengths and widths the 5 cm width roll was used for construction of the supination splints by placing the loop of the roll through the child thumb then on a dorsum of the hand so it comes out on the ulnar side to volar part then dorsal again, overlap the part around the wrist, then continually up to forearm then around the elbow to epicondyles¹¹.

Results

Patients Characteristics

Table 1 shows the demographic and clinical characteristics of all patients. There were 13 patients (43.3%) are boys and 17 patients (56.7%) as girls there were 17 patients (56.7%) had mild degree spasticity, and 13 patients (43.3%) had moderated degree of spasticity on modified ashworth scale. Right hand dominance reported in 27 patients (90%), while 3 patients (10%) were left hand dominance. There was no significant difference between both groups in terms of age ($p=0.74$), sex ($p=0.5$), degree of spasticity ($p=0.23$) and hand dominances ($p=0.5$)

Changes in the hand dexterity

Mean test scores and standard deviations for both groups are shown in the Table 2. The mean value of finger dexterity in both groups at baseline measurement

(pre-treatment) was insignificant ($p>.05$).

Both groups had a significant decline in the time required to complete the NHP board task post-treatment. The average reduction in the time required to complete the task trend to being highly significant in the study group (64.33 ± 6.51 versus 49.33 ± 11.47 , $P=0.001$) than in the control group (66.67 ± 6.17 versus 64.73 ± 7.11 , $P=0.03$). The percentage of reduction in the time required to complete the task were significant post-treatment with greater percentage observed in the study group (23.3 %) compared to the control group (2.89%).

Table 2: The average test time in seconds in both groups.

Test time	Study group Mean \pm SD	Control group Mean \pm SD	p-values (Between group)
Pre-treatment	64.33 \pm 6.51	66.67 \pm 6.17	0.32
Post-treatment	49.33 \pm 11.47 [†]	64.73 \pm 7.11 [*]	0.01
% of reduction	23.31 [†]	2.89%	0.01
p-values (Within group)	0.001	0.03	

*Significant ($p<0.05$) within group,

† Significant ($P<0.05$) between group

Discussion

Supination is a particularly difficult movement component for children with abnormal tone. Even children with only slightly low tone tend to stabilize in full pronation when engaging in fine motor tasks. Pronation interfere significantly with thumb mobility and distal finger control being able to hold various degrees of supination is critical for higher levels hand skills, helpful in performing activities. The most important range of supination for functional skills use is between full pronation and midposition. During most skills that involve controlled use of the radial finger and thumb, the forearm is in approximately 30 to 45 degrees of supination¹².

The position from which the hand is able to function is when the forearm is midway between pronation and supination, the wrist in extension, the thumb in abduction and digits in moderate flexion in order for the hand to assume or maintain this functional position there need to be a balance between the extrinsic and intrinsic muscle groups of the forearm and hand, the wrist and digital joints.

Spasticity cause the rate of the affected muscle growth to be reduced causing disproportionate in muscles versus long bone growth. Consequently long bones grow at a faster rate than muscles as the muscle sarcomeres are not arranged in the same longitudinal manner as they are in normally innervated muscles. Thus muscle shortening occur as a result of dynamic stretch reflex and reduced sarcomere formation lead to decreased of sarcomere numbers.

The muscle that usually develop shortening first is pronator teres muscle, consequently supination of the forearm will be restricted. By applying a low load prolonged stress to the shortened muscles at the end of their available range, they will ultimately be able to grow because the cross bridges between the myosine and actin filaments in the sarcomeres will be disrupted and

Table 1: Patients characteristics.

Variables	Control group (n=15)	Study group (n=15)	p-values
Age (years)	6.53 \pm 1.06	6.4 \pm 1.18	0.74
Sex N (%)			
Boys	6(40%)	7(46.7%)	0.5
Girls	9(60%)	8(53.3%)	
Degree of spasticity n(%)			0.23
Grade 1	10(66.7%)	7(46.7%)	
Grade 1+	5(33.3%)	8(53.3%)	
Hand dominance n (%)			0.5
Right	13(86.7%)	14(93.3%)	
Left	2(14.3%)	1(6.77%)	

periarticular connective tissue stiffness will be reduced¹⁴.

When muscle is stretched on long run it responds by adding new sarcomeres. This makes them return to their optimum tension generating length with no change to the muscle tendon.

Prolonged stretch is the key for decreasing of spasticity via stimulation of muscle spindle and golgi tendon organ. first step is firing of gamma fibers which connected with contractile part of intra-fusal muscle fiber producing contraction of contractile part and stretching of non contractile part of intra-fusal muscle fiber which stimulate stretch receptors (flower-spray, annulo-spiral receptors) sending impulses to Ia and II afferent to PHC to AHC to alpha motor neuron which produce contraction of extra-fusal muscle fiber lead to stimulation of golgi tendon organ which sending impulses to Ib afferent to PHC to Ib inter-neuron which reverse signals into inhibitory impulses which inhibit AHC which inhibit alpha motor neuron which inhibit extra-fusal muscle fiber produce relaxation of spastic muscles. The passive stretch to contracted muscle and sheath which destruct adhesions in muscle and sheath increasing their elasticity and maintaining it.

It has been appeared that most long standing pronation deformity are due to a combination of contracture of the involved muscles and their sheaths in addition to spasticity of the involved muscles. Tight pronator muscles cause an imbalance in forearm motor control which lead to poor hand functions and inability to perform ADL activity due to limited supination. The specialized treatment program produce improvement in all functional skills of the hand and dexterity of the fingers, which included the use of utensils for eating, improved handwriting skills¹³.

Conclusion

The specialized treatment program outcome is to Reduce excessive forearm pronation in hemiplegic cerebral palsy patient. The benefit of this program which included passive and prolonged stretching for contracture reduction and tone management respectively which lead to regained of supination and improvement of finger dexterity in affected forearm in addition to the continued use of the program in home therapy will allow the patient to retain both functional skills and the improvements in range of motion.

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A comparative study on effectiveness of ultrasound therapy and low level laser therapy in the management of second stage pressure sores

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Abstract

Objective

The purpose of this study was to compare the effectiveness of Ultrasound and Low Level Laser Therapy (LLLT) on second stage pressure sores so as to be able to deliver better therapy for pressure sore patients on wound healing.

Methods

Forty subjects were taken for the study along with the routine medical management. 20 subjects receive the pulsed ultrasound therapy three times a week for four weeks with frequency of 3 MHz, and intensity of 0.5W/cm² to 0.8 W/cm², for five min with direct technique using hydrogel sheet. Another 20 subjects received the LLLT. The laser emission device used was Gallium Arsenide (GaAs) (904 nm) laser. It was made of a semiconductor infrared radiation source. The non contact method of application was used with 0.5 to 4.0 J/cm² for 2 min for three times a week for 4 weeks. The wounds were traced before starting the treatment and after 4 weeks of treatment, on transparent paper and wound area was calculated with digitizer (AutoCAD software).

Results

The results showed a significant ($p = 0.001$) decrease in pressure sore surface area in both ultrasound and laser group. When both the groups were compared, the laser therapy is found to be more beneficial than the ultrasound therapy ($p=0.046$).

Conclusion

Both ultrasound and laser can be used in the management of pressure sores. However in the present study it is seen that LLLT is more beneficial than the ultrasound therapy in the management of pressure sores.

Key Words

Ultrasound therapy; Low Level Laser Therapy; Pressure sores; Wound healing; Physical therapy.

Introduction

The term pressure sore is used to describe any localized areas of tissue necrosis resulting from ischaemia in skin and subcutaneous tissue subjected to pressure. The condition is widespread and its effects, costly prevention and treatment deserve careful examination. There are numerous approaches to the problem, ranging from the patho-physiology and biomechanics of the ulcer's origin to the pharmacology and biophysics of its treatment. Increasingly, physiotherapists are called upon to contribute to the treatment and they have a growing array of techniques at their disposal¹.

The problems related to wound healing are still the cause of significant morbidity and mortality. In spinal cord injury and immobilization one of the main problems is decubitis or pressure ulcers. Much time and money are spent treating this problem. Studies on wound healing have increased our knowledge and understanding of

these pressure ulcers, which constitute an important clinical problem in rehabilitation medicine².

Current management of pressure sore involves treatment of malnutrition and the general condition, Debridement, Surgical management³. In physiotherapy various methods of treatments can be given for open wounds namely Ice therapy, Ultra violet rays, Ionozone therapy, Ultra sound therapy, Pulsed high frequency energy,⁴ Diathermy, Negative pressure therapy, Infrared radiation⁵, and Laser therapy⁶.

In literature, there are not much of comparative studies has been done between ultrasound and laser therapy on wounds healing². The present study was aimed at comparing the effectiveness of ultrasound therapy and LLLT in the management of pressure sores hence we can recommend making use of the effective therapy.

Methodology

Methods

The study was conducted in K.S.Hegde Charitable Hospital, Deralakatte, Mangalore both inpatient and outpatient Physiotherapy department after approval from the institutional ethical committee. Inclusion criteria were all the subjects with second stage pressure sores. Tumors, Metal implants (local), Photo allergy Burns, Tuberculosis, Skin disease like Psoriasis, History of long-term steroid therapy and radiation, Uncontrolled diabetes, Vascular diseases, Infected pressure sores, Pressure sores other than the pelvic region, were excluded from the study. 40 subjects with, second stage pressure sores sample has been taken by convenient sampling. A consent letter was obtained from each subject and then subjects were divided in to 2 groups. Group 1 Pressure sore getting Ultrasound therapy with routine medical management Group 2 Pressure sore getting Low-level laser therapy with routine medical management.

Group 1 Pressure sore getting Ultrasound therapy with routine medical management

After the preparation of subject and equipment group 1 received the pulsed ultra sound therapy with pulsed ratio of 1:4, with frequency 3 MHz, and intensity of 0.5 to 0.8 W/cm², for five min, for three times a week for four weeks^{1,4,7, 8, 9,10}. Ultra sound therapy application was done by solid sterile gel as couplant with Polyurethane dressing film. The flexible sheet, cut to an appropriate size, is placed over the open wounds with the little sterile normal saline to ensure that there are no air bubbles

between the gel sheet and the pressure sore. The outside surface of the gel sheet was slightly wetted and it will allow the treatment head to move smoothly over it¹¹.

Group 2 Pressure sore getting Low-level laser therapy with routine medical management

After the preparation of subject and equipment group 2 received the Gallium arsenide (Semiconductor IR laser) Laser therapy. The wave length of laser device was 904nm with power of 0.5 to 4 J/cm² for two min, for 3 times a week for 4 weeks^{2,6,12,13,14}. Non contact method of application was used with base of wound were visual divided in to square centimeter areas (grid" technique) and each square area will be treated with the above laser parameters. The laser probe is held perpendicular to the center of each square at a distance of 0.5 to 1 cm from the wound surface and is kept in the entire centimeter square in a circular motion. Each square centimeter of involved tissue is stimulated equally for effective coverage⁶.

Wound measurement

The area of pressure sore was traced by sterile transparency paper (cleaned with spirit). The area of pressure sore were measured by Digitizer^{15,16,17}. Pressure sore were measured before starting the treatment and repeated at the end of 4 weeks of treatment.

Data Analysis

The area of pressure sore is measured by digitizer with AutoCAD software. The scores were recorded as per cm² area. The data was analyzed using Mann

Fig. 1: Administration of Ultrasound treatment.



Fig. 2: Administration of Laser Treatment.



Whitney 'U' test for ultrasound group and laser group. The Wilcoxon's signed rank sum test was used for comparing the surface area before starting the treatment and after four weeks of treatment.

Results

The results were measured according to wound surface area before starting the treatment and after fourth week of treatment. None of the pressure sores were healed completely. Using statistical methods the data analysis was done. The results obtained are as follows.

Table I: Comparison of Ultrasound group and Laser group (Group statistics)

	Group	N	Mean (cm ²)	S.D.	Z
Before treatment	Ultra sound group	20	4.7940	3.89	0.7300
	Laser group	20	4.9425	2.63	
After 4 weeks of treatment	Ultra sound group	20	3.2581	2.50	0.4870
	Laser group	20	2.6927	1.40	

In the above table comparison is being done between ultrasound group and laser group before starting the treatment. The numbers of patients in both groups were 20. The mean surface area for ultrasound group is 4.7940 cm² and for laser group it is 4.9425 cm². The standard deviation was 3.89 and 2.63 for ultrasound and laser group respectively.

After 4 weeks of treatment the mean surface area for ultrasound group was 3.2581 cm² with standard deviation of 2.50. In case of laser group, the corresponding mean surface area is 2.6927 cm² with standard deviation of 1.40.

Table II: Paired Sample test

Group	Paired Difference		Z	p
	Mean (cm ²)	SD		
Ultrasound group	1.5359	1.40	3.920	0.001 VHS
Laser group	2.2498	1.24	3.980	0.001 VHS

The paired differences are indicated in the above table for both ultrasound and laser group. The paired difference for the mean surface area in ultrasound group is 1.5359 cm² with standard deviation of 1.40. The result is very highly significant (p= 0.001).

The paired difference for the mean surface area in laser group is 2.2498 cm² with standard deviation of 1.24. The result shows that there is reduction in a mean surface area, which is, very highly significant (p=0.001).

Table III: Difference between ultrasound group and laser group.

Group	N	Mean (cm ²)	S.D.	Z
Ultrasound group	20	1.5359	1.40	2.012
Laser group	20	2.2498	1.24	P=0.046 (S)

The table indicates the mean reduction in surface area

Fig. 3: Tracing of wound on transparent paper.



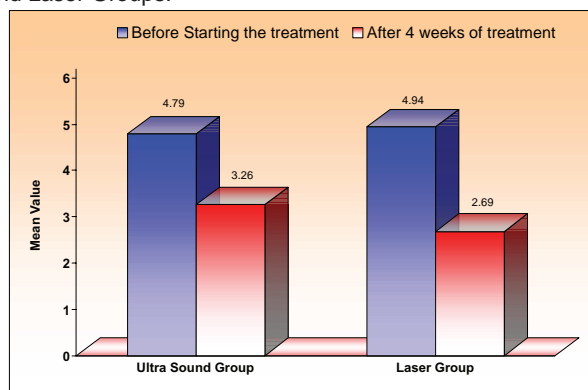
between ultrasound group and the laser group. The mean surface area for ultrasound group is 1.5359 cm² with standard deviation of 1.40. For the laser group, the mean reduction in surface area is 2.2498 with a standard deviation of 1.24. When both the groups are compared, the laser group shows significant reduction in surface area as compared to ultrasound group ($p=0.046$). This table shows that LLLT is more beneficial than the ultrasound therapy in the management of pressure sores as it comparatively reduces the surface area of pressure sores

Discussion

Recently, some physical methods, including therapeutic ultrasound and laser treatment were found to accelerate and facilitate wound healing scar quality. However, conflicting findings have been reported in some studies and some investigators found no treatment effect on accelerating the repair of wounds².

The ultrasound benefits patients with venous ulcers. Eriksson et al showed no benefit treating with ultrasound twice weekly at 1 MHz with a continuous spatial average intensity of 1.0 W/cm². Where as Dyson et al showed significant benefit treating ulcers three times weekly at 3 MHz with an SATA intensity of 0.2 W/cm² (1:4 pulse ratio) Collam et al used a higher ultrasound intensity (Continuous SATA intensity of 0.5 W/cm²) then of Dyson et al once weekly at 1 MHz and found a significant benefit. When Lundeborg et al however, used the same SATA intensity dosage as callam et al but in a pulsed

Fig. 4: Comparison of Mean surface area between Ultrasound and Laser Groups.



mode with a pulse ratio of 1:9 the treatment showed only a clear tendency to benefit healing¹⁸.

In some animal studies, researchers found that ultrasound at the intensities of 0.1W/Cm² and 0.5 W/Cm² accelerates the inflammatory phase of repair. This reported accelerated repair agrees with the findings from several other suggestions that low dose ultrasound of approximately 0.5 W/Cm² pulsed with a frequency of 1 to 3 MHz promotes the wound healing². The biological process, which have been found to be specifically affected by ultrasound include, general protein and collagen synthesis by fibroblasts, fibroblasts motility, permeability of fibroblasts membrane, lysosomal fragility, tensile strength and elasticity of scar tissue, modification of contraction in skin wounds¹. There fore our treatment protocol includes pulsed ultrasound with a dose of 0.5 to 0.8W/Cm² at frequency of 3 MHz for 3 times a week for 4 weeks. The result of the study also supports the other studies.

Laser can be classified as surgical (High power) and non surgical (Low Power) for therapeutic purposes. Non surgical lasers are widely used as tissue stimulator to improve wound repair. They also have anti inflammatory and analgesic effects¹⁹. Yong et al tested the response of macrophage like cells to laser irradiation and non-coherent light. They found calcium uptake showed maximum enhancement at the energy density of 4 to 8 J/cm², with wave length of 660, 820 (laser) and 870 nm and a pulse repetition rate (PR) of 5000 or 16pps². It has been noted that in clinical practice, ulcers that appear to plateau in their healing process respond favorably to a change of PR from 5000 to 16pps until healing is complete or the next plateau occurs¹⁸.

As the wound lacks the usual protective layers of dermis, the dosages applied during treatment will be much lower than during application over intact skin and typically cited radiant exposures are somewhere in range of 1- 10 J/ cm², with 4 J/ cm² being most commonly recommended as Mester Protocol¹². Stimulating non healing human wounds with He Ne and argon lasers showed that it can increase the collagen synthesis, diminished the cellular substances, significant vascularization and increase in tensile strength⁶. The infrared and red pulsed monochromatic light with varied pulsation and wavelengths have increased healing rate and shortened healing time in pressure ulcers²⁰.

The issue of significant thermal change is controversial, although some studies conclude that the low energy laser does not produce significant tissue temperature changes. A wide variation exists in recommendations for the optimal energy for different conditions the usual ranges are from 0.5 to 10 J/Cm². Generally, a laser wavelength of 600 to 984 nm is used in physical medicine and a laser wavelength of 632.8 nm He Ne and 904 nm Ga As are most frequently used in wound healing². Therefore we have used the Ga As (semiconductor infrared radiation source) with wavelength of 904 nm and power of 0.5 to 4 J/cm². The result of the study also supports the other studies.

The study showed that ultrasound therapy and

laser therapy treatment both have beneficial effect on pressure sores ($p=0.001$) and when we compare the effects between both group the laser therapy shows better results than the ultrasound therapy ($p=0.046$).

Limitations of the study

There was no control group, so the study could not find the effect is due to medical management or with ultrasound or laser management. The study was done considering only size of the pressure sore. The age, cause for the pressure sore and predisposing factors was not considered.

Recommendation for further studies

Separation between age groups, cause and predisposing factors in each group will give better results. Further study can be done between ultrasound therapy and LLLT with controlled group with larger sample size. Use of histological investigations to know the results like cellular content, granulation, tissue formation and collagen deposition will give better and more accurate results.

Conclusion

The results of the current study found that both ultrasound and LLLT can be used in the management of pressure sore patients with routine medical management ($p=0.001$). However the results of this study shows that LLLT is more beneficial than the ultrasound therapy in the management of pressure sores ($p=0.046$).

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Comparison of the effects of therapeutic ultrasound v/s myofascial release technique in treatment of plantar fasciitis

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Abstract

Background

Plantar fascia acts as a truss, maintaining the medial longitudinal arch of foot & assists during gait cycle, facilitates shock absorption during weight bearing activities. Plantar fasciitis (PF) is most common cause of inferior heel pain. Therapeutic ultrasound (U.S) is the most common treatments used in management of soft tissue lesions. Myofascial release (MFR) is a non invasive & safe technique with virtually no side effects; it comes with a record of good results.

Aim

To compare effects of U.S v/s MFR technique in treatment of PF.

Setting & Design

A Prospective experimental study was undertaken to compare effects of U.S v/s MFR in treatment of PF.

Methods and Material

60 subjects were alternately allocated into two groups U.S (Group A-30 subjects) & MFR technique (Group B-30 subjects). Conventional exercises were common. Outcome measures were recorded on first & tenth day using Visual analog Scale (VAS) for pain intensity & Foot Function Index (FFI) for functional outcome.

Statistical Analysis

For intergroup comparison of sex distribution, Chi-Square test was used. For intragroup comparison of VAS & FFI, Wilcoxon Signed Rank test was used & for intergroup comparisons of VAS & FFI, Mann-Whitney U test was used.

Result

60 Subjects were divided into two groups & their age & sex were matched which was found non significant $p=0.1405$. VAS on first day was non significant for both groups with $p=0.981$ were as on tenth day both groups showed statistically significant difference in reduction of pain on VAS $p=0.023$ but intergroup analysis showed that group B is statistically more significant. Same for FFI $p=0.272$ on first day were as on tenth day both groups showed statistically significant difference in improvement of functional outcome on FFI $p=0.023$ but intergroup analysis showed group B is statistically more significant.

Conclusion

U.S & MFR technique were found to be effective but MFR technique was more effective than U.S.

Key Words

Plantar Fasciitis, Therapeutic Ultrasound, Myofascial release Technique.

Introduction

PF is a painful inflammatory condition caused by excessive wear to the plantar fascia of the foot or biomechanical faults that cause abnormal pronation of foot. Classic presentation of PF is pain on sole of foot at the inferior region of heel. Patient reports pain to be

particularly bad with first step taken on rising in morning or after an extended refrain from weight bearing activity. Pain is usually experienced along the plantar aspect of the heel where plantar fascia inserts on medial tubercle of the calcaneus. Excessive pronation of the subtalar joint, which may be reinforced by hypomobile gastrocnemius-soleus muscles, predisposes foot to abnormal forces and irritation of plantar fascia. Conversely, stress forces on fascia can also occur with an excessively high arch. Pressures transmitted to irritated site with weight bearing or stretch forces to the fascia, as when extending the toes during push-off, causes pain.

Its a condition, which can be treated by a wide variety of methods like manual therapy, stretching exercises, taping, orthotic devices, night splints, electrical modalities, etc. Various methods of treatment exist with own claims of success without any attempts of comparing maximal effective method and very few studies have been conducted to support these therapies.

Manual therapy includes various joint mobilization and soft tissue manipulation techniques for PF. There is a growing body of literature in MFR's effectiveness in various soft tissue conditions. MFR therapy refers to a class of manual technique that is used to relieve abnormal constriction of tense fascia. MFR stem from the foundation that fascia, a connective tissue found throughout the body, reorganizes itself in response to physical stress and thickness along the lines of tension . By myofascial release there is a change in viscosity of ground substance to a more fluid state which eliminates fascia's excessive pressure on pain sensitive structure and restores proper alignment. Hence this technique is proposed to act as a catalyst in resolution of PF.

In a study done by Suman Kuhar, concluded that MFR is an effective therapeutic option in treatment of PF.

Similarly US is one of the most commonly used treatment modality in management of soft tissue lesions. US consists of inaudible high-frequency mechanical vibrations created when a generator produces electrical energy that is converted to acoustic energy through mechanical deformation of a piezoelectric crystal located within the transducer. Waves produced are transmitted by propagation through molecular collision and vibration, with a progressive loss of the intensity of the energy during passage through tissue (attenuation), due to absorption, dispersion or scattering of wave. Although many laboratory-based research studies demonstrated a number of physiological effects of US upon living tissue, there is remarkably little evidence for benefit in treatment

of soft tissue injuries. Pain relief through US can be explained through thermal and non-thermal physical effects in tissues.

US's non thermal effects helps by stimulating histamine release from mast cells and factors from macrophages that accelerates normal resolution of inflammation as suggested by Young and Dyson, cavitations, acoustic streaming and micromassage. All this contributes to reducing pain and improving functional outcome in PF patients.

Studies to find effectiveness of US in treatment of PF are sparse. Also comparison between US and MFR is lacking. Hence the present study was undertaken with an intention to find out and compare effectiveness of US v/s MFR a newer technique towards betterment in treatment of PF.

Material & Methods

This Prospective experimental study carried out over one year from March 2008 to March 2009 at Physiotherapy OPD in Tertiary Care Hospital. Materials used were ultrasound machine (EMS – Electro sound), aquasonic gel, tennis ball and a napkin (Figure 1). 60 subjects (both males and females) were selected with a medical diagnosis of PF, they were alternately assigned into two groups i.e. group A and group B. Subjects with infective conditions of foot, tumor, calcaneal fracture, metal implant, radiological diagnosis of calcaneal spur, dermatitis, impaired circulation in lower extremity, referred pain, any neurological deficit, uncontrolled diabetes mellitus and subjects who received Corticosteroid injection in heel preceding 3 months were

Figure 1: Therapeutic Ultrasound applications.



Figure 2: Plantar fascias stretching.



excluded from study. Study was approved by Institutional Ethics committee (EC/53/08) and written consent was taken from all participants to undergo treatment for 10 consecutive days. Objective assessment of the involved foot for tenderness, pain on plantar fascia stretch, swelling and temperature was done. Pain intensity was assessed on VAS. Patients were asked to mark their pain intensity on the scale and functional evaluation was done on a questionnaire in the form of FFI on 1st & 10th day.

Subjects in group A were treated with pulsed US (Figure 1) having an intensity of 1W/cm², frequency of 1MHz for 7mins and with conventional exercises consisting of intrinsic muscle strengthening in this the patient is sitting on a chair with foot flat on the end of a towel placed on a smooth surface. Keeping the heel in contact with the floor, the towel is pulled towards the body by curling the towel with the toes, plantar fascia stretching (Figure 2) in this the patient is comfortably sitting on chair with tennis ball under their foot. Then they roll the ball with the help of their foot in forward and backward direction, tendoachilles stretching (Figure 3) in this the patient is asked to stand facing a wall and place the affected leg behind the contralateral leg. Point the toes of the affected foot towards the heel of the front foot and lean towards the wall. Then bend the front knee while keeping the back knee straight and the heel firmly on the ground. Then they are supposed to hold the stretch for 1min and repeat 5 times and active ankle range of motion exercises.

Subjects in group B received MFR (trigger band) (Figure 4) in this the patient was in supine with the therapist at the foot end of the couch. The therapist uses a closed fist to contact the sole of the patient's foot just proximal to the metatarsal heads. While applying pressure to the plantar aspect of the foot, the therapist positions the foot into dorsiflexion & toe extension. Then the therapist drags his/her fist over the plantar fascia contacting the restricted layer and applies pressure in the length of the fascia maintaining the same pressure throughout and then releases it, along with the same conventional exercise program as in group A.

All subjects were advised not to stand in same position for long period of time, not to walk bare foot and footwear modifications were given.

Statistical analysis: Data was assessed for normal distribution using the Kolmogorov Smirnov test and was not found to be normally distributed and hence the Mann – Whitney U test was used for intergroup comparison. For intragroup comparison Wilcoxon Signed Rank test was used. Data analysis of intergroup comparisons of sex distribution was done using Chi- Square test.

Results

Above table reveals that age of the patients were ranging from 30 - 62 years with average age of 42.7 years (Lower limit CI 40.069 - Upper limit CI 45.331) among Group A and 40.13 (Lower limit CI 37.362- Upper limit CI 42.904) with 58 Degree of Freedom. among Group B which were comparable and difference was statistically not significant.

Figure 3: Tendo Achilles stretching.



Figure 4: Myofascial release trigger band technique.



Table 1: Demographic data

PARAMETERS	Group A	Group B
No. of Patients	30	30
*Age (Yrs)		
Mean	42.7	40.13
SD	±7.047	±7.422
Range	32 - 62	30 - 59
† Sex (%)		
Male	13 (22%)	15 (50%)
Female	17 (28%)	15 (50%)

*Mann Whitney U Test (b/w groups) $p=0.1405$ Not Significant
 †Chi square test

The number of females in group A were more in comparison to group B but the difference was statistically not significant and hence the groups were age and sex matched.

Above table shows that mean Visual analogue scale score was 5.223 for group A (Lower limit CI 4.994- Upper limit CI 5.452) and 5.18 for group B (Lower limit CI 5.013- Upper limit CI 5.347) with 58 Degree of Freedom which were same and difference was statistically non significant ($p=0.981$).

Post treatment score i.e. on tenth day showed that mean Visual analogue scale score had a significant fall in both the groups. Both the groups showed statistically significant difference in reduction of pain on VAS but Intergroup analysis showed that group B is statistically more significant than group A ($p=0.02$).

Above table shows that mean Foot Function Index (FFI) score was 59 for group A (Lower limit CI 55.997- Upper limit CI 62.003) and 57.2 for group B (Lower limit CI 53.653- Upper limit CI 60.747) with 58 Degree of Freedom. Which was same and difference was statistically non significant ($p=0.272$).

Table 2: Comparison of pain on VAS in group A and group B

	Group A	Group B	P value (Mann Whitney Test)
Pre Day 1	5.223 ± 0.61	5.18 ± 0.44	($P= 0.981$)
Post Day 10	3.673 ± 0.871	3.163 ± 0.90	-
Mean Change Pre – Post	1.583*	2.017*	($P =0.023$)
P value (Wilcoxon Rank Test)	($P < 0.0001$)	($P < 0.0001$)	

* $p<0.05$ significant

Post treatment score on day ten showed that mean Foot Function Index score had a significant fall in both groups which indicates that there was an improvement in foot function. Both groups showed statistically significant difference in improvement of functional outcome on FFI but on Intergroup analysis group B was found to be statistically significant than group A ($p=0.03$).

Analysis of pre and post test results showed that subjects in groups A and B had statistically significant improvement like reduction in pain on VAS and improvement in functional outcome on FFI however group B showed statistically more significant improvement than group A.

Discussion

Aim of study was to compare the effects of US v/s MFR in treatment of PF. A prospective study of 60 subjects was carried out. Outcome measures were assessed using VAS for pain and FFI for functional outcome. Subjects were divided into two groups; Group A received US plus conventional exercise program and Group B received MFR plus conventional exercise program. Outcome measures were assessed on day one pre treatment and on tenth day post treatment. Data obtained was analyzed statistically intragroup results showed statistically significant reduction in pain on VAS and improved functional outcome on FFI. However, when intergroup comparison was done, both groups were found to be statistically significant in reducing pain and improving functional outcome in patients with PF but group B was found to be statistically more significant than group A.

Various methods of treatment exist with own claims of success without any attempts of comparing the maximal effective methods. The objective of this study

Table 3: Comparison of FFI in group A and group B

	Group A	Group B	P value (Mann Whitney test)
Pre Day 1	59 ± 8.0	57.2 ± 9.4	(P = 0.272)
Post Day 10	34.63 ± 11.13	28.93 ± 7.18	-
Mean Change Pre – Post	24.36*	28.26*	(P = 0.03)
P value (Wilcoxon Rank test)	(P = 0.0001)	(P = 0.0001)	

*p<0.05 significant

was to compare the effects of US v/s MFR in PF.

Analysis of VAS and FFI in Group A showed that results were statistically significant on tenth day stating that US was effective. According to a study performed by Hana Hronkova, group which received US for PF showed significant reduction in pain. In contrast a study done by Crawford F, et al in 1996 therapeutic ultrasound was given to patients with heel pain and found no evidence to support the effectiveness of US. Pulsed ultrasound was used as it's preferred for soft tissue repair as affirmed by Young, 1 MHz was chosen as it is capable of reaching to deeper layer. Pain relief could have occurred due to non thermal effects of pulsed ultrasound in form of stimulation of histamine release from mast cells and factors from macrophages that accelerated the normal resolution of inflammation (as suggested by Young and Dyson) cavitations, acoustic streaming and micromassage. Although the results are contradictory to a review carried out by Robert and Baker of 35 randomized controlled trials looking at evidence of the biophysical effects of ultrasound out of which only two trials were found to be more effective than placebo ultrasound and ten of the 35 trials studied were judged to be robust.

Similarly analysis of VAS and FFI in Group B showed statistically significant result on tenth day stating that myofascial release was effective.

MFR uses hands on manipulation to promote healing and in relieving pain. Injuries, stress, trauma and poor postures can cause restriction to fascia. Goal of myofascial release is to release fascia restriction and restore its tissue. This technique is used to ease pressure in the fibrous bands of the connective tissue, or fascia. Gentle and sustained stretching of myofascial release is believed to free adhesions and soften and lengthen the fascia. By freeing up fascia that may be impeding blood vessels or nerves, myofascial release is also said to enhance body's innate restorative powers by improving circulation and nervous system transmission. Some practitioners contend that the method also release pent-up emotions that may be contributing to pain and stress in the body. Myofascial release works on a broader swath of muscles and connective tissue.

Movement has been likened to kneading a piece of taffy- a gentle stretching that gradually softens, lengthens, and realigns the fascia. Direct MFR method works directly on the restricted fascia. MFR seeks for changes in the myofascial structures by stretching, elongation of fascia or mobilizing adhesive tissues. DiGiovanna and Schionitz have described several principles underlying MFR.

This include,

- Increased circulation to the area of restriction delivers oxygenated blood and nutrients to the tissue and remove harmful metabolic waste product.
- Increased venous and lymphatic drainage decreases local swelling and edema caused by tissue inflammation
- Elasticity and flexibility of connective tissue elongates connective tissues secondary to mechanical loading
- Increased temperature causes an increase in elasticity and stretch of muscle.

With the two techniques used in the study the role of conventional exercises were to stretch the tightened structures like the plantar fascia and tendo Achilles tendon to break the vicious cycle which aggravates the condition, to maintain and restore the proper biomechanics, and maintain the integrity of muscles and related tissues.

After this study now I use myofascial release as a treatment method for treating PF patients as it is being found to be more effective. It can be given manually. It can also be taught to the patients as a home exercise program. Therefore myofascial release is a good adjunct for treatment of PF.

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Slow breathing training on cardio-respiratory control and exercise capacity in persons with essential hypertension – a randomized controlled trial

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Abstract

Background

In persons with hypertension there is decreased exercise tolerance and elevated total peripheral resistance due to autonomic imbalance. Slow breathing improves autonomic imbalance by reducing sympathetic overactivity in hypertensive patients.

Aim

To find the effect of slow breathing training on cardio-respiratory control and exercise capacity in patients with essential hypertension.

Setting

Medicine Out-Patient Department of a tertiary care hospital.

Design

Randomized controlled trial.

Methods

Forty persons with essential hypertension of age group 35 – 60 years were recruited and randomly allocated in to 2 groups; experimental group (n=20), who received slow breathing exercises twice a week for 4 weeks along with pharmacological treatment and control group (n=20), who received pharmacological treatment alone. After 4 weeks, persons in both the groups were measured for outcome variables like submaximal exercise capacity by using 6 minute walk test (6 MWD), Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), Heart Rate(HR) and Respiratory Rate (RR).

Results

A statistically significant difference was found in exercise group between pre and post intervention for all the outcome variables, whereas for control group no significant difference was found between pre and post intervention. Between the exercise and control group, a statistically significant difference was found for the variables, HR (P =0.009), SBP (P =0.012), DBP (P =0.000) and RR (P =0.000), but there was no significant difference in mean difference of 6 MWD (95% CI = -4.443, 2.543; P =0.585) between the groups.

Conclusion

Slow breathing training significantly improves cardio-respiratory control but it fails to improve the exercise capacity in patients with essential hypertension.

Keywords

Slow breathing exercises, Blood pressure, Autonomic imbalance, Exercise tolerance, Sympathetic overactivity.

Introduction

Hypertension means increase in normal blood pressure both in SBP and DBP. According to the Joint National Committee - seventh report (JNC-VII), SBP above 140-160mmHg and DBP above 90-100mmHg is considered as hypertension (Stage-1)¹. Approximately 90-95% of individuals with hypertension have no specific cause for their disease and are said to have Primary or Essential hypertension. The remainder has Secondary

hypertension resulting from other identifiable medical problems, such as renovascular or endocrine disease. Regardless of the underlying causes, it results due to failure of control mechanisms that is responsible for lowering blood pressure².

Hypertension is a leading cardiovascular disease in the industrialized nations of the world. A study on the prevalence of hypertension on urban community in India revealed that the systolic hypertension (140mm of Hg) is 40.9% and diastolic hypertension (90mm of Hg) is 29.3% among study population³.

If hypertension is not controlled then there will be future cardio-vascular complication like Atherosclerotic heart disease, congestive heart failure, cerebrovascular accidents, aneurysm, peripheral vascular disease and renal failure².

Primary prevention of hypertension can be done by pharmacological or non-pharmacological (change in life style, weight loss, alcohol and dietary salt restriction and moderate intensity exercises) management which reduces morbidity and mortality associated with hypertension⁴.

Autonomic imbalance has a major role in etiology of hypertension which is characterized by increase in sympathetic activity. One of the mechanisms associated with autonomic imbalance is reduced baroreflex sensitivity which in turn fails to reduce sympathetic over-activity⁵. In hypertension, chemoreflex activation can also be an additional mechanism responsible for increase in sympathetic activity⁶.

During rest, individuals with essential hypertension have increased total peripheral resistance and a low or normal stroke volume. When they are exercising, the stroke volume increases subnormally and the heart rate during peak exercise is lower. The cardiac output is therefore lower, exercise time is decreased, the anaerobic threshold is reached earlier and maximal oxygen uptake is reduced. Exercise capacity in hypertensive individuals is reduced as much as 30% compared to age-matched normotensive controls⁷.

Breathing exercise and ventilatory training can take on many forms including diaphragmatic breathing, segmental breathing, ventilatory muscle training, etc for the relief of dyspnea with exertion and to promote relaxation and stress⁸. Breathing exercises controlled at 6 rate per minute (rpm) are known as slow controlled breathing exercises which are characterized by increased respiratory amplitude (Tidal volume) and decreased respiratory rate⁹. Respiratory retraining using the slow

breathing technique appears to be a useful adjunctive for cardio-respiratory control in hypertensive persons¹⁰.

Slow breathing at 6 cycles/ minute has the effect of entraining all R-R interval fluctuations, thereby causing them to merge at the rate of respiration and to increase in amplitude which activates Hering-Breuer reflex and enhances the central inhibitory rhythms which in turn reduces the chemoreflex sensitivity and enhance the baroreflex efficiency¹¹⁻¹³. It occurs because the changes in sympathetic activity and in baroreflex sensitivity are interrelated¹⁴.

Thus, this study aimed to find the effect of slow breathing exercises on cardio-respiratory control and exercise capacity in persons with essential hypertension.

Methodology

Participants

The source of data was from a medicine out-patient department of a tertiary care hospital. By purposive sampling 40 participants were recruited in the study based on the following inclusion criteria; Persons who were having Systolic blood pressure between 140-160mm of Hg and Diastolic blood pressure between 90-100mm of Hg, according to JNC-VII criteria and also who were diagnosed as Essential or Primary hypertension with the age group between 35–60 years. Those who were having secondary hypertension due to Liver/Heart/Renal failure, recent cardiovascular events, pulmonary diseases, diabetes mellitus, neuropathies, autoimmune diseases, cardiac arrhythmias, cigarette smoking, alcohol consumption, use of oral contraceptives, use of neuroleptics/anti-arrhythmic and Lithium were excluded from the study.

After being approved by the Institution's Ethical and Scientific Review Committee, an informed written consent was obtained from all the patients who were willing to participate in the study after explaining the purpose and procedure of the study.

Randomization

The recruited participants were allocated into two groups (intervention group and control group) randomly by using simple randomization (computer generated random numbers) procedure. Sequence generation and allocation concealment were done with the help of a Biostatistician, hence the anticipated selection bias was avoided. To eliminate the measurement bias the therapist who was measuring the outcome variables was blinded.

Tools

The tools used in the study were Sphygmomanometer, Stop watch, Measuring tape, Stethoscope and Weighing machine. The following outcome measures were used in this study; 6 minute walk test, Heart rate, Blood pressure, and Respiratory rate.

Procedure

The participants in both the groups were continued

with their pharmacological treatment but the experimental group was only treated with slow breathing technique, additionally.

Then, the baseline characteristics like blood pressure, heart rate, respiratory rate and sub-maximal exercise capacity were measured for all the subjects in both the groups. The submaximal exercise capacity was measured by using 6 minute walk test according to American Thoracic Society (ATS) guidelines¹⁵ which possesses good reliability and validity¹⁶.

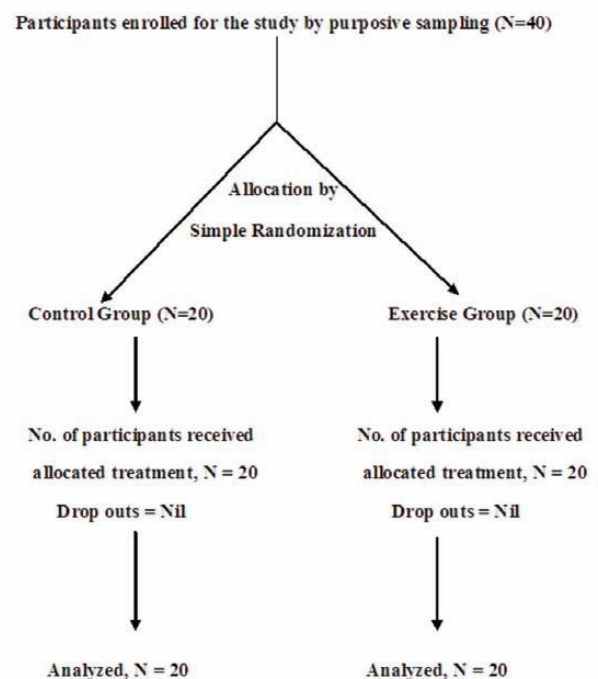
The training protocol for breathing control was applied using Diaphragmatic, Intercostal, and Upper chest breathing patterns to make them aware of their respiratory movements. Persons were asked to lie supine, with knees flexed and feet flat on the floor, and raised their hands to the area of the chest related to each breathing pattern: Diaphragm, Inter-costal muscles and Clavicular region. For each breathing pattern, the individual was instructed to feel and identify the rib cage motion and its amplitude. Then, they were also instructed to decrease their respiratory rates gradually while increasing respiratory amplitude. This procedure was then performed in sitting position, in the same manner as performed in supine position.

After 4 weeks, post intervention outcome measures (6 minute walk test, Heart rate, Blood pressure, and Respiratory rate) were recorded for all the participants in both the groups.

Results

For data analysis, statistical software SPSS (v 16) was used. Descriptive statistics were calculated for all the variables. Shapiro- Wilk test of normality was done for all the variables. Based on its results, Wilcoxin

Figure 1: Flow chart of participants and allocation of treatment



signed rank test was done for comparing the pre and post intervention of 6 MWD and for the pre and post comparison of the remaining variables (HR, SBP, DBP and RR) paired t – test was performed; For between group comparison of 6 MWD independent t – test was done and for the remaining variables (HR, SBP, DBP and RR) Mann – Whitney U test was used.

Table 1: Descriptive statistics of age of participants in Exercise group and Control group

Group	N	Mean ± SD
Exercise	20	53.00 ± 5.40
Control	20	52.15 ± 4.58
Total	40	52.57 ± 4.96

SD: Standard Deviation; N: Number of subjects

Table 2: Gender distribution in Exercise group and Control group

Gender	Exercise Group	Control Group	Total
	N (%)	N (%)	N
Male	12 (60)	14 (70)	26
Female	8 (40)	6 (30)	14
Total	20 (100)	20 (100)	40

N: Number of participants

The exercise group showed statistically significant difference between pre and post intervention for 6 MWD ($p = 0.001$), HR (95% CI = 0.61, 2.59; $p = 0.003$), SBP (95% CI = 1.36, 5.44; $p = 0.002$); DBP (95% CI = 1.87, 6.13; $p = 0.001$); and RR (95% CI = 0.94, 3.96; $p = 0.003$), whereas for control group no significant difference was found between pre and post intervention for 6 MWD (0.063); HR (95% CI = -0.93, 0.73; $p = 0.804$); SBP (95% CI = -1.05, 0.65; $p = 0.629$); DBP (95% CI = -1.73, 0.13; $p = 0.088$); RR (95% CI = -0.44, 0.04; $p = 0.104$).

Between the exercise and control group, a statistically significant difference was found for the outcome variables, HR ($p=0.009$), SBP ($p=0.012$), DBP ($p=0.000$) and RR ($p=0.000$), whereas there was no significant difference in mean change of 6 MWD (95% CI = -4.443, 2.543; $p=0.585$) between the groups.

Discussion

Hypertension is mainly characterized by Autonomic imbalance. The mechanism responsible for autonomic imbalance is reduced baroreflex sensitivity and increased chemoreflex activation^{5,6}. As a result of decreased maximal VO₂ and elevated total peripheral

resistance, exercise tolerance is decreased in patients with hypertension compared to normotensive⁷.

Prevention of hypertension can be done primarily by pharmacological or non pharmacological intervention which includes change in life style, weight loss, and moderate intensity exercises⁴. Earlier studies also confirmed that slow breathing exercises can reduce the sympathetic over activity and increase parasympathetic activity in hypertensive individuals⁵.

The slow breathing (6 breaths/min) technique can acutely reduce blood pressure and improve baroreflex sensitivity in persons with hypertension⁵.

In a previous study it was found that respiratory retraining using slow breathing technique can improve autonomic balance, respiratory control and lower the blood pressure in essential hypertension¹⁰ which is well correlated with the results of this study.

It was investigated whether slow breathing can modify chemoreflex and baroreflex sensitivity and found that increase in tidal volume due to slow breathing rates activate the hering breuer reflex which in turn reduces chemoreflex sensitivity and thus might enhance baroreflex sensitivity¹².

From the results of this study it is also evident that there is no significant improvement in exercise capacity as measured with 6 MWD, which is inconsistent with the findings of a previous study⁹ where the effect of breathing rate on respiratory indices and Oxygen saturation in the artery (SaO₂) at 15 rpm, 6 rpm and 3 rpm was evaluated and found that respiratory retraining at slowing respiratory rate reduced dyspnea and improved exercise performance and pulmonary gas exchange in persons with Chronic Heart Failure.

Although we observed short term effects of slow breathing, it remains to be assessed whether changes in the autonomic imbalance due to slow breathing training persist after resuming normal respiration.

In view of this body of evidence, the findings of this study can be explained by the following mechanisms as proposed in earlier studies^{12,14}. The slow breathing rate at 6 breaths/min reduces the chemoreflex response to both hypoxia and hypercapnia by enhancing the baroreflex sensitivity. There is an interaction of baroreceptor and chemoreceptor reflex control of sympathetic nerve activity in normal humans which explained that the baroreceptor activation inhibits the sympatho-excitatory response to stimulation of peripheral chemoreceptors (hypoxia) whereas its inhibitory response was not observed during stimulation of central chemoreceptors (hypercapnia).

So, it can be inferred from this study that slow controlled breathing (6 rpm) training can modulate the

Table 3: Within group comparison of 6 minute walk distance between pre and post intervention

Group	6 MWD	Minimum	Maximum	Median	Inter-quartile range	P value
Control	Pre	402	501	444	60.75	0.063
	Post	402	504	445.50	55.50	
Exercise	Pre	411	540	439.50	62.75	0.001
	Post	411	552	445.50	62.00	

($\alpha=0.05$)

6 MWD: 6 Minute Walk Distance (in metres)

Table 4: Within group comparison of Physiological Variables between pre and post intervention in both groups

Group	Physiological Variables		Mean	SD	SEM	95% Confidence Interval of the Difference		t statistic	p value
						Lower Bound	Upper Bound		
Control	HR	Pre	81.70	6.199	1.386	-0.93	0.73	-0.252	0.804
		Post	81.80	5.800	1.297				
	SBP	Pre	139.50	6.517	1.457	-1.05	0.65	-0.490	0.629
		Post	139.70	5.921	1.324				
	DBP	Pre	83.40	5.548	1.241	-1.73	0.13	-1.798	0.088
		Post	84.20	4.808	1.075				
RR	Pre	23.45	2.704	0.605	-0.44	0.04	-1.710	0.104	
	Post	23.65	2.601	0.582					
Exercise	HR	Pre	79.70	79.70	1.216	0.61	2.59	3.387	0.003
		Post	78.10	78.10	1.010				
	SBP	Pre	140.10	140.10	1.664	1.36	5.44	3.489	0.002
		Post	136.70	136.70	1.208				
	DBP	Pre	84.50	84.50	1.521	1.87	6.13	3.938	0.001
		Post	80.50	80.50	1.321				
RR	Pre	23.40	23.40	.622	0.94	3.96	3.386	0.003	
	Post	20.95	20.95	.478					

SD: Standard Deviation; SEM: Standard Error of Mean; HR: Heart Rate; SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; RR: Respiratory Rate

Table 5: Comparison of Physiological Variables between Exercise and Control groups

Physiological Variables	Group	Minimum	Maximum	Median	Inter-quartile range	P value
HR	Control	-4.00	2.00	0.000	1.50	0.009
	Exercise	-6.00	2.00	-2.000	1.50	
SBP	Control	-4.00	2.00	0.000	4.00	0.012
	Exercise	-12.00	4.00	-3.000	6.00	
DBP	Control	-4.00	4.00	2.000	2.00	0.000
	Exercise	-18.00	2.00	-3.000	5.00	
RR	Control	0.00	2.00	0.000	0.00	0.000
	Exercise	-9.00	3.00	-2.500	3.50	

HR: Heart Rate; SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; RR: Respiratory Rate

Table 6: Comparison of 6 minute walk distance between Exercise and Control groups

Variable	Group	Mean	SD	Mean Difference	Std. Error of Mean Difference	95% Confidence Interval of Mean Difference		t Statistic	p Value
						Lower Bound	Upper Bound		
6 MWD	Control	4.300	5.20	-0.950	1.726	-4.443	2.543	-0.550	0.585
	Exercise	5.250	5.70						

($\alpha=0.05$)

SD: Standard Deviation; 6 MWD: 6 Minute Walk Distance (in metres)

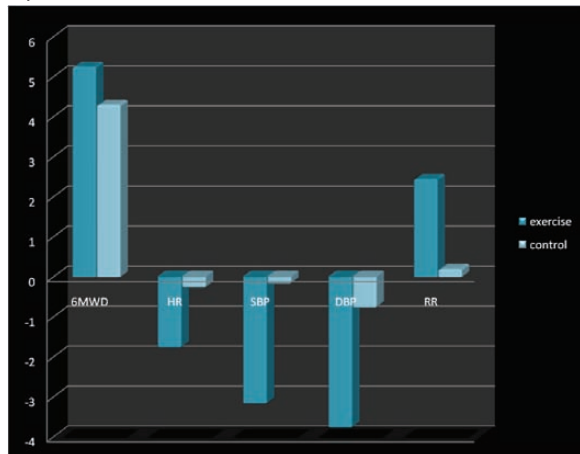
cardio-respiratory control by altering the autonomic imbalance.

cardio-respiratory control i.e. Heart rate, Blood pressure and Respiratory rate by altering the autonomic imbalance whereas it fails to improve the exercise capacity measured by 6 minute walk test in persons with Essential hypertension.

Conclusion

The slow breathing training significantly improves

Graph 1: Comparison of mean difference score (post – pre) of 6 MWD, HR, SBP, DBP and RR between exercise and control groups



6 MWD: 6 Minute Walk Distance; HR; Heart Rate; SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; RR: Respiratory rate

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Postural stability during seven different standing tasks in persons with chronic low back pain – A cross-sectional study

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Abstract

Background

Proprioceptive impairments reflected by poor joint position sense have been identified in persons with Low Back Pain (LBP) and thus leading to impaired postural control.

Aim

To evaluate the postural stability during seven different standing tasks in persons with CLBP compared to persons without LBP.

Setting

Movement Science Lab.

Design

Cross-sectional study.

Methods and Material

A force plate was used to measure the Centre of Pressure (COP) excursion in antero-posterior (A-P) and medial-lateral (M-L) directions in persons with CLBP ($n = 20$) and normal subjects ($n = 20$) for 7 different standing tasks with eyes opened and closed.

Statistical Analysis

Independent t test and Mann – Whitney U test were used based on the normality assumption for comparing the COP excursion between CLBP and normal subjects.

Results

The CLBP group showed statistically significant increase in COP excursion for normal standing with eyes opened (NSEO) [$P = 0.000$], normal standing with eyes closed (NSEC) [95% CI = 0.39, 0.66; $P = 0.000$], tandem standing with eyes opened (TSEO) [$P = 0.000$], tandem standing with eyes closed (TSEC) [$P = 0.000$], foam standing with eyes opened (FSEO) [$P = 0.0001$], foam standing with eyes closed (FSEC) [95% CI = 0.56, 1.05; $P = 0.000$], and one leg standing (OLS) [95% CI = 0.07, 0.47; $P = 0.010$] as compared to normal subjects.

Conclusion

There was an increase in postural sway among the persons with CLBP compared to that of the normal individuals in all the 7 different standing tasks.

Keywords

Postural control, Postural steadiness, Postural sway, Balance, COP Excursion.

Introduction

Low back pain (LBP) is defined as a range of symptoms which include pain, muscle tension or stiffness. It is generally located between the shoulder blades and the folds of the buttocks, with or without spreading to the legs¹. It may be either acute or sub acute or chronic, according to complaint period. Acute low back pain is generally characterized by a period of complaint of 6 weeks or shorter, sub-acute low back pain as a period between 6 and 12 weeks and chronic low back pain as a

period of complaint longer than 12 weeks.

Chronic low back pain (CLBP) starts to emerge from acute pain of muscle and connective tissue which persists in approximately 30% of acute cases and becomes chronic.² A common condition of LBP is comprising a major health problem worldwide,³ which causes considerable disability, work absenteeism, and use of health services. It is said to affect 50% to 80% of us in our lifetime and 15% to 30% of us at any given time. During any 6-month period, 72% of adults in the general population will report LBP and 11 % will report disabling LBP⁴.

The causes for LBP may be specific or non-specific. Non-specific low back pain is defined as a pain not attributed to a recognizable pathology or specifically proven patho-anatomic causes such as infection, tumors, osteoporosis, rheumatoid arthritis, fracture or inflammation⁵.

The factors contributing to the chronicity of LBP are psychological factors and abnormal movement patterns. The continuing or constant pain in persons with CLBP is associated with widespread neuroplastic changes at multiple levels within the nervous system^{6,7,8} including primary afferent neurons, spinal cord, brainstem, thalamus, limbic system and cortex^{9,10,11,12}.

The state of bodily equilibrium or the ability to maintain the center of body mass over the base of support has been defined as balance and postural stability^{13,14,15}. Postural stability can be defined as postural balance or postural steadiness while postural balance is defined as the ability to stay upright or to recover equilibrium after external dynamic perturbations, whereas sometimes under altered somato-sensory conditions postural steadiness refers to standing as still as possible on a force platform^{16,17}. Postural unsteadiness may accompany with high risk of falling^{18,19}. Postural stability is maintained by integration of vestibular, visual and proprioception neural input to CNS^{13,14,20}.

The spinal motor control depends on lumbopelvic stability. There are 3 subsystems that contribute to lumbopelvic stability; active system, passive subsystem and neural control subsystem. There is an immense challenge for this neural control subsystem to coordinate responses to afferent feedback from unpredictable challenges. This feedback-mediated control is altered in persons with CLBP²¹ due to altered lumbosacral proprioceptive acuity^{22,23}, dysfunction in trunk muscle control^{24,25} and leading to altered postural balance^{26,20}. The underlying mechanisms of trunk muscle dysfunction

and altered postural control in patients with LBP, however, is still obscure²⁷. During standing on “foam” the CNS of the healthy persons gives significantly increased importance for the proprioceptive signals from the paraspinal muscles and less importance for those from the ankle muscles to control postural balance²⁸.

Low back pain patients differ from normal subjects in positioning their centre of pressure (COP) more posteriorly^{20,28} and they are less likely to be able to balance on one foot with their eyes closed compared to healthy people. LBP is known to negatively influence the proprioceptive capacity^{20,29} which probably leads to increased dependence on the visual system^{22,29,30} and it would be related to similar pre-synaptic inhibitory mechanisms similar those observed in fear or any anxiety situations^{31,32}.

An increase in sway using measures of Center of Mass (COM) or Center of Pressure (COP) line, indicating a change in postural control, postural stability, or risk of falling is commonly seen in persons having low back pain^{33,34}. There were no significant differences in postural sways between persons with and without LBP during quiet standing conditions, but when the complexity of the task was increased, the postural stability decreased in persons with LBP compared to healthy controls^{20,35}.

So, this study was intended to investigate the postural stability during seven different standing tasks in persons with CLBP compared to persons without LBP by using the measures of COP excursion in antero-posterior and medial-lateral directions.

Subjects and Methods

Twenty persons with non-specific mechanical Chronic Low Back Pain for more than 3 months duration and 20 healthy volunteers of age group 20-30 of both genders were included in the study. Individuals with spine and lower limb fractures, any orthopedic impairment, gross structural defect of spine, spondylolisthesis, previous lumbar or abdominal surgery, unresolved lower limb musculoskeletal pathology, known sensory or neurological disorders, respiratory or cardiovascular impairment were excluded from the study. Ethical clearance and approval was obtained from the institution’s ethical committee. The purpose of the study was explained and a written consent for participation in the study was obtained from all the subjects. All the subjects were measured for Height, Weight, Body Mass Index (BMI) and Pain intensity by using Visual Analog Scale (VAS).

For measuring COP excursion, Bertec Force plate (Columbus, OH 43229, U.S.A) was used and for challenging the proprioceptive system 10 cm height foam was used.

Procedure

All the subjects were interviewed and examined and those fulfilled the selection criteria were included in the study. They were explained and demonstrated about the following standing positions.

Tasks performed by subjects on the force platform with eyes opened:

- Task 1: Normal standing with eyes opened (NSEO)
- Task 2: Tandem standing with eyes opened (TSEO)
- Task 3: Foam standing with eyes opened (FSEO)
- Task 4: One leg standing (OLS)

Tasks performed by subjects on force platform with eyes closed:

- Task 5: Normal standing with eyes closed (NSEC)
- Task 6: Tandem standing with eyes closed (TSEC)
- Task 7: Foam standing with eyes closed (FSEC)

In NSEO the subjects were asked to stand erect over the force plate with approximately 10 cm distance between the feet and look straight; in NSEC the subjects were asked to stand in the same manner as for NSEO but with eye closure. In TSEO the subjects were asked to stand with one foot ahead of other in such a way that heel of one foot is approximating the toes of other foot and look straight; in TSEC they were asked to maintain the same position as for TSEO but with eye closure. In FSEO the subjects were asked to stand erect over 10 cm height foam kept on the force plate with approximately 10 cm distance between the feet and look straight; in FSEC they were asked to perform the same procedure like FSEO but with eye closure. In One Leg Standing subjects were instructed to flex any of the leg such that hip at slight degrees of flexion and knee at 70-90 degrees of flexion and cross their arms over the chest. All the testing conditions were tested in a well illuminated room with calm atmosphere. The subjects were instructed to avoid tight fit clothing especially a waist belt during assessment and also they were asked to stand with barefoot foot for all the testing conditions. All the subjects were given 2 repetitions for each position on the floor and only after that they were allowed to perform on the force plate. Once balance was achieved, subjects were provided verbal signal and the force plate measures were recorded. COP excursion was measured for above tasks in anterior- posterior and medial-lateral directions.

Results

For data analysis statistical software, SPSS (v 16) was used. Shapiro-Wilk test of normality was done for all the variables. Levene’s test for equality of variance performed to find the homogeneity of groups for all the

Table 1: Demographic and Basic Characteristics of CLBP and Normal Subjects

Characteristics	CLBP (n=20) (Mean ± SD)	Normal (n=20) (Mean ± SD)	P value
Age (years)	21.65± 1.84	23.80 ± 2.37	0.791
Height(cm)	161.5 ± 14.51	166 ± 9.74	0.436
Weight(kg)	61.03 ± 12.47	57.66 ± 10.70	0.677
BMI	23.70 ± 4.84	20.90 ± 3.37	0.120
VAS	4.72 ± 3.54	NA	NA

($\alpha = 0.05$)

BMI: Body Mass Index; VAS-Visual Analog scale; NA: Not Applicable

demographic and basic characteristics (age, height, weight and BMI) showed that these variables have met the equality of variance assumption at a 0.05 level of significance. Among the 7 variables, NSEC, FSEC and OLS were having normal distribution and hence independent t-test was performed. The remaining variables NSEO, TSEO, TSEC and FSEO were not having normal distribution for one of the groups, so Mann-Whitney U test was used.

The results thus obtained suggest that the CLBP group showed statistically significant increase in COP excursion (measured in cm) for all the 7 different standing tasks as compared to normal subjects as following; for NSEO (P = 0.000), NSEC (95% CI = 0.39 – 0.66; P = 0.000), TSEO (P = 0.000), TSEC (P = 0.000), FSEO (P = 0.000), FSEC (95% CI = 0.56 – 1.05; P = 0.000), OLS (95% CI = 0.07 – 0.47; P = 0.010). Although a statistically significant difference was found for OLS, it was not clinically significant.

Discussion

Optimal postural control is an essential prerequisite to perform daily activities³⁷. The ability to select and reweigh (multi-) sensory signals adaptively in conflicting and demanding situations is one of the most critical factors for postural control²². The central nervous system (CNS) integrates the afferent input from visual, vestibular and proprioceptive systems and this is essential for

maintaining postural stability³⁸, so loss of input from even anyone of these systems will lead to postural instability.

Balance dysfunction in CLBP may be due to altered proprioceptive feedback from the lumbar spine^{30,39,40} and lower limbs⁴¹. In a previous work, it was found that posture stabilization under altered proprioceptive conditions required an increased AP sway for CLBP patients³⁵.

Many authors have studied the COP excursion in CLBP patients by removing the visual information^{22,29,30}. In this study the visual system as well as the proprioceptive system is challenged by making them to stand on foam which further adds the complexity to maintain the postural stability as only a few studies had focused on this system.

The increased COP excursion observed in this study among the CLBP subjects compared to that of the normal subjects suggests that there was an impaired postural control among the CLBP subjects. It was also inferred from the results of this study that the COP excursion was higher in all the conditions performed with closed eyes for both the groups compared to that of those conditions performed with opened eyes and also this is more for the persons with CLBP. In the present study COP excursion during OLS was measured only with eyes opened as, even the normal subjects found that condition as more complex and difficult. Interestingly, the same was inferred from the results and revealing a difference which was clinically not significant.

Table 2: Mann-Whitney U test analysis of NSEO, TSEO, TSEC and FSEO for CLBP and Normal Subjects

Task	Group	Minimum Value	Maximum Value	Median	Inter-quartile range	P Value
NSEO	CLBP	0.80	1.50	1.15	1.00 – 1.30	0.000
	Normal	0.60	1.00	0.80	0.70 – 0.90	
TSEO	CLBP	1.00	2.30	1.65	1.42 – 2.00	0.000
	Normal	1.10	3.50	2.00	1.50 – 2.10	
TSEC	CLBP	2.00	4.70	2.55	2.22 – 3.22	0.000
	Normal	0.90	6.10	3.50	2.52 – 4.35	
FSEO	CLBP	1.30	3.20	2.40	2.02 – 2.40	0.000
	Normal	0.90	3.60	1.40	1.20 – 1.40	

($\alpha = 0.05$)

NSEO: Normal standing with eyes opened; TSEO: Tandem standing with eyes closed; TSEC: Tandem standing with eyes closed; FSEO: Foam standing with eyes opened; CLBP: Chronic low back pain

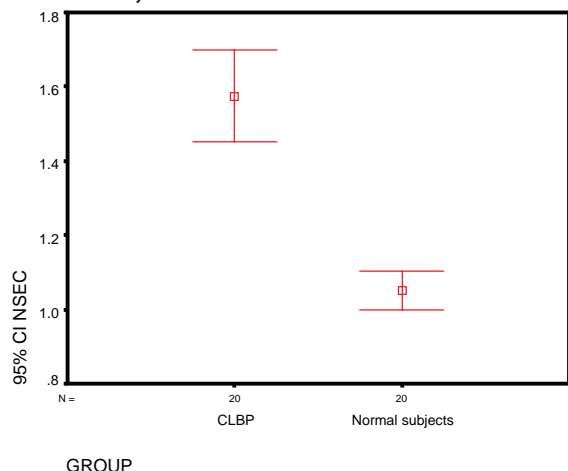
Table 3: Independent t-test analysis of NSEC, FSEC and OLS for CLBP and Normal Subjects

Task	Group	Mean	SD	Mean Difference	Std. Error of Mean Difference	95% Confidence Interval of Mean Difference		t statistic	p Value
						Lower Bound	Upper Bound		
NSEC	CLBP	1.58	0.27	0.53	0.06	0.39	0.66	8.174	0.000
	Normal	1.05	0.11						
FSEC	CLBP	2.51	0.43	0.81	0.12	0.56	1.05	6.571	0.000
	Normal	1.71	0.33						
OLS	CLBP	2.42	0.32	0.27	0.10	0.07	0.47	2.706	0.010
	Normal	2.15	0.31						

($\alpha = 0.05$)

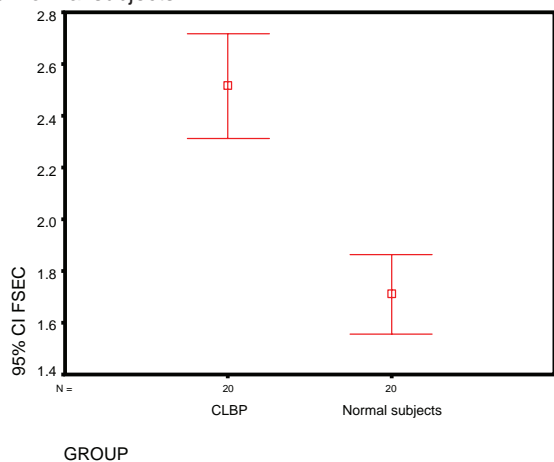
NSEC: Normal standing with eyes closed; FSEC: Foam standing with eyes closed; OLS: One leg standing; CLBP: Chronic low back pain; SD: Standard deviation

GRAPH 1: Mean and 95% CI of mean for NSEC between CLBP and Normal subjects



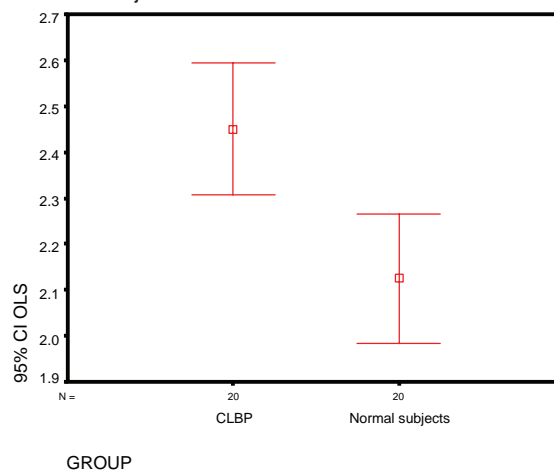
NSEC: Normal standing with eyes closed; CLBP: Chronic Low Back Pain; CI: Confidence Interval

GRAPH 2: Mean and 95% CI of mean for FSEC between CLBP and Normal subjects



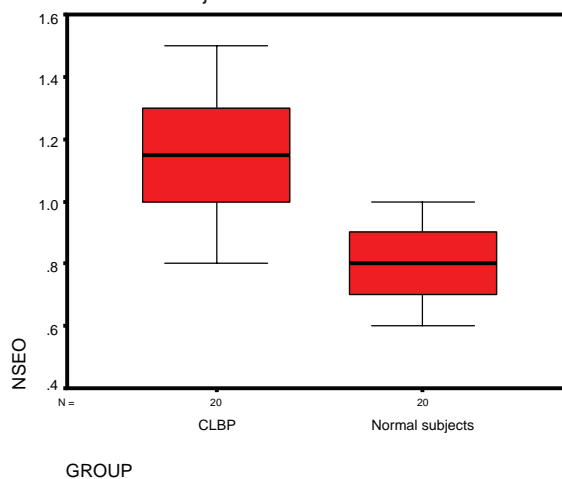
FSEC: Foam standing with eyes closed; CLBP: Chronic Low Back Pain; CI: Confidence Interval

GRAPH 3: Mean and 95% CI of mean for OLS between CLBP and Normal subjects



OLS: One leg stance; CLBP: Chronic Low Back Pain; CI: Confidence Interval

GRAPH 4: Median and Inter-quartile range for NSEO between CLBP and Normal subjects



NSEO: Normal standing with eyes opened; CLBP: Chronic Low Back Pain

One of the findings of this study (COP excursion is higher in tasks performed with closed eyes) has agreement with a previous study where postural stability was measured with 12 CLBP patients and 12 control subjects by using dynamic posturography, while the subjects stood quietly on a moveable platform under six sensory conditions that altered the available visual and proprioceptive information and it was reported that CLBP subjects showed increased postural sway in AP direction with greater dependence on visual input compared to healthy subjects³⁵. The effect of LBP on body balance during normal and visual deprivation measured with the help of a 3-D force platform showed that resultants COP velocities were larger for LBP group when visual information was removed⁴².

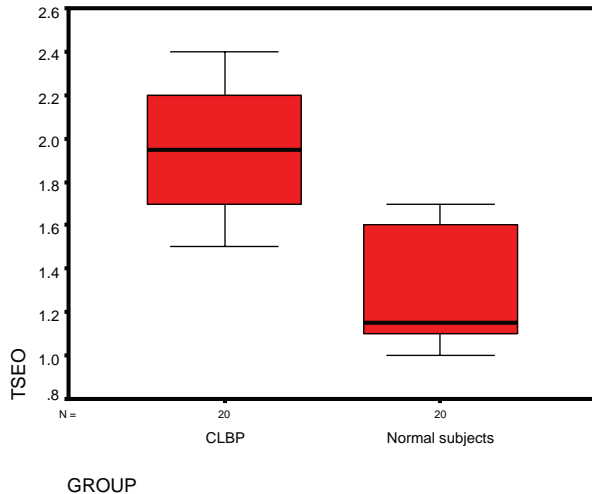
Persons with LBP demonstrated a greater postural sway, an increased difficulty with adapting to changing condition and a decreased recovery of postural balance after perturbation compared with the healthy control^{13,14}. Chronic low back pain (CLBP) patients showed more

postural sway compared to the normal subjects in various demanding situations, with and without sensory feedback which included single legged and intermittent heel and toe stance²⁸, which is consistent with our results.

Many studies are in accord with the results of our study, that COP excursion is increased in the most difficult task such as tandem and foam standing among the CLBP patients and also the same is further increasing with eye closure. But, in another study it was found that there was no significant difference in COP excursion between the persons with and without LBP for the stable support surface condition³⁵. In quiet standing conditions, there were no significant differences in postural sways between persons with and without LBP but a decrease in postural stability was observed in persons with LBP compared to healthy controls when the complexity of task was increased^{20,35}.

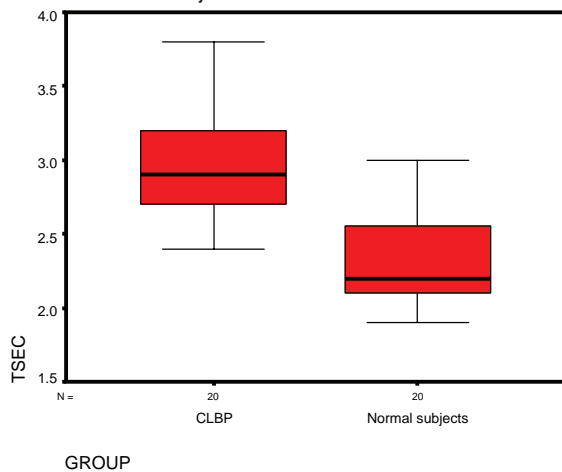
Many authors found that several factors are affecting postural control and relative utilization of hip and ankle strategies. The first factor is position of COP

GRAPH 5: Median and Inter-quartile range for TSEO between CLBP and Normal subjects



TSEO: Tandem standing with eyes opened; CLBP: Chronic Low Back Pain

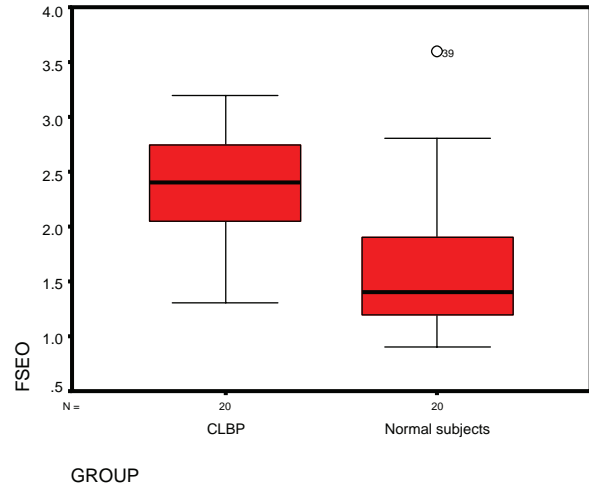
GRAPH 6: Median and Inter-quartile range for TSEC between CLBP and Normal subjects



TSEC: Tandem standing with eyes closed; CLBP: Chronic Low Back Pain

in LBP subjects²⁰, second factor is changes in postural activity of trunk muscles⁴³ and other factor is deficit in proprioception in the lumbar spine in people with LBP³⁹. These changes may lead to compromised postural control and may be greater dependence on visual input to control balance and thus less likely to maintain their balance when visual input is altered or removed as we did in our study. Keeping in view all these, it is suggested to focus on the postural control during the evaluation and intervention of the persons with CLBP. Further studies are recommended to assess the feedforward mechanisms of postural control in CLBP subjects, as the present study did not evaluate this mechanism which is one of the limitations of this study and also to determine the influence of this impaired postural stability in the performance of functional activities of patients with CLBP and its correlation with other clinical findings and disability index.

GRAPH 7: Median and Inter-quartile range for FSEO between CLBP and Normal subjects



FSEO: Foam standing with eyes opened; CLBP: Chronic Low Back Pain

Conclusion

It is inferred from this study that there is an increased COP excursion in antero-posterior as well as medial-lateral directions in patients with Chronic Low Back Pain and thus a decreased postural stability compared to that of the normal subjects.

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Efficacy of lateral wedged insole with subtalar strapping on the functional status of medial compartment 3rd grade osteoarthritis of the knee

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Abstract

Knee osteoarthritis is the most common disease encountered in the Physical Therapy Clinic. The main outcomes of Physiotherapy treatment is based on symptomatic pain relief along with prevention of deterioration of the functional capacity and improvement in ADL. Among the various conservative treatments for knee OA, lateral wedged insole is the latest treatment concept based on correction of knee varus deformity with the change in foot position. Addition of exercise helps in the maintenance of the correction as muscle strength is required to align the bony levers. This study compares the effect of lateral wedged insole with subtalar strapping along with exercises as treatment option for knee OA with that of exercises alone.

Objectives

To find out the efficacy of lateral wedged insole with subtalar strapping along with exercises on medial compartment 3rd grade knee OA.

Methods

30 subjects were included in the study based on the inclusion and exclusion criteria and clinical criteria for diagnosis of knee OA. The subjects were divided into 2 groups containing 15 each. Both the groups were administered KOOS scale and a baseline assessment was formed for the functional status. Group I was subjected to the use of wedged insole with subtalar strapping along with a set of 5 exercises and Group II was prescribed only exercises for a period of 1 month. At follow-up, the scale were administered again and the effects of the intervention were gauged by comparing the pre intervention and post intervention values.

Results

Based on the effect size and % change, the data analysis reveals that though both the groups had significant effects of the intervention and exercises, the experimental group (group I) showed a higher effect size and percentage change compared to the control group (group II).

Interpretation and Conclusion

It is concluded that lateral wedged insole with subtalar strapping will be highly efficacious if used along with strengthening exercises for patients with medial compartment 3rd grade knee OA.

Keywords

Knee Osteoarthritis, KOOS, Functional status, Wedged insole, Subtalar strapping.

Introduction

Knee OA, also known as DJD, is one of most common disorders of middle age to elderly population and the involvement of the medial compartment of knee joint is almost three times more than the other compartments. It is a condition more often seen in women. According to researches, the incidence of OA in men is comparable to that in women, but women are more likely to be symptomatic. Although it is the most common presentation encountered in any physical therapy clinic, it also remains the most unsatisfactorily

treated condition as the treatment interventions are usually directed towards symptomatic pain relief and strengthening.

With respect to treatment of knee OA, from time immemorial, various treatment regimes are used by practitioners; pharmacological and non-pharmacological including Physiotherapeutics and Surgery. Surgery remains to be the only permanent alternative. Due to the high risk of complications following surgeries like high tibial osteotomies and inability to cope up with the demands of post-surgical recuperation in old age, surgery is not always preferred and patients usually opt for conservative management.

In medial compartment OA of the knee, varum is produced in the knee due to the degeneration of medial articular cartilage. This presentation is not adequately met by any of the interventions available in current practice and thus pathomechanics is still persisting/continuing even though the symptomology is relieved transiently through some of the treatment modalities. Therefore, there is a need for a conservative treatment to replace the permanent solution of surgery.

The purpose of this study is to develop and determine the effects of a treatment alternative aimed at biomechanical correction of the knee OA pathomechanics. The lateral wedged insole is introduced recently for the treatment of knee OA. Trails using 16mm, 12mm and 8mm elevations have reported 12mm and 8mm to be most effective. But these studies have failed to correlate their findings (i.e. specific degree of elevation) with specific grade of OA.

Aim and Objective

To find out the efficacy of 12mm lateral wedged insole with subtalar strapping on patients with 3rd grade medial compartment OA of the knee.

Methodology

Materials used and the characteristics of the sample:

Wedged insole, Ankle binder and Knee Osteoarthritis Outcome Score (KOOS) are the materials used.

The population of the study is defined as having 3rd grade medial compartment knee OA and a sample of 30 females are selected randomly from the population, the source of which is ITI General Hospital and Garden City College OPD, Bangalore.

The sample is equally divided into two groups; alternate members are assigned to the two groups randomly.

Inclusion Criteria

- Patients having medial compartment osteoarthritis with grade 3 of Kellgren and Lawrence grading system for osteoarthritis, 1957.
- Patients having medial compartment osteoarthritis with at least 3 of the clinical symptoms according to Criteria for classification of idiopathic Osteoarthritis of the knee, 1986 (American college of Rheumatology)
- Full range of motion in subtalar joints

Exclusion Criteria

- Patients currently using wedged insole.
- Patients having any foot deformity
- Any peripheral or central nervous disorders.
- Patients with any other compartment of the knee involvement.

Study Design

Two-group simple randomized design.

Methods

The study includes 30 female patients randomly assigned in two groups. The patients have to undergo radiographic examination of the knee in AP view standing on one leg without the insole.

The stage of osteoarthritis is determined according to the Kellgren and Lawrence grading system for osteoarthritis, 1957.

According to this grading system

Grade 3 – moderate osteophytes and joint space narrowing, some sclerosis and possible deformity.

Patients are then assessed for the clinical symptoms according to Criteria for classification of idiopathic Osteoarthritis of the knee, American college of Rheumatology, 1986. The patient should have knee pain and at least 3 positive symptoms out of the 6 to fulfill these criteria.

To measure the functional status of the patient before and after the insertion of lateral wedged insole, they are made to fill questionnaire i.e. KOOS

The patients in group 1 are given lateral wedged insole along with a home exercise program whereas patients in group 2 are assigned only to the home-exercise program. The patients are instructed to wear lateral wedge with subtalar strapping for a period of 3-6 hours each day. The home-exercise program included a set of 5 exercises;

- Static glutei
- Static quadriceps
- Short arc quadriceps
- Long arc quadriceps
- Closed-chain short-arc knee extension

These exercises are held for 6-7 secs, and then slowly relax; rest period of 2-3 secs between squeezes, performed 3-5 times a day and each exercise repetition are 5-7 times per session (American Geriatrics Society 2001). The use of the insole and exercises continued for a period of 4 weeks duration.

The patients consent is obtained by filling the consent forms.

The KOOS questionnaire is filled again after the completion of the duration of the study.

Construction of the Lateral Wedged Insole with Subtalar Strapping

The wedged insole was made of Microcellular rubber, the length of 75mm, breadth of 55mm and height of 12mm. the angulation formed was 11.2°. A base layer of 2mm ether flex was used for adhesive application on the ankle binder.

The ankle binder was purchased from MGRM Medicare limited. The size was determined based on the circumference of the ankle joint in inches;

- 6-8 inches circumference - small
- 8-10 inches circumference - medium
- 10-12 inches circumference - large
- 12-14 inches circumference- X large

Results

Data analysis is done by using Student paired t-test, which is used to find the significance of efficacy of the intervention.

Effect size of each of the domains in the KOOS is measured by Cohen's method.

Table 1: Basic characteristics of the study based on age and onset of disease

Basic characteristics	Experimental (n=15)	Control (n=15)	P value
Age in years	52.07±7.08	54.00±4.88	0.392
Onset of disease in years	2.63±1.43	2.40±0.99	0.607

Discussion

The P-value of the experimental group and the control group both showed significant improvement in the overall function of knee OA patients as measured by KOOS but in the dimension of Sports and Recreational function in the control group there was no significant improvement as the P-value = 0.104, indicating that for sporting and recreational activities muscle strengthening alone will not be sufficient without biomechanical correction.

Figure 1a: Basic Characteristics of the study based on age

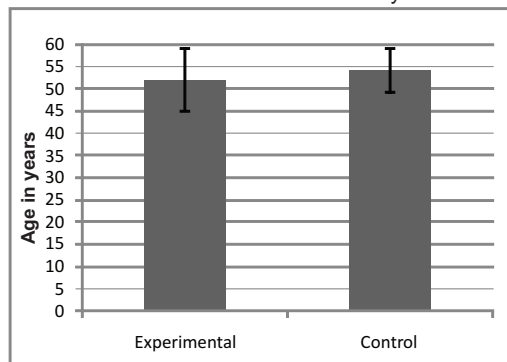


Table 2: Interventional Efficacy between the two groups using KOOS

KOOS		Experimental (n=15)	Control (n=15)
Pain	Pre	22.13±3.56	21.33±1.23
	Post	13.07±3.97	19.87±0.99
	P value	P<0.001	P<0.001
	ES	2.40	1.76
	% Change	40.94	8.98
Symptoms	Pre	13.80±4.65	14.27±1.44
	Post	8.67±3.47	12.27±1.44
	P value	P<0.001	P<0.001
	ES	1.25	1.39
	% Change	37.17	14.02
ADL	Pre	37.73±5.09	30.13±3.11
	Post	23.67±6.39	29.00±3.18
	P value	P<0.001	P<0.001
	ES	2.43	0.36
	% Change	37.26	3.75
Sports & Recreation	Pre	18.40±1.91	19.07±1.03
	Post	13.53±2.88	18.80±0.94
	P value	P<0.001	P=0.104
	ES	1.99	0.27
	% Change	26.47	1.42
Quality of life	Pre	11.93±1.03	11.07±0.70
	Post	7.87±1.73	10.13±0.64
	P value	P<0.001	P<0.001
	ES	2.85	1.40
	% Change	34.03	8.49

When comparing between the mean score differences of pre and post of experimental with that of pre and post values of control group, larger improvement is seen in the dimensions of pain and ADL indicating that the intervention is efficacious in alleviating pain and improving function in the knee OA patients.

The optimal tilt of a lateral wedge insole with subtalar strapping is affected by age. In this study, 12mm elevation

Figure 1b: Basic Characteristics of the study based on onset

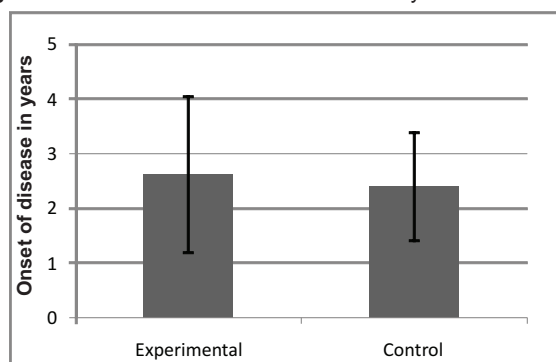


Figure 2a: Pre and Post mean score comparison of each domain of KOOS in Experimental Group

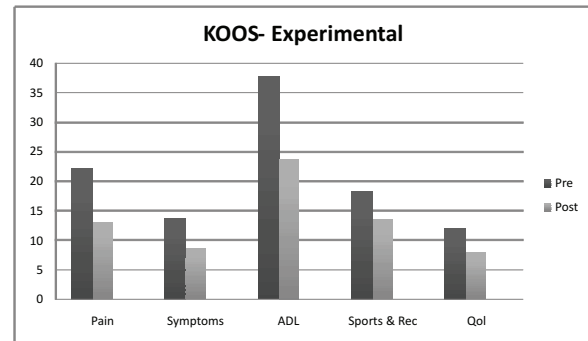


Figure 2b: Pre and Post mean score comparison of each domain of KOOS in Control group

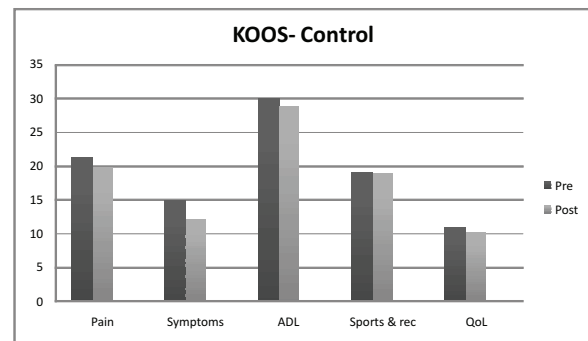
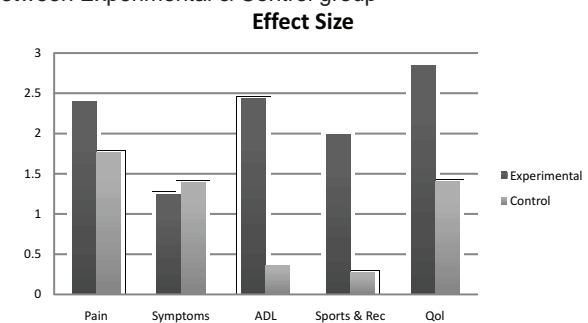


Figure 3: Effect size comparison of each domain of KOOS between Experimental & Control group



was used to assess effects on older patients with 3rd grade OA. Comparing the results of other studies, 8mm elevation was recommended for older adults. This maybe probably as the grade of OA selected was usually ≤ 2nd grade. Since our study was undertaken on 3rd grade OA, 12mm elevation proved to be efficacious. Some studies also concluded lack of effect on older population due to insufficient muscle strength to preserve the biomechanical correction. Therefore, in our study we added strengthening of lower limb muscles. The results showed that only muscle strengthening in the control group also had positive effects; hence when added to the experimental group, it proved to be a valuable adjunct to the intervention.

Conclusion

It has been concluded that lateral wedged insole with subtalar strapping is a cost effective, conservative means

that improves functional status of knee OA patients. It is also easily applicable in terms of compliance with the patient as the duration of application is limited to only 3-6 hours a day.

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An examination of Cyriax's passive motion tests as a diagnostic tool in patients having osteoarthritis of the knee joint

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Abstract

Background and purpose

The selective tissue tension scheme of James Cyriax is an evaluation method commonly used by physical therapists. Cyriax's scheme consists of active range of motion (AROM), passive range of motion (PROM), and resistive tests followed by palpation of anatomical structures. Based on the conflicting results of the past research and the importance of Cyriax selective tissue tension scheme for soft tissue diagnosis, further research in this area appears warranted. The purpose of this study was to examine the capsular pattern and the pain resistance sequence in patients suffering from knee osteoarthritis.

Material and Methods

Both males and females subjects referred to physical therapy centers for treatment of unilateral knee OA and fulfilling the ACR criteria for Osteoarthritis of knee (n=30) were included in the study after they gave their informed consent. All the subjects were tested only once for VAS, chronicity, capsular pattern and pain resistance sequence.

Findings

13.3% patients demonstrated capsular pattern in knee whereas 86.70% patients showed non capsular pattern. The frequencies of capsular pattern and non capsular pattern were significantly different. ($\chi^2 = 16.13, p < .001$). Therefore the hypothesis that significant proportion of subjects would have capsular pattern was not supported as the results were in opposite direction. 27% patients felt pain before resistance on PRS testing, 33% patients felt pain during resistance whereas 40% patients felt pain after resistance on PRS testing. It was found that PRS was significantly correlated with pain intensity and is not correlated with chronicity.

Conclusion

The results of this study provide evidence of the need to question and further examine the existence of capsular pattern and pain resistance sequence as a diagnostic tool.

Key Words

Capsular pattern, pain resistance sequence, Cyriax's scheme.

Introduction

The selective tissue tension scheme of James Cyriax is an evaluation method commonly used by physical therapists. Cyriax's scheme consists of active range of motion (AROM), passive range of motion (PROM), and resistive tests followed by palpation of anatomical structures.

According to Cyriax,¹ active movements indicate the patient's willingness to move, the available active range of motion, and the muscular power available. Their chief value is to indicate quickly the structure where symptom originates and which set of tissues to test in detail. The active range may be normal, limited or excessive. If limited, it may be limited in every direction, in some directions but not in others, or in one direction only. If in

only one direction, the limitation may be proportionate or disproportionate type. Resistive movements can be used to assess the status of the contractile structures (muscle, tendon) around the joint.

In the assessment of passive range of motion, Cyriax¹ contended that the examiner should assess the available passive range of motion, the nature of the end feel for the motion, and the relationship of the onset of pain with the onset of resistance during passive range of motion (pain-resistance sequence [PRS]).

A "capsular pattern" is a proportional motion restriction unique to each joint that indicates irritation of entire synovial membrane or joint capsule, as occur with an active inflammatory process (arthritis) or degenerative joint changes (arthrosis)¹. A non capsular pattern deviates from the specific pattern and can indicate the presence of ligamentous adhesions (e.g. Post traumatic medial collateral ligament adhesion at the knee), internal derangements (e.g. Meniscal tear), and extra articular lesions (e.g. Bursitis, muscle injury)².

Cyriax (1) claims the system can be used to identify patients having osteoarthritis (OA), even though the disease primarily involves articular cartilage. Cyriax (1) suggested that in knee osteoarthritis passive motion is restricted in a capsular pattern with proportionally "great limitation of flexion and slight limitation of extension". According to Cyriax,¹ a patient with a substantial loss of flexion and no loss of extension during passive range of motion of the knee would have non capsular pattern, and the limitation would more likely be caused by a contracture of the knee's extensor mechanism or an internal derangement than by involvement of the whole joint (i.e. capsule, synovium). A patient with a capsular pattern of the knee (gross loss of flexion, with a slight limitation of extension) would have pathology more likely involving the joint capsule or synovium³.

The pain-resistance sequence is assessed to guide the vigor of treatment and is often interpreted as an indicator of the chronicity of inflammation (active, less active, none)². According to Cyriax,² pain before resistance is felt by the examiner suggests a lesion with active inflammation, pain synchronous with resistance suggests a lesion with less active inflammation, whereas pain after resistance suggests a lesion without inflammation.

Various researches have been conducted to evaluate Cyriax's selective tissue tension scheme, leading to results both supporting and rejecting the scheme.

Bijl D. et. al. in 1998⁴ analyzed the validity of Cyriax's concept of the "capsular pattern" in the diagnosis

of osteoarthritis of hip and knee and found only few subjects with limited ranges of motion for both flexion and extension. Thus they concluded that the capsular pattern cannot be regarded as a valid test for the diagnosis of osteoarthritis of the hip or knee. Similar research was done by Klassbo M. et. al. in 2003⁵ examining the concept of capsular pattern for the osteoarthritis of hip. He counted the number of hips presenting Cyriax's and Kaltenborn's capsular patterns and founded that few osteoarthritis hips showed Cyriax's capsular pattern and none showed Kaltenborn's capsular pattern and concluded that it is impossible to anticipate radiological evidence of hip osteoarthritis from the multitude of passive range of motion patterns.

In contrary to this Fritz JM et al in 1998³ provided an evidence to support the capsular pattern of motion restriction in persons with evidence of arthritis. They did not use Cyriax's original formulations of the pattern or those definitions suggested by other authors, but rather developed their own formulation based on observed ratios of motion loss, thus defined capsular pattern as a ratio of extension loss to flexion loss between 0.03 and 0.50. Based on this, capsular pattern was found to be 3.2 times more likely to present in patients with either arthritis or arthrosis of the knee joint. Fritz JM et al³ also examined another element of the passive range of motion portion of Cyriax's selective tissue tension scheme in patients with knee dysfunction- the Pain Resistance Sequence. They measured the PROM of the knee and the relationship between the onset of pain and resistance to PROM and found that PRS measurements were not reliable.

Hayes et al⁶ explored the construct validity and test retest reliability of the passive motion component of the Cyriax soft tissue diagnosis system and it was concluded that PRS as indicators of knee osteoarthritis should be reexamined. The validity of the PRS as representing chronicity and the reliability of end feel and PRS are questionable.

Thus based on the conflicting results of the past research and the importance of Cyriax selective tissue tension scheme for soft tissue diagnosis, further research in this area appears warranted. The purpose of this study was to examine the capsular pattern and the pain resistance sequence in patients suffering from knee osteoarthritis.

Material and Methods

Both males and females subjects referred to physical therapy centers for treatment of unilateral knee OA and fulfilling the ACR criteria for Osteoarthritis of knee (n=30) were included in the study after they gave their informed consent. Subjects were excluded from the study if they suffered from any neurological disorder, any cardiovascular conditions like myocardial infarction, poorly controlled hypertension etc, any malignancies and infections in lower extremity, signs of acute infection and inflammation, any systemic disease like Rheumatoid Arthritis, Psoriatic Arthritis, secondary osteoarthritis, had any metal prosthesis in or near knee joint, any history of knee surgery or major knee trauma, hip or

ankle instability, weakness, surgery or trauma, severe valgus or varus knee deformity, high risk health status like uncontrolled blood pressure. Patients who received intra articular injections in previous 3 months were also excluded.

Potential subjects were apprised of the procedure and its potential risks and benefits and the evaluation was done. Subjects who fulfilled the inclusion and exclusion criteria and gave their informed consent were included in the study. All the subjects were then tested only once for VAS, chronicity, capsular pattern and pain resistance sequence.

VAS

Pain intensity was measured by asking subjects to mark a VAS on a 10 cm long visual analog line with 0 representing no pain and 10 representing maximum pain. The subject was asked to bisect the line at a point representing self-assessed position on the scale representing their pain intensity⁷.

Chronicity

Chronicity was measured by subject report of the number of months for which they had felt symptoms in their knee resulting from their disease⁶.

Capsular pattern

Passive range of motion knee extension

Extension PROM of the knee joint was measured with the help of goniometer with the subject positioned supine. The heel was elevated on a pillow to allow for full hyperextension, if present. Fulcrum of the goniometer was centred over the lateral epicondyle of the femur. The stationary arm of the goniometer was placed along the lateral femur taking the greater trochanter as reference point and moving arm was aligned with the lateral fibula taking the head of fibula and lateral malleolus as the reference point⁸.

Passive range of motion knee flexion

Flexion PROM was measured with the subject positioned supine and the hip initially in extension. Then hip and knee were simultaneously flexed and knee flexion passive range of motion was taken with the goniometer aligned in the same manner as per measuring knee extension. (8)

Determination of capsular / non capsular pattern

Capsular pattern was defined as extension loss (with full extension defined as 0 degrees) between 6% to 16.67% of the flexion loss (with full flexion defined as 150 degrees to accommodate the maximum flexion ROM of all subjects)⁹.

Pain resistance sequence

The pain-resistance sequence was assessed during the measurement of flexion PROM. The examiner first asked each subject to rate his or her baseline level of

pain from 0 to 10, with 0 representing no pain and 10 representing the worst pain imaginable, with the knee relaxed in an extended position. The examiner then moved the knee passively into flexion, and the subject was asked when the pain increased above the baseline level during this motion. If the limitation of PROM for flexion was encountered before the subject reported an increase in pain, mild pressure was applied over the subjects anterior tibia to move the knee farther into flexion. The subject was again asked whether the pain had increased above the baseline level. The examiner recorded whether the point of increased pain occurred before, during or after the limitation of PROM was encountered⁶.

Data Analysis

One-way chi - square analyses were used to test first set of hypothesis pertaining to the proportion of subjects with capsular pattern and painless endfeels or pain after resistance at baseline. To examine the relationship between the baseline measures of pain resistance sequence and pain intensity or chronicity, Spearman rank correlation coefficients were calculated.

Findings

The basic characteristics of the group were as summarized in table: 1. The test results for the group are summarized in table: 2 and 3

Table 1: Detail of the Patients Included

Total number of subjects	30
Males%	43%
Females %	57%
Mean age(SD)(in years)	57.4(10.156)
Mean height(SD)(in cms)	163.1(8.860)
Mean weight(SD)(in kgs)	70.66(9.86)
Involved side- Right knee (%)	57%
Left knee (%)	43%

*SD- Standard Deviation

Capsular Pattern

The descriptive statistics for capsular pattern is given in table: 2 and Fig 1. The frequencies of capsular pattern and non capsular pattern were significantly different. ($\chi^2 = 16.13, p < .001$). Therefore the hypothesis that significant proportion of subjects would have capsular pattern was not supported as the results were in opposite direction.

Pain Resistance Sequence

The number of subjects demonstrating each type of pain resistance sequence is given in table: 3 and Fig 2. There was no statistical difference between the number of subjects demonstrating pain after resistance or otherwise. ($\chi^2 = 1.2$).

The spearman rank correlation coefficient for PRS and pain intensity was $-.335 (n=30, p = .07)$. This indicates

that the PRS is correlated with the pain intensity.

The spearman rank correlation coefficient for PRS and chronicity was $-.207 (n = 30, p = .271)$. This indicates that the PRS is not correlated with the chronicity.

Table 2: Percentage of subjects having capsular and non capsular pattern

Pattern of restriction	Percentage
Capsular pattern	13.30%
Non capsular pattern	86.70%

Table 3: Percentage of subjects having various pain resistance sequences

Pain resistance sequence	Percentage
Before resistance	27%
During resistance	33%
After resistance	40%

Conclusion

The study examined two passive motion components of the soft tissue diagnostic system proposed by Cyriax: The PRS and a capsular pattern of motion restriction. This study examined whether the two passive motion components were indicators of subjects with OA of the knee. The results of this study provide evidence of the need to question and further examine the existence of capsular pattern and pain resistance sequence as a diagnostic tool. Very few subjects exhibited a capsular pattern by Cyriax's quantitative definition. The PRS was found to be an indicator of pain intensity but not chronicity. Few subjects had painless end feel or pain after resistance during end feel testing and more number of subjects had pain during and before resistance during end feel testing.

Figure 1: Occurrence of Capsular and Non Capsular Pattern

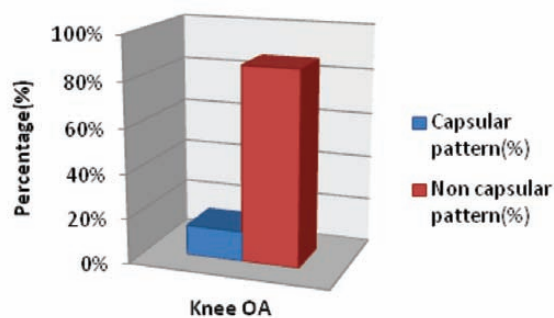
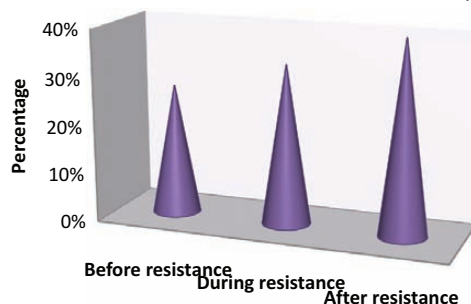


Figure 2: Occurrence of Various Pain Resistance Sequences



Thus more investigations are required to either establish or reject the Cyriax soft tissue diagnosis system.

Acknowledgements

We express our gratitude to all those who have contributed in completing this research work, especially all the subjects who willingly agreed to participate in this study.

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Abdominal versus pelvic floor muscles exercises in mild stress urinary incontinence in obese Egyptian women

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Abstract

Objective

To compare the benefits of 12 weeks abdominal and pelvic floor muscles (PFM) strength training for mild stress urinary incontinence (SUI) in obese women.

Design

A randomized control trial with three months follow up.

Subjects

Thirty female obese patients with mild SUI.

Intervention

Abdominal exercises (Abd. ex's) group (n=15) received specific exercises for transversus abdominis and internal obliquus muscles. Whereas, pelvic floor exercises (PF ex's) group (n=15) received pelvic floor exercises.

Main outcome measures

Vaginal pressure, leak point pressure (LPP) and waist hip ratio (WHR) were measured for both groups at three intervals (baseline, 12 weeks of intervention and 3months follow up i.e. 24 weeks from the start of the study).

Results

Both abdominal and pelvic floor groups showed a significant increase in vaginal pressure after 12 weeks of intervention ($P < 0.0001$ and $P < 0.021$ respectively) and at follow up ($P < 0.0001$ and $P < 0.009$ respectively) compared to baseline. This effect was greater for Abd. ex's group at 12 weeks ($P < 0.041$) and at follow up ($P < 0.022$) when compared with PF ex's group. Also, both abdominal and pelvic floor groups showed a significant increase in LPP after 12 weeks of treatment ($P < 0.001$ and $P < 0.008$ respectively) and at follow up ($P < 0.0001$ and $P < 0.007$ respectively) compared to baseline; there were no significant differences between the two groups at these time points.

Conclusion

Overall, the results of this study suggest that 12 weeks of abdominal muscles strengthening training has superior effects compared to pelvic floor strength training for mild SUI in obese patients.

Keywords

Urinary incontinence; obesity; pelvic floor; abdominal; exercise.

Introduction

Stress urinary incontinence (SUI) is urodynamically proved as involuntary loss of urine occurs following a sudden rise in the intra-abdominal pressure caused by coughing, sneezing, straining, laughing or other physical activities, when the intravesical pressure exceeds the maximum urethral pressure in the absence of detrusor contraction^{1,2}. SUI is the most common type of urinary incontinence in women with risk factors includes advancing age, childbirth, smoking, chronic bronchitis, and obesity³.

There are many methods to diagnose SUI. Leak point pressure (LPP) testing originated from extensive video urodynamic studies done for patients with idiopathic incontinence, SUI and neurogenic conditions⁴. In addition, the perineometer, through a compressible vaginal catheter that is connected to a manometer, measures the increase of intravaginal pressure that is produced by the contraction of pelvic floor muscles (PFMs)⁵.

There are several mechanical and physiologic reasons why an increased body mass index (BMI) may be associated with, if not causative of, urinary incontinence⁶. Each 5-unit increase in BMI associated with a 60% to 100% increased risk of daily incontinence⁷. Obese individuals have higher resting intra-abdominal and intravesical pressures⁸, which adversely stress the pelvic floor and the neuromuscular function of the genitourinary tract⁹.

The use of abdominal muscles training to rehabilitate pelvic floor muscles may be useful in treating SUI¹⁰. Madill and McLean¹¹ found that deep abdominal muscle contraction increased intra-vaginal pressure. Moreover, PFMs act as part of an integrated abdominal-pelvic unite, that ensures automatic responses to any change in trunk postures and trunk muscles activity¹².

In response to PFMs contraction, transversus abdominis showed greater electromyography (EMG) activity than rectus abdominis and obliquus externus abdominis when the spine was extended¹³. Also, urethral pressure increases with voluntary PFMs contraction and isometric abdominal muscles holds^{14,15}.

So far, only one randomized control trial has addressed the effect of abdominal muscle training on SUI. The results showed that additional training of the transversus abdominis (TrA) after PFMs training and neuromuscular stimulation did not provide incremental improvement of SUI¹⁶. However, the coactivation and coordination of the TrA and PFMs was not the target.

According to the previously mentioned facts, we encouraged to make an attempt to compare the response when training each of abdominal and pelvic floor muscles separately for mild SUI in obese women.

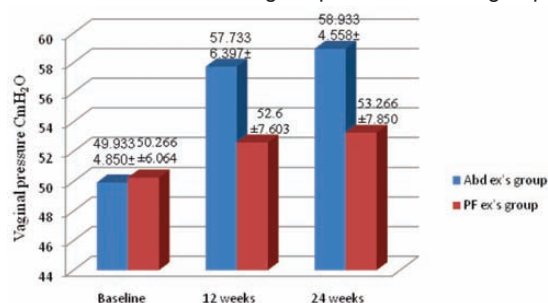
Patients and methods

Thirty female patients were diagnosed with mild SUI. The diagnosis made via history taking, vaginal examination & Urodynamics study. The patients were referred from the gynecological and urological outpatients' clinics at Bab El Sharia University Hospital. The ethical

Table1: The demographic data of subjects in both groups.

	Groups	Range		Mean	SD	t-value	P- value
		Min.	Max.				
Age (Yrs)	Abd ex's group	35	45	39.87	3.54	0.11	0.92
	PF ex's group	35	45	39.74	3.64		
Weight (Kgs)	Abd ex's group	72	97	84.94	7.35	0.99	0.34
	PF ex's group	70	98	82.80	8.10		
Height (Cm)	Abd ex's group	153	174	162.27	7.86	1.04	0.32
	PF ex's group	152	173	160.20	7.36		
BMI (Kg/m ²)	Abd ex's group	30.72	33.75	32.23	0.93	0.12	0.91
	PF ex's group	31.11	33.75	32.20	0.83		

Fig. 1: The mean values of vaginal pressure in both groups



committee in the hospital approved the study. Inclusion criteria were: age 30-40 years, parity ≤ 3 times, BMI 30-34 Kg\ m², and waist\hip ratio ≥ 0.8 . Demographic data are summarized in table1. The exclusion criteria were pregnancy, lower urinary tract infections, neurological problems, pelvic tumor, diabetes, smoking, chronic chest diseases as well as, other types of urinary incontinence, and any medications or medical\surgical interventions for SUI.

All patients gave a written consent to participate in the study and were provided with a full explanation of the treatment protocol.

Assessment procedures

Patients were assessed at three time points: baseline, following 12 weeks of exercise intervention and then after 24 weeks from the beginning of the study as follow-up. Outcome measures were as follows:

Perineometer (Peritron 9300; Cardio Design Pty Ltd Australia) assess vaginal pressure as a marker of PFMs strength. During assessment, the patients were asked to strongly squeeze, lift and maintain hold (as long as possible) on the vaginal probe of the perineometer. In addition, the patients taught not to involve rectus abdominus or the gluteal muscles at all during assessment. The examiner observed the cranial movement of the perineum through the slight anterior tilt of the sensor (towards the anus) and recorded of the readings over the monitor. This maneuver was repeated three times per session and the mean of vaginal pressure was calculated

Urodynamics studies by using a Merkur 2000 in order to confirm the diagnosis of SUI and also to measure valsalva LPP.

Weight\height scale was used to calculate the BMI, in order to confirm the degree of the patient's obesity. This was done only one time at baseline assessment.

Tape measurement was used to calculate waist\hip ratio (which must be ≥ 0.8) at baseline assessment. The normal value is 0.7 for women¹⁷.

Procedures

Eligible patients were randomly allocated into two groups by using simple random method. Concealed papers picked by a third parity to pick patient's name for each group at a time. By the end, there were two groups abdominal exercises (Abd. ex's) group (n=15) underwent abdominal muscles exercise strength training program specifically for TrA and internal oblique muscles 18 and pelvic floor exercises (PF ex's) group (n=15) underwent PFMs strength training program. Both groups trained for 12 weeks with frequency 3sessions/week.

All patients received the standard treatment for SUI and obesity including education, advice and dietary modification in form of 1200 Kcals\ day divided into 3 main meals and 2 snacks. In addition, counseling and diet modification every week during the intervention. Both groups were asked to continue their own program plus the dietary modification after the intervention until they reassessed after 3 months. Statistical analysis, applied the central limit theory that assuming large sample. Statistical comparisons within each group were made using paired t-test for pre and post treatment measurement variables. Comparisons between groups were made using unpaired t-test. The P-value was set at 5% level.

Results

There were no significant differences between the groups at baseline to the three parameters.

Vaginal pressure, both groups showed a significant increase after 12 weeks of treatment (P < 0.0001 and P < 0.021 respectively) and after 24weeks (P< 0.0001and P < 0.009 respectively) compared to baseline, table2. Comparing both groups, Abd. ex's group was greater than PF ex's group at 12 weeks (P < 0.041) and after 24 weeks (P < 0.022), Fig.1. The improvement percentages after 12 & 24 weeks were (15.620% &18.02 %) respectively in Abd. ex's group, while in PF ex's group were 4.6% and

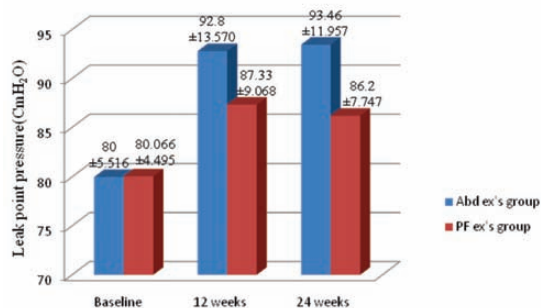
Table 2: The mean difference values of the vaginal pressure at baseline, post 12 & 24 weeks in both groups.

		Mean difference	S.D.	t-value	P-value	significance
Abd ex's group	Baseline Post 1	-7.80	5.89	-5.12	0.0001	Significant
	Baseline Post 2	-9.00	5.65	-6.16	0.0001	Significant
	Post1 Post 2	-1.20	3.50	-1.32	0.207	Non significant
PF ex's group	Baseline Post 1	-2.33	3.47	-2.59	0.021	Significant
	Baseline Post 2	-3.00	3.82	-3.04	0.009	Significant
	Post1 Post 2	-0.66	1.04	-2.46	0.027	Significant

Key

S.D. = standard deviation, Post 1= 12 weeks, Post 2= 24 weeks

Fig. 2: The mean values of leak point pressure (LPP) in both groups



5.96% respectively.

Leak Point Pressure; both groups showed a highly significant increase after 12 weeks of treatment ($P < 0.001$ and $P < 0.008$ respectively) and after 24 weeks ($P < 0.0001$ and $P < 0.007$ respectively) compared to baseline, table3. Comparing both groups, there were no significant differences at 12 weeks ($P < 0.205$) & 24 weeks ($P < 0.058$), Fig.2. The improvement percentages after 12 & 24 weeks were 16 % and 16.83 % respectively in Abd. ex's group. While there was (9.07% & 7.66%) respectively in PF ex's group.

Waist/hip ratio, both groups showed a significant decrease in WHR after 12 weeks & after 24 weeks compared to baseline Abd. ex's group: $P < 0.0001$ & $P < 0.0001$; and PF ex's group: $P < 0.021$ & $P < 0.006$ respectively), table4. In comparison of both groups, there were no significant differences at 12 weeks ($P < 0.095$) & 24 weeks ($P < 0.069$), Fig.3.

Discussion

To the best of our knowledge, there is no study tested the effect of the abdominal muscles training

alone versus PFMs for SUI. But there are many studies supporting the relation between these two groups of muscles. A recent study by Hung et al.¹⁹, found that retraining diaphragmatic, deep abdominal and PFMs could improve symptoms and quality of life in women with SUI or mixed urinary incontinence.

The decrease in WHR in both groups can be explained as weight reduction by changes in dietary intake and physical activity may reduce forces on the bladder and PF, thus reducing incontinence²⁰.

In the current study took 12 weeks of intervention either abdominal or PF exercises, as improvement in muscle strength can be observed after 8 weeks of training²¹. Even if pelvic floor or abdominal muscles are severely as in cases of persistent postnatal SUI, 8 weeks of PF or PF plus abdominal training are sufficient to improve PF strength¹⁷.

Abd. ex's group improvement can be explained as transversus abdominis and obliquus internus¹⁴, 16 act indirectly to activate the PFMs and maintain its coordination, support, endurance and strength 10. Thompson et al.²² found abdominal muscles were more active than PFMs in symptomatic women.

In addition, PFMS contraction during low abdominal hollowing in four-point kneeling results in greater increase in transversus abdominis thickness 23 and internal obliquus muscles²⁴. In contrast, Bo 25 concluded that instruction to contract the PFMs produces more effective PFMs contraction than instruction for transversus abdominis muscle contraction.

PF ex's group improvement can be explained as the PF contraction enhances pressure & closure of the urethra and leakage is avoided. Contraction also helps to maintain urethral position during intra-abdominal pressure increase²⁶.

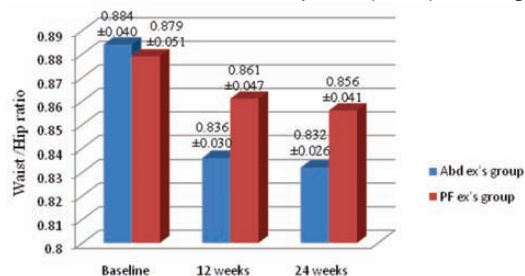
Table 3: The mean difference values of the LPP at baseline, post 12 & 24 weeks in both groups.

		Mean difference	S.D.	t-value	P-value	significance
Abd ex's group	Baseline Post 1	-12.80	11.44	-4.33	0.001	Significant
	Baseline Post 2	-13.46	9.87	-5.28	0.0001	Significant
	Post1 Post 2	-0.66	2.69	-0.96	0.353	Non significant
PF ex's group	Baseline Post 1	-7.26	9.18	-3.06	0.008	Significant
	Baseline Post 2	-6.13	7.47	-3.18	0.007	Significant
	Post1 Post 2	-1.13	5.01	0.87	0.396	Non significant

Table 4: The mean difference values of the WHR at baseline, post 12 & 24 weeks of in both groups.

		Mean difference	S.D.	t-value	P-value	significance
Abd ex's group	Baseline Post 1	0.048	0.037	4.990	0.0001	Significant
	Baseline Post 2	0.052	0.035	5.674	0.0001	Significant
	Post1 Post 2	0.003	0.024	0.529	0.605	Significant
PF ex's group	Baseline Post 1	0.018	0.026	2.60	0.021	Significant
	Baseline Post 2	0.022	0.027	3.238	0.006	Significant
	Post1 Post 2	0.004	0.013	1.38	0.187	Non significant

Fig. 3: The mean values of waist /hip ratio (WHR) in both groups



The are many studies which had shown the effects of pelvic floor exercises as elevation of the bladder neck, increased pelvic floor contraction pressure^{27,28}, and decrease in volume of leaked urine²⁹. PF exercises can be maintained for up to 5 years even with a reduction in frequency of exercise to as little as one session/week³⁰.

Finally, we recommend for further studies using another methods of assessment e.g. one pad test. In addition, compare the abdominal versus the pelvic floor exercises in normally weight females with SUI or mixed urinary incontinence.

Interest of conflict

There is no interest of conflict with any organization, and this research is not funded.

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A study to compare the effects of moist heat therapy with ultrasonic therapy and ultrasonic therapy alone in lateral epicondylitis

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Abstract

Aims and Objectives

1. To compare different clinical methods for the treatment of tennis elbow.
2. To check out which modality is better for the treatment of tennis elbow.

Hypothesis

There will be significant changes between the results of the two modalities used in the treatment of tennis elbow.

Study Design

Experimental

Subjects

20 subjects with Tennis elbow participated in the study.

Methodology

Based on the inclusion and exclusion criteria subjects were included in the study. Convenient samplings was done for patients with random allocation into the following two groups.

GROUP A: (Control Group) Ultrasonic therapy (10 patients).

GROUP B: (Experimental Group) Ultrasonic with moist heat (10 patients).

Conclusion

The present study provides evidence that moist heat with ultrasonic therapy is more beneficial in treating pain and increasing functional activity in tennis elbow patient and can be used as a safe alternative in patients with lateral epicondylitis.

Key Words

(ECRB) extensor carpi radialis brevis, (EDC) extensor digitorum communis, (EDL) extensor digitorum longus, VAS- Visual Analogue Scale, (UST) Ultrasonic therapy.

Introduction

Lateral epicondylitis or Tennis elbow is a condition where the outer part of the elbow becomes painful and tender, usually as a result of a specific strain or overuse. Although it is called "tennis elbow" it should be noted that it is by no means restricted to tennis players. If one hyper extends an elbow in any sports, this may be classified as tennis elbow. Anyone who does a lot of work involving lifting at the elbow or repetitive movements at the wrist is susceptible to tennis elbow. The condition was first described in 1873. The medical term is Lateral epicondylitis¹.

Tennis elbow, the extensor carpi radialis brevis (ECRB) tendon has been identified as the primary site of pathological change. There have also been pathological changes found at extensor digitorum communis (EDC) extensor digitorum longus (EDL). The ECRB has a small origin and does transmit large forces through its tendon during repetitive grasping. It has also implicated

as being vulnerable during shearing stresses during all movements of the forearm. There is no evidence relating mode of onset to pathology although it is generally acknowledge that tennis elbow is caused by repetitive micro trauma/overuse. Inflammatory changes have been noted in acute stages of the condition but have been found to be absent if the symptoms become chronic (3 months +). This may explain why approaches such as corticosteroid injections have little impact in the chronic stages of the condition. Although the name suggests otherwise tennis elbow can affect anyone not just racquet sports players although there are numerous studies that have implicated racquet sports as a cause or contributing factor for tennis elbow.

The peak incidence is between 34 to 54 years of age. No difference in incidence between men and women or association between tennis elbow and the dominant hand has been shown. A weak association has been found between work and tennis elbow development. Risk factors vary from unaccustomed strenuous activity, decreased reaction time and speed, unconditioned forearm, extreme torque of repetition, faulty sports equipment and repetitive eccentric muscle contraction.

Mechanism of Injury⁷

- Overload with increased tension on soft tissue around radial head.
- Inadequate forearm endurance.
- Extreme torque or repetition.
- Sudden increased activity of wrist extensors on an unconditioned forearm.
- Improper Equipment and Surface.
- Lack of Flexibility.
- Excessive forearm pronation e.g. back hand stroke in Tennis.

Accurate diagnosis requires a through understanding of the anatomic, epidemiologic and pathological factors. Clinical features may include pain and tenderness over lateral epicondyle of the humerus. Pain is burning and radiating to forearm, pain on resisted dorsiflexion of the wrist, middle finger or both, decrease in grip strength, elbow range limited in chronic cases, tightness and inflexibility of forearm muscles and in some cases morning stiffness⁸.

Preventive Measures

- Pre strengthening of elbow, forearm and wrist muscles.
- Increased Flexibility.

- Warm Up & Cool Down sessions.
- Use of proper Equipment i.e. larger grip, reduced racquet string tension etc.
- Proper Playing surface/field.
- Activity Modification e.g. avoid grasping in pronation etc.
- Aerobic Training
- Climate Fluid & Hydration
- Bracing

Other non operative treatment involves rest, ice, ultrasonic therapy, non steroidal anti-inflammatory agents, and possibly corticosteroid injection followed by guided rehabilitation and return to sport. Many studies have been done in the past to compare the effectiveness of various modalities for the treatment of tennis elbow present study compares the effect of moist heat with ultrasonic therapy (UST) and ultrasonic therapy alone in tennis elbow.

Study Design

Methodology

20 healthy subjects (11males and 9 females) with tennis elbow participated in the study. The subjects were recruited from Department of physiotherapy, Susheela Tiwari Govt Hospital Haldwani. Subjects were randomly allocated into two groups. The mean and standard deviation of age for subjects in Group A were (45.2+11.1) yrs. and in Group B it was (50.7+8.9) yrs.

Inclusion Criteria

1. Patients having tenderness on palpation at the lateral epicondyle of the humerus
2. Patients having pain in resisted wrist extension
3. Age group between 18-75 years

Exclusion Criteria

1. Any infectious disease like osteomyelitis around the elbow
2. Any bone tumor around the elbow.
3. Radial nerve compression
4. Fracture around the elbow joint.
5. Ligament injury around the elbow
6. Trauma around the elbow
7. Narcotic abused patients
8. Allergy to heat
9. Patients with sensory loss
10. Blood coagulative disease

Instrumentation

- Ultrasonic machine
- Moist heat therapy machine/unit

VARIABLES

Dependent variable

VAS

Independent variable

- Ultrasound
- Moist heat therapy
- Pain

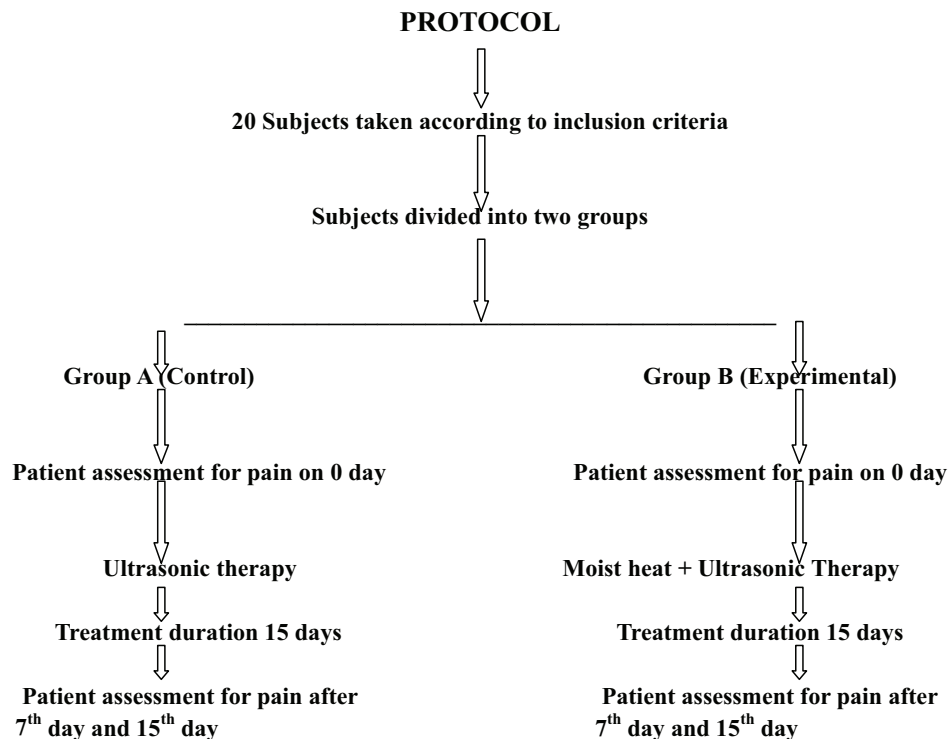
Protocol

Based on the inclusion and exclusion criteria subjects were included in the study. Convenient samplings were done for patients with random allocation into the following two groups:

GROUP A: (Control Group) Ultrasonic therapy (10 patients).

GROUP B: (Experimental Group) Ultrasonic with moist heat (10 patients).

Procedure:



Group A (Control Group)

Position of the patient: Sitting with back support

Position of Hand: Resting on chair's arm with pillow under the elbow

Position of the Therapist: Sitting

Technique: After positioning the patient, ultrasonic gel is applied on the affected area around the lateral epicondyle and then the UST machine is set up at pulse mode and intensity of 1.2w/cm² for 8 minutes is applied. After the treatment treated part is cleaned with cotton swab.

The above procedure is repeated daily continuous for 15 days.

Group B (Experimental Group)

Position of the patient: Supine lying or sitting with back support

Position of the Therapist: Sitting

Technique: This group received UST with moist heat for 15 days. After positioning the patient, hot packs are placed in the polythene bag and covered with towel and then applied to the affected area for 15 minutes and then UST is applied as mentioned above.

The above procedure is repeated daily continuous for 15 days.

Data Analysis

The data analysis was done using SPSS software version 11.0.

Results

Results were calculated using 0.05 level of significance. Paired t test was applied to compare the mean values between different sessions (0, 7 and 15) with in Group A and Group B. Unpaired t test was applied for comparing the mean difference between the Group A and Group B. The significant level taken in the present study was (p<0.05).

Table 1: Mean and Standard Deviation of age for subjects of Group A and B

	Group A Mean + SD	Group B Mean + SD
Age	45.2 + 11.1	50.7 + 8.9

Table 2: Mean and SD of subjects at 0, 7 and 15 session for Group A, Group B.

Groups	0 session Mean + SD	7th session Mean + SD	15th session Mean + SD
Group A	8.5 ± 1.20	5.6 ± 1.07	2.9 ± 0.98
Group B	8.8 ± 0.94	4.55 ± 0.95	1.7 ± 0.67

Table 3: Comparison of mean value 0 Vs 7 session and 15 session and 0 Vs 15 session within Group A and Group B.

Sessions	Group A		Group B	
	T value	P value	T value	P value
(0 Vs 7) session	10.11	P< 0.05	13.72	P< 0.05
(7 Vs 15) session	10.37	P< 0.05	15.54	P< 0.05
(0 Vs 15) session	16.09	P< 0.05	24.76	P< 0.05

Table 4: Mean differences and SD of subjects at (0-7), (7-15) and (0-15) sessions for Group A and Group B.

Group	(0-7) sessions Mean + SD	(7- 15) sessions Mean + SD	(0-15) sessions Mean + SD
Group A	-2.9 + 0.90	-2.9 + 0.87	-5.8 + 1.16
Group B	-4.25 + 0.97	-2.85 + 0.57	-7.1 + 0.90

Table 5: Comparison of mean differences at (0-7) session, (7-15) session and (0-15) session between Group A and Group B

Group	Group A Vs Group B	
	T value	P value
(0-7) sessions	3.19	P< 0.05
(7- 15) sessions	-0.15	P< 0.05
(0-15) sessions	2.79	P< 0.05

Discussion

The result of the study shows that there were significant changes between the different sessions within Group A (Control group) and Group B (Experimental group). On comparing both the groups, Group B (Experimental group) gave better results than Group A (Control group). Therapeutic ultra sound is often used in the treatment of tennis elbow, but alone it does not appear to be beneficial. Ultrasound in combination with moist heat therapy appeared to provide improvement in functional outcomes the results suggest the patients treated with moist heat therapy with ultrasound recovered well after 2 weeks and were able to resume their duties whereas the patients receiving ultrasound alone had complaint of pain even after 2 week.

According to Maffuli N et al ultra sound works more efficiently in hydrated tissues by applying moist heat prior to UST the muscles became relaxed and local blood supply is increased which might have helped better penetration of the sound waves to the area treated, supporting the findings of the present study¹⁴.

A comparative study between continuous ultrasound, placebo ultrasound and rest concluded that ultrasound therapy is effective in treating tennis elbow but best results are achieved only on relaxed and hydrated muscles. Binder A et al found that ultrasound therapy enhances recovery in most patients with tennis elbow. Manias P et al found an increase in hand grip strength in patients in the US and moist heat groups at the end of treatment, and he observed that improvement in functional condition and activities of daily living were observed in the patients with lateral epicondylitis receiving US treatment with moist heat^{12,16,2}.

Further, Christopher R Carciapt et al stated that like wise for our modalities such as ultrasound or moist heat, they are not a "generic" modality. The mechanical and thermal effects of these interventions are distinct, and believe that the outcome depends on applying the modality correctly¹⁵.

According to results of our study, a decrease especially in pain and accordingly improvement in functional condition and activities of daily living were

observed in the patients with lateral epicondylitis receiving US treatment with moist heat. Therefore, we concluded that US treatment with moist heat is a safe treatment alternative in patients with lateral epicondylitis. However, the short monitoring period is the limitation of the study. Thus, studies with longer monitoring periods are needed.

Conclusion

The present study provides evidence that moist heat with ultrasonic therapy is more beneficial in treating pain and increasing functional activity in tennis elbow patients and can be used as a safe alternative in patients with lateral epicondylitis.

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The effect of neural mobilization with cervical traction in cervical radiculopathy patients

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Abstract

Aims and Objectives

1. To find the effectiveness of conventional treatment in cervical radiculopathy.
2. To find the effectiveness of NM in combination with CT on pain in subjects with cervical radiculopathy.
3. To compare the efficacy between the two.

Hypothesis

There will be a significant reduction in pain in subjects with cervical radiculopathy by using NM in combination with CT.

Study Design

Experimental.

Subjects

This study was done on subjects of age group 25-50 years.

Sample size: 40 subjects divided into two groups, Group-A had 20 subjects, Group-B 20 subjects.

Methodology

In Group-A all subjects received CT for 15 minutes. Before traction hot packs were given to the patient for 10 minutes.

In Group-B all subjects were given CT and neural mobilization of MN. Method of mechanical CT was same as in Group- A.

Conclusion

The present study provides evidence that neural mobilization in combination with CT is an effective treatment in improving ROM and decreasing pain in cervical radiculopathy patients.

Key Words

CT-Cervical traction, MN-Median Nerve, Neural Mobilization, Cervical radiculopathy, VAS- Visual Analogue Scale, ROM-Range of Motion, ULTT- Upper Limb Tension Test.

Introduction

Nerve root dysfunction which is usually secondary to chronic pressure or invasion of root causes a radicular syndrome of pain and segmental neurological deficit.

Cervical disc syndrome involves pain, numbness and muscular spasm of the neck radiating to the shoulders caused by limitation and compression of cervical nerve root by protruding IV disc.

Several conditions can put pressure on nerve roots in the neck region, the most common reasons are

- Herniated Cervical disc
- Spinal Stenosis
- Degenerative disc disease

Plane spine films may show arthritis or metastatic disease, C.T scan defines the dimensions of the bony canal and lateral nerve compressions. MRI gives excellent images of spinal lesions.

The treatment consists of three parts-

- Rest

- Medications
- Physical therapy

REST: Few days or wearing a soft collar (cervical) may relieve the compression on the nerve roots by limiting neck motion.

MEDICATION: Non narcotic drugs for pain relief and anti inflammatory drugs for relieving any swelling.

PHYSICAL THERAPY: After muscle spasm subsides, cervical traction (CT) or other types of physical therapy such as moist heat, isometric neck strengthening exercises can be advised.

Cervical traction can be applied in acute as well as chronic pain full conditions of neck. The time period can vary from 20 to 30 minutes or as long as several hours but the recognized time for stretch is about 20 minutes. Positioning is a key element in CT prescription specifications of sitting or supine lying should be best on patients comforts.

Mechanical CT in cervical spine holds good results in the elongation of the structures which helps in releasing the nerve by vertebral separation and results in pain relief which is due to the nerve compression.

Neural mobilization technique 4 (NMT) and neural tension tests performed were useful in examination and interventions tools for cervical radiculopathy patients. Kleinrensink et.al⁴ found that the tests for median nerve (MN) is most specific and considerably more tension is produced in the MN than radial or ulnar nerve. The goal of mobilization is to increase the flexibility of collagen that maintains the integrity of the nerve and movement of the nerve in relation to its surrounding structures.

Neural testing and NM was done as described by David Butler. Pullos (1986) applied the test to 100 normal subjects and reported that the normal defect in range of elbow extension during the test was 16.5degree- 53.2 degree.

Methodology

This study was done on subjects of age group 25-50 years.

Sample size: 40 subjects divided into two groups, Group-A had 20 subjects, Group-B 20 subjects.

Source of subjects and data: Department of Physiotherapy, IAHSET, Govt. Medical College Haldwani.

Inclusion Criteria

- Age group between 25-50 years.
- Subjects having radiating symptoms (C6-C7)

radiculopathy.

- Subjects having symptoms from at least 2 months (sub acute).
- Purely non surgical subjects.
- Subjects having MN involvement.
- Subjects having controlled ROM (shoulder depression, shoulder abduction, shoulder ER, forearm supination or wrist extension).

Exclusion Criteria

- Traumatic cases
- Acute inflammation
- R.A.
- Malignancy
- Osteoporosis
- Hyper mobility
- Person under medications
- Subjects having problem for more than 1 year
- Subjects having RN and UN involvement
- Subjects having C.S. radiculopathy with VBI.

Study Design

Experimental.

Instrumentation

- Goniometer
- Mechanical Cervical Traction

Variables to study

VAS

ROM: passive range of elbow extension was manually done during examination of ULTT-1 by goniometer.

Independent variables:

Mechanical cervical traction

ULTT-1 (MN) as described by Butler.

Protocol

Assessment was done, the patients were included and excluded according to inclusion and exclusion criteria. After assessment subjects were divided into 2 groups, Group-A had received conventional treatment (CT, moist heat and isometric neck strengthening exercises), Group-B received CT with neural mobilization. Subjects pre test measurements was done using ULTT-1, goniometer and VAS score.

Procedure

In Group-A all subjects received CT for 15 minutes. Before traction hot packs were given to the patient for 10 minutes.

Position of the patient- Supine lying. Head position in 30 degree flexion. Apply head halter and adjust the halter to fit the patient comfortably. Attach the halter to the spreader bar of the traction unit, check the patient is aligned for proper pull set the controls and then activate the unit.

Hold time-10 sec

Rest time-10 sec

Duration- 15 min

Treatment was given 6 days a week/ for 2 weeks.

After CT neck isometrics were given to the patient.

In Group-B all subjects were given CT and neural

mobilization of MN. Method of mechanical CT was same as in Group- A. after traction neural mobilization of MN based on the work of David Butler was given to subjects. For mobilization of MN the patient U/E was taken through the sequence of movements used during test. This mobilization involved positions very similar to used for MN tests, that would place the greatest amount of tension on MN and produced the greatest movement in the MN. The mobilization was then performed by flexing and extending the elbow. The mobilization was performed gently extending the elbow joint into the range where the patient felt tension but no pain and then flexing the elbow to the point where the patient felt no tension. 6-7 mobilizations were done emphasizing the MN. The patient did not report any pain during mobilization the ROM of elbow extension was reduced. Grade of treatment, amplitude of mobilization and profession was individualized based on irritability and severity of patient's symptoms.

Data Analysis

The data analysis was done using statistical package of social science- SPSS (Version-11) software.

Results

Table 1: Comparative table of pain scores after conventional treatment.

	Pain score at 0 wk		Pain score at 2 wk
Mean	6.8		2.4
S-D	1.5033		1.067
Sample Size	20		20
Mean of Difference		4.4	
S-D of difference		1.5009	
d-f		19	
t-value		13.110	
t-value at 5% level		1.729	

On the basis of Table 1 we can say that mechanical cervical traction is beneficial within the Group A.

Table 2: Comparative table for passive ROM after conventional treatment in Group A.

	Passive ROM at 0 wk		Passive ROM at 2 wk
Mean	87.78		25.5
S-D	16.000		7.88
Sample Size	20		20
Mean of Difference		62.25	
S-D of difference		14.909	
d-f		19	
t-value		18.671	
t-value at 5% level		1.729	

On the basis of Table 2 there is significant reduction in Passive range of motion after 2 weeks when the conventional treatment traction was given in Group A.

Table 3: Comparative table of pain scores after mechanical cervical traction with neural mobilization within Group B.

	Pain score at 0 wk		Pain score at 2 wk
Mean	6.6		0.8
S-D	1.319		0.979
Sample Size	20		20
Mean of Difference		5.8	
S-D of difference		1.507	
d-f		19	
t-value		17.201	
t-value at 5% level		1.729	

On the basis of Table No.3 there is significant reduction in the pain scores at 2 weeks, comparing at 0 week after cervical traction with neural mobilization within the group. i.e. Group B.

Table 4: Comparative table of passive ROM after cervical traction with neural mobilization (within) Group B.

	Passive ROM at 0 wk		Passive ROM at 2 wk
Mean	80.75		7.20
S-D	15.67		7.73
Sample Size	20		20
Mean of Difference		73.55	
S-D of difference		17.721	
d-f		19	
t-value		18.560	
t-value at 5% level		1.729	

On the basis on Table No.4 there is a significant reduction in passive ROM at 2 weeks, comparing at 0 week after the cervical traction with neural mobilization within Group B.

Discussion

The result of the study shows that there is a significant improvement in PROM of elbow during ULTT-1 (MN) and pain relief after 2 weeks of treatment sessions in both the groups, but when group B was compared with group A statistically significant difference in mean values was observed between the groups, so this indicated that use of mechanical traction in combination with neural mobilization significantly increases the pain relief and PROM more quickly compared to only conventional treatment.

We found that pain relief and ROM was greatest in group B during first week and this continues to the second week on comparison of mean values of VAS and ROM. As both the groups aimed to increase ROM and pain relief we believed that by the application of Mechanical CT in cervical spine, the most reproducible result is the elongation which helps in releasing the nerve by vertebral separation and results in pain relief and hence effective for cervical radiculopathy patients which is due to compression on /off nerve roots.

This was supported by Criyax 7, Breig 7, Michael Wieting, Michael Hutsan whereas NM Technique and

Table 5: Comparative table of pain scores between Group A and Group B.

	Group A		Group B
Mean of difference	4.4		5.8
S-D of difference	1.500		1.507
Sample Size	20		20
S-D of both group		1.504	
d-f		38	
t-value		2.942	
t-value at 5% level		1.645	

On the basis of Table 5 we can conclude that there is a significant reduction in pain scores of Group B in comparison to Group A.

Table 6: Comparative table of passive ROM between Group A and Group B.

	Group A		Group B
Mean of difference	62.25		73.55
S-D of difference	14.9098		17.7214
Sample Size	20		20
S-D of both group		16.3760	
d-f		38	
t-value		2.1821	
t-value at 5% level		1.645	

On the basis of Table No. 6 we can conclude that there is significant reduction in the passive ROM of Group B in comparison of Group A.

neural tension test performed were useful examinations and interventions tools for cervical radiculopathy patients. Kleinrensink et al. found that the test for MN is most specific with considerably more tension produced in MN than radial or ulnar nerve.

Neural testing and neural mobilization was done as described by David Buttler⁷. The intervention for the patients in the present study included conventional treatment and CT with neural mobilization.

On the basis of comparison of mean values of ROM and VAS combination of Mechanical CT and NM Technique shows greater pain relief and ROM due to vertebral separation of spine flexibility and mobility of the nerves this shows that this can be the choice of treatment for cervical radiculopathy.

Conclusion

The present study provides evidence that neural mobilization in combination with CT is an effective treatment in improving ROM and decreasing pain in cervical radiculopathy patients.

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Effects of motor imagery in phantom pain management following amputation: A review of literature

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Abstract

Background

Phantom limb pain (PLP) is a common problem in amputees. Motor or mental imagery (MI) has been shown to produce PLP relief owing to the changes occurring in cortical mechanisms.

Aims

The purpose of this study is to identify the analgesic effects of MI as a primary intervention in the management of PLP following amputation.

Methods

A systematic electronic search of literature was carried out in the following databases: Ovid MEDLINE, PsycINFO (via Ovid), EMBASE (via Ovid), and EBM Reviews - ACP Journal Club, Cochrane Central Register of Controlled Trials, Cochrane Database of Systematic Reviews, Database of Abstracts of Reviews of Effects. A hand search of reference lists of relevant articles and relevant journals was done.

Results

Four studies met our inclusion criteria and were assessed for the level of evidence. The mean effect sizes (%) with 95% confidence intervals were calculated for outcome measures, before and after MI intervention. Three studies reported > 30% PLP relief following MI intervention.

Conclusions

There is some evidence to support the effects of MI in PLP management. Further research with high quality randomized controlled trials (RCTs) is recommended.

Key Words

Amputation, motor imagery, pain, phantom limb, therapy.

Introduction

Phantom limb pain (PLP) is reported in 50-85% of persons with amputation¹. Central neuropathic mechanisms include neuroplastic changes occurring in the somato-sensory, primary motor (M1), and supplementary motor (S1) cortices³. The magnitude of PLP is related to the extent of reorganization occurring in the cortical map, and reversing such cortical changes is believed to relieve PLP¹. Though the cause-effect relationship of cortical reorganization and PLP is still unclear, those clinical interventions such as mirror box therapy (MBT), motor or mental imagery (MI), and sensory discrimination, which address the central cortical mechanisms might result in promising outcomes¹.

Initially Ramachandran and colleagues² used a mirror feedback such that the reflection of intact hand movement was perceived as movement of the phantom limb. With this therapy, patients reported improvement in voluntary control of the phantom limb, and pain relief³. Anecdotal evidence exists to show that visual mirror

feedback using MBT reverses cortical reorganization and potentially alleviates PLP⁴. In recent years, mental visualization of movements alone has been shown to relieve PLP and reverse cortical changes⁵.

MI refers to mental rehearsal or simulation of a movement without actual body movement⁶⁻⁷. Traditionally MI practise has been reported to improve motor performance and learning in athletes and healthy individuals.⁸⁻⁹ Several studies using brain imaging techniques have shown that, during MI, brain areas (M1, S1) related to motor execution were activated.⁸⁻⁹ In the light of such findings, MI is widely used in the neurological rehabilitation of stroke and complex regional pain syndrome (CRPS) to potentially improve voluntary control and motor function¹⁰⁻¹¹.

In the amputee literature, similar activation patterns in brain areas related to motor execution and PLP relief have been reported following MI training^{5,12-13}. MI might improve voluntary control of phantom limb (motor performance) and concomitantly relieve PLP. However, there is no review of literature summarizing the therapeutic effectiveness of MI in relieving PLP following amputation. The aim of this review is to provide a critical overview of available evidence regarding the effects of MI in PLP management.

Methods

Search Strategy

The available literature investigating the effectiveness of MI in PLP management was retrieved using an electronic search. The search was restricted to publications in English and a hand search of reference lists of relevant articles and relevant journals was done. The search strategy is outlined in Fig.1.

Inclusion criteria

1. Studies investigating upper and/or lower limb amputees.
2. Studies specifying MI as a primary intervention for PLP management.
3. Studies assessing primary outcomes of PLP intensity/severity using standardised self-report pain scales such as Visual Analogue Scale (VAS), and Numerical Rating Scale (NRS).

Exclusion criteria

1. Studies focussing on other neurological disorders such as Stroke, Parkinsonism, and CRPS.
2. Studies investigating the combined effects of MI with



Fig 1: Summary of Study selection process

MBT, Laterality recognition, or Hypnosis.

Following execution of the electronic search, screening of relevant titles and exclusion of duplicates were done by one reviewer (D.H). Then the abstracts and full text articles were independently screened for relevance by two reviewers (D.H. and P. S.). Any disagreement between the reviewers was settled by discussion.

Strength of evidence

On satisfying the eligibility criteria, the level of evidence of the included studies was independently assessed by two reviewers (D.H and P.S) using the classification described by Jovell & Navarro-Rubio¹⁴.

Treatment effects

Whenever the p values and mean scores with standard deviation (SD) were reported for the outcome measures, before and after the MI intervention, corresponding % mean differences with 95% confidence intervals were calculated.

Data Extraction & Analysis

The following data were extracted from the included studies: authors, diagnosis, subject characteristics,

baseline measurements, intervention, and outcome measures. Table 1 provides a summary of results and levels of evidence assessment.

Results

Selection of studies

Our electronic search strategy resulted in 35 studies after excluding duplicates. Only two studies^{5,15} met our inclusion criteria. On screening the references of included studies and by hand searching the literature, two additional studies¹⁶⁻¹⁷ which met the inclusion criteria were identified and included in the review.

Treatment effects

Two studies^{5,16} investigated the isolated effects of MI while other studies employed MI either following observation of videotaped movements¹⁵ or combined with prosthetic training.¹⁷ The % mean differences (treatment effect size) with 95% confidence intervals are summarized in Table 2. Three studies^{5, 15, 17} reported >30% mean difference in PLP severity following MI intervention. The greatest change 45-50% in PLP relief was found in Maclver et al's study⁵ compared to other studies by Ulger et al¹⁷ 33.7% and Beaumont et al¹⁵ >30% in 4 patients.

Table 1: Summary of included studies

Author	Diagnosis	Subject characteristics	Baseline measurements	Intervention	Outcome measures
Mac Iver et al ⁵ Level VIII	UL amputees Cause: Trauma (n-12), tumour (n-1)	Controls: n- 6 30-56 years Experimental group: n- 13 32-75 (52.92 ±13.6) 11 male, 2 female	NRS fMRI Anxiety, Depression and MI ability	Patients were encouraged to feel and move the phantom limb.	NRS fMRI
Chan et al ¹⁶ Level III	LL amputees Cause: Not specified	Sham group: n- 6 Mirror box therapy group: n-6 MI group: n-6	VAS	Patients were asked to mentally visualize the phantom limb with eyes closed.	VAS
Beaumont et al ¹⁵ Level VIII	Trauma UL amputees	Number-7 (4 UL, 3 LL amputees) 32-65 years (52±11) 7 male	VAS MI scale Interviews, questionnaires	After watching the videotaped movements the patient has to perform MI exercise of the same movement with their eyes closed.	VAS Follow-up (6 months) MI Scale
Ulger et al ¹⁷ Level III	UL (n-9) and LL amputees (n-11) Trauma	MI group: n- 10 Controls: n- 10	VAS	The patients were instructed to feel and move both the intact and the phantom limb. Controls: General exercises	VAS

UL- Upper limb, LL- Lower limb, PLP- Phantom limb pain, VAS- Visual analogue scale, NRS- Numerical Rating scale, MI- Motor/mental imagery, fMRI- Functional magnetic resonance imaging, n- Number

Discussion

In this review, we systematically reviewed the literature published in the period 1950-2011. Of the four included studies, three studies reported PLP relief following MI intervention while one study reported better PLP relief in MBT group compared to MI group.

Level of evidence: Of the included studies, two studies were randomized controlled trials (RCTs) with Level III evidence. One of the RCTs¹⁶ compared the effects of MI group and MBT group. But the method of randomization was not specified. The other pilot RCT¹⁷ employed a control group and MI group. The other two studies^{5,15} were non-controlled clinical case series with low levels of evidence (Level VIII). In general, the sample size of all the included studies was low (6-13) which might increase the risk of type II error.

Patient characteristics: One of the included studies¹⁶ did not specify the age range of the participants. All the participants in the other studies were of middle to old age (30-75 years). The majority of study participants were males in two studies^{5,15}. Reports on subject characteristics were not mentioned in the other two studies¹⁶⁻¹⁷. In all the studies, only those with traumatic amputation were included. This might have minimized the confounding effects of pre-amputation pain owing to comorbidities associated with other causes of amputation (e.g. malignancy and vascular causes)¹⁸. Three studies^{5,15,17} reported some amount of voluntary control over phantom limb throughout the study period, for most of the participants.

Treatment characteristics: Only one study⁵ clearly explained the type of imagery (Visual and Kinaesthetic imagery) utilized in the PLP management. Although other studies¹⁵⁻¹⁷ adopted a similar treatment approach,

the imagery techniques used were not clearly reported. However, all the participants were instructed to feel the phantom limb, which indicates the general use of kinaesthetic imagery.

Three studies included instructions requesting the patients "to move and feel the movements of phantom limb"^{5,15,17}. In fact, studies^{5,15,17} incorporating specific, standardized instructions along with MI exercises showed greater PLP relief compared to the study¹⁶ which did not include such instructions. Facilitatory techniques have been reported to augment MI exercises in two studies^{5,15}. MacIver et al⁵ utilized body-scan relaxation technique to facilitate imagery, while Beaumont et al¹⁵ employed observation of videotaped movements to augment MI. Two other studies¹⁶⁻¹⁷ did not include facilitation techniques prior to MI intervention. Currently, there is no clear consensus about the type of facilitatory techniques to be included prior to MI exercises.

The treatment duration of MI exercises varied considerably among all the included studies, the total treatment duration was high in MacIver et al study⁵ (28 hours/ 6 weeks) compared to other studies by Beaumont et al¹⁵ (20 hours/ 8 weeks), Ulger et al¹⁷ (7hours/weeks) and Chan et al¹⁶ (7 hours/4 weeks). Moreover, to increase the adherence to MI intervention, various reinforcements have been utilized. For example, videotapes were used in two studies^{5,15}. The details of such reinforcements and home MI exercise programmes were not reported by two other studies¹⁶⁻¹⁷. Indeed, studies^{5,15} which utilized such reinforcements have reported better treatment effects compared to other studies¹⁶⁻¹⁷.

Therapeutic effectiveness of MI: Certain factors in the three studies appear to result in greater PLP relief (>30%)^{5,15,17}. Firstly, the greater treatment duration of MI in three studies could have contributed to better PLP relief^{5,15,17}. In the Ulger et al¹⁷ study, although the

Table 2: Summary of treatment effects

Study	Outcome measure	Mean effect size Control Group (pre-post MI)	Mean effect size MI group (pre-post MI)
Ulger et al ¹⁷	VAS	18.28% (9.97- 26.58%)	33.7 % (18.39 – 49.01%)
Maclver et al ⁵	NRS	No control group	Constant Pain: 44.89% (35.66 - 54.12%) Intermittent Pain: 50.08% (39.78 - 60.38%)
Beaumont et al ¹⁵	VAS	No control group	4 weeks: 16.87% (14.02 – 19.72%) 8 weeks: 28.23% (23.46 – 32.99%) 6 months: 19.97% (16.59 – 23.34%)
Chan et al ¹⁶	VAS	Could not be calculated owing to the paucity of information.	

CIs- Confidence intervals, MI- Motor or mental imagery, VAS- Visual analogue scale, NRS- Numerical rating scale.

treatment duration (7 hours/ 4 weeks) was less than in the other studies,^{5,15} patients were encouraged to do the MI exercises at home whenever they experienced PLP during the study period. This could have increased the MI treatment duration and potentially resulted in better outcomes. Secondly, specific instructions while performing MI exercises and implementation of the facilitatory techniques prior to MI exercises could have increased patient compliance and enhanced the effectiveness of MI intervention. Finally, all the study participants in the three studies^{5,15,17} exhibited some amount of voluntary control over phantom limb which could have potentially influenced to achieve better outcomes. Other authors have reported similar pain relieving effects by gaining motor control over the phantom limb³⁻⁴.

Chan et al¹⁶ reported superior effects of MBT compared to MI group. However, the treatment protocol of MI exercises is not clearly defined by the authors. In particular, the lack of facilitatory techniques, specific instructions, and shorter treatment duration compared to other studies could have potentially biased the results.

Only two studies^{15,17} have reported the long term effects of MI. Beaumont et al¹⁵ investigated the effects of MI exercises at 6 months and reported no significant PLP relief. However, the participants in the study were asked to discontinue the MI exercises after the treatment period of 8 weeks. In another study,¹⁷ patients were instructed to continue MI exercises after the study period, and follow-up reports after 2 months showed a decrease of PLP episodes.

Mechanisms: Mirror neurons present in the premotor cortex (M1) are thought to integrate visual and proprioceptive cues.¹⁹ It is postulated that activation of mirror neurons by visual feedback or by MI could rectify the mismatch between the afferent (sensory and kinaesthetic feedback) and the efferent motor command resulting in PLP relief⁴. In the light of such findings, the increased voluntary control of phantom limb in three studies^{5,15,17} could have been due to the activation of mirror neurons in MI resulting in PLP relief. Maclver et al⁵ showed a two-way cortical reorganization (somatosensory cortex

and M1, S1) prior to MI training in patients with PLP compared to healthy controls. After training, the change in constant PLP scores significantly correlated with the extent of cortical reorganization. Similar results of M1, S1 activation and concomitant PLP relief have also been reported following the use of myoelectric prosthesis²⁰ and sensory discrimination²¹. Nevertheless, little is known about the cause-effect relationship of imagery-mediated -M1, S1 activation and PLP relief.

Strengths and limitations: To our knowledge, this is the only review to systematically search and summarize the clinical applications of MI in PLP management following amputation. However, we have limited our search to OVID database and studies published as journal articles in English.

Future investigations are recommended to conduct well designed RCTs with larger samples and adequate follow-up with clear treatment protocols. Moreover, comparing the effectiveness of different forms of virtual therapy such as MI, MBT, laterality recognition, are other potential areas for future research.

Conclusion

According to the literature reviewed in our study, there is some evidence for the effectiveness of MI in PLP management following amputation. Owing to clinical and statistical heterogeneity of the included studies, firm conclusions cannot be made. However, the results reporting PLP relief following MI exercises in three of the included studies are encouraging. Future studies investigating higher cortical mechanisms with different types of MI in patients with acute and chronic PLP are warranted. The results of such findings will improve our understanding of the mechanisms of MI, and help in the development of a standardised treatment protocol for this promising intervention in PLP management.

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Conflicts of Interest

There is no conflict of interest

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The beneficial effects of low intensity laser acupuncture therapy in chronic tonsillitis

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Abstract

The purpose of this study was to evaluate the beneficial effects of low intensity laser acupuncture therapy in chronic tonsillitis. Forty patients had chronic tonsillitis were participated in this study. Their age ranged from 30 to 55 years. The patients were randomly divided into 2 groups of equal number: Group (1); received infrared laser acupuncture therapy, 2 sessions per week for one month in addition to medical treatment while Group (2); received medical treatment only for one month. VAS, IgM, IgA and IgG were measured at the beginning and after one month of treatment. By comparing both groups after treatment; the results of the study showed significant differences as regard to IgG and VAS but no significant differences as regard to IgA and IgM. Also the results showed that there was normalization to levels of IgG, IgA& IgM in group 1 while there were still abnormalities in certain readings in IgG, IgA& IgM in group 2. On conclusion; Laserpuncture has an effects for enhancement of immune response and decrease level of pain in chronic tonsillitis patients.

Key Words

Low intensity laser acupuncture therapy - Immunoglobulins- Chronic tonsillitis.

Introduction

The tonsils are part of the secondary lymphatic system in which B lymphocytes are predominant. Tonsils have important role in specific immunity. Palatine tonsils play a prominent role in the development of the immune system, being the first organ in the lymphatic system that analyses and reacts to antigenic stimulation. Tonsillar plasma cells produce all classes of Igs (immunoglobulins)¹.

Inflammation of the tonsils, or tonsillitis, caused by bacterial or viral infection, can be acute or chronic. The uncomplicated acute form usually lasts 4 to 6 days. Symptoms of tonsillitis are generalized inflammation of the pharyngeal wall (throat), swollen tonsils with or without pus on their surface, Purulent (with pus) drainage when pressure is applied to the tonsils and fever and generalised body aches².

Immunoglobulin or antibodies are gamma globulin proteins that are found in blood or other bodily fluids of vertebrates, and are used by the immune system to identify and neutralize foreign objects, such as bacteria and viruses³.

Acupuncture is a treatment based on Traditional Chinese Medicine (TCM), a system that dates back thousands of years. Acupuncture attempts to regulate and restore energy balance by stimulating specific points along the paths and hence treat the disease. Acupuncture has been shown to stimulate the immune system⁴.

Classical acupuncture has existed for centuries. However, with the introduction of new technologies

for health care, needles have been often replaced by electroacupuncture and laser acupuncture. Both of these methods are non-invasive and less painful. All methods of acupuncture follow the same classical acupuncture principles⁵.

Laserpuncture (laser acupuncture, photopuncture, laser acu-therapy) is the application of therapeutic laser to acupoints on the body, ear, or hand. It is a simple, effective, noninvasive approach that has been shown to be a dependable pain management tool⁶.

laser acupuncture has some distinct advantages over the traditional needle method. Many patients who are usually afraid of needles, such as children, prefer laser acupuncture. Use of a laser makes it a typically noninvasive, aseptic procedure, which significantly reduces the pain and recovery time associated with invasive treatments. Generally, laser acupuncture can treat the same range of complaints as needle acupuncture⁷.

Patients were frequently seen in otolaryngology practice for complaints related to the tonsils and adenoid. The most common complaint is tonsillitis which caused by infection and lower immunity. Increase the recurrence of tonsillitis lead to tonsillectomy that is the most common major surgical procedures. By normalization of the immune elements, there is enhancement of the immune system and the rate of tonsillitis recurrence is decreased and so on decrease the need of tonsillectomy so there is more restoration to the immunity as the tonsil is a part of the immune system in the body. Also there is a direction to reduce the dependence on medications as every drug has side-effects, drug interactions, allergies, contraindications, and other complications. Through this study, the effect of laser acupuncture in chronic tonsillitis were studied by determining its immunomodulatory effects.

Patients and Methods

Subjects

This study was carried out on 40 patients (9 male and 31 female), who had chronic tonsillitis. Patients were selected from outpatient department at Teaching Hospital in Cairo, Egypt, from the period of July 2009 to February 2010. They received the treatment at National Institute of Laser Enhanced Sciences (NILES), Cairo, Egypt. All patients had three or more episode of chronic tonsillitis in one year, their age ranged from 30 to 55 years. Reasons for exclusion were patients had any

disease affect the result of the study such as allergic rhinitis, asthma, atopic dermatitis, diabetes mellitus and any other causes of immunity modulation. Also patients had pregnancy, fever, alcoholic and smoker patient were excluded.

The patients were randomly divided into 2 groups of equal number: Group (1); received infrared laser acupuncture therapy in addition to medical treatment (oral penicillin "ospen" in the dose of 1000 mg/12h for one month on empty stomach) while Group (2); received the same medical treatment only.

Ethical consideration

The experimental protocol was explained in details for each patient before the initial assessment and signed informed consent was obtained from each participant before enrollment in the study. The trial protocol was approved by the meeting of the department of surgery, faculty of physical therapy, Cairo university. There was no harm inflicted on the patients. On the contrary, all had benefited from the final results of the study.

Measurements

Measurement of serum immunoglobulins

Blood sample was taken from each patient in both groups before and after one month of treatment for determination of IgM, IgG and IgA serum content. 3cm³ blood was taken from each patient and then emptied into plain tube (red tip tube) which had the patient's name and number of assessment. The sample was analyzed by the lab through using MININEPH™ device (MININEPH™, ED 200, Serial number: 4730).

Measurement the level of pain

Visual Analogue Scale (VAS) was used to assess level of pain. Operationally a VAS is horizontal line, 100 mm in length, represented by a number from zero to ten, anchored by word descriptors at each end, with one end meaning no pain and the other end meaning the worst pain imaginable. The patient marks on the line the point that represents his perception of their current state. The VAS score is determined by measuring in millimetres from the left hand end of the line to the point that the patient marks^{8,9}.

Treatment procedures

Infrared diode laser equipment (model Giotto, Sp A version 2.0.2. Via selciatella⁴⁰. APRILIA (LT) ITALY, Laser class: 3B laser product, Power supply: 90-240 Volt, AC: 50-60 Hz, Fuse: 2 x T4A (90 V. AC), 2 x T2A (240 V. AC), S.N: 2035055307, Beam: invisible beam) used in this study. The parameters used in this study were (wave length 905nm, intensity 0.2 mw, frequency 100 Hz, energy 20 mJ for 100 seconds)¹⁰.

Group (1); received infrared laser acupuncture therapy. The treatment procedure was started during the attack of chronic tonsillitis. Each patient was placed in a comfortable position and worn protective eye glass to avoid permanent eye damage resulting from direct exposure to laser beam. The acuopoints for laser puncture were cleaned before the application.

The parameters were settled and the probe was placed contact with the skin perpendicular over the acupuncture point CV 22 (Tian Tu), GV 14 (Daz Hui), LI 4 (He Gu), LU9 (Tai Yuan), SI 17(Tian Rong), ST 9 (Ren Ying) & ST 36 (Zu San Li), for both sides of the body table (1). The frequency of treatment was two days per week for one month. In addition to laser treatment, patients received medical treatment (oral penicillin "ospen" in the dose of 1000mg/12h for one month on empty stomach). Group (2); received same medical treatment only.

Statistical Analysis

Data were expressed as mean ± standard deviation (SD). The mean, the standard deviation and range were used as a primary source of connecting facts about each parameter to measure central tendency. Paired t test was used to detect level of significance in each group before and after the treatment. Unpaired t test was used to detect significance level between the two groups. Both the descriptive and the analytic statistical were used to examine, describe and analyze the collected data in order to detect if there was any difference before and after treatment applications. Analysis was performed using SPSS/PC software (SPSS Inc., Chicago, IL, USA). All p values less than 0.05 were considered to be statistically significant.

Results

Data concerning the patients' demographic data as well as clinical data (age, sex, VAS, IgA, IgG, IgM) had been collected at the beginning of the study. Follow up evaluation of VAS, IgA, IgG, IgM had been performed after one month of treatment.

Demographic and clinical characteristics of the patients.

As shown in table (1), there were no statistical significant differences (P>0.05) observed between both groups concerning general characteristics (age, sex) as well as clinical characteristics (VAS, IgA, IgG, IgM) before intervention.

Table 1: Statistical analysis of the demographic & clinical characteristics of patients between both groups before intervention.

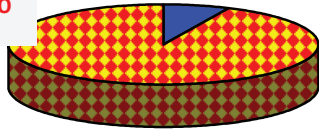
	Group 1	Group 2	P value
Age (years)	46.2±7.2	48.8±6.5	0.238*
Sex(male/female)	4/16	5/15	0.708*
VAS	7.6±1.9	8.2±1.7	0.277*
IgA	378.7±34.2	394.25±48.88	0.251*
IgG	1862.9±191.1	1917.5±153.4	0.326*
IgM	133.8±84.1	137.9±72.3	0.853*

P-value=Probability level,*Non-Significant (P>0.05).

Comparative analysis of VAS, IgA, IgG, IgM between both groups after intervention.

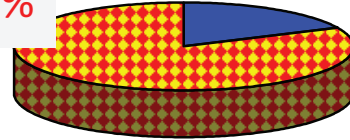
As shown in table (2) the mean value, standard deviation and p value of VAS, IgA, IgG, IgM between both groups. The results showed highly significant difference as regard to IgG and significant difference as regard

93%



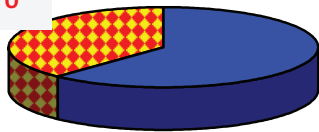
Percentage of improvement of VAS in
Group (1).

82%



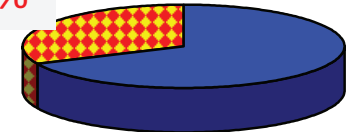
Percentage of improvement of VAS in
Group (2).

38%



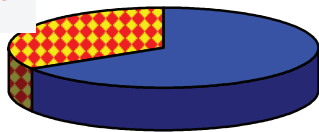
Percentage of change of IgA in
Group (1).

32%



Percentage of change of IgA in
Group (2).

34%



Percentage of change of IgG in
Group(1).

20%



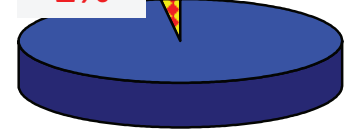
Percentage of change of IgG in
Group(2).

8%



Percentage of change of IgM in
Group(1).

2%



Percentage of change of IgM in
Group (2).

to VAS (p value <0.05) but no significant difference as regard to IgA and IgM (p value >0.05).

Table 2: Results of VAS, IgA, IgG, IgM between both groups after intervention.

	Group 1	Group 2	P value
VAS	0.5±0.95	1.4±1.6	0.048**
IgA	234.54±34.8	265.77±62.44	0.058*
IgG	1229.5±111.6	1525.0± 128.8	0.000***
IgM	132.7±83.9	135.0±71.76	0.835*

P-value=Probability level *Non significant ** Significant *** highly significant

Discussion

Tonsils are ball-like areas of soft tissue on both sides of the throat; they are part of the secondary immune system. They help the body fight infection by filtering out germs that enter the body through the mouth and nose. The tonsils are involved in the production of mostly secretory IgA, which is transported to the surface providing local immune protection¹¹.

The immunological effects of laser sources have remained insufficiently studied especially in form of laser puncture, which has restricted the use of laser in the treatment of diseases associated with immune system disorders. This study was an attempt to study the immunological effects of laserpuncture as this still remain poorly studied.

The results showed significant differences as regard to IgG and VAS but no significant differences as regard to IgA and IgM by comparing both groups after treatment. Also The results showed that there was normalization to levels of IgG, IgA& IgM in group 1 while there were still abnormalities in certain reading in IgG, IgA& IgM in group 2. This confirm the effectiveness of Laserpuncture for enhancement of immune response and decrease level of pain in chronic tonsillitis patients.

Laser light acts on cellular immunity. Laser therapy produces an immunomodulating action on T-lymphocytes and an immunostimulating one on B-lymphocytes, potentiating phagocytic ability of neutrophils¹². Laser irradiation and the resulting from its primary and secondary effects enhance the neuro - humoral reactions leading to activation of the immune system and increase the adaptive hormones concentration¹³.

Several publications indicate normalization of the immunoglobulins content after a course of treatment sessions with red and/or IR laser light in patients with bronchial asthma and rheumatoid arthritis, as well as for the pre-surgery preparation of cardiovascular patients¹⁴⁻¹⁶.

Combination of the acupoint Shaoshang (LU 11) and Shangyang (LI 1) for the purpose to clear away heat and dissolve toxins simultaneously was used to treat 58 outpatients of acute tonsillitis in the study of SUN Yu et al. At the moment, sore throat was relieved obviously and difficulty in swallowing disappeared. On the next day, congestion in the tonsil disappeared and pustule was absorbed. The results showed cure in 38 cases,

remarkable effect in 17 cases and failure in 3 cases by one treatment, and the total effective rate in 95%¹⁷.

Volkov and Volkov⁵ compared the response of Biological Active Points (BAP's) to Low Energy Laser Therapy (LELT), as compared to needle acupuncture and electroacupuncture. They found that the effect of laser acupuncture is more profound and lasts longer than of either electroacupuncture or classical needle acupuncture

According to Cocilovo 18 article, stimulation of body points CV-22, LU-1, LU-7& LI-11 in case of upper respiratory infection, pharyngitis with sore throat lead to a positive effect as there is improvement in symptoms and sense of well being from the day of treatment. And the case with the same condition was treated with antibiotics only, and was much slower to recover.

Stoyanov and Iliev¹⁹ measured the immunological changes to patient who had suffered more than 15 recurrences per year of herpes simplex infection after direct irradiation of the herpetic lesions with He-Ne laser and Body acupuncture to immunomodulating points GV.20 (Bai Hui), LI.4 (He Gu), LI.11 (Qu Chi), ST.36 (Zu San Li), SP.6 (San Yin Jiao) and GV.14 (Da Zhui). immunological parameters were measured before and after treatment of patients show a tendency towards normal values in response to the treatment.

According to the data of other authors²⁰⁻²²; reporting there is normalization of Ig levels after irradiation with visible and IR light from low-intensity laser. From the results of the current study and from the previous literatures, it can be concluded that low intensity laser acupuncture therapy is effective for treating chronic tonsillitis due to its immunomodulatory effects and normalizations of Ig levels.

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Early clinical exposure as a teaching learning tool to teach neuroanatomy for first year occupational and physical therapy students – our preliminary experience

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Abstract

Background

In most teaching institutions within our country and across the world, first year medical and paramedical students are not provided with any real life clinical experience applicable to the learning of basic sciences within the first twelve months or more of their curriculum. The artificial divide between the pre-clinical sciences and clinical medicine often results in students not encountering patients until the second year of study.

Aim

The focus of our study was to assess the effectiveness of an Early Clinical Exposure program as a teaching-learning tool to teach neuroanatomy to first year occupational and physiotherapy students as well as student reactions to it as an alternative approach.

Method

In addition to the regular classroom lectures and examination of prosected specimens, the program included visits to the Physical Medicine and Rehabilitation ward to learn neuroanatomy in a clinical setting using patients with different neurological disorders. Anatomical basis for loss of function/dysfunction was explained and neuroanatomical pathways revised in the ward classroom. An objective assessment of student performance was done by a written and practical viva voce examination and the marks compared with those of students not exposed to the ECE program.

Result

95% of students found it useful for better understanding and memory of the subject than the conventional classroom method. In view of the excellent rating of the program, ECE may be implemented for effectively teaching neuroanatomy for students.

Key Words

Early clinical exposure; neuroanatomy; physiotherapy; occupational therapy; teaching learning tool.

Introduction

In most paramedical institutions within our country and even across the world, we follow a traditional curriculum where students are exposed to a series of classroom lectures followed by practicals. Education in the anatomical sciences has undergone several changes over the last decade¹. Amidst the 'Winds of Change' so to speak, first year students in India are still not provided with any real life clinical experience applicable to the learning of basic sciences within the first twelve months or more of their medical or paramedical program. In such a traditional curriculum, the artificial divide between the pre-clinical sciences and clinical medicine often results in students not encountering patients until the second or even third year of study². Such curricula have frequently been criticized for its late clinical exposure, which was one of the factors contributing to the 1993 Edinburgh Declaration³. In 1993, the UK's General Medical Council's

(GMC) advocated introducing students to clinical medicine early in their studies, using real clinical situations to make teaching more practical, relevant, stimulating, and reinforcing the vertical integration between the basic medical and clinical sciences. In 1998 a position paper from the World Federation of Medical Education (WFME) clearly recommended that, "Medical education must to the greatest possible extent integrate basic and clinical disciplines with a focus on key principles. Students should meet patients early on"⁴. In developing countries such as India, it is of even greater importance than in developed countries that students recognize the need to prepare for community and primary health care settings from early in their medical training².

Early Clinical Exposure (ECE) programs are an increasingly widespread component of undergraduate education.⁵ As Wartman et al. rightly put it, "It involves an active, experiential learning from patients, designed to be the 'beginning of a life-time of learning focused on the patient'"⁶. Many faculties of medicine now include programs using ECE to introduce their medical students to important topics in medicine⁷. However, ECE has not been used as a teaching-learning tool to teach basic sciences for first year Occupational and Physiotherapy students in India and probably across the world. Currently in India, Occupational and Physiotherapy students study gross anatomy for a period of 12 months before entering clinical areas where they encounter patients for the first time. Correlating their knowledge of basic sciences with the patient in front of them seems difficult and disconnected as they usually have forgotten much of their anatomy and physiology by then. Our clinical faculty opinions indicate that students starting their clinical rotations usually do not recall important anatomical or physiological concepts or could not apply these to patients.

The teaching of gross anatomy is an integral part of the curriculum as anatomy is one of the key building blocks necessary to effectively evaluate and treat patients. Teaching neuroanatomy to first year medical or paramedical students in ways to make it understandable and interesting has always been a challenge. Traditionally, neuroanatomy is taught through a series of classroom lectures followed by examination of prosected specimens of brain and spinal cord in the dissection hall. The focus of this study is to assess the effectiveness of ECE as a Teaching-Learning tool to teach neuroanatomy to first year occupational therapy and physiotherapy students as well as student reactions to an alternative approach.

The ECE program was used as a supplement to the traditional teaching method. In addition to the regular classroom lectures and dissection practical, it included hospital visits to the Physical Medicine and Rehabilitation ward to learn neuroanatomy in a clinical setting using patients with different neurological disorders.

Material and Methods

Sixty occupational and physiotherapy students studying in the latter part of first year at our institution were part of the study. They had completed studying the anatomy of limbs, abdomen, thorax, and head and neck through the traditional teaching method. Twenty of the students were exposed to the ECE program in which neuroanatomy (brain and spinal cord) was taught using:

1. The regular didactic lecture method (using a LCD projector/ powerpoint and blackboard diagrams)
2. Dissection room practical sessions using prosected cadaveric specimens of brain and spinal cord and,
3. Ward visits, bedside teaching and ward classroom teaching at the Physical and Medicine Rehabilitation Ward Unit.

The remaining forty students were not exposed to the ECE program. They had the regular neuroanatomy didactic lectures using powerpoint presentations and blackboard diagrams. Practical sessions included studying prosected cadaveric specimens of brain and spinal cord. Instead of ward visits they had clinical scenarios discussed orally within the regular lectures hours.

Four patients with demonstrable neurological disorders were chosen. They included:

- a patient with bilateral cerebellar disease
- a patient with middle cerebral artery stroke affecting the non-dominant hemisphere with retention of speech function
- a quadriplegic patient with injury at the C5/C6 level
- a paraplegic patient with injury at the T 10 level

A brief history of the disease and functional disability was taken followed by a relevant clinical examination. Clinical signs were demonstrated on the patients. Anatomical localization of the injury, anatomical basis for the present condition, and anatomical/ physiological explanation for the loss of function/dysfunction/clinical

Table 1: Typical Comments from students on their experience using the ECE program as a Teaching-Learning tool

1. "It was easy to understand..."
2. "Rather than sitting in a classroom and just imagining what is being taught, seeing patients and learning was obviously more interesting"
3. "It helps to understand the subject better."
4. "Since we can see the condition for ourselves, it is useful to retain memory of the subject"
5. "Seeing helped us remember more than listening"
6. "We can know about patient problems and their suffering"
7. "Helped me to relate what I was reading"
8. "When I read the book I can only imagine, but when I see the patient it gives me a clear understanding."
9. "Clinical exposure was a brilliant strategy"

signs were taught. Neuroanatomical pathways were revised in the ward classroom. The students were encouraged to ask questions and clear any doubts.

A total of 42 hours was allotted to teach neuroanatomy, of which 18 hours (42.8 %) were classroom lectures, 12 hours (28.6%) dissection hall practical, 4 hours (9.5%) clinical bedside teaching, 4 hours (9.5%) revision time and 4 hours (9.5%) for mid and final assessment test. Those not exposed to ECE had longer practical hours. The effectiveness of the ECE was assessed by an examination as well as a questionnaire. The questionnaire was given at the end of the neuroanatomy teaching period. It had 11 questions, of which 3 were open-ended questions, which yielded narrative comments, and 8 structured questions, which yielded quantitative data. A written and practical viva voce examination was conducted at the end of the teaching period and the marks obtained were compared with those of the forty students who had not been exposed to the ECE program. The same lecturer taught both groups of students. A five point Likert scale (1 = very poor, 2 = poor, 3 = average, 4 = good, 5 = excellent), was used to find out the overall rating of the ECE program by the students. External audit, which involved review of the data by a colleague who was not a participant in the study, was done to ensure trustworthiness of the study. Member check, where the analyzed data was reviewed by two participants in the study was done.

Findings

Quantitative data is reported in frequency distributions. Qualitative data analysis of the student comments was done and the results tabulated and included as typical student comments in the results section. When asked if students found the ECE program useful for learning neuroanatomy, 65% said it was 'very useful' and 35% found it 'useful' (Fig.1).

Most students found the clinical bedside class on quadriplegia and paraplegia very useful to understand the tracts of the spinal cord. Typical student comments included, "Especially about dermatomes which was a question mark in my mind for a long time, now I'm sure I will not forget it". All the students found patient assisted learning to be useful for better understanding and better retention of memory of the subject.

95% of the students found it more interesting to learn

Figure 1: Usefulness of ECE as a teaching-learning tool to teach neuroanatomy

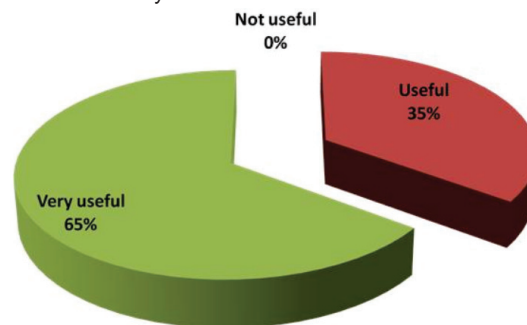
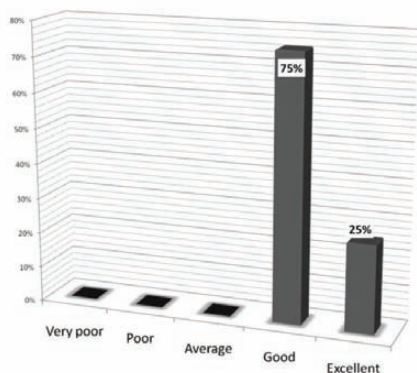


Figure 2: Overall rating of the ECE program using a Likert scale



neuroanatomy this way than conventional classroom based lecture methods. Typical comments included, "Rather than sitting in a classroom and just imagining what is being taught, seeing patients and learning was obviously more interesting". 85% of the students said they had sufficient number of lectures and sufficient time allotted to learn from gross anatomy specimens and that visiting the wards to see patients contributed significantly to the learning process. 90% of students said it would have been more interesting to learn the anatomy of limbs, thorax and abdomen also using the ECE program. The overall rating of the ECE on the Likert scale was between good and excellent, with 75% of the students rating it as good and 25% rating it as excellent (Fig. 2).

The objective assessment included a written and practical viva voce examination conducted by the faculty in the department. The marks obtained were objectively compared with those who did not have the ECE program. Students who attended the ECE program had a test average of 62.6%, whereas those who were not exposed to the ECE program had a test average of 60.7%. This rather small difference may be attributed to the fact that even the non-exposed group of students had oral discussions of clinical scenarios within the regular lecture hour. Though there was only a mild increased performance among the exposed group, student feedback definitely suggests that it was much more interesting to learn neuroanatomy using bedside clinics. Typical student comments are included in table 1 and general student suggestions to improve the ECE program are included in table 2.

Conclusion

The academic transition from school to first-year medical education can be difficult for students because of the dramatic increase in the volume and content. Further, in most medical institutions including ours, students represent a broad spectrum in terms of culture, ethnicity, level of preparedness, as well as learning preferences and styles. This diversity presents a challenge for instructors to meet the educational needs of all students.⁸ Since students have significantly different learning styles, it is also the responsibility of the instructor to address this diversity and develop appropriate learning approaches⁹. Studies have shown that student

Table 2: General comments and suggestions to improve this program

- "Visits to the ward can be made more frequent."
- "We would learn better with case based approach."
- "It would be more interesting to see patients with different conditions."
- "All the regions of the body can be taught using patients."

motivation and performance improves when instruction is adapted to student learning preferences and styles¹⁰. 'VARK' is an acronym that stands for four major sensory modes of learning: visual, aural, reading and kinesthetic, which a learner prefers to receive information^{11,12}. For example, visual learners learn through seeing drawings, pictures, and other image-rich teaching tools. Auditory learners learn by listening to lectures, exploring material through discussions, and talking through ideas. Reading learners learn through interaction with textual materials, whereas kinesthetic learners learn through touching and experiences that emphasize doing, physical involvement, and manipulation of objects. Lujan and DiCarlo in their study found that most students (64%) preferred multiple modes of information presentation and state that most students are able to learn effectively as long as the teacher provides a blend of visual, auditory, reading/writing, and kinesthetic activities¹³.

Our traditional lecture method supplemented by the ECE program was multisensorial and reached all types of learners in the visual, auditory and kinesthetic schemes. ECE is an Active Learning Strategy where students learn basic science concepts through active experiential learning using real clinical situations to make learning more practical, relevant and stimulating. Taking a good clinical history from the patient, thinking through the symptoms and signs, examining for the integrity of cerebellar, cranial nerve and spinal cord functions, demonstration of muscle power, dermatomes, deep and superficial reflexes, all stimulates thought process at a higher cognitive level. In stark contrast, the traditional lecture format assumes that all students are only auditory learners. As the students have rightly pointed out, ECE also helps to have better understanding and memory of the subject.

The major strength of the study was the constant availability of patients with various neurological disorders as our institution is a tertiary level healthcare set up. The major limitation was the constraint of time to finish the portions within the allotted time.

Early clinical exposure forms a crucial part in the initiation of students into clinical and rehabilitative medicine. During times when students often spend long hours in the classroom, it serves to remind students why they want to be occupational and physiotherapists and what their profession demands of them. It seems quite evident that most students benefit from active learning strategies over the traditional lecture format. In view of the better performance and good/excellent rating of the program by the students, the authors conclude that there is value in adding an ECE program in teaching neuroanatomy to students.

Acknowledgment

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A comparative study on the effects of incentive spirometry and deep breathing exercise on pulmonary functions after uncomplicated coronary artery bypass grafting surgery

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Abstract

Purpose

Compare the effects of Incentive spirometry and deep breathing exercise on pulmonary functions after uncomplicated coronary artery bypass surgery.

Methods

Thirty two patients for elective coronary artery bypass surgery with age group of 38-68 years were included for the study. They were trained preoperatively and randomly assigned to two groups and performed either incentive spirometry or deep breathing exercises according to the group they assigned.

Measurements

Pulmonary function test variables including; FEV1, FVC, and FEV1/FVC were measured preoperatively and third postoperative day. Arterial Blood Gas analysis for PaO₂, PaCO₂ were done on first three postoperative days before and after the breathing exercises.

Results

Independent paired test was performed to compare between the groups, and paired test was used to compare all variables within each group. Significant differences were found in PaO₂ and PaCO₂ in all three postoperative days after breathing exercises. There was no significant difference between the groups.

Conclusion

The results of this study suggest that, deep breathing exercises and incentive spirometry are of equal effect, provided the patients do not have any complication after coronary artery bypass surgery.

Key Words

Incentive spirometry, Deep breathing exercises, CABG.

Introduction

There is a strong positive correlation of increase in cardiovascular diseases in India with primordial risk factors of urbanization, excessive fat intake, faulty diet, tobacco consumption, and sedentary life style. There is an urgent need to develop CHD risk factor surveillance and prevention effort in India¹. Coronary revascularisation plays an important role in the management of patients with ischemic heart diseases. Coronary artery bypass grafting (CABG) is commonly performed via a median sternotomy with a reversed saphenous vein (SV) and / or an internal mammary artery (IMA) graft. Sternotomy and IMA harvesting may adversely affect postoperative respiratory function^{2,3,4}.

Physiotherapy maneuvers in the form of Chest physiotherapy (CPT) including breathing exercises, incentive spirometry, and airway clearance procedures to clear bronchial secretions during assisted and spontaneous breathing and early mobilization are routinely used at the earliest after major cardio thoracic

surgeries with the aim of preventing postoperative pulmonary complications⁵.

It is therefore important to investigate whether physiotherapy maneuvers following CABG are able to confer further improvement in cardiopulmonary performance as well as increasing functional capacity.⁶ In midst of many studies showing conflicting conclusions regarding the effects of Deep Breathing Exercises and Incentive Spirometry, it is necessary to compare the effects of both Incentive Spirometry and deep breathing exercises in post CABG patients with a better study design so as to formulate a better treatment regime for these patients.

Methods

Patients

A convenient sample of thirty-two patients with the age of 53.875 ± 7 Years scheduled to undergo CABG surgery in the department of CTVS, G.B. Panth hospital, was included in the study after obtaining personal consent from individual subjects. Patients with complete heart block dependent on external cardiac pace maker, Haemodynamic instability including cardiac arrhythmias, hypotension (BP <90/60 mmHg), hypertension (BP >180/100mmHg). Mechanical ventilation for >24 hours were excluded from the study.

Interventions

After patients met the inclusion criteria, they were randomly assigned into one of the two groups. 16 patients were included in Group A and they received Incentive Spirometry and 16 patients in Group B, received Deep Breathing exercises. Subjects in both the groups were seen before the surgery by the physiotherapist, who explained the physiotherapeutic protocols and interventions after surgery. Subjects were taught routine physiotherapy maneuvers.

Subjects in Group A were positioned comfortably in a relaxed position by elevating the head end of bed to around 45° on first postoperative day and in upright sitting with back support on second and third postoperative days, and made to do Incentive Spirometry. The patients were instructed to hold the spirometer upright in front of face and were asked to inhale slowly and to raise and maintain the balls in the first and second chambers for 2-3 seconds. Patients in Group B received deep breathing exercises and performed in a relaxed upright position.

The patients were asked to place dominant hand over upper abdomen below the xiphisternum, and other hand across the body of sternum. Patients were instructed to let the abdominal belly rise on inspiration while keeping the shoulder girdle and upper chest as still as possible. The patient then took a maximal inspiratory breath while maintaining the above-explained pattern of movement followed by 2-3 seconds breath hold.

Subjects in both the groups performed the exercises by three sets of 10 consecutive breaths with a pause of one minute between each set. Subjects performed breathing exercises under supervision of the physiotherapist or ICU nurse or resident on duty.

Data Acquisition and Measurements

Subjects included for the study were measured for pulmonary function tests and Arterial Blood Gas Analysis receiving the breathing exercises

Pulmonary Function Tests.

Pulmonary Function Tests were performed preoperatively, one or two days prior to the surgery and post operatively on third postoperative day. Appropriate technique were instructed and demonstrated before the test in a pre operative occasion.

Pulmonary function test were performed according to recommendations of the European Respiratory Society. The highest values of three technically satisfactory maneuvers were retained. All measured variables (including FEV₁, FVC and their ratio: FEV₁/FVC) were compared against predicted standards for age, sex, and height and expressed as percentage predicted.

Arterial blood gas analysis

Arterial blood gas (ABG) analysis was done immediately before and after the breathing exercises in the morning sessions on first, second and third postoperative days. Special care was taken to perform the tests in the standard way.

Data Analysis

Data analysis was performed using the software package SPSS 14.0 Paired t-test was used to compare PaO₂, and PaCO₂ at before and after treatment on first, second, and third postoperative days, and FEV₁, FVC, and their ratio (FEV₁/FVC) between preoperative and third postoperative days. Independent samples test was used to compare the dependent variables between the two groups.

The general linear model, repeated measure analysis of variance (ANOVA) was used to examine the changes in mean differences between pre intervention and post intervention on dependent variables; PaO₂, PaCO₂ between the first, second, and third postoperative days.

Results

Thirty-two coronary artery disease patients with age group of 38-68 years were included for the study. All were admitted in the hospital for elective coronary artery bypass graft surgery. There was no significant

difference between the two groups in the preoperative PFT variables (p>0.05).

The mean ± SD for FEV₁, FVC, and their ratio (FEV₁/FVC) was similar in Group A and B. Both of the PFT and ABG values were not significantly different between the groups A and B postoperatively (p>0.05).

Pulmonary function tests

There was no significant difference in FEV₁ and FVC preoperatively. Both of the PFT and ABG values were not significantly different between the groups A and B postoperatively (p>0.05). Postoperatively there were significant reductions in FEV₁ and FVC in both the groups, however the ratio was increased a little in group B (p = 0.016) than group A (p = 0.601). Ratio between Forced expiratory volume in one second (FEV₁) and Forced Vital Capacity (FVC) shows a significant difference between the groups. In group A the ratio had no significant difference pre and postoperatively (p = 0.601). But, in group B it was (p = 0.001).

Partial Pressure of Oxygen (PaO₂)

The results showed a comparatively better partial pressure of oxygen in the first POD before the treatment in both the groups comparing to second and third postoperative days. The result didn't show any significant difference between the groups in PaO₂ before and after the treatment (p > 0.05)

Table 1: Demographic data

Characteristic	Mean±SD	
	Group A (I.S)	Group B (D.B)
Age (yrs)	53.87 ± 9.85	53.87 ± 8.08
Height (cm)	164.5 ± 7.80	163.5 ± 6.81
Weight (kg)	61.81 ± 10.0	65.13 ± 10.18
BMI (kgm-2)	22.87 ± 3.28	24.75 ± 4.61

Table 2: PaO₂ Comparison between the groups

PaO ₂	Mean ± SD		t-value	p-value
	Group A	Group B		
D 1pre	89.7 ±9.68	89.89±7.20	0.031	0.975
D1post	91.70±9.77	91.7±6.65	0.000	1.000
D2 pre	73.3 ±8.52	78.67±11.26	1.509	0.142
D2post	75.27±8.30	81.38±10.28	1.851	0.074
D 3 pre	77.43±9.21	80.5±10.79	0.874	0.389
D 3post	79.77±9.22	82.85±10.53	0.880	0.386

There was significant increase in PaO₂ after the treatment (p < 0.05), which was similar in each postoperative day and was similar in both groups (p > 0.05).

Table 3: Day wise comparison in differences in PaO₂

Groups	Mean ± SD			t-value	p-value
	Day1*	Day 2	Day 3		
A	1.91 ±1.28	1.99 ±1.11	2.34 ±1.64	0.504	0.609
B	1.81 ±1.44	2.71 ±2.12	2.33 ±0.87	1.33	0.280

Partial pressure of Carbon dioxide

Partial pressure of Carbon dioxide on first postoperative day before the treatment was higher in both the groups A and B, but more in group A, with a subsequent reduction on second, and third postoperative days. However, there was no significant difference in between the groups in reduction of PaCO₂ after the treatment (p >0.05).

Table 4: PaCO₂ Comparison between the groups.

PaCO ₂	Mean ± SD		t-value	p-value
	Group A	Group B		
D1pre	36.08±3.84	34.76±3.78	0.983	0.333
D1post	32.95±3.64	32.61± .39	0.316	0.754
D2pre	34.85±2.48	33.11±2.62	1.929	0.063
D2post	32.97±2.54	31.44±2.45	1.743	0.092
D3pre	34.0±2.72	32.69±4.69	0.968	0.341
D3post	32.31±3.18	31.07±4.30	0.925	0.36

ANOVA were used to find pre and post treatment differences in PaCO₂ on three postoperative days within each group. Results show similar reduction of PaCO₂ on each day in both groups with no significant differences between the days.

Table 5: Day wise comparison of difference in PaCO₂

Grps	Mean ± SD			t-value	p-value
	Day 1	Day 2	Day 3		
A	3.07±2.3	1.88 ±1.01	1.69 ±0.86	3.964	0.030
B	2.54±3.9	1.96 ±1.5	1.62 ±0.81	0.516	0.602

Discussion

The study designed to compare Incentive spirometry and Deep breathing exercises for their effects on pulmonary functions postoperatively. The present data demonstrate that there is no significant difference between the two physiotherapy maneuvers, i.e. deep breathing exercises and Incentive Spirometry in uncomplicated post Coronary Artery Bypass Graft patients.

A marked reduction in lung function was present on the third postoperative day, which was of the same extent as found in previous studies after CABG surgery.⁷ Although there were a minimal increase in the ratio between FEV₁ and FVC (FEV₁/FVC) postoperatively, it doesn't make any clinical relevance. Overall, there was no significant difference in between the groups A and

Figure 1: FEV₁ Between Group Comparison

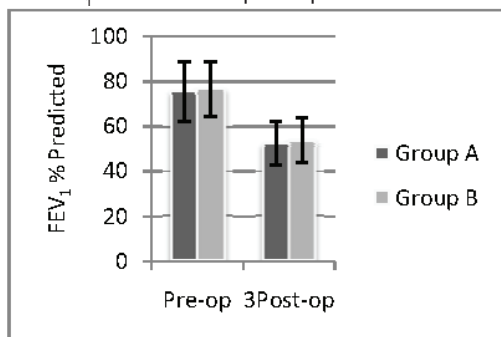


Figure 2: FVC Between Group Comparison

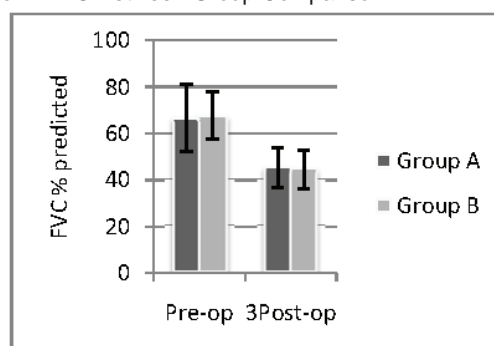


Figure 3: FEV₁/FVC Between Group Comparison

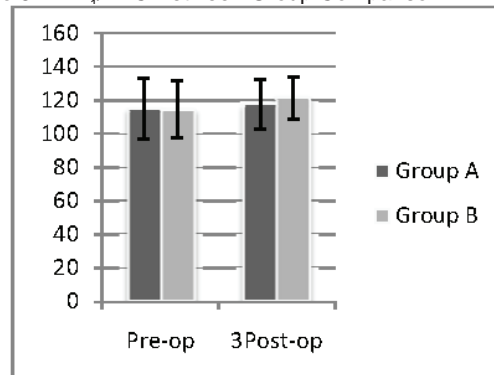
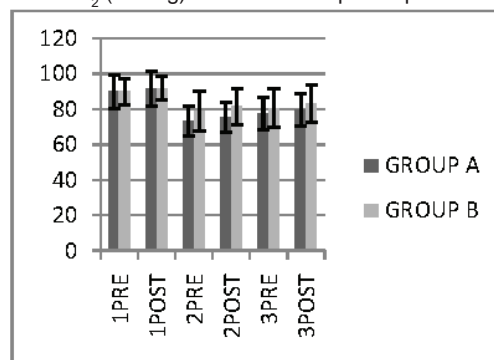


Figure 4: PaO₂ (mmHg) Between Group Comparison



B, which performed either deep breathing exercises or incentive spirometry respectively. The possible causes for reduction in FEV₁ and FVC can be development of atelectasis as a result of post operative lack of deep inspiration and coughing efforts, or of left lower lobe injury after lung retraction during the surgery, or due to increase in intrathoracic fluid volume leading the replacement of functional gas unit by liquid, and finally may be because of postoperative pain and fatigability resulting in inspiratory effort of reduced amplitude.⁸

Mean differences were calculated from pre and post intervention values of PaO₂ and PaCO₂ on each postoperative day to find the changes in these values. In this study there were statistically significant mean differences of PaO₂ postoperatively from day one to three in both the groups. It didn't show any significant difference between the groups performed deep breathing exercises or incentive spirometry. The study by Westerdahl and associates showed an immediate decrease in atelectatic

Figure 5: PaCO₂ (mmHg) Between Group Comparison

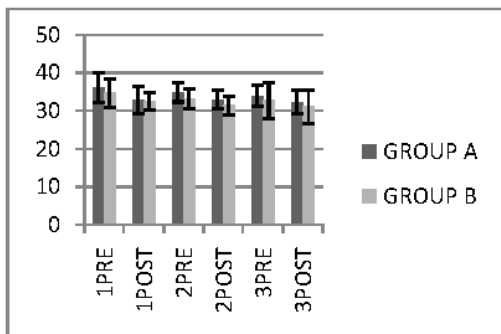
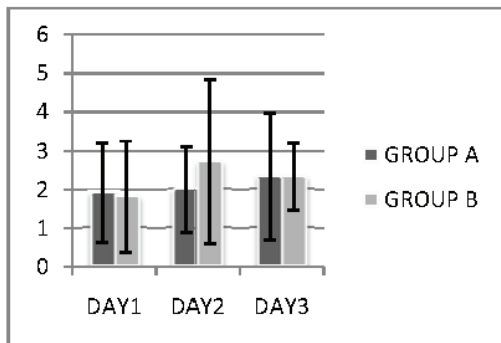


Figure 6: Mean Difference in PaO₂ Between Group Comparison

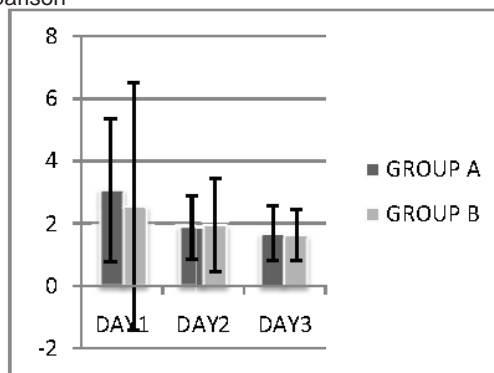


area and an increase in oxygenation after a session of thirty deep breathing exercises performed on the second postoperative day in post CABG patients, which correlate well with the findings of this study. The present study demonstrated a statistically significant improvement on oxygenation after a series of three sets of ten breaths either by incentive spirometer or manually on first, second, and third postoperative days. There were no differences within the groups regarding the effects of breathing exercises on PaO₂ on subsequent postoperative days, measuring that the rise in PaO₂ on all three postoperative days was regular, and this effect was also similar in both the groups.

There were similar and significant reductions in PaCO₂ in the both groups on all the three postoperative days. A marginally significant change was found in the mean difference of first postoperative day in the group A when compared to group B. But this difference was not clinically significant. Previous studies have not shown any clinically significant changes in PaCO₂. The exact reason for this change is not understood. According to Rogert E. Dales et al value of PaCO₂ above 50 mm Hg for 24 hours is considered as postoperative respiratory complication.⁹ This study population was screened for uncomplicated CABG, measurement of PaCO₂ helped to maintain the homogeneity of the population.

An increase in base line value of PaO₂ before the intervention on the first postoperative day in the both groups were present, and the least one was on the second postoperative day, again it raised on third postoperative day, the possible explanation for the higher level of PaO₂ on first day can be, the patient were on oxygen support with a face mask till ten minutes before the blood sample was taken, the raised level can be

Figure 7: Mean Difference in PaCO₂(mmHg) Between Group Comparison



due to this only as it was uniform for all the subjects.¹⁰ The mean difference in PaO₂ between pre and post intervention on each subsequent postoperative day was minimal and seemingly of little clinical importance, as the improvement in PaO₂ is approximately of 2 mmHg on each day. Although a modest effect on PaO₂ was achieved by just one series of breathing exercises in both the groups. In clinical practice, it can be possible that the exercises can have more profound effect on moderate to high risk population or when they can repeat every hour during day time and continued for several days. It is not unlikely that repeated exercises will have more substantial effect, which could be different in both the groups we used, but this requires further study. The possible explanation for increased PaO₂ after breathing exercises in this study can be reduced atelectasis, as one previous study gives strength to this assumption, which used CT scan for measuring changes in atelectatic area after three sets of ten deep breaths and showed a significant reduction in atelectatic area¹¹.

Conclusion

The results of this study suggest that, deep breathing exercises and incentive spirometry are of equal effect, provided the patients do not have any complication after coronary artery bypass surgery. Clearly, if patients develop chest infection or if other complications arise, then additional treatments will be required. The implications of our findings are that, provided a physiotherapist encourages the patients, the deep breathing exercise is equally effective as incentive spirometry in uncomplicated patients and can be used without any preference to this population.

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Sjogren's Syndrome – A case report

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Introduction

Sjogren's Syndrome (SS) is a disorder of connective tissue, with dryness of the mouth (xerostomia) and dryness of the eye (kerato conjunctivitis sicca) occurring in association with rheumatoid arthritis. It occurs in approximately 10 per cent of patients with the latter condition, but it can occur – and frequently does so – independently of rheumatoid disease. The lack of tears gives rise to symptoms of dryness and grittiness of the eyes, the dry mouth can occasionally be so severe as to cause a dysphagia. The disease is due to the autoimmune destruction of the salivary glands and the lacrimal glands. The disorder is usually associated with specific Human leukocyte antigen (HLA) antigen. Treatment is unsatisfactory and is limited to oral and ocular hygiene as well as the provision of artificial tears in the form of cellulose eye drops¹. Here reported case is of 35 years old female who was diagnosed as Sjogren's syndrome at the age of 31 years.

Case Report

The 35 years old female was living normal healthy life till 26 years of age. Then she felt fever with yellowness of body. She was investigated but jaundice was ruled out by the reports. She also developed pain in the low back and stiffness with pain and swelling in small joints of hands, elbows, knees. She consulted orthopedic surgeon and continued medication for pain relief for three to four months but found no relief. Patient was referred to Physician for further assessment. Physician referred her to Rheumatologist and was diagnosed as having Rheumatoid Arthritis. Patient was prescribed Disease Modifying Anti Rheumatic Drugs i.e. Methotrexate but patient did not start this treatment. Then patient took only aayurvedik treatment for 2 years. After that patient started Disease Modifying Anti Rheumatic Drugs.

At the age of 26 years, patient was prescribed Anti-Nuclear Antibody Immunofluorescence assay test and was found anti-nuclear body positive that made patient suspected for a number of autoimmune disease like Scleroderma, Rheumatoid Arthritis and Sjogren's disease.

At the age of 31 years, patient was prescribed for Extractable Nuclear Antigen (ENA) Profile 3 EUROLINE (Antibodies against nuclear antigens Immunoglobulin G (IgG) and was found Ribo Nuclear Protein (RNP)/ Sm positive (normal is negative) and SS-A/Ro-52 weak positive (normal is negative) and was diagnosed as

Sjogren's syndrome. Moreover, patient was investigated for Haemogram report for haemoglobin, total count and differential count of white blood cells and erythrocyte sedimentation rate, liver function test, urine test, biochemistry report for Serum Glutamate Pyruvate Transaminase (S.G.P.T) once or twice per year as routine check-up.

On assessment, patient had morning stiffness mainly in the small joints of both hands, fixed flexion deformities of distal interphalangeal, proximal interphalangeal, metacarpophalangeal joints of both hands. Patient was having pain in both knees, hips in the past but with medication patient was able to do activities of daily life.

Physiotherapy was aimed to reduce pain and stiffness of small joints of both the hands and wrist joints. Patient was given paraffin wax bath, active exercises, resisted exercises, and low grade mobilization for affected joints.

Discussion

Swedish ophthalmologist Henrik Sjogren first described it in 1899–1986². Nine out of ten Sjogren's patients are women and the average age of onset is late 40s, although Sjogren's occurs in all age groups in both women and men³.

Sjogren's disease is a chronic inflammatory and lymphoproliferative disease with autoimmune features characterized by progressive mononuclear cell infiltration of the exocrine glands, notably the lacrimal and salivary glands.

Primary Sjogren's syndrome is defined by xerostomia (dry mouth) and xerophthalmia (dry eye), often with extraglandular manifestations but without additional autoimmune rheumatic disease. Secondary Sjogren's syndrome occurs in association with Rheumatoid Arthritis, Systemic Lupus Erythematosus or another autoimmune disease.

Fig.1 & 2: Fixed deformities of small joints of both hands



Other glandular features found are sensation of burning of foreign body in the eye, dry cracker sign (unable to eat a cracker without drinking fluids), dryness if other areas such as nose, throat, vagina, rectum, skin, swelling of major salivary glands particularly parotid. Systemic manifestations are symmetrically synovitis of small joints, vasculitis of small and medium-sized vessels, dysphagia, chronic bronchitis, lymphocytic interstitial pneumonitis, pseudo-lymphoma with nodular infiltrates, pleural effusions, pulmonary hypertension, lymphoma, renal dysfunction, peripheral neuropathy, Non-Hodgkin's lymphoma⁴.

The combination of several tests can lead to a diagnosis of Sjogren's syndrome. Blood tests can be done to determine if a patient has high levels of antibodies that are indicative of the condition, such as anti-nuclear antibody (ANA) and rheumatoid factor (because SS frequently occurs secondary to rheumatoid arthritis), which are associated with autoimmune diseases. Typical Sjogren's syndrome ANA patterns are SSA (or Ro) and SSB (or La), of which SSB is far more specific; SSA is associated with numerous other autoimmune conditions but are often present in Sjogren's^{5,6}.

The Schirmer test measures the production of tears: a strip of filter paper is held inside the lower eyelid for five minutes, and its wetness is then measured with a ruler. Producing less than five millimeters of liquid is usually indicative of Sjogren's syndrome. A slit-lamp examination is done to look for dryness on the surface of the eye. Salivary gland function can be tested by collecting saliva and determining the amount produced in a five minute period. A lip biopsy can reveal lymphocytes clustered around salivary glands, and damage to these glands due to inflammation.

Ultrasound examination of the salivary glands is the simplest confirmatory test radiological procedure can also be used as a reliable and accurate way of diagnosing Sjogren's syndrome. Patient-reported symptoms must include both ocular symptoms, such as daily, persistent, troublesome dry eyes for more than 3 months, and oral

symptoms, such as needing to drink water to swallow food.

Objective evidence of eye involvement relies on Schirmer's test and the Rose bengal score (or similar). Histopathology studies should show focal lymphocytic sialadenitis. Autoantibodies against Ro (SSA) and/or La (SSB) antigens are also expected⁷.

Treatment for dry eyes includes conserving tear with glasses which shield the eye from wind and reduce evaporation of tears and use of artificial tears. For dry mouth maintain good oral hygiene, and chewing gums to stimulate residual salivary flow and keep mouth wet by drinking small sips of water frequently. Drug therapies will include oral pilocarpine or cevimeline, a derivative of acetylcholine stimulates receptors of salivary and lacrimal gland epithelial cells with improvement of ocular and oral symptoms⁴.

Acknowledgement

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Effect of Bean pillow as an adjunct to exercises for neck pain in cervical spondylosis: A pilot study

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Abstract

Objective

To study the effects of Bean pillow as an adjunct to exercises for neck pain in Cervical Spondylosis.

Subject

20 patients aged between 30-50 years with Cervical Spondylosis

Intervention

Control Group received conventional exercise program; Experimental group was given Bean pillow along with conventional exercise program. Patients received therapy 3 times a week for 6 weeks.

Main outcome measures

- 1) Cervical range of motion
- 2) Visual Analog Scale
- 3) Neck Disability Index.

Results

Statistical analysis showed that Bean pillow was consistently associated with statistically significant improvements in cervical ranges ($p=0.05$) except for cervical extension ($p=0.10$) as well as in pain intensity ($p=0.05$) and pain relief. It was also associated with statistically significant decrease in neck disability ($p=0.05$) but less significant in headache ($p=0.10$) due to neck pain. Patients in experimental group showed relief from morning stiffness.

Conclusion

Thus, Bean pillow was less effective on headache due to neck pain but morning stiffness and neck pain had decreased while cervical ranges had improved.

Key Words

Cervical Spondylosis; Cervical Pillow; Neck Pain; Cervical support.

Text

Introduction

Neck pain is a commonly reported problem that affects 70 % of individuals at some time in their lives¹. It is estimated that in general population the point for prevalence for neck pain varies between 9.5 % to 22%.

Disorders of the cervical spine include neck pain, with or without radiation to the extremity, or headache and can be severely disabling and costly. Neck pain can result from many causes- for example, traumatic, infections or inflammatory conditions, rheumatic diseases, and congenital diseases².

Cervical spine affectations e.g. degenerative disc disease (cervical Spondylosis) is the most common cause of neck- pain mainly in the Indian population. Cervical Spondylosis is a process that may be triggered

by diverse constitutional/ degenerative & environmental factors.

Cervical Spondylosis encompasses a sequence of degenerative changes in the intervertebral discs, osteophytosis of the vertebral bodies, hypertrophy of the facets and laminal arches, and ligamentous and segmental instability³.

The patient usually complains of neck pain & stiffness. Pain in the neck, or from the neck, constitutes the second most prevalent musculoskeletal disability confronting the Occupational Therapists.

Along with the above symptoms, avoidance of joint motion, adaptation of posture of least pain and fear of performing exercises causes dependence in ADLs, including self- care skills, home management, community mobility, job tasks, and a vocational activities⁴.

In the past decade, there has been a proliferation of neck support pillows recommended for patients with neck pain⁵. Various authors suggest that the use of a cervical pillow or support during sleep may benefit people with neck pain associated with the rheumatic diseases by immobilizing the joints, allowing the muscles to relax, maintaining the cervical lordosis, or providing heat and joint protection⁶.

Cervical collars are usually used during ambulation and daily functional activities to reduce pain but these do not restrict unconscious neck movements during sleep which give rise to sleep disturbance & patients complains of early morning pain & stiffness. Hence, the use of cervical pillow which will conform to the normal contours of the cervical spine is very important in the management of Cervical Spondylosis to decrease pain.

The purpose of this study is to determine the effectiveness of Bean pillow as an adjunct to exercises in the management of cervical pain, quality of sleep, morning stiffness and cervical ranges in patients with Cervical Spondylosis.

Method

Over a period of 22 months (June 2005 to April 2007), patients diagnosed as case of cervical spondylosis at Occupational Therapy department were recruited for the study. Participating patients had been diagnosed as a case of cervical spondylosis, their age ranged from 30 to 50 years were referred from Orthopedic out patient department of the same hospital. They were explained about the study details & follow instructions, gave their written informed consent of participation in the study approved by the hospital ethical committee.

Cervical spondylosis patient with neurological deficits or patient suffering from Vertebro-Basilar Insufficiency, Cervical Spondylo- Myelopathy, Spondylolisthesis & Ankylosing Spondylosis were excluded from the study.

The therapist enrolled the patients who were eligible for the study. Patients were randomly assigned in 2 groups by using block randomization.

Intervention

Control group patients received 30 minutes of conventional exercise program thrice a week for 6 weeks. Experimental group patients were provided with the cervical bean pillow and were instructed to sleep using this pillow every time they sleep during the entire period of the study along with 30 minutes of conventional exercise program thrice a week for 6 weeks.

Bean Pillow

The beans in form of small thermacol balls present in the Bean pillow is compressed by the head and neck, and it transfers this weight to the adjacent thermacol balls. The 3/4th filled Bean pillow spontaneously redistributes the weight of the head and neck during changes in sleep positions. The flat surface of the bed is considered to be important for maintaining the appropriate orientation of the pillow during use. Some of the Assumed benefits of Bean pillow are as follows-

1. Bean Pillow keeps the head and neck well aligned with the spine thus reducing the pressure over the cervical nerve roots as a result decreasing neck pain and peaceful sleep at night.
2. It supports the neck in all sleeping positions such as supine and on the sides as the thermacol balls in the Bean Pillow grants the support to the neck curvature.
3. Since the breathing passage also gets aligned, snoring is reduced considerably when a cervical pillow is used.

Outcome Measures

Patient were evaluated & assessed on cervical range of motion, Visual Analogue Scale (VAS) & Neck Disability Index (NDI) initially & at the end of 6 weeks study period.

Cervical flexion, extension & lateral flexion were evaluated using 1800 goniometer while patients were asked to rate their severity of pain on VAS which is a 10 cm scale and grades pain from 0-10 where 0 represents no pain and 10 represents severe pain⁷.

NDI questionnaire was administered by the therapist on patient to assess the intensity of neck pain & related disability:

NDI was developed in 1989 by Howard Vernon. The NDI has become a standard instrument for measuring self-rated disability due to neck pain & is used by clinicians & researchers alike. Pain Intensity, Personal Care, Lifting, Work, Headaches, Concentration, Sleeping, etc. are some of the 10 items rated. Each of the 10 items is scored from 0-5. The maximum score is therefore 50. The disability percent is calculated as (total score) / 50 * 100. Occasionally, a respondent will not complete one

question or another. The average of all other items is then added to the completed items⁸.

Statistical Analysis

Patient's score was analyzed statistically. Mean of each parameters like Cervical range of motion- flexion, extension and lateral flexion, VAS, NDI along with its components- Sleeping and Headache (separately) were calculated. Cervical range of motion, VAS, NDI along with its sleeping and headache components were analyzed initially & at the end of 6th week with unpaired Students 't' test.

Results

Flowchart of the study

22 patients including males & females with Cervical Spondylosis as per inclusion criteria were taken up for the study. 2 patients dropped out during the trial period in 2nd and 4th week as they didn't follow- up for 6 weeks. Both dropouts were from control group of the study. 20 patients, 10 patients consisting of 7 females and 3 males in each group of age ranging from 30 years to 50 years completed 6 weeks of therapy.

Table I: Cervical Range of Motion

		Mean	Unpaired	
			't' test	P- value
Cervical Flexion				
Comparison of	CG	7.5		
2 groups	EG	2	1.87	0.05
Cervical Extension				
Comparison of	CG	35.5		
2 groups	EG	45	1.96	0.05
Cervical Lateral Flexion				
Comparison of	CG	43		
2 groups	EG	45	1.31	0.10

This table compared control group and experimental group for cervical range of motion. Results showed that cervical flexion was significant while cervical extension was less significant and lateral flexion was highly significant. Thus, Bean pillow was responsible for the difference in increase in cervical range of motion of experimental group as compared to control group.

Table II: Visual Analogue Scale

		Mean	Unpaired	
			't' test	P- value
Comparison of	CG	6.1		
2 groups	EG	7.4	1.94	0.05

This table compared control group and experimental group for VAS. Results showed that there was significant change in VAS of pain in experimental group. Thus, Bean pillow was responsible for the difference in decrease in pain assessed on VAS of experimental group as compared to control group.

Flowchart of the study

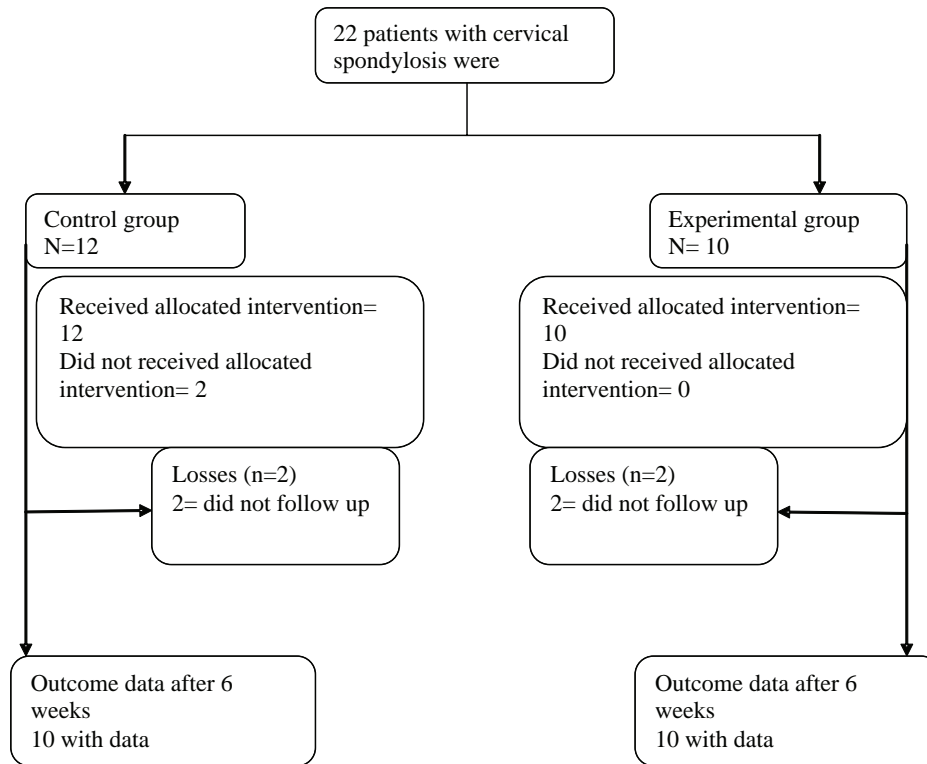


Table III: Neck Disability Index

		Mean	Unpaired	
			't' test	P- value
Comparison of	CG	52.59		
2 groups	EG	44.41	1.87	0.05

This table compared control group and experimental group for NDI score. Results showed that there was significant change in NDI score in experimental group. Thus, Bean pillow was responsible for the difference in decrease in neck disability assessed on NDI of experimental group as compared to control group.

Table IV: Sleeping component of NDI

		Mean	Unpaired	
			't' test	P- value
Comparison of	CG	2.2		
2 groups	EG	2.2	0	0

From the above table it is clear that there is no difference between the improvement of quality of sleep in 2 groups.

Table V: Headache component of NDI

		Mean	Unpaired	
			't' test	P- value
Comparison of	CG	2.5		
2 groups	EG	1.8	1.37	0.10

This table compared control group and experimental group for headache component of NDI score. Results

showed that there was less significant change in headache component of NDI score in experimental group. Thus, Bean pillow was not much effective responsible in decreasing in headache due to neck pain assessed on headache component of NDI of experimental group as compared to control group.

Discussion

The use of soft cervical supports is controversial. They do not immobilize the neck but may contribute to comfort. A single study has suggested that soft cervical collars were beneficial for pain reduction. Although soft cervical collars do not limit cervical active range of motion, it has been suggested that they may be beneficial if worn during sleep to limit unconscious neck movement⁹.

The current study was a randomized controlled trial of the efficacy of Bean pillow for neck pain in Cervical Spondylosis. Bean pillows were studied to assess pain relief, quality of sleep, decrease in early morning stiffness and improvement in cervical range of motion. Bean pillow was consistently associated with statistically significant improvements in cervical ranges except for cervical extension as well as in pain intensity and pain relief. It was also associated with statistically significant decrease in neck disability but less significant in headache due to neck pain.

Data analysis showed statistically significant improvement in cervical flexion p= 0.05, cervical lateral flexion p=0.02 except for cervical extension p= 0.10. This improvement could be contributed to adequate head and neck support during sleep resulting in decreased cervical

spasm and thus less pain leading to pain-free ranges of neck.

Early morning stiffness was one of the major problems complained by the patients. Patients in experimental group showed relief from morning stiffness due to Bean pillow as compared to control group. Neck pain is often worsened in the morning after awakening which however improve over the course of the day in some patients. These could be due to diverse cervical pathology such as cervical degeneration, nerve irritation and paraspinal muscles spasm. During the day-time, individuals with neck pain may guard against excessive movements or postures associated with pain. Patients of control group as compared to experimental group use to be awakened from sleep experiencing increased morning headaches and neck pain. This may be due to poor head and neck support during sleep. On contrary, patients in the experimental group showed significant improvement neck pain i.e. VAS score $p=0.05$. This could be attributed to adequate head and neck support during sleep which might have a beneficial carryover effect on daytime pain relief and morning stiffness.

Smythe postulates that proper neck support may help to improve the neck position during sleep and therefore improve the upper extremity symptoms⁶. In one of the randomized crossover study of patients with chronic neck pain by Lavin RA, 3 types of pillows were compared. A water-based pillow compared to the patient's regular pillow, or a roll pillow, was associated with greater pain relief and improved quality of sleep⁹.

Statistical analysis of sleeping component of NDI showed no difference $p=0$ in both the groups. This observation could be by chance but patients in the experimental group subjectively reported more improvement in the quality of sleep.

On analyzing the headache component of NDI, it was observed that there was less significant improvement in headache of patients in experimental group. This could be attributed to many other factors other than cervical pain causing headache.

Data analysis of NDI showed significant decrease in scores $p=0.05$ and also overall functioning of the patients. This could be attributed to improvement in cervical ROM, neck pain. However, a further detailed item-analysis of NDI is required.

The presumed positive effects of the Bean pillow may be due to its ability to spontaneously conform to the position and shape of the head and neck, thus providing adequate head and neck support. The only complaint by the experimental group subjects was the noise occurring due to the movement of thermacol balls while changing

positions during sleep.

As this was a pilot study of only 20 patients, a longitudinal study of more follow-ups and larger sample size are required to carry out more research which will evaluate the presumed benefits of Bean pillows with regard to pain reduction and sleep parameters. A better understanding of the design of pillow would benefit individuals with neck pain and potentially decrease reliance on medications and other medical interventions.

Conclusion

Thus, the results indicate that Bean pillow as an adjunct to exercise protocol was quite effective in patients with neck pain in Cervical Spondylosis. Though there was less effect on headache due to neck pain but morning stiffness and neck pain had decreased while cervical ranges had improved. Although statistically there was no improvement in Quality of sleep but experimental group subjects reported improvement in quality of sleep.

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Effectiveness of nerve mobilization in the management of sciatica

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Abstract

Study Objective

To find out whether Nerve mobilization techniques enhance patient outcomes in the management of sciatica when added to the standard care.

Design

Pre test Post test experimental design.

Setting

Out patient physical therapy department, G.B.Pant Hospital, New Delhi

Subjects

30 patients, both male and female with a primary diagnosis of sciatica

Measurement

After measuring the baseline pain (NPRS) and functional status (SF-12) scores one group was given conventional physical therapy while the other group was given nerve Mobilization with conventional physical therapy alone. At discharge the patients' scores in both the groups was re assessed. Both the groups received treatment 3 days a week for a total period of 2 weeks.

Results

Non parametric tests were used to compare the mean statically difference between the groups. Within group analysis was done using Wilcoxon signed ranks test and between group analyses was done using Mann Whitney U Test. The results showed that there was significant difference in pain and functional status scores as indicated by the significance obtained in their respective p values.

Conclusion

The study results show that neural mobilization techniques when added to standard care enhance patient outcomes in sciatica in comparison to conventional physical therapy alone.

Key Words

Sciatica, Neural Mobilization, Pain, SLR, NPRS, SF-12.

Introduction and Background

Sciatica, a symptom often attributed to lumbosacral spine pathology, is frequently discussed both in the lay press and in medical literature. It can be defined as a sharp burning radiating down the posterior or lateral aspect of the leg, usually to the foot and ankle, often associated with numbness or paresthesia.

Sciatica is a disorder with radiating pain in one or more lumbar or sacral dermatomes, and can be accompanied by phenomena associated with nerve root tension or neurological deficits³⁴. Occasionally more than one root is involved. The most important symptoms are radiating leg pain and related disabilities.

Most patients with LRS are treated conservatively in the first 6–12 weeks (acute and sub acute phase). Conservative treatment for sciatica is primarily aimed

at pain reduction, either by analgesics or by reducing pressure on the nerve root in the form of physical therapy. However, the effectiveness of most of the conservative interventions has not yet been demonstrated beyond doubt. The review of Vroomen et al about conservative treatment of sciatica showed the lack of evidence either for or against the efficacy of traction, exercise therapy or drug therapy for the management of LRS. Therefore, there is no evidence that one type of conservative treatment is clearly superior to others for patients with LRS³⁵.

Empowering patients with appropriate pain management tools and getting them actively involved in their own care is crucial to enhancing compliance with physical therapy regimens and improving outcomes¹⁴. In more recent years there has been an increase in the understanding of pain physiology and there has been much interest into the area of neural tissue involvement in pain disorders (Greening & Lynn 1998; Zusman 1998), particularly from a physiotherapy perspective. This knowledge requires careful consideration in the management of neural tissue disorders and has necessitated a change in the understanding of the physical treatment of pain (Butler 1998), particularly in regard to neurogenic pain (Elvey 1998).

Neural mobilization is aimed at reconstructing normal neuromechanical condition, i.e. adapting the nervous system to constantly changing loads and mechanical tension. Scientists have unraveled the logical processes occurring in neural and perineural tissue during neuromobilization and conditions in the treatment of which the technique can be used. As any other physiotherapeutic method, neuromobilization relies on specific clinical tests and an in-depth diagnosis of the functional status of the nervous system, as well as on etiology and pathogenesis of the disease²⁴.

Although clinicians employ Neural mobilization techniques in contemporary practice with increasing verification for their use in assessment and numerous trials of treatment effect, there is lack of synthesized evidence regarding the efficacy of this conservative management approach in adults exhibiting symptoms and signs of sciatica.

Material and Methods

A total of thirty patients referred to out patient physical therapy department of G.B.Pant Hospital were taken for the study based on inclusion and exclusion criteria. Mean values of their age was 52.8±7.34 years. All

the subjects were informed about the nature, purpose, and possible risk involved in the study.

The subjects were matched with inclusion and exclusion criteria and then randomly assigned into two groups, A & B, each group consisting 15 patients. Randomization was done in a sealed opaque envelope and the subjects were asked to pick paper slots containing the appropriate therapeutic intervention.. All patients provided informed written consent prior to participation.

Space and location; Out Patient Physical Therapy Department of G.B.Pant Hospital, New Delhi.

Subjects included were of Age 45-64 years of age (male and female), presenting sciatica with or without low backache, duration of symptoms from 2 weeks to three months with leg pain greater than back pain in a radicular distribution, Positive findings (reproduction of radicular symptoms) at nerve tension test i.e., straight leg raise (SLR) of more than 35 degrees, Any Persistent pain radiating to the lower limb. Patients with "Red flags" for a serious spinal condition (infection, tumours, secondary metastases, Osteoporosis, spinal fracture, cauda equina syndrome, etc) were excluded from the study, Surgery or epidural steroids indicated for prolapse intervertebral disc (PIVD), lumbar canal stenosis, etc. Positive neurological signs exhibited a SLR test of less than 35 degrees, History of a major psychiatric or systemic illness and an NRS score of less than 3 on a 10 point scale for leg pain were excluded.

Study Design

Pre- test, post-test experimental design with random allocation of subjects into two groups.

Group A: Sciatic Nerve Mobilization with conventional physiotherapy (Experimental Group)

Group B: conventional Physiotherapy only (Control Group).

Dependent Variables were Pain (Measured with NPRS), Functional Status (Measured with SF-12 questionnaire) and independent variables were Sciatic Nerve Mobilization, Conventional Physical Therapy

Protocol

The therapeutic protocols were developed and administered in consensus with the Head of Department, Physical therapy, G.B.Pant Hospital. Subjects were randomly divided into two groups A and B.

Experimental Group A (Nerve Mobilization)

The first group received sciatic Nerve mobilization to the lower limb as explained by Butler¹ additional to conventional physiotherapy. Straight leg raise with tibial nerve bias (SLR/DF/EV/HAd) 1, 11 or Straight leg raise with peroneal nerve bias (SLR/PF/INV/HAd) 1, 11 was given by adding the sensitizing components from proximal to distal with hip adduction and internal rotation being the last component. Graded Neural Tissue Mobilization was given based on irritability and severity of the condition. Two sets of 20 repetitions each were performed slowly and rhythmically in each session. All patients were treated thrice a week for a period of 14 days.

Control Group (Conventional Physical Therapy alone)

Patients randomly assigned to this group received flexion or extension exercises⁵⁰ as advised and 4-channel high frequency TENS (100Hz) 51 using gymnex4 model was given daily for 30 minutes. It also consisted of giving information and advice about Sciatica. All patients were treated thrice a week for a period of 14 days.

Finding

Sciatic nerve mobilization with conservative physiotherapy is more effective than only conventional therapy.

Conclusion

From this study it appears that neural mobilization exercises when added to the standard care may help in the reduction of short-term disability and improvement of function and decreasing pain in patients with sciatica; while the efficacy of these techniques is still at the incipient stage and needs to be explored, trends toward pain and symptom reduction, combined with the low monetary and temporal cost of the treatment, make this treatment a reasonable option for physical therapists in treating patients with sciatica.

Interest of conflict

This study evaluated the effects of nerve mobilization only in a sub-group (n=30) of sciatica patients attending a single outpatient physical therapy department. So these results are not generalizable to all the patients suffering from sciatica. Because the sample size was relatively small firm conclusions regarding the efficacy of nerve mobilization in sciatica cannot be drawn. The efficacy of all neurodynamic mobilizations was also not tested; the study was restricted to tibial and peroneal components of the sciatic nerve.

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Effects of customized proprioceptive training and balance exercises among diabetic patients

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Abstract

Background and Objectives

Diabetes mellitus (DM) is a prevalent disease considered to be a Public Health problem, with high social and economic costs¹. Among the clinical complications of DM there are blindness, renal insufficiency, peripheral neuropathy^{2,3} and many more. Peripheral neuropathy seems to develop as an autonomic and sensorial disturbance and as a progressive and irreversible motor disease⁴. It can interrupt the afferent and efferent functions of the lower extremities that are responsible for maintaining normal posture and normal walking⁵. As a consequence, proprioception is lost hence balance is lost. Little is known about possible treatment strategies. This study evaluates the effects of a customised training programme on proprioception and balance in diabetic patients.

Methodology

The present clinical trial was conducted among 20 patients (n=20) referred to K.L.E'S Institute of Physiotherapy who were clinically diagnosed with diabetes and fulfilling the inclusion criteria. Ethical clearance was obtained from the institution. Written informed consent was taken from the participants. The intervention consisted of physiotherapeutic training including proprioceptive and balance exercises (daily over 1 month).

Outcome measures used in the study was Berg Balance scale, Falls Efficacy Scale International & was measured before and after completion of therapy.

Results

After intervention, the subjects showed improved balance (p=0.000) and the FES-I score (p=0.000) which were highly significant.

Results of the study are highly significant and confirmed that approach to balance in diabetes mellitus patients should be customised. Customised Proprioception & Balance training is effective in diabetic patients which (BBS score, p =.0000) reduced risk of falls (FES, p= .000) in diabetics. Findings are being well co related with previous findings of balance and proprioceptive trainings which proved to be effective¹⁻⁶.

Conclusion

A customized proprioceptive and balance training programme based on a individual needs and functional limitations can improve proprioception and balance and also decrease the risk of falls.

Keywords

Diabetes Mellitus, proprioceptive training, balance exercises, berg balance scale, fall efficacy scale.

Introduction

Humans are the most superior beings with respect to exploit their physical environment and are also prone to many diseases due to various causes. One among those chronic diseases is Diabetes mellitus (DM). Diabetes mellitus is a prevalent disease considered to be a Public Health problem, with high social and economic costs¹. It is a group of metabolic diseases in which a person has high blood sugar, either because the body does not

produce enough insulin, or because cells do not respond to the insulin that is produced. This high blood sugar produces the classical symptoms of polyuria, polydipsia and polyphagia¹.

Over 140 million people world wide suffer from diabetes with a projected increase to 300 million by year 2025. With urbanisation the prevalence of type 2 DM which currently accounts for 80% -90% of the diabetic population¹.

All forms of diabetes are treatable since insulin became available in 1921, and type 2 diabetes may be controlled with medications. Both type 1 and 2 are chronic conditions that usually cannot be cured. Diabetes causes many complications. Acute complications include diabetic ketoacidosis, & serious long-term complications like peripheral neuropathy^{2,3}. Since entire function of the body is regulated by the nervous system and diabetes is a disease which affects all organs and systems as well as peripheral nerves: pain fibers, motor neurons, autonomic nerves, hence the consequences of the disease need to be addressed.

Peripheral neuropathy seems to develop as an autonomic and sensorial disturbance and as a progressive and irreversible motor disease⁴. It can interrupt the afferent and efferent functions of the lower extremities that are responsible for maintaining normal posture, balance and normal walking⁵. As a consequence, proprioception is lost hence balance is lost.

Proprioception is the ability to perceive position and movement. This ability allows for the monitoring of the progression of any movement sequence and makes later movements possible. It is a sensory modality mediated by mechanoreceptors, which are receptors found in muscles and neurotendinous organs. The function of mechanoreceptors is to discriminate between temporal and spatial information about pressure of contact on the feet^{6,7}.

Due to decrease sensitivity in the sole of the foot, the information coming from mechanoreceptors is decreased; this results in decline of balance in the elderly and in individuals with diabetes. Balance control requires the integration of visual, somatosensory and vestibular inputs and their adaptations to changes in the environment and in the task or activities of daily living is concerned⁹.

Postural instability was further found to be significantly associated with sensory neuropathy¹⁰. Due to these balance impairments, diabetic patients are known to suffer from increased risk of injurious falls^{11,12,13,14,16}.

There is scarcity of literature on the fall prevention as well as intervention of balance problems in the diabetic patients. Few studies have been done on balance and proprioceptive training in DM patients. Amongst them some are using sophisticated equipments for training which is not affordable in Indian setups. More over most of the studies are using circuit training programs which cannot be adapted to all the patients because of variations in their balance problems as well as functional requirements hence the study is focused on customised training.

Methodology

This Clinical trial with one (intervention group) was conducted at the KLE University Dr. Prabhakar Kore Hospital of Belgaum, Karnataka, India. The study was approved by the Institutional Ethics Committee.

A sample of 38 diabetic patients referred to KLEU's Institute of Physiotherapy was recruited of these, 20 patients were randomly included in the study. Patients included were diagnosed with type 2 diabetes (fasting blood sugar ≥ 7 mmol/l), patients without deformities in lower extremity and history of falls one or more times. Exclusion criteria were: patients with concomitant foot ulcers, orthopedic or surgical problems affecting gait variables, non-diabetic neuropathy, blindness, other neurological pathologies (other than peripheral neuropathy).

Patients were informed about the study intervention in their own vernacular language & consent was obtained from them. Patients who agreed to join the study were evaluated for the baseline characteristics like age, sex, occupation, history of falls. After this patients underwent a clinical examination, an analysis of both static and dynamic balance test, and also filled in a fear of falls questionnaire. All outcome measures were assessed at baseline, and after 12 sessions by the same physiotherapist each time.

Test description and measures Prior to and after the treatment the Berg Balance Score was taken. Patients worry of falling when performing different activities was assessed with the Falls Efficacy Scale International (FES-I)¹⁵.

Procedure: The duration of each treatment session was 40 min, 3 times a week for 4 weeks (12 sessions). The intensity was chosen on the basis of previously developed successful interventions in pre-frail elderly persons^{7,11}. Each patient had a customized training for proprioception and balance training.

Balance exercises given were sitting at a table and reaching in different directions; stepping forward, backward and sideways; tandem walking; obstacle crossing; sit to stand from various stool heights; reaching for objects in standing; single limb standing.

Proprioceptive exercises given were stand on one foot on a flat surface with eyes open (30seconds), stand on one foot on a flat surface with eyes close (30seconds), stand on one foot on a flat surface with eyes closed and move head from side to side (30seconds), stand on one foot on a soft surface (ex. a pillow or bed) with eyes

closed and move head from side to side (30 seconds), walking on different surfaces.

Outcome measures i.e Berg Balance scale, Falls Efficacy Scale International was measured before and after completion of therapy (one month).

Statistical Analysis

Statistical analyses were performed using SPSS version. Data are presented as means & standard deviations and percentages. The paired't' test was used to calculate p values for the comparison of means between pre and post treatment and the p values were highly significant.

Results

The baseline characteristics of all 20 subjects are shown in (Figure. 1, 2 & 3).

Fig. 1: Age range in the group, maximum patients were in the range of 50-60 years.

Fig. 2: Gender ratio, which showed male 60% and female 40%.

Fig. 3: History of falls is presented, which showed that twice fall a year was more common among the subjects.

Baseline characteristics

Descriptive statistics show patients Berg Balance Score (Table 1 & Fig 4) and FES (Table 2 & Fig 5) which illustrates the improvement of the intervention group in all variables post-intervention.

Table 1: Shows the mean scores of all patients before and after the treatment.

Pre treatment	post treatment	mean diff	t value	p value
36.1 \pm 2.77	50.05 \pm 2.30	13.95 \pm 1.39	44.736	0.000

Significant difference was found between pre & post mean score of Berg Balance Score and p value was 0.000 which was highly significant.(Table 1 & Figure 4).

Significant improvement is noted in terms of fall prevention & risk of falling among the subjects. The mean values of pre and post treatment in FES-I scale were highly significant (p=0.000).(Table 2 and figure 5)

Fig. 1: Age in years of 20 patients

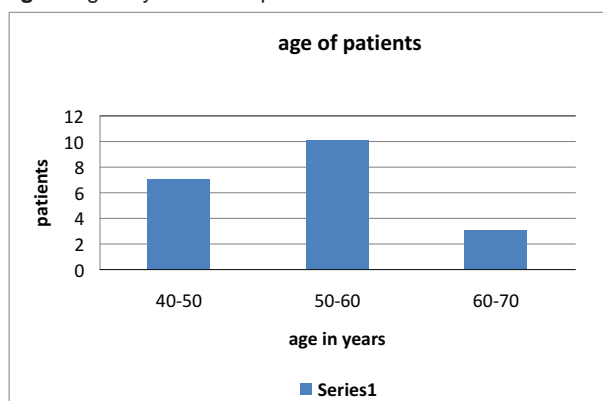


Table 2: Mean Score of FES-I (Name of Items of FES-I is given in ref no. 15)

Items	Pre	Post	Difference	t values	p values
Item1	1.95±0.21	1.5±0.26	0.45±0.22	9.096	0.000
Item2	1.79±0.27	1.45±0.23	0.34±0.14	10.255	0.000
Item3	1.68±0.22	1.32±0.25	0.36±0.15	10.908	0.000
Item4	3.45±0.31	3.58±0.56	0.13±0.43	1.382	0.183 NS
Item5	2.91±0.32	3.21±0.39	0.30±0.36	3.768	0.001
Item6	2.36±0.62	2.01±0.61	0.35±0.12	12.862	0.000
Item7	3.30±0.31	2.94±0.26	0.36±0.17	9.013	0.000
Item8	2.83±0.34	2.49±0.33	0.34±0.16	9.488	0.000
Item9	3.14±0.28	2.76±0.27	0.38±0.14	11.545	0.000
Item10	1.92±0.48	1.62±0.47	0.30±0.1	13.077	0.000
Item11	3.55±0.27	3.17±0.32	0.38±0.17	9.97	0.000
Item12	2.45±0.25	2±0.27	0.45±0.27	9.008	0.000
Item13	2.71±0.27	2.3±0.29	0.41±0.13	13.358	0.000
Item14	3.54±0.29	2.99±0.26	0.55±0.21	11.629	0.000
Item15	3.55±0.27	3.12±0.32	0.43±0.21	8.925	0.000
Item16	2.67±0.36	2.28±0.38	0.39±0.22	7.902	0.000

Discussion

This study was aimed to evaluate the effect of customised proprioceptive and balance training in diabetes patients, which takes into account the individual differences of activity limitation and participation restriction. No two individuals with diabetes mellitus have similar impairments and thus same functional limitations. So therapy should be based more on individual needs (customized approach).

Results of the study are highly significant and confirmed that approach to proprioceptive & balance problems in diabetic patients should be customized. Customised Proprioception & Balance training is effective in balance improvement (BBS score, $p = .0000$) & as well as reduces risk of falls (FES, $p = .000$) in diabetics (Table 2,3). This study was based on core components for successful fall prevention in the elderly diabetic patients. The results confirmed that proprioception and balance in type 2 diabetic patients aged between 40-70 years had marked improvement by a customized intervention over a period of 1 month.

The Berg Balance score item related to standing with eyes closed, single leg standing, tandem standing, stepping on a stool, standing unsupported eyes closed,

Fig. 2: Male to female ration

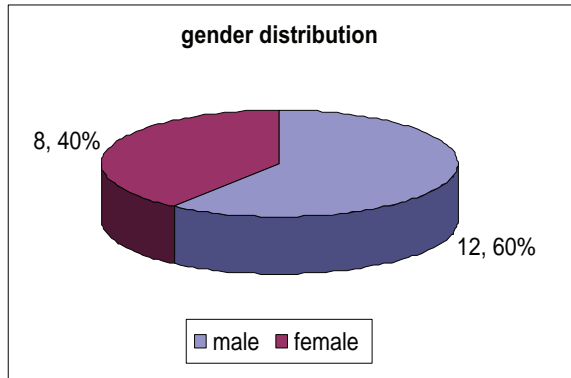


Fig. 3: Graph showing the number of falls in one year

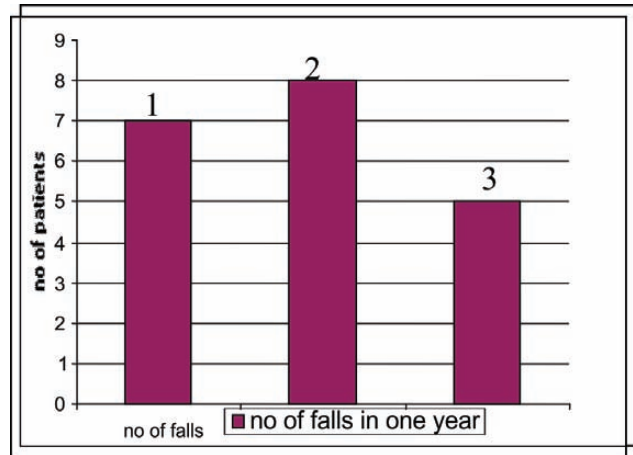


Fig. 4: Mean score of Berg Balance Score is plotted in bar graph

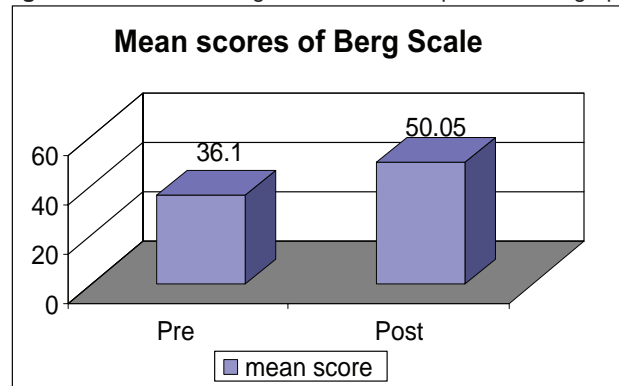
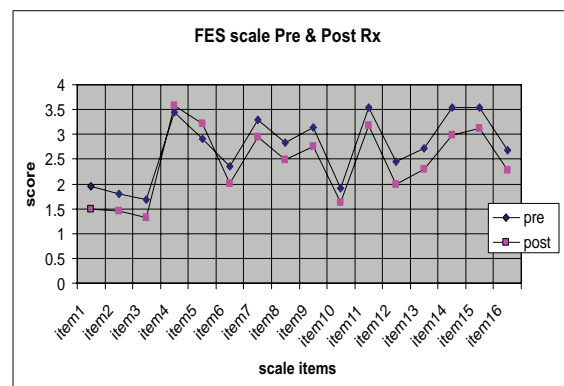


Fig. 5: Mean Score of FES plotted on graph



were the major issue for the patient and this was addressed and found significant improvement after the treatment. Each patient had a different protocol depending upon their needs; their deficits, the exercises were tailored. Regarding the FES-I, patients showed a lot of concern about item like walking on slop or uneven surfaces, tandem walking, climbing stairs etc. which showed that the patients sensorimotor is hampered. This was considered and treatment was tailored or customized according to the functional demand. All subjects in this study relatively improved with balance, proprioception and functional capacity.

Physical activity is being considered as a therapeutic intervention to ameliorate postural instability. Studies that

analyzed the effects of proprioceptive exercise programs for individuals with diabetes⁵ report that balance and postural stability can be improved, probably by means of an increase in peripheral afferents, leading to a reduction of falls related to sensory deficits. Postural control is the resultant from the interaction of the vestibular, visual and sensory systems, and any alterations in one or more of these systems, such as sensory deficits on the feet, can result in postural instability. The improvement of tactile sensitivity through various exercise like walking on different texture surfaces i.e proprioceptive exercises observed in this study after the training protocol could be attributed to the multisensory nature of the stimulation provided by the intervention.

The feasibility of a low cost intervention protocol to prevent morbidities in individuals with diabetes was investigated¹⁷. The present study also contemplated the social aspect of treatment as it proposed low cost, viable procedures.

A study assessed the effects of balance/strength training on falls risk⁷ and posture in older individuals with type 2 diabetes with mild to moderate neuropathy and found that subjects improved in balance and strength when compared to normal individual. The present study dealt with patients with varying degree of neuropathy and varying functional demands and the exercise protocol for these patients improved their functional capacities.

To the best of our knowledge, this is one of the clinical trials to describe an effective customized physiotherapy training programme geared to concurrently improving the balance, proprioception and decrease the risk of falls in diabetic patients.

Findings are being well co related with previous findings where balance and proprioceptive trainings are proved to be effective¹⁻⁶.

Further studies are required to compare the conventional balance training with customised balance training in diabetes patients on a larger sample size & the related fall risk in diabetic patients may be another interesting issue for further quantitative and qualitative studies.

Conclusion

A customized proprioceptive and balance training programme based on an individual needs and functional limitations can improve proprioception and balance and also decrease the risk of falls. Further studies with a larger sample size are needed to explore the influence of these improvements on the number of reported falls, patients' physical activity levels and quality of life.

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Extubation outcome after spontaneous breathing trials with T-tube or pressure support ventilation

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Abstract

A 2-h T-tube trial of spontaneous breathing was used in selecting patients ready for extubation and discontinuation of mechanical ventilation. However, some doubt remains as to whether it is the most appropriate method of performing a spontaneous breathing trial. We carried out a prospective, randomized, study involving patients who had received mechanical ventilation for more than 48 h and who were considered by their physicians to be ready for weaning according to clinical criteria and standard weaning parameters. Patients were randomly assigned to undergo a 2-h trial of spontaneous breathing in one of two ways: with a T-tube system or with pressure support ventilation of 7 cm H₂O. If a patient had signs of poor tolerance at any time during the trial, mechanical ventilation was reinstated.

Patients without these features at the end of the trial were extubated. Of the 20 patients assigned to the T-tube group, 15 successfully completed the trial and were extubated; 5 of them required reintubation. Of the 20 patients in the group receiving pressure support ventilation, 17 were extubated and 3 of them required reintubation. The percentage of patients failing the trial and ICU mortality was significantly higher when the T-tube was used. Clinical evolution during the trial was not different in patients reintubated and successfully extubated. Spontaneous breathing trials with pressure support or T-tube are suitable methods for successful discontinuation of ventilator support in patients without problems to resume spontaneous breathing.

Key Words

Pressure Support Ventilation, T-Tube, Extubation Outcome, Spontaneous Breathing Trials

Introduction

Once a patient recovers from the illness leading to the application of mechanical ventilation, discontinuation of ventilator support and extubation must be attempted. It is therefore essential to be able to distinguish patients who are ready to sustain immediate spontaneous ventilation from those who need a gradual transition from mechanical ventilation to spontaneous ventilation.

Predictive criteria of weaning may help to evaluate the suitability of disconnecting a patient from the ventilator, but some of the criteria, especially the classic criteria (vital capacity, maximal inspiratory pressure, minute ventilation, etc.), are frequently inaccurate. Rapid shallow breathing, as reflected by the breathing frequency to tidal volume (f/V_T) ratio, seems to be the most useful parameter because of its simplicity and reliability^{4,7,9,11}.

Recent studies have shown us that a T-tube trial of spontaneous breathing lasting 2 h is a useful test in selecting patients who are ready for extubation. Such a trial is associated with a rate of extubation failures, i.e., the percentage of patients who must be reintubated. Despite these studies, some doubt remains as to whether

it is the most appropriate method^{1,5,6,17,21,22}.

The increase in the work of breathing caused by the presence of an endotracheal tube may be an excessive load for some patients breathing through the T-tube circuit, and poor tolerance of the trial can result from this. Pressure support ventilation is useful to counteract the extra work imposed by breathing through an endotracheal tube. In general, the level of pressure support necessary to decrease the work of breathing to that after extubation is 7 to 8 cm H₂O^{2,3,8,18,19}.

The added stress provided by T-tube trials could increase trial failure rates. On the other hand, the reduction of the work of breathing provided by the pressure support could lead to extubation of patients who are only marginally able to sustain spontaneous breathing, and so a higher reintubation rate would be expected. If the above hypothesis is true, the rate of successful extubation after trials of spontaneous breathing with T-tube or pressure support would be similar^{10,12,13,14,15,16,20}.

The aim of this study was to determine the optimal approach to performing spontaneous breathing trials before extubation. We have compared the percentage of patients who remained extubated for 48 h after discontinuation of mechanical ventilation and extubation in two groups of ventilated patients who were randomly assigned to undergo a trial of spontaneous breathing with either T-tube or pressure support of 7 cm H₂O. Secondary objectives were to identify which patients would be more likely to require reintubation within 48 h and to analyze the effect of reintubation on mortality.

Material and Methods

Patients

The study was conducted between January 2010 and December 2010 in medical-surgical intensive care units in Rajiv Gandhi Cancer Institute and Research Center Rohini New Delhi 85. The study population consisted of 40 patients who received mechanical ventilation for more than 48 h before the spontaneous breathing trial was performed. The reasons for the initiation of ventilator support in respiratory system cancer patients such as carcinoma lung, esophagus, trachea, larynx, pharynx, glottis, epiglottis, tongue, cheek, pallet, lips, etc were the following: chronic obstructive pulmonary disease with acute respiratory failure in¹² patients, and acute respiratory failure in 28 patients. The acute respiratory failure was a result of surgery, pneumonia acute respiratory

distress syndrome All patients had en-dotracheal tubes of at least 8 mm in diameter.

To be enrolled in the study, the patients had to have an improve-ment or resolution of the underlying cause of acute respiratory failure: adequate gas exchange, as indicated by a partial pressure of arterial ox-ygen (PaO₂) higher than 60 mm Hg breathing a fraction of inspired oxygen (FIO₂) 0.40 with a positive end-expiratory pressure of 5 cm H₂O; a Glasgow Coma Score higher than 13; a core temperature below 38 C; a hemoglobin level above 10 g/dl; and no further need for vaso-active or sedative agents. In addition, the attending physician had to agree that the patient was in stable condition and ready to be weaned from the ventilator. Patients with a tracheostomy were excluded. The study was approved by the Ethics Committees of the hospital.

Protocol

After patients were enrolled in the study, each patient breathed spontaneously for 3 min through a T-tube circuit, with the FIO₂ set at the same level as that used during mechanical ventilation. Tidal volume and respira-tory frequency were measured with a spirometer during this period. Maximal inspiratory pressure was measured, and the most negative value of three efforts was selected. Patients underwent a trial of spon-taneous breathing lasting as long as 2 h when they met at least two of the following criteria: maximal inspiratory pressure less than 20 cm H₂O, tidal volume greater than 5 ml/kg body weight, and a respiratory frequency of less than 35 breaths/min. Patients were randomly assigned using a random-number table to undergo the trial of spontaneous breathing in one of two ways: with a T-tube circuit or with pressure support ventilation of 7 cm H₂O. The patients were allocated to the two groups in a blinded fashion with the use of opaque, sealed, numbered envelopes, which were opened only when a patient fulfilled all of the inclusion criteria.

Respiratory frequency, heart rate, systolic blood pressure, and ar-terial oxygen saturation measured by pulse oximetry were recorded every 15 min during the trial of spontaneous breathing. The primary physician terminated the trial if a patient had any of the following signs of poor tolerance: a respiratory frequency of more than 35 breaths/min, arterial oxygen saturation below 90%, heart rate above 140 beats/min or a sustained increase or decrease in the heart rate of more than 20%, systolic blood pressure above 200 or below 80 mm Hg, agitation, diaphoresis, or anxiety. If a patient had signs of poor tolerance at any time during the trial, mechanical ventilation was reinstated. Patients who had none of these features at the end of the trial were immediately extubated. After extubation, the patients received supplemental oxygen by face mask. Successful extubation was considered if extubation was performed after the 2-h trial of spontaneous breathing, and reintubation was not required within 48 h of extubation. All patients were followed until death or hospital discharge.

Statistical Analysis

Data are presented as medians with the 25th–75th percentile ranges or percentages as appropriate. All categorical variables were analyzed by chi-square tests, except when small size required the use of Fisher's exact test. Comparison of continuous variables among T-tube and pressure support groups was performed using Student's t test for variables, with normal distribution and the Mann-Whitney U test for variables with nonnormal distribution. Comparisons of continuous vari-ables among the following three groups: (1) patients who failed a spon-taneous breathing trial (Trial Failure Group), (2) patients reintubated (Reintubation Group), (3) patients successfully extubated (Successful Extubation Group) were made using one-way analysis of variance for continuous variables with normal distribution and the Kruskal-Wallis test for variables with nonnormal distribution. The incremental area under the curve was used as a summary statistic for the measurements for each patient to compare the respiratory frequency, heart rate, systolic blood pressure, and oxygen saturation in the trial failure, and reintubation and successful extubation groups for the 2-h spontaneous breathing trial.

Findings

Our study has two major findings. One, the percentage of patients successfully extubated after spontaneous breathing trials was 10% higher with pressure support of 7 cm H₂O than with T-tube. Two, reintubation was associated with a dramatic increase in mortality. Recent studies have shown that almost 75% of patients ventilated can be extubated after a 2-h trial of spontaneous breathing, and reintubation within 48 h is needed in 15 to 19% of extubated patients. All these studies have performed breathing trials using a T-tube circuit. The endotracheal tube can impose substantial

Table 1: Sex Ratio

Male - 30 Female - 10				
Total	Male		Female	
	Pressure Support Group	T-Tube Group	Pressure Support Group	T-Tube Group
40	18	12	04	06

Table 2: Age wise distribution of patients in tabular form

Age in years	Total No. of Patients	Patients treated with Pressure Support Ventilation	Patients treated with T - Tube Ventilation
18 - 20	08	04	04
20 - 30	02	02	00
30 - 40	04	02	02
40 - 50	02	02	00
50 - 60	20	06	14
60 - 70	04	04	00
Total	40	20	20

Photo 1: Photo showing Writes Spirometer For Measuring Tidal Volume



Photo 2: Photo showing Meter For Measuring Maximum Peak Inspiratory Pressure, i.e. (PiMax)



Photo 3: Photo Showing Mechanical



resistive work.

Several studies have shown that pressure support compensates for the additional work imposed by the endotracheal tube. This task can be accomplished with a level of pressure support of 7 cm H₂O.

Our results show that a significantly higher percentage of patients in the pressure support group successfully underwent spontaneous breathing trials. The finding that spontaneous breathing trials with pressure support lead to higher trial-success rates but not to higher risk for reintubation, suggest that some patients fail spontaneous breathing trials with the T-tube because of the respiratory load imposed by the T-tube system, but they can be successfully extubated when this overload is eliminated by the pressure support. Further studies with higher sample size are needed to demonstrate that the marginal effect of pressure support on the trial-success rate found by us becomes apparent on the percentage of patients successfully extubated. Immediately after discontinuation of ventilator support, patients failing a spontaneous breathing trial

Photo 4: Photo showing Endotracheal Tube



Photo 5: Photo Showing Pressure Support



Photo 6: Photo showing T - Piece Ventilator



showed respiratory frequencies, heart rates, and systolic blood pressures significantly higher than patients who tolerated the whole 2-h period, and oxygen saturations significantly lower.

The results available from this study confirm the finding previously reported by the Spanish Lung Failure Collaborative Group, that ventilator support can be successfully discontinued in two thirds of ventilated patients after a 2-h trial of spontaneous breathing. The present study has shown that both pressure support of 7 cm H₂O and T-tube are suitable methods for spontaneous breathing trials before extubation in ventilated patients without difficulty in resuming spontaneous breathing.

Conclusion

Of the 40 patients, 20 patients were assigned to undergo spontaneous breathing trials with T-tube circuits and 20 were assigned to pressure support ventilation of 7 cm H₂O. The two groups were similar with respect to the patient characteristics, the indications for mechanical ventilation, and respiratory functional parameters measured before the trial of spontaneous breathing

was performed.

15 patients in the T-tube group successfully completed a 2-h trial of spontaneous breathing and were immediately extubated; 5 of them required intubation within 48 h. 17 patients in the pressure support group were extubated after a successful 2-h trial of spontaneous breathing, and 3 of them required intubation within 48 h. The percentage of patients failing the trial of spontaneous breathing was significantly greater when the T-tube was used.

The reintubation rate causing the initiation of mechanical ventilation was not different when the T-tube and the pressure support groups were pooled together.

In patients who tolerated the trial of spontaneous breathing there were no differences between T-tube and pressure Support groups regarding ICU mortality.

ICU mortality among patients requiring reintubation was significantly higher than mortality in successfully extubated patients. Mortality rate among patients failing the trial of spontaneous breathing was 20% in the T-tube group and 27% in the pressure support group.

Acknowledgement

Our sincere thanks to Dr. Rajiv Goyal HOD, Chief Of Respiratory Medicine, Rajiv Gandhi Cancer Institute & Research Center, Sec. 5 Rohini, New Delhi 110085 & Dr. G.L.Khanna Dean Academics, Faculty of Allied Sciences, Manav Rachna International University Faridabad.

Interests of conflicts

I hereby declare that there are no interests of conflicts.

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Effectiveness of valgus insole on pain, gait parameters and physiological cost index of walking in flat feet in 5-15 years

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Abstract

Background

This clinical trial was carried out to find the prevalence of flat feet in 5-15 years children and to compare the effect of valgus insole on the pain, gait parameters and PCI in flat feet children.

Subjects

80 children with flat feet were included in the study.

Method

All subjects were randomly assigned to 1 of 2 groups after screening for flat feet- an experimental group which received a valgus insole and a control group without a valgus insole. Both groups were assessed for pain, gait parameters and physiological cost index of walking before and after the use of valgus insole. The primary outcome measures were pain and PCI with gait parameters being secondary outcome measure.

Results

The characteristics of and outcome measurements for the subjects in the 2 groups were similar at baseline. Significant improvements were found in pain and PCI in experimental group with no significant change in gait parameters.

Conclusion

The result of this study support the use of valgus insole in children with flat feet as it helps reduce the pain and improve PCI.

Key Words

Flat feet. Pain. Gait parameters. Physiological cost index of walking (PCI).

Introduction

Reviewing the concepts about human foot evolution, it is evident that the lower limb, and particularly the foot, is amongst the most distinctive characteristics of human anatomy. The overwhelming development of human brain cortex, vocal apparatus, and lower limb and foot structure make a triad distinguishing men from other mammals¹. Intuitively feet affect posture. Structural Engineers use this concept daily: "As goes the foundation {foot}, so goes the building {posture}"².

Pes planus (flatfoot) is one of the most common conditions observed in pediatric health practice³. The prevalence of pediatric pes planus has been reported to be between 2.7% and 12.3%⁴. There is no universally accepted definition for pes planus. Clinically, a pes planus is one that has a low or absent longitudinal arch. A flexible flat foot will have an arch that is present in open kinetic chain (non-weight-bearing) and lost in closed kinetic chain (weight-bearing). A rigid flatfoot has loss of the longitudinal arch height in open and closed kinetic chain⁵. Normally developing infants have a flexible flatfoot and gradually develop a normal arch during the first 5 years of life⁶.

Children with flat feet often grow into adults with flatter feet^{7,8}. Though children with flat feet may not have the same complaints or symptoms as their adult counterparts, this does not mean that their condition should go undiagnosed or untreated. Children may not present with a chief complaint of arch pain or heel cord tightness. Their symptoms may be disguised as tired or achy feet or complaints that they can't run as fast as the other kids. Generalized foot fatigue in children with flat feet can be caused by overuse of both the intrinsic and extrinsic foot musculature⁹. Fallen arches produce biomechanical malalignment in foot which inadvertently produces unequal forces. These asymmetrical forces imposed during activities can eventually result in significant cumulative trauma to the foot/ankle complex, knees, hips, and low back; thus resulting in abnormal kinetic chain stresses on pelvis and spine.

Notwithstanding the underlying pathology of pes planus, there are conflicting opinions on the intervention of pediatric pes planus⁴. The primary goals of treatment of flatfeet are relief of pain or disability and the prevention of future disability⁶. While some experts consider that pes planus is normal in early childhood and that the condition usually resolves spontaneously without treatment¹⁰, others experts suggest treating the flexible form of pes planus is necessary as it may lead to disability, joint damage and in later life a rigid fixed foot deformity¹¹.

Studies pertaining to intervention in flat feet have been carried out in age groups of 3-6 years and most of them have defied use of inserts as the flat feet in this age group is considered physiological. Very few studies have been reported in higher age groups. In India Few studies have been done on incidence of flat feet. One such study reports the incidence to be 18.26% in school children of Patiala city 13 while no documentation is found on effect of corrective footwear on pain, PCI and gait parameters in flat feet.

Age of around 5 -15 years is the one where active sports participation and recreational activities are at a peak and children have reported reduced participation due to foot pains and early fatigue due to flat feet. Aches and pains may reduce walking speed and altered biomechanical alignment of foot for years (in high age groups) may increase PCI. Gait parameters during normal walking have been compared between flat feet and normal children and reported to be invariably equal in both groups¹². But the efficacy in gait parameters amongst the children with flat feet with and without shoe inserts and hence changes in PCI and pain have not been reported.

Effect of pain and altered biomechanics of foot on gait parameters and PCI needs to be addressed and our study attempts to find the relation between these 3 outcome parameters and flat feet.

Method

Subjects

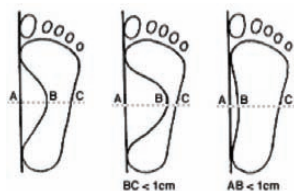
The study was conducted between September 2008 and September 2009 at primary and secondary schools in Mumbai. Exclusion criteria were:

1. Evidence of fixed-foot deformity.
2. Previous intervention such as surgeries for foot deformities.
3. Any kind of pain in the lower limb or injuries that had required a period of non-weight bearing at the time of the study.
4. Children with systemic problem.

Methodology

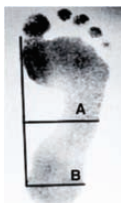
The study topic was explained in a parents meeting arranged by the school. Written consent was taken from the parents and written assent taken from children 7 years and above.

- Flat feet assessment:
Ink was smeared to the feet of subjects and footprints were taken on a paper.
The curvature of the foot was then assessed from the footprint.



(If the width of the instep (AB) at its widest part is less than 1cm, the foot is considered as flat.)

Plantar arch index was also calculated from the footprints.



It is calculated as a ratio of A/B. those with arch index of ≥ 1.15 were considered to be flat feet¹⁶.

- Among the flat feet students, 80 students selected at random for the further study and assessed for the outcome measures in following manner:

1. Pain assessment using visual analogue scale.
Pain:
0 \longrightarrow 10
2. PCI was calculated as follows:
Resting heart rate of the subject was taken and then the subject was asked to walk a distance of 100 meters in 5 laps at his/her comfortable pace. Heart rate of each lap and time taken to complete the same

was measured. Then average heart rate and speed was calculated and PCI of walking calculated from following formula

Basal HR =

Laps	1 st	2 nd	3 rd	4 th	5 th
HR					
Time					

Avg HR = Avg speed =

PCI = Avg HR – basal HR/ speed =

3. Following Gait parameters were assessed by smearing ink to subject's feet and making him/her walk a 10 meter walkway and analyzing the parameters from the foot imprint along the walkway.

- Step length.
- Stride length
- Cadence.
- Walking velocity.

Out of the total 80 students, age, and sex, matched two groups were made at random CONTROL GROUP consisting of 35 students and EXPERIMENTAL GROUP consisting of 45 students.

The experimental group was then provided with valgus insole for a period of one year. The subjects were provided with a chart for marking their level of comfort with shoe insert, activity levels while in the study process, and duration for which the insert was worn each day. The subjects were asked to wear the shoe insert for a period of 6 hours, 6 days a week.

The valgus pad was made of rubber material with an average thickness 4cms.

For control group no valgus insole was provided

- Frequency of follow up: once in 6 month time
- Drop outs in the study: 20

Reasons for dropouts:

1. Irregular users
2. Left the school

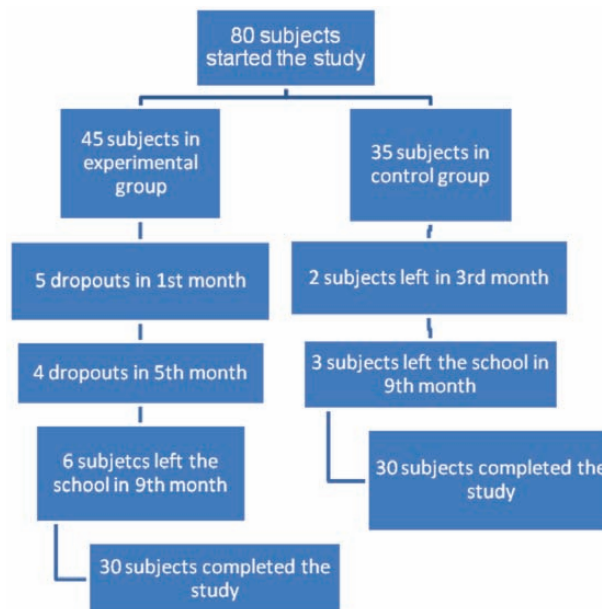


Table 1: demographical data:

Parameters	Experimental	Control
No. of Cases	30	30
Age (yrs)		
Mean	09.40	09.30
SD	02.66	02.44
Range	5-15 yrs	5-14 yrs
Sex (%)		
Male	15 (50.0)	15 (50.0)
Female	15 (50.0)	15 (50.0)

By Student't' Test P>0.05 Not Significant

By Chi - Square Test

Prevalence of flat feet and BMI:

At the end of the year 30 subjects from each group completed the study.

Data Analysis

1. Data analysis was performed using Student't' tests.
2. Pain assessment was performed using Wilcoxon non parametric test and the results converted to parametric form.

Results

The subjects in both the groups were age and sex matched. (Tab 1)

Discussion

The prevalence of flat feet in our study was found to be 13%. We found Only 9 subjects with flat feet had high BMI. This suggests that high BMI is not always associated with flat feet. Presence of other risk factors may be needed along with high BMI for flat feet to manifest.

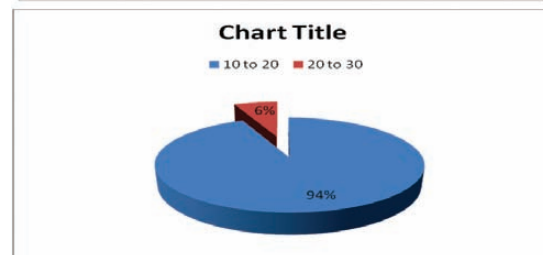
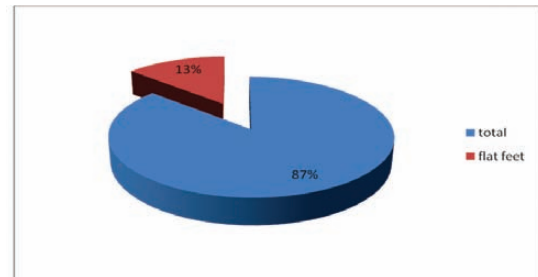
From the charts and tables our study reveals marked improvements in pain and PCI post intervention. This can be because with the use of valgus insole, the arch is supported; hindfoot valgus corrected thus re-aligning the foot to neutral. Arch support reduces the degree and duration of abnormal pronation during stance phase and thus has the potential for decreasing strain in the plantar ligaments which may be therapeutic for the foot 15. The work of extrinsic and intrinsic foot muscles is reduced with arch support and this delays the onset of fatigue and enhances participation in strenuous activities. Taylor has put forth goals for the pediatric orthosis, including reduction of discomfort, allowance for increased participation in activity, reduction of normal shoe wear, and reduction of abnormal pronation¹⁷.

A similar study done in 1988 by Otman S, Basgoze O, Gokce-Kutsal Y deduced that oxygen consumption during walking is decreased when a suitable arch support is applied to patients with flat feet¹⁸. This correlates with the improvement in energy cost of walking found in our study with arch support.

In our study though there was marginal improvement in gait parameters it was not statistically significant. This could be attributed to the idiosyncrasy of walking patterns¹⁴.

Table 2: prevalence of flat feet and BMI

Total subjects	894
Flat feet	139
BMI	SUBJECTS
10-20	130
20-30	9



Clinical or radiologic measurements and 3-D gait analysis in children with pes planus concluded Clinical or radiological methods, had very limited ability to predict gait deviance of pes planus²⁰.

Though the kinematics have not been found to be altered significantly, Force plate studies have shown altered force patterns in pes planus.

The distributed plantar vertical force of neutrally aligned and pes planus feet found that Pes planus feet had significantly more force at the subhallucal area with no difference seen under the other areas, indicative of aberrant first ray mechanics in pes planus feet¹⁹.

Conclusion

The results of this study suggest that pain perceived and PCI of walking can definitely be enhanced by use of valgus insole. The prevalence of flat feet was found to be 13% with no influence of BMI on flat feet. The secondary outcome measure i.e. gait parameters were not influenced by valgus insole.

Limitations of the Study

1. Objective Assessment of gait parameters could not be done due to unavailability of infrastructure.
2. Large drop outs in the study.
3. Our study did not find whether use of valgus insole leads to any structural change in the arch and the time required for the same. For this a long term use of arch support and follow up is required.

Problems faced

1. As the involved population in the study was pediatric a constant coaxing was required for them to be compliant with the use of shoe insert.

Table 3: Comparison of changes in mean pain between experimental and control groups:

Period	Mean Pain (X±SD)		p value
	Experimental	Control	
Pre	3.50 ± 2.57	3.50 ± 2.35	1.0000
Post	0.64 ± 1.09	4.33 ± 2.58	0.0001
Mean Change	@ *-2.87 ± 2.25	*0.82 ± 1.52	0.0000

By Student't' Test *P < 0.05 Significant@Betn Grp
P < 0.05 Significant

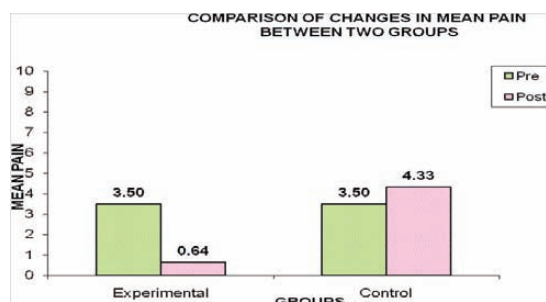
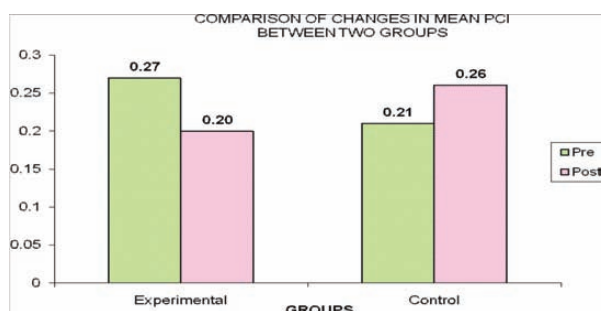


Table 4: Comparison of changes in mean PCI between experimental and control groups:

Period	Mean PCI (X±SD)		P.value
	Experimental	Control	
Pre	0.27 ± 0.15	0.21 ± 0.10	0.0735
Post	0.20 ± 0.06	0.26 ± 0.12	0.0264
Mean Change	@ *-0.07 ± 0.16	0.05 ± 0.14	0.0031

By Student 't' Test * P < 0.05 Significant
P < 0.05 Significant
@Betn Grps



2. As in the initial period there was increase in the pain it was difficult to convince the subjects to continue using the shoe insert.

Table 5c: Comparison of changes in mean cadence between experimental and control groups:

Period	Mean Cadence (X±SD)		P.value
	Experimental	Control	
Pre	121.87 ± 09.15	121.53 ± 11.00	0.897
Post	117.93 ± 08.99	121.83 ± 11.84	0.1565
Mean Change	-3.93 ± 12.30	0.30 ± 11.11	0.235

By Student't' Test P > 0.05 Not Significant
Betn Grps P > 0.05 Not Significant

Table 5a: Comparison of changes in mean step length between experimental and control groups

Period	Mean Step Length (X±SD)		p value
	Experimental	Control	
Pre	44.91 ± 11.11	44.60 ± 12.22	0.919
Post	47.80 ± 10.81	43.83 ± 09.94	0.1444
Mean Change	2.89 ± 9.83	-0.77 ± 8.92	0.385

By Student 't' Test P > 0.05 Not Significant
Betn Grps P > 0.05 Not Significant

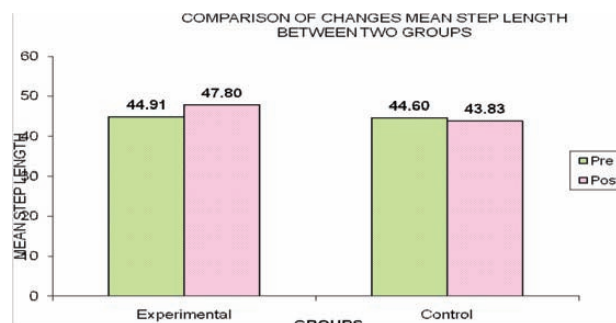
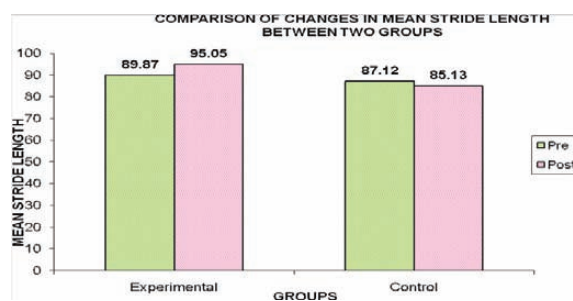


Table 5b: Comparison of changes in mean stride length between experimental and control groups:

Period	Mean Stride (X±SD) Length		P.value
	Experimental	Control	
Pre	89.87 ± 19.70	87.12 ± 24.43	0.633
Post	95.05 ± 20.74	85.13 ± 17.56	0.0505
Mean Change	5.02 ± 17.04	-1.98 ± 19.79	0.526

By Student 't' Test P > 0.05 Not Significant
Betn Grps P > 0.05 Not Significant



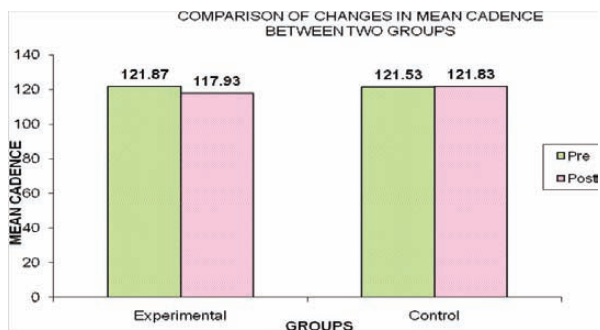
Summary

Though the orthotic treatment may not provide correction of the arch, through our study we found that early intervention definitely provides relief from pain and improves cost of walking. Our study implicates use of

Table 5d: Comparison of changes in mean velocity between experimental and control groups:

Period	Mean Velocity (X±SD)		P.value
	Experimental	Control	
Pre	0.91 ± 0.19	0.87 ± 0.20	0.430
Post	0.93 ± 0.19	0.86 ± 0.16	0.1290
Mean Change	0.02 ± 0.11	-0.02 ± 0.13	1.000

By Student't' Test P > 0.05 Not Significant
Betn Grps P > 0.05 Not Significant



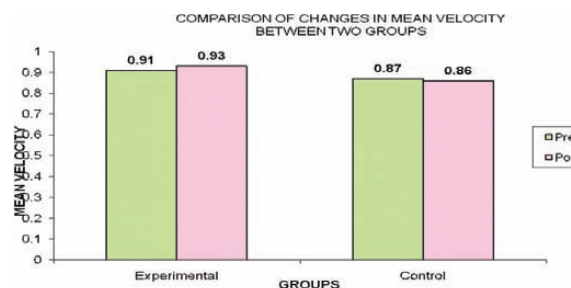
shoe inserts in flat feet to prevent future complications and improve participation.

Conflict of Interest Statement

We, Bharati Asgaonkar and Pradnya Kadam, declare that there are no conflicts of interest and the study presented here is original work of the authors.

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The effects of upper limb exercises on hand writing speed

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Abstract

Introduction

Hand writing is an essential tool required by students. It is a complex process which involves close coordination between musculo skeletal and nervous systems.

Objective

To assess the effectiveness of upper limb exercises on handwriting speed.

Methodology

An interventional prospective study involving undergraduate students. Structured exercise programme was held five days a week (for about 20 minutes) for 4 weeks. Writing speed, strength of palmar pinch grip and upper limb coordination was measured at beginning, two and four weeks later.

Results

At the beginning hand writing speed was 23.9 wpm. The pinch grip strength and coordination of upper limb were, 3.8kg and 8.6 (pegs/15 seconds) respectively. Exercise programme showed statistical significant improvement in all 3 areas measured. There was a 21% improvement in hand writing speed, 41.7% improvement in Pinch grip strength of dominant hand and 11.9% improvement in upper limb coordination.

Conclusions

Upper limb exercise programmes can be used to improve the hand writing speed.

Key Words

Upper limb exercise, Hand writing speed.

Introduction

Writing is one of the most unique features of humans' cultural development. Writing continues to be an essential life skill, in daily-life, as a form of communication, archiving, expression of creativity and knowledge. Therefore it is an essential skill one should possess in today's context and it forms an integral part of a student's life whether primary, secondary or tertiary.

Handwriting is a complex, fine motor skill, where fine, precise, coordinated movements occurs in the extremity. It is a complex integration of muscular, skeletal and neurological systems together. Many factors influence handwriting such as anatomy of extremity, general health, mental acuity, writing instrument and surface¹. During the process of handwriting most of the movements come from the forearm while shoulder provides the power with minimum movement occurring at fingers and wrist².

Strength and flexibility of the muscles, the position of the pen grip and the overall posture of the writer, affects the final output. The most common pen-holding position, is by keeping the pen between the index and

middle fingers, and held in place by the thumb using palmar pinch grip. Joint position sensation is the most important factor in determine handwriting². Though it seems paradoxical, since small muscles having better control, the shoulder-girdle group, once trained, does the job better².

Handwriting speed varies with age. Study on a group of Australian school children showed that hand writing speed to be 33, 34, 38, 46 and 52 (wpm) for students of grade 3, 4, 5, 6 and 7 respectively³. It also showed that skills such as word spacing and letter size decreased gradually with advancing age.

Writing speed of teenagers improve rapidly parallel to their physical maturity. Girls on average achieve a maximum writing speed earlier than boys. The average rate is 14.7 wpm for girls and 13.8 wpm for boys⁴. A range of writing speeds between 10 and 20 wpm is considered normal for normal a 15 year old. Hedderly called one with and an average speed of around 15-wpm as "those pupils writing at a speed."⁵ Those with a speed of 8 wpm or less will almost certainly be handicapped⁵.

According to teacher estimates, approximately 11% to 12% of female and 21% to 32% of male school-aged children have handwriting difficulties². Slow Handwriting may be due to delays in information processing, difficulties with spelling, improper motor co-ordination and adopting labor intensive writing styles⁶. Furthermore, research has indicated that slow handwriting leads to avoidance of writing thus resulting in low self-esteem, evading school work and possibly ending with learning difficulties and behavior problems⁷. Better hand writing speeds will help in quick assimilation of knowledge and perform well at examinations thus achieving higher academic grades⁸. However, unfortunately the efforts taken by teachers, parents and students to improve hand writing skills and speed are poor and schools lack necessary tools⁵.

Graham et al⁹ showed that training could improve handwriting speed and legibility in Grades 1–9 students. Similar results were shown by Kao¹⁰ when he studied a group of twelve undergraduates. Nadine and co workers studies¹⁶, first and second grade Australian students in a handwriting training session at school for 45 minutes once a week for 8 weeks and showed that legibility, form, alignment, size, spacing, and speed improved¹¹.

This study attempts to find the effects of strengthening and coordination exercises of distal upper limb muscles on handwriting speed in a group of undergraduate students of University of Colombo, Sri Lanka.

Material and Methods

Study Design

The descriptive cross sectional experimental study involving randomly selected 40 (20 male and 20 female) physiotherapy undergraduate students of University of Colombo. Any student with a congenital or acquired anatomical or functional defect of either upper limb was excluded. The study was approved by the ethical review committee of faculty of Medicine, University of Colombo. Informed written consent was obtained.

Writing speeds of the subjects were measured at the beginning, at two weeks and at the end (4 weeks) of the exercise programme. Exercises were designed to strengthen the muscles involved in handwriting.¹² Each subject did ten types of exercises for about 20 min. on each day, 5 times a week (Appendix 1).

Strength of palmar pinch grip was measured using pinch grip dynamometer¹³ and coordination of upper limbs was measured by using Perdue peg board test,¹⁴ at same time hand writing speed was measured. All assessments were done by a single investigator (KVKC).

Hand writing speed measurement

Subjects were given a single audio recording in English medium, and were asked to transcribe on a A4 sheet in two minutes. Test was done in a single lecture room with similar writing surface and seating facilities. At the end the number of words was counted and writing speed was calculated.

Pinch grip force measurement

Pinch Grip dynamometer, ranging from 0-10 Kg, was used for the measurement. Subjects stood in up right posture in front of the examiner with shoulders abducted to 0° and neutrally rotated, elbow flexed to 90° and the wrist and forearm kept in neutral position.

At each time three measurements of the pinch grip of the dominant upper limb was measured. The median value was obtained. A single dynamometer was used throughout the study.

Coordination measurement

The Perdue peg board was used for the measurement of coordination of dominant upper limb. Subject sat on a chair in upright posture in front of the table. The non dominant hand was rested on the ipsilateral thigh. The number of pegs placed on the peg board in 15 seconds was measured. At each occasion it was done three times and median value was taken. Same instrument was used throughout the test. Both Pinch grip dynamometer and Perdue peg board test had been validated for such use¹⁵.

Data Analysis

Descriptive statistics were used to present data. Measurements at the beginning and at the end were compared using paired t- test. A $p < 0.05$ (2-tailed test) was considered to be significant. Correlation between hand writing speed and exercise parameters were calculated by Pearson rank order correlation. Data are presented according to gender as well as whole population. Statistical analysis was done using SPSS version 17 for windows XP.

Results

The study population consisted of 40 physiotherapy undergraduate students (males 20). The mean age of the study population was 23.4(1.1) years and the mean age of the male and female subjects were 23.2(1.1) and 23.6(1.0) years respectively. Thirty eight were right hand dominant and 2 male subjects were left hand dominant.

Table 1 shows the mean hand writing speed of the study population and for each gender at different time intervals of the study period. At the beginning the overall mean hand writing speed was 23.9±5.1 wpm. After four weeks of exercise it increased to 28.9±4.7 wpm. Table 2 shows the results of the Pinch grip strength analysis of the study population. Mean Pinch grip strength of the dominant hand of the study population was 3.8±1.7kg. At the end of 4 weeks it increased to 5.3±1.9kg. Table 3 shows the data of the assessment of coordination of dominant upper limb of the study population, Mean

Table 1: Hand writing speed of all subjects, and by gender at beginning, midpoint and end of intervention.

N	Whole group		Male		Female	
	40		20		20	
	Mean(SD)	Range	Mean(SD)	Range	Mean(SD)	Range
Beginning of study	23.9(5.1)	14.5-33.0	23.5(5.1)	15.0-31.0	24.3(5.1)	14.5-33.0
Middle of the study	26.8(4.5)	18.0-36.0	28.34(4.54)	21.0-36.0	25.3(4.01)	18.0-33.0
End of study period	28.9(4.7)	19.5-40.5	29.4(5.7)	19.5-40.5	28.5(3.54)	21.5-34.5

Table 2: Pinch grip strength of all subjects, and by gender at beginning, midpoint and end of intervention

N	Pre-Strength-All (kg)		Pre-Strength- Male (kg)		Pre-Strength- Female (kg)	
	40		20		20	
	Mean(SD)	Range	Mean(SD)	Range	Mean(SD)	Range
Beginning of study	3.8(1.7)	1.0-7.0	4.8(1.5)	1.0-7.0	2.7(1.3)	1.0-5.5
Middle of the study	4.8(1.7)	1.5-8.0	5.8(1.4)	3.0-8.0	3.8(1.3)	1.5-6.0
End of study period	5.3(1.9)	2.0-8.5	6.7(1.3)	3.5-8.5	3.9(1.2)	2.0-6.0

Table 3: Coordination of the dominant hand of all subjects, and by gender at beginning, midpoint and end of intervention.

	Coordination All (pegs/15sec.)		Coordination Male (pegs/15sec.)		Coordination Female (Pegs/15sec.)	
N	40		20		20	
	Mean(SD)	Range	Mean(SD)	Range	Mean(SD)	Range
Beginning of study	8.6(1.5)	5-12	9.1(1.3)	7-12	8.1(1.6)	5-11
Middle of the study	9.7(1.3)	8-13	10.1(1.3)	9-13	9.3(1.2)	8-12
End of study period	10.1(0.97)	8-12	10.2(1.0)	8-12	10.1(0.94)	8-12

Table 4: Comparison of Pre and post (end of 4 weeks) hand writing speed, pinch grip strength and coordination for the whole group.

		Mean	N	SD	SE Mean	T	Df	p
Hand Writing Speed	Pre	23.91	40	5.07	0.802			
	Post	28.95	40	4.71	0.745	-7.876	39	<0.001
Pinch grip strength	Pre	3.77	40	1.72	0.272			
	Post	5.35	40	1.87	0.295	-7.529	39	<0.001
Coordination of the dominant hand	Pre	8.58	40	1.50	0.237			
	Post	10.13	40	0.97	0.153	-7.658	39	<0.001

coordination of dominant upper limb of study population was 8.6 ± 1.5 pegs/15sec. At the end of 4 weeks it improved to 10.1 ± 0.97 pegs/15sec.

Table 4 shows the results of the comparison of the three measurements for the whole population at the beginning and end of 4-week exercise programme. All showed statistically significant improvement. When data of individual genders were compared, they also showed statistically significant improvement (data not shown). Similar comparison was done for all three measurements at beginning and at 2 weeks after commencement of the programme. They also showed statistically significant improvement in all 3 areas in both gender groups (data not shown).

The whole study group showed a 21.1% improvement in hand writing speed with the male subjects showing 25.1% and the female subjects showing a 17.2% improvement. Pinch grip strength of the whole population improved by 41.7%. Improvement was higher in female students (44.9%) than in male students (39.9%). Coordination of the upper limb showed an 11.9% improvement in the whole group and 12.7% and 24.07% in male and female respectively. All were statistically significant.

There were insignificant positive correlations between hand writing speed with pinch grip strength ($r=0.052$, $p=0.752$) and hand writing speed and upper limb coordination ($r=0.218$, $p=0.176$).

Discussion

Handwriting is an essential skill required in the educational setting and the speed of handwriting will have an impact on outcomes.⁶ Only ten types of exercises were included in our exercise programme considering the feasibility and compliance. Exercises

were user friendly and participants enjoyed. There were no exercise related complications.

Hand writing speed is commonly measured as the average number of words written per minute.¹⁶ Our data were in agreement with data produced by Graham and co workers.⁹ In that study females had a higher handwriting speed (24.3 wpm) compared to males (23.5 wpm). Also it was reported that legibility was higher in girls and speed was higher in right hander's than left hander's. There were only 2 left hander's in our study and was not possible to compare. However, the two in our study showed considerable increase in writing speed (by 4 & 8 wpm) following the exercise programme. The reason why a left hander has a slower speed is not clear. Probably the direction of writing could have made an influence. Conventional writing direction, left to right, is set for the right hand person who will write away from the body, but a left hand person has to write towards the body and that could make some obstruction during the latter part of completion of a line hindering the speed. Researching more on this area would enable to identify appropriate positioning of the hand and instruments to improve speed. Improved legibility may, however, result in reduced speed, thus taking more time to complete an assignment.⁹ Therefore, a correct balance between speed and legibility need to be identified. In our study all had clear hand writing but we did not make a formal evaluation.

Despite the small sample size, our data has confirmed that exercise improves hand writing. Shoemaker et al, observed an 11.8% improvement in handwriting speed after 18 exercise sessions.¹⁷ Similar to our data Zivani and co workers reported higher hand writing speeds in boys.¹⁸ Pinch grip strength showed a 41.7% (1.6kg) improvement ($P<0.005$) following 4 weeks of exercise.

Rogers and co workers in their work showed an increase of 3.6 kg ($p < 0.002$) and 2.9 kg ($p < 0.0005$) in right and left hand isometric grip respectively.¹⁹ Literature shows that function of the hand can be improved by exercise not only in healthy individuals but also in disease conditions as well¹⁵.

Although at the beginning, males (9.1 pegs/15 seconds) demonstrated higher value of coordination than females (8.1 pegs/15 seconds), at the end of the training programme female's had a better coordination than their male counterparts. The overall improvement in coordination was 24.07% in females and 12.7% in males. Work by Satheesha and co workers showed improvement in dominant hand coordination in a group of patients recovering from cerebral tumor.²⁰ The positive relationship between handwriting speed with pinch grip strength and upper limb coordination are in agreement with other studies.²¹

Due to many factors this study was confined to 4 week duration and limited to 10 exercises. It would be interesting to find out the outcomes by increasing the duration of exercise period and also by changing the number of exercises and identifying the best. Less number of exercises would increase the compliance and especially if such programmes are intended to introduce to school children.

According to Peterson and Nelson, improving legibility should precede attempts to improve writing speed.²² Even though current study focused on handwriting speed it is important to identify legibility which is an important component in handwriting parameters perhaps difficult to correct at this age.

Summery

Handwriting speed, pinch grip strength and upper limb coordination can be improved after upper limb exercise programme. While males showed greater improvement in handwriting speed, females demonstrated greater improvement in pinch grip strength and upper limb coordination. Although not significant, positive correlations were seen between handwriting speed with pinch grip strength and upper limb coordination. These data need to be affirmed by studies involving more subjects from different age groups, especially primary school children to incorporate such training programmes in their school curricular. Similarly it would be interesting to study how such structured programmes would be useful in training individuals with different handicap states.

Appendix 1- Types of exercises used in the programme

1. Strengthening exercise for Brachioradialis – dumbell exercise
2. Strengthening exercise for wrist extensors - dumbell exercise
3. Strengthening exercise for Biceps - dumbell exercise
4. Coordination exercise for hand muscles – crumble a piece of cloth
5. Endurance exercise for hand muscles – finger meld
6. Endurance exercise for hand and forearm muscles – praying exercise

7. Endurance exercise for hand muscles – straight finger flexion
8. Coordination exercise for hand muscles – reciprocal movement of the fingers
9. Coordination exercise for hand and forearm muscles– drawing exercise
10. Coordination exercise for hand and forearm muscles -clapping.

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Effect of spinal manipulation in primary dysmenorrhoea

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Abstract

Dysmenorrhoea is chronic, cyclic pelvic pain associated with menstruation. Typically it is cramping, lower abdominal pain occurring just before and during menstruation. As dysmenorrhoea affects approximately 90% of menstruating women, this has the potential to create a significant health and socio-economic issue (Reddish, 2006). Many studies have been done on effect of exercise regimen and spinal manipulation alone on Dysmenorrhoea but comparatively less number of studies have been done to find out the effect of exercise regimen and spinal manipulation together in Dysmenorrhoea. In this study effect of exercise regimen and spinal manipulation was studied on 30 subjects which included females. The mean, standard deviation, t- value f-value and post hoc analysis for all the variables were calculated. It was concluded that spinal manipulation has a significant effect for the treatment of Primary Dysmenorrhoea.

Key Words

Primary dysmenorrhoea, Manipulation, Exercise protocol, Nausea, Pain, Range of motion, Fatigue.

Introduction

Dysmenorrhoea is defined as difficult menstruation flow or painful menstruation (Deligeoroglou, 2006)³. The term dysmenorrhoea is derived from Greek word dys meaning difficult/Painful/abnormal, meno meaning month and rhea meaning flow (Harel, 2008)⁵. It is the common complaint among young women, dysmenorrhoea is estimated to the present in 40-50% of them with severe focus giving rise to work or school absenteeism in 15% and mild forms requiring no medication or occasional over the counter analgesics in about 30% (Dawood,2006)². Dysmenorrhoea is classified as primary or secondary. Common associated symptoms are generally minor and include nausea, vomiting, diarrhea, headache, fatigue irritability. The common management strategies available for dysmenorrhoea are medical management, surgical management and therapeutic interventions. The common therapeutic interventions available for dysmenorrhoea are transcutaneous nerve stimulation, acupuncture and acupressure, exercise therapy and spinal manipulation.

The therapeutic interventions consist of various exercises and spinal manipulation. A lot of studies have been conducted to see the effect of exercises on dysmenorrhoea. The aerobic exercises stimulate the release of beta endorphins (hormones) which act as an analgesic for non-specific pain. The technique which is used in spinal manipulation to treat dysmenorrhoea is high velocity thrust and low force mimic manoeuvre. The spinal manipulation acts on parasympathetic and sympathetic pelvic nerve pathways which are closely associated with the spinal vertebrae, in particular the

second to fourth sacral segments and the 10th thoracic to the second lumbar segments (Jamison 1992)⁶. The present study attempts to study the effect of spinal manipulation on dysmenorrhoea. The present study aims to study the effect of various exercise regimen on dysmenorrhoea and the effect of exercise regimen and spinal manipulation together its clinical findings like pain, nausea, fatigue. As there are few studies which are available to study the effect of spinal manipulation on dysmenorrhoea. The study by Proctor⁷ et al., 2010 has inspired me to study the effect of spinal manipulation on dysmenorrhoea.

Material and Methods

Study was performed on 30 subjects taken from the Punjabi University, Patiala under the age group of 18-25 years. This was a Randomized Controlled Trail, which was performed in the Department of Physiotherapy. Study was performed in accordance with ethical considerations of the institute and their consent was taken prior to the study. Before beginning with the procedure, the subjects who were selected on the basis random sampling by applying inclusion criteria and were explained the entire procedure in detail. They were then assessed according to the assessment chart. Girls who have normal BMI and with regular menstrual cycle were taken and diagnosed to have primary dysmenorrhoea were included. The subjects who have secondary dysmenorrhoea and other gynaecological conditions were excluded. Subjects who take NSAIDS were excluded. Subjects were excluded if they are suffering from any musculoskeletal conditions. Group 1 was the control group, group 2 was the experimental group 1 and group 3 was the experimental group 2. The group 1 was control group and the girls of this group did not receive any treatment during the whole month. The control group was supervised for 1 month Group 2 was the experimental group 1 and the girls of this group were given exercise protocol consisting of abdominal exercises, pelvic floor exercises and general exercises like walking. Group 3 was the experimental group 2 and the girls of this group were given spinal manipulative therapy (high velocity thrust) during the menstrual days on the 3 consecutive days of menstrual cycle and exercise therapy during the rest of whole month. Then subjects of all three groups were assessed after 1 month. Pre intervention and post intervention values of VAS scale, Fatigue scale, Nausea scale and Lumbar range of motion were taken. The data was collected and analyzed.

Table 1: Mean and SD of Age, Height, Weight and BMI for the subjects of Group A, Group B and Group C

Demographic	Group A		Group B		Group C	
	Mean	SD	Mean	SD	Mean	SD
Age	24.00	0.94	23.80	1.13	23.10	1.10
Weight	51.30	4.13	56.30	2.35	56.50	3.89
Height	160.90	4.72	160.40	3.06	160.70	4.90
BMI	20.02	2.14	21.92	1.42	21.88	1.29

Table 2: Comparison of mean value for VAS, Nausea and Fatigue at Pre and Post within Group A, Group B and Group C

Groups	Session	VAS			Nausea			Fatigue		
		Mean	SD	t value	Mean	SD	t value	Mean	SD	t value
Group A	Pre	7.40	0.69	-1.406 (NS)	0.20	0.42	-1.000 (NS)	0.00	0.00	0.000 (NS)
	Post	7.70	0.48		0.30	0.67		0.00	0.00	
Group B	Pre	6.80	0.78	3.000 (S)	0.40	0.84	0.577 (NS)	0.20	0.63	1.000 (NS)
	Post	6.30	1.15		0.30	0.48		0.10	0.31	
Group C	Pre	6.50	0.52	9.303 (S)	0.40	0.69	1.500 (NS)	1.40	2.11	-1.500 (NS)
	Post	4.00	1.15		0.20	0.63		0.80	1.13	

Table 3: Comparison of mean value for Lumbar Flexion, Lumbar Extension and Lumbar Side Flexion at Pre and Post within Group A, Group B and Group C

Groups	Session	Lumbar Flexion			Lumbar Extension			Lumbar Side Flexion		
		Mean	SD	t value	Mean	SD	t value	Mean	SD	t value
Group A	Pre	5.40	2.06	-1.000 (NS)	2.50	0.78	-1.406 (NS)	17.90	5.13	-1.000 (NS)
	Post	5.50	2.06		2.65	0.70		18.10	5.21	
Group B	Pre	5.10	1.52	1.000 (NS)	2.25	0.58	-0.577 (NS)	18.90	3.72	0.000 (NS)
	Post	5.05	1.49		2.30	0.48		18.90	3.72	
Group C	Pre	4.50	1.00	5.161 (S)	1.86	0.80	-3.498 (S)	15.35	3.36	-5.785 (S)
	Post	5.55	0.92		2.41	0.85		17.30	3.94	

Results- Tables and Graphs

Table 1 describes the mean and standard deviation of age, weight, height, and BMI of groups A, B and C.

Table 2 describes the comparison of mean value for VAS, Nausea and Fatigue at Pre and post within group A, B and C. The t- value of VAS for group B is 3.000 which is significant and t- value of VAS for group C is 9.303 which is significant. The t- value of Nausea and Fatigue for group A, B and C are not significant.

Table 3 describes the comparison of mean value for lumbar flexion, lumbar extension and lumbar side flexion at pre and post within group A, B C. The t- value of lumbar range of motion for group C is significant.

Table 4 describes the comparison of mean value for VAS, Nausea and Fatigue at Pre, Post and Mean diff between group A, B and C. The value for VAS pre, post and mean difference is significant. The F- value for Nausea Pre, post and Mean difference is not significant. The F- value for Pre and Post fatigue is significant.

Table 5 explains the post hoc value for VAS, Nausea and Fatigue for Groups A, B and C. The post hoc value of VAS for A Vs B, A Vs C and B Vs C and is significant. The post hoc value of A Vs C and B Vs C for mean difference VAS is significant, the post hoc value for rest all outcome measures is not significant.

Table 6 describes Comparison of mean value for

Lumbar Flexion, Lumbar Extension and Lumbar Side Flexion at Pre, Post and Mean difference between Group A, Group B and Group C. The F- value for mean difference VAS, Nausea and Fatigue is significant.

Table 7 explains the post hoc value for lumbar flexion, lumbar extension and lumbar side flexion for Groups A, B and C. The post hoc value of A Vs C, B Vs C for mean difference lumbar flexion is significant. The post hoc value for mean difference lumbar extension of B Vs C is significant. The post hoc value of A Vs C and B Vs C for mean difference lumbar side flexion is significant.

Findings

Dysmenorrhoea is chronic, cyclic pelvic pain associated with menstruation. As dysmenorrhoea affects approximately 90% of menstruating women, this has the potential to create a significant health and socio-economic issue (Reddish, 2006)⁸. Dysmenorrhoea is of two types primary and secondary. Primary Dysmenorrhoea is defined as cramping pain in the lower abdomen occurring just before menstruation. It is distinguished from secondary dysmenorrhoea, which refers to painful menses resulting from pelvic pathology such as endometriosis. (Andrew, 1999)¹. There are various management strategies available to treat dysmenorrhoea. The common management strategies

Table 4: Comparison of mean value for VAS, Nausea and Fatigue at Pre, Post and Mean diff. (Pre-Post) between Group A, Group B and Group C

Session	VAS Group (A Vs B Vs C)		Nausea Group (A Vs B Vs C)		Fatigue Group (A Vs B Vs C)	
	F value	P value	F value	P value	F value	P value
Pre	4.536	P < 0.05	0.290	P > 0.05	3.518	P < 0.05
Post	35.966	P < 0.05	0.092	P > 0.05	4.104	P < 0.05
MD	42.870	P < 0.05	1.167	P > 0.05	1.824	P > 0.05

Table 5: Post Hoc Analysis of VAS, Nausea and Fatigue

Group Comp.	VAS			Nausea			Fatigue		
	Pre	Post	MD	Pre	Post	MD	Pre	Post	MD
	Mean Diff.	Mean Diff.	Mean Diff.	Mean Diff.	Mean Diff.	Mean Diff.	Mean Diff.	Mean Diff.	Mean Diff.
A Vs B	0.600 NS	1.400 S	-0.800 NS	-0.200 NS	0.000 NS	-0.200 NS	-0.200 NS	-0.100 NS	-0.100 NS
A Vs C	0.900 S	3.700 S	-2.800 S	-0.200 NS	0.100 NS	-0.300 NS	-1.400 NS	-0.800 NS	-0.600 NS
B Vs C	0.300 NS	2.300 S	-2.000 S	0.000 NS	0.100 NS	-0.100 NS	-1.200 NS	-0.700 NS	-0.500 NS

Table 6: Comparison of mean value for Lumbar Flexion, Lumbar Extension and Lumbar Side Flexion at Pre, Post and Mean diff. (Pre-Post) between Group A, Group B and Group C

Session	Lumbar Flexion Group (A Vs B Vs C)		Lumbar Extension Group (A Vs B Vs C)		Lumbar Side Flexion Group (A Vs B Vs C)	
	F value	P value	F value	P value	F value	P value
Pre	0.830	P > 0.05	1.952	P > 0.05	1.951	P > 0.05
Post	0.308	P > 0.05	0.658	P > 0.05	0.339	P > 0.05
MD	19.809	P < 0.05	4.755	P < 0.05	22.476	P < 0.05

Table 7: Post Hoc Analysis of Lumbar Range of Motion

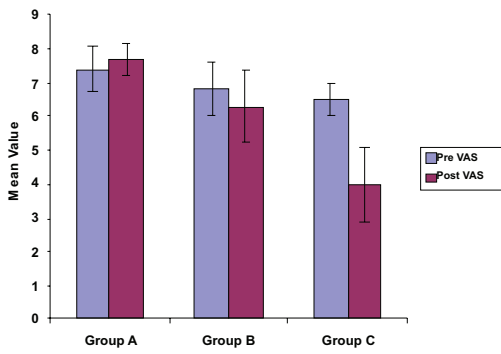
Group Comp.	Lumbar Flexion			Lumbar Extension			Lumbar Side Flexion		
	Pre	Post	MD	Pre	Post	MD	Pre	Post	MD
	Mean Diff.	Mean Diff.	Mean Diff.	Mean Diff.	Mean Diff.	Mean Diff.	Mean Diff.	Mean Diff.	Mean Diff.
A Vs B	0.300 NS	0.450 NS	0.150 NS	0.250 NS	0.350 NS	0.100 NS	-1.000 NS	-0.800 NS	0.200 NS
A Vs C	0.900 NS	-0.050 NS	-0.950 S	0.640 NS	0.240 NS	-0.400 NS	2.550 NS	0.800 NS	-1.750 S
B Vs C	0.600 NS	-0.500 NS	-1.100 S	0.390 NS	-0.110 NS	-0.500 S	3.550 NS	1.600 NS	-1.950 S

are medical management, surgical management and therapeutic management. The present study initiated its research, based on present scenario of therapeutic intervention in Dysmenorrhoea. This theme is also supported by various authors who conducted researches to study the effect of exercise regimen and spinal manipulation in Dysmenorrhoea. Proctor et al, 2004 conducted a study to find the effect of spinal manipulation on dysmenorrhoea. He used VAS scale as the outcome measure for his study. Many studies have also been done to find the effect of exercise regimen on Dysmenorrhoea. The study by Tina Dusek⁴, 2001 discussed about the effect of high intensity exercise training on menstrual cycle disorders in athletes.

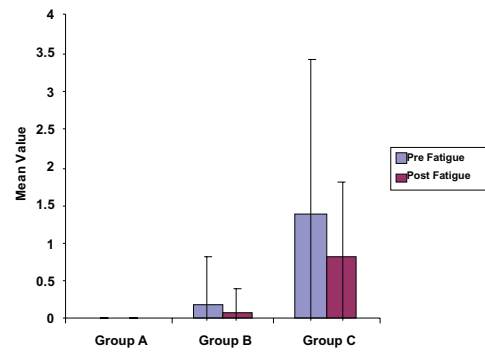
The present study is done to find the effect of Spinal manipulation on Dysmenorrhoea. In this study randomized controlled trial is conducted. A population of 50 subjects is taken out of which 30 subjects are randomly allotted to 3 groups. Group A is the control

group and did not receive any treatment, Group B is the experiment group I which received the exercise regimen for the whole month but not during the menstrual days and Group C is the experimental group II which received the spinal manipulation during the menstrual day 1, 2, 3 and exercise regimen during the rest of the month. The subjects are assessed based on the following outcome measures such as VAS Scale, Fatigue Scale, Nausea Scale and Lumbar range of motion. The data is collected and analyzed using SPSS 16 software and one-way ANOVA and Post hoc Scheffe test are applied. The present study found that Group C is better than Group A and Group B for all the variables. ANOVA test was applied for comparison of Pre-Interval, Post-Interval and Mean Difference (Improvement) between the three groups. Further after, ANOVA was significant Post Hoc Scheffe test is used in order to statistical compare the effectiveness of the treatment protocol used for 3 groups. Going through Scheffe analysis it is revealed that group

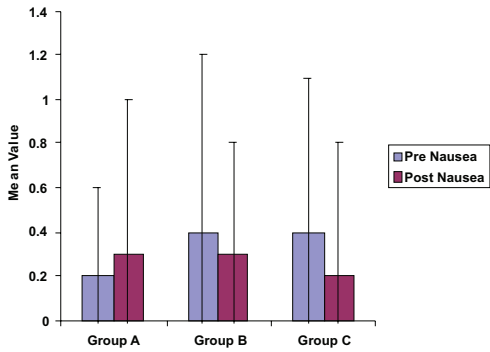
Comparison of mean value for VAS at Pre and Post interval within Group A, B and C



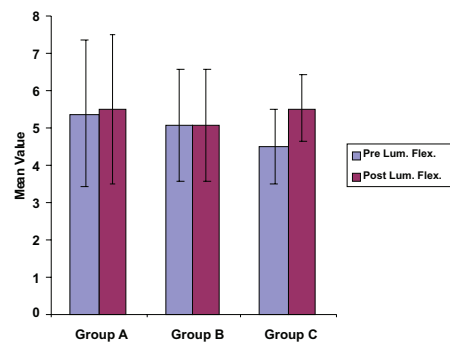
Comparison of mean value for Fatigue at Pre and Post interval within Group A, B and C



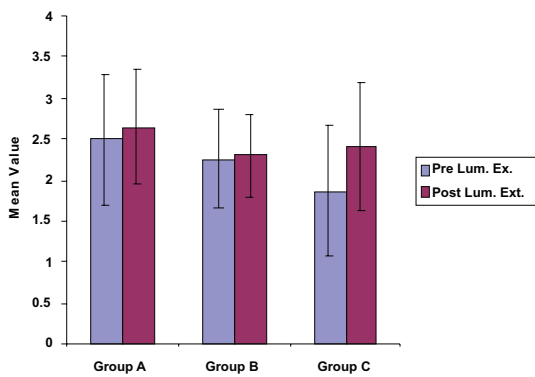
Comparison of mean value for Nausea at Pre and Post interval within Group A, B and C



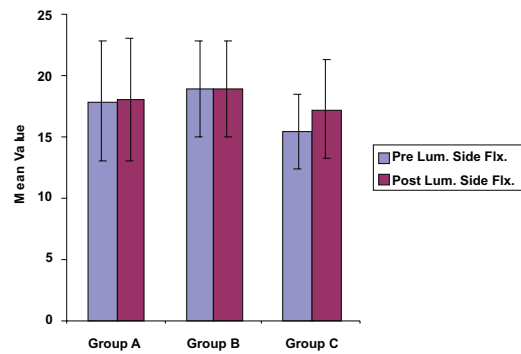
Comparison of mean value for Lumbar Flexion at Pre and Post interval within Group A, B and C



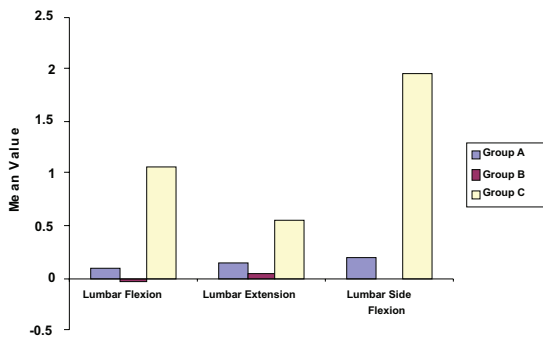
Comparison of mean value for Lumbar Extension at Pre and Post interval within Group A, B and C



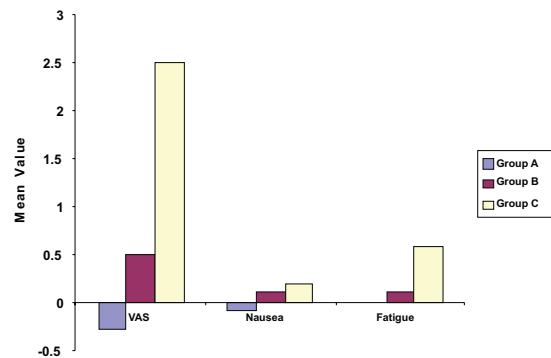
Comparison of mean value for Lumbar Side Flexion at Pre and Post interval within Group A, B and C



Comparison of Improvement for Lumbar Flexion, Lumbar Extension and Lumbar Side Flexion between Group A, Group B and Group C



Comparison of Improvement for VAS, Nausea and Fatigue between Group A, Group B and Group C



C stands out to be statistically significant from Group A and Group C for VAS, lumbar flexion, lumbar extension and lumbar side flexion.

Conclusion

The present study, concluded that efficacy of manipulation is found to be significant in pain as well as increase in range of motion of lumbar spine. The present study also found that exercise protocol has significant effect in pain reduction but it is more efficient when it is combined with spinal manipulation. The present study recommends that regular exercise regimen is more helpful in Dysmenorrhoea. It will help reduce the intake of NSAIDS as well as other intake medicine options. It also recommended that exercise regimen can be added in the normal routine life.

Acknowledgement

I wish to show my gratitude towards Department of Physiotherapy, Punjabi University, Patiala.

Interest of Conflict

The present study was done to find the effect of spinal manipulation in Primary Dysmenorrhoea. Few studies have been done to find the effect of spinal manipulation in Dysmenorrhoea and spinal manipulation alone does

not have considerable effect in Dysmenorrhoea as stated in Cochrane Review.

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Reliability of the six-minute walk test in individuals with transtibial amputation

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Abstract

Objective

To determine inter- and intra-rater reliability of the Six-minute walk test (6MWT) in individuals with Transtibial Amputation.

Design

Prospective; test-retest method by a pair of physical therapists.

Setting

Indoor Physical Therapy department of the National Institute for the Orthopaedically Handicapped (NIOH), Kolkata.

Participants

Twenty one subjects (16 men, 5 women; mean age + mean standard error: 42.95 + 3.02 year) with transtibial amputation, who had completed two weeks of prosthetic training in the Inpatient Rehabilitation set up.

Interventions

Each subject performed a total of four 6MWTs, one test for each rater, on two consecutive days at approximately the same time of day. Subjects were given at least a 20 minutes rest between tests. The order of raters were randomized on the first day and reversed for the next day. The walk tests were performed in the same enclosed corridors with the same starting point for all tests. Subjects were allowed to walk with a mobility aid of their choice. Raters used a digital stopwatch to time the tests and the distance walked was measured in meters with the help of measuring tape. The raters were blinded to each other's scores.

Main Outcome Measure

Distance walked in 6 minutes (in meters).

Results

Within-rater reliability was good, with ICCs ranging from 0.79 to 0.83. Between-rater reliability was also high, with ICCs ranging from 0.81 to 0.88. A 2-way repeated-measures ANOVA showed significant differences ($P < 0.001$) both within raters and between raters. It was seen that the proportion of variation within raters was more for the second rater whereas the proportion of variation between raters were more on the first day i.e day 1 of the test. Regardless of the tester, distances walked on day 2 were greater than on day¹.

Conclusion

Although the 6 MWT showed good evidence of inter and intra rater reliability in individuals with unilateral below knee amputation, the distances walked in 6 minutes continued to improve over time. This improvement was mainly the result of training and learning effect.

Key Words

Amputation; Prosthetic training; Walk test.

Introduction

The ability to walk for a distance is a quick and inexpensive measure of physical function, and an important component of quality of life, since it reflects the capacity to undertake day-to-day activities.¹ The Six

Minute Walk Test (6MWT) has been first introduced as a functional exercise test by Lipkin in 1986 in chronic heart failure patients.² Self-paced 6MWT assesses the submaximal level of functional capacity. In view of the fact that most activities of daily living are performed at submaximal levels of exertion, the 6MWT may better reflect the functional exercise level for daily physical activities.³

Measures of functional performance are of particular importance in lower extremity amputees because rehabilitation goals focus on improving mobility and activity levels.⁴ The Amputee Mobility Predictor (AMP) is a validated assessment tool designed to predict the potential of an amputee to ambulate.⁵ Other outcome measures that have been shown to be more responsive include the Barthel Index, the Rivermead Mobility Index, and the Functional Independence Measure. While these scales were able to measure improvements between the first assessment taken within one month of the original injury and a follow-up assessment three months later, the values obtained at the six- and 12-month follow-ups failed to demonstrate significant improvements. This was due to a ceiling effect as patients reached the maximum performance values within the initial few months of their rehabilitation.⁶

Since the main objective of outcomes assessment is quantifying changes in patient ability and performance, an instrument is required that is sensitive enough to register even small improvements and that will continue to recognize improvements throughout a patient's rehabilitation without encountering a ceiling effect. The simple, timed walking tests appear to be more responsive to patient changes across a broader range of functional ability than several of the more complex and time-consuming outcome indices.⁶

An informal, unpublished, Canadian survey in 1998 of amputee programs reported that the 2-minute walk test was the second most used outcome measure, after the FIM instrument⁷. In 2009, Phil Stevens et al have opined in their study that 6MWT is more commonly found in peer-reviewed investigations. The reliability of this assessment have been verified and reported in populations with SCI, chronic cerebral vascular accident (CVA), traumatic brain injury (TBI)⁶. Hence purpose of the present study was to examine the inter and intra-rater reliability of the 6MWT in individuals with transtibial amputation.

Methods

An informed consent was taken from all subjects before the testing commenced. A total of twenty one individuals with transtibial amputation (16men, 5women) who had completed two weeks of prosthetic training in the rehabilitation ward were recruited. Five of the subjects had undergone amputation on the left lower extremity, and sixteen had undergone amputation on the right side. The majority of the subjects (n=18) required a mobility aid as follows: walker (4) and crutches (14).

Participants

Study inclusion required each individual to be a transtibial amputee, with lower limb prosthesis. All the participants have completed 2 weeks of prosthetic training (to tolerate 6 minutes of walking) with no prosthetic modifications planned and have no other medical restrictions preventing them from participating in the test. Subjects were excluded if they were cognitively impaired or unable to give consent, poorly motivated to co-operate with the procedure, or unable to participate on two consecutive days.

Study Protocol³

The walk tests were performed in an enclosed corridor. The same corridor was used for each test. The corridor was a level ground, relatively free from distractions, and longer than 40m. The walking course was 30 m in length³. The starting point was the same for all tests and was clearly marked. The subjects were instructed to walk as far as they could in 6 minutes. Subjects were allowed to walk with a mobility aid of their choice and were given a rolling start of 2 or 3 steps. No talking was permitted by raters or subjects during the tests. Raters used a digital stopwatch to time each test and the distance walked was measured using measuring tape in meters. The raters were blinded to each other's score.

Statistical Analysis

Reliability was determined by calculating the intra class correlation (ICC). The ICC provides a measure for evaluating reliability because it takes into account both the between and within-subjects components of variance as well as the heterogeneity of the sample⁸. Values greater than 0.60 were considered to be an acceptable reliability^{9,10}. The consistency of the test was examined over time by repeated-measures 2-way analysis of variance (ANOVA) to determine the difference over the 2 days and between therapists. A regression analysis was used to know the proportion of variation in the values.

Results

The characteristics of the subjects in the total sample are in table 1.

The mean age of the sample (N=21) were 42.95 + 3.02 as the mean standard error (SE). Out of the 21 amputees, majority were males (n=16) with the right

Table 1: Subject characteristics and total sample

Subject characteristics			Total sample	
N			21	
Age (y) + SE			42.95 + 3.02	
Gender	Male	Female	16	5
Side involved	Right	Left	16	5

extremity most commonly involved (n=16). Table 2 portrays the mean distance walked on the 2 days for the 2 raters. Within-rater reliability was good, with ICCs ranging from 0.79 to 0.83. Between-rater reliability was also high, with ICCs ranging from 0.81 to 0.88. Figure 1 shows the changes in the distance walked for tests 1 and 2 (on day 1) and tests 3 and 4 (on day 2).

Table 2: Distance Walked in 2 Minutes and Inter- and Intra rater Reliability (ICCs) of 2 Raters Recording 6MWTs (m) of Transtibial Amputees on 2 Days

	Rater 1	Rater 2	Inter class correlation
Day 1	226.64 + 13.50	241.31 + 10.87	0.88
Day 2	242.33 + 11.80	247.31 + 12.13	0.81
Intra class correlation	0.79	0.83	

A 2-way repeated-measures ANOVA showed significant differences (P<0.001) both within raters and between raters. After adjusting for the squares of the regression co-efficients (R²), it was seen that the proportion of variation within raters was more for the second rater whereas the proportion of variation between raters were more on the first day i.e day 1 of the test. Regardless of the tester, distances walked on day 2 were greater than on day 1(fig 1).

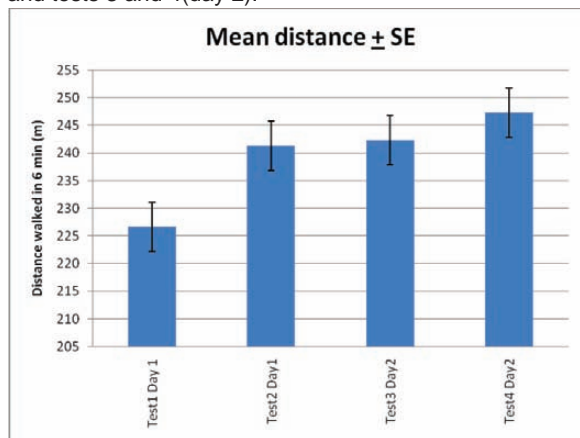
Discussion

Reliability is a fundamental measurement property that is relatively easy to determine. It is quantified in terms of degree of consistency and repeatability when properly administered under similar circumstances¹¹. Clinically, this property is important because it allows the clinician to determine the amount of noise or random error in the tool.¹²

The present study showed that the 6MWT exhibits good within- and between-rater reliability in individuals with transtibial amputation. However, the distance walked in 6 minutes was not constant over time, but increased over the 2 days of testing in these individuals. This improvement was statistically significant (p<0.00). One possible explanation is that subjects experienced training or learning effect. This finding is also supported by the study of Guyatt et al which established the presence of learning and training effect by performing 6 repeated tests on the 2-minute walk¹³.

Furthermore, training and learning effects with repeated testing also have been identified in the study on the 6-minute walk test by Solway S et al in 2001¹⁴. This justifies the finding that the proportions of variation within

Figure 1: Changes in the distance walked for tests 1 and 2(day 1) and tests 3 and 4(day 2).



raters were more for the second rater as compared to the first rater.

Another finding of this present study showed that the proportion of variation between raters were more on the first day as compared to the second day. According to this finding, the distance walked on the first day improved in the second attempt (rater 2) as compared to the first attempt (rater 1). In the second day, this difference was much reduced. These results were similar to the study by Guyatt et al in 1984 which showed that 6MWT distances could improve by 60m after 3 repeated walk tests in individuals with COPD. However, this effect was attenuated by the third test.¹³ Again Guyatt et al in their study in 1985 stated that the distance walked improved on the first 2 walks compared with the last 4 walks in adults with chronic airflow limitation or chronic heart failure or both¹⁵.

Other factors that may have contributed to the improvement over time may be that the same corridor and starting point were used for all tests. This continued improvement supports the notion of a potential effect of memory and the individual desire to show improved performance.

Repeated walking as performed during the tests may be therapeutic, and therefore the changes may reflect a treatment effect of the test itself.

One limitation of this study was that the number of days since amputation of an individual was not taken into account. The walking capacity of a recent amputee may be supposed to be much less than a person who had undergone amputation long back. Most other studies evaluating the 6MWT have evaluated different populations. McDowell and Newell highlighted that reliability is population specific¹⁶. Hence the continuous improvement seen in our present study reflects the specific activity limitations of individuals recovering from lower-extremity amputation and further research on the learning effect in this population is needed. Further validation of the 6MWT in these individuals should be undertaken, including different time frames for testing, comparisons with other measures of functional mobility (eg, the timed-up-and go), balance tests, and formal gait analysis.

Conclusion

The 6 MWT is practical, simple, quick, and easy to administer. In the present prospective study, good evidence of inter- and intra rater reliability of the 6MWT was found for persons with unilateral below-knee amputation. However, the distance walked in 6 minutes was not constant, and it improved over time. The improvement was the result of training and learning effect and appeared to plateau with repetition.

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Evaluation of thumb pain and lumbrical grip of post graduate physiotherapist practising Maitland's mobilisation

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Abstract

Present study deals with the difference between thumb pain and hand grip of postgraduate students performing two way Maitland's mobilisation. The test was performed on two groups A and B. In group A, mobilisation was performed with the thumbs not supported with index fingers, MCP joints touching and thumbs not overlapping and in group B, mobilisations was performed with thumbs not supported with index fingers, MCP joints not touching, thumbs overlapping. Maitland's mobilisation grade 2 with 45 oscillations was performed daily with the time duration of 15 minutes for 20 days continuously.

It has been observed that the thumb pain was increased as a result of daily practicing Maitland's mobilisation as compared to lumbrical grip strength. It showed that the lumbrical grip was equally reduced in both group A and group B as compared on 0th, 10th and 20th day but the thumb pain was statically significantly increased in group A as compared to B group.

Key Words

Maitland's Mobilisation, MCP, Thumb Position, Thumb Pain.

Introduction

Gerard Buckingham, Rebekah Das and Patricia Trott in (2007) conducted a study on position of undergraduate students thumbs during mobilisation is poor: an observational study. They included eleven physiotherapy educators and 25 physiotherapy 4th year students and concluded that this study has occupational health and safety implications for physiotherapy students. Smart K, Doody C (2007) conducted a study on the clinical reasoning of pain by experienced by musculoskeletal physiotherapists. They found out 5 main categories of pain based clinical reasoning which were Biomedical, Psychosocial, Pain mechanism, Chronicity, Irritability/Severity. But, still there is currently no research within physiotherapy to explain the extent to which current theories and models of pain influence clinician's reasoning related to clinical presentation of pain. Margaret Mc Mohan, Kathy Stiller and Pat Trott (2006) in the study of prevalence of thumb problems in Australian physiotherapist took consent of 1562 (approximately 10% of total) registered physiotherapists and concluded that thumb problem in Australian physiotherapist appears to be high and can be of sufficient severity to impact on careers. Susanne J.Sondgrass, Darren A. Rivett and Val J. Robertson in (2006) conducted a study on Manual forces applied during posterior to anterior spinal mobilization. The objective of the study was to evaluate the evidence of consistency of force application by manual therapists when carrying out posterior – anterior

mobilisation techniques and concluded that techniques most commonly responsible for aggravation of symptoms were unilateral (87%) and central posteroanterior glides (85%). Most subjects (74%) changed their choice of treatment techniques to alleviate symptoms. Wajon A, Ada L, Refshauge K in (2006) conducted a study on work related thumb pain in physiotherapists is associated with thumb alignment during performance of PA pressure. This study was performed with a purpose to investigate whether there is an association between the alignment of thumb during performance of posteroanterior pressures and presence of thumb pain and concluded that there was an association between work related thumb pain and alignment of the thumb during performance of PA pressure participants who were able to maintain their MP and IP joints in extension were less likely to report pain. Wajon, Anne in (2005) worked on prevention and management of Trapeziometacarpal joint pain with an aim to examine factors associated with prevention and management of Trapeziometacarpal osteoarthritis both in musculoskeletal physiotherapist and general patient population. They identified that 83% of respondents complained of an aggravation of thumb pain due to performance of spinal manipulative therapy techniques, with 85-87% of painful respondents complaining of thumb pain aggravated by unilateral and central PA glides and suggested that musculoskeletal physiotherapists should be taught to perform these techniques with their thumbs in extension in an effort to reduce work related thumb pain.

Winzeler S, Rosensyein BD in (2005) performed a study on the occupational injury and illness of the thumb: causes and solutions and this study revealed that repetitive and forceful thumb movements can aggravate or cause de Quervain's tenosynovitis stenosing tenosynovitis and carpometacarpal joint arthritis as the thumb accounts for 50% of overall hand use and ergonomics solutions to decrease thumb motions and forceful thumb pressures should be suggested. Hurley DA, Mc Donough SM, Baxter GD, Dampster M, Moore AP in (2005) conducted a study of usage of spinal manipulative therapy techniques within a randomized clinical trial in acute low back ache with a purpose to describe the spinal manipulative therapy technique utilized within a RCT of manipulative therapy, interferential therapy and a combination of both for people with acute low back pain. Spinal manipulative therapy was defined as any mobilisation or manipulation

techniques of spine described by Maitland and Cyriax and found that use of manipulation technique was considerably higher. Warreb Glover Alison McGergor, Claire Sullivan and Jan Hague in (2005) conducted a study on work related musculoskeletal disorders affecting members of the chartered society of physiotherapy with a aim to quantify the manual forces applied to the cervical spine during joint mobilisation. The study included 10 physiotherapists who performed posterior to anterior mobilisations to C2 and C7 on a single asymptomatic male subject and found that there were considerable differences between therapists for mean peak force, force amplitude and oscillation frequency for each technique. Susanne J.Sondgrass, Darren A. Rivett, Pauline Chiarelli, Angela M.Bates et.all in (2003) done a study on factors related to thumb pain in Physiotherapists and included 24 physiotherapists with work related thumb pain (pain group) and 20 physiotherapists without thumb pain (non-pain group) who were working atleast for 20 hours per week in out patient musculoskeletal setting were compared on number of factors such as hand and thumb strength, height, hand position etc. found that work related thumb pain affects physiotherapists ability to administer manual treatments and suggest that decreased stability and strength of thumb may be associated with work related thumb pain. Jean E Cromie, Valma J Robertson, Margaret O Best in (2000) in their study on work-related musculoskeletal disorders in physical therapists: prevalence, severity, risks and responses included 8 page questionnaire and found that lifetime prevalence of work related musculoskeletal disorders was 91% and 1 in 6 physical therapists moved within or left the profession as a result of work related musculoskeletal disorders and younger therapists reported higher prevalence of thumb symptoms. Many physiotherapist suffer from thumb pain after Maitland's mobilisation so, this study has been performed to analyze the results of Maitland's mobilisation on two groups.

Material and Methods

Study Design was Quasi Experimental Design (pre test post test design), Study Setting was Lovely school of applied medical sciences, LPU and the Population of the Study included all postgraduate students of Lovely Professional University practicing mobilization.

The Hand held dynamometer is used to measure the lumbrical grip strength and the Numeric Pain Rating Scale (NPRS) is used for measuring the pain of the physiotherapist who were performing Maitland's mobilisation.

Technique of Data Collection

Signed informed consent was obtained from all the subjects. Subjects were placed in respective experimental group A and B by randomization. Before starting with the mobilisation techniques the 0th day was considered as practice session for both group A and group B. The

subjects included in group A performed mobilisation with the thumbs not supported with index fingers, MCP joints touching and thumbs not overlapping. The subjects included in group B performed mobilisations with thumbs not supported with index fingers, MCP joints not touching, thumbs overlapping. The mobilisation was performed on models. The subjects were positioned prone on the treatment couch for the therapist to perform mobilisation on L3, L4, and L5 lumbar segment alternatively. The therapist performed mobilisation in standing position with the foot rest under his feets so as to maintain his elbows in extension with shoulder joint flexed to approximately 10 degree. The therapist performed Maitland's mobilisation grade 2 with 45 osscitations on different spinal segments with rest time of 5 second after each 45 oscillatory session. The time of oscillations performed was between 28 – 30 seconds which varied from therapist to therapist. The lumbar spine on which mobilisation is performed is exposed. The mobilisations was performed daily with the time duration of 15 minutes for 20 days continuously. The therapist were assessed for thumb pain and lumbrical grip on 0th, 10th and 20th day.

Technique of Data Analysis and Interpretation

Statistics were performed by using SPSS¹¹. Results were calculated by using 0.05 level of significance.

Using statistical formula for the mean, for a given number of subjects, mean of different variables were calculated by -:

$$\bar{X} = \frac{\sum X}{N}$$

Where, N = Number of subjects

X = each subjects value

STANDARD DEVIATION (σ)

$$s = \sqrt{\frac{\sum X^2}{N}}$$

x = deviation of score from mean

N = Number of subjects

t- test of independent means

$$t = \frac{M_1 - M_2}{S_{DM}}$$

$$S_{DM} = \sqrt{\left[\frac{(N_1 - 1)(s_1^2) + (N_2 - 1)(s_2^2)}{N_1 + N_2 - 2} \right] \left[\frac{1}{N_1} + \frac{1}{N_2} \right]}$$

$$s = \sqrt{\frac{\sum X^2}{N}}$$

$$df = N_1 + N_2 - 2$$

Where:

M = mean, SDM = standard error of the difference between means

N = number of subjects in group, s = standard deviation of group

df = degrees of freedom

t- test of dependent means

$$t = \frac{M_1 - M_2}{S_{DM}}$$

$$S_{DM} = \sqrt{\left[\frac{(N_1 - 1)(s_1^2) + (N_2 - 1)(s_2^2)}{N_1 + N_2 - 2} \right] \left[\frac{1}{N_1} + \frac{1}{N_2} \right]}$$

$$s = \sqrt{\frac{\sum X^2}{N}}$$

$$df = N_1 + N_2 - 2$$

Where:

SMD = Standard deviation of the mean difference

D = difference between a pair of means

M = mean

Results and Discussion

Table 1 shows the distribution of mean values and standard deviation of NPRS of therapists on 0th, 10th and 20th day. There is a trend of steady increase in pain in group A and group B. The mean values and standard deviation values of Group A on 0th are 0.00 and 0.00, on 10th day are 2.4 and 0.51, on 20th day are 4.0 and 0.66. Whereas the mean and standard deviation values of Group B on 0th day are 0.00 and 0.00, on 10th day are 2.1 and 0.31, on 20th day are 3.2 and 0.42.

Table 1: Mean and Standard deviation of NPRS at 0, 10th and 20th day for Group A and Group B

Variables	Group A		Group B	
	Mean	SD	Mean	SD
NPRS 0 Day	0.00	0.00	0.00	0.00
NPRS 10th Day	2.4	0.51	2.1	0.31
NPRS 20th Day	4.0	0.66	3.2	0.42

The inter-group comparisons (t – value) for NPRS of therapists on 0th, 10th and 20th day are given in table 2. Highly significant difference (P < 0.05) were noted in both group A and group B. NPRS when compared between (0 vs 10th day) of Group A was found to be t = -14.69, NPRS (0 vs 20th day) t = -18.97, NPRS (10th vs 20th day) t = -9.79. Whereas NPRS when compared between (0 vs 10th day) of Group B t = -21.00, NPRS (0 vs 20th day) t = -24.00, NPRS (10th vs 20th day) t = -11.00.

Table 3 exhibits the distribution of mean values and standard deviation of Lumbrical Grip Strength (LGS) of the therapists on 0th, 10th and 20th day. For LGS also a trend of gradual increment is observed in both the group A and B. The mean values and standard deviation values of Group A on 0th day are 15.8 and 3.76, on 10th day are 8.20 and 2.44, on 20th day are 6.60 and 2.11. Whereas

Table 2: Comparison of mean values of NPRS at 0, 10th and 20th day for Group A and Group B

Variables	Group A		Group B	
	t value	P value	t value	P value
NPRS (0 Vs 10 th) Day	-14.69	P < 0.05	-21.00	P < 0.05
NPRS (0 Vs 20 th) Day	-18.97	P < 0.05	-24.00	P < 0.05
NPRS (10 Vs 20 th) Day	-9.79	P < 0.05	-11.00	P < 0.05

the mean and standard deviation values of Group B on 0th day are 17.00 and 4.76, on 10th day are 11.00 and 3.26, on 20th day are 8.80 and 1.75.

Table 3: Mean and Standard deviation of LGS at 0, 10th and 20th day for Group A and Group B

Variables	Group A		Group B	
	Mean	SD	Mean	SD
LGS 0 Day	15.8	3.76	17.00	4.76
LGS 10th Day	8.20	2.44	11.00	3.26
LGS 20th Day	6.60	2.11	8.80	1.75

Inter-group comparisons for LGS are given in table 4. Highly significant differences (P < 0.05) were noted in both group A and group B. LGS when compared between (0 vs 10th day) of Group A was found to be t = 6.04, LGS (0 vs 20th day) t = 8.04, LGS (10th vs 20th day) t = 2.66. Whereas LGS when compared between (0 vs 10th day) of Group B were found to be t = 5.63, LGS (0 vs 20th day) t = 6.31, LGS (10th vs 20th day) t = 2.61.

Table 4: Comparison of mean values of LGS at 0, 10th and 20th day for Group A and Group B

Variables	Group A		Group B	
	t value	P value	t value	P value
LGS (0 Vs 10th) Day	6.04	P < 0.05	5.63	P < 0.05
LGS (0 Vs 20th) Day	8.04	P < 0.05	6.31	P < 0.05
LGS (10 Vs 20th) Day	2.66	P < 0.05	2.61	P < 0.05

Table 5 highlights the distribution of comparisons of mean values for NPRS and LGS as on (0 vs 10 vs 20 day) within group A and Group B. Highly significant differences were noted in both A and B groups (P < 0.05). NPRS when compared between (0 vs 10 vs 20 day) of Group A was found to be F = 171.00 and LGS when compared between (0 vs 10 vs 20 day) F = 29.43. Whereas NPRS when compared between (0 vs 10 vs 20 day) of Group B was found to be F = 285.00 and LGS when compared between (0 vs 10 vs 20 day) F = 14.84.

Table 5: Comparison of mean values for NPRS (0 Vs 10 Vs 20) and LGS (0 Vs 10 Vs 20) day within Group A and Group B

Group	NPRS (0 Vs 10 Vs 20)		LGS (0 Vs 10 Vs 20)	
	F Value	P value	F Value	P value
Group A	171.00	P < 0.05	29.43	P < 0.05
Group B	285.00	P < 0.05	14.84	P < 0.05

Table 6 shows the mean difference and standard deviation of NPRS and LGS for Group A and Group B (20th – 0day). For Group A NPRS (20th – 0 day) mean and standard deviation values are 4.00 and 0.66 whereas the LGS values are 9.00 and 3.55. In Group B NPRS (20th – 0 day) mean and standard deviation values are 3.20 and 0.42 whereas the LGS values are 8.20 and 4.10.

Table 6: Mean diff. (20th – 0) day and Standard deviation of NPRS and LGS for Group A and Group B

Variables	Group A		Group B	
	Mean	SD	Mean	SD
NPRS (20th – 0 day)	4.00	0.66	3.20	0.42
LGS (20th – 0 day)	9.00	3.55	8.20	4.10

Table 7 shows comparison of mean values for NPRS and LGS at 0 day between the group A and B. It shows that there is no significant difference between age and NPRS and LGS of the therapist at 0th day ($P > 0.05$). For age the $t = -0.983$. The NPRS at 0th day was found to be $t = 0.00$ and LGS value at 0th day was found to be $t = -0.625$.

Table 7: Comparison of mean values for NPRS and LGS at 0 day between Group A and Group B

Variables	Group A Vs Group B	
	t value	P Value
Age	-0.983	$P > 0.05$
NPRS 0 day	0.00	$P > 0.05$
LGS 0 day	-0.625	$P > 0.05$

Intra-group comparisons for mean difference values of NPRS and LGS between group A and group B are given in table 8. Highly significant difference was noted between the NPRS of group A and Group B ($P < 0.05$). The NPRS on (20th – 0 day) for group A and B is $t = 3.20$ and whereas there was a non-significant difference between the LGS of both groups A and B ($P > 0.05$). The LGS on (20th – 0 day) for group A and B is $t = 0.466$.

Table 8: Comparison of mean diff. (20th – 0) day values for NPRS and LGS between Group A and Group B

Variables	Group A Vs Group B	
	t value	P value
NPRS (20th – 0 day)	3.20	$P < 0.05$
LGS (20th – 0 day)	0.466	$P > 0.05$

Decrease in the Lumbrical strength manifested by increase in the thumb pain is virtually the most obvious expression of biomechanical overload. This study was designed to find out if there lies any difference between the thumb pain and hand grip of postgraduate physiotherapist performing two way Maitland mobilisation. The purpose of study was to prevent work related thumb injuries of physiotherapists who regularly perform Maitland's mobilisation for treating their patients in and out of the department.

In table 1 a trend of steady increase in the pain of the therapist was noted on 0th, 10th, 20th day. Highly significant difference was found in the thumb pain of both groups A and group B.

In table 3, steady increment in the lumbrical strength was noticed in both A and B groups. Once again, significant difference was found in group A and B as noticed on 0th, 10th and 20th day. From this study, it is noticed that as the pin level increases the lumbrical grip strength also decreases.

In table 5 the mean values for NPRS and LGS of group A and B were compared (0 vs 10th vs 20th day). It was found that there is a highly significant difference in these groups regarding the pain and lumbrical grip strength.

The table 7 showed the comparison of mean values for NPRS and LGS at 0 day between the group A and B. It shows that there is no significant difference between age and NPRS and LGS of the therapist at 0th day.

In the table 8 intra-group comparisons for mean difference values of NPRS and LGS between group A and group B are given. Highly significant difference was noted between the NPRS of group A and Group B whereas a non-significant difference between the LGS of both groups A and B was noticed. The previous study conducted by Gerard Buckingham support these results of group A that the increase in pain is due to biomechanical factor. The therapist is unable to maintain the stable position of metacarpophalangeal and Interphalangeal joints. In these studies out of 25 participants only two are able to maintain the position.

In group A thumb pain threshold level was statically significantly increased as compared to group B and the lumbrical grip strength showed non significant increase. In the previous done by Cromie J.E found that young graduate physiotherapists reported thumb problems. Whether it is increased laxity due to the use of thumbs for massage and mobilisation or just poor technique, students could potentially be at risk of long term injury due to inability to maintain recommended position of their thumbs during posteroanterior techniques.

This study showed that the therapists who perform mobilisation in a position that the thumbs are not supported with index fingers, MCP joints not touching and thumbs overlapping as in Group B have significantly less pain. It appears from the result of the study that thumb pain threshold level increased significantly in group A but the lumbrical grip strength showed a non significant difference.

In the previous study done by Suzzane J. Sondgrass supports our result that therapist with thumb pain has generalized joint laxity, reduced hand and thumb strength. Physiotherapists with work related thumb pain tended to report low severity but a high frequency of pain. According to them hand strength was greater in non pain group as compared to pain group and the pain group had increased mobility at the CMC joint of dominant hand.

Whereas, in group B thumb pain threshold level was less increased as compared to group A and there was non significant difference between the lumbrical grip strength.

In the study done by Wajon A support the results of group B that there was an association between work related thumb pain and alignment of the thumb during performance of posteroanterior pressures. According to them participants who were able to maintain their MP and IP joints in extension were less likely to report pain.

Conclusion

The study shows that the thumb pain was increased

as a result of daily practicing Maitland's mobilisation as compared to lumbrical grip strength. It showed that the lumbrical grip was equally reduced in both group A and group B as compared on 0th, 10th and 20th day but the thumb pain was statically significantly increased in group A as compared to B group.

Although intergroup comparison showed that there was a significant difference between the thumb pain and lumbrical grip as assessed on 0,10th and 20th day. But intra group comparison (between group A and group B) showed that that there was a statistically significant increase in the thumb pain($P < 0.05$) and lumbrical grip did not showed any statistically significant change($P > 0.05$). The thumb pain threshold was raised immediately after the 10th day in group A and group B along with decrease in lumbrical grip strength which was not significant when compared of group A and B.

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Effect of different body positions on manual dexterity in clinical nurses

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Abstract

Objective

The main objective of this study was to determine the effect of posture on psychomotor efficiency using Purdue Pegboard Test (PPT) and to compare the effect of different postures on psychomotor efficiency using Purdue Pegboard Test (PPT).

Design of Study

A prospective non randomized comparative study design.

Participants

Healthy nurses in age group of 20-40 years.

Main outcome Measures

Manual dexterity was tested using Purdue Pegboard Test.

Results

The result showed a better dexterity in sitting position in all the four tasks (mean and standard deviation of RHT was 18.50 ± 1.872 ; for LHT it was 16.52 ± 1.772 ; for BHT it was 14.29 ± 1.415 , for AT it was 39.00 ± 6.176), comparatively lesser in standing (mean and standard deviation of RHT was 17.73 ± 1.830 ; for LHT it was 15.82 ± 1.684 , for BHT it was 13.64 ± 1.621 ; and for AT it was 36.38 ± 8.006) while least in waist bent position (mean and standard deviation of RHT was 16.70 ± 1.761 , for LHT it was 15.16 ± 2.131 ; for BHT it was 12.71 ± 1.784 ; and for AT it was 33.57 ± 8.381). Similar results were seen for the comfort level of the positions with sitting as most comfortable and easy while waist bent position was most painful with least comfort and easy level.

Conclusion

The result of this study shows dexterity is strongly related with posture and its comfort ability. Change in posture produces a change in dexterity in a significant manner. Positions such as waist bent are both uncomfortable as well as provide less dexterity whereas sitting positions proves to be comfortable as well as imparts better dexterity. Thus sitting position should be considered as the preferred position wherever possible by the clinical nurses, so as to improve dexterity and perform functions skillfully.

Key Words

Hand function; Dexterity; nurse; posture; Purdue Pegboard Test.

Introduction

The human hand is a miraculous instrument that serves us extremely well in multitude of ways¹. The hand is not only a motor organ but also a very sensitive and accurate sensory receptor, which provides feedback information essential for its own performance. Manual dexterity can be defined as the readiness and grace in physical activity; skill and ease in using the hands; expertness in manual acts.

The work of nurses has always been complex and varied, demanding a combination of practical skill and manual dexterity². Nursing personnel need manual dexterity because they must be adept at handling

hypodermic needles, catheters, hemostats (clamps), and other small instruments and tools³.

Purdue Pegboard measures 2 types of dexterity one involving gross movement of hands, fingers, & arm; and other fingertip dexterity.⁴ The test consists of picking up small steel pegs from a well in the pegboard and placing them sequentially in 10 holes as quickly as possible.⁵

In ergonomics, handgrip has been perceived as one of the most important hand functions; however, other types of functions of the hand are also important to the ergonomist, such as finger and manual dexterity, on which few ergonomic studies have been done.⁶

Nurses perform skills that require a high level of manual dexterity and coordination, such as injections, putting intravenous fluids, catheters and changing dressings. These skills are needed to be performed by them in different body postures. Being a part of health care team it is our duty to coordinate with other members of the team to provide total health care to the patient.

There are insufficient studies that determined the effect of various postures on manual dexterity in clinical nurses.

The aim of this study was to study the effect of position on psychometric performance in terms of dexterity in clinical nurses.

Material and Methods

Subjects: The participants in this study were healthy nurses in age group between 20-40 years.

Inclusion criteria

- Clinical Nurses
- Age Group of 20-40 years
- Females
- Non Alcoholic
- Ability to follow instructions
- Informed Consent

Patient with Long-Sightedness (Can see far off objects but unable to see nearby objects), males, alcoholic, amputees, Subjects who had suffered recent fractures in upper limbs, any other major disease affecting psychomotor efficiency, any injury preventing the subject from performing the test, subjects who were unable to follow instructions were excluded from the study.

The study employed a prospective non randomized comparative study design

Outcome measures

The dexterity was assessed by Purdue pegboard test in different positions.

Purdue pegboard test is said to be the reliable and valid test to evaluate dexterity^{7,8}.

Method

Considering the inclusion and exclusion criteria, 100 subjects were included in the study. Informed consent was obtained prior to conducting tests from each subject. The study was in a single group form that is all subjects in the study underwent the same tests.

Each subject was instructed to complete a demographic questionnaire that included questions about handedness, medications, and chronic diseases that might influence the interpretation of the Purdue Pegboard Test.

Each subject was instructed to maintain a particular position for 60 seconds considered as warm up following which the subject was instructed to insert pegs in to the pegboard holes first only with the dominant hand, then with the non dominant hand, followed by both hands simultaneously and then assembly task using both hands simultaneously to complete an assembly of pins, washers and collars.

The position of the peg board was front of the subjects at a height that allows their forearms to be parallel to the floor in a given position.

The score was the maximum number of pegs inserted into the holes of Purdue pegboard in 30 seconds for dominant, non dominant and both hand task, and 60 seconds for assembly task.

Three different positions which are commonly needed by a nurse to carry out tasks such as standing with waist bent, standing erect, and sitting straight were tested for the Purdue Pegboard Test scores. The positions were chosen randomly by flipping a coin.

Purdue Pegboard Test

The Purdue Pegboard was directly in front of the subject with row of cups at far end of board. The extreme right hand & extreme left hand cup contained 25 pins in each. Cup immediately to right of centre contained 20 collars & cup immediately left to center contained 40 washers.

The subjects were explained for the procedure as follows:

This is a test to see how quickly & accurately you can work with your hands. Before you begin each part of test you will be told what to do then you will have an opportunity to practice 3 times. Be sure you understand exactly what to do.

- 1) Right hand: Instructions: Pick up one pin at a time with your right hand from right hand cup. Starting with top hole, place each pin in right hand row. If during testing you drop a pin do not stop to pick it up. Simply continue by picking another pin out of cup. This is to be done for 30 seconds. Now you do 3 trials for practice. At the end of exactly 30 seconds the subject was asked to stop. The numbers of pins inserted were counted which depicted the right hand score.
- 2) Left hand: Instructions were given to the subject similar to that given for Right hand subtest.
- 3) Both hands: Instructions were given to the subject

similar to that given for Right hand subtest to perform this subtest with both hands.

- 4) Assembly: Sequence consists of assembling pins, collars, & washers. Instructions: Pick up one pin from right hand cup with your right hand. And while you are placing it in top hole in right hand row, pick up a washer with your left hand. As soon as pin has been placed, drop the washer over the pin, while the washer is being placed over the pin by left hand pick up a collar with your right hand, while collar is being dropped over the pin pick up another washer with left hand & drop it over the collar. This completes first assembly consisting of pin, washer, collar, washer, while final washer for first assembly is being placed with your left hand start second assembly by picking up another pin with your right hand, place it in next hole, drop the washer over it with left hand & so on completing another assembly till 1 min., three trials for practice were given. After practice subject was asked to return the components to proper cup & then told: When I say "begin" place as many assemblies as you can, beginning with top right hand hole. Work as rapidly as you can until I say stop. Are you ready, and begin. At the end of exactly 1 min the subject was asked to stop. The numbers of part assembled were recorded giving the score for assembly.

Scoring

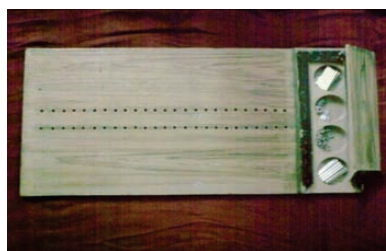
- 1) For right & left hand each properly inserted pin is equal to 1 point.
- 2) For both hands each pair of pin properly inserted is equal to 1 point.
- 3) Each assembly is 4 points. If in 1 min. subject completes 13 complete assembly & pin & first washer of 14th assembly are properly placed. The score is $13 \times 4 + 2 = 54$ points.

Positions

Three different positions were evaluated: standing bent forward at the waist, standing erect and sitting straight. Subjects were put into the 3 positions and were told to stay still for 60 seconds before doing the PPT.

For the waist bent position, subjects were asked to bend forward from the waist so that their backs were >20 degrees from erect. The work surface was low, resulting in a situation in which the forearms usually sloped down to the surface.

For the seated position, they sat in an erect posture in a sturdy metal chair that had a padded seat and back. The chair was placed close enough to the table that the subject could reach the pegboard easily. The table height was adjusted to be at a height of 30" or should have the



comfortable with mean and standard deviation as 4.31 ± 0.825 and 4.06 ± 0.802 and least painful with mean and standard deviation of 2.60 ± 0.791 . Waist bent position was most painful with mean and standard deviation of 3.93 ± 1.094 .

The results of the present study are consistent with a previous study conducted by Charles Buffington et al who reported that manual dexterity is best when subjects are seated in a comfortable position. They conducted the study on anesthesia providers and suggested that a similar effect of posture on manual dexterity might be found on other populations¹³.

The present study hypothesized that there would be a significant difference in Purdue Pegboard Test scores in different positions among the nurses populations. The scores obtained with the dexterity test were strongly correlated with the posture in clinical nurses.

The study also tried to provide a position that imparts maximum dexterity for the functions to be performed skillfully as well as is comfortable for the clinical nurses.

Based on the statistical analysis, the nurses showed a better dexterity in sitting position in all the four tasks (mean and standard deviation of RHT was 18.50 ± 1.872 ; for LHT it was 16.52 ± 1.772 ; for BHT it was 14.29 ± 1.415 , for AT it was 39.00 ± 6.176), comparatively lesser in standing (mean and standard deviation of RHT was 17.73 ± 1.830 ; for LHT it was 15.82 ± 1.684 , for BHT it was 13.64 ± 1.621 ; and for AT it was 36.38 ± 8.006) while least in waist bent position (mean and standard deviation of RHT was 16.70 ± 1.761 , for LHT it was 15.16 ± 2.131 ; for BHT it was 12.71 ± 1.784 ; and for AT it was 33.57 ± 8.381). Similar results were seen for the comfort level of the positions with sitting as most comfortable and easy while waist bent position was most painful with least comfort and easy level.

Therefore the study rejects the null hypothesis and accepts the alternate hypothesis.

Conclusion

Thus, it can be concluded that dexterity is better in sitting position than standing or waist bent position in clinical nurses. Positions such as waist bent are both uncomfortable as well as provide less dexterity whereas sitting positions proves to be comfortable as well as imparts dexterity.

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Comparative study of spinal cord independence measure scale versus functional independence measure scale to assess functional capacity in patients with spinal cord injury

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Abstract

Aim

To compare the ability of Spinal Cord Independence Measure Scale (SCIM) Versus Functional Independence Measure Scale (FIM) to assess functional capacity in patients with Spinal Cord Injury.

Methods

The study was performed to evaluate the effectiveness of SCIM to assess functional changes in spinal cord injury patients compared with the Functional Independence Measure (FIM). Thirty patients with Spinal Cord Injury having both paraplegia and quadriplegia were included. Scores were recorded one week after admission and after one month during hospitalization. The scores by SCIM were correlated with the FIM scores by using Pearson's correlation coefficient.

Result

Mean SCIM at 1st day was 49.73±28.83 and Mean FIM was 76.86±25.20. Significant positive correlation was found between SCIM and FIM ($r=0.896, p=0.000$). Mean SCIM after 1 month was 59.43±28.01 and mean FIM was 87.00± 30.02. Significant positive correlation was found between SCIM and FIM after 1 month of follow up ($r=0.834, p=0.000$).

Conclusion

Spinal Cord Independence Measure Scale is effective enough to assess functional capacity in patients with Spinal Cord Injury.

Introduction

Spinal Cord Injury is a low incidence, high cost disability requiring tremendous changes in individual lifestyle¹. Spinal Cord Injuries are grossly divided into two main categories²

- 1) Traumatic
- 2) Non-traumatic

Traumas are by the far most frequent cause of injury in adult rehabilitation. The causes of traumatic injuries are motor vehicle accident 37.2%, followed by violence, fall, sports injury and others.

The functional disabilities in patients with spinal cord injury are, inability to take self care, respiration and sphincter problems and immobility.

Various scales are used for evaluation of spinal cord injury, they are,

- 1) Modified Barthel Index (MBI)^{3,4}
- 2) Functional Independence Measurement Scale (FIM)^{3,5}
- 3) Quadriplegic Index Of Function (QIF)^{3,6}

Functional Independence Measure (FIM), however, was developed as a measure to assess the burden of care and functional ability in patients with spinal cord injury but it could not access the mobility and walking related problems in these patients⁷.

Several authors have found the MBI and the FIM appropriate for functional evaluation of SCI patients^{3, 9,10} although others, raised doubts about their efficiency in measuring functional changes in this population.^(6,8) MBI and the FIM, which were developed for the functional assessment of patients with several different kinds of impairments, do not satisfactorily reflect the rehabilitation outcome in SCI patients. Our impression is that they lack sensitivity to functional changes and do not attach sufficient importance to certain achievements of these patients. The QIF has overcome some of the limitations of the MBI and FIM, but it was designed especially for patients with tetraplegia and is not suitable for the assessment of patients with paraplegia. for example, it does not include an evaluation of mobility functions. To fill this gap SCIM was developed.

SCIM Scale covers all the three areas of function-Self Care, Respiratory and sphincter, and Mobility³.

The purpose of this study is to examine the reliability of spinal cord Independence measurement scale to assess functional changes in Spinal Cord Injury patients.

Methodology

Study Design

Prospective cross sectional hospital based study. Consisting of subjects with Spinal Cord Injury.

Study Setting

Study was conducted at 950 bedded tertiary care teaching hospitals, Departments of Orthopaedics, Medicine, Neurosurgery and physiotherapy unit coordinated the study.

Sample and Sampling Method

30 patients with clinical and MRI diagnosis of spinal cord injury were included in the study with a positive sampling technique.

Duration of Study

Dec 2009 –August 2010

Inclusion Criteria

1. Diagnosed cases of spinal cord injury.
2. Both sexes were included.
3. Patient conscious and able to follow the commands.
4. Other spinal diseases like, meningioma, spinal tumour, compressive Degenerative spinal lesions

were ruled out.

Exclusion Criteria

1. Patients having cognitive problems.
2. Patients having head injury.
3. Patients with associated upper limb and lower limb injuries.

Alternate Hypothesis

Spinal Cord Independence Measure Scale is effective enough to assess functional capacity in patients with spinal cord injury.

Null Hypothesis

Spinal Cord Independence Measure Scale is not effective enough to assess functional capacity in patients with spinal cord injury.

Procedure

After obtaining the approval from Institutional Ethical Committee patients were included for the study in accordance to the inclusion and exclusion criteria. The purpose of the study was explained to the patients and a signed informed consent (Vernacular language) was obtained from all the patients who willingly volunteered for the study.

Data was collected in two measurement session at the hospital bedside or physical therapy. First assessment was done on within 7 days after the hospitalization and the second assessment was done after 1 month.

Demographic details of the patient included in the study was noted in an assessment proforma specially design for this study. Beside Age, Sex, Duration of condition, Level of injury was also noted.

Main Outcome Measure

1. Spinal Cord Independence Measure Scale^{3,5}
2. Functional Independence Measure Scale³

Spinal Cord Independence Measure Scale

1. Self-care - scores for this area range from 0 to 20.
2. Respiration and Sphincter management - scores for this area range from 0 to 40.
3. Mobility is divided into two parts: tasks performed in the room and toilet, and tasks performed all over the house (indoors and outdoors) - Score for this area range from 0 to 40. The total score of SCIM is 0 – 100.

FIM include 6 components

- 1) Self Care
- 2) Sphincter Control
- 3) Transfer
- 4) Locomotion
- 5) Communication
- 6) Social Cognition

Total Score—126

Between December 2009 to August 2010 a longitudinal hospital based study was carried out in patient with Spinal Cord Injury. Data was collected and was subjected to appropriate statistical analysis by using Pearson’s correlation coefficient.

Observations and Results

Table 4, Graph 3: Correlation of SCIM and FIM at first day and after 1 month follow

Table 1: Comparison of SCIM at first day and after 1 month follow up (Students paired t test)

Table 1: Comparison of SCIM at first day and after 1 month follow up(Students paired test)

	Mean	N	Std. Deviation	Std. Error Mean
First Day	49.73	30	28.83	5.26
After 1 month	59.43	30	28.01	5.11

Students paired t test

First day- After 1 month	Paired Differences					t	Df	p-value
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
	-9.70	19.52	3.56	-16.98	-2.41	2.72	29	0.011 NS, p<0.05

Table 2: Comparison of FIM at first day and after 1 month follow up (Students paired t test)

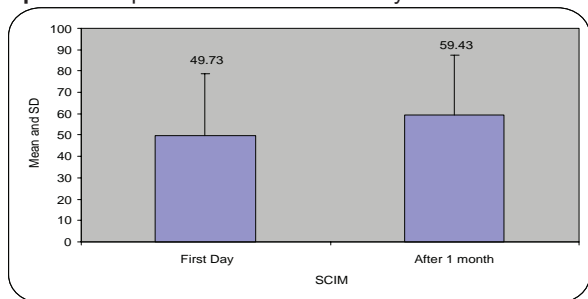
Descriptive Statistics

	Mean	N	Std. Deviation	Std. Error Mean
First Day	76.86	20	25.20	4.60
After 1 month	87.00	30	30.02	5.48

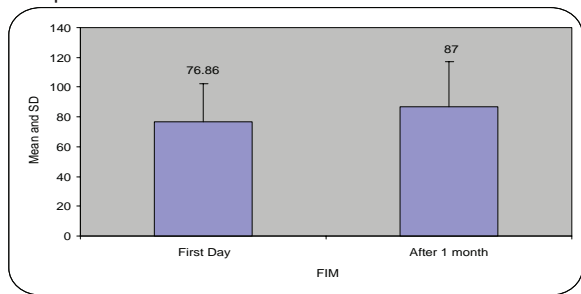
Students paired t test

First day- After 1 month	Paired Differences					t	Df	p-value
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
	-10.13	11.49	2.09	-14.42	-5.84	4.83	29	0.000 S,p<0.05

Graph 1: Comparison of SCIM at first day and after 1 month



Graph 2: Comparison of FIM at first day and after 1 month follow up



Mean SCIM at 1st day was 49.73±28.83 and after 1 month of follow up it was 59.43±28.01 by using student pair t test statistical significant difference were found at 1st day and 1 month of follow up (t=2.72,p=0.011)

Table 2: Comparison of FIM at first day and after 1 month follow up (Students paired

Mean FIM at 1st day was 76.86-25.20 & after 1 month of follow up it was 87.00- 30.02 by using student

pair t test statistical significant difference were found at 1st day & 1 month of follow up (t=4.83, p=0.000)

Table 3: Correlation of SCIM and FIM at first day and after 1 month follow up with level of injury.

Mean SCIM at 1st day having level of injury C1-C2 was 77.00±5.65, C2-C3 was 81.00±0.00, C3-C4 was 8.00±1.63, C5-C6 was 50.25±35.04, C7-C8 was 53.00±0.00, T8-T9 was 56.00±4.24 T10-T11 was 73.00±0.00, T11-T12 was 62.33±11.80, L1 was 66.28±23.81 .Significant variation is found in SCIM at 1st day at various level of injury. (f=5.65 , p=0.001)

Mean SCIM at 1 month having level of injury C1-C2 was 100.00±0.00, C2-C3 was 100.00±0.00, C3-C4 was 29.25±21.66, C5-C6 was 32.25±29.69, C7-C8 was 59.00±0.00, T8-T9 was 59.00±0.00, T10-T11 was 77.00±0.00, T11-T12 was 72.50±13.66, L1 was 60.57±26.0.

Significant variation is found in SCIM at 1st day at various level of injury.

(f=2.70, p=0.031)

Mean FIM at 1st day having level of injury C1-C2 was 103.00±4.24, C2-C3 was 106.00±0.00, C3-C4 was 39.00±7.83, C5-C6 was 63.25±30.92, C7-C8 was 86.00±0.00, T8-T9 was 86.50±0.70, T10-T11 was 82.00±0.00, T11-T12 was 89.33±13.58, L1 was 88.14±16.55.

Significant variation is found in FIM at 1st day at various level of injury. (f=5.02, p=0.001)

Mean FIM at 1 month having level of injury C1-C2 was 125.00±1.41, C2-C3 Was 124.00±0.00, C3-C4 was 51.75±30.32, C5-C6 was 72.00±41.08, C7-C8 was 47.50±6.36, T8-T9 was 91.00±4.24, T10-T11

Table 3: Correlation of SCIM and FIM at first day and after 1 Month follow up with level of injury

Level of injury	SCIM at first day	SCIM after 1 month follow up	FIM at first day	FIM after 1 month follow up
C1-C2	77.00±5.65	100.00±0.00	103.00±4.24	125.00±1.41
C2-C3	81.00±0.00	100.00±0.00	106.00±0.00	124.00±0.00
C3-C4	8.00±1.63	29.25±21.66	39.00±7.83	51.75±30.32
C5-C6	32.25±29.69	50.25±35.04	63.25±30.92	72.00±41.08
C6-C7	10.00±0.00	26.00±12.72	45.50±3.53	47.50±6.36
C7-C8	53.00±0.00	59.00±0.00	86.00±0.00	94.00±0.00
T8-T9	56.00±4.24	59.00±0.00	86.50±0.70	91.00±4.24
T10-T11	73.00±0.00	77.00±0.00	82.00±0.00	84.00±0.00
T11-T12	62.33±11.80	72.50±13.66	89.33±13.58	99.00±12.58
L1	66.28±23.81	60.57±26.06	88.14±16.55	98.85±19.53
F-value	5.65	2.70	5.02	3.07
p-value	0.001 S,p<0.05	0.031 S,p<0.05	0.001 S,p<0.05	0.017 S,p<0.05

Table 4: Correlation of SCIM and FIM at first day and after 1 month follow

		Mean	Std. Deviation	N	Correlation 'r'	p-value
At first day	SCIM	49.73	28.83	30	0.896	0.000 S,p<0.05
	FIM	76.86	25.20	30		
After 1 month follow up	SCIM	59.43	28.01	30	0.834	0.000 S,p<0.05
	FIM	87.00	30.02	30		

was 84.00 ± 0.00 , T11-T12 was 99.00 ± 12.58 , L1 was 98.85 ± 19.53 .

Significant variation is found in FIM at 1st day at various level of injury. ($f=3.07$, $p=0.017$)

Table 4: Correlation of SCIM and FIM at first day and after 1 month follow up - Mean SCIM at 1st day was 49.73 ± 28.83 and mean FIM was 76.86 ± 25.20 significant positive correlation is found between SCIM and FIM ($r=0.896$, $p=0.000$) Mean SCIM after 1 month was 59.43 ± 28.01 and mean FIM was 87.00 ± 30.02 . Significant positive correlation is found between SCIM and FIM after 1 month of follow up ($r=0.834$, $p=0.000$)

Discussion

The present study was carried out to determine the efficacy of Spinal Cord Independence Measure Scale to assess functional capacity in patients with Spinal Cord Injury.

The results of present study indicate that Spinal Cord Independence Measure Scale is effective enough to assess Functional capacity in patients with Spinal Cord Injury thereby supporting the hypothesis.

The forerunners of the SCIM, such as the Modified Barthel Index (MBI)⁴, the Functional Independence Measure (FIM)(5) and the Quadriplegic Index of Function (QIF)(6) do not satisfactorily measure the outcome of treatment^{11,3,6,8,12}. The MBI and the FIM were designed for evaluation of patients with impairment and they fail to attribute sufficient importance to the particular achievements striven for in patients with SCI.

The FIM, measures primarily the burden of required care and may not reveal significant changes in certain functions such as sphincter management and mobility. The QIF, is too specific have been designed exclusively for patients with tetraplegia. The scale was developed to fill the need for a rating Instrument that measures and reflects the meaningful functional changes in SCI patients. Marino et al.⁸ pointed out that if a scale is not sensitive enough, it will miss real changes in patients' functional status.

To fill this gap, a new scale for the functional assessment of patients with SCI was developed at the Department of Spinal Rehabilitation of Lowenstein Rehabilitation Hospital³. This scale, the Spinal Cord Independence Measure (SCIM). The SCIM covers three areas of function: self-care (score range 0 ± 20), respiration and sphincter management (0 ± 40), and mobility was scored in the room and toilet and indoors and outdoors (0 ± 40). The final score ranges between 0-100.

In our study the correlation of SCIM and FIM at first day and 1 month follow up is significant (p -value < 0.05) the comparison of scores between each pair of raters revealed a remarkable consistency. ($r=0.896$, 0.834 : $p<0.05$). The SCIM score (Mean 59.43 , SD 28.01) was lower than the total FIM score (Mean 87.00 , SD 28.02). The result of our study shows that SCIM is reliable and more sensitive than FIM to assess the functional changes in patients with spinal cord injury. The division of spinal cord injury population into subgroups reduced the number of item available for each comparison, with

a consequent decrease in the chance of displaying statistical significance for difference between SCIM and FIM. When tested in individual's areas of function, the advantages of SCIM and FIM was similar in subgroups to that found in whole cohort. The SCIM was more sensitive to access functional changes in respiration, sphincter management and mobility indoor and outdoor.

The main difference between the SCIM and FIM was relative weight given to the difference in everyday task³. The main disability affecting everyday function in spinal cord injury patients are poor Sphincter control and poor mobility. Rehabilitation treatment is largely focused on these areas and success in dealing with these problems contributes to both life expectancy and quality of life. Therefore the relative weight given to these areas is greater in SCIM than FIM. The FIM is less sensitive to small gains compared with the QIF in persons with tetraplegia, less sensitive to walking recovery than the walking index for spinal cord injury and less sensitive to functional changes in SCI than the SCIM. The FIM were to be used in clinical research settings to assess motor function, it may be more useful to only use the motor subscale portion of the FIM.

The SCIM was found to be more sensitive than FIM to changes in function in SCI patients. The SCIM detects all the functional changes detected by FIM³. The differences between the scales were significant ($p < 0.001$). The mean total SCIM score was 51.2 (SD= 21) and total mean FIM score was 86.8 (SD= 23). A positive correlation was found between two scales. ($r=0.85$, $p < 0.01$).

The total mean score by Catz-Itzkovich SCIM was 49.4 (SD= 21) and that by FIM was 88.2 (SD= 23.6)¹¹ there was a high positive correlation found between the scales (spearman's $r=0.84$, $p < 0.001$). Similarly in our study the mean total of SCIM is 59.43 ,SD= 28 and total mean of FIM score is 87.00 and SD= 30 . A positive correlation found between SCIM and FIM scale ($r=0.83$, $p < 0.005$).

The SCIM is sensitive to change in function in persons with SCI and demonstrates the ability to capture changes in function not captured by the FIM. The content advantages of the SCIM over the FIM in the areas of bladder, bowel, respiration, and mobility but The SCIM is insensitive to changes or differences in walking speed because it does not measure this component of function.

Conclusion

Spinal Cord Independence Measure Scale is effective enough to assess functional capacity in patients with Spinal Cord Injury.

Clinical Implications

1. Further study could be done incorporating with Walking and Ambulation.
2. Further studies could be done incorporating in Head injury patients with cognitive problems.

Limitations

Some limitations of the study have been identified which may have affect the assessment of functional

ability of patients with Spinal Cord Injury.

- 1) Study was conducted with a small sample size of 30 patients.
- 2) Patients with musculoskeletal injury. (fracture) upper limb and lower limb) because this affect the performance of functional activity and also hampered the assessment.

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Prevalance of low back pain in geriatric population in and around Ludhiana, Punjab

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Abstract

- Low back ache is a common mechanical problem for geriatric population throughout the world.
- In India, occurrence of low back ache is also alarming; nearly 60% of people in India have significant back pain at some time or other in lives.
- 80% people in modern industrial society and 60% of general population experience low back pain.
- O.A is most common form of arthritis. It mainly affects over 80% people over the age of 60. In arthritic degeneration, changes describe a slow and progressive loss of cartilage that acts bones, while helping to keep the joints flexible. Once the cartilage is thinned or lost the constant grinding of it's started. Abnormal and excess bone formations called spurs grow from the damaged bone causing further pain and stiffness.

Keywords

Obesity and BMI.

Aims and Objectives

1. To assess the prevalence of low back pain among geriatric population in and around Ludhiana.
2. To identify the association of age, BMI and gender on the prevalence and severity of low back pain in geriatric population.

1.1 Introduction

Low back pain is a common musculoskeletal disorder which affects the lumbar segment of spine. It can be acute, sub acute or chronic in its clinical presentation.

Anatomy of Low Back

The first step to understanding the various causes of low back pain is learning about the normal design (anatomy) of the tissues of this area. Imp. structures of low back that can be related to symptoms there include the bony lumbar spine (vertebrae); discs between vertebrae; ligaments around the spine and discs; spinal cord and nerves; muscles of low back; internal organs of the pelvis and abdomen; and the skin covering the lumbar area.

- The bony lumbar spine is designed so that vertebrae "stacked" together can provide a movable support structure while also protecting the spinal cord from injury. The spinal cord is composed of nervous tissue that extends down the spinal column from the brain. Each vertebrae has a strong bony "body" in front of the spinal cord to provide a platform suitable for weight bearing of all tissues above the buttocks. On each side, the sacrum meets the iliac bone of the pelvis to form the sacroiliac joint of the buttocks.
- The discs are the pads that serve as "cushions" between individual vertebral bodies. They help to minimize the impact of stress forces on the spinal

column. The central portion of disc is capable of rupturing through the outer ring, causing irritation of adjacent nervous tissue and sciatica.

- Ligaments are strong fibrous soft tissues that firmly attach bones to bones. They attach the vertebrae to each other and surround the each disc.
- The nerves that provide sensation and stimulate the muscles of low back as well as the lower extremities exit the lumbar spinal column through bony portals, each of which is called a "foramen".
- Many muscle groups that are responsible for flexing, extending and rotating the waist, as well as moving lower extremities, attach to the lumbar spine through tendon insertions.

Function of Low Back

The low back, or lumbar area, serves a number of important functions for the human body. These functions include structural support, movement and protection of certain body tissues.

Common Causes of Low Back Pain

1. Lumbar Strain (acute, chronic): A lumbar strain is a stretch injury to the ligaments, tendons and muscles of the back. Lumbar strain is considered one of the most common causes of low back ache. The injury can occur because of overuse, improper use or trauma. Lumbar strain most often occurs in people in their forties.
2. Nerve irritation: The nerves of lumbar spine can be irritated by mechanical impingement between vertebrae. Damage to disc.
3. Lumbar radiculopathy: It is the nerve irritation i.e caused by damage to the discs between vertebrae. Damage to disc occurs because of degeneration outer ring of the disc, traumatic injury or both.
4. Bony encroachment: Any condition that results in movement or growth of vertebrae of lumbar spine limits the space for the adjacent spinal cord and nerves. Causes of encroachment of the spinal nerves include foraminal narrowing, spondylolisthesis and spinal stenosis.
5. Bone and joint conditions: Bone and joint condition that lead to low back pain include those existing from birth (congenital); those that result from wear and tear (degenerative) or injury; and those that are due to inflammation of the joints (arthritis).
6. Congenital bone condition:-Include scoliosis and spina bifida.

7. Degenerative bone and joint condition:-As we age, the water and protoglycan content of the body's cartilage changes. This change results in weaker, more fragile cartilage. Degeneration of disc is called Spondylosis. It is the deterioration of the disc that predisposes the disc to herniation and localized lumbar pain.
8. Injury to bone and joints:-Fracture of the lumbar and sacrum bone most commonly affects elderly people with osteoporosis.
9. Arthritis:-The spondyloarthropathies are inflammatory types of arthritis. Examples are: Ankylosing spondylitis; Reactive arthritis (Reiter's Degenerative Disc Disease (DDD)).

Other Common Causes of Low Back Pain

1. Kidney Problems: Stones and traumatic bleeding of kidney are frequently associated with low back pain.
2. Pregnancy: Leads to low back pain by mechanically stressing the lumbar spine and by positioning of the baby inside the abdomen.
3. Ovary problems: Ovarian cysts, uterine fibroids and endometriosis.
4. Tumors: Low back pain can be caused by tumors that originate in the bone of the spine/ pelvis and spinal cord tumors.

Uncommon Causes of Low Back Pain

1. Paget's disease of bone.
2. Bleeding/ Infection in pelvis.
3. Infection of discs (septic discitis) and bone (osteomyelitis).
4. T.B infection of spine (Pott's disease).
5. Aneurysm of aorta.
6. Shingles (Herpes Zoster).

Risk Factors

A risk factor is something that increases your chance of getting a disease or condition.

Risk factors include

1. Older age
2. Certain activities (such as lifting)
3. Sedentary life style
4. Pregnancy
5. Obesity
6. Injury
7. Pre-existing back injury due to: (a) lifting of heavy weights (b) improper lifting (c) sudden bending or twisting
8. Prolonged sitting or standing
9. Bad posture
10. Fatigue or sleep deficit
11. Stress

Problems of Geriatric Population

Geriatric population is defined as population above 60 years and above.

1. According to 1991 census, the geriatric population constituted 6.3% of total Indian population. The rapid growth of the population of elderly is a challenge to

- medical profession, administration and society.
2. The elderly people suffer from a variety of problems. On retirement, income is suddenly reduced. Economic hardship, with continued low standard of living, affects the body and mind.
3. Change in housing; illness or death of spouse greatly affects the physical well being of an aged person. In most of the developing countries, pension and social security is restricted to those who have worked in the public sector or organized sector of industry.
4. Alzheimer's disease affects some elderly.
5. Parkinsonism is a movement disorder which is more common in older people.
6. Cataract, the eye's lens becomes cloudy and vision is affected.
7. Dementia is a problem with advancing age.
8. Glaucoma mainly affects older people. It is a major cause for loss of vision.

Degenerative Changes of Other Joints

1. Human ageing is characterized by progressive decline (referred to as homeostenosis) in the homeostatic reserve of every organ. This phenomenon is usually evident by 3rd decade although the rate and extent of decline may vary.
2. The elderly people suffer from health problem due to ageing process like senile cataract; musculoskeletal changes affecting locomotion; glaucoma; nerve deafness; failure of special senses and poor reflex (resulting in accident proneness).
3. Arthritis is a general term used for many conditions that result from the degenerative changes of joint and its structure.
4. O.A is most common form of arthritis. It mainly affects over 80% people over the age of 60. In arthritic degeneration, changes describe a slow and progressive loss of cartilage. Abnormal and excess bone formation called spurs grows from the damaged bone causing further pain and stiffness.

Ageing Changes

1. SPINE: - The spine is made up of bones called vertebrae. Between each bone is a gel- like cushion (intervertebral disc). The trunk becomes short as the discs gradually lose fluid and become thinner.
2. HIP AND KNEE JOINT: - Joint may begin to lose structure (degenerative changes). The joints become stiffer and less flexible. Fluid in the joints may decrease and cartilage may begin to rub together and erode. Mineral may deposit in some joints (calcification).

1.2 Hypothesis

1. Null hypothesis

There is no relationship between low back pain and geriatric population.

2. Alternate hypothesis

There is significant relationship between low back pain and geriatric population.

1.4 Research Design and Methodology

1. Material and method:
 - i. Research Design: Cross sectional prospective survey design.
 - ii. Research Setting: In and around Ludhiana.
 - iii. Sample and Sampling Technique: Simple random sampling
 - iv. Tool and Method of Data Collection: Personal invitation or voluntary consent using Oswestry Disability Questionnaire as a diagnostic tool.
 - v. Reliability Validity and Cost effectiveness of tool was established.
 - vi. Target Population: 50 male and female aged between 65-80 years.
2. Eligibility criteria:
 - i. Age eligible for study: 65 years and older
 - ii. Gender eligible for study: Both
 - iii. Accepts healthy volunteers: No
3. Criteria:
 - i. Inclusion Criteria
 - 65 years of age/ older.
 - Hair intact cognition [Mini Mental Status Examination (MMSE).23]
 - Degenerative disease
 - ii. Exclusion Criteria
 - Do not meet the above inclusion criteria
 - Have previously participated in mindfulness meditation program.
 - Severe visual or hearing impairment since this study will involve questionnaires and telephone evaluations, severe visual/hearing impairments may interfere with data collection.

1.5 Procedure

After welcoming all the subjects and screening was done on the basis of inclusion and exclusion criteria. Informed consent form was got signed by elderly people who live in and around Ludhiana city. Questionnaire consists of 10 questions was distributed to 50 elderly

Table 1: Distribution of subjects as per socio-bio-demographic profile

Variables	F	(%)	Mean+SD
Age in years			
60-70 years	39	78	68.68 + 4.71
70-80 years	09	18	
>80 years	02	4	
Gender			
Male	21	42	
Female	29	58	
BMI			
Underweight	00	00	25.6 + 3.29
Normal	24	48	
Overweight	20	40	
Obese	06	12	

people. After giving proper instructions, each member was asked to complete the questionnaire. 50 questionnaires were returned and analyzed.

2.1 Analysis

Table 1 reveals that the subjects studied were distributed into the categories of age, gender and BMI. The findings show that maximum number of subjects be N=longed to age group 60-70 years (78%) followed by the age group 70-80 years (18%). According to gender maximum subjects were females (58%) while males were (42%). According to BMI maximum patients carried normal weight (48%) while 40% were overweight followed by 12% obese patients.

Thus it concludes that majority of the subjects were in 60-70 years of age and were females and majority were overweight.

Table 2: Distribution of subjects as per Low Back Pain Disability Level

Low Back Pain Disability level	f (%)	Mean+SD
Minimal (0%-20% disability)	09	36.82+15.30
Moderate (20%-40% disability)	22	
Severe (40%-60% disability)	16	
Very severe to crippled (>61% disability)	03	N=50

Table 2 reveals that the subjects studied were distributed into the categories of minimal, moderate; severe and very severe to crippled disability level. The findings show that maximum numbers of subjects belonged to moderate disability level 20-40% disability category (22%) followed by the severe disability level 40% -60% disability categories (16%).

Thus it concluded that majority of the subjects were in moderate low back pain disability level.

Table 3 reveals that the subjects studied were distributed according to level of pain and 10 low back pain variables. The findings show that the maximum numbers of subjects with respect to 10 low back pain variables fall under mild level of pain (29.6%) followed by moderate level of pain (21.8%) and minimum numbers of subjects with respect to 10 low back pain variables fall under worst level of pain (2.4%) followed by very severe level of pain (6.6%)

Table 4 revealed that the prevalence LBP disability was found higher among obese subjects. On the other hand prevalence of LBP disability was comparatively lower among normal BMI subjects. Among obese subjects the prevalence of disability due to LBP were found to be statistically significant ($p < 0.05$).

Thus it concludes that more the BMI (obese) more is the disability level due to LBP.

Table 5 revealed that the prevalence LBP disability were found higher among 60-70years of subjects.. On the other hand prevalence of LBP disability was comparatively lower among 70-80 years, but it was found to be statistically non significant ($p > 0.05$).

Thus it concludes that age has no effect over the low

Table 3: Distribution of Ten Low Back pain measuring variables in Geriatric population.

Level of Pain LBP Variables	Nil 0	Mild 1	Moderate 2	Severe 3	V severe 4	Worst 5
Pain Intensity	10	23	15	0	2	0
Personal Care	13	16	9	10	2	0
Lifting	2	20	13	4	6	5
Walking	5	14	12	12	4	3
Sitting	6	10	17	16	1	0
Standing	3	5	18	12	11	0
Sleeping	6	35	5	4	0	0
Sex life	0	2	0	0	0	0
Social life	10	9	6	22	2	1
Traveling	8	11	14	8	5	3
% level of pain	12.6	29.6	21.8	17.6	6.6	2.4

back pain disability level.

Table 6 reveals that the prevalence LBP disability was found higher among female subjects. On the other hand prevalence of LBP disability was comparatively lower among male subjects, but it was found to be statistically non significant ($p > 0.05$).

Thus it concludes that gender has no effect over the low back pain disability level.

2.2 Results

- Majority of the geriatric population belonged to age group 60-70 years (78%) with mean age 68.8 + 4.71.
- 48% of the geriatric population was having normal BMI with mean 25.6 + 3.29.
- According to distribution of subjects as per low back pain disability level, the majority of the geriatric population comes under moderate disability level with

Table 4: Association between of BMI and Low back pain disability level.

LBP disability Level	BMI			Total f (%)	χ^2 Value
	Normal 18.5-24.9 f (%)	Overweight 25-29.9 f (%)	Obese >30 f (%)		
Mild <20	2	7	0	9	$\chi^2=16.10^*$ $P < 0.05$ $df=6$
Moderate 21-40	13	7	2	22	
Severe 41-60	9	5	2	16	
Very severe to crippled >60	0	1	2	3	

Table 5: Association between Age and Low back pain disability level

LBP disability Level	Age(years)			Total f (%)	χ^2 Value
	60-70 f (%)	70-80 f (%)	>80 f (%)		
Mild <20	7	2	0	9	$\chi^2=3.33NS$ $df=6$
Moderate 21-40	17	3	2	22	
Severe 41-60	13	3	0	16	
Very severe to crippled >60	2	1	0	3	

NS= Non significant ($p > 0.05$)

mean 36.82 + 15.30.

- The geriatric population who are obese (i.e. more BMI) have high prevalence of low back ache significant at the level of $p < 0.05$.
- Low back ache in geriatric population affects their daily activities especially personal care, standing, lifting and sleeping.

2.3 Conclusion

Geriatric population is prone to have low backache from minimal to severe level of disability.

Geriatric populations who are obese have high prevalence of low back ache due to stress on low back muscle and ligaments.

Low back ache in geriatric population effects their daily activities especially personal care, lifting sleeping, social life and travelling.

2.4 Limitation of the Study

1. The sample size and demography for the study was small as it was restricted to in and around Ludhiana, only.
2. This study was to see the prevalence of Low Back pain among geriatric population only.
3. The response to the questionnaire was subjective.
4. Severity of pain was not co-related with any of the causative factors.

2.5. Future Scope of Study

1. Similar study can be conducted in other demographic areas will large number of subjects to make the results more consistent.
2. Comparative study can be undertaken to evaluate any variation that may exist in the prevalence of low back pain among geriatric population.

Table 6: Association between Gender and Low back pain disability level.

LBP disability Level	Gender		Total f (%)	χ^2 Value
	Male f (%)	Female f (%)		
Mild <20	3	6	9	$\chi^2=1.64$ NS df=5
Moderate 21-40	11	11	22	
Severe 41-60	5	11	16	
Very severe to crippled>60	1	2	3	

NS= Non significant ($p>0.05$)

3. Similar study can be undertaken to found out prevalence of low back pain in younger population.

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Correlation between ankle range of motion and balance in community - dwelling elderly population

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Abstract

Objective

To investigate the relationship between balance measures and ankle range of motion (ROM) in community dwelling elderly population.

Methodology

37 subjects (20 females, 17males) with age group of 65-85 years, were screened for any previous medical issues or recent history of falls. Out of this 6 subjects were excluded and for rest 31 further examination was done. Balance was measured using Functional Reach Test (FRT) while ankle ROM was measured with goniometer, both actively and passively.

Result

The mean age group of the study was (71.65 + 5.701). There was a high correlation between active ankle ROM and balance measure ($r=0.717$, $p=0.001$)

Conclusion

This study shows that reduced ankle ROM affects balance measures as age advances, leading to falls and life dependency. Henceforth, future studies pertaining to intervention and treatment efficacy may be suggested which may have an influence on reducing falls in elderly.

Keywords

Community dwelling elderly, Balance, Functional reach test, Ankle Range of Motion.

Introduction

With aging there is deterioration in many systems like sensory, neural and musculoskeletal systems, which affect balance, restrict safe mobility and thus reducing quality of life¹. This has been the main concern among various medical professionals and also the individuals who are above the age of 60 years (constituting about more than 7.7% of total population of India²).

Balance is needed while the individual manipulates the environment and the feet are stationary. Activities such as bending or reaching up or to the side require shifting the center of gravity (COG) within the base of support (BOS). If the appropriate movement strategy is not executed, the individual may stumble or fall in an attempt to regain balance³. Falls are a common cause of injury and disability in older adults⁴. These are also associated with mortality, and constitute two-thirds of deaths resulting from unintentional injuries, thus decreasing quality of life^{5,6}. Risk factors for falling have been identified in a variety of studies. Risk factors for falls have been classified as intrinsic (those related to the individual) and extrinsic (those associated with environmental features). Among the intrinsic factors,

researcher, have been identified decreased balance and mobility skills as very strong predictors of the likelihood for falls⁷⁻¹¹. Not all risks can be eliminated, but Speechley and Tinetti, contend that the modification of even one risk factor can be a worthwhile therapeutic goal, even for people with multiple problems¹².

The assessment of balance in elderly is important to direct appropriate interventions to improve balance performance and to monitor changes in balance over time^{13,14}. There are various scales to measure balance in elderly like Berg Balance Scale(BBS), a performance-oriented measure of balance in elderly individuals¹⁵; Timed Up & Go Test(TUG)¹⁶. Comfortable and Fast Gait Speeds (CGS and FGS)¹⁷ Functional Reach Test (FRT).

Among elderly people, decreased force production in the lower extremities has also been identified as a potential risk factor in those who fall when compared with those who do not fall¹⁸⁻²⁰, with the greatest compromise in ankle dorsiflexion force. Studies have shown that there is significant reduction in ankle range of motion with advancing age and noted that elderly above 70 years of age has Ankle dorsiflexion range of about $8 + 8^\circ$, and Ankle Plantarflexion range of about $35 + 150^\circ$ ²¹. ROM tends to decline as the person grows older because of the changes taking place in mechanical properties and morphology of joint structures i.e. periarticular connective tissue. Because of these mechanical and morphological changes the postural control strategies also changes which can have effect on balance. A certain amount of ankle ROM is needed for functional activities such as walking, which requires a minimum of 10 degrees of dorsiflexion²², which however reduces with advancing aging leading to life dependency. Study done by Vandervoort AA et. al. stated that women show greater age-related declines than men do²³.

Thus, decreased ankle ROM may require altered movement patterns, and these altered movement patterns may compromise balance. Many studies have been reported in western population related to balance and falls. But there is dearth of literature on Indian population. Objective of this study is to investigate the relationship between balance measures and ankle range of motion (ROM). If Ankle ROM is identified as one of the factors for falls in elderly, then future study can be focused on improving ROM in ankle in addition to various other interventions to prevent fall and thus improving their quality of life.

Materials and Methodology

Subjects

An observational study was done on 37 individuals of either sex between the age group of 65 – 85years. These were recruited from the old age homes, between the period of September 2010 to December 2010, by convenient sampling method. They volunteered to take part in the study and met the following inclusion criteria: Elderly subjects of either sex above the age of 60 years, and subjects who were ambulant independently. While those who were having history of Stroke, vestibular disorders, other neurological problems, Uncorrected visual problems, Heart attack, Uncontrolled hypertension, Severe ankle edema, Abnormal sensation in lower extremities, Foot abnormalities, Leg-length discrepancy, and A grade of less than Fair (3) on manual muscle testing of the ankle were excluded from the study.

Measuring tools

Goniometer was used to measure the ankle ROM using standard measurement techniques, in high sitting.

Balance was measured using FRT, a functional performance tests (Tyson and De Souza, 2002b). These have an advantages of simplicity, reliability, validity, sensitivity and user friendliness to the extent that they have been described as ‘almost the perfect measure’ (Wade, 1992; Berg and Norman, 1996). Functional Reach is strongly associated with the risk of increasing falls in the aged, and is used as a predictive test for this population²⁴. It measures the maximal distance an individual who is standing, and can reach forward while the feet are in a fixed position. Height is related to performance in the Functional Reach test, so that for every 10 cm of height functional reach increases by 3.3 cm (Isles et al., 2004). 15 centimeters or less on the Functional Reach Test indicates a significant increase in the risk of falls^{25,26}. The FRT’s intraclass correlation coefficient (ICC) is 0.92, for intrarater reliability 0.98, and interrater and test-retest reliability is 0.092²⁴.

Procedure

First the purpose and procedure of the test was explained to subjects including its benefits and flaws, and consent was taken. Total of 37 subjects (20 females and 17 males) were then screened for the eligibility using the screening form. Out of which 6 did not meet the eligibility criteria, so they were excluded. Total 30 subjects fulfilled the eligibility criteria, for which further examination was processed. First their ankle ROM was measured, both passively and actively using goniometer (dorsiflexion, plantarflexion, inversion, and eversion). Following which

balance was checked using functional reach test.

For functional reach test, the person was positioned close to the wall so that they may reach forward along the length of the yardstick, which was already stuck to the wall. The patient was now instructed to stand with feet shoulder distance apart and raise the arm up so that it’s parallel to the floor. At this time the examiner took an initial reading on the yard stick, usually spotting the tip of middle finger. Now the person was instructed to reach forward, to the maximum level, along the yardstick, using only ankle strategy, and made to hold for 3sec. Three reading on the yardstick of the farthest reach attained by the patient without taking a step was taken. The initial reading is subtracted from the final to obtain the functional reach score.

Result and Discussion

The mean functional reach score of our sample was 10.50 with standard deviation of 3.64, which indicated high risk for fall in our selected elderly population (Table 1).

This study indicated that there is positive correlation between ankle ROM and balance in elderly population. The Correlation between bilateral active ROM and functional reach rest (Graph 1) was found highly positive in our sample as compared to correlation between passive ROM and functional reach test which was moderately positive correlated (Graph 2). According to previous research active ROM has more implication over balance. Our data suggest that decreased performance on balance measures associated with restricted ROM in ankle may be due to non contractile tissues such as capsule, ligaments rather than short gastronemius muscle length.

The mean age of our sample was 70.77 and as the literature suggest that various changes takes place in musculoskeletal system as the person grow older which is a natural process, so these changes may have an implication over ankle ROM. As we know that ankle strategy is the first strategy which person uses to correct balance as centre of gravity is displaced so if ankle ROM is compromised the person’s ability to maintain balance might be affected.

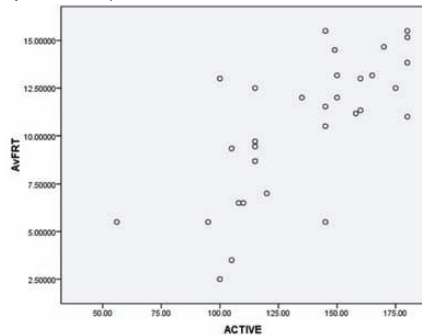
Conclusion

We found that high positive correlation exists between Ankle ROM and Balance measure. So along with various other measures to improve and maintain balance in elderly, ROM exercise for the lower extremity mainly ankle ROM should be focused. Thus, future studies pertaining to intervention and treatment efficacy may be suggested which may have an influence on reducing falls in elderly.

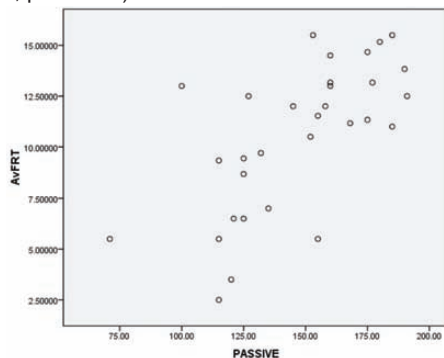
Table 1: Mean and standard Deviation of Age, Right and Left Ankle ROM and the Average FRT score obtained.

	Age	Average FRT	Right Ankle		Left Ankle	
			Active	Passive	Active	Passive
Mean	71.65	10.50	70.29	76.00	66.19	70.77
Std. Deviation	5.701	3.636	15.799	13,947	16.598	16.218

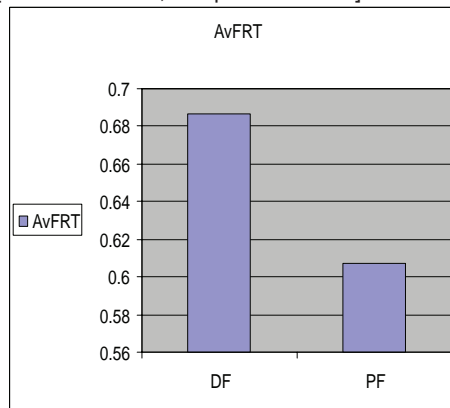
Graph 1: Correlation between active Ankle ROM and Balance ($r = 0.717, p = 0.001$)



Graph 2: Correlation between active Passive ROM and Balance ($r = 0.662, p = 0.001$)



Graph 3: Pearson product moment correlations between bilateral individual motions and Functional Reach Test [27] scores [DF=dorsiflexion, PF=plantar flexion]



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A pilot study to compare between effectiveness of functional mobility and strengthening exercises and strengthening exercises alone in Guillain Barre Syndrome patients

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Abstract

Introduction

Guillain Barre Syndrome (GBS) is an acute inflammatory demyelinating polyradiculopathy that affects nerve roots and peripheral nerves leading to motor neuropathy and flaccid paralysis. Rehabilitation helps an individual become functionally independent.

Objective

1. To evaluate the effectiveness of functional mobility training and strengthening exercises in GBS patients.
2. To evaluate the effectiveness of strengthening exercises alone in GBS patients.
3. To compare the effectiveness of combined functional mobility training and strengthening exercises and strengthening exercises alone in GBS patients.

Material and Methods

Data was collected from KLES Dr. Prabhakar Kore hospital, Belgaum. 8 patients both males and females diagnosed with GBS were conveniently taken into the study. 2 groups were done consisting of 4 patients in each group. Group A received only strengthening exercises only and group B received combined functional mobility training and strengthening exercises.

Outcome measures Overall Disability Sum Score and MMT will be measured before and after completion of therapy.

Result

After 15 days of treatment, after comparing both the groups, group B showed higher significance than group A for ODSS (P 0.003) but MMT showed no significant difference in the p values.

Conclusion

Hence, combined functional mobility training and strengthening exercises showed improvement in GBS patients.

Key Words

Functional mobility training, strengthening exercises, GBS, Overall Disability Sum Score.

Introduction

Guillain-Barré Syndrome (GBS) is an autoimmune disorder that affects the nerves outside the brain and spinal cord. The incidence of GBS is approximately 1 to 4 cases per 100,000 persons. Epidemiological studies show that males are affected by GBS twice more often than females. Most of the people who do get GBS recover and are able to return to their normal lives and activities.

A variant form of GBS i.e. acute axonal neuropathy has good prognosis. Less common forms are acute motor and sensory axonal neuropathy, which has less positive prognosis. Mille-Fisher syndrome with primarily cranial nerve symptoms, ataxia and areflexia and chronic inflammatory demyelinating polyradiculoneuropathy (CIDP) causes progressive or relapsing and remitting numbness and weakness.

Guillain-Barré can affect people of any age, but it becomes more common with increasing age. Recent studies into the complex pathogenesis of the forms of demyelinating inflammatory polyradiculoneuropathy have demonstrated significant association with autoimmune reactions such as autoantibodies against myelin constituents and against gangliosides and glycolipids of axonal myelin membranes. Because of damage to myelin sheath, saltatory propagation of the action potential is disturbed, resulting in slow conduction velocity, dyssynchrony of conduction, disturbed conduction of higher frequency impulses, or complete conduction block. As a result, someone with GBS may have weakness or problems moving, or may feel numbness and tingling in the arms or legs. If the muscles in the chest are affected, for example, it may interfere with the ability to breathe and require the person to use a respirator for a while.

Although some patients have a fulminating course of progress with maximal paralysis within 1 to 2 days of onset, 50% of patients reach nadir (the point of greatest severity) of the disease within 1 week, 70% by 2 weeks and 80% by 3 weeks. In some cases, the process of increasing weakness continues for 1 to 2 months. Onset of recovery is varied, with most patients showing gradual recovery of muscle strength 2 to 4 weeks after progression has stopped or the condition has plateaued. Although 50% patients may show minor neurological deficits and 15% may show persistent residual deficits in function, approximately 80% become ambulatory within 6 months of onset of symptoms. 3 - 5% of patients die of secondary cardiac, respiratory or other systemic organ failure. Fatigue or poor endurance was also noted as long term consequence of GBS possibly attributed to deconditioning.

Functional mobility occurs throughout the daily routine under varying circumstances within changeable environments. Patients with GBS will have difficulty or will be unable to carry out functional mobility due to weakness of all 4 limbs. Hence, functional mobility training, where training from bed rolling to complex activities in standing, will help the patients to deal with the activities of daily living.

Also strengthening exercises like active assisted, active and resisted exercises help the patient to increase the muscle power. Exercise improves blood circulation through the body. Nerve fibers are not as vascular as muscles which are why they can take longer to repair. They are not receiving the nutrients from blood as readily

as a muscle or other vascular organ. Exercise increases blood flow, thus supplying the oxygen and minerals that nerve fibers need for repair and improves in muscle strength, which reduces the effects of neuropathy leading to muscle plasticity. Thus making the patient functionally independent to carry out the activities of daily living.

Material and Methods

Source of data was collected from KLES Dr. Prabhakar Kore hospital and MRC and BM Kankanwadi Ayurveda Hospital and MRC Belgaum.

Subjects

Patients with AMAN variant of GBS with age ranging from 20 – 50 years and muscle power more than grade 2 were included in the study. Exclusion criteria included other variants of GBS, muscle power grade less than 2, and patients with cardio respiratory problems. The patients who actively showed interest in the study and who were aware of the disease and its consequences were taken into the study. 8 patients with AMAN variant of GBS were taken into the study and divided into 2 groups i.e. group A where only strengthening exercises were given and group B where combined functional mobility training and strengthening exercises were given.

Arm disability scale – function checklist	Not affected	Affected but not prevented	Prevented
Dressing upper part of body (excluding buttons/zips)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Washing and brushing hair	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Turning a key in a lock	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using knife and fork /spoon—applicable if the patient never uses knife and fork)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Doing/undoing buttons and zips	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Arm grade			
0 =	Normal		
1 =	Minor symptoms or signs in one or both arms but not affecting any of the functions listed		
2 =	Moderate symptoms or signs in one or both arms affecting but not preventing any of the functions listed		
3 =	Severe symptoms or signs in one or both arms preventing at least one but not all functions listed		
4 =	Severe symptoms or signs in both arms preventing all functions listed but some purposeful movements still possible		
5 =	Severe symptoms and signs in both arms preventing all purposeful movements		
Leg disability scale – function checklist	No	Yes	Not applicable
Do you have any problem with your walking?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Do you use a walking aid?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How do you usually get around for about 10 metres?			
Without aid	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
With one stick or crutch or holding to someone's arm	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
With two sticks or crutches or one stick or crutch and holding to someone's arm	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
With a wheelchair	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If you use a wheelchair, can you stand and walk a few steps with help?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If you are restricted to bed most of the time, are you able to make some purposeful movements?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Leg grade			
0 =	Walking is not affected		
1 =	Walking is affected but does not look abnormal		
2 =	Walks independently but gait looks abnormal		
3 =	Usually uses unilateral support to walk 10 metres (25 feet) (stick, single crutch, one arm)		
4 =	Usually uses bilateral support to walk 10 metres (25 feet) (sticks, crutches, two arms)		
5 =	Usually uses wheelchair to travel 10 metres (25 feet)		
6 =	Restricted to wheelchair, unable to stand and walk few steps with help but able to make some purposeful leg movements		
7 =	Restricted to wheelchair or bed most of the day, preventing all purposeful movements of the legs (eg, unable to reposition legs in bed)		
Overall disability sum score = arm disability scale (range 0–5) + leg disability scale (range 0–7); overall range: 0 (no signs of disability) to 12 (maximum disability).			
For the arm disability scale: allocate one arm grade only by completing the function checklist. Indicate whether each function is 'affected,' 'affected but not prevented,' or 'prevented.'			
For the leg disability scale: Allocate one leg grade only by completing the functional questions.			

Assessment

Assessment was done of motor component thoroughly. Overall disability sum score (table 1) was used to measure the disability and manual muscle testing was done by assessing muscle power of individual muscles. (Table 1)

Overall disability score consisted of arm disability scale and leg disability scale. And the sum of these to i.e. the overall range is calculated. Arm disability score consisted of 0-5 scoring showing 0 where patient has no disability and 5 with maximum disability. Leg disability score consisted of 0-7 scoring where 0 is no disability and 7 is severe disability.

Intervention

Patients allocated in 2 groups were treated for 15 days. Group A received strengthening exercises which consisted of active assisted and active exercises while group B received functional mobility training which included bed rolling, pelvic bridging, supine to sit, transfers from bed to wheelchair/chair and vice versa, sit to stand, reach outs and gait training with or without support and also received strengthening exercises as given in group A. Statistical analysis was done using paired t test.

Results

In this study, total 8 patients were included with their mean age 35.6 ± 8.2 with gender distribution of 5 males and 3 females. All these patients had minimum duration of hospital stay of 1 month.

1. Comparison between pre and post values of strengthening exercises alone:

In this study, comparison between pre and post values of strengthening exercises alone, after 15 days of treatment, pre and post values of both the groups were compared. In group A, there is significant difference in the ODSS values with p values of 0.03 (table 2) (diagram 1) but MMT showed no significant difference (diagram 2). This signifies that strengthening exercises alone gave deterioration in ODSS value by $.25 \pm 0.5$, however the difference was too small but still significant as far as recovery is concerned, as increase in ODSS value signifies in reduction in the muscle strength.

(Table 2)

(Diagram 1)

(Diagram 2)

2. Comparison between pre and post values of functional mobility training and strengthening exercises:

In group B, there is significant difference in the

ODSS values with p values of 0.0428 (table 3) (diagram 3) but MMT showed no significant difference (diagram 4). In this group, ODSS value is increased by $2 \pm .81$ which is significant for the effectiveness of functional mobility and strengthening exercises together.

(Table 3)

(Diagram 3)

(Diagram 4)

3. Comparison between functional mobility training and strengthening exercises and strengthening exercises alone:

After comparing both the groups, group B showed higher significance than group A for ODSS (P 0.003) (table 4) (diagram 5) but MMT showed no significant difference in the p values (table 5). As the ODSS value decreased significantly in group B suggestive of better outcome by the method used for the treatment of group B individuals.

(Table 4)

(Diagram 4)

(Table 5)

Discussion

Guillian barre syndrome, a condition which is acute on onset causes severe disability in atleast 5% of total affected individuals. The incidence of disease increases linearly by age and men are more affected than women. This study was aimed to improve functional mobility in GBS. The strength helps to perform the functions and functional mobility helps to carry out activities of daily living. In this pilot study total 8 participants had under gone strengthening alone, functional mobility and strengthening and their outcome is compared based upon MMT and overall disability sum score. In this study the group which was given with functional mobility and strengthening together had improved with muscle power and ODSS score. This effect possibility was because strengthening was incorporated and directed towards functional activity whereas in the 1st group

Diagram 1: Pre ODSS and post ODSS values of group A

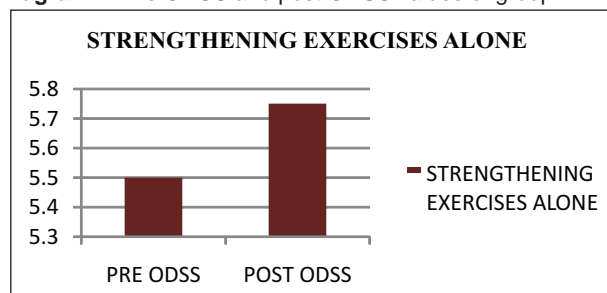


Table 2: Pre ODSS and post ODSS scores of group A

GROUP A	PRE ODSS	POST ODSS	diff.	t value	Df	p value
Strengthening exercises alone	5.5 \pm 1.31	5.75 \pm 2.21	.25 \pm 0.5	2.37	6	0.03

Table 3: Pre ODSS and post ODSS scores of group B

GROUP B	PRE ODSS	POST ODSS	diff.	t value	df	p value
Functional mobility and strengthening exercises	5.5 \pm 1.29	3.5 \pm 1.29	2 \pm .81	2.433	6	0.0428

Diagram 2: MMT values of group A

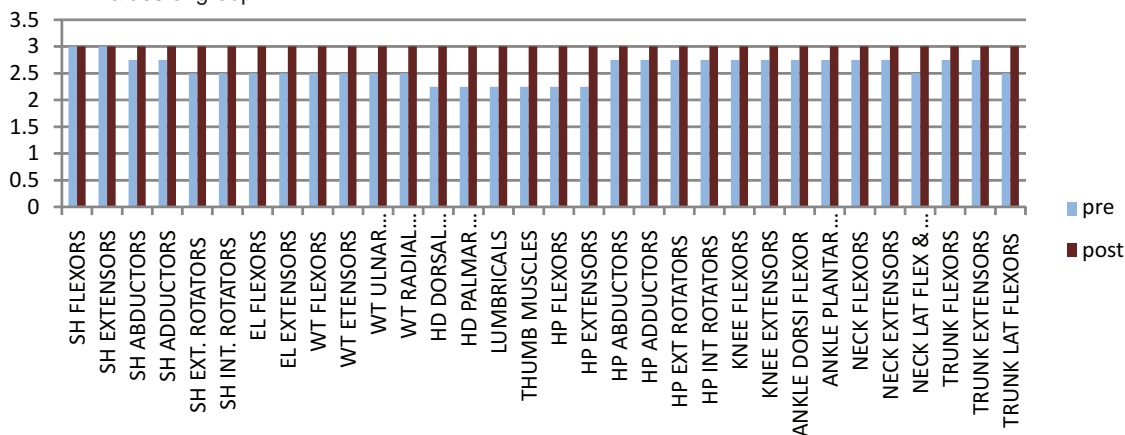
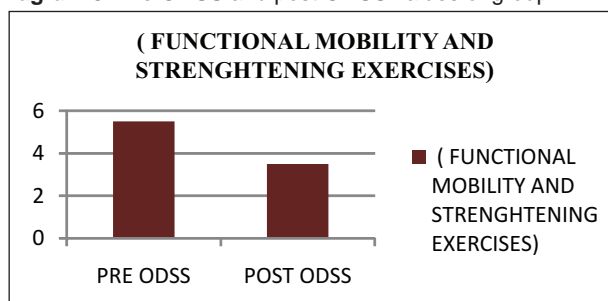


Diagram 3: Pre ODSS and post ODSS values of group B



strengthening exercises were given alone could not fetch good results and the ODSS group suggested that decline towards functional activity. The study done by El Mhandi L et. al. in which 6 GBS patients were assessed for recovery in functional strength and functional activity, they concluded that there was significant improvement in strength upto 18 months after onset and proposed to assess the outcome after 24 months. Our study was limited to only 15 days of follow-up with different exercises and shown improvement in these patients. In another study, performed for 12 weeks by using bicycle exercises training in 20 patients with severe fatigue, 16 with affected fitness and 4 with chronic inflammatory demyelinating disease and reported that the training was well tolerated and self reported fatigue scores was

decreased by 20%. Physical fitness, functional outcome and quality of life were improved in those patients. In 1 case study of 30 year old male marathon runner with GBS rehabilitation programme was given which helped him to regain functional independence and muscle strength and fatigue.

This pilot study demonstrated that 15 days of treatment comprising of combined therapy of functional mobility training and strengthening exercises showed significant improvement in patients with AMAN variant of GBS. ODSS showed improvement in functional mobility while MMT showed very minimal improvement of GBS patients.

Conclusion

The results of the study showed combined functional mobility training and strengthening exercises showed significant improvement in GBS patients.

Table 4: Pre ODSS and post ODSS scores between group A and group B

	PRE AND POST DIFF	t value	df	p value
GROUP A	0.25±.50	4.7	6	0.003
GROUP B	2±.81			

Diagram 4: MMT values of group B

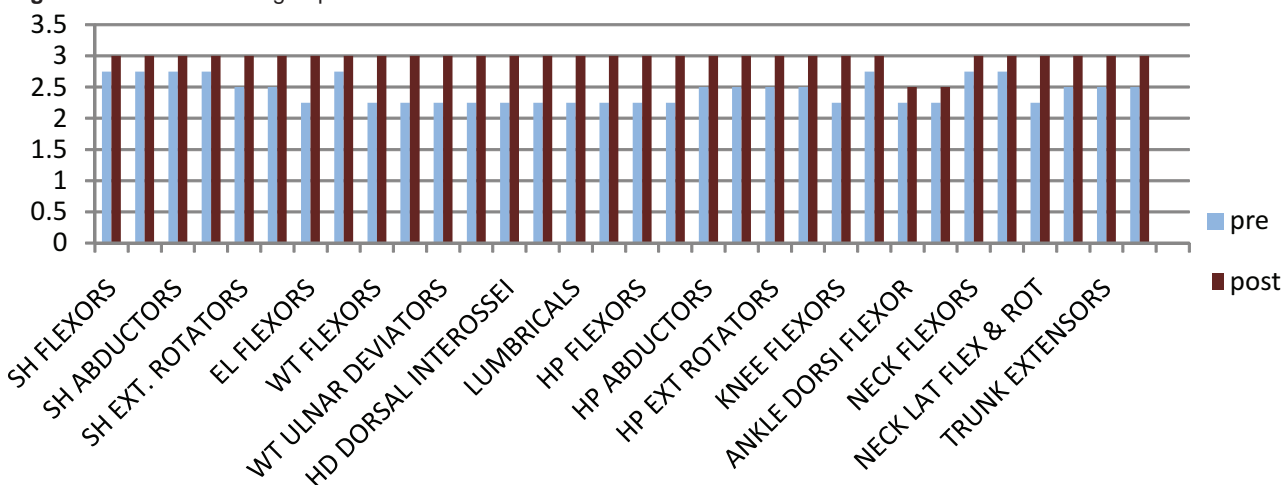


Diagram 5: MMT values between group A and group B

p values			
SH FLEXORS	0.686	HP FLEXORS	1
SH EXTENSORS	0.686	HP EXTENSORS	1
SH ABDUCTORS	1	HP ABDUCTORS	0.134
SH ADDUCTORS	1	HP ADDUCTORS	0.134
SH EXT. ROTATORS	1	HP EXT ROTATORS	0.134
SH INT. ROTATORS	1	HP INT ROTATORS	0.134
EL FLEXORS	0.537	KNEE FLEXORS	0.024
EL EXTENSORS	0.537	KNEE EXTENSORS	0.024
WT FLEXORS	0.537	ANKLE DORSI FLEXOR	0.537
WT ETENSORS	0.537	ANKLE PLANTAR FLEXOR	0.134
WT ULNAR DEVIATORS	0.537	NECK FLEXORS	1
WT RADIAL DEVIATORS	0.537	NECK EXTENSORS	1
HD DORSAL INTEROSSEI	1	NECK LAT FLEX & ROT	0.537
HD PALMAR INTEROSSEI	1	TRUNK FLEXORS	0.537
LUMBRICALS	1	TRUNK EXTENSORS	0.563
THUMB MUSCLES	1	TRUNK LAT FLEXORS	1

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Mulidisciplinary VM – Weight distribution analysis system: A diagnostic and evaluative tool for altered weight distribution

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Abstract

Weight distribution pattern is a vital biomechanical parameter to evaluate knee joint changes and its functional correlates in knee osteoarthritis. VM - Weight Distribution Analysis System is a uniquely designed foot plate consisting of transducers (load cells), the interface and, digital display unit to measure static load distribution as well as variation in load distribution in different functional positions to quantify the variability in weight distribution and identify the biomechanical factors / attributes responsible for altered weight distribution. Understanding of this altered distribution is of utmost importance in the treatment of arthritic knee leading to compromised lifestyle and pain. The treatment process in knee osteoarthritis includes selection and prescription of: appropriate knee orthosis, shoe modification and exercise regime to maximize the efficiency of a person within the environmental context. The knowledge of this altered weight distribution in knee osteoarthritis over different areas of feet guides the process of designing, selection and prescription of orthosis as well as treatment implementation. This VM - Weight Distribution Analysis System provides the knowledge of altered load distribution over different regions of feet simultaneously and guide the clinical decision making process.

Key Words

VM-Weight Distribution Analysis System; Knee Osteoarthritis; Altered weight distribution.

Introduction

The knee is a major weight bearing joint and foot as its mobile foundation for the actual weight distribution. The magnitude of load experienced by foot is astounding and the distribution of loads under foot has been the subject of intense investigation for the last half century. Foot is the direct contact between the body & external environment and the central nervous system relies on sensory input from the muscles & cutaneous receptors in the lower extremity to generate effective motor patterns for human posture and locomotion. Feedback that originates from these receptors provides a constant source of information on loading, joint kinematics, plantar pressure distribution²⁻⁶. Weight (/load) distribution is a vital biomechanical parameter to evaluate knee joint changes and its functional correlates in causation of knee osteoarthritis. In knee osteoarthritis (OA) condition, there is shift of center of gravity which causes higher weight distribution over medial aspects of foot. Better understanding of foot loading characteristics can help in preventing overloading of knee and foot and correct / modify the altered weight distribution pattern¹.

Method

Description of VM - Weight Distribution Analysis System

VM - Weight Distribution Analysis System is an

indigenously designed foot plate system consisting of sixteen load cells with eight cells for each foot. Out of eight, six load cells are square shaped while two are rectangular in shape. Each load cell is calibrated to detect up to thirty kilograms of weight and composite weight in each foot region can range up to (30 x 8) 240 kilograms.

The three sections of each foot i.e. forefoot, mid foot & hind foot are divided into seven different compartments. The instrument is sensitive in detecting / measuring static load distribution as well as variation in load distribution in different functional positions like standing, Squatting, Minisquat, One leg stand etc. The unique property of this equipment (i.e. sensitivity to load variation) helps to quantify the variability in weight /load distribution over feet in different positions / postures and identify the biomechanical factors / attributes responsible for altered weight distribution.

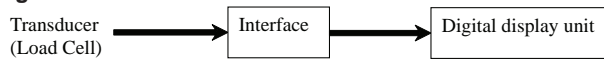
Instrumentation

The VM - Weight Distribution Analysis System (/ VM-Foot Plate System) comprises of mainly three units, namely, the transducers (sixteen load cells), the interface and, digital display unit. The load cells are used as the transducers and incorporate as its integrated portion, the arrangement for initial balancing (i.e. obtaining 'zero' output at 'zero' load on the load cells). Each load cell has a constant power supply and works on 12 volt power consumption and connected to mother card. The main power supply to mother card / digital display card is from an inbuilt transformer (two) within the digital display unit. From the load cell, analog signals are converted to the digital signal via digital converter in the main card. Then the digital signals get displayed in the digital display unit for each load cell which gives the quantitative data of weight over each load cell. The digital display unit was graduated directly in terms of kilograms and is divided into two sections i.e. left and right for each foot separately. The digital display of first load cell corresponds to weight over great toe, second corresponds to 3rd, 4th and 5th toe, third corresponds to proximal half of medial arch, fourth corresponds to proximal half of lateral border, fifth corresponds to distal half of medial arch, sixth corresponds to distal half of lateral border, and seventh & eight corresponds to heel (Annexure A).

Procedure

Each load cell, with its corresponding part of the interface, was termed as one channel. Thus there were eight numbered channels for each foot. The person /

Figure 1.1



patient are instructed to stand over the foot plate and place feet over the subsequent left and right subdivisions. Then patients is asked to take a deep breath for 10 seconds and readings are recorded for each functional position i.e. Stand, Minisquat, Squat, and One leg stand for each foot. The process is to be repeated thrice and the average load on each channel is determined.

Each load cell, with its corresponding part of the interface, was termed as one channel. Thus there were sixteen channels with eight for each foot. Initially the patient is asked to relax for 5 minutes then patients are instructed to stand over the foot plate and place feet over the subsequent left & right subdivisions in desired position. Then patients are asked to acquire each of the functional positions i.e. stand, Minisquat, squat, and one leg stand. Three readings are recorded and average load on each cell is determined.

The plantar weight distribution has been known as a vital biomechanical parameter to aid diagnostic, evaluative as well as treatment process. A number of biomedical researchers have presented varied opinions regarding percentage weight distribution over different areas of foot and suggested the bare foot standing weight distribution of total weight as 60 % in rear foot, 8 % in midfoot and 28 % in forefoot^{3,7}. Knowledge of this distribution is of value in the treatment of arthritic knee. The deviation of the static weight-bearing patterns under the feet of a lower extremity may be measured quantitatively in terms of the Static Weight-Bearing in different positions. The Static Weight-Bearing Index can be conveniently used for evaluation of the functional status of the human lower extremity system in stance phase. The distribution & magnitude of weight over feet in functional position (Stand, Minisquat, Squat, One leg stand) can provide useful information to guide the treatment process. The treatment process includes selection and prescription of: appropriate knee orthosis, shoe modification and exercise regime.

Currently, the concept of selection of orthosis is based on musculoskeletal and biomechanical factors. An appropriate design of an orthosis plays a crucial role in maximizing the efficiency of a person within the environmental context. The performance of the person may be affected due to pathological conditions or biomechanical abnormalities resulting in undue

abnormal stress over anatomical structures. This may result in associated secondary condition such as Knee Osteoarthritis, repetitive strain injuries etc. and vice versa. The associated biomechanical abnormalities may either result from, or lead to muscle dysfunction and associated structural abnormalities. These abnormalities gradually tend to affect the alignment of bodily segments which finally alters plantar weight distribution. The knowledge of this altered weight distribution over different areas of feet has been known to affect the clinical decision making process for designing, selection and prescription of orthosis as well as treatment process.

The knowledge of this altered weight distribution over different areas of feet guides the process of designing, selection and prescription of orthosis as well as treatment implementation. This indigenously designed microprocessor based multidisciplinary VM - Weight Distribution analysis System provides us with the knowledge of altered Load distribution over different regions of feet simultaneously and guide the clinical decision making process.

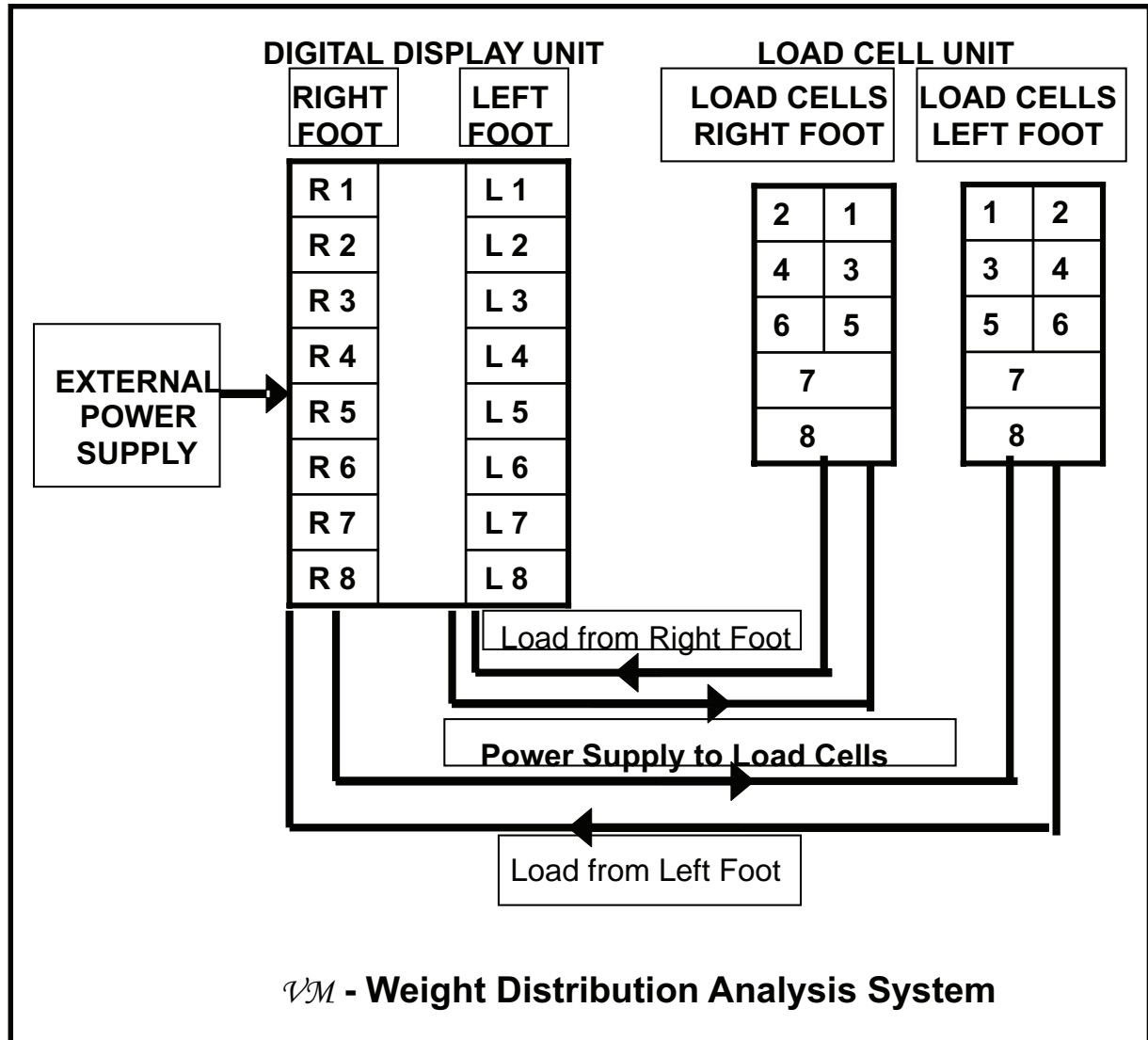
Acknowledgement

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ANNEXURE A



Low back pain in pregnancy – incidence & risk factors

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Abstract

The incidence of women who experience low back pain during their pregnancy ranges from 24% to 90% for different population samples in both retrospective and prospective studies. This study was conducted in order to assess the incidence of LBP and to identify the possible risk factors for LBP during pregnancy by using an epidemiological design.

Key Words

Low back pain, Pregnancy, Incidence, Risk factors.

Introduction

During the nine months of pregnancy, the female body undergoes a number of hormonal and anatomical changes. Many of these changes can cause musculoskeletal problems. The most common orthopedic complaint in pregnancy is Low Back Pain (LBP)^{1,5}. It is estimated that 50% women who are pregnant will experience LBP some time during pregnancy^{1,2,3,4,6,7}. The condition accounts for a significant portion of pregnancy induced discomfort to the gravid female.

Several theories have been proposed for the mechanisms behind LBP during pregnancy. It is widely accepted that pregnancy is characterized by a multitude of physiologic, endocrine, and physical adjustments which include an increase in the load imposed on pregnant women's spine³. It is especially prone to occur in women who had borne many children. Repeated pregnancies produce scarring and weakening of the major pelvic and lumbosacral ligament supports, which are unable to bear the stresses brought about by another pregnancy¹³.

The pelvic floor is bordered by the abdominal wall, which also stretches during pregnancy. While the pelvic floor is severely stretched for a comparatively short period of time, the abdominal wall continues to expand continually for nine months. It must have elasticity to return to its original size and shape. If the abdominal muscles are weak, the growing uterus will put a strain on the lower back that can result in severe and debilitating pain⁹.

The presence of foetus in the pelvis, anterior to lumbar spine increases the lumbar lordosis, and decreases the support of abdominal muscles. Along with the weight of the baby, this increases the biomechanical stress on lumbar spine increasing the discomfort².

Because of the special status of pregnancy, it has been thought that this problem should be allowed to resolve spontaneously, that overzealous intervention is inappropriate or dangerous to the mother or the foetus,

or that nothing could be done to alleviate this problem short of the mother completing the pregnancy^{1,8}.

In this study, an attempt is made to measure the incidence of LBP among the pregnant women attending the Obstetrics and Gynecology, Unit I, Rajah Muthiah Medical College and Hospital (RMMC&H), Annamalai University, Chidambaram, Tamil Nadu and to use an epidemiological design to determine whether risk factor for LBP in pregnancy could be identified.

Need of the Study

Pregnancy-related LBP is a common problem with significant physical, psychological, and socioeconomic implications that should not be ignored. Interestingly, despite the growing recognition of the importance of LBP during pregnancy, there is a paucity of data regarding the incidence and risk factors of this problem in Tamil Nadu. We are unaware of any other studies that are designed to determine the incidence and risk factors of LBP during pregnancy among women in Tamil Nadu. We therefore designed this study which highlights the incidence and risk factors of LBP in pregnant women who live in and around Chidambaram who visits RMMC&H for the antenatal check-up.

Objectives

1. To study the incidence of LBP among the pregnant women attending the O & G, Unit I, Rajah Muthiah Medical College & Hospital.
2. To identify the possible risk factors for LBP during pregnancy by using an epidemiological design.

Methodology

Study Area

The Out Patient Department (OPD) of Obstetrics and Gynecology, Unit 1, RMMC&H was the study area for the proposed study. This unit functions two days in a week, Mondays and Thursdays. An average of 20-25 antenatal women is attending this unit on each of these days.

Study Population

The antenatal women irrespective of the gestational period were taken as the study population.

Inclusion criterion

Non-specific LBP of atraumatic origin not caused by, or related to, any medical diseases.

Exclusion criterion

The pregnant women with systemic medical conditions, spinal deformities and hip pathology.

Study design

This was a prospective clinical study extended from 1st January 2005 to 30th May 2005. The sample consisted of 172 pregnant women. The study objectives and procedures were explained to all participants and informed consent was obtained. The medical records of all participations were reviewed. Relevant data were collected by using a pre-tested proforma. The height, weight and abdominal circumference at umbilical level of all subjects were measured.

Subjects were asked to report whether they experienced LBP after conception. If pain was reported, Numerical Analogue Scale (NAS) 14 was used to quantify pain intensity.

All the subjects were provided with a handout consisting of diagrams and details printed in Tamil for home program. Subjects' identification number and date of assessment were noted in that handout and they were asked to bring this on the follow-up visits, so that they could easily be identified by the investigator.

Reviews were performed at subsequent follow-up visits of the subject to the O & G OPD. In the proforma, provision for recording the follow-up assessment was also included. During every visit the weight and abdominal circumference were rechecked and recorded and the absence / presence / no change / change in LBP was noted.

After the completion of sample collection in the first 2 months (1st January 2005 to 28th February 2005), no new cases were recruited during the following 3 months of study. The reviewing of the already recruited cases only was performed till 30th May 2005, to detect further onset / change in LBP.

Data were collected, tabulated, analyzed and interpreted with suitable statistical tools.

Analysis of Data & Results

Table 1: Incidence of LBP in Pregnancy

LBP	Frequency	%
Present	104	60.5
Absent	68	39.5
Total	172	100

Out of 172 women examined, 104 (60.5%) had LBP.

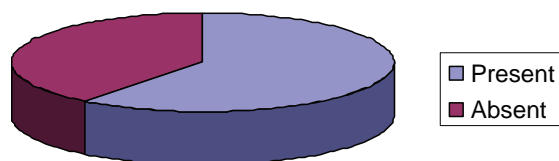


Table 2: Incidence of LBP by Maternal Age

Age range (years)	Present	%	Absent	%	Total
<20	12	57.1%	9	42.9%	21
21-25	53	54.6%	44	45.4%	97
26-30	35	71.4%	14	28.6%	49
31-35	4	80.0%	1	20.0%	5

p <0.001

Chi-square trend = 8.24

80% of the antenatal women with an age of >30 years were having LBP whereas only 57% women with the age group of <20 years were having LBP. So there exists a significant statistical association between maternal age and incidence of LBP. i.e., it has been found to increase with increasing maternal age.

Table 3: Incidence of LBP by Occupation

Occupation	LBP				Total
	Present	%	Absent	%	
Housewife	99	61.1%	63	38.9%	162
Employee	5	50.0%	5	50.0%	10
Total	104	--	68	--	172

Out of 172 women, 162 (94.2%) were housewives and employed women were only 10 (5.8%). Because of the inadequate sample size of employed women, it was unclear whether the occupation of the women is a risk factor for LBP during pregnancy.

Table 4: Incidence of LBP by Height

Height Range (cm)	LBP				Total	%
	Present	%	Absent	%		
≤150	45	62.5	27	37.5	72	42
151-160	54	62.1	33	37.9	87	50.5
>160	5	38.5	8	61.5	13	7.5

Chi-square trend = 9.57

P = <0.01

Among the study population, 72 women were with the height of <150cm. Among them 45 women (62.5%) were having LBP whereas out of 13 women with the height of >160cm, only 5 (38.5%) were having LBP. The chi-square trend also confirm the significant association between the height of the mother and LBP i.e., short stature women are more prone to develop LBP.

The average weight of the women who were having LBP was 44kg at the gestational age less than 16 weeks, whereas it was slightly increased for the women without LBP. Afterwards, in almost all the gestational age groups, the weight was slightly increased for those women who were having LBP compared to the women who were not having LBP. However, no statistical significance was found out between the weight of the mothers, and the incidence of LBP irrespective of gestational age.

In case of women with <16 weeks of gestational period, the mean abdominal circumference was more

Table 5: Incidence of LBP and Weight by Gestational Age

Gestational age (in weeks)	LBP				t	p
	Present		Absent			
	Mean weight (kg)	SD	Mean weight (kg)	SD		
<16	43.6	7.6	51.9	11.7	1.882	0.076
17-20	47.6	4.2	44.2	7.4	-1.114	0.287
21-24	49.8	11.3	43.4	6.7	-1.634	0.114
25-28	54.9	12.6	49.6	6.5	-0.892	0.384
29-32	49.5	7.7	49.7	11.0	0.070	0.945
>33	48.29	6.6	51.6	9.5	1.364	0.179
Total	49.4	9.2	49.3	9.7	--	--

Table 6: Incidence of LBP and Abdominal Circumference by Gestational Age

Gestational age (in weeks)	LBP				t	p
	Present		Absent			
	Mean abd. cirm. (cm)	SD	Mean abd. cirm. (cm)	SD		
<16	72.6	12.3	79.1	9.3	1.33	0.199
17-20	80.4	5.1	73.83	5.8	-2.241	0.045
21-24	84.9	11.1	80.0	4.9	-1.326	0.196
25-28	92.1	11.8	89.2	10.3	-0.497	0.625
29-32	89.9	7.4	88.4	9.1	-0.581	0.585
>33	91.3	6.2	90.4	9.4	-0.380	0.706
Total	87.3	10.7	85.3	10.2	--	--

for those without LBP compared to those having LBP. In all the other groups, the mean abdominal circumference was more for women with LBP. However, the linear correlation between the two factors was found to be statistically insignificant.

Table 7: LBP by Parity

Parity	LBP				Total
	Present	%	Absent	%	
Multi	71	67.6	34	32.4	105
Uni	33	49.3	34	50.7	67
Total	104	-	68	-	172

Odd's ratio – 2.15

68% of multiparous women and 49% of uniparous women were having LBP in the current pregnancy. Odd's ratio was used to assess the strength of association

between parity and incidence of LBP. The Odd's ratio 2.15 infers that the chance of developing LBP was 2 times higher for a multiparous women compared to uniparous women.

Among the women who were below 20 weeks gestational period, 53% of them were having LBP. 76% of women with gestational period of 25-28 weeks were having LBP. However, the incidence of LBP was reduced to 45% among the women with gestational period of 33 weeks or more. Pearson chi-square test indicates that there exists significant positive association between the incidence of LBP and gestational age. That is, the incidence of LBP increases with increase in gestational period.

Among the study population, 44% of women had previous episodes of LBP. Among them 67% were currently having LBP. To find out the association, Odd's ratio was calculated. It infers that the chance

Table 8: Incidence of LBP by Gestational Period

Gestational period range (in wks)	LBP				Total	%
	Present	%	Absent	%		
≤ 20	18	52.9	16	47.1	34	19.77
21-24	18	64.3	10	35.7	28	16.28
25-28	16	76.2	5	23.8	21	12.21
29-32	31	73.8%	11	26.2%	42	24.41
≥33	21	44.7	26	55.3	47	27.33
Total	104	--	68	--	172	--

Pearson chi-square = 11.351, degrees of freedom (df) = 5
P = 0.04 s

Table 9: Incidence of LBP by Previous History of LBP

Previous H/o LBP	LBP				Total	%
	Present	%	Absent	%		
Present	51	67.1	25	32.9	76	44.18
Absent	53	55.8	43	44.8	96	55.82
Total	104	--	68	--	172	--

Odd's ratio = 1.65

of developing LBP during pregnancy was 1.65 times higher for women who were having history of LBP before pregnancy compared to the women who were not having LBP previously.

Discussion

Out of 172 women examined, 104 women (60.5%) had LBP during their current pregnancy. This result was in concordance with that of similar studies^{1,2,3,4,5,6,7,8}.

Risk factors

a) Maternal age

A statistical association was found between the maternal age and the incidence of LBP. LBP during current pregnancy could be predicted by age, i.e. older women were more likely to develop this problem, with an incidence of 80% of subjects having LBP in the 31-35 age group. A review of literature on this subject is confusing because of contradicting results.

This result corresponds to the findings of James D. Heckman and Ostegaard¹⁵. Shu- Ming Wang¹² observed younger age increased the risk of LBP, whereas the report given by Orvieto¹¹ was found to have no association between maternal age and LBP.

b. Occupation

Out of 172 women examined, 162 (94.2%) were housewives and only 10 (5.8%) were employed. Because relatively few subjects were in the category of employed women, a statistical analysis could not be performed. Hence it will be necessary to evaluate this correlation in a future study with more samples and preferably in an urban setting.

c. Height

A strong statistical association was found between the incidence of LBP and height. Out of this 172 subjects, 72 were ≤ 150 cm where, the incidence rate of LBP was 62.5% whereas in the >160 group, out of total 13 women, 38.5% only were having this problem. From these results, it is inferred that the short stature women are more prone to develop LBP in pregnancy. But the available literature could not support this finding^{11,13}. This discrepancy may be due to the relatively small sample size of the group.

d. Weight

The relationship between of LBP and maternal weight was analyzed based on the gestational period, and it was found that there exists no association between these two factors, and these results are in accordance with the available literature^{1,2,6,11}.

e. Abdominal circumference

As with the weight, the incidence of LBP by transverse

abdominal circumference too, was correlated considering the gestational period. No statistical association was observed with the increase in abdominal circumference and LBP. This result contradicts the reports available. Hans L Carlson et al.⁶ found that the abdominal sagittal and transverse diameter is one of the biomechanical factors of pregnancy that is shown to be associated with LBP of pregnancy.

f. Parity

Out of 172 subjects, 105 were multiparous and 67 were uniparous. In multiparous, the incidence rate was 67.6% where as in uniparous, the rate was 49.3%. From this result, one could infer that, multiparous women are 2 times more at risk of developing LBP than the uniparous women. Most of the literature^{1,2,5,12,13,15} support this finding. However, Orvieto et al.¹¹ could find no significant correlation between the number of prior pregnancies and LBP.

g. Gestational period

A linear statistical correlation was found between gestational period and LBP upto the 28th weeks (i.e. 7th month of pregnancy), where there was a gradual increase in the incidence of LBP with advancing pregnancy. From the 8th month onwards the rate decreases. The peak incidence rate was observed in the 25-28wks of gestation. This may be due to the fact that some adjustments may occur in the pregnant women's body to the stressful postural changes. Another explanation could be the relative reduction in physical work and chances for getting adequate rest during the third trimester of pregnancy. The similar findings are reported by Shah Alam Khan¹³ and Kristiansson¹⁰, whereas Orvieto et al.¹¹ reported that gestational age was not found to be a risk factor of LBP.

h. Previous history of LBP

Out of the 104 women who reported LBP in current pregnancy, 76 patients had the history of LBP previously. It was found that, those women are 1.65 times more at risk for developing LBP during subsequent pregnancies, compared to the women who were not having LBP previously. All the available literature supports this observation.

Conclusion

LBP is the most common musculoskeletal complaint in pregnancy which scored 60.5% in the present study. The risk factors that were contributory for this problem included increase in the maternal age, decrease in height, increase in parity, gestational period and previous history of LBP. The association of occupation, weight and

abdominal circumference to the incidence of LBP could not be observed.

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Health related quality of life in chronic non specific low back pain individuals with type II diabetes

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Abstract

Background

Quality of life (QOL) is increasingly recognized as a key outcome of evaluation research. The SF-36 is a well-validated health status instrument measuring eight different health concepts for measuring HRQOL. Now a day, a work is needed to reliably and accurately measure health-related quality of life among individuals with chronic non-specific LBP with type II Diabetes in the community setting to optimize the effects of increasingly complex and intensive treatments for it.

Objective

Our aim of this study was to compare health status measured by SF-36 in Chronic Low Back Pain individuals with type-2 diabetics and non diabetics.

Methodology

In the present Observational Study a HRQOL questionnaire (generic SF-36v2) was administered to fifty (30 males and 20 Females) out patients of either sex, aged above 40 years with Chronic non specific Low back pain (LBP) with or without type II diabetes and selectively assigned to 1 of 2 groups: a group consists of 25 Non-Diabetics and a matched group consists 25 controlled Type II Diabetics of atleast 4 years of duration.

Results

Results revealed Health Related Quality of Life was affected in all the participants but it was more affected in group 2 than group 1. Furthermore, on comparing the health status of group 1 with group 2 showed that mental health in group 2 was significantly affected than Physical health in group 1.

Conclusion

Diabetes significantly affects "Health Related Quality Of Life" in individuals with Non specific LBP. Mental Health is significantly affected than Physical Health in individuals with Non specific LBP and Type II Diabetes.

Keywords

Health related quality of life (HQOL), Type-2 diabetes, non-specific low back pain (LBP), SF-36 v2 (Short Form-36 Health Survey-version 2).

Introduction

Measuring health status in a population is important for the evaluation of interventions and the prediction of health and social care needs. Health-related quality of life(HRQOL) is "an individuals or groups perceived physical and mental health over time". According to Cella, (1995) the extent to which one's usual or expected physical, emotional and social well-being are affected by a medical condition or its treatment.

Quality of life (QoL) studies are an essential complement to medical evaluation. QoL is a multi-faceted concept, which encompasses crucial areas such as physical health, psychological well being, social relationships, economic circumstances, personal

beliefs and their relationships to salient features of the environment¹. Thus, quality-of-life issues are crucially important, because they may powerfully predict an individual's capacity to manage his disease and maintain long-term health and well-being.

Several scales have been used to measure the different domains HRQOL. Certain scales are generic such as the "Sickness Impact Profile" (SIP), the "MOS 36 item Short Form Health Survey" (SF-36), and the "Nottingham Health Profile" (NHP), while others are specific to a disease, a particular function (e.g. pain) or to a group of patients. The SF-36 is the most widely used generic QOL instrument worldwide because of its comprehensiveness, its brevity and its high standard of reliability and validity in assessment of LBP and diabetic health status^{2,3,4,5}.

Chronic low back pain is a common health problem in many countries. Over 80% of adults experience low back pain (LBP) sometime during their life⁶. The coexistence of musculoskeletal diseases like LBP should be taken into account in research and clinical practice because of its high prevalence and its substantial impact on health related quality of life^{7,8}. Diabetes is a co morbid condition for Low Back Pain (LBP). According to the Diabetes Atlas, 2006 published by the International Diabetes Federation, "India is a diabetic capital of world" So diabetes mellitus has become an important public health concern. People with diabetes are at high risk to develop musculoskeletal problems like back pain due to diffuse idiopathic skeletal hyperostosis (DISH) in response to raised blood sugar levels and metabolic perturbations^{9,10}.

Now a days, a work is needed to reliably and accurately measure health-related quality of life among Non specific LBP individuals and Diabetes and hence to measure and optimize the effects of increasingly complex and intensive treatments.

So here an attempt is made to evaluate the impact of nonspecific Low Back Pain and co-existing Type II Diabetes mellitus on Health-related quality of life including physical, mental and social domains using SF-36.

Methodology

Study design

Observational study, Selective sampling

Study Setting

Musculoskeletal Outpatient department of RNPC

In a present Observational study, Fifty (30 males and 20 Females) out patients of either sex, aged above 40 years with Chronic non specific Low back pain (LBP) with or without type II diabetes included in the study. The duration of symptoms of back pain ranged from 2 months to 10 years. Prior to participation, subjects signed a consent form that was approved by institutional review boards. These participants randomly divided into two groups of 25 patients each as Group 1 consists of 25 Non-Diabetics individuals (age = 53.36 ± 5.99 years) and a matched Group 2 consists 25 controlled Type II Diabetics of at least 4 years of duration (age = 55 ± 4.8 6.9 years) on oral hypoglycemics.

The patients having hypertension, heart disease, lung diseases neurological diabetic complications-neuropathies, lumbar radiculopathy and acute LBP were excluded from the study.

Instrumentation

Health-related QOL for participants was measured using SF-36. SF-36 includes eight individual sub-scales (physical function, physical role, emotional role, social function, bodily pain, mental health, vitality and general health perceptions and two summary scores (Physical and Mental summary score/Component score). A higher SF-36 score indicates better functioning¹¹.

- After identifying eligible individuals, the Short Form 36 (SF-36) was administered by self-administration or face-to-face interviews (for illiterate persons) which measures health-related QOL.
- Data obtained from participants using SF-36 were electronically scored via the instrument- scoring software available at www.sf-36.com (Scoring for version 2 of the SF-36 is based on the algorithms).

Statistical Analysis

Statistical analysis was performed using- Data were entered into an Excel spreadsheet (Microsoft Corporation) and analyzed using SPSS version 14 (SPSS Inc., Chicago, Illinois) software.

- A Unpaired Student's t- tests with 24 deg of freedom at 5% level of significance
- Pearson's Co-relation Coefficient

Table 3: Student's unpaired t-test results when Group 1 and group 2 were compared for SF 36 Domains

SF 36 Domains	95% Confidence interval	p value	Statistical Significance
Physical Functioning	-1.156 to 6.028	0.1792	Not significant
Role Physical	-1.258 to 2.426	0.527	Not significant
Bodily Pain	1.661 to 6.930	0.0019	Very significant
General Health	1.725 to 5.906	0.006	Extremely significant
Vitality	1.250 to 5.485	0.0024	Very significant
Social Functioning	2.284 to 7.739	0.0006	Extremely significant
Role Emotional	3.815 to 7.960	0.0001	Extremely significant
Mental Health	2.985 to 6.93	0.0006	Extremely significant
Mental Health Component	4.565 to 7.450	< 0.0001	Extremely significant
Physical Component Score	-1.14262 to 3.91062	0.2762	Not significant

Results

A total of 50 individuals from Group 1 and 2 were interviewed and completed SF-36-v2 at initiation of the project.

Table 1: Characteristics of study subjects: Age and Sex Distribution

	Group A	Group B
Mean age (SD)	53.36 yrs ± 5.99	55.48 yrs ± 6.9
Males (%)	15(60%)	15(60%)
Females (%)	10(40%)	10(40%)

Table 2: Mean Duration of symptoms (in years):

	Group A	Group B
Duration of LBP Mean (SD)	2.94 (± 2.84)	3.40 (± 2.40)
Duration of DM Mean (SD)	--	4.10 (± 3.17)

Pearson's co-relation

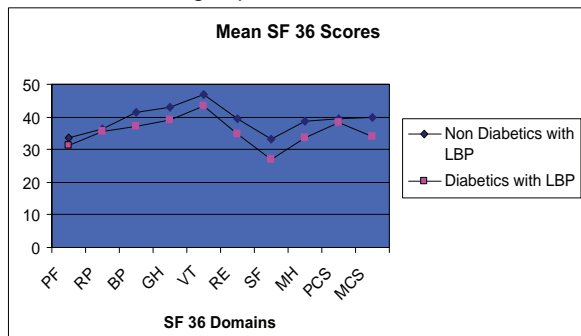
To study the relationship of age and duration of diabetes and SF-36 scores in group 2, Pearson's Co-relation test was done at the level of 0.05.

Table 4:

SF-36 Domains	r value AGE	r value Duration
PF	-169	-0.074
RP	-254	-0.144
BP	-123	-0.039
GH	-368	0.433
VT	-065	-0.266
SF	-285	-0.23
RE	-286	-0.15
MH	-411	-0.374

Results showed a negative correlation of age with all the SF36 domains & duration of diabetes show a positive correlation with the SF 36 domain - General Health. [GH, r=0.433]

Line diagram 1: The individual dimension of SF 36 Domains mean scores in both groups.



Discussion

In the present study, SF-36 health survey was used to evaluate the HRQoL in Chronic LBP individuals without and with Type II diabetes¹². And many studies validate the use of short form-36 among people with type 2 diabetes in general practice. Although valid and reliable, SF-36 scores are strongly affected by non-diabetic co-morbidity in type 2 diabetes, supporting the complementary use of a diabetes-specific measure, providing information about the impact of diabetes specifically¹³. Subjects with diabetes and multiple co-existing chronic medical conditions have poorer HRQoL than those without these conditions. In another study, subjects with diabetes and co-existing coronary artery disease, peripheral sensory neuropathy and peripheral vascular diseases reported significantly lower scores on several SF-36 scales^{14,15}.

This study confirmed that HRQoL was reduced in patients with LBP and diabetes when compared to non diabetic LBP patients. This cohort study compares favorably with other studies which show that Diabetes and LBP significantly lowers the HRQoL due to physiologic and psychosocial effects of Diabetes which should be managed¹⁶.

In this study, we found that diabetes affects HRQoL in patients with LBP, with greater impact on the SF-36 scores measuring mental health components (vitality, role-emotional, social functioning and mental health) relative to physical health components (physical functioning, role-physical, bodily pain, general health) in this study sample. Statistically it was found that SF-36 Mental health component and its sub-scale domain scores decreased significantly in patients with LBP with Diabetes. In contrast, no significant change was observed in the Physical health component and its sub-scale domain scores (Physical Functioning and Role Physical) for these patients, except for the two domains. Also mental health summary scores (MCS) of diabetics with LBP subjects were significantly lower than physical health summary scores when compared to Non diabetics with LBP. This proves that Mental Health is significantly affected than Physical Health in individuals with Non specific LBP and Type II Diabetes. The results of the study conducted by Robert D. Goldney¹⁷ favours our results in which he found that 23.6% of those with diabetes had a depressive syndrome compared with 17.1% of the non diabetic population. And the depression associated with

diabetes adds an effect on a quality of life, as measured by standardized scores across all SF-36 dimensions for the diabetes. In a study done by Lustman and Clouse¹⁸ concluded that optimal therapies for depression in diabetes are still not available. Nevertheless, despite the imperfections of available treatments for depression, the magnitude of the impact of depression and diabetes on a range of quality-of-life dimensions indicates that attention to the optimum management of depression in the primary care setting would result in appreciable alleviation of suffering in those with diabetes and depression along with musculoskeletal problem like LBP. More so, failure to manage depression may compromise the management of LBP and diabetes itself.

The SF-36 and its eight domains scores were found to have statistically significant negative correlation with age. Yogesh Gautam et al¹⁹ reported similar findings in Indian population where all domains, other than GH, had significant association with age and marital status. The mean duration of diabetes among respondents in the present status was 4.10 ± 3.17 years. Results suggests that, there was no effect of duration of Type II diabetes on HRQoL in patients with LBP, except for the one parameter of SF 36 i.e. general health suggesting duration of Type II Diabetes was not consistently associated with HRQoL in subjects with Non specific LBP. This finding also goes in accordance with the study done by Rubin RR & Peyrot M²⁰ in which they found that duration and type of diabetes are not consistently associated with quality of life. Complications of diabetes are the most important disease-specific determinant of quality of life. Lau Infact Chuen-Yen²¹ found a direct relationship between glycemic control and QOL and Improved diabetic control is associated with improved mental, but not physical health over a one year period in the community setting.

Clinical Implication

According to present study, HQoL in individuals with musculoskeletal problems such as LBP associated Type II diabetes was significantly influenced by the psychological, emotional and physical aspects of the functional status of the individual. Depression for those with diabetes is an important comorbidity that requires careful management because of its severe impact on quality of life.

Therefore, in addition routine treatment for LBP like Physiotherapy and Back Care along with specific exercises for back; the control of glycemic levels in diabetics, diet control, regular endurance exercises, Diabetes self-management training^{22,23} & psychological counseling - COPING ABILITY [coping skills with diabetes regimen] should be focused in the multidisciplinary approach to improve HRQoL in individuals with Nonspecific LBP along with Type II Diabetes.

Limitations of study

Small sample size, didn't consider the effect of duration of LBP on SF-36 scores

Conclusion

Diabetes significantly affects "Health Related Quality Of Life" in subjects with Non specific LBP. Diabetes affects mental health considerably than physical health in individuals with Non specific LBP.

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Effect of dorsal neck muscle fatigue on postural control

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Abstract

Background

There appears to be a relationship between muscle fatigue in the cervical spine and deficits in postural control, however, no previous studies have been examined the effects of specific dorsal neck muscle fatigue on designated movers of cervical spine. By systematically fatiguing dorsal neck muscles and measuring subsequent postural control, it may be possible to determine to what extent deficits in postural control exist after fatigue.

Methods

30 subjects were included in the study. Initial dorsal muscle neck strength (Kg) was measured with digital dynamometer and postural sway velocity analysis (mm² / sec) with eyes closed was measured with posturography. Then the subjects were made to follow the dorsal neck muscle fatigue protocol, where the patient is positioned in prone lying with legs straight and arms positioned at the sides in the bed. Load of 2 kg for women and 4 kg for men is applied around the head above the ears. The load is sustained till the subject's tolerance and then post analysis of postural sway velocity and dorsal muscle neck strength were measured.

Results

There was a significant increase in postural sway velocity (<0.01) with eyes closed and the strength of dorsal neck muscles (<0.01) decreased following dorsal neck muscle fatigue protocol.

Conclusion

Postural control alters with dorsal neck muscle fatigue.

Keywords

Dorsal Neck Muscle, Muscle Fatigue, Posturography, Postural control.

Introduction

Muscle fatigue is related to a decline in tension capacity or force output after repeated muscle contraction¹. The onset of fatigue may be attributed to metabolic or neurologic factors controlled peripherally and centrally by the neuromuscular system¹⁻¹¹. Fatigue has been demonstrated to have an adverse effect on neuromuscular control^{8,11-14}. One way of quantifying an aspect of neuromuscular control is through measures of postural control. Maintenance of posture is reliant on input from the visual, vestibular, and somatosensory systems. The somatosensory system receives input from articular, cutaneous, and musculotendinous receptors, including muscle spindles and Golgi tendon organs, that send afferent signals regarding changes in length and tension¹²⁻¹⁴. It is theorized that muscle fatigue may impair the proprioceptive and kinesthetic properties of joints by increasing the threshold of muscle spindle discharge, disrupting afferent feedback, and subsequently altering conscious joint awareness¹²⁻¹⁴. Therefore, altered somatosensory input due to fatigue could result in deficits

in neuromuscular control as represented through deficits in postural control.

The location of the dorsal neck muscles suggest that they potentially play an important role in stabilizing the cervical spine¹⁵⁻¹⁶. In upper quadrant postural dysfunction the dorsal neck muscles are always overused due to forward head position adapted by the subject resulting in loss of strength and endurance¹⁷⁻¹⁹. It is apparent that the afferent input originating from the dorsal neck muscles does exert an influence in the activation of the muscles that control the cervical motion and, thus, may contribute to dynamic stability of the cervical spine¹⁷⁻¹⁹. Little is known, however, about how dorsal neck muscle fatigue affects postural equilibrium and orientation.

Methods

An advertisement in the physical therapy department was given in the form of posters for the voluntary participation of the subjects in the study. Screening was done and the subjects were selected according to the inclusion criteria, where the sample size is 30 subject. (n=30) irrespective of their gender. The study purpose was explained to the subjects and written consent and demographic profile was taken from the subject. At the beginning of the first session pre dorsal neck muscle strength (Kg) were measured using digital dynamometer with the subject lying in prone with leg straight and arm positioned at the sides. Followed by pre postural control analysis in the form of postural sway velocity (mm² / sec) of the subjects were measured using posturography by asking the subject to stand with equal distance between both the leg on the fixed instrument platform (force plate) connected to sensitive detector (force and movement transducers) with both the hands flexed across the chest and eyes closed for 30 second. Then the subjects were made to follow the standardized neck muscle fatigue protocol, where the subject is positioned in prone lying with legs straight and arms positioned at the sides in the bed. Load of 2 kg for women and 4 kg for men is applied around the head above the ears²⁰. The load is sustained on the subject until the subject's tolerance. Immediately following the fatigue protocol, dorsal neck muscle strength (Kg) and postural control (mm² / sec) were measured using the same protocol.

Results

Paired t test was used for comparison of pre and post dorsal neck muscle strength and postural sway velocity with eyes closed. The results of the present

Table 1: Pre and post fatigue change in muscle strength and sway velocity (n=30)

Measure	Pre Fatigue Exercise	Post Fatigue Exercise	P
	Mean ± SD	Mean ± SD	
Strength (Kg)	6.95±1.44	4.99± 1.29	<0.01
Sway Velocity (mm ² /s)	7.49±2.40	12.03±2.91	<0.01

study show that there is a significant decrease in dorsal neck muscles strength (<0.01) and increase in postural sway velocity with eyes closed (<0.01) following fatigue protocol (Table 1).

Discussion

The results of the present study showed that postural sway velocity with eyes closed increased following fatiguing the dorsal neck muscles. The possible reason for increased postural sway might be that dorsal neck muscles are more responsible for stabilization of cervical spine and fatiguing these muscles might modify the discharge of sensory receptors such as muscle spindles or Golgi tendon organs²¹⁻²².

The dorsal neck muscle strength decreased significantly following fatigue protocol, which implies that the fatigue protocol used in the study was able to fatigue the dorsal neck muscles resulting in altered postural sway. Muscle fatigue has been shown to increase body sway significantly after strenuous physical exercise possibly owing to alteration in proprioception²³⁻²⁴.

As in this study, our present results lead us to suggest that localized muscle fatigue of the dorsal neck muscles may modify sensory inputs, affecting central mechanisms of postural control. This may have occurred because of an increased inflow from free nerve endings because of ionic or metabolic changes, such as elevated interstitial potassium concentration, or insufficient oxygen input due to reduced blood flow²⁵⁻²⁷.

Because fatigue slows neural transmission, perhaps the ability to efficiently create compensatory contractions about a joint is reduced, resulting in a lack of neuromuscular control and greater changes in joint position²⁷. This larger variability in joint motion in the absence of corrective muscle actions may result in diminished postural control, as indicated by greater excursion²⁶⁻²⁷.

In a study, it is found that there is decrease in balance performance after fatigue protocol, although our fatigue protocol did not include the same type of muscles, our results immediately after the end of our fatigue protocol concur with those of previous researchers with respect to postural²⁸. Another study suggests that localized muscle fatigue of the dorsal neck muscles may modify sensory inputs, affecting central mechanisms of postural control²⁹.

These results would suggest that patients with cervical disorders may be more susceptible to altered postural sway velocity by neck muscle fatigue than normal subjects. It is possible that the chronic pain state experiencing by patients could lead to disturbed postural control and its ability to compensate for abnormal neck input. Indeed, it is known that cervical pain-related input is able to provoke deficits in postural control induces

changes in the perception of the vertical. Further studies are needed to obtain the results in different cervical pathologies.

Conclusion

The results of the present study proved that dorsal neck muscle fatigue will alter the postural control. Therefore it is understood that endurance of this muscle plays vital role in maintaining cervical postural control, which is necessary for maintaining position sense.

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