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Effect of Two Different Kinesio-Taping Techniques on Pain, Strength & Knee Function in Patellofemoral Osteoarthritis: A Comparative Study

Amita Aggarwal¹, Gurjit Singh², Tushar J. Palekar¹, Shivani Deshmukh², Purva Paranjape², Tejashree Rao²

¹Asst. Professor, ²Post graduate student, ³Principal Professor, Dr. D.Y. Patil College of Physiotherapy, Dr. D.Y. Patil Vidyapeeth, Pimpri, Pune

Abstract

Background: Patellofemoral osteoarthritis (PFOA) is the leading cause of musculoskeletal pain and disability. Treatment of PFOA has been challenging to clinicians. Physical therapy like taping can help alleviate pain and can thereby improve the physical function.

Introduction: OA is the third leading cause of life years lost due to disability. Anterior knee pain is the most common symptom in OA knee and in that patellofemoral joint is an important source of symptom than tibiofemoral joint. There are studies exploring effects of various treatment interventions like manual therapy and electrotherapy to reduce pain, swelling, improve range of motion and knee function. Taping has been studied to treat PFOA. Space correction taping technique works on the principle of offloading joint and muscle taping on facilitation of muscle when applied from origin to insertion. Hence the study was undertaken to compare the two taping techniques and compare the effects of the same.

Methodology & Results: 32 individuals aged between 35-65 years fulfilling the inclusion criteria were selected for the study. Subjects were randomly divided into 2 groups. Then they were assessed for pain using VAS, strength using single leg triple hop jump test and knee function by WOMAC scale. Group A received muscle taping and B received space correction taping technique. In both groups Taping was given for one week along with conventional therapy.

Conclusions: It was found that the effect of muscle kinesio-taping technique and space correction kinesio-taping technique showed almost similar results on pain, strength & knee function in patellofemoral osteoarthritis.

Keywords: Muscle taping technique, Space Correction taping technique, WOMAC, Single-Leg Triple-Hop Jump.

Introduction

Osteoarthritis (OA) is the leading cause of musculoskeletal pain and disability and is the third leading cause of life years lost due to disability.¹ Research has revealed that patellofemoral joint Osteoarthritis is more common than previously thought. In a community-based study of knee osteoarthritis (N = 218), the frequency of radiographic osteophytes was greater in the patellofemoral joint (65% knees) than in the tibiofemoral joint (TFJ) (55% knees). Within the patellofemoral joint, the lateral compartment is more frequently affected by the osteoarthritis process than the medial.²

Also, Amongst the 9 studies that included samples from the general population aged 30 years or more, radiographic patellofemoral joint osteoarthritis prevalence was 25.2%.³ Patellofemoral osteoarthritis, a common cause of anterior knee pain, has been known to be refractory to treatment. This can be attributed to
the complexity of the patellofemoral joint structure and insufficient recognition of the biomechanics of the joint.

An early recognition of patellofemoral osteoarthritis might be important to reduce or intervene at the symptoms which occur with knee OA. Associations were found between increased severity of radiographic isolated patellofemoral osteoarthritis and higher levels of pain, stiffness and functional limitations.

Depending on the direction of application, KT may have facilitatory or inhibitory effects on the muscle. The tape used in the Kinesio Taping is hypothesized to encourage normal muscular function, increase lymphatic and vascular flow, diminish pain, and aid in correction of possible articular malalignments.

Methodology

An experimental study was conducted from March 2018 to December 2018. The participants were randomly assigned for 1 week intervention protocol to either Group A (Muscle Kinesio taping technique) or Group B (Space correction Kinesio taping technique). 40 subjects from Dr. D.Y Patil College of Physiotherapy, Pimpri, Pune (OPD) received a screening containing inclusion criteria (Both genders aged 35-65 years with primary complaint of unilateral knee pain, clinically diagnosed with patellofemoral osteoarthritis and positive Clarke’s test. Patients who had any history of patella fracture in past 3 months, recurrent patellar dislocation, skin infections or allergies to tape and associated knee injury like ACL, MCL tear were excluded.

In total 32 subjects met the above criteria and then subjects were randomized using a chit method based upon numbers. All odd numbers were assigned to the Group B, and even numbers were assigned to the Group A. 3 subjects were dropped out of the study. All the participants were informed about the content and purpose of the study and written informed consent was taken from the participants in the study.

The principal investigator (trained physiotherapist) undertook a standardized history and physical examination of patients. Demographic data like age, gender, location and nature of patient’s symptoms were noted. Clarke’s test was used to test the subjects clinically. During the test, standardized verbal instructions were given by the examiner to explain the test to each subject. Each subject was asked to lie on plinth in supine position. The patient is asked to actively contract the quadriceps muscle while the examiner’s hand exerts pressure on the superior pole of patella. When patient complains of reproduction of the same pain, it denotes that the test is positive.

To determine the intensity of pain visual analogue scale was used in that the subjects were asked to mark the point on the line where they feel it represents their perception of the pain. To determine the strength, single-leg triple-hop jump test was used and to determine knee function, WOMAC scale was used. Then the data were analyzed for statistical significance by using Primer software.

Therapy protocol for Group A i.e. Muscle taping technique (Figure 1)

Subjects (n=16) were asked to lie in Supine position on plinth. The base was affixed to anterior inferior iliac spine. Then the knee was flexed and tape was applied with 10% of stretch along muscle belly up to fingers width above patella. Then the tape was cut at the lower section. The tape was affixed around patella and finally end of tape was affixed with the knee extension at tibial tuberosity.

Therapy protocol for Group B i.e. Space Correction taping technique (Figure 2)

Subjects were asked to lie in Supine position on plinth. The tape was cut to a length approximately 2” longer than the patella. Then, the tape was folded in half and three longitudinal cuts were made, keeping the ends intact. To apply the tape, the tibiofemoral joint was flexed to 120 degrees. The rationale for knee flexion is the increased epidermal tension under the tape in order to assist with the “lifting phenomenon.” The paper on the back of the tape was torn in the middle third and stretched with light to moderate tension (~35%) over
the patella. Finally, with knee in extension, the ends were applied to the superior and inferior aspects of the patella and then rubbed to activate the adhesive.

**Figure 2:** Space Correction Taping Technique with Kinesio Tape

**Data Analysis**

**Table No. 1: Intergroup Pre comparison of outcome measures before intervention**

<table>
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<tr>
<th></th>
<th>Mean ± SD</th>
<th>p value</th>
<th>t value</th>
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<tbody>
<tr>
<td>VAS</td>
<td></td>
<td></td>
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<tr>
<td>Group A</td>
<td>6.57 ± 1.09</td>
<td>0.587</td>
<td>0.549</td>
</tr>
<tr>
<td>Group B</td>
<td>6.33 ± 1.23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single Leg Triple Hop Test</td>
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<td></td>
<td></td>
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<tr>
<td>Group A</td>
<td>36.71 ± 17.74</td>
<td>0.649</td>
<td>0.46</td>
</tr>
<tr>
<td>Group B</td>
<td>33.67 ± 17.89</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WOMAC</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Group A</td>
<td>53.14 ± 10.3</td>
<td>0.074</td>
<td>-1.861</td>
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<tr>
<td>Group B</td>
<td>61.13 ± 12.61</td>
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**Interpretation:** Table 1 denotes that pre mean score of pain, strength and WOMAC score in group A was 6.57, 36.71, 53.14 and group B was 6.33, 33.67 and 61.13.

**Table No. 2: Intragroup comparison between pre and post mean score for various outcome measures in group A**

<table>
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<th>Mean ± SD</th>
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<tbody>
<tr>
<td>VAS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>6.57 ± 1.09</td>
<td>0.001</td>
<td>7.98</td>
</tr>
<tr>
<td>Post</td>
<td>3.29 ± 1.68</td>
<td></td>
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<tr>
<td>Single Leg Triple Hop Test</td>
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<tr>
<td>Pre</td>
<td>36.71 ± 17.74</td>
<td>0.001</td>
<td>-8.16</td>
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<tr>
<td>Post</td>
<td>59.64 ± 21.48</td>
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<tr>
<td>WOMAC</td>
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<tr>
<td>Pre</td>
<td>53.14 ± 10.3</td>
<td>0.001</td>
<td>18.11</td>
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<tr>
<td>Post</td>
<td>29.86 ± 8.96</td>
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**Interpretation:** Table 2 shows that pain score reduces from 6.57 to 3.29, strength increases from 36.71 to 59.64 and WOMAC score decreases from 53.14 to 29.86 in group A.

**Table No. 3: Intrgroup comparison between pre and post mean score for various outcome measures in group B**

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<tr>
<td>VAS</td>
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<tr>
<td>Pre</td>
<td>6.33 ± 1.23</td>
<td>0.001</td>
<td>10.693</td>
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<tr>
<td>Post</td>
<td>3.53 ± 0.99</td>
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<tr>
<td>Pre</td>
<td>33.67 ± 17.89</td>
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<tr>
<td>Post</td>
<td>51.4 ± 15.75</td>
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<td></td>
</tr>
<tr>
<td>Pre</td>
<td>61.13 ± 12.61</td>
<td>0.001</td>
<td>15.536</td>
</tr>
<tr>
<td>Post</td>
<td>41.13 ± 10.19</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Interpretation:** Table 3 shows that pain score reduces from 6.33 to 3.53, strength increases from 33.67 to 51.40 and WOMAC score decreases from 61.13 to 41.13 in group B.

**Table No. 4: Intergroup comparison of pre & post mean difference of Pain, Strength and Knee Function**

<table>
<thead>
<tr>
<th></th>
<th>Mean ± SD</th>
<th>p value</th>
<th>t value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>3.3 ± 1.54</td>
<td>0.322</td>
<td>1.01</td>
</tr>
<tr>
<td>B</td>
<td>2.8 ± 1.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strength</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>59.6 ± 21.48</td>
<td>0.247</td>
<td>1.184</td>
</tr>
<tr>
<td>B</td>
<td>51.4 ± 15.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knee function</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>23.29 ± 4.81</td>
<td>0.082</td>
<td>1.804</td>
</tr>
<tr>
<td>B</td>
<td>20 ± 4.99</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Interpretation:** Table 4 shows that A taping technique was more beneficial than B taping technique in pain, strength and knee function.

**Results**

Out of 32 patients, 29 patients were included and there data was entered into EXCEL sheet, among which 14 samples were in group A and 15 samples were present in group B. 2 samples were dropouts from group A and 1 from group B. normalization of raw data was done and then t-test and paired t test was used accordingly.

Table 1 denotes that pre mean score of pain, strength and WOMAC score in group A was 6.57, 36.71, 53.14 and group B was 6.33, 33.67, and 61.13.
Table 2 showed that pain score reduces from 6.57 to 3.29, strength increases from 36.71 to 59.64 and WOMAC score decreases from 53.14 to 29.86 in group A.

Table 3 shows that pain score reduces from 6.33 to 3.53, strength increases from 33.67 to 51.40 and WOMAC score decreases from 61.13 to 41.13 in group B.

Table 4 showed that A taping technique was more beneficial in reducing pain, increasing strength & improving knee function than B taping technique.

Hence the study shows that muscle taping technique and space correction taping technique shows almost similar results in reducing pain, improving strength and reducing the disability than the in patellofemoral OA knee.

Discussion

The results of the current study revealed that patient with patellofemoral osteoarthritis who received either of muscle or space correction K-taping technique have shown similar improvement for knee pain, functional strength and physical function. These changes were statistically significant.

Patients with a mean age of 49.2 for females and 47.9 years for males had right knee affection which is greater than left side i.e. 55.2% of subjects have patellofemoral osteoarthritis in right knee. Though in our study right knee is found but a study done on laterality of radiograph on osteoarthritis of the knee showed no difference according to leg dominance. 5

According to a cross sectional survey, more than 99% of the physical therapists reported using a combination of two or more interventions; the combination of therapeutic exercise, education, and manual therapy as most frequently used management protocol for patellofemoral arthritis. 6

Kinesio taping of the knee can reduce knee pain by improving patellofemoral alignment and lowering mechanical stress on soft tissues. Lee et al. 7 studied the effect of kinesiology taping application to the vastus medialis oblique and vastus lateralis in patients with patellofemoral pain. And found that pain was relieved, and the activity of either muscle was decreased during moving up and down stairs. In the present study, the results of analysis of pain using the VAS revealed that pain was significantly reduced in the muscle taping group. From this, it can be assumed that the tape is applied when the muscle is maximally elongated, wrinkles on the skin are seen when the tape returns to its normal length. Thus fascia below the skin is separated from the skin allowing blood and lymph circulation to increase within the inner space, which would allow the quick removal of pain inducing substances. 7, 8

The strength of the quadriceps is important in knee OA because this muscle predicts the level of functional abilities. Kinesio tape is hypothesized to facilitate small, immediate increases in muscle strength by producing a concentric pull on the fascia, which may stimulate increase muscle contraction. Anandkumar et al. 9 demonstrated that the application of therapeutic KT applied from the origin of quadriceps muscle to the insertion is effective at increasing isokinetic quadriceps torque, even the eccentric quadriceps torque was found to be increased immediately after taping at angular velocity of 90° per second and 120° per second with large effect size. 9

Function is the most important outcome of treatment, and the WOMAC is one of the most commonly used functional and disability score for knee OA. The study by Anandkumar et al. on a standardized stair-climbing task in patients with knee OA revealed that there is reduction in pain and improvement in the performance in KT group. Similarly present study shows that there is improvement in the knee function. 10 The reason can be that when the stimulus of kinesio tape is attached to the muscle around the knee joint. It helped in the homeostasis of the muscle and thereby gradually reduced the pain and stiffness. As the pain level was reduced, the knee function automatically improved. 9

Regular exercise has a great importance in maintaining good health. The benefits of regular and moderate exercise include reduced risks for some musculoskeletal disorders, such as OA. 11 Physical exercise can play a crucial role in the treatment of OA in optimizing both physical and mental health, enhancing energy, decreasing fatigue and improving sleep. 12 Biomechanical stimulus generated by dynamic compression during moderate exercise can reduce the synthesis of proteolytic enzymes, regulating the metabolic balance and preventing the progression of the disease.

Sathiyavani Dhanakotti et al. studied Effects of Additional Kinesiotaping Over the Conventional
Physiotherapy (CPT) Exercise on Pain, Quadriceps Strength and Knee Functional Disability in Knee Osteoarthritis Participants, which showed That the addition of kinesiotaping to the CPT was capable of reducing pain, improving quadriceps strength and knee functional ability in knee OA participants.

All of the above studies mentioned the effect of taping on pain, strength and knee function but none of the study compared muscle taping versus space correction kinesio taping technique. Hence the present study was carried out and it was seen that both the taping techniques were effective however muscle taping technique showed better results in reduction of pain and improvement in knee strength and function. With the limitation of less number of sample size, Short term follow up and Carry over effect of the interventions was not studied. Range of motion can be assessed as an outcome measure for future scope.

**Ethical Clearance:** Taken from Dr. D.Y. Patil College of Physiotherapy Research & Recognition committee, Pimpri, Pune.

**Source of Funding:** Self

**Conflict of Interest:** Nil

**References**


Effects of Six Weeks Sprint Specific Plyometric Training on Gait Variables of Sprinters

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Abstract

Background: Sprinting is the act of running over a short distance at top speed. Sprinting is involved in many sports as a way of quickly reaching goal. Plyometric training is involved in dynamic sports and plyometric exercises such as jumping, hopping and bounding are executed with a goal of increasing dynamic muscular performance and explosiveness. Plyometrics is used in the measurement of sports performance outcomes such as throwing velocity, jump height or sprint speed. During sprinting gait, foot motion facilitates and can be affected by compensatory movement of other joints in lower extremity thus it is essential to understand the gait patterns while sprinting in the sprinters. The purpose of study was to find the effect of six weeks sprint specific plyometric training on the gait variables in sprinters.

Material & Method: 40 university level sprinters were randomly assigned into two groups, group 1 (G1; n=20) sprint specific plyometric training group (mean age 18.65±0.875; mean height 164.10±11.30 cm; mean mass 59.20±10.74 kg) and group 2 (G2; n= 20) control group (mean age 18.95±1.19; mean height 166.60±9.80 cm; mean mass 61.60±9.24 kg). Both sprint specific plyometric training group and control group were assessed for GAIT parameters by Zebris FDM Treadmill. Control group had followed their routine training schedule and plyometric group performed sprint specific plyometric training for 6 weeks.

Findings: Statistically significant gait variable changes were found in group 1 that is training group: velocity (p=0.00), cadence (p=0.04), step length (lt) (p=0.00) and (rt) (p=0.01) (p=0.00), stance phase (rt) (p=0.04), swing phase (lt) (p=0.02), foot rotation (rt) (p=0.04) and stride length (p=0.00).

Conclusion: The study demonstrates that the neuromuscular training program can increase the proprioception and explosiveness of lower extremity which can lead to increase in overall performance of the sprinters.

Keyword: Plyometrics, Sprinting, Gait, Strength, Speed, Treadmill

Introduction

Humans are considered to be the best distance runners among all running animals: humans have more endurance than the game animals who can run fast over short distances.1) Sprinting is a running short distance event on track and field. Plyometric exercises plays an integral role in strength and conditioning or in performance enhancement regardless the phase it has been used.2) Plyometric training is involved in every sport to increase strength and explosiveness of muscles.3) Sprint running contributes in various sports for successful performances. Various training techniques commonly used to increase the sprinting performance are the speed training, weight training, sprint drills and plyometrics.4) Plyometric is a type of training which have the ability to develop force at high speed in dynamic movements. These dynamic movements includes the stretch of muscle immediately followed by an explosive contraction of the muscle. This is also termed as stretch-shortening cycle (SSC).4) Plyometrics is actually a derivation from the Greek words plythein or plyo, which means to increase and metric, which means to measure. Typically used in the measurement of sports performance outcomes such as throwing velocity, jump height or sprint speed.5,6,7) Plyometric regime includes “on the spot” vertical jump
and bounds as high as possible in vertical and horizontal planes.\(^8,9\) Plyometric exercises used for training the athlete should match the characteristics of their sporting activity they are involved with. That is, to optimize the activity by the principle of specificity. For example, only jumping specific exercises will not increase the running speed.\(^10,11\)

Plyometric exercises can be done alone or combined with any other training program. These exercises can be performed at various intensities, low to high levels, bounding activities (alternating single-leg jumps for maximum horizontal distance), body weight jumping exercises such as drop jump or countermovement jump and alternate-leg hopping.\(^12,13,14,15\)

Some researchers have found and some did not found improvement in previous studies in the sprint speed using plyometric training. The plyometric program used in these studies were not sprint specific therefore, it can be suggested as this can be the reason responsible for absence or little improvement in sprint time.\(^18,16,17\) These studies also did not provided the data regarding the changes in the stride length, stride frequency and other gait parameters which may have accounted for the change in sprint performance. It is suggested that athletes increase their sprinting speed by increasing step frequency whereas world class sprinters achieve their maximum sprinting speed by greater step length.\(^18\) Sprint specific plyometric training includes activities like skipping, jumping and hopping for distance and because of these activities it is suggested that it would improve speed by decreasing the ground contact time and thus increasing the step frequency.\(^19\)

### Material and Method

A total 40 university level sprinters (mean age, height, mass) volunteered and were randomly allocated in two groups, Group 1 (G1; \(n = 20\)) sprint specific plyometric training group and Group 2 (G2; \(n = 20\)) control group. The procedure, benefits and potential risks of study was explained to the subjects before the test started and duly signed informed consent was taken. It was insured that the subjects were free of any musculoskeletal conditions or any neurological dysfunctions. This study was approved by the Institutional Ethics Committee of MYAS-GNDU Department of Sports Sciences and Medicine, Guru Nanak Dev University, Amritsar, Punjab.

The participants allocated to each group of the study agreed not to change or increase their current exercise routine during the course of the study. The sprint specific plyometric training group participated in a six week exercise program thrice a week which included various jumping, bounding and sprinting exercises designed (table) where the control group continued their routine training schedule. Participants gait parameters was measured by Zebris FDM treadmill and software. The plyometric training group performed a 5 minute warm-up protocol consisting of general stretching before each session. The participants were tested before and after the six weeks training protocol. The procedure was conducted using the Zebris treadmill gait analyser. Participants was made to run barefoot on a set speed of 2.7 meter/second on the treadmill.\(^20\) The various gait parameters including the spatial and temporal and other set parameters were considered in the reporting.

<table>
<thead>
<tr>
<th>Table 1: 6-week exercise program performed by the Subjects in the Plyometric Group</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sprinting based program</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Plyometrics program</th>
<th>Sets</th>
<th>Sprint distance (m)</th>
<th>Repetition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Week 1</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Double leg tuck jump</td>
<td>5×8</td>
<td>40</td>
<td>5</td>
</tr>
<tr>
<td>Double leg speed jump</td>
<td>5×8</td>
<td>40</td>
<td>5</td>
</tr>
<tr>
<td><strong>Week 2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Double leg tuck jump</td>
<td>5×8</td>
<td>40</td>
<td>5</td>
</tr>
<tr>
<td>Single leg tuck jump</td>
<td>2×5</td>
<td>25</td>
<td>2</td>
</tr>
<tr>
<td>Double leg speed jump</td>
<td>5×8</td>
<td>40</td>
<td>5</td>
</tr>
<tr>
<td><strong>Week 3</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Double leg bound</td>
<td>2×6</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>Single leg tuck jump</td>
<td>2×8</td>
<td>40</td>
<td>2</td>
</tr>
<tr>
<td>Double leg speed jump</td>
<td>4×10</td>
<td>55</td>
<td>4</td>
</tr>
<tr>
<td>Single leg hop</td>
<td>4×8</td>
<td>40</td>
<td>4</td>
</tr>
</tbody>
</table>
Findings

Represented in the form of table attached as a separate file

The present research aim was to find the effect of 6-weeks of sprint specific plyometric training on changes in sprinting gait variability in sprinters. The variables included the gait phase parameters, spatial gait parameters and temporal gait parameters. The results of this experiment have shown that 6 weeks of sprint specific plyometric protocol performed led to the improvements in gait variables. We reported that the mean change values were particularly evident in following parameters: cadence, stride length and velocity, step length, single support line, swing phase, foot rotation, velocity, step time and stride time. Study done by Mackala K and Fostiak M, 2015 postulated that increase in running speed was the result of increase in 1 or both component: stride length and stride frequency. Similar study done by Singh et al (2018) also found changes in gait variables post 6 weeks agility training. In accordance with above stated studies, present study also suggested the improvement in stride length and stride frequency post training which can be the reason for improvement in sprint performance. However, this does not indicate how plyometric intervention program would determine the changes in sprinting gait variability. The significant increase in stride length which is an indicator of ground contact time reduction during support phase resulted in increased sprint performance. The present study was in accordance to Rimmer & Sleivert, 2000 who found that plyometric combined with sprinting training improved sprinting speed as well as overall performance of the sprinter. The velocity principle of training may be the reason of the change in sprint performance occurring as a result of sprint specific plyometric program. Therefore, in our study, participants who underwent sprint specific plyometric training appeared to have positive effect on sprinting performance. The addition of plyometric with the sprinting program seemed mostly to augment gains in the sprinting variability and can be implemented to increase overall performance in sprinters as well as other sports.

Conclusion

The results from our study highlights and suggests the benefits of sprint specific plyometric training on sprinting as well as overall performance in sprinters.

Practical implications

The most important finding of this study is that a sprint specific plyometrics training program can improve sprint performance, but this is no greater than improvements observed with standard sprint training. Explosive speed is required in many sports and physical activities; coaches and participants should therefore consider plyometric training program that incorporates sprint specific activities.

Conflict of Interest: There were no conflicts of interest.

Source of Funding: The study was conducted at MYAS-GNDU Department of Sports Sciences and Medicine, Guru Nanak Dev University, Amritsar, Punjab, India. This centre is funded by Ministry of Youth Affairs and Sports Government of India.
Ethical Clearance

The ethical clearance was taken from the Institutional Ethical Committee, Guru Nanak Dev University, Amritsar, Punjab, India.

References


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Comparative Analysis of Developmental Milestones in Normal Children in the Age Group of 6 Months to 36 Months from Low-Income Group and High-Income Group: A Pilot Study

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Abstract

Background: Developmental milestones are specific skill attainments occurring in a predictable sequence over time, reflecting the interaction of the child’s developing neurological system with the environment. This study proposes to analyse socioeconomic status as an important factor influencing the age of attainment of developmental milestones in normal children.

Methodology: A cross-sectional assessment-based study based on Denver II developmental screening tool and Kuppuswamy scale, was conducted on 64 children in the age group of 6 months to 3 years.

Conclusion: Comparative analysis of developmental milestones in children from high income group versus those from lower income group showed a mild difference in achievement of milestones.

Keywords: Developmental Milestones, Gross motor, Fine motor, Cognitive development, Socioeconomic status.

Introduction

The early years of a child’s life are extremely important for his or her growth and development¹. This growth of the child is assessed by comparing it with normal developmental milestones. Socioeconomic Status (SES) is one of the factors that affect the age of achievement of developmental milestones. Persistent poverty is a crucial risk factor that affects children’s cognitive development²-⁴.

Socioeconomic inequality is regarded as a fundamental cause of disparities in physical, socioemotional, and cognitive development across the life course. The difference in the exposure to knowledge and surrounding has direct effect on the motor, cognitive and social development of the growing child.

There are several factors that come with different SES which may in turn have effect on the achievement of developmental milestones. Parents in high SES can provide for their children with wide range and variety of nutritional food, anything that a child might need for a proper growth and development. In comparison, for the parents in low SES, nutritional food isn’t the first priority, affordability and availability are the main priority. Educational, occupational, and financial factors all work to create SES-related differences in parents’ circumstances and characteristics⁵,⁶. Parent from higher SES might be in a privileged position to be able to provide the child with a larger exposure in terms of providing toys, books, games etc. On contrary, parents in low socioeconomic group are keener on the gross motor development of the child and often encourage the child to achieve those functions sooner. Hence the purpose of this study is to compare of achievement of milestones in children from low income family and high-income family.

Materials and Method

Study Designs: A comparative age stratified cross-sectional study with convenient sampling of subjects assessed using a Denver II development screening tool and Kuppuswamy scale for assessment. Assessment was done on 64 children, with 16 in each age group and 8 in each SES division.

Inclusion Criteria: Normal children in the age group of 6 months to 36 months from different socioeconomic status group.
Exclusion Criteria: Children who didn’t cry immediately after birth or at risk of delayed milestones due to genetic or medical reasons

Ethical Clearance: was taken from Institutional Ethics Committee by submitting a detailed synopsis of the research.

Outcome Measures: Denver II Developmental Screening tool

Methodology: 8 children from low social income group and high social income group each, for each age group were selected based on the above inclusion criteria. The purpose and procedure were explained to the parents and voluntary consent was obtained. Then the assessment was done using the Denver II Developmental Screening Tool & Kuppuswamy scale.

Results & Discussion

Assessing of developmental milestones has not only become important method of identifying of multiple disorders in children but is also one of the best tools to provide an early intervention. Our research apart from assessing developmental milestones, also points to various contextual factors, like personal as well as environmental, that will have a direct effect on the developmental milestones. SES is one such factor which majorly affects the development of the child.

Our study on comparing and assessing developmental milestones in normal children between 6 months and 36 months from low income group and high-income group gave us the following results

Demographic data: Gender wise distribution:

In the age group of 6 months 37.5% children were male, 62.5% were female. In 12 months and 24months, 62.5% were males where as 37.5% were females. In 36 months old, 68.75% were male children and 31.25 % female.

In high SES, for 36 months old children in High SES, 62.5 % parents had more than one child. This correlates with the fact that the birthrates are higher in areas with low SES group8 and also shows gap between the children. The younger siblings often look up to their elder siblings in various regards and tend to imitate them involuntarily. They pick up several habits from observing them, and also gather certain motor and cognitive skills.

Body Mass Index: In this study, 18.75% children are underweight, 37.5% children are normal, 15.63% children are overweight, and 28.13% children were obese. BMI has a direct effect on developmental milestones and vice-versa (WHO).

Since motor activities, like crawling, walking running are energy intensive physical activities, hence latter attainment of these milestones can be a determinant of childhood obesity9. Sara B et al (2012) in their study also found that children with later age of walking have moderately higher percentage fat9

Gross Motor Milestones

According to this study, in 6 months old, 75% of children from high SES could achieve pull to sit whereas only 62.5% of children from low SES group could achieve this. One probable reason for this can be that children in high SES are mostly made to sit in high chairs, whereas children from low SES are made to sit on the ground more often, hence the achieve tripod sitting sooner. In 12 months old children, more number of children had achieved these gross motor milestones in high SES than in children from low SES group. Pull to sit function, pull to stand and catching a rolling ball were achieved completely by all the children participating in the research.

100% of high SES children but only 75% of children from low SES could achieve crawling. Crawling is an activity which requires space. Children from low-income group living in slums and chawls have less space as compared to high-income group, living in flats and bungalows and so there is more room for them to explore by crawling and so they tend to achieve it faster.

Also 100% of children from high SES but only 87.5% of children from low SES could walk holding only one hand. Inquisitiveness to know more about the surrounding and explore unfamiliar places will motivate the child to stand and explore the surrounding.

Achievement of these tasks, largely depends on parent’s motivation. More the parents motivate the children the sooner they achieve these tasks. 24 months old children, running was an activity achieved by all the children, a greater number of high SES children could achieve other activities like jumping, kicking a ball, doing overhead throw and climbing stairs without holding railing.
87.50% of children from high SES but only 37.5% of children from low SES could climb stairs without holding. In a country like India, where people from low SES still live in chawls or small houses on the side of the road in comparison with children from high SES living in a building, thus being more exposed to stairs.

For 36 months old children, walking up the stairs without holding seemed to be a task achieved by everyone. 100% children from low SES but only 75% from high SES could walk down the stairs without holding.

62.5% children from low SES and 75% children from high SES could Pedal a tricycle. This difference in pedaling tricycle can be attributed to the lack of availability of the tricycle to the children in low SES, due to which the child isn’t exposed to it and hence couldn’t do it. This is supported by Abbott et al. who concluded that the home environment influences the infant motor development10.

**Fine Motor Milestones**

According to this study, all the children in the category of 6 months from both the groups of income, could play with rattle and hold cube in one hand each. Rattle is an extremely easily available toy and hence chances of every child be exposed to this toy and playing with it are very high, hence all the children could do it.

All the children, in 24 months age group from high SES could stack 6 cubes one over the other and knew how to use spoon. Only 75% of the children from low SES could stack cubes and 62.5% children know how to use a spoon. Using fork and spoon are the method used by highly educated and privileged parents. These habits are passed down from parents to the children and so it isn’t very surprising if children from low SES might not know to use one.

87.5% of children from high SES only 37.5% children from low SES could copy a vertical line. In higher SES educated parents dedicated to the development of the child are usually enthusiastic to for the child to start writing and hence children are exposed to pencils sooner.

62.5% from low SES while 87.5% from high SES could copy both a horizontal line and circle.

**Speech-Language Milestones**

Among the 12 months old, all the children from low SES could wave bye-bye, but only 87.5% children from high SES could do so. All the children from high SES could talk instead of using gestures. 87.5% children from low SES could form 2-word phrases.

At 36 months, all the children could follow a 2-step command. 75% of children from high SES and 60% from low SES could use 3-4-word sentences, say a sequential narrative, respectively. When it comes to verbal interaction, higher-SES children hear speech that contains a greater variety of words, greater syntactic complexity, and a larger proportion of conversation-eliciting questions (Hoff-Ginsberg, 1991, 1998; Snow et al., 1976). Both the quantity and the quality of speech have positive relations to language development (Huttenlocher, Haight, and Lyons, 1991), which suggests that higher-SES children are provided a better database from which to learn language than lower-SES children. More educated mothers also provide more detailed information as they have more knowledge when they talk to their children than do less educated mothers6.

**Cognitive**

At 24 months, a significant difference was seen in trying to make the broken toys work. 62.5% children from high SES but only 25% children from low SES could perform. Cognitive abilities were better developed in the 36 months old children from high income group than the children from low income group. Children from varying SES are raised very differently in terms of cognition. The children from affluent families are exposed to numerous fundamental skills quite early on, due to educated parents, as compared to children from less privileged families. Skills like naming colors, numbering things, identifying animals etc. According to our study, 53.13% parents were uneducated, and 46.88% parents were educated.

Children from privileged families are also quite exposed to more variety of toys and get to discover more places around them more often as the parents are motivated to show the children all the fascinating places. On the other hand, children from less privileged families have less toys and are well versed with their locality, hence their cognitive growth is limited to the means available.
Numerous studies have documented that poverty and low parental education are associated with lower levels of school achievement and IQ later in childhood. Gómez-Sanchiz et al. prove that parental intelligence have an integral role cognitive development of the child.11

Social-Emotional

87.5% from low SES showed empathy, 62.5% preferred familiar people and 62.5% did back and forth expressions. Whereas, 62% from high SES showed empathy, 75% preferred familiar people and 87.5% did back and forth expressions.

In 24 months old, 75% of the children from low SES did social referencing, 62.5% could comfort others and 87.5% often used the phrase ‘no, mine’. Whereas 100% of the children from high SES socially referred, 87.5% comforted others and 75% children often used ‘no, mine’.

Children from low-income group live in areas like chawls and slums, whereas children from high-income group are raised in buildings. Also, buildings have multiple residents the houses are quite isolated and so children only come in contact with other children when they go out to play, comparatively, houses is slums and chawls are more crowded, hence more opportunity for the child to have interactions and hence more scope of social-emotional development.

All in all, sensory inputs and environment play a very important role in a child’s life. Sensory inputs motivate the child to explore the surrounding and hence cause motor and cognitive growth. Lack of sensory inputs due to the socioeconomic status of the child, can have detrimental effects on the child.

Also, according to the principle of specificity, you achieve what you train for. A convenient and supportive environment motivates the child to achieve the developmental milestones sooner rather than later.

Tables 1: Status at 36 Months

<table>
<thead>
<tr>
<th>Activity</th>
<th>Low Income Group</th>
<th>High Income Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedal Tricycle</td>
<td>62.5%</td>
<td>75%</td>
</tr>
<tr>
<td>Walk up the stairs without railing</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Walk Down the stairs without railing</td>
<td>100%</td>
<td>75%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fine Motor</th>
<th>Speech-Language</th>
<th>Cognitive</th>
<th>Social-Emotional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copy horizontal Line</td>
<td>62.5%</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>Copy Circle</td>
<td>62.5%</td>
<td>87.5%</td>
<td></td>
</tr>
<tr>
<td>Stack 10 cubes</td>
<td>87.5%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Drink from an open cup</td>
<td>100%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Use spoon/fork</td>
<td>0.875</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Remove shoes and socks</td>
<td>87.5%</td>
<td>87.5%</td>
<td></td>
</tr>
<tr>
<td>Follow 2-step command</td>
<td>100%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>75% speech clear</td>
<td>50%</td>
<td>75%</td>
<td></td>
</tr>
<tr>
<td>What Why How</td>
<td>75%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>3-4 word sentences</td>
<td>87.5%</td>
<td>75%</td>
<td></td>
</tr>
<tr>
<td>Say a sequential narrative</td>
<td>50%</td>
<td>75%</td>
<td></td>
</tr>
<tr>
<td>Name one color</td>
<td>37.5%</td>
<td>62.5%</td>
<td></td>
</tr>
<tr>
<td>Count 2 objects</td>
<td>50%</td>
<td>75%</td>
<td></td>
</tr>
<tr>
<td>Finish 3-4 puzzle</td>
<td>50%</td>
<td>62.5%</td>
<td></td>
</tr>
<tr>
<td>Do role play</td>
<td>75%</td>
<td>75%</td>
<td></td>
</tr>
<tr>
<td>Initiate peer interaction</td>
<td>87.5%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

Tables 2: Status at 24 Months

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Low Income Group</th>
<th>High Income Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Motor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Can run</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Can jump</td>
<td>75%</td>
<td>88%</td>
</tr>
<tr>
<td>Can Kick</td>
<td>63%</td>
<td>100%</td>
</tr>
<tr>
<td>Can do overhead throw</td>
<td>63%</td>
<td>75%</td>
</tr>
<tr>
<td>Can climb stairs without holding</td>
<td>38%</td>
<td>88%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fine Motor</th>
<th>Speech-Language</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copy vertical line</td>
<td>37.5%</td>
</tr>
<tr>
<td>Stack 6 cubes</td>
<td>75%</td>
</tr>
<tr>
<td>Knows how to use spoon</td>
<td>62.5%</td>
</tr>
<tr>
<td>Help in dressing</td>
<td>62.5%</td>
</tr>
<tr>
<td>Can the child talk instead of gesture</td>
<td>88%</td>
</tr>
</tbody>
</table>
In conclusion, there was a mild difference observed in achievement of milestones in children from low income group and children from high income group. In 6-months old significant cognitive development was seen in low-income group and social-emotional development was seen in high-income group. In 12-months old significant gross motor, fine motor and social-emotional development was seen in high-income group whereas, speech-language growth was seen in low-income group. In 24-months old children from high-income group showed a more significant achievement of developmental milestones. In 36-months old significant gross motor development was seen in low-income group whereas, significant fine motor, cognitive, speech-language and social-emotional was seen in high-income group.

Conflict of Interest: No potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Source of Funding: None

References


A Comparison between Kinesio Taping and Medial Arch Support Combined with Exercises in Adult Flatfoot – An Experimental Study

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Abstract

Background: Flatfoot is a commonly observed musculoskeletal disorder in clinical practice. Any deviations from normal foot posture that contributes in reducing medial longitudinal arch can lead to flatfoot that can affect alignment of lower extremity leading to muscle imbalance contributing to musculoskeletal disorders.

Objective: To find the effective treatment among kinesio taping and medial arch support combined with exercises in adult flatfoot using Modified Foot Posture Index (MFPI), Navicular Drop Test (NDT) and Visual Analogue Scale (VAS).

Materials and method: A total of 41 young adults from Belagavi city in age ranging from 18-40 years were screened for eligibility criteria (defined by pronated foot type with MFPI ≥6), 30 young adults met the inclusion criteria and were allocated into two treatment groups Kinesio Taping (Group A, n=15) and Medial Arch (Group B, n=15). The outcome measures used were Modified Foot Posture Index (MFPI), Navicular Drop Test and Visual Analogue Scale (VAS). Subjects were assessed for outcome measures before and after intervention. Post intervention data was analysed using SPSS software version 21.0.

Results: This study has shown 0.79% and 0.83% change in Right FPI scores and 5.04% and 1.80% change in Left MFPI scores, 1.98% and 8.11% change in Right NDT scores and 3.23% and 3.92% change in Left NDT scores, 44.16% and 42.43% change in V AS score in Group A and B respectively.

Conclusion: It was concluded that, both Kinesio taping and medial arch support can be used in combination with exercises as an intervention for adult flatfoot.

Keywords: Flatfoot, kinesio taping, medial arch, MFPI, NDT, Foot posture

Introduction

Variations in foot posture (most commonly flatfoot) are thought to influence the functions of lower extremity like functional alignment and muscle activation patterns. Gastrocnemius tightness, posterior tibial tendon (PTT) dysfunction, congenital, midfoot laxity, excessive tension in plantar fascia are found to be possible factors causing flatfoot. Hence, flatfoot plays a role in predisposition to lower limb injuries like frequent knee pain, low back pain, heel pain, ankle injuries and medial tibiofibular cartilage damage in older adults due to excessive internal rotation of the tibia, excessive anterior pelvic tilt as well as altered knee movements. The prevalence of flatfoot correlates
inversely with age from 54% in 3 year old to 11.25% in 18-25 year old adults.\textsuperscript{6-10}

K. Vadivelan et al. and few other authors reported that kinesio-taping, custom-made medial arch support and strengthening exercises have effect on reducing symptoms of flatfoot.\textsuperscript{11-14} Arch support insoles have found to reduce ground reaction force by 6.9% and increase propulsive force by 7% which minimizes risk of lower extremity injuries.\textsuperscript{5,12,13} Saadah et al. reported reduction in foot pressure and muscle work that helps in strengthening of medial longitudinal arch following the use of medial arch support.\textsuperscript{5,16} Specific strengthening exercises for anterior & posterior leg muscles using exercise band and short foot exercises (through sensory-motor training) helps in reducing flatfoot symptoms.\textsuperscript{12,13}

To the author’s knowledge there is paucity in literature on effective intervention in treating flatfoot. Hence, the purpose of this study was to come up with the most effective treatment among Kinesio taping and medial arch support when combined with exercises in adult flatfoot.

**Method**

**Design:** An experimental study

**Methodology**

The study was conducted over a period of 3 months after obtaining ethical clearance from Institutional Ethical Committee of KAHER Institute of Physiotherapy, Belagavi. A total of 41 young adults from Belagavi city in age ranging from 18-40 years were screened for eligibility criteria (defined by pronated foot type with MFPI ≥6). 30 young adults met the inclusion criteria and were allocated into two treatment groups Kinesio Taping (Group A, n=15) and Medial Arch (Group B, n=15). A written Informed Consent was obtained from all the subjects before commencement of the study. Demographic characteristics of the subjects were noted. The outcome measures used were Modified Foot Posture Index (MFPI), Navicular Drop Test and Visual Analogue Scale (VAS). Subjects were assessed for outcome measures before and after intervention. The inclusion criteria were as follows: age group 18-40 years of either gender willing to participate in the study and the exclusion criteria were as follows: subjects with recent lower limb injuries, neurovascular or other musculoskeletal conditions affecting lower limb and those already on treatment for flatfoot.

**Outcome Measures**

**Navicular Drop Test:**

According to Loudon et al. (1996) which suggests Navicular Drop between 6-9mm is considered normal and above 10mm is considered abnormal. NDT was found to be moderately reliable test.\textsuperscript{17,24} Measured in millimetres (mm).

**Modified Foot Posture Index:**

Modified Foot posture index scores were interpreted based on talar head palpation, supra and infra lateral malleolar curvature, calcaneal Frontal plane position, bulging in the region of Talo-Navicular Joint (TNJ), height and congruence of the medial longitudinal arch, abduction/adduction of the forefoot on the rear foot. MFPI was found to be moderately reliable index.\textsuperscript{18,23}

**Visual Analogue Scale (VAS):**

It is a 0-10 point scale (100mm) used to grade an individual’s pain intensity, where 0 indicates No pain at all and 10 indicates unbearable pain. VAS is a valid and highly reliable scale.\textsuperscript{22}

**Procedure**

**Kinesio Taping:**

Taping was done with 2 straps of Kinesio Tape (KINESIO\textsuperscript{®}), 1\textsuperscript{st} u shaped application of extending from medial malleoli to the lateral malleoli. 2\textsuperscript{nd} strap from dorsal aspect of distal 1/3\textsuperscript{rd} of 4\textsuperscript{th} metatarsal from plantar aspect extending in front of medial malleolus diagonally then anteriorly to the lateral malleoli ending posteriorly at medial malleoli. Tape once applied was kept for 2-3 days and was re-applied after 24hrs (4 sessions of application).\textsuperscript{21}

**Medial Arch support:**

Subjects were provided with a pair of medial arch support made of carbon fibres which was placed in their footwear (preferably shoes) by the assessor and were instructed to continue wearing the same footwear without fail for a minimum of 4hrs/day for 2 weeks.\textsuperscript{3,19}

**Exercises (6 sessions/week for 2 weeks)**

- Stretching (5-6 repetitions, 1 set) for Gastrocnemius and Soleus.
Strengthening exercises (10 repetitions, 3 sets) included Toe scrunches, 3 way heel raises, Heel walking (5mints), Toe walking (5 mints), Supination walk (5 mints) and Elastic band exercises for dorsiflexors, plantar flexors, inverters and everters.

Data Analysis

Data was analysed using SPSS 21.0 version software. Male and female distribution was done using Chi square test. Demographic variables like age and BMI were analysed using t test. Normality of pretest and posttest scores were analysed using Kolmogorov Smirnov Test. Comparison of right and left pretest and posttest MFPI, NDT (in mm) and VAS scores was done by Wilcoxon matched pairs test.

Results

41 participants were screened, of these 11 participants were excluded as they did not meet eligibility criteria. 30 young adults from Belagavi city were recruited in the study where Group A (KT) had 9 male (60%) and 6 female (40%), Group B (MA) had 5 male (33%) and 10 female (67%). Mean Age and BMI were 26.33±4.79 and 22.12±2.51 (p=0.2076) in Group A and 24.33±3.62 and 20.99±2.16 (p=0.1944) in Group B. No significance was found for demographic characteristics.

This study has shown 0.79% and 0.83% change in Right MFPI and 5.04% and 1.80% change in Left MFPI, 1.98% and 8.11% change in Right NDT and 3.23% and 3.92% change in Left NDT, 44.16% and 42.43% change in VAS scores in Group A and B respectively.

Table 1: Normality of Pretest and posttest scores

<table>
<thead>
<tr>
<th>Variables</th>
<th>MFPI</th>
<th>NDT</th>
<th>VAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time-points</td>
<td>Right</td>
<td>Left</td>
<td>Right</td>
</tr>
<tr>
<td>Group A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td>0.8910</td>
<td>0.3860</td>
<td>0.7170</td>
</tr>
<tr>
<td>Posttest</td>
<td>0.8060</td>
<td>0.2920</td>
<td>0.4330</td>
</tr>
<tr>
<td>Difference</td>
<td>0.0001*</td>
<td>0.0230*</td>
<td>0.0010*</td>
</tr>
<tr>
<td>Group B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td>0.3600</td>
<td>0.4260</td>
<td>0.6850</td>
</tr>
<tr>
<td>Posttest</td>
<td>0.3940</td>
<td>0.2740</td>
<td>0.5050</td>
</tr>
<tr>
<td>Difference</td>
<td>0.0001*</td>
<td>0.0010*</td>
<td>0.1470</td>
</tr>
</tbody>
</table>

*p<0.05, MFPI – Modified Foot Posture Index, NDT – Navicular Drop Test, VAS – Visual Analogue Scale

As shown in Table 1, there was significant difference in MFPI and NDT scores in both the Groups. VAS scores of both groups follow a normal distribution.

Table 2: Comparison of group A and Group B with Pretest and posttest MFPI and NDT scores

<table>
<thead>
<tr>
<th>Time points</th>
<th>Groups</th>
<th>Mean±SD</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>MFPI</td>
<td>NDT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Right</td>
<td>Left</td>
</tr>
<tr>
<td>Pretest</td>
<td>Group A</td>
<td>8.47±1.81</td>
<td>7.93±1.28</td>
</tr>
<tr>
<td>Group B</td>
<td>8.00±1.85</td>
<td>7.40±1.24</td>
<td>7.40±1.45</td>
</tr>
<tr>
<td>Posttest</td>
<td>Group A</td>
<td>8.40±1.88</td>
<td>7.53±1.36</td>
</tr>
<tr>
<td>Group B</td>
<td>7.93±1.79</td>
<td>7.27±1.16</td>
<td>6.80±1.47</td>
</tr>
<tr>
<td>Difference</td>
<td>Group A</td>
<td>0.07±0.26</td>
<td>0.13±0.35</td>
</tr>
</tbody>
</table>

As shown in Table 2, there was no significant difference found in pretest and posttest scores between group for MFPI and NDT scores.
Table 3: Comparison of Pretest and posttest MFPI and NDT scores in group A and Group B

<table>
<thead>
<tr>
<th>Group</th>
<th>Time</th>
<th>Mean±SD</th>
<th>% of change</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Right</td>
<td>Left</td>
<td>Right</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8.47±1.81</td>
<td>7.93±1.28</td>
<td>0.79</td>
</tr>
<tr>
<td></td>
<td>Pretest</td>
<td>8.40±1.88</td>
<td>7.53±1.36</td>
<td>0.83</td>
</tr>
<tr>
<td></td>
<td>Posttest</td>
<td>7.93±1.79</td>
<td>7.27±1.16</td>
<td>1.98</td>
</tr>
<tr>
<td>Group B</td>
<td>Pretest</td>
<td>6.73±1.98</td>
<td>6.20±1.37</td>
<td>8.11</td>
</tr>
<tr>
<td></td>
<td>Posttest</td>
<td>6.60±1.88</td>
<td>6.00±1.31</td>
<td>0.83</td>
</tr>
<tr>
<td></td>
<td>Posttest</td>
<td>7.40±1.45</td>
<td>6.80±1.57</td>
<td>1.98</td>
</tr>
</tbody>
</table>

As shown in Table 3, significant difference was found in pretest and posttest scores within group for MFPI(Left) and NDT(Right)

Table 4: Comparison of group A and Group B with Pretest and posttest VAS scores

<table>
<thead>
<tr>
<th>Time points</th>
<th>Group</th>
<th>Mean±SD</th>
<th>SE</th>
<th>t-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>Group A</td>
<td>5.54±1.37</td>
<td>0.35</td>
<td>0.2911</td>
<td>0.7731</td>
</tr>
<tr>
<td></td>
<td>Group B</td>
<td>5.37±1.74</td>
<td>0.45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Posttest</td>
<td>Group A</td>
<td>3.09±1.71</td>
<td>0.44</td>
<td>0.0000</td>
<td>1.0000</td>
</tr>
<tr>
<td></td>
<td>Group B</td>
<td>3.09±2.13</td>
<td>0.55</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difference</td>
<td>Group A</td>
<td>2.45±0.79</td>
<td>0.21</td>
<td>0.6798</td>
<td>0.5022</td>
</tr>
<tr>
<td></td>
<td>Group B</td>
<td>2.28±0.52</td>
<td>0.13</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As shown in Table 4, there was no significant difference found in pretest and posttest scores between group for VAS scores

Table 5: Comparison of Pretest and posttest VAS scores in group A and Group B

<table>
<thead>
<tr>
<th>Group</th>
<th>Time</th>
<th>Mean±SD</th>
<th>Mean Diff.</th>
<th>SD Diff.</th>
<th>% of change</th>
<th>Paired t</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>Pretest</td>
<td>5.54±1.37</td>
<td>2.45</td>
<td>0.79</td>
<td>44.16</td>
<td>11.9268</td>
<td>0.0001*</td>
</tr>
<tr>
<td></td>
<td>Posttest</td>
<td>3.09±1.71</td>
<td>2.28</td>
<td>0.52</td>
<td>42.43</td>
<td>16.9851</td>
<td>0.0001*</td>
</tr>
<tr>
<td>Group B</td>
<td>Pretest</td>
<td>5.37±1.74</td>
<td>2.28</td>
<td>0.52</td>
<td>42.43</td>
<td>16.9851</td>
<td>0.0001*</td>
</tr>
</tbody>
</table>

As shown in Table 5, there was significant difference found in pretest and posttest scores within group for VAS scores

Discussion

Although the effects of medial arch support and kinesio taping being studied and proved, this study attempted to investigate effective treatment in treating adult flat foot. 30 participants with flatfoot were studied and the study revealed that both the techniques to be equally effective after 2 weeks of intervention in terms of MFPI, NDT and VAS.

Both groups have shown significant change in VAS scores which might be due to reduction in plantar pressure on medial side of foot due to the support provided by kinesio tape and the medial arch support together with exercises which reduced peak plantar pressure which is in accordance with a study done by O’Sullivan et al.19,20 Kinesio taping group has shown significant change in left MFPI when compared with medial arch support.
group which is in accordance with a study done by Maria Bravo et al. on effect of kinesio taping in amateur runners which concluded that kinesio taping can modify foot posture in amateur runners towards a more neutral posture after 45 minutes of application, where as in the present study subjects were taped for more than 48 hrs which might have shown significant results in foot posture. Medial Arch group has shown significant change in NDT scores on Right compared to kinesio taping group which may be due to increase in strength of medial arch stabilizers in preventing excessive navicular drop which is supported by a study done by Saadah et al. on the effect of using medial arch support in security guards before and after their duty hours which concluded that using medial arch to reduce foot pressure and muscle work can help in strengthening the medial longitudinal arch. Previous studies reported the effects of arch support insoles and found that wearing insoles for minimum of 4hrs/day for 8 weeks has shown to increase standing balance and prevention of falls. However, in the present study the subjects were instructed to wear the medial arch support whenever they had to perform activities involving walking. Asymmetry in the findings of MFPI and NDT scores could be due to the variation in the severity of flatfoot in right and left foot. Though positive changes have been depicted following intervention, it is not clear if the type of arch used was maintaining the arch completely which might one of the possible factor for not showing significant results in all the components.

Conclusion

It is concluded that, both kinesio taping and medial arch support can be used in combination with exercises as an intervention for flatfoot.

Limitations & Scope

It was not clear if taping and medial arch support had any influence on strength and integrity of the structures maintaining medial longitudinal arch. Future studies should include these as an outcome measure.

Clinical Applications

Kinesio taping and medial arch support can be used in people with flatfoot/pronated foot in order to reduce the symptoms but not to normalize the arch.

Source of Funding: Self

Conflict of Interest: Nil

References

8. Daniel DK, Chandrasekaran C, Mano A. A Study on Prevalence of Flat Feet Among School Children in Kanchipuram Population. 8


Effect of Hippotherapy Simulator on Spasticity in Children with Cerebral Palsy
(A Quasi-experimental Pilot Study)

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Abstract

Cerebral palsy (CP) is a common disorder which leads to physical disability in children throughout life and begins in early childhood. Management of spasticity is still a challenge in the field of CP rehabilitation. Hippotherapy simulator (HS) has been reported to have beneficial effects on spasticity, postural control and motor function in children with spastic CP which is considered as an alternative method for hippotherapy (HT). The aim of the study was to investigate the effects of HS on spasticity in children with spastic CP. This is a pilot quasi experimental study. 12 children with spastic diplegia, aged between 2-6 years were selected and underwent the HS. Changes in adductor spasticity were assessed by Modified Ashworth Scale (MAS). In addition hip abduction Range of Motion (ROM) was measured by Goniometer and distance between knees by inch tape. Paired ‘t’ test was used to compare the pre and post intervention scores. The pre and post intervention scores are significant with the p value (p<0.01) which shows that there was reduction in adductor spasticity, improvement in hip abduction range of motion and distance between knees. Hence it is concluded that HS is effective in reducing spasticity and improving range of motion in hip joint in spastic CP. HS can be recommended as the best intervention and alternative for HT. This technology can be easily installed in home and clinical setting to make the rehabilitation more fun and attractive for children, enhancing the motivational part of the therapy.

Keywords: Cerebral Palsy, Hippotherapy Simulator, Spasticity, diplegia.

Introduction

Cerebral palsy is the most common cause of physical disability in childhood, which is estimated the world wide incidence of 2 to 2.5 per 1000 live births.¹,² Spastic diplegia considered as a primary type of cerebral palsy which is 40% to 60% of all cases.³,⁴ Children with spastic cerebral palsy encounter many problems include, spasticity, muscle weakness, limited range of motion, contractures and deformity.⁵,⁶ In cerebral palsy spasticity is considered as a primary factor leads to much impairment which is inversely related to functional development that means greater the spasticity lowers the level of function.⁷ Spasticity in hip adductor can lead to spastic hip dysplasia, hip subluxation and problems with perineal hygiene.⁸,⁹ The effects of treatment on muscle tone can be documented with MAS scale. Assessment of range of motion is also sensitive to change after the anti spastic therapy in CP. Literatures supported that goniometric assessment of range of motion has moderate to high intra rater and inter rater reliability when used with CP children.¹⁰ The maximal distance between knees can help to monitor the treatment effects on hip adductor spasticity.¹⁰

The therapeutic results obtained with the application of hippotherapy treatments has encouraged research into developing on hippotherapy platform or stimulators that imitate the movements of horse.¹¹ This therapy maybe more accessible and adaptable to patients.¹²,¹³ Mohammed Ali Elshafey et al, stated that hippotherapy stimulator is an efficient alternative method for hippotherapy.¹⁴ Management of spasticity for children
with spastic cerebral palsy aimed at improving the biomechanical alignment of the body and functional development\textsuperscript{15}. Positioning which includes sustained stretching of adductors and iliopsoas for a prolonged period can prevent forceful contraction of adductor muscle\textsuperscript{16}. The proper posture during horseback riding is to maintain $90^\circ$ hip joint and $90^\circ$ knee joint, such posture induces decrease in the muscle tone and spasticity of the riders\textsuperscript{17}. The posture of children during horseback riding naturally alleviates the tension and enables functional movement. While taking therapeutic riding children with cerebral palsy recovers and maintain an appropriate posture plays an important role of reducing spasticity. Though various therapeutic approaches have been used to treat spasticity such as positioning and stretching, HRS is an innovative therapeutic intervention which is considered as the best alternative for hippotherapy. The aim of this study is to find out the effects of HRS on adductor spasticity in children with spastic diplegia. This research, being pilot study, would further inform about the accessibility, adoptability and safety proposed HRS in children with spastic CP.

Materials and Method

The study protocol was reviewed and approved by the Institution Human Ethics Committee (IHEC), Rajah Muthiah Medical College, Annamalai University. CP children were recruited from the Division of Physical Medicine and Rehabilitation (PMR) in Rajah Muthiah Medical College and Hospital, RMMCH, Annamalai University, Tamil Nadu, India.

Participants: Children aged between 2 to 6 yrs who have been diagnosed as spastic diplegia and undergoing physiotherapy intervention in the division of PM&R, RMMCH, were included in the study. They were selected based on the selection criteria such as Gross Motor development 1 to 3 (as per GMFCS) adductor tone up to 3 (as per MAS), children who are all able to sit on a saddle with support and attained complete head control. The children with the history of recent surgeries and uncontrolled seizures are excluded from the study.

Study Design: The study employed as a pilot quasi-experimental design. One group of 12 children with spastic cerebral palsy participated in hippotherapy simulator intervention

Outcome Measures: Spasticity, hip abduction range of motion and distance between knees measured by MAS, Goniometer and the inch tape.

Hippotherapy Simulator: OSIM U-Gallop (OS-950 Gallop 2) was used in this research. It is an innovative indoor exercise equipment which utilizes the oscillatory action of the seat to stimulate the horse riding experience. It has 4 manual speed modes. One auto program with variations in speed. Strategically located control panel allows easy access, stirrup and handle strap is available for more comfort.

Procedure: The parents and caregivers of CP children were explained about the therapy and informed consent was obtained. The initial assessment regarding the eligibility of participants was done by a senior therapist specialized in pediatric physiotherapy. On the day of initial evaluation the outcome measures such as Adductor Tone (AT), hip abduction passive ROM and distance between knees were measured. After the initial assessment, the children were placed on saddle of Hippotherapy Simulator (HS). They were asked to hold the stir-up for support. If they finds difficult in holding the strap minimal support was given to the children whenever needed. The parents or caregiver were allowed to accompany the children throughout the treatment session. They were allowed to sit in front of the children and the therapist sat at the back of the simulator, which provides the safe environment throughout the session. The simulator was given for 30 minutes/day and 3 sessions per week for 4 weeks. The post assessment was done by the same therapist after 4 weeks. During the riding session, if the children find any difficulty and discomfort the test was immediately stopped.

Data Analysis and Results

A total of 12 children with spastic diplegia were selected for the present study. The study population includes 6 male and 6 female children. Paired 't' test was used to compare the pre and post intervention scores. An $\alpha$ level of 0.05 was set as a level of significance and data were analyzed using SPSS version 18. The baseline characteristics such as age, sex, level of motor function along with pre and post assessment of study variables displayed in table-I.
Table I: Basic characteristic features and study variables of children with spastic cerebral palsy

<table>
<thead>
<tr>
<th>No</th>
<th>Basic Characteristics</th>
<th>Adductor Tone</th>
<th>Hip Abduction PROM</th>
<th>Distance b/w knee cm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Age (y)</td>
<td>Sex</td>
<td>GMFCS</td>
<td>Pre</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>2</td>
<td>M</td>
<td>3</td>
</tr>
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<td>11</td>
<td>4</td>
<td>4</td>
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<td>1</td>
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<tr>
<td>12</td>
<td>3</td>
<td>3</td>
<td>M</td>
<td>2</td>
</tr>
</tbody>
</table>

GMFCS: Gross Motor Functional Classification, PROM: PASSIVE RANGE OF MOTION

The observed mean age of the study population was 3.25 with a standard deviation of 1.45 years; the mean value of level of motor function was 2.16 with a standard deviation of 0.9.

Table II: The mean difference between pre and post intervention with HS

<table>
<thead>
<tr>
<th>Study variables</th>
<th>Pre-intervention</th>
<th>Post- intervention</th>
<th>t-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Adductor tone (Rt)</td>
<td>0.20</td>
<td>0.67</td>
<td>1.38</td>
<td>0.43</td>
</tr>
<tr>
<td>Adductor tone (Lt)</td>
<td>0.20</td>
<td>0.63</td>
<td>1.46</td>
<td>0.39</td>
</tr>
<tr>
<td>Hip abduction ROM (Rt)</td>
<td>27.08</td>
<td>8.64</td>
<td>32.08</td>
<td>7.82</td>
</tr>
<tr>
<td>Hip abduction ROM (Lt)</td>
<td>29.17</td>
<td>9.49</td>
<td>34.58</td>
<td>8.90</td>
</tr>
<tr>
<td>Distance b/w knee</td>
<td>36.33</td>
<td>4.47</td>
<td>40.17</td>
<td>4.85</td>
</tr>
</tbody>
</table>

SD: Standard Deviation

The mean values with the standard deviation of adductor tone in both sides are same which about 2 ± 0.6 is. The mean value with the standard deviation of hip abduction range of motion differs in both sides, right side shows 27 ± 8.6 and left side is about 29 ± 9.4, the distance between knee the observed mean and standard deviation is 36 ± 4.4. Paired sample ‘t’ test was used to find out the difference between the variables.

Changes in adductor tone: There was a statistically significant changes observed in adductor tone scores after intervention with a mean difference of right and left side shows with the significant ‘t’ value with the p value (P < 0.01).

Changes in range of motion: The changes in hip abduction range of motion scores after the intervention. The observed mean values shows significance in right side with the ‘t’ value of 8.1 (P < 0.01) and the left side with the ‘t’ value of 7.2 (P < 0.01).

Distance between knee: The distance between the knees also shows the significant ‘t’ value with the p value (P < 0.01).

Discussion

This study hypothesized that hippotherapy simulator is effective in reducing adductor spasticity and improving range of motion. Reduction in adductor...
spasticity and improvement in hip abduction range of motion and distance between knees observed from the results supports this hypothesis. The major finding of this pilot study is the hippotherapy simulator is effective in reducing adductor spasticity in children with CP. These findings are supported by Mohamed Ali Elshafey et al. who revealed that cerebral palsied children treated with mechanical saddle, replicated horse riding and found out increased passive range of motion, reduced hyper tonicity compared to static saddle. He also observed the reduced electromyography (EMG) activity in the hip adductors\textsuperscript{13, 14}.

Pre and post evaluation of study variables shows that there is significant difference observed in all the study variables such as adductor tone, hip abduction range of motion and distance between knees. It denotes that the children who have undergone horse riding simulator shows reduction in adductor tone, improvement in hip abduction range of motion and distance between knees. This study strongly supported by the literatures explained that astride sitting posture on HRS offers prolonged stretching of adductor muscle. Similar results obtained in the study done by Pablo Herrero et al revealed that rhythmic and repetitive movement produced while riding on simulator leads to active extension of the trunk, stabilization of the pelvis and abduction of the leg, such posture decreases the muscle tone\textsuperscript{17}. Peeraya et al stated that sitting astride on a saddle could stretch the muscles of lower extremities, especially the adductor group which always shows high muscle tension in children with spastic CP\textsuperscript{18}. Literature supported that prolonged stretching around 30 minutes of lower extremity muscles can result in decreasing spasticity, as a consequence an improvement in the range of motion can be observed\textsuperscript{19}. Hebert stated that low frequency mechanical vibration reduces H-reflex leading to muscle relaxation and dampen spasticity\textsuperscript{20}. The recreation based therapeutic intervention employed in this study might have influenced the adductor spasticity in children with spastic CP.

**Strength and limitations of the study:** The CP children participated in the study attended the session with lot of fun and enjoyment. This type of innovative therapeutic intervention based on recreation therapy is needed for CP children. In this study therapeutic intervention incorporated with the hippotherapy simulator reducing the spasticity in CP children. Hippotherapy simulator is successful in motivating the CP children. The study population did not report any history of fall and other adverse effects during the intervention period.

Being a pilot quasi experimental study, a single group with a small number of samples is one of the major limitations of this study. Further studies are needed with large sample including the longer duration and sessions of hippotherapy. Only adductor muscle tone and hip abduction range of motion is included into the study. Other movements in hip as well as other joints such as knee and ankle are not included in this study. Future studies should attempt to include the other variables and relate the postural control, sitting balance and motor function which were not included in this study. Though type II $\beta$ error is common with the small sample size and lack of control group are the major limitation of the current study.

**Conclusion:**

Hippo therapy simulator is effective in reducing the spasticity and improving the range of motion which can be incorporated in clinical and rehabilitation settings to motivate the children with cerebral palsy.

**Conflict of Interest:** Nil

**Source of Funding:** Nil

**Ethical Clearance:** Nil

**References**

6. Powell TG., Pharoah PO, Cooke RW, Rosenbloom L. Cerebral palsy in low birth weight infants. I. Spastic hemiplegia: associations with intrapartum


A Study to Find Out the Effect of Extracorporeal Shock Wave Therapy for Chronic Musculoskeletal Conditions – A Systematic Review

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¹Assistant Professor at R.K. University, ²PT in P.P.Savani University, Gujarat, India

Abstract

Background and Objectives: Extracorporeal Shock Wave Therapy, (or ESWT), is a new technology using shockwaves to treat chronic, painful conditions of the musculoskeletal system. A shockwave is an intense, but very short energy wave traveling faster than the speed of sound. The word “Extra-corporeal” means “outside the body” and refers to the fact that the shockwaves are generated outside the body. Complaints involving attachment points for tendons and ligaments in major joints like the shoulder (such as the rotator cuff), elbow (epicondylitis or tennis elbow), hip, and knee (tendinitis or “jumper’s knee) are common sites for ESWT.

Data Sources: All English-language articles on ESWT for chronic painful conditions of the musculoskeletal system indexed in PubMed, Medline, Embase, Central Register of Controlled Trials, Cochrane Library, Physiotherapy Evidence Database, and Health STAR published prior to December 2018 were included.

Results: Twenty-eight RCTs met the inclusion criteria. Studies were heterogeneous. Twenty RCTs compared ESWT energy levels and placebo and consistently showed that high-energy ESWT was significantly better than placebo in decreasing pain and improving function and resorption of calcifications in calcific tendinitis. No significant difference was found between ESWT and placebo in treatment of noncalcific tendinitis.

Conclusion: ESWT is often a last resort treatment once other less expensive treatments have failed (ie. manual therapy, US). Best results when used in conjunction with exercise Not a stand-alone modality. Positive findings for plantar fasciitis, patellar tendinopathy, and Achilles tendinopathy. Mixed results for calcific tendinopathy of the shoulder and lateral epicondylitis.

Keywords: Extracorporeal Shock Wave Therapy, Musculoskeletal system, Plantar fasciitis, Patellar tendinopathy, Lateral epicondylitis.

Introduction

• Extracorporeal Shock Wave Therapy, (or ESWT), is a new technology using shockwaves to treat chronic, painful conditions of the musculoskeletal system. A shockwave is an intense, but very short energy wave traveling faster than the speed of sound.¹

• The word “Extra-corporeal” means “outside the body” and refers to the fact that the shockwaves are generated outside the body. ¹

• The basic science behind ESWT is analogous to lithotripsy, the technology that uses acoustic shockwaves to break up kidney stones without surgery. ¹

• The technique of using shockwaves to break up kidney stones has been around for a nearly a quarter century now, and in the process of treating thousands and thousands of patients, it was found that many people undergoing the procedure had other unrelated aches and pains disappear. It was at this point that scientists began to consider that shockwaves may have an effect to heal other sorts of tissues.

• Specialized machines were then developed specifically with the idea of using these shockwaves on other parts of the body, and this is the origin of ESWT.²
Different forms of shockwave therapy

- Electro hydraulic shockwave (such as the HMT Ossa Tron machine)
- Electro magnetic shockwave (such as the Sonocur and Dornier Epos machine)
- Radial pressure wave (such as the Dolorclast system)
- Piezo electric shockwave (such as the machine we use, the Piezoson by Wolf)

Doses

Energy Flux Density

- Degree of energy transmitted to the tissues
  - Low (<0.08 mJ/mm²)
  - Medium (0.08 to 0.28 mJ/mm²)
  - High (0.28 to 0.60mJ/mm²)

  Pulses Per Dose
  
  → Ranges from 1000 to 3000
  → Several doses may be given over course of a treatment

Contraindications

- There are a few occasions when shockwave should not be used:
  - Pregnancy
  - Application over open growth plates – not suitable for under 18 years.
  - Over metal pins or plates
  - Malignant tumors
  - Nerve or circulation disorders
  - Infections
  - If the patient is taking anticoagulants

Need of the study

- The vast majority of the published papers including randomized control trials and cohort studies showed positive effects and evidence base medicine in favor of ESWT.
- However, a few studies reported that ESWT is ineffective or less effective with the results comparable to the placebo effect, and this has stirred up the debate and controversy.

Aim of the study

- To find out the effect of extracorporeal shock wave therapy for chronic musculoskeletal conditions.

Objectives

- To find out the effect of extracorporeal shock wave therapy for chronic musculoskeletal conditions.

Methodology

- The research was adhered to the Preferred Reporting Items for Systematic reviews and Meta-analyses (PRISMA) guidelines in search strategy and reporting, and followed guidance of Cochrane Handbook for Systematic Reviews for the preparation of this intervention review.

Data Sources

- All English-language articles on ESWT for chronic painful conditions of the musculoskeletal system Indexed in PubMed, Medline, Embase, Central Register of Controlled Trials, Cochrane Library, Physiotherapy Evidence Database, and Health STAR published prior to December 2018 were included.

Study Selection

Inclusion Criteria

- Main inclusion criteria were the publications of studies of ESWT in the treatment of Achilles tendinopathies, rotator cuff (calcific & non-calcific) tendinopathies, tennis elbow, hip and knee (tendinitis) and plantar fasciitis.
- Information extracted from each study included study design, inclusion criteria, number of patients, statistical analysis, treatment regimes, outcome measures, and results.

Exclusion Criteria

- Exclusion criteria were as follows: uncontrolled studies and those without a control involving a suitable sham treatment, those with methodological errors including no formal randomisation process, different baseline characteristics of study groups, mixed study populations (wide age range, different pathologies, coexisting disease, acute and chronic
disease mix), inappropriate statistical analysis or no details given, unvalidated outcome measures.

**Data Collection**

- 200 English-language articles on ESWT for chronic painful conditions were searched.
- After screening the titles and abstracts and removed duplicates, 38 articles were considered potentially relevant.
- 10 articles were excluded after full-text review because they did not meet criteria.
- In total, research included 28 RCTs that reported.
- Of the 28 RCTs used in our analysis, 20 compared ESWT with other treatment modalities.

**Summary of Evidence Search and Selection**

<table>
<thead>
<tr>
<th>Records identified through electronic database search for studies (n = 200)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total excluded (n = 162)</td>
</tr>
<tr>
<td>Duplicates: 42</td>
</tr>
<tr>
<td>Abstract screening: 70</td>
</tr>
<tr>
<td>Title screening: 50</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Full-text articles assessed for eligibility (n = 38)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Included articles (n = 28)</td>
</tr>
<tr>
<td>Full-text articles that did not meet criteria (n = 10)</td>
</tr>
</tbody>
</table>

**Quality of Included Trials**

- The sample sizes ranged from 20 to 144 participants.
- Trial duration ranged from 3 to 12 months.
- Only 6 trials were double-blinded; the rest were either single-blinded (15 trials) or did not report blinding (7 trials).

**Results**

**Effect Of Extracorporeal Shock Wave Therapy For Chronic Plantar Fasciitis.**

- 8 studies investigated the effect of shockwave therapy in the treatment of plantar fasciitis and reported a success rate ranging from 34% to 88%.
- The majority of the published papers reported a positive and beneficial effect of ESWT in plantar fasciitis.
- Additional studies are needed to validate the effectiveness of ESWT in the treatment of plantar fasciitis.\(^5\)

**Effect Of Extracorporeal Shock Wave Therapy For Chronic Calcifying Tendinitis Of Rotator Cuff.**

- 7 RCTs compared ESWT energy levels and placebo and consistently showed that high-energy ESWT was significantly better than placebo in decreasing pain and improving function and resorption of calcifications in calcific tendinitis.
- No significant difference was found between ESWT and placebo in treatment of noncalcific tendinitis.\(^6\)

**Effect Of Extracorporeal Shock Wave Therapy For Chronic Lateral Epicondylitis Of The Elbow.**

- 5 studies investigated the effect of shockwave therapy in the treatment of Lateral epicondylitis of the elbow.
- \(\text{Wang et al}\) compared the results of shockwave therapy in 57 patients with lateral epicondylitis of the elbow with a control group with a follow-up of 12 months. The overall results of the treatment group were complaints free and significantly better in 61.4%. In the control group, however, the results were unchanged in all patients.\(^7\)

**Effect Of Extracorporeal Shock Wave Therapy For Chronic Patellar Tendinopathy (Jumper’s Knee) And Achilles Tendinopathy.**

- 8 studies investigated the effect of shockwave therapy in the treatment of tendinopathy.
- \(\text{Rompe et al}\) compared 25 patients treated by eccentric stretching exercises with 25 patients treated with repetitive ESWT, and the results showed that eccentric loading is inferior to ESWT in the treatment of patients with chronic Achilles tendinopathy.\(^8\)
- \(\text{Peers KH et al}\) compared 30 knees in 27 patients treated with ESWT with 24 knees in 23 patients treated conservatively, the results at 2 year follow-up showed 43% excellent results for the study group, and none excellent results for the control group (P < 0.05).
• Ultrasonographic examination showed a significant increase in the vascularity of the patellar tendon and a trend of reduction in the patellar tendon thickness after ESWT as compared to conservative treatments.8

Discussion

• In this systematic review the result shows that extracorporeal shock wave therapy was effective for the treatment of chronic musculoskeletal conditions.

How Does it Work?

• Mechanical pressure increases cell membrane permeability.
• Acoustic waves cause small capillaries in tissue to rupture, which increases growth factors to the area.
• Neovascularization or new blood supply, More blood = more oxygen = better healing.
• Stimulates fibroblasts for connective tissue healing, Tendon, ligament, fascia.
• Stimulates osteoblasts for healing and new bone production.
• Destroys calcifications.

Eswt is Safe

• The safety of ESWT was also clearly supported by the cumulative data. There were no reports of serious adverse events in any of the studies included in this analysis.

Limitations of the Study

• All conclusions of the present study are only valid for those shock wave generators that were used in the RCTs on ESWT.
• This is particularly important considering the substantial variability in treatment success and rates of unwanted side effects found when treating the same clinical condition (lateral epicondylitis) with different electromagnetic and piezoelectric ESWT devices operated at comparable energy settings.

Further Recommendation

• Further well designed trials are needed to either verify or refute the value of this treatment.

• The value of ESWT for more acute symptoms and its use in combination with other forms of treatment have not yet been addressed.

Conclusion

➢ Extracorporeal shock wave therapy is effective for the treatment of chronic musculoskeletal conditions.
➢ EWST is often a last resort treatment once other less expensive treatments have failed (ie. manual therapy, US)
➢ Best results when used in conjunction with exercise.
➢ Positive findings for plantar fasciitis, patellar tendinopathy, and Achilles tendinopathy
➢ Mixed results for calcific tendinopathy of the shoulder and lateral epicondylitis.

Acknowledgement

➢ I would like to thank my family, my life partner Dr.Urvisha Chavda & all MPT friends and their support & guidance.

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

Source of Funding: No fund was needed.

Ethical Clearance: From K.K. Sheth Physiotherapy College, Rajkot.

Reference

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Effect of Task-Specific Training for Patients with Knee Osteoarthritis

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Abstract

Background: Task-specific training improves functional performance in older adults requiring assistance with activities of daily living (ADLs) as well as community-dwelling older adults. While this approach seems appropriate for individuals with chronic knee pain, there is a lack of evidence regarding the effects of task-specific training to improve performance or general function in this population. This study explores the role of task-specific training for individuals with knee osteoarthritis (KOA), with respect to pain and physical functions to improve efficacy of performing ADLs and knee-related quality of life (QOL).

Method: After Ethical approval, 60 patients clinically diagnosed with KOA having moderate difficulties with ADL’s were screened. Among these, 37 patients having NPRS score from 3-7 were enrolled for the study. 30 patients completed the treatment protocol. Pain was measured using Numerical Pain Rating Scale (NPRS), Knee Osteoarthritis and Other Symptoms (KOOS) was used for ADL and QOL subsets. Three Performance-based outcome measures selected were 30-second Chair Climb Test (30 SCRT), Timed Stair Climb Test (TSCT) and Floor Transfer Test (FTT).

Results: There was significant improvement (p<0.001) seen in all outcome measures. NPRS reduced from 5.9±1.7 to 3.4±1.8, 30-SCRT repetitions increased from 9.06±3.4 to 12.76±3.82, TSCT seconds reduced from 27.06±7.38 to 20.76±6.38, FTT seconds reduced from 12.03±4.23 to 9.43±3.73. In KOOS, ADL score improved from 30.13±9.86 to 14.50±7.92 and QOL score improved from 9.4±3.03 to 4.5±1.9 after 8 treatment sessions of functional training.

Conclusion: Task-specific training program is effective in reducing pain, improving performance and functional ability and quality of life in patients with KOA.

Keywords: Task-specific training, Knee osteoarthritis, Functional training, KOOS Scale, Numerical Pain Rating Scale (NPRS), Floor transfer Test (FTT), Activities of Daily Living (ADL)

Background

Knee osteoarthritis (KOA) is a common cause of knee symptoms in 10% of individuals above 55 years. Among these, 25% individuals land up with disability. In India, the incidence of KOA was 28.7% in year 2016. Symptoms include pain and functional disabilities, changes in gait, muscle weakness, and impaired proprioception.

Guidelines support exercise to reduce pain and improve function in people with KOA. Recommendations include strength training, mobility and flexibility exercises to reduce impairments which contribute to functional limitation and disability. Systematic reviews indicate modest benefits for pain and functional improvement. This may be due to an impairment-based approach to KOA rather than a preventive approach. Though limited joint range of motion and muscle
weakness may improve with exercise, these may not translate into improvements of activity limitation and participation restrictions associated with KOA.

Research suggests reductions in impairments may not correlate with functional improvement. An exercise approach targeting muscle strength, joint mobility and balance may be insufficient to impact basic functional tasks, such as ambulation. Studies have explored which daily tasks are difficult to perform with KOA. Problematic tasks are sit-to-stand transfers, ascending and descending stairs, floor transfers. This study explores the effect of task-specific training for individuals with KOA.

**Materials and Method**

Ethical approval was obtained from institutional ethics committee. 60 patients having KOA were screened, 37 who met inclusion criteria were recruited after informed consent. 30 patients completed the study. Details are in figure no. 1 below.

Outcome Measures: Pain was measured using the Numerical Pain Rating Scale (NRPS) and Knee injury and osteoarthritis outcome score (KOOS scale) and Three Performance based tasks: 30-Second Chair Rise, Timed Stair Climb Test, and Floor Transfers Test.

Normality of baseline data was checked. Paired t-test was used for analysis within the group. P value was 95% confident interval.

**Findings**

Participant’s age ranged from 38 to 60, mean and SD being 50.96±1.37. One third were females and 76.66% had left side KOA.

Statistical analysis of outcome measures are shown in Table 1 below.

**Table 1: Statistical analysis of outcome measures**

<table>
<thead>
<tr>
<th>No.</th>
<th>Outcome Measures</th>
<th>Pre reading</th>
<th>Post reading</th>
<th>T value</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Numerical pain Rating scale</td>
<td>5.9(1.78)</td>
<td>3.4(1.81)</td>
<td>12.06</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>2</td>
<td>30 Second Chair Raise Test (Sec)</td>
<td>9.06(3.4)</td>
<td>12.76(3.8)</td>
<td>-9.02</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>3</td>
<td>Timed Stair Climb Test (Sec)</td>
<td>27.06(7.3)</td>
<td>20.76(6.3)</td>
<td>6.84</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>4</td>
<td>Floor Transfer Test (Sec)</td>
<td>12.03(4.2)</td>
<td>9.4(3.7)</td>
<td>4.74</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>5</td>
<td>KOOS- Activity of Daily Living Subset</td>
<td>30.13(9.8)</td>
<td>14.5(7.9)</td>
<td>15.50</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>6</td>
<td>KOOS- Quality of Life Subset</td>
<td>9.4(3.0)</td>
<td>4.5(1.9)</td>
<td>12.81</td>
<td>p&lt;0.001</td>
</tr>
</tbody>
</table>
The ADL components are shown in Table 2.

**Table 2: ADL Components**

<table>
<thead>
<tr>
<th>Activity of Daily Living (ADL) Component</th>
<th>Pre</th>
<th>Post</th>
<th>T value</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 Descending Stairs</td>
<td>2.4±0.81</td>
<td>1.43±0.67</td>
<td>7.87</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>A2 Ascending Stairs</td>
<td>2.1±0.93</td>
<td>1.03±0.49</td>
<td>7.94</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>A3 Rising from Sitting</td>
<td>2.06±0.73</td>
<td>.76±0.62</td>
<td>10.14</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>A4 Standing</td>
<td>1.40±0.81</td>
<td>.66±0.54</td>
<td>5.80</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>A5 Bending to floor</td>
<td>1.30±0.91</td>
<td>.46±0.57</td>
<td>5.00</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>A6 Walking on Flat surface</td>
<td>1.30±1.02</td>
<td>.66±0.71</td>
<td>4.28</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>A7 Getting in/out of car</td>
<td>1.6±0.93</td>
<td>.93±0.44</td>
<td>4.81</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>A8 Going shopping</td>
<td>2.0±0.98</td>
<td>1.06±0.52</td>
<td>5.41</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>A9 Putting on socks</td>
<td>1.03±0.88</td>
<td>.46±0.62</td>
<td>4.95</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>A10 Rising from bed</td>
<td>1.96±0.88</td>
<td>.90±0.66</td>
<td>7.06</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>A11 Taking off socks</td>
<td>1.16±0.91</td>
<td>.46±0.62</td>
<td>5.88</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>A12 Lying in bed</td>
<td>1.50±1.07</td>
<td>.66±0.75</td>
<td>6.11</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>A13 Getting in/out of bath</td>
<td>2.10±1.06</td>
<td>1.26±0.63</td>
<td>5.22</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>A14 Sitting</td>
<td>1.86±1.10</td>
<td>.76±0.72</td>
<td>5.67</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>A15 Getting on/off toilet</td>
<td>2.36±0.92</td>
<td>1.26±0.58</td>
<td>7.50</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>A16 Heavy domestic duties</td>
<td>1.66±1.12</td>
<td>.90±0.75</td>
<td>5.76</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>A17 Light Domestic Duties</td>
<td>1.66±1.066</td>
<td>.80±0.714</td>
<td>6.11</td>
<td>p&lt;0.001</td>
</tr>
</tbody>
</table>

The analysis of Mean and Standard Deviation for Quality of Life (QOL) components are given in table 3.

**Table 3: Quality of Life components**

<table>
<thead>
<tr>
<th>Component</th>
<th>Pre</th>
<th>Post</th>
<th>T value</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1 How Often are you aware of your knee problem?</td>
<td>3.0±0.64</td>
<td>2.0±0.49</td>
<td>12.74</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Q2 Have you modified your lifestyle to avoid potentially damaging activities to your knee?</td>
<td>1.96±1.03</td>
<td>1.03±0.66</td>
<td>7.39</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Q3 How troubled are you with lack of confidence in your knee?</td>
<td>2.30±1.11</td>
<td>0.66±0.75</td>
<td>10.05</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Q4 In general how much difficulty do you have with your knee?</td>
<td>2.23±0.81</td>
<td>0.93±0.58</td>
<td>10.14</td>
<td>p&lt;0.001</td>
</tr>
</tbody>
</table>

**Discussion**

Results indicate task-specific training program gives effective reduction in pain and effective improvement in performance of specific tasks and scores on outcome measures.

Many patients reported clinically improvement in stair climbing with increased speed and less assistance, floor transfer with reduced discomfort and minimal assistance. It is possible that the alternative techniques allow the patients to negotiate with less pain.

There are various studies which are found to have effective results in managing pain symptoms in KOA. A systematic review and meta-regression analysis of RCTs for KOA concluded that exercises have positive effects on pain and disability. Another study suggested that task-specific exercise approaches need to be explored for people with KOA. The current study shows significant reduction in the NPRS score (p<0.001) after functional training in patients with KOA. Task-specific training has been reported as beneficial for the 30-second chair rise test. This was also seen in the current study. A study comparing traditional strengthening exercises versus functional task training in KOA found the ability to ascend and descend stairs improved in both groups.

The KOOS has been used as a primary outcome measure for KOA. Studies have shown improvement on the KOOS pain and ADL subscales.
Non-exercise components of interventions including medications, dietary advice, and shoe inserts have also been attributed to improvement in KOOS scores. In the current study, significant improvements (p<0.001) have been seen with KOOS scores, denoting decrease in the level of affection while performing ADLS.

**Conclusion**

Task-specific training in patients having chronic knee pain leads to reduction in pain, improved performance, functional outcomes and quality of life.

**Conflict of Interest:** Nil

**Source of Funding:** Nil

**Ethical Clearance:** Taken from Institutional Sub-Ethics Committee of Dr. D. Y. Patil College of Physiotherapy, Pune.

**References**


Physiotherapy and Its Implications on Functional Disability in a Child with Leigh’s Syndrome: An Interesting Case Report

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Abstract

Leigh syndrome, also termed as sub-acute necrotising encephalopathy, is a rare, inherited progressive neurodegenerative disorder with characteristic pathological features usually presenting in infancy or early childhood.¹ Leigh’s disease has very less documented evidence regarding problem solving approach for associated impairments and disabilities through physiotherapy management. So, here we report a case of a 7-year-old boy clinically diagnosed to have Leigh’s disease with delayed milestones, who underwent physical therapy rehabilitation for 8 weeks. Documented improvement in Gross Motor Function Measure (GMFM) was seen. Thus, we propose that physical therapy rehabilitation focussing on solving the associated impairments and disabilities might improve the functional outcome in children diagnosed with Leigh’s disease.

Keywords: Leigh syndrome, Physical therapy rehabilitation, Exercise, Children, Gross Motor Function, Functional disability

Introduction

Leigh syndrome is a rare and progressive mitochondrial disorder of childhood with an incidence of 1:40000 live births.² Onset of the disease presentation is 7 months but in 80% of children, onset is before 2 years of age.³ Mutations of the mitochondrial genome or nuclear dysfunction of the respiratory chain (complex I, II, III, IV or V) or coenzyme Q is the cause of Leigh’s disease.⁴ Common clinical manifestations include hypotonia, dysphagia, ataxia, psychomotor retardation, optic atrophy, nystagmus, respiratory distress, marked fatigue.¹ Loss of head control and other motor milestones occur during the first year of onset. Complaints of difficulty in walking, dystonia, dysarthria or intellectual regression are seen in the second or third year of life. Ultimately, respiratory symptoms become more consistent and respiratory failure becomes the highest cause of death.⁵

The purpose of this case report is to explain the role of physical therapy in speeding the recovery of a child clinically diagnosed with Leigh’s disease.

Case Report: The child is a 7 year old male diagnosed with Leigh’s disease. He was presented with difficulty in performing activities of daily living such as independent sitting, sit to stand transition, independent standing and walking. He was able to crawl independently, attain supine to sitting with minimal support and uses both upper limbs symmetrically. He was on physiotherapy treatment since he was 5 years old. He used to take treatment in a community set up twice a week. He was not regular to the treatment because of his family conditions. Mother was very keen to see the improvement in the child. They approached Physiotherapy department of justice K S Hegde charitable hospital on friend’s advice.

Initially assessment was taken and as the diagnosis was confirmed as Leigh’s disease elsewhere, assessment was more focussed on gross motor activities. Child’s ADL’s history was taken from mother and child was observed for various transitions. Assessment was taken by experienced physiotherapy faculty who is trained in paediatrics and NDT. On examination, weakness was found in bilateral gluteus maximus, quadriceps, and abductor muscles of hip. Trunk control was examined
and found to be having poor control, on standing weight bearing was not symmetrical on bilateral feet. As the child was 7 years old and cognitively sound (confirmed by paediatric MMSE) Task oriented physical therapy management primarily child centered was used to strengthen the weak muscles and to restore the delayed motor activities. Balance activities in sitting position, assisted sit to stand activities and vice versa with appropriate proprioceptive feedback were given. Quadriceps strengthening exercises (ball kicking), weight bearing and weight shifting exercises were given in standing and trunk control exercises were given in sitting and standing. Finally, gait training was given on the floor and followed by treadmill training which is shown in fig 1-4. The treatment was given during months on November 2017 to January 2018. Total treatment duration was one hour a day including 15 minutes rest in between the session, 6 days a week for 8 weeks.

**Goal:** Master X will be able to walk for 30 meters independently under observation to drink water in the physiotherapy department.

**Problem List and Treatment Given:** Primary problem faced was difficulty in sitting independently. Keeping the goal as to achieve independent sitting, pelvic alignment exercises and trunk control exercises were given. Difficulty to do independent sit to stand was the second problem faced. To achieve independent sit to stand, quadriceps strengthening exercises and assisted sit to stand with proper feedback was given. Difficulty in doing independent stand to sit was the next problem faced and to achieve that assisted stand to sit with proper feedback was given. Child was not able to stand independently for a prolonged period of time. To achieve this weight bearing exercises and trunk and pelvic control exercises were given. Independent walking was the last problem faced and gait training on floor and treadmill was given to achieve this.

**Fig 1:** made the child to stand with proper weight bearing at ankle with the knees straight

**Fig 2:** walk stance for proper weight shifts to improve balance and pelvic control

**Fig 3:** Gait training on floor with the therapist guiding from behind

**Fig 4:** gait training on treadmill with the therapist standing behind
Discussion

During the course of treatment GMFM – 88 was taken on day 1, 4th week and at the end of 8th week. There was tremendous improvement in sitting, standing and walking components of GMFM-88 which is shown in table 1 and figure 5. 

Table 1: GMFM-88 Goal area Scores on day 1, end of week 4, and at the end of 8th week.

<table>
<thead>
<tr>
<th>Gmfm-88 Goal Area</th>
<th>Day-1</th>
<th>End of 4th Week</th>
<th>End of 8th Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting</td>
<td>48%</td>
<td>60%</td>
<td>85%</td>
</tr>
<tr>
<td>Standing</td>
<td>25.6%</td>
<td>35.8%</td>
<td>56.4%</td>
</tr>
<tr>
<td>Walking, Running, Jumping</td>
<td>5.5%</td>
<td>8.33%</td>
<td>19.4%</td>
</tr>
</tbody>
</table>

The improvements in sitting, standing and walking are primarily because of child centered task oriented training where he has been given freedom in choosing and completing the tasks. Cooperation from family members in maintaining the change at home by proper home program with involvement of child in daily activities was helpful in getting early recovery and preventing sessions to get missed. Less improvement in walking because we felt it’s too early to focus on independent gait, we believe on long term basis we can even achieve it. We know the fact that we cannot completely reverse the cause but we focussed on maintaining and improving active and functional movements of the child within the limits. We chose ICF framework in listing problems and giving treatment. Frequent reassessments during the course of treatment helped us in solving the problems and attaining the goal. Although we attained minute goals in a span of 8 weeks we believe if we follow this goal directed problem solving physiotherapy protocol we can achieve further improvement in the child.

Conclusion

Thus we conclude that a problem solving approach targeting the impairments and disabilities with a well-defined treatment regime and with thorough reassessments can improve the functional status in children with Leigh syndrome.

No ethical clearance was taken for this study as this is just a case report. Only consent was taken from the parents.

Funding: Nil

Conflict of Interest: None

References

Immediate Effect of Diaphragmatic Myofascial Release in COPD Patient

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1BPT intern, 2Assisant professor, Dr. A.P.J. Abdul Kalam College of Physiotherapy, PIMS (DU), Ahmednagar, Loni

**Background:** Diaphragmatic myofascial release techniques are manipulative treatments that attempts to release tension in the fascia in which pressure is applied to muscle and fascia. Though these techniques are widely used in clinical practice, there is hardly any study which determined the immediate effect of diaphragmatic myofascial release techniques on Peak Expiratory Flow Rate and dyspnea in Chronic Obstructive Pulmonary disease. Hence this study was designed with the same objective.

**Methodology:** Sixty COPD patients were selected by convenient sampling. Outcome measures used were Peak Flow Meter, Modified Borg Scale. Their pre intervention peak expiratory flow rate and dyspnea was measured. After recording pre-intervention reading diaphragmatic myofascial release was given with 2 sets of 10 repetitions with one-minute interval between them. Then post-intervention outcome readings were recorded.

**Results:** The data was analyzed using student’s t-test p<0.001. Pre-intervention score for peak expiratory flow rate showed average (±SD) 96.5±36.72 and for Modified Borg Scale score it was 3.68 ± 0.812856. Post intervention data collected showed the average (±SD) of 136± 56.99 for Peak Expiratory Flow Rate and 1.78 ± 0.80 for Modified Borg Scale.

**Conclusion:** Study concluded that diaphragmatic myofascial release significantly improves peak expiratory flow rate (PEFR) (p<0.001) and reduces dyspnea in COPD patients.

**Keywords:** COPD, Diaphragmatic Myofascial Release, Peak Flow Meter, PEFR, Dyspnea, Modified Borg Scale.

**Introduction**

Chronic obstructive pulmonary disease is a progressive inflammatory disease of lung, caused by narrowing of small airways and emphysematous destruction of lung parenchyma. It causes limitation in expiration further leads to air trapping and decrease in FVC (forced vital capacity), causing increase in (RV) residual volume more than the total lung capacity and lung hyperinflation. Normally diaphragm muscle fibers lie vertically in zone of apposition but due to hyperinflation it becomes more transversely oriented. This altered orientation makes the diaphragm’s contraction less effective at raising and expanding the lower rib cage and may even lead to a decrease in the transverse diameter of the lower rib cage during inspiration. It further causes decrease in diaphragmatic motion which is major risk factor for mortality in COPD patients.

A systematic review, meta-analysis, and studies carried out in 28 countries between 1990 and 2004 suggest that prevalence of COPD is higher in smokers and ex-smokers with >/= forty years aged also more in men compared to women. According to BOLD (Burden of Obstructive Lung Disease) and other epidemiological studies, in 2010 there were about 384 million cases of COPD all over the world. With global prevalence of 11.7 %. According to WHO COPD is the fourth leading cause of death. Every year 3 million people die due to COPD. India and china alone estimated to account for 66% of total global COPD mortality. In next 30 years prevalence of COPD is expected to rise due to increase in prevalence of smoking in developing countries, and aging population in high income countries. By 2030, 4.5 million people will die annually from COPD and related conditions. Important risk factors include tobacco smoke, occupational exposure, socio-economic status, genetic predispositions. Signs and symptoms include cough, wheeze, exertional dyspnea, night
waking, post-bronchodilator forced expiratory volume in one second (FEV₁)/forced vital capacity (FVC) \( \leq 0.7 \) confirms airflow limitation. Chest radiograph shows increased broncho-vascular markings, lung hyperinflation, tubular shaped heart, widened AP diameter in lateral radiograph suggesting barrel chest, flattening of diaphragm which reduces the efficiency of respiration, thereby decreasing the ventilation causing health consequences. Increase in air flow resistance, air trapping, and hyperinflation causes inspiratory muscles to shorten and placed at mechanical disadvantage. Thus, causing reduction in the diaphragm mobility. Other changes that are associated with COPD are mucus hypersecretion, ciliary dysfunction, airflow limitation, pulmonary hyperinflation, gas exchange abnormalities, pulmonary hypertension, and cor pulmonale.

Smoking cessation is one of the most important treatment for smokers with COPD. Researches done in developing countries on women exposed to various levels of indoor pollutants that are emitted from cooking, baking and heating with unprocessed solid fuels, including biomass, charcoal, have suggested that chronic exposures are related with chronic airway obstruction in adults and acute respiratory infection in children. Thus, reducing biomass and charcoal exposure will also help.

Dyspnea, which is one of the important symptoms that is observed in COPD patients is associated with dysfunction. Therefore, focusing the treatment on dyspnea, might improve functional outcome. Teaching patients pursed lip breathing will reduce dyspnea by creating back pressure in the airways and keeps the airways open. Studies suggests that pursed lip breathing decreases the respiratory rate and the work of breathing, increases the tidal volume and improves the exercise tolerance.

Many patients with COPD may suffer from periodic episodes of dyspnea so it is important for the patient to recognize early signs of dyspnea and various ways to overcome it. During such instances ask the patient to assume relaxed forward bent posture, this position will stimulate diaphragmatic breathing by pushing viscera forward and will help the diaphragm to descend. Pursed lip breathing followed by diaphragmatic breathing should be done in this position until the episode of dyspnea subsides. Selecting a treatment plan, the benefits and risks to the individual and the costs, direct and indirect, to the community must be considered.

There are various tests and tools to measure the amount of obstruction in COPD patients. Out of which, Peak flow meter is accurate tool for measuring airflow obstruction in COPD patients. And it correlates well with forced expiratory volume (FEV₁) which is ideal parameter for measuring airflow obstruction (measured by formal spirometry).

PEFR is person’s maximum speed of expiration, as measured with a peak flow meter, a small hand-held device used to monitor a person’s ability to breath out air. It measures the flow of air through the bronchi and therefore the degree of obstruction within the airways. It is typically measured in units of liters per minute (L/min).

Jackson H et. al, suggested that peak expiratory flow rate is good at detecting patients with chronic obstructive pulmonary disease in the community. Spirometry measurements provide additional information, but are more complex and time-consuming, and their benefit in primary care has not been quantified. Another advantage is that it is portable, lightweight, compact. It also gives visual feedback to the patient. This helps the patient to get motivated and can perceive the progress by himself. Thus, it increases patient’s awareness of their disease status and control.

Modified Borg Dyspnea scale is one of the assessments tool to assess degree of dyspnea in patient. It starts at number 0 where breathing is causing no difficulty at all and progresses through to number 10 where breathing difficulty is maximal. Modified Borg Dyspnea Scale is valid and reliable to assess dyspnea. It is easy to use, and language used in this scale adequately expresses dyspnea perceived by the patient.

In COPD patients there is a progressive limitation of the airflow, which causes pathological adaptation of the diaphragm, (the diaphragm is lowered than its normal position) these changes adversely affect the exercise tolerance. Pathological changes which occur are, decrease in contractile force of the diaphragm, decrease mechanical excursion (due to fiber shortening), decrease in anaerobic type fibers (type 2), increase in aerobic fibers. All these changes worsen as the disease progresses. Due to chronic lowering of diaphragm the nerve is stretched resulting in neuropathy.

With consequent shortening of diaphragm as the disease progresses, it results in altered respiratory biomechanics and length tension relationship. Literatures
have stated that diaphragm release techniques have been indicated to improve length tension relationship of the diaphragm to increase respiratory performance, but limited researches have proven this.21

There are very limited studies available on diaphragmatic myofascial release and as per our knowledge no study has been done to determine immediate effect of diaphragmatic release on PEFR and on dyspnea in COPD patients and that too in Indian population. Thus, present study aims to find out immediate effect of diaphragmatic release in COPD patients.

**Material and Method**

**Design:** This study was approved by Research Ethics committee of Pravara Institute of Medical Sciences, Loni (Ref. No. PIMS/CPT/IEC/2018/554). Screening was done and those fulfilling the inclusion criteria were selected by convenient sampling from department of medicine (ward no 32 to 39) of Pravara Rural Hospital.

**Participants:** The study’s inclusion criteria were people aged 45-90 years because COPD is uncommon in younger people, both gender, Dyspnea grade 2 and grade 3 on MMRC scale, and patients willing to participate.

And study’s exclusion criteria were patient’s having significant or unstable cardiac, musculoskeletal or psychological problem, dyspnea grade 1 and grade 4 on MMRC scale, patients not willing to participate.

A portable peak flow meter was used to assess PEFR and Modified Borg Dyspnea Scale was used to assess Dyspnea. Age and Gender were also recorded at baseline.

**Intervention**

As per our inclusion criteria patients were selected by convenient sampling. Before giving diaphragmatic myofascial release, patient’s dyspnea score was recorded according to Modified Borg Scale and along with that PEFR (L/min) was measured with peak flow meter. Then patient was asked to be in supine lying position. Therapist was standing at the head end of the patient. Manual contact (pisiform, hypothenar region, and last three fingers) was made with underside of the costal cartilages of seventh to tenth ribs. While the patient inspires, accompanying the elevation movement of the ribs the therapist gently pulls the diaphragm along the cephalad direction. And while the patient expires, therapist deepens the contact towards the inner costal margin. This procedure was followed for subsequent 10 repetitions, then 1 min rest was given and again a set of 10 repetitions was performed. After giving diaphragmatic myofascial release patient was asked to be in sitting position and again PEFR(L/min) was measured immediately. Also, patient was asked about the dyspnea and aginandyspnea score was recorded.

The device was cleaned after each use. Data was collected from all 60 samples and further analysis was done to find out the results.

**Findings**

**Effect of Diaphragmatic Myofascial Release:**

**Peak Expiratory Flow Rate (l/min)**

The PEFR was improved post intervention. Pre-intervention score for PEFR was recorded, it showed average (±SD) 96.5±36.72. Post intervention data collected showed the average (±SD) of 136±56.99. Similar study was conducted by Abdelaal Ashraf AM et al (May 2013- August 2014) in Sadr-Al-Abasia hospital, Egypt to check effect of diaphragmatic and costal manipulation on pulmonary function and functional capacity in COPD patients, found that post intervention there is significant improvement in FEV1 FVC and 6MWT values.22 Though outcome measures were evaluated with FEV1 research done by Nolan D et.al, suggest that FEV1 correlates well with PEFR values.16

Another study conducted by Taciano Rocha et.al in the physiotherapy department of Universidade Federal de Pernambuco, Brazil to determine the effects of the Manual Diaphragm Release Technique in adults with clinically stable COPD patients, concluded that the manual diaphragm release technique produced statistically significant improvements in diaphragmatic mobility(2mm-6mm), 6-minute walking distance and inspiratory capacity in people with COPD.3 This study hypothesized that the manual action on underside of last four costal cartilages allowed the traction of the lower rib cage in cranial direction and that the manual compression of the tissues in the area of insertion of the anterior costal diaphragm fibers lengthened the diaphragm in its insertional zone and improved diaphragmatic mobility.3 As, In COPD the orientation of diaphragm muscle fibers alters due to hyperinflation. This altered orientation makes the diaphragm’s contraction less effective at raising and expanding the lower rib cage and may even
lead to a decrease in the transverse diameter of the lower rib cage as patient inspires. Consequent shortening of diaphragm, as the disease progresses, it results in altered respiratory biomechanics and length tension relationship of the diaphragm, as diaphragmatic myofascial release helps to improve length-tension relationship and diaphragmatic mobility; these changes might allow the diaphragm to work efficiently and increase the patient's ability to exhale and thus improves Peak expiratory flow rate of the patient. Our study may have reported an increase in PEFR because of use of similar technique and repetitions of diaphragmatic myofascial release.

Modified Borg Dyspnea Scale

Pre-intervention score for Modified Borg Scale score was 3.68 ± 0.81. Post intervention data collected showed the average (±SD) of 1.78 ± 0.80 for Modified Borg Dyspnea Scale. Which suggest that there was decrease in degree of dyspnea perceived by the patient. (P<0.001)

In a study done by Yelvar GDet.al, suggested that Diaphragmatic release may cause activation of parasympathetic system which regulates relaxation, thus, reducing dyspnea. Also, respiratory muscle length and thoracic cage flexibility increases, reducing the work of breathing and development of dyspnea in COPD patients.

Comparing the post interventional PEFR and dyspnea scores, the study proved that diaphragmatic myofascial release was significant in improving PEFR values and decreasing dyspnea perceived by the patient.

Conclusion

Study concluded that diaphragmatic myofascial release significantly improves peak expiratory flow rate (PEFR) and reduces dyspnea in COPD patients.

Ethical Clearance taken from Research Ethics committee of Pravara Institute of Medical Sciences, Loni (Ref. No. PIMS/CPT/IEC/2018/554).

Source of Funding: Self

Conflict of Interest: Nil

References


Effect of the Traditional Toys Exercises as an Adjunct to Hand Therapy Following Post-Traumatic Forearm Bone Fracture in Children

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Abstract

Background: The purpose of this study was to determine the effect of traditional toys exercises as an adjunct to hand therapy to improve functional outcome of hand in children’s with post traumatic forearm bone fracture.

Method: An experimental study was conducted on 10 post traumatic forearm bone fracture children with age range 5-11 years which were selected as per inclusion and exclusion criteria. Before and after treatment subjects were assessed by goniometry (ROM), Manual muscle testing (MUSCLE STRENGTH) and Michigan hand outcome questionnaire (FUNCTIONAL OUTCOME).

Results: The statistical analysis showed extremely significant improvement in ROM muscle strength and functional outcome with p value <0.0001

Conclusion: The study showed improvement in functional outcome of hand in subjects with forearm bone fracture.

Keywords: Traditional toys exercises, forearm bone fracture, children.

Introduction

The shaft of ulna and shaft of radius are included in forearm fracture. Galeazzi and Monteggia fracture can also occur. The classifications of forearm fracture are according to fracture pattern, location, angulation, and displacement. Fall on outstretched hand, direct blow during road traffic accident this can be the mechanism of injury.¹, ²

Children are more prone for forearm type of fracture³. It can be due to direct fall, 75% involve the distal one third of forearm⁴. The clinical feature of forearm bone fracture are pain, swelling, deformity and loss of function². Most of the fractures in children have been treated by closed anatomical reduction and immobilization in a cast⁵. Fracture healing can be similar to the healing of soft tissue wounds, except that soft tissue heals with fibrous tissue and end result of bone healing is mineralised mesenchymal tissue that is bone fracture². Healing is quick and the fractures have an excellent capacity to spontaneously correct residual axial deformities during the growing years⁶-⁷. Treatment of choice for isolated ulna fracture both bone forearm fracture is cast immobilization, because of this the interosseous space is maintain with forearm in neutral rotation and long arm cast with elbow in 90⁰ of flexion is general treatment of choice for middle one third fracture¹. The complication of forearm bone fracture are stiffness, malunion, refracture, cross union, vascular complication (rare)⁸.

Physiotherapy interventions for treating immobilization are paraffin wax bath, active exercises, and mobilization⁹.

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Children appreciate the possibilities for activities and looks of the product. Toys are a part of child’s growing age. They are fascinated by various colourful toys and readily get attracted to it. Making the child use therapeutic tools will not give us the desired result as the child get bored after a while. If toys are used as a part of hand rehabilitation, it will act as a biofeedback; they will use them as a part of their play and unknowingly perform the desired movement thereby giving us the desired result. Incorporating toys in hand therapy rehabilitation maybe motivating to children.\textsuperscript{10}

Hand is an important unit of upper limb. Any injury to hand like forearm fracture will affect hand functioning, so faster rehabilitation is required. So this study was carried out with the aim to see the combine effect of paraffin wax bath, Maitland mobilization and the traditional toys exercise on functional outcome of hand.

Material and Methodology

An ethical clearance was taken from institutional ethical committee of KIMSDU Karad prior to initiation of the study. An Experimental study was conducted at physiotherapy department of Krishna College of physiotherapy. Total 10 post traumatic forearm bone fracture childrens were taken by the simple random sampling method and as per inclusion, exclusion criteria for study. Inclusion criteria was- age 5-11years, both males and females, injury to forearm bone immobilised in pop cast, stiffness of hand and wrist, exclusion criteria was- tendon injuries of hand, loss of sensation in hand and nerve injuries. Written informed consent was taken and whole study was explained to them. Subjects were treated with the paraffin wax bath, mobilization, and traditional toys exercises for 4 days per week for 6 week. The interpretation of study was done on the basis of comparing pre test and post test assessment.

Results

Statistical Analysis: The statistical analysis was done by using paired $t$ test for comparing the pre and post interventional data. The INSTAT soft ware was used for the same.

**RANGE OF MOTION (Measured By Universal Goniometer)**

<table>
<thead>
<tr>
<th>Range of motion</th>
<th>Pre interventional</th>
<th>Post interventional</th>
<th>T Value</th>
<th>P Value</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrist Flexion</td>
<td>40.4±7.560</td>
<td>45±7.659</td>
<td>12.393</td>
<td>&lt;0.0001</td>
<td>Extremely significant</td>
</tr>
<tr>
<td>Wrist Extension</td>
<td>45.5±5.169</td>
<td>49.1±5.646</td>
<td>7.216</td>
<td>&lt;0.0001</td>
<td>Extremely significant</td>
</tr>
<tr>
<td>radial Deviation</td>
<td>12.6±2.221</td>
<td>16.3±2.869</td>
<td>10.091</td>
<td>&lt;0.0001</td>
<td>Extremely significant</td>
</tr>
<tr>
<td>Ulnar Deviation</td>
<td>15.1±5.763</td>
<td>19.7±5.293</td>
<td>12.393</td>
<td>&lt;0.0001</td>
<td>Extremely significant</td>
</tr>
<tr>
<td>Forearm supination</td>
<td>50.7±16.097</td>
<td>54.7±16.634</td>
<td>7.171</td>
<td>&lt;0.0001</td>
<td>Extremely significant</td>
</tr>
<tr>
<td>Forearm pronation</td>
<td>52.6±17.083</td>
<td>58±17.114</td>
<td>5.511</td>
<td>0.0004</td>
<td>Extremely significant</td>
</tr>
<tr>
<td>Finger Flexion</td>
<td>52.2±21.017</td>
<td>56.3±20.133</td>
<td>6.781</td>
<td>&lt;0.0001</td>
<td>Extremely significant</td>
</tr>
<tr>
<td>Finger Extension</td>
<td>27.7±8.341</td>
<td>32±8.300</td>
<td>12.836</td>
<td>&lt;0.0001</td>
<td>Extremely significant</td>
</tr>
</tbody>
</table>

i) Wrist flexion: The pre interventional wrist flexion ROM was 40.4±7.560 and the post interventional wrist flexion ROM 45±7.659. The p value was <0.0001 which was statistically extremely significant ($t = 12.393$). This showed improvement in wrist flexion ROM post intervention.

ii) Wrist extension: The pre interventional wrist extension ROM was 45.5±5.169 and the post interventional wrist extension ROM 49.1±5.646. The p value was <0.0001 which was statistically extremely significant ($t = 7.216$). This showed improvement in wrist extension ROM post intervention.

iii) Wrist radial deviation: The pre interventional wrist radial deviation ROM was 12.6±2.221 and the post interventional wrist radial deviation ROM was 16.3±2.869. The p value was <0.0001 which was statistically extremely significant ($t = 10.091$). This showed improvement in wrist radial deviation ROM post intervention.
iv) Wrist ulnar deviation: The pre interventional wrist ulnar deviation ROM was 15.1±5.763 and the post interventional wrist ulnar deviation ROM was 19.7±5.293. The p value was <0.0001 which was statistically extremely significant (t = 12.393). This showed improvement in wrist ulnar deviation ROM post interventional.

v) Forearm supination: The pre interventional forearm supination ROM was 50.7±16.097 and the post interventional forearm supination ROM was 54.7±16.634. The p value was <0.0001 which was statistically extremely significant (t = 7.171). This showed improvement in forearm supination ROM post interventional.

vi) Forearm pronation: The pre interventional forearm pronation ROM was 52.6±17.083 and the post interventional forearm pronation ROM was 58±17.114. The p value was 0.0004 which was statistically extremely significant (t = 5.511). This showed improvement in forearm pronation ROM post interventional.

vii) Finger flexion: The pre interventional finger flexion ROM was 52.2±21.017 and the post interventional finger flexion ROM was 56.3±20.133. The p value was <0.0001 which was statistically extremely significant (t = 6.781). This showed improvement in finger flexion ROM post interventional.

viii) Finger extension: The pre interventional finger extension ROM was 27.7±8.341 and the post interventional finger extension ROM was 32±8.300. The p value was < 0.0001 which was statistically extremely significant (t = 12.836). This showed improvement in finger extension ROM post interventional.

### Manual Muscle Testing

#### Table No. 2

<table>
<thead>
<tr>
<th>MMT</th>
<th>Pre interventional</th>
<th>Post interventional</th>
<th>T value</th>
<th>P Value</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrist Flexors</td>
<td>0.6±2.271</td>
<td>3.1±0.5676</td>
<td>3.101</td>
<td>0.0127</td>
<td>considerable significant</td>
</tr>
<tr>
<td>Wrist Extensors</td>
<td>-0.3±2.869</td>
<td>3±2.160</td>
<td>2.538</td>
<td>0.0318</td>
<td>considerable significant</td>
</tr>
<tr>
<td>Finger Flexors</td>
<td>1.4±2.119</td>
<td>3.4±0.5164</td>
<td>2.928</td>
<td>0.0168</td>
<td>considerable significant</td>
</tr>
<tr>
<td>Finger Extensors</td>
<td>1±2.582</td>
<td>3.4±0.6992</td>
<td>2.882</td>
<td>0.0181</td>
<td>considerable significant</td>
</tr>
<tr>
<td>Hand Grip</td>
<td>33.1±8.999</td>
<td>39.4±8.316</td>
<td>7.465</td>
<td>&lt;0.0001</td>
<td>Extremely significant</td>
</tr>
</tbody>
</table>

i) Wrist flexors: The pre interventional wrist flexors strength was 0.6±2.271 and the post interventional wrist flexors strength was 3.1±0.5676. The p value was 0.0127 which was considered statistically significant (t = 3.101). This showed improvement in wrist flexors strength post interventional.

ii) Wrist extensors: The pre interventional wrist extensors strength was -0.3±2.869 and the post interventional wrist extensors strength was 3±2.160. The p value was 0.0318 which was considered statistically significant (t = 2.538). This showed improvement in wrist extensors strength post interventional.

iii) Finger flexors: The pre interventional finger flexors strength was 1.4±2.119 and the post interventional finger flexors strength was 3.4±0.5164. The p value was 0.0168 which was considered statistically significant (t = 2.928). This showed improvement in finger flexors strength post interventional.

iv) Finger extensors: The pre interventional finger extensors strength was 1±2.582 and the post interventional finger extensors strength was 3.4±0.6992. The p value was 0.0181 which was considered statistically significant (t = 2.882). This showed improvement in finger extensors strength post interventional.

v) Hand Grip Strength: The pre interventional Hand Grip Strength was 33.1±8.999 and the post interventional was Hand Grip Strength 39.4±8.316. The p value was <0.001 which was statistically extremely significant (t = 7.465). This showed improvement in Hand Grip Strength post interventional.
Michigan Hand Outcome Questionnaire

Table No. 3

<table>
<thead>
<tr>
<th>Michigan hand outcome questionnaire</th>
<th>Pre interventional</th>
<th>Post interventional</th>
<th>T Value</th>
<th>P Value</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left hand(5)</td>
<td>123.2±9.602</td>
<td>134.6±7.057</td>
<td>4.231</td>
<td>0.0134</td>
<td>considerable significant</td>
</tr>
<tr>
<td>Right hand(5)</td>
<td>114.8±9.011</td>
<td>132.6±7.092</td>
<td>7.069</td>
<td>0.0021</td>
<td>Considerable very significant</td>
</tr>
</tbody>
</table>

i) MHOQ of left hand: The pre interventional MHOQ of left hand was 123.2±9.602 and the post interventional MHOQ of left hand was 134.6±7.057. The p value was 0.0134 considered statistically significant (t = 4.231). This showed improvement in MHOQ of left hand post interventional.

ii) MHOQ of right hand: The pre interventional MHOQ of right hand was 114.8±9.011 and the post interventional MHOQ of right hand was 132.6±7.092. The p value was 0.0021 which was considered statistically very significant (t = 7.069). This showed improvement in MHOQ of right hand post interventional

Treatment

- A 35–45min of protocol was given comprising of traditional toys exercise, Paraffin wax bath and Maitland mobilization. The treatment began by giving the patients paraffin wax bath which will be followed mobilization.

Discussion

This research was undertaken with the aim to study the effect of traditional toys exercises as an adjunct to hand therapy following post traumatic forearm bone fracture children.

10 subjects (1 female, 9 males) diagnosed as forearm bone fracture and managed conservatively of age group 5 to 11 years approaching to OPD of Krishna College of physiotherapy participated in the study. Subjects were selected as per the inclusion and exclusion criteria.

Paraffin wax bath, Mobilization, Traditional toys exercises, intrinsic muscle strengthening were the exercises included in treatment session. Treatment session- 4 days per week for 6 Paraffin wax applied prior to the mobilization and exercise.

Pre and Post-test Range of motion, Manual muscle testing, Michigan hand outcome questionnaire assessment was taken. The interpretation of the study was done on basis comparing pre-test and post-test assessment of range of motion. Thus the study was concluded by statistical analysis of the outcome measures. Statistical analysis was done using paired’ t test. The average age of the study was 9.5 years.

In the study the pre interventional values of wrist flexion ROM was 40.4±7.560 and the post interventional wrist flexion ROM 45±7.659 (t=12.393, p<0.0001 extremely significant). The pre interventional wrist extension ROM was 45.5±5.169 and the post interventional wrist extension ROM 49.1±5.646 (t=7.216, p<0.0001 extremely significant).

The pre interventional wrist radial deviation ROM was 12.6±2.221 and the post interventional wrist radial deviation ROM was 16.3±2.869 (t=10.091, p<0.0001 extremely significant). The pre interventional wrist ulnar deviation ROM was 15.1±5.763 and the post interventional wrist ulnar deviation ROM was 19.7±5.293 (t=12.393, p<0.0001 extremely significant).

The pre interventional forearm supination ROM was 50.7±16.097 and the post interventional forearm supination ROM was 54.7±16.634 (t=7.171, p<0.0001 extremely significant). The pre interventional forearm pronation ROM was 52.6±17.083 and the post interventional forearm pronation ROM was 58±17.114 (t=5.511, p is 0.0004 extremely significant).

The pre interventional finger flexion ROM was 52.2±21.017 and the post interventional finger flexion ROM was 56.3±20.133 (t=6.781, p<0.0001 extremely significant). The pre interventional finger extension ROM was 27.7±8.341 and the post interventional finger extension ROM was 32±8.300 (t=12.836, p<0.0001 extremely significant).

The pre interventional wrist flexor strength was 0.6±2.271 and the post interventional wrist flexors
strength was 3.1±0.5676 \((t=3.101, p=0.0127)\). The pre interventional wrist extensors strength was -0.3±2.869 and the post interventional wrist extensors strength was ±2.160 \((t=2.538, p=0.0318\) considered significant).

In the study the pre interventional values of finger flexors strength was 1.4±2.119 and the post interventional finger flexors strength was 3.4±0.5164 \((t=2.298, p=0.0168\) considered significant). The pre interventional finger extensors strength was 1±2.582 and the post interventional finger extensors strength was ±2.160 \((t=2.882, p=0.0181\) consider significant).

In the study the pre interventional values of Hand Grip Strength was 33.1±8.999 and the post interventional was Hand Grip Strength 39.4±8.316 \((t=7.465, p<0.0001\) extremely significant).

In the study the pre interventional values of MHOQ of left hand was 123.2±9.602 and the post interventional MHOQ of left hand was 134.6±7.057 \((t=4.231, p=0.0134\) considered significant). The pre interventional MHOQ of right hand was 114.8±9.011 and the post interventional MHOQ of right hand was 132.6±7.092 \((t=7.069, p=0.0021\) very significant).

Mobilization techniques helped to reduce pain due to its neurophysiologic effect on the joint and also helped to maintain extensibility of articular, periarticular structure due to its biomechanical effect which is focused directly on the tension of periarticular tissue to prevent complication resulting from immobilization and trauma. Mobilization techniques helped to reduce post traumatic stiffness and increase range of motion\(^{15}\).

Paraffin wax bath therapy provides superficial heating to tissues. It increases the local circulation to the area, to reducing joint stiffness, post immobilization stiffness, reducing pain and increase range of motion and improve circulation and promotes relaxation\(^{9,16,17,18}\). To obtain a slight resistance, to facilitate the performance of exercises such as soft exercise dough made from flour, water, salt and liquid paraffin used by patients which approximately took them to perform exercise\(^{19,20}\). As per study done by Myriam Villeneuve\(^{21}\) and co-workers suggest that piano exercises helped to improve gross manual dexterity as well as there is more functional use of hand in exercises\(^{21}\).

After distal radius fracture, there are limitations in wrist movement. This is usually common. along with this there may be deficit in joint proprioception .Due to less joint position sense a narrative review on proprioception of wrist suggest possible role proprioceptive re-education with wrist injuries\(^{22,23}\).

The games like tilt maze, can be used as skilled therapy technique following distal radius fracture. Thus addressing proprioceptive deficit encouraging wrist range of motion\(^{23}\).

Limitations of study were Small sample size, Short duration of study; it was done as pilot study. Further studies can be done with a large sample size. The study can be done with longer duration and long term follow up. Further studies can be done in adults.

**Conclusion**

The study concluded that there was statistically significant effect of traditional toys exercises as an adjunct to hand therapy following post traumatic forearm bone fracture in children.

**Conflict of Interest:** The author declares that there are no conflicts of interest concerning the content of the present study.

**Source of Funding:** This study is self-funded study.

**Ethical Clearance:** The study was approved by the institutional ethics committee of Krishna institute of medical sciences deemed to be university karad.

**Reference**

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Effect of Smartphone Usage on Cognition and Balance in Geriatric Individuals

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Abstract

Introduction: Smartphone is a device which has features of both a computer and a mobile device. These new technologies appear to be associated with greater integration into peer groups and even increased cognitive abilities such as faster task-switching. Mobile phones adoption is increasing amongst elderly population and the potential benefits of mobile phone usage. Over the age of 65, 1 in every 3 adults will suffer from fall, and given the explosion in the number people living today over 65 years of age, falls are major healthcare crisis. Mobile phone users adapt their visual search behavior and gait to incorporate mobile phone use in a safe manner when negotiating static floor based obstacles. It’s improving their balance while using phones.

Objectives: The main objective of this study is to evaluate the effect of Smartphone usage on Cognition and balance on geriatric individuals.

Method: 135 geriatric individuals in the age group of 60-75 are selected having a graduate degree and are using smart phone. Individuals should have independent according to Functional independence scale. After the selection on the basis of criteria, geriatric individuals will be divided into 3 groups of 45 each. Group A will be the subjects who do not use smart phone, Group B will be the subjects who use smart phone less than 4 hours and Group C will be the subjects who use smart phone more than 4 hours. All the three groups will be measured for cognition with the help of Addenbrooke Cognitive Examination and balanced will be assessed through Berg Balance Scale.


Keywords: Smartphone; Cognition; Balance; Geriatric individuals

Introduction

According to Lusekelo et al.¹ a Smartphone is a device which has features of both a computer and a mobile device (cell phone). Unlike a normal mobile device a smart phone has a vast amount of both local storage and memory. Smart phones have operating units like computers. Smart phones act as mobile entertainment units where a user can: watch videos, listen to music, update blogs, as well as audio and video blogging.

Kathryn² proposed that adaptations to these new technologies appears to be associated with greater integration into peer groups and even increased cognitive abilities such as faster task-switching. Mobile phones also can be considered as memory aids for compensating aging-related memory decline. Symmetric vestibular sensory hair cell loss, declining visual acuity and declining muscular strength and mobility are age-related changes to humans balance system.

Susan et al.³ suggested that cognition is act or process of knowing including both awareness and judgment. It is a process by which an organism becomes knowledgeable. It is influenced by one’s personality characteristics, emotional factors, and subjectivity. It is one of the most significant factors in determining an individual’s way of dealing with one’s world.

According to Konard et al.⁴ over the age of 65, 1 in every 3 adults will suffer from fall, and given the explosion in the number people living today over 65 years of age, falls are major healthcare crisis.

Brittany et al.⁵ explained that balance can be defined as the ability of an individual to maintain the position of
their body, center of gravity, within specific boundaries of space.

Hrysomallis et al.\textsuperscript{6} proposed that the maintenance of balance is essential in the prevention of injuries and this ability depends on proprioceptive input from mechanoreceptors in the capsule, ligament, muscle and tendon, in addition to vestibular and visual input to the central nervous system. This input is used to provide the appropriate neuromuscular response. Alteration in any of these inputs would disturb balance and increase the risk of injury.

Hyong et al.\textsuperscript{7} suggested that Smartphone using during walking, such as listening to music, sending a massage, web surfing, or playing game, is considered to affect the dynamic balance ability necessary for functional activities.

Matthew et al.\textsuperscript{8} suggested that Mobile phone users adapt their visual search behavior and gait to incorporate mobile phone use in a safe manner when negotiating static floor based obstacles. It’s improving their balance while using phones.

Plaza et al.\textsuperscript{9} proposed that mobile phones adoption is increasing amongst elderly population and the potential benefits of mobile phone usage, apart from being a convenient means of communication, includes maintaining relationships with the social contacts as well as of entertainment and mental stimulation. Besides games and audio-visual player functions of mobile phones offer entertaining mental exercises.

Nichola et al.\textsuperscript{10} proposed that the Internet, with its breadth of information and resources, provides an important tool for the rapidly increasing older population to lead independent lives, to keep in touch with friends and family through e-mail, and to make informed decisions on many issues from health information to travel and hobby interest.

Material and method: Study Design: This study is of Cross-sectional design.

Sampling Technique: The subjects will be selected by Purposive sampling

Source of Data: Subjects will be taken from in and around the Ludhiana.

Eligibility

Inclusion Criteria
- Subjects with age group of 60-75 years
- Able to communicate
- Use Smartphone
- Education should be at least 12th class or more.
- Subjects who were independent according to functional independence measure (FIM).
- Urban population taken

Exclusion Criteria
- Auditory, visual or perceptual deficits
- Any pathologies of lower limbs, upper limb and spine
- Surgical operations in lower limb and upper limb
- Sensory loss
- Any neurological conditions

Procedure
Based on the Inclusion and Exclusion criteria 135 Elderly subjects will be enrolled for the study by purposive sampling. Informed consent will be obtained from all the subjects. The subjects will be divided into 3 groups A, B and C of 45 each both male and female.

Group A, 45 subjects not using Smartphone. Group B, 45 subjects using Smartphone less than 4 hours per day. Group C, 45 subjects using Smartphone more than 4 hours per day.

Berg Balance Scale and Addenbrookes Cognitive Examination are used to assess the Cognition and Balance.

Findings: Data was meaningfully assorted through calculation of Mean and Standard Deviation and ANOVA and T test. “ANOVA” test was used to investigate usage effect of using smart phone on balance and cognition in elderly people. The level of significance for all statistical tests was set at p<0.05 followed by least significant difference test for comparisons in case of significance. The level of significance for all statistical tests was set at P-value less than 0.05. The comparison of Berg Balance Scale and Addenbrooke Cognitive scale score was examined first to determine the potential effect
of smart phone usage on outcome of the study. The relation between Berg Balance score and Addenbrooke Cognitive score in elderly people was significant in three groups.

The Means ± SD value of the group A is 66.13±3.35 and group B is 64.56±3.77 and group C is 65.98±3.38. The descriptive values of the age variable are higher than p-value and result are non-significant in age variable. There were no statistically significant differences between subjects in all groups concerning age.

The Mean± SD of group A is 66.13±3.35 and group B is 64.56±3.77 and group C is 65.98±3.38. The descriptive values of the age variable are higher than p-value and result are non-significant in age variable. There were no statistically significant differences between the groups as the p value comes be zero. The result is highly significant.

The Means ± SD value of the group A is 66.13±3.35 and group B is 64.56±3.77 and group C is 65.98±3.38. The descriptive values of the age variable are higher than p-value and result are non-significant in age variable. There were no statistically significant differences between the groups as the p value comes be zero. The result is highly significant.

The Mean± SD of the group A is 66.13±3.35 and group B is 64.56±3.77 and group C is 65.98±3.38. The means value of the study emphasize the crucial role played by the cerebral cortex particularly the frontal lobe, in human balance and locomotor control as mentioned by Nutt et al.

According to Suzuki et al found the activation of prefrontal cortex in locomotor control while adjusting walking speed on the treadmill.

As postulated by Hyoun&ldquo; Walking and working while using different functions of the smart phone may be called dual tasking or multitasking.

Performing two tasks at the same time is called dual tasking, while performing more than two tasks simultaneously is referred to as multitasking as mentioned by Won.

According to Yogev et al many studies have reported that dual tasks activate the prefrontal cortex (PFC), which plays roles in executive functions such as attention and multi-tasking.

Miremian stated that many studies have found that dual tasks, such as verbal fluency or calculating during walking, activate the PFC. Dual tasking increased brain activation in prefrontal areas during walking in young adults.

Yahya et al mentioned that Dual-task cost has been correlated with cognitive function, in particular, attention and executive function.

Roudia et al found in his study that training-related benefit to gross motor performance that stem from a cognitive training protocol. The present results offer a method of enhancing one specific aspect of executive functioning, dual-task coordination, that may in turn improve physical status and mobility.

Yoon et al found that A 12-week cognitive activity combined with physical exercise (CAE) program resulted in improvements in balance, memory and QOL. Therefore, some older adults with dementia have the ability to acquire effective skills relevant to daily living.

Svoboda et al found that 10 individuals with ABI could learn how to use PDAs and smart phones, and that their use was associated with improvement in everyday memory functioning.

Although there are now just a few randomized controlled studies on the use of smart phone apps for the
cognitive training of the elderly as mentioned by Shin et al. If compared with the smartphone app focused on physical training, the findings indicate that smartphone apps have a promising potential for the enhancement of cognitive competences of older people, specifically for the improvement of their working memory and reasoning skills. The result indicates that the smartphone apps thanks to their independence on time and place may serve as good intervention tools for cognitive training of older individuals as mentioned by Kilmova et al.

**Conclusion**

The present study concluded that the smartphone have a good impact on cognition and balance in elderly those who use smartphone more than 4 hours. The results are statistically significant in group who use smartphone more than 4 hours as compared to other two groups who use less smartphone and not use smartphone. However the impact of smartphone on cognition and balance is statistically significant. In case of the age results are clinically non-significant.

So it can be concluded from the current study that smartphone has a positive effect on cognition and balance in elderly individuals. And smartphone can be used in clinical and rehabilitation program to improve both the cognition and the balance in elderly individuals. Using smartphone in rehabilitation will help in improving balance and cognitive abilities of elderly people. The positive outcome of smartphone will help in reducing the dependency of elderly people and help them to become independent and also reduce the risk of falls which are common in older people due to aging. These positive impacts of smartphone on cognition and balance will help in improving executive functioning through which the can cope up with age related declining factors and become independent.

**Limitations**

1. Sample size is small.
2. Area is limited. Subjects were only taken from Ludhiana.
3. Cognition and balance can be checked on specific smartphone functions e.g. messages, video calls, and other smartphone applications.
4. Exact timing of hours is not being considered.
5. Examination of muscle activity and biomechanics of the body is not considered.

**Future scope**

1. Scale or questionnaire can be filled from rural and illiterate population they will give different results.
2. Time period of smartphone usage can be taken in other time units.

**Conflict of Interest:** Nil

**Source of Funding:** Self

**Ethical Clearance:** Ethical clearance has been taken from All Saints Institute of Medical Sciences and Research, Ludhiana, Punjab

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Effect of Passive Stretching v/s Myofascial Release in Improving Piriformis Flexibility in Females – A Comparative Study

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¹Graduate, ²Assistant Professor, ³Principal, Dr. D. Y. Patil College of Physiotherapy, Pune

Abstract

Study Design: Comparative Study Design.

Background: Piriformis, a key internal rotator of the hip which develops muscular imbalance due to overuse and pressure. The eccentric contraction lead to loading of the piriformis muscle when the hip is excessively abducted and internally rotated causing over lengthening and compression on the muscle, which in turn causes several disabling conditions like low back pain, sciatica and much more.

Objective: Hence, the present study was conducted to see the prevalence of Piriformis tightness in young adult females, to compare the effects between two definitive forms of treatments which are passive stretching (STR) and myofascial release (MFR) on improving the flexibility of Piriformis muscles.

Procedure: In this study, 30 individuals were assessed for tightness and then recruited on the basis of inclusion and exclusion criteria. Individuals were sorted into two groups A and B. Pre and post assessment was taken by Range of Motion.

Result: Significant improvement in flexibility of Piriformis muscle was found post intervention compared to pre-intervention in both the groups (p<0.001). However greater improvement in flexibility was seen in group B (Myofascial Therapy) when compared to group A (passive stretching).

Conclusion: The effect of Myofascial release on piriformis flexibility is a more effective than passive stretching.

Keywords: Flexibility, Internal Rotator, Myofascial Release (MFR), Piriformis, Passive Stretching (STR), Range of Motion (ROM).

Introduction

Piriformis muscle is flat muscle which lies below and parallel to the posterior border of the gluteus medius. The muscle originates from the pelvic surface of the middle three pieces of the sacrum, by three digitations and upper margins of the greater sciatic notch and insertion of the rounded tendon occurs at the apex of the greater trochanter of the femur.¹ It acts as external rotator of the hip below 60 degrees and internal rotator above 60 degrees, thus making it a key internal rotator of the hip joint.²

Piriformis muscle tightness is often confused with Piriformis Syndrome which is defined as neuritis of sciatic never caused by an injured or irritated piriformis muscle³ whereas tightness is simply the shortening of the length of the muscle due to sedentary lifestyle. There are various disabling conditions caused due to a simple tightness of Piriformis muscle like low back pain, sciatic nerve pain through muscle hypertrophy or a nearby anomaly due to its anatomically closeness to the sciatic nerve, pain and alteredesthesia in hip, thigh, calf and foot are symptoms that commonly occur in Piriformis

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syndrome. It also becomes hence making difficult to differentiate from other disease related to hip- spine hence making it difficult to diagnose.

Overuse and pressure on the muscle leads to muscular imbalance which in turn leads to chronic pain development in the lower back region. The piriformis muscle consists of type 1 fibers which often tend to develop shortness or tightness when is muscle is under stress. The eccentric contraction during functional activities can lead to loading of the piriformis muscle when the hip is excessively abducted and internally rotated causing over lengthening and greater eccentric load compression on the muscle.

The conservative treatment for the tightness of the muscle includes NSAIDs, muscle relaxants, hot/cold fermentation and to lengthen the muscle by stretching or by releasing the fascia covering the muscle.

Stretching has mainly two components by increasing the resting length of the muscle and decreasing the compression force on the sciatic nerve. Relaxation post stretching is explained as a reciprocal inhibition mechanism of the automatic motor neurons which occur in antagonist muscles. Passive stretching of Piriformis muscle is given by first flexing the hip at 90 degree then adduction of the hip and lastly external rotation of the hip, this is known as the Adduction stretch. This stretch will be sustained for 15-30 seconds and then relaxed. Each stretch will be repeated 3 times per session, daily one session for 3 days.

The other treatment preferred is by myofascial release of the Piriformis muscle. Myofascial release is an example of manual therapy which has recently gained a lot of attention and popularity, also is widely used by practitioners. The technique involves application of a low load- long duration stretch to the myofascial complex which intends to restore the optimal length, decrease pain and improve functional mobility of the muscle. Direct technique MFR is either given by knuckles or by elbow or by other tools to slowly sink into the fascia and the pressure is applied is a few kilograms of force to contact the restricted fascia, apply tension or stretch the fascia. The release will be given for 3 minutes 3 times per session and for 3 session on alternative days.

To avoid bias in the study the body composition or the BMI of the participating females would be under normal to obesity class 1. Body mass index (BMI) is a simple index of weight-for-height that is commonly used to classify overweight, underweight and obesity in adults. It is defined as a person’s weight in kilograms divided by the square of his height in meters ($kg/m^2$).

**Method**

Ethical clearance was obtained from the Institutional Ethical Committee. Individuals who came to the physiotherapy OPD and college were screened. Approximately 100 females were screened. 30 individuals meeting the inclusion criteria and who were willing to participate in the study were included. Individuals height and weight were recorded to find the body composition. Then the individuals were sorted in the control group by chit method. There were two groups:

1. **Group A** receiving **Passive stretching** (STR)
2. **Group B** receiving **Myofascial release** (MFR)

**Inclusion Criteria**

1. Females of age group 20-40 years.
2. Females with piriformis tightness

**Exclusion Criteria**

1. Post-partum females
2. Recent Hip Trauma or injury
3. Recent Abdominal Surgery
4. Pregnant Females
5. Congenital anomalies

The subjects were then assessed for the outcome measure using Hip ROM pre-intervention. After this procedure, STR and MFR was administered to them for a session post which individuals were assessed again for the said outcome.

**Intervention Procedure**

Before starting with the intervention procedure were instructed not to undergo any other intervention for piriformis tightness.

**Testing For Tightness**

**Subject position**: Subject in high sitting, the leg being tested is supported by the therapist. Action: knee extension, hip adduction and internal rotation.
Test procedure

Treatment Protocol – 1 session with pre and post assessment.

Group A: Passive stretching – Adduction stretch

Subject’s position: supine

Therapist position: on the side of the leg where the stretch is to be given.

Technique:
Step 1: flexion of hip at 90 degree
Step 2: adduction of the hip
Step 3: external rotation of the hip

Duration: Stretch was sustained for 30 seconds and repeated 3 times in a session.

Stretching technique:

Group B: Myofascial Release

Subject’s position: Prone

Therapist’s position: Standing beside the subject at the waistline, working on the contralateral side.

Technique: Piriformis muscle was located by an imaginary line drawn between the midpoint of the lateral aspect of the sacrum and the greater trochanter. A contact was established in the gluteal area about 3 cm from the sacrum. With an elbow, a gradual pressure will be applied in an anterior direction. When the first layer of resistance was engaged, a constant pressure was maintained until that layer softened and the fibres of Piriformis were contacted (approximately 90 s). A line of tension was taken along the muscle, in the direction of the greater trochanter. Possibilities of muscle guarding were monitored and the depth of contact adjusted accordingly. The lower leg was lifted off the table to 90 of knee flexion while maintaining the pressure in the Piriformis. The leg was supported and guided into internal rotation with an active assistance from the client with direction. Duration: 3 minutes.

Result

A total of 30 subjects were recruited for the study. In the study we considered hip as a single entity and all the subjects having piriformis tightness. They were evaluated before and after the session. The demographic characteristics of the participants were presented in Table 1. There is a positive significant difference in mean difference of all hip range of motions where individuals received MFR as intervention, the pre and post assessment of these ranges show an increase of range of motion more significantly in rotation ranges (p<0.001) (Table 2). There is a positive difference in mean difference of all hip range of motions where individuals received STR as intervention, the pre and post assessment of these ranges show an increase of range of motion more significantly only in rotation ranges (p<0.001) (Table 3). In the present study, the intergroup analysis of mean STR and MFR values in the subjects which revealed significant improvement after the session and hence concluding that MFR was a better choice of treatment (p<0.001) (Table 4).
### Table 1: Representing distribution of age group in a total of 30 samples.

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>No. of Subjects</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-24</td>
<td>26</td>
<td>87</td>
</tr>
<tr>
<td>25-30</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>31-35</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>36-40</td>
<td>1</td>
<td>3</td>
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</table>

### Table 2: Representing mean of Hip ranges in Group B

<table>
<thead>
<tr>
<th>Group</th>
<th>No. of Subjects</th>
<th>Flexion</th>
<th>Extension</th>
<th>Internal Rotation</th>
<th>External Rotation</th>
<th>Abduction-adduction</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (Pre)</td>
<td>15</td>
<td>96.53</td>
<td>24.13</td>
<td>19.8</td>
<td>19.07</td>
<td>29.13</td>
<td>0.001</td>
</tr>
<tr>
<td>2 (Post)</td>
<td>15</td>
<td>103</td>
<td>28.53</td>
<td>29.2</td>
<td>25.93</td>
<td>33.4</td>
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</tbody>
</table>

### Table 3: Representing mean of hip ranges in Group A.

<table>
<thead>
<tr>
<th>Group</th>
<th>No. of Subjects</th>
<th>Flexion</th>
<th>Extension</th>
<th>Internal Rotation</th>
<th>External Rotation</th>
<th>Abduction-adduction</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (Pre)</td>
<td>15</td>
<td>100.4</td>
<td>22.47</td>
<td>20.4</td>
<td>18.33</td>
<td>25.73</td>
<td>0.001</td>
</tr>
<tr>
<td>2 (Post)</td>
<td>15</td>
<td>102.7</td>
<td>24.93</td>
<td>23.87</td>
<td>22.93</td>
<td>28.67</td>
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</table>

### Table 4: Representing mean difference of ranges (in degrees) of Group A and Group B

<table>
<thead>
<tr>
<th>Group</th>
<th>No. of Subjects</th>
<th>Flexion</th>
<th>Extension</th>
<th>Internal Rotation</th>
<th>External Rotation</th>
<th>Abduction-adduction</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MFR</td>
<td>15</td>
<td>6.467</td>
<td>4.400</td>
<td>4.267</td>
<td>9.400</td>
<td>6.867</td>
<td>0.001</td>
</tr>
<tr>
<td>STR</td>
<td>15</td>
<td>2.333</td>
<td>2.467</td>
<td>2.933</td>
<td>3.467</td>
<td>4.600</td>
<td></td>
</tr>
</tbody>
</table>

### Discussion

This study was conducted amongst female individuals who presented with no apparent complain in their daily life. On asking and assessing these females of age 18-40 it was found that 90% of the females had tenderness on the origin of the muscle bulk and only on palpation was the pain made aware to them. According to Malika Mondal et al the prevalence of tightness in piriformis muscle was found out to be 79.5% in the sedentary individuals.²

The purpose for this study was to check the prevalence amongst female population and was to assess the effective method of treatment. The individuals were assessed using the sit and stretch test where she was asked to sit of the plinth in high sitting the tested limb was supported by the therapist and the knee was taken passively into extension, hip into adduction and internal rotation.

Before giving treatment to the individuals were asked if they had any sort of discomfort in their hip or if they had any sort of pain and if they had pain so was the pain radiating. Also, the individuals were palpated for presence of tenderness and if they had it were recorded. Later they were sorted into two groups by the chit method. Myofascial release has widely practiced in used for treatment of more and more conditions nowadays. Going by definition it is basically the facilitation of mechanical, neural and psycho-physiological adaptive potential as interfaced via musculo-facial system.

Myofascial release for piriformis muscle was given to the female individuals and significant increase in range of motion was noted. The treatment was given for a session which lasted 3 minutes⁶ and significant decrease of pain was experienced by those individuals. Before the session was given pre assessment of hip ranges were taken and after the treatment post assessment was taken of the same. There was a significant increase in
all the ranges including flexion, extension, adduction, abduction, internal rotation and external rotation. To check for the authenticity of the treatment post one week one more assessment was taken post 1 week from the session and there was increase in all hip range of motion and decreases in tightness. The individuals even were relieved of any discomfort caused by the previous tightness. And also reported a difference in latent pain pre and post the course of treatment.

Similarly, the second group that is the STR (stretching group) of individuals received stretching for 30 seconds 3 times in a session. According to Brandy et al who reported that 30 seconds or 60 second stretching is more effective stretching than 15 second stretching\(^8\) and Ogura et al emphasized the importance of the duration of stretching, reporting that 60 second stretching decreases muscle strength while 30 second stretching did not affect muscle function.\(^9\)

Hence the treatment time was decided as 30 seconds of individual stretch, before the treatment was given all the hip range of motion were recorded prior and immediate post after the treatment ranges were taken after the completion of the session of treatment. To assess the effect of treatment post assessment was taken after 1 week of the session. The individuals of this group didn’t have a significant difference in the pain and their ranges had relapsed by a few degrees along with some of them even had tightness present. Precisely there was a decrease in flexion, extension abduction and adduction as well. The internal rotation and external rotation didn’t have any decrease in the range. During the period of treatment, the individuals were advised to continue with their daily activities and make no difference in their routine. This was done to prevent bias in the study. Post completion of the study, statistical analysis of the study was conducted by using paired t-test, the individual effect of both the treatment proved to be significant in increasing all the ranges of the hip statistically but clinically there was a better result in the MRF therapy group. The inter group study was analyzed using unpaired t-test which revealed that the study is strongly significant and both the treatment are equally effective in increasing the hip range of motion. But clinical perspective suggests that as myofascial release was more effective in improving the range by significant difference as well as was effective in decreasing the pain. The statistical result and the experimental result prove that myofascial release is a better choice of treatment and to avoid relapse of tightness, self-release techniques along with a basic exercise regimen and difference in improvement lifestyle can be precisely more effective form of treatment.

**Conclusion**

The effect of Myofascial release on piriformis flexibility is a more effective than passive stretching.

**Conflict of Interest:** Nil

**Source of Funding:** Self

**Ethical Clearance:** Taken from the Institutional Sub-Ethics Committee of Dr. D. Y. Patil College of Physiotherapy, Pune.

**References**

A Study on the Effects of Kinesio Taping on Planter Flexor Spasticity, Balance and Functionality in Chronic Stroke Condition

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Abstract

Background and Objectives: Stroke is a “neurological deficit of cerebrovascular cause that persists beyond 24 hours or is interrupted by death within 24 hours. Patients with stroke suffer from spasticity, which is most common sign secondary to attack of stroke. Spasticity mostly developed in antigravity group of muscles. In lower limb planter flexors are one of them. Spasticity of that muscle leads balance and walking disturbances. Various physiotherapy treatments exist. It is proposed that the application of tape aims to relieving pain, correcting joint positioning, increasing proprioception, and increasing or inhibiting muscle recruitment and provide proprioceptive feedback. Thus the objective of the study was to find the effects of kinesio taping on reducing planter flexors spasticity, balance and functionality in chronic stroke patients.

Method: 51 participants were included in study, treatment was given five days a week for 4 week, through purposive sampling and assigned into 3 groups i.e. Group A conventional therapy alone, Group B kinesio taping plus conventional therapy and Group C sham taping plus conventional therapy. Outcome measures were R.O.M, M.A.S, and MINI-BESTest. Pre and Post treatment measurement were taken for analysis.

Results: There was no significant difference between all three groups (P>0.05). Significant difference was observed during within group comparison in kinesio taping group and sham taping group in ROM and Mini-BESTest score for long term but not in MAS grade. Conclusion: There is no additional effect of kinesio taping with conventional therapy in reducing planter flexors spasticity.

Keywords: Chronic Stroke, Planter flexors spasticity, Balance, Kinesio taping.

Introduction

Stroke is one of the leading causes of death and disability in India. The estimated adjusted prevalence rate of stroke range, 84-262/100,000 in rural and 334-424/100,000 in urban areas(1). Stroke is a central nervous system disease that causes partial loss and functional disorder of the brain due to a disability of blood supply in blood vessels of the brain(2). Most stroke patients typically experience motor function disorder(3) and show an abnormality in standing and walking because of asymmetric alignment and posture, abnormal balance ability, lack of weight movement ability to the paralyze part and difficulty in specific functional movements(4). There is decrease in proprioceptive sense. Decreased proprioceptive sense causes a decrease in balance ability related to handling of postural control, joint movement position, and external sway (5). Stroke patients also show abnormal walking patterns as compensation due to muscular weakness and loss of balance ability(6). Spasticity is abnormal muscle tone which is common after stroke occur within the first few days or weeks (7). It is more formally defined as: ‘a motor disorder characterized by velocity dependent increase in tonic stretch reflexes with exaggerated tendon jerks, resulting from hyper excitability of the stretch reflex(8). In the lower limbs, The spasticity of the planter flexors disturbs walking, can impede toe clearance during the
swing phase of gait causing the patient to fall as a result of their toe ‘catching’ on the ground(9). In stroke patients characteristically the extensors of the leg are spastic and the flexors are weak(10). All these changes lead to gait disturbance as well as impaired functional mobility of patients. There are many different options in the treatment of spasticity secondary to stroke. Most of the current options like antispastic drugs, physical therapy agents, and surgical procedures have dis advantages like generalized weakness or lack of long-term efficacy(11). In physiotherapy, for reducing spasticity-muscle stretching and many approaches like The Bobath approach(12)The Brunnstrom approach(13) used.

Dr. Kenzo Kase first developed the Kinesiotaping method in mid 1970s(14) Kinesio taping is a relatively new technique being used during physical therapy treatments. It is a thin, water resistant, latex-free, anti-allergenic, highly elastic material which can be stretched up to 130-140% times its original length(15). Depending on the direction of application and tape tension, the clinical uses of Kinesio tape include: relieving pain, correcting joint positioning, increasing proprioception, and increasing or inhibiting muscle recruitment(16). KT application from muscle origin to insertion facilitate muscle tone and improve strength, while from insertion to origin the tape produces a pulling force opposite to the direction of muscle contraction and may reduce tension in the muscle, so correct application of the tape is necessary for having the best effects of tape(17).

The aim of this study is whether kinesio taping used as an adjunct therapy along with traditional stroke rehabilitation shows any major change in reducing spasticity, in improving balance and functionality.

Method

This is a pre and post experimental study where 51 chronic stroke patients (male & female) through purposive sampling were taken who had lower extremity Brunnstrom motor recovery stage 3 or 4, planter flexor spasticity grade (MAS) 1-3/4, post stroke duration >=6 months, right or left side affection, who were able to walk with or without assistive device were included and patients were excluded if they had planter flexor contracture, cognitive or sensory impairment, previous trauma or surgery in the past 6 months. Written informed consent was obtained. Eligible patients were quasi randomized in to three groups. Group A Conventional therapy, Group B Conventional therapy plus Kinesio taping, Group C Conventional therapy plus sham taping. A common intervention program was executed for all the three groups as conventional therapy(18).

Techniques of Application

Group A—Conventional therapy group where patients received traditional exercises which includes—stretching, strengthening, balance and mobility exercise of lower limb for 40-45 minutes with one minute rest between each exercise for 4 weeks

Group B & C—Kinesio tape & Sham taping plus conventional therapy group.

• In Group B, first kinesiotape was applied and then conventional therapy & In Group C, first sham taping and then conventional therapy was administered as described above in group A for 40-45 minutes.

• Kinesio taping application follow the principles described by Kenzo Kase as standardized for inhibition of muscle tone. Participant was in prone position on a plinth with feet placed outside the end edge of the plinth.

• Direction of tape application: From muscle insertion to origin to get inhibitory effect on reducing planter flexors spasticity. The Kinesio Y strip was made from a single strip of strain with a cut-down the middle to produce two equal size strips. The Base of Y- strip tape was placed from contour of heel to tendo Achilles by keeping the ankle in neutral position with no added tension and rubbed in place for several times to initiate glue adhesion (19). Two equal size of Y-strip tapes were applied to the soleus and gastrocnemius muscle respectively with subject’s knee extended and the ankle is in stretched position. Here both strips applied from tendo Achilles to medial and lateral femoral condyles. Then both strips were warmed by rubbing them several times on the application zone for creating glue adhesion.

• Sham tape was applied with the same material of Kinesio tape on spastic planter flexors of affected side by giving the prone position on the plinth with the only difference being, it not follow the principles of Kinesio taping described by Kenzo Kase. so it was simply applied in circular manner at mid of planter flexors’ muscle bulk. If tape gets pill-off by itself in between days, new one was applied.

• Clinical Assessment: Pre clinical assessment was
done on Day 1 of first week before the intervention started. Passive ankle dorsiflexion range of motion was measured with universal goniometer while the patient is in high sitting position, resting foot on floor or stool\textsuperscript{[20]}, Planter flexors spasticity of affected side was evaluated according to Modified Ashworth Scale(Score 0 to 4) while patient is in supine position\textsuperscript{[21]}. Dynamic balance was evaluated using Mini BESTEST which consist of 14 items grouped in 4 system of dynamic balance scored on ordinal scale 0 to 2 with total score adds to maximum of 28 points\textsuperscript{[22]}. Post measurements of above mentioned outcomes were measured on 7th day, 14th day, 21st day and 28th day after treatment using the same method as for pre test procedure in the recording data sheet. To check long term effect follow up assessment was taken on 7th day and 28th day after completion of 4 week intervention. Entire procedure was carried out by same researcher.

Results

Descriptive statistics including mean, standard deviation, frequency and percentage were analysed (table 1). ANOVA was used for comparing mean between all the three groups. Results were considered to be significant at \( p<0.05 \) and confidence interval was set at 95\%. All statistical analysis was done using SPSS version 20.

Mean comparison of outcome measures between all three groups shows no significance difference \((p>0.05)\) (table 2). Repeated measures ANOVA for within group comparison of weeks shows significant difference \((p<0.05)\) (table 3). Within group comparison of weeks shows how much significant difference was there for that post hoc pair wise comparison of all outcome measures was done (table 4, 5, 6).

Table 1

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Group A</th>
<th>Group B</th>
<th>Group C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Mean ± SD)</td>
<td>54.76 ± 7.155</td>
<td>53.47 ± 8.625</td>
<td>57.59 ± 10.572</td>
</tr>
<tr>
<td>Stroke Duration(in months) (Mean ± SD)</td>
<td>10.29 ± 2.418</td>
<td>9.47 ± 3.430</td>
<td>10.18 ± 3.107</td>
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<tr>
<td>Brunnstrom recovery stage for lower limb (Mean ± SD)</td>
<td>3.53 ± .514</td>
<td>3.65 ± .493</td>
<td>3.53 ± .514</td>
</tr>
<tr>
<td>Gender (%): Male</td>
<td>12</td>
<td>24</td>
<td>12</td>
</tr>
<tr>
<td>Gender (%): Female</td>
<td>88</td>
<td>76</td>
<td>88</td>
</tr>
<tr>
<td>Affected Side (%): Right</td>
<td>53</td>
<td>53</td>
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<tr>
<td>Affected Side (%): Left</td>
<td>47</td>
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Table 2: Tests of Between-Subjects Effects

<table>
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<th>Measure</th>
<th>Df</th>
<th>F</th>
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<tbody>
<tr>
<td>ROM</td>
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<td>1.226</td>
<td>.302</td>
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<tr>
<td>Group MAS</td>
<td>2</td>
<td>1.402</td>
<td>.256</td>
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<tr>
<td>Mini-BESTest</td>
<td>2</td>
<td>.029</td>
<td>.971</td>
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Table 3: Test for Within-Subjects Effects

<table>
<thead>
<tr>
<th>Measures</th>
<th>Df</th>
<th>F</th>
<th>Sig.</th>
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<tbody>
<tr>
<td>Week ROM</td>
<td>3.587</td>
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<tr>
<td>Week MAS</td>
<td>3.024</td>
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<td>Week Mini-BESTest</td>
<td>1.332</td>
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<tr>
<td>Week*Group MAS</td>
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<td>Week*Group Mini-BESTest</td>
<td>2.664</td>
<td>4.172</td>
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### Table 4: Post Hoc Pair Wise Comparisons of ROM in all Groups

<table>
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<tr>
<td></td>
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<td>Mean Diff.</td>
<td>Sig.</td>
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<tr>
<td>ROM</td>
<td>Baseline-1st Wk</td>
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<tr>
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<td>1st Wk-2nd Wk</td>
<td>-0.647</td>
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<td>0.157</td>
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<td>0.353</td>
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<td>Follow up</td>
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<tr>
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<td>5th Wk-6th Wk</td>
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<tr>
<td>Total</td>
<td>Baseline-6th Wk</td>
<td>-0.216</td>
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</tbody>
</table>

### Table 5: Post Hoc Pair Wise Comparisons of MAS in all Groups

<table>
<thead>
<tr>
<th>Measure</th>
<th>Level of Measurements</th>
<th>Control</th>
<th>KT</th>
<th>ST</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean Diff.</td>
<td>Sig.</td>
<td>Mean Diff.</td>
</tr>
<tr>
<td>MAS</td>
<td>Baseline-1st Wk</td>
<td>0.000</td>
<td>1.000</td>
<td>0.118</td>
</tr>
<tr>
<td></td>
<td>1st Wk-2nd Wk</td>
<td>0.118</td>
<td>0.133</td>
<td>0.235</td>
</tr>
<tr>
<td></td>
<td>2nd Wk-3rd Wk</td>
<td>0.000</td>
<td>1.000</td>
<td>0.118</td>
</tr>
<tr>
<td></td>
<td>3rd Wk-4th Wk</td>
<td>-0.118</td>
<td>0.151</td>
<td>-0.294</td>
</tr>
<tr>
<td>Follow up</td>
<td>4th Wk-5th Wk</td>
<td>0.000</td>
<td>1.000</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>5th Wk-6th Wk</td>
<td>0.000</td>
<td>ND</td>
<td>0.000</td>
</tr>
<tr>
<td>Total</td>
<td>Baseline-6th Wk</td>
<td>0.000</td>
<td>1.000</td>
<td>0.059</td>
</tr>
</tbody>
</table>

ND: no difference

### Table 6: Post Hoc Pair Wise Comparisons of Mini-BESTest in all Groups

<table>
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<th>Level of Measurements</th>
<th>Control</th>
<th>KT</th>
<th>ST</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean Diff.</td>
<td>Sig.</td>
<td>Mean Diff.</td>
</tr>
<tr>
<td>Mini-BESTest</td>
<td>Baseline-1st Wk</td>
<td>-0.176</td>
<td>0.247</td>
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<tr>
<td></td>
<td>1st Wk-2nd Wk</td>
<td>-0.765</td>
<td>0.015</td>
<td>-0.294</td>
</tr>
<tr>
<td></td>
<td>2nd Wk-3rd Wk</td>
<td>-1.294</td>
<td>0.000</td>
<td>-1.765</td>
</tr>
<tr>
<td></td>
<td>3rd Wk-4th Wk</td>
<td>-0.765</td>
<td>0.010</td>
<td>-0.765</td>
</tr>
<tr>
<td>Follow up</td>
<td>4th Wk-5th Wk</td>
<td>-0.059</td>
<td>0.555</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>5th Wk-6th Wk</td>
<td>0.000</td>
<td>1.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Total</td>
<td>Baseline-6th Wk</td>
<td>-3.059</td>
<td>0.000</td>
<td>-2.941</td>
</tr>
</tbody>
</table>

Evrim Karadag-Saygi (23) et al, focused on the effect of kinesio taping as an adjuvant therapy to botulinum toxin-A injection in lower extremity spasticity. The result showed no significant difference was found between groups other than passive range of motion, which was found to increased more in kinesio taping group. Frank Reiter (24) et al, focused on efficacy of a combined treatment for spastic foot using selective injections of botulinum toxin followed by ankle taping, and to compare it with current BTA treatment procedure. Ashworth scores decreased in both groups, but the benefit appeared of shorter duration in taping group. Passive ankle range of motion appeared higher in BTA group.

In above mentioned studies, they showed that range of motion was improved but it was because of only kinesio taping or because of botulinum toxin injection was not clear. The result of this study shows that there is statistically significant difference in range of
motion during follow up period in kinesio taping group indicating that, kinesio taping with conventional therapy has long term effect on range of motion as compare to group A & B, but there is no statistically significant difference on modified ashworth score during follow up period in all three group indicating that, there is no long term effect of kinesio taping on modified ashworth score in addition to conventional therapy.

Woo-II Kim (25) et al, evaluate the changes in function and balance after Kinesiotaping applications in stroke patients. They assessed immediate effect of kinesio taping. There were statistically significant differences between the results of the straight line walking and 10 m walking tests in the pre-post analysis for the experimental group. There were a statistically significant difference in the Berg Balance Scale and 10 m walking test between the two groups.

In our study Mini-BESTest was used for assessing dynamic balance instead of berg balance scale which was mentioned in study by Woo-II Kim(25).They checked immediate effect of kinesio taping and applied to facilitate muscle strength while we checked long term effect of kinesio taping and we used kinesio tape to inhibit muscle tone.

The result of this study shows statistically significant improvement on Mini-BESTest score during treatment period in all three groups but during follow up period there is no statistically significant change in all three groups.

Since all three group showed within group significant changes in range of motion, MAS grade and Mini-BESTest score. Kinesio taping group and sham taping group shows significant difference for long term in ROM and Mini-BESTest score but not in MAS grade. So kinesio taping does not have any clinically significant effect in reducing spasticity in chronic stroke condition.

**Limitations**

Participants with Brunnstrom recovery stage 3 and 4 were taken into the study. The results of the study can’t be made applicable to any respective population of Stroke with at specific Brunnstrom stage. Blindedness was not maintained. There was heterogeneous population.

**Conclusion**

The results of the present study showed application of kinesio taping adjunct to conventional therapy provided no superior effect in reducing planter flexors spasticity in chronic stroke condition.

**Ethical Issued Clearance:** By the Institutional Committee of Ethics of The Sarvajanik College of Physiotherapy.

**Source of Funding:** Self

**Conflict of Interest:** Nil

**References**

A Study on Prevalence of Carpal Tunnel Syndrome in Obese Individuals and Electrophysiological Assessment in Symptomatic and Asymptomatic Cases

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Physiotherapist MPT (Neurological Science), Associate Professor & Principal In-charge, Lecturer, Sarvajanik College of Physiotherapy, Rampura, Surat

Abstract

Carpal tunnel syndrome is most common injury affects upper limb and it has so many risk factors like diabetes, hypothyroidism, rheumatoid arthritis, pregnancy, obesity, family history, and trauma. There were few studies that the correlation between obesity and CTS. So this study will add a review for correlation between BMI and CTS.

Many studies say that NCS can be used as a diagnostic tool for CTS. But less literature found for its application in asymptomatic patient and in much literature it is define as mild to moderate reliable as a diagnostic tool in CTS. As there is controversies for NCS as a diagnostic tool in CTS this study will give the answer that NCS is appropriate diagnostic tool for asymptomatic CTS. Objective of this study is to find prevalence of carpal tunnel syndrome in obese individuals and electrophysiological assessment in symptomatic and asymptomatic cases.

Method: A total 105 adult obese individual with Body Mass Index more than 25 was selected and they were given a questionnaire. Whoever was showing symptoms of CTS based on questionnaire was stated as symptomatic and who were not having any kind of symptoms were stated as asymptomatic. Further two groups were formed 1. Symptomatic and 2. Asymptomatic and their electrophysiological assessment of median nerve was done by means of motor and sensory nerve latency-1, latency-2, and velocities. And mean of all nerve conduction parameters in both groups was compared.

Results: Mann Whitney U test was done and only 15% out of 105 individuals were having CTS. And there is no difference found in any parameter in both group.

Conclusions: there is no relation found between CTS and obesity and electrophysiological study of symptomatic and asymptomatic suggests that nerve conduction studies can give controversial results.

Keywords: Carpal tunnel syndrome, body mass index, obesity, nerve conduction study.

Introduction

Carpal tunnel syndrome (CTS) is one of the most common disorders of the upper extremities and the most prevalent compression neuropathy (1). About 3% of adults are affected, typically those between the ages of 40 and 60 years (2). Women are 3 times more likely than men to develop CTS. Other risk factors include diabetes, hypothyroidism, rheumatoid arthritis, pregnancy, obesity, family history, and trauma. A history of hand-related repetitive motions also increases the risk (3) (4) (5). Median nerve is most common to get affected as it passes from tunnel which is most likely to get compressed (4). Evidence does not support a definite link between keyboard or mouse use and CTS; however, occupations that require use of hand-operated vibratory tools or repeated and forceful movements of the hand/wrist (such as assembly work and food processing or packaging) are associated with CTS (6) (7).
Increased pressure in the carpal tunnel compresses the median nerve, leading to numbness, tingling, or pain in the palmer aspect of the thumb, index and middle fingers and the radial half of the ring. Symptoms vary widely, with pain or numbness localized to the hand or wrist in some cases and pain radiating into the forearm or shoulder in others. There are some tests which are used to assess the carpal tunnel syndrome. Thorough evaluation of the neck, shoulder, elbow, and wrist is crucial for all patients with signs and symptoms associated with CTS. Mainly used test are phalen’s and reverse phalen’s test and tinel test. As we have seen so many non-occupational reasons are there, one of them is obesity. As we know that obesity is a growing public health concern not only in the developed countries but also in the developing countries. Recent researches and reports indicate that India ranks among the top 10 obese nations in the world.

World Health Organization (WHO) defines obesity as a condition with excess body fat to the extent that health and well-being are adversely affected. Although not a direct measure of adiposity, the most widely used method to gauge obesity is the body mass index (BMI) which is weight/height$^2$ (in kg/m$^2$). BMI of 30 is most commonly used as threshold for obesity. Some authorities use the term overweight to describe individuals with BMI between 25 and 30. BMI between 25 and 30 should be viewed as medically significant and worthy of therapeutic intervention. Various studies in industrial workers have suggested that obesity increases the risk of carpal tunnel syndrome as in that the pressure on carpals bones get increases due to increase in fat deposition surrounding the wrist. Widely used questionnaire is Boston questionnaire which consists of two components that are symptom severity scale and functional status scale, and both consist of set of questions. This questionnaire is reliable for CTS. As electro diagnosis is the gold standard for diagnosis, it is widely used now a day. Nerve Conduction Studies (NCS) are frequently used to confirm the clinical diagnosis of CTS, and as outcome measures in clinical trials. They can demonstrate objective evidence of nerve dysfunction and may aid in the selection of patients for a specific treatment, especially if there is a reasonable correlation between pre-treatment results of NCS and clinical outcome. Despite of reliability and validity of nerve conduction studies, many researcher found controversial results like normal nerve conduction results in symptomatic patients and abnormal results in person with no symptoms which is known as a neurophysiologic paradox and studies has found that there is mild to modest relation between clinical diagnosis and nerve conduction studies. So this study was aimed to show whether nerve conduction study results show appropriate results for symptomatic and asymptomatic cases of carpal tunnel syndrome or it has discrepancy.

**Method**

The subjects who met the inclusion criteria i.e. BMI more than 25 were selected. The selected individuals were given carpal tunnel syndrome symptom severity and functional scale. If, the participants were found symptomatic, they were taken for NCS. Thus, two groups were formed: Symptomatic and Asymptomatic. Participants were excluded if they had ever had surgery(successful or unsuccessful) to treat CTS, had moderate or severe CTS as defined by motor deficits seen in the electrophysiological findings, or had any history of neurological disorders, heart disease, lung disease or diabetes as determined by self-report. After providing written informed consent, a brief physical examination was done. The tests were performed for each subject. The protocol commenced with a clinical exam, which was performed, that included Phalen’s test, Tinel’s sign, and a test for cervical radiculopathy. After that patient was asked to fill the Boston Carpal Tunnel Questionnaire. The questionnaires that were completed by the participants were used to gather descriptive demographic information. NCS were performed on Hands of each subject. The choice of electro physiologic studies was based on the recommendations set forth by the American Association of Electro diagnostic Medicine. The parameters used were distal motor latency and sensory conduction velocity and latency. For the sensory nerve velocity the ring type finger electrodes were used. Orthodromic, midpalmar- wrist mixed nerve latencies were determined by performing supramaximal stimulation in the palm with a handheld bipolar stimulator median nerve latencies were recorded, with the electrodes that are ring electrodes placed on index fingers over with the anode angled toward the web between the index and middle finger. Stimulation was given on approx 10-12 cm proximal to the cathode on the center of the wrist, directly over the median nerve proximal to the distal wrist crease. Stimulation given till it reaches to its supramaximal level. Orthodromic median motor nerve velocities measures by using disc electrodes. The active recording electrode (negative) was placed over the belly of the abductor pollicis brevis.
muscle and the reference electrode was placed at the base of the thumb. In all cases, median sensory nerve distal latencies should be measured.

**Results**

Total 100 subjects of BMI > 25 were included. Subjects were assessed using the Boston questionnaire for carpal tunnel syndrome. Among these obese individuals, 20 people who were having symptoms and 20 who were not having symptoms were selected. And their nerve conduction studies for median nerve were done. The result which were obtained were considered significant if the value of p<0.05. Descriptive statistics including mean, standard deviation were analyzed. Mann Whitney test was used as data was not normally distributed.

The mean values for the median nerve latency 1 at wrist and elbow, latency 2 for wrist and elbow, velocities of wrist and elbow for motor nerve was used and for sensory nerve latency1, latency2 and velocity was used .Data analysis was done using the SPSS software (version 20.0).

**Figure: 1 Carpal tunnel syndrome among obese individuals**

![Figure 1: Carpal tunnel syndrome among obese individuals](image)

**Table: 1 Motor nerve latency-1 for wrist and elbow Ranks**

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean Rank</th>
<th>Sum of Ranks</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latency 1 of Wrist</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sym</td>
<td>20</td>
<td>20.98</td>
<td>419.50</td>
<td></td>
</tr>
<tr>
<td>NS</td>
<td>20</td>
<td>20.03</td>
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<tr>
<td>Total</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Latency 1 of Elbow</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sym</td>
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<td>21.90</td>
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<td>NS</td>
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</table>

**Table: 2 Motor nerve latency-2 for wrist and elbow**

<table>
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<tr>
<th>Group</th>
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<th>Mean Rank</th>
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<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latency 2 of Wrist</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sym</td>
<td>20</td>
<td>21.53</td>
<td>430.50</td>
<td></td>
</tr>
<tr>
<td>AS</td>
<td>20</td>
<td>19.48</td>
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<tr>
<td>Total</td>
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<td></td>
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<tr>
<td>Latency 2 of Elbow</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sym</td>
<td>20</td>
<td>20.93</td>
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<td>AS</td>
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</table>

(Sym: Symptomatic, AS: Asymptomatic)

**Table: 3 MNCV for Wrist and Elbow**

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean Rank</th>
<th>Sum of Ranks</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>MNCV at Wrist</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sym</td>
<td>20</td>
<td>20.25</td>
<td>405.00</td>
<td></td>
</tr>
<tr>
<td>AS</td>
<td>20</td>
<td>20.75</td>
<td>415.00</td>
<td>.892</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MNCV at Elbow</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sym</td>
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<td>18.63</td>
<td>372.50</td>
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<td>AS</td>
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<td>22.38</td>
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<td>Total</td>
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</table>

(Sym: Symptomatic, AS: Asymptomatic)

**Table : 4 Sensory nerve latency-1**

<table>
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<tr>
<th>Group</th>
<th>N</th>
<th>Mean Rank</th>
<th>Sum of Ranks</th>
<th>Sig.</th>
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</thead>
<tbody>
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<td>SNCV Latency 1</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Sym</td>
<td>20</td>
<td>20.25</td>
<td>405.00</td>
<td></td>
</tr>
<tr>
<td>AS</td>
<td>20</td>
<td>20.75</td>
<td>415.00</td>
<td>.892</td>
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<tr>
<td>Total</td>
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</table>

(Sym: Symptomatic, AS: Asymptomatic)

**Table : 5 Sensory nerve latency-2**

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<tr>
<th>Group</th>
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<th>Mean Rank</th>
<th>Sum of Ranks</th>
<th>Sig.</th>
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</thead>
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<td>SNCV Latency 2</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sym</td>
<td>20</td>
<td>19.53</td>
<td>390.50</td>
<td></td>
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<tr>
<td>AS</td>
<td>20</td>
<td>21.48</td>
<td>429.50</td>
<td>.598</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
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<td></td>
</tr>
</tbody>
</table>

(Sym: Symptomatic, AS: Asymptomatic)

**Table: 6 Sensory nerve conduction velocity**

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean Rank</th>
<th>Sum of Ranks</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNC Velocity</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sym</td>
<td>20</td>
<td>21.60</td>
<td>432.00</td>
<td></td>
</tr>
<tr>
<td>AS</td>
<td>20</td>
<td>19.40</td>
<td>388.00</td>
<td>.552</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
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<td></td>
<td></td>
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</table>

(Sym: Symptomatic, AS: Asymptomatic)
Discussion

In this study result found that 85% people were asymptomatic and 15% people were positive or were symptomatic for CTS. The reason for not finding much correlation between obesity or BMI and CTS can be because of data selection. As data was taken mainly from gymnasium and garden and health centers, so individuals were used to do every day exercise and because of that their forearm and hand muscle were strong enough to get trauma. Other possible reasons for not getting a positive association between obesity and carpal tunnel syndrome include ethnicity. Most of the studies were carried out in Western population and there is scarcity of the same in Indian population. The role of ethnicity is yet to be proved.

In the second part of the study Mann Whitney test for all the motor parameter like latency-1, latency-2, and velocity showed no significant difference between groups. It may happen as sensory nerve parameters are more reliable to predictive for CTS than motor nerve parameters. As it was stated in study of Warner et al. (26) who studied on prolonged median sensory latency as a predictor of future carpal tunnel syndrome. They studied on 77 workers who were identified as asymptomatic cases with electro diagnostic findings of median mononeuropathy and after follow-up they found that many workers developed symptoms of CTS. In this study too sensory components were also the same for both the group as mean rank is same in symptomatic and asymptomatic. Reason for this result can be the mild to moderate relation between clinical tests and nerve conduction study. Same kind of study was done by Ebenbichler et al. studied on correlating nerve conduction study and clinical tests and they found the actual correlations between NCS and clinical outcome measures are weak to moderate. This discrepancy, or “clinical-neurophysiologic paradox,” raise a question whether clinical or neurophysiological parameters must be used as the “gold standard” for the diagnosis of CTS(17).

Similar study was done by Vogt and Scholz et al in that prospective study, 43 patients investigating the predictive value of NCS on clinical outcome after endoscopic carpal tunnel surgery, all electrophysiological parameters improved after surgery. It was, however, not possible to predict failure in clinical improvement or worsening of NCS in individual cases. Many patients still showing abnormal NCS results were satisfied with the result of the surgery, whereas others reporting of serious symptoms had improved or normal NCS results. From this result one can suggest to not to totally rely upon nerve conduction studies. One needs to correlate it with other outcome measures as well as need to correlate with clinical signs and symptoms (27). In one study Smith et al stated that NCS cannot be considered essential in assessing outcome in CTS, to discard them completely as an “unnecessary luxury” is also inappropriate. In assessing outcome, clinicians must balance between the strength of NCS in providing objective evidence of nerve dysfunction and their shortcomings. For scientific purposes, it is recommended that clinical questionnaires and NCS be combined in a standardized approach, to cover the spectrum of signs and symptoms in CTS (30).

Limitations

In this study recruited a small sample size of patient participants. We used only obese individuals for our study; it can be done on normal individual also. For future recommendation other neuropathy condition can be taken for nerve conduction studies. One can implement other measure too to cross check the results. Like ultrasonography and EMG can be used.

Conclusion

The results of this study failed to reveal a significant correlation between the BMI and carpal tunnel syndrome. Results of nerve conduction studies found no significant difference in NCS between symptomatic and asymptomatic group.

Ethical Issued Clearance: By the Institutional Committee of Ethics of The Sarvajanik College of Physiotherapy.

Source of Funding: Self

Conflict of Interest: Nil

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27. Jeblecki et al. Literature review of the usefulness of nerve conduction studies and electromyography for the evaluation of patients with carpal tunnel syndrome. Muscle and Nerve. 2002; 16.

A Pilot Study of Randomized Clinical Controlled Trail on Role of Physiotherapy on Physical and Psychological Dimensions of Sexual Health in Post Stroke Patients

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¹Research Scholar, JIJU, Rajasthan, India, Physiotherapist, Lalita Superspecialty Hospital, Guntur, India, ²Lecturer, Department of Physiotherapy, ³Faculty, Department of Physiotherapy, Uttar Pradesh University of Medical Sciences, India

Abstract

Background and Purpose: This study is aimed to assess the role of Physiotherapy on Physical and Psychological dimensions of sexual health in Post-stroke patients.

Method: This is a single blinded randomized clinical controlled trial with a 6 month follow-up. 40 patients were recruited and were randomly assigned into two groups, Group A (Treatment) (n=20) and Group B (control) (n=20). Group A was given Structured Physiotherapy Exercise Program emphasizing on Sexual rehabilitation and Counseling using PLISST model for 1-hour individualized protocols for a period of 2 weeks under the supervision of Physiotherapist at Hospital and was later advised to continue the exercises at home. Group B was given Physiotherapy and counselling for Functional independence without giving an emphasis on sexual health or rehabilitation for 1 hour daily for a period of 2 weeks and was advised to continue the same at home after discharge from Hospital.

Results: 40 patients were analyzed. The Paired t test was used to analyze the statistical differences between pretest and post in each group and unpaired t-test was used to find a statistical difference between Group A and B for pretest and posttest differences in CFQ-14 and DASS-21. The mean of differences between pretest and posttest CFQ-14 in Group A is 22.7 SD +/-9.65 and that of Group B is 3.5 SD +/- 5.37. The mean of differences in Pre-test and Post-test scores of DASS-21 in Group A are 4.5 +/- 4.67, 9.2 SD +/- 8.1, 11.9 SD/-7.79 and that of Group B are 1.8 SD +/-2.04, 4 SD +/-6.95, 2 SD +/- 2.24 respectively.

Conclusion: We conclude from this study that Physiotherapy in the form of a structured rehabilitation program and verbal communication improves the Physical and Psychological dimensions of sexual health in Post-stroke Patients

Keywords: Stroke, Sexual Health, CFQ-14, DASS-21, Sexual Rehabilitation, Physiotherapy, PLISSIT model.

Introduction

Sexual health is an integral part of life and persons with stroke often experience decreased sexual health which can affect their overall quality of life. Stroke is the 3rd leading cause of death and one of the major causes of long term disability¹. An important disability of stroke is the loss of or challenges with the sexual function which is not often addressed and can influence the quality of life among stroke survivors as well as their partners in a negative way². Stroke often leads to a limitation in physical disability and function that might affect sexual health in a negative way³. Sexuality ease one of the most complex aspects of human life with myriad physiological and psychological influence⁴.⁵. Discussion with the client by a medical professional on sexual dysfunction is challenging and quiet most of the times may be embarrassing to the patient⁶. It can also cause a lot of discomforts. The common sexual dysfunction amongst stroke survivors are decreased libido, impaired erectile and ejaculatory functions, decreased vaginal lubrications, impaired ego, self-esteem, and depression⁷. The sexual life in stroke patients affected by the motor, sensory, cognitive and physiological effects of stroke
and affect the desire and ability to engage in sexual activities in many ways. The shift of age on incidence of stroke has been decreased and is affecting more and more individuals who are still sexual active. This study in sexual health and stroke patients shall address the problems in sexual health and stroke and the role of physiotherapy in sexual rehabilitation.

**Aims of the Study**

To find the effectiveness of structured Physiotherapy and verbal communication on improving physical and Psychological dimensions of Sexual Health among the stroke survivors.

**Objectives of the Study**

1. To investigate the role of structured Physiotherapy and verbal communication in improving Physical dimensions of sexual health among the Stroke Survivors.

2. To investigate the role of structured Physiotherapy and verbal communication on Psychological dimensions of sexual health.

**Materials and Method**

The study was conducted at Lalita Superspeciality Hospitals, Guntur, Andhra Pradesh, India during 2016-17 for a period of 1 year. It is a single - blinded Pilot study, (the subjects of the study are blinded) of Randomized clinical control trial. A total of 150 hemiplegic patients from a 1st stroke admitted into the Hospital were screened for the study of whom 40 full filled the inclusion criteria and agreed to join the study as subjects. Patients had to satisfy the following inclusion criteria for this study. Confirmed diagnosis of stroke by CT / MRI scan. 2. Mentally cognitive and ability to communicate 3. Interested to participate in the study and cooperative 4. Both sexes were included. 5. A minimum of FIM(Functional Independence Measure) scores 4 or more. 6. Sexually active persons before the incidence of stroke.

Patients were excluded if they had any one of the following criteria 1. Severe cognitive issues 2. Dementia 3. Aphasia 4. Associated cardiac problems which demand cardiac pacemaker 5. Psychologically unfit 6. Uncooperative patients 7. Patients with less than 4 FIM (Functional Independence Measure) scores. 8. Sexually inactive persons before the stroke.

The patients were explained about the study and took prior consent before enrolling them into the study. The patients are randomly assigned into two groups after satisfying the inclusion criteria, Group A (Experimental) (n=20) and Group B (control) (n=20).

**Intervention**

Group A (Experimental) was given 1-hour individualized sexual rehabilitation programme daily which includes counseling in the form of verbal communication, training bed mobility, active and passive movement Physiotherapy, Sexual positioning and transferring activities in and out of Bed. Training was given under the direct supervision of the trained Physiotherapist for motor relearning and the techniques of oral sex. Bolster positioning between the knees to reduce adductor spasticity, stretching exercises. The Physiotherapist demonstrated various altered sexual positions depending upon the motor capabilities of the Patient with pictorial illustrations. The Patients were given Physiotherapy under the supervision of Physiotherapist for a period of 2 weeks during the hospital stay and after discharge, the patient was provided with pictorial and written instructions about the sexual positioning, oral sex, and various exercises and was advised to continue the same at home.

The patients were given Verbal communication and counseling on Sexual Health by using PLISSIT model.

The controlled group was given active and passive routine Physiotherapy with no emphasis on sexual health. The patients were given counseling to motivate to participate in the physiotherapy sessions and to improve the self-esteem of the patients but never addressed the sexual problems.

Both Group A and Group B were screened after a period of 6 months for follow up.

**Outcome Measures:** The sexual functioning of the patients was assessed Pre-test and Post-test by CSFQ –F-C for female patients and CSFQ-M-C for male patients. The psychological dimensions like depression, anxiety and stress status of the patient were assessed pretest and posttest by DASS-21. The CSFQ-14 has strong construct validity and internal reliability. The DASS-21 is a set of 3 self-report scales designed to measure the emotional states of depression, anxiety and stress. DASS-21 is reliable and suitable to assess
depression, stress, and anxiety with good validity and reliability.\textsuperscript{13}

Statistical Analysis

In this study to analyze the role of Physiotherapy on Physical and Psychological dimensions of Sexual health in stroke patients, The pre - training outcome variables of age, time since onset of stroke, Gender, Diagnosis (Ischemic or Hemorrhagic), side of hemiplegia were compared using Mann Whitney U test.(Table-1). All pretest and posttest scores of CSFQ-14 and DASS-21 were expressed as Mean +/- Standard deviation (SD) and was statistically analyzed using paired t test within the groups and unpaired t-test to determine statistical difference among the groups at 5 % level of significance. We used one-way Anova and tukey significant difference test for Post hoc comparison. To explore the practical significance of group differences, the effect size was calculated. The established criteria of the ES, which reflects the effect of treatment within a population of interest, are small (<0.41), medium (0.41 to 0.7), or large (> 0.70).\textsuperscript{14}

Table 1: Baseline Demographic Characteristics of Group A and Group B.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Characteristic</th>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Age (years)*</td>
<td>40.2</td>
<td>42.1</td>
</tr>
<tr>
<td>2</td>
<td>Gender (male/female)</td>
<td>10/10</td>
<td>12/8</td>
</tr>
<tr>
<td>3</td>
<td>Etiology (ischemic/hemorrhagic)</td>
<td>14/6</td>
<td>16/4</td>
</tr>
<tr>
<td>4</td>
<td>Side of hemiplegia (right/left)</td>
<td>9/11</td>
<td>11/9</td>
</tr>
<tr>
<td>5</td>
<td>Time post stroke before recruitment (in Months)</td>
<td>5.85</td>
<td>4.5</td>
</tr>
</tbody>
</table>

Table 2: Pretest and Posttest Differences of CSFQ-14 and DASS-21 in Group A and Group B.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group A</th>
<th>Difference</th>
<th>Group B</th>
<th>Difference</th>
<th>t value</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre test</td>
<td>Post test</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>SD +/-</td>
<td>Mean</td>
<td>SD +/-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CSFQ-14</td>
<td>35.75</td>
<td>5.54</td>
<td>58.45</td>
<td>8.06</td>
<td>22.7</td>
<td>65.54</td>
</tr>
<tr>
<td>DASS-21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>9.65</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DEPRESSION</td>
<td>14.3</td>
<td>9.31</td>
<td>9.8</td>
<td>5.34</td>
<td>4.5</td>
</tr>
<tr>
<td>ANXIETY</td>
<td>18.6</td>
<td>10.01</td>
<td>9.4</td>
<td>4.05</td>
<td>9.2</td>
<td>8.1</td>
</tr>
<tr>
<td>STRESS</td>
<td>21.9</td>
<td>8.95</td>
<td>10</td>
<td>6.98</td>
<td>11.9</td>
<td>7.79</td>
</tr>
</tbody>
</table>

Table 3: Post hoc comparison between Group A and Group B.

<table>
<thead>
<tr>
<th>Variable</th>
<th>F statistic</th>
<th>p value</th>
<th>tukey HSD Q statistic</th>
<th>THSD P value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSFQ-14</td>
<td>80.92</td>
<td>5.931</td>
<td>12.72</td>
<td>0.001</td>
<td>P&lt;0.01</td>
</tr>
<tr>
<td>DASS-21</td>
<td>DEPRESSION</td>
<td>5.60</td>
<td>0.0231</td>
<td>3.3483</td>
<td>0.023</td>
</tr>
<tr>
<td>ANXIETY</td>
<td>6.06</td>
<td>0.0184</td>
<td>3.4829</td>
<td>0.0184</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>STRESS</td>
<td>29.7</td>
<td>3.18</td>
<td>7.7139</td>
<td>0.001</td>
<td>P&lt;0.01</td>
</tr>
</tbody>
</table>

Table 4: Effect size significance between Group A and Group B

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cohen’s d</th>
<th>Gates delta</th>
<th>Hedges g</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSFQ-14</td>
<td>2.45</td>
<td>1.98</td>
<td>2.45</td>
<td>Large</td>
</tr>
<tr>
<td>DASS-21</td>
<td>DEPRESSION</td>
<td>0.74</td>
<td>0.57</td>
<td>0.74</td>
</tr>
<tr>
<td>ANXIETY</td>
<td>0.68</td>
<td>0.64</td>
<td>0.68</td>
<td>Medium</td>
</tr>
<tr>
<td>STRESS</td>
<td>1.72</td>
<td>1.27</td>
<td>1.72</td>
<td>Large</td>
</tr>
</tbody>
</table>
### Table-5: Cutoff scores for DASS-21

<table>
<thead>
<tr>
<th>Meaning</th>
<th>Depression</th>
<th>Anxiety</th>
<th>Stress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>0-9</td>
<td>0-7</td>
<td>0-14</td>
</tr>
<tr>
<td>Mild</td>
<td>10-13</td>
<td>8-9</td>
<td>15-18</td>
</tr>
<tr>
<td>Moderate</td>
<td>14-20</td>
<td>10-14</td>
<td>19-25</td>
</tr>
<tr>
<td>Severe</td>
<td>21-27</td>
<td>15-19</td>
<td>26-33</td>
</tr>
<tr>
<td>Extremely severe</td>
<td>28+</td>
<td>20+</td>
<td>34+</td>
</tr>
</tbody>
</table>

### Results

There was no clinically relevant difference for age, gender, Diagnosis, Side of Hemiplegia, Time since the onset of stroke which was analyzed by Mann Whitney U test. (Table 1). The pretest CSFQ-14 mean of Group A is 35.75 SD +/- 5.54 and posttest mean is 58.45 SD +/- 8.06. The pretest mean of CSFQ-14 of Group B is 34.4 SD +/- 5.06 and posttest mean is 37 +/- 5.29. The mean of differences between pretest and posttest CSFQ-14 in Group A is 22.7 SD +/-9.65 and that of group B is 3.5 SD +/- 5.37. with ‘t’ value 8.9, the test is significant at p<0.05, which indicates the results are significant. The DASS-21 analyzes the level of depression, anxiety, and stress. The pretest mean of depression, anxiety and stress in Group A are 14.3 SD +/-9.33, 18.6 SD +/- 10.01, 21.9 SD +/- 8.95, and that of Group B are 16.7 SD +/- 8.9, 18.4 SD +/- 11.45, 24.9 SD +/- 6.97 respectively. The posttest mean values of depression, anxiety and stress levels in Group A are 9.8 SD +/- 5.34, 9.4 SD +/- 4.05, 10 SD +/- 6.98 and that of Group B are 14.9 SD +/-8.09, 14 SD +/- 7.86, 22.9 SD +/-5.67. The mean of differences in Pretest and posttest scores of DASS-21 in Group A for depression, anxiety and stress are 4.5 +/- 4.67, 9.2 SD +/- 8.1, 11.9 SD +/-7.79 and that of Group B are 1.8 SD +/-2.04, 4 SD +/-6.95, 2 SD +/- 2.24 respectively, with ‘t’ value 4.30,5.05 and 6.823, the test is significant at p<0.05.(table 2) The post hoc comparison was done by one way Anova and tukey significant difference test which revealed the test is significant at p<0.05 (table 3). Effect sizes were calculated for CSFQ-14 and DASS-21 (Anxiety, Depression and stress levels separately) to see the potential of having a significant effect for the insignificant ones, for both CSFQ-21 and DASS-21 effect sizes revealed a large value in the Group A Vs. Group B. (table 4) By examining the above statistical analyses we reject the null hypothesis as Gr A showed a significant increase in CSFQ-14 scores and decrease in DASS-21 scores than Group B.

### Discussion

In this study the Role of Physiotherapy on physical and psychological dimensions of sexual health in stroke patients, physiotherapy was found to be effective in improving physical dimensions of sexual health like pleasure, desire, frequency, interest, arousal, excitement, orgasm etc and improved the symptoms of depression, anxiety and stress due to sexual dysfunction in post-stroke patients. Of many causes of sexual dysfunction, motor dysfunction and lack of communication are two major causes. Physiotherapy improves the motor functions by structured exercises and techniques and improves the functional independence level in post - stroke survivors.

The CSFQ has a total score range of 14-70, where the cutoff point is 41.0, A patient having a total score less than 41.0 is considered to be having sexual dysfunction. The Group A who were given Physiotherapy by emphasizing on the sexual rehabilitation and counseling using PLISSIT model showed a significant increase in the CSFQ scores, with a mean of 58.45 SD +/- 8.06 from 35.75 SD +/- 5.54. This indicates a significant increase in the sexual health of these patients. Whereas Group B, where the sexual rehabilitation and counseling was not given showed sexual dysfunction, with a mean of 37 +/-5.29 from 34.4 SD +/- 5.06.

The DASS-21 assess the levels of Depression, Anxiety and, Stress. The cutoff values of DASS-21 are shown in table 5. In this study, it is observed that the patients in Group A who were given Sexual Rehabilitation and Counseling, the DASS-21 scores, the Depression scores changed from Moderate to Normal, Anxiety scores changed from Severe to mild, and Stress scores changed from moderate to normal. Where as in Group B, there was no significant change in Depression and stress levels, but the anxiety levels changed from Severe to moderate.

In a study by Songhet.al, effects of a sexual rehabilitation intervention program on stroke patients and their spouses, they found the evidence of usefulness of sexual education, counseling, and rehabilitation on the sexual health of post - stroke patients. In the study, sexual function in post –stroke patients: considerations for rehabilitation in 2013 by Rosenbaum et.al, have concluded that sexual function is an important component to quality of life and activities of daily living, physicians and rehabilitation specialists should receive training in addressing sexuality in the treatment of post-stroke patients.
In the study, Sexual dysfunction in women post stroke: The hidden Morbidity by Santosh K Chaturvedi and Poornima Bhola, mentioned that Neurologists and Neuro rehabilitation and Physical medicine therapists mainly focus on motor and sensory functions and their recovery after stroke, but the extent to which sexual activity is addressed in the rehabilitation process is limited both in clinical practice and research.17

Thus, there is a need for the intervention of Physiotherapy in sexual rehabilitation of stroke patients in a more conservative country like India where the health care givers and patients talk less about sexual health issues.

**Conclusion**

We conclude from this study that Physiotherapy in the form of a structured rehabilitation program and verbal communication improves the Physical and Psychological dimensions of sexual health in Post-stroke Patients.

**Conflict of Interest:** The authors declare no conflicts of Interest.

**Funding:** The study was not funded by any organization.

**Declaration:** we, all the authors herewith certifying that the article is approved for the final version of the manuscript being submitted. We warrant that the article is the author’s original work, hasn’t received prior publication and isn’t under consideration for publication elsewhere.

**Ethical clearance:** Ethical clearance was obtained from the institutional ethical board, Lalitha superspeciality Hospitals, Guntur

**References**

Child Behavioral Problem and its Relationship with Parenting Stress of Mothers of Cerebral Palsy Children and Autistic Children

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Abstract

Introduction: Cerebral palsy (CP) and Autistic spectrum disorder (ASD) are the most complex childhood developmental disabilities. Parenting a child with ASD and CP is a very much stressful experience and can disturb the whole family life resulting in economic, social, physical and psychological problems. Recent studies suggest that childhood problematic behaviour of ASD and CP children may be a cause for mother’s stress and vice versa.

Aims & objectives: 1. To compare the parenting stress psychological distress (in terms of anxiety and depression) between mothers of ASD children and CP children 2. To correlate child behaviour to parental stress of mothers of ASD children and CP children.

Method: Design: Observational case control study. Participants: mothers of ASD & CP children. Number of participants: Among 60 participants, 28 CP and 32 ASD mothers. Tools / Instruments used: Perceived Stress Scale, Hamilton Anxiety Rating Scale, Hamilton Depression Scale, Care giver Burden Scale and Child Behaviour Check list.

Results: The parenting stress and anxiety of mothers of children with ASD have more than the mother of children with CP (p<0.05). Child behaviour problems is positively associated with parental stress of mothers (r=0.353, p=0.05).

Conclusion: Parenting stress of mother of ASD children is higher than mother of CP children and stress of mother is a cause for problematic child behaviour of ASD & CP children.

Keywords: Parenting stress, behavioural problem, autistic child, cerebral palsy child.

Introduction

Developmental disability is a diverse group of chronic condition that are resulting from physical or intellectual impairment. Some of the common developmental disabilities includes intellectual disabilities, Down syndrome, Cerebral Palsy and Autistic spectrum disorder (ASD)¹. Cerebral palsy (CP) is the most common motor disability in childhood characterized by multiple impairments and functional limitation. It mainly affects the development of movement and posture ². As CP is associated with multiple impairments it leads to multiple activity limitations and participation restriction³. In the other hand autism is one of the most complex paediatric developmental disability challenges with social skills, stereotypical behaviors, verbal and nonverbal communication⁴. To bring up a child with ASD is a very stressful experience⁵. Parenting a child with autism not only disturb the whole family life but also affects the economic, social, physical and psychological condition⁶,⁷,⁸. Similarly stress due to parenting a child
with cerebral palsy can be comparable with the parents of children with cancer.

Parents of CP children suffer from anxiety, depression, emotional and cognitive problems which may be a cause for feelings of parental incompetence. Literatures have suggested that mothers of children with developmental and psychiatric difficulties are at risk of greater distress than the mothers of normally developing children. Also mothers of children with ASD have higher level of distress and depression than mothers of children with other developmental disabilities as Down syndrome, fragile X syndrome and CP. There are different opinions by authors about the contribution of childhood behavioral problems to increased maternal distress.

Analysing these studies and clinical experience the study was designed to investigate and compare the parenting stress and psychological distress between the parents of children with ASD and Cerebral palsy and to find out the relationship between parental stress with children behavior. This study hypothesized that parenting stress and psychological distress will be higher in mother of children with ASD than the mothers of cerebral palsy and a positive correlation exists between parental stress and child’s behavior.

**Materials and Method**

**Aim:**

1. To compare the parenting stress between mothers of ASD children and CP children.
2. To compare the psychological distress (in terms of anxiety and depression) between mother of ASD children and CP children.
3. To correlate child behavior to parenting stress of mother of ASD children and CP children.

Participants were recruited for a cross sectional study by consecutive sampling from the department of Occupational Therapy attending paediatric and sensory integration therapy unit of outpatient & in-patient department of SVNIRTAR. Total number of 44 patients out of which 21 are mothers of CP and 23 are mothers of ASD children were recruited.

Tools / Instruments: Perceived Stress Scale (PRSS) for measuring perceived stress in mothers, Hamilton Anxiety Rating Scale (HAM-A) for measuring anxiety and Hamilton Depression Scale (HAM-D) for measuring depression, Care giver Burden Scale and Child Behaviour Check List (CBCL) for measuring a broad range of behavioural and emotional problem of children.

Permission were obtained from the ethical committee of SVNIRTAR. Perceived Stress Scale, Hamilton Anxiety Scale, Hamilton depression Scale, Care giver burden Scale and Child Behaviour checklist were administered and recorded after informed consent and sociodemographic data.

**Results**

**Table-1: (Sociodemographic Data)**

<table>
<thead>
<tr>
<th>No of patients (n)</th>
<th>ASD(N=23)</th>
<th>CP(N=21)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in Years (Mean± SD)</td>
<td>4.6±1.72</td>
<td>3.7±2.1</td>
</tr>
<tr>
<td>Gender</td>
<td>Male 22 16</td>
<td>Female 1 5</td>
</tr>
<tr>
<td>Family structure</td>
<td>Joint 6 8</td>
<td>Nuclear 17 13</td>
</tr>
<tr>
<td>Family occupation</td>
<td>Business 5 3</td>
<td>Cultivation 0 8</td>
</tr>
<tr>
<td>Level of education of parents</td>
<td>Under Matriculate 0 3</td>
<td>Matriculate 2 4</td>
</tr>
</tbody>
</table>

The groups were similar with respect to size (mothers of ASD children =23 & mothers of CP children=21). Mean age of the children with ASD & CP is 4.6±1.72SD & 3.7±2.1 SD years respectively.

**Table-2 (Comparison of stress and psychosomatic properties of mother of ASD and CP Children)**

<table>
<thead>
<tr>
<th>Outcome measures</th>
<th>ASD (Mean±SD)</th>
<th>CP (Mean±SD)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRSS</td>
<td>30.21±7.34</td>
<td>24.76±7.41</td>
<td>0.014*</td>
</tr>
<tr>
<td>HAM-A</td>
<td>21.56±15.56</td>
<td>22.66±2.12</td>
<td>0.005*</td>
</tr>
<tr>
<td>HAM-D</td>
<td>10.17±4.0</td>
<td>11.61±5.38</td>
<td>0.940</td>
</tr>
</tbody>
</table>

*p value is significant

Mann–Whitney U test compared the stress, anxiety and depression between mothers of children with ASD and CP children (Table-2). There is significant level of increase in stress between the mothers of children with ASD is more as comparison to CP children (p<0.01).
Similarly, the test revealed the significant level of anxiety in mothers of children with ASD vs CP children (p<0.05). But no significant level of depression persists between the groups.

**Table-3 (Co-relation between child behavior to stress and psychological distress).**

<table>
<thead>
<tr>
<th>Outcome measures</th>
<th>CBCL</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRSS</td>
<td>r=.353</td>
<td>0.01*</td>
</tr>
<tr>
<td>HAM-A</td>
<td>r=-.131</td>
<td>0.398</td>
</tr>
<tr>
<td>HAM-D</td>
<td>r=-.148</td>
<td>0.336</td>
</tr>
</tbody>
</table>

*p value is significant

Statistically significant positive correlation between child behavior (CBCL) and maternal parenting stress (PRSS) in Pearson’s correlation test (p< 0.05, r =.353) which indicates that child problem behavior was positively associated with parenting stress. There is no significant correlation found between child behavior (CBCL) to maternal anxiety (HAM-A) and also to maternal depression (HAM-D).

**Discussion**

In our study mothers of ASD children had higher levels of stress and anxiety than mothers of CP children which corroborate with child problem behavior was associated with elevation in parenting stress22. The cause for the relationship between parenting stress, anxiety and child problem behavior may be supported by Hastings’s model16. This transactional model suggests child problem behavior leads to increase parenting stress which in turn disrupts parenting behavior and these behaviors give feedback to increase child problem behavior17. So Parenting stress stems from a complex combination of the parent, the child and the interaction between them23.

The parenting stress in mothers of children with ASD is more than mother of children with CP. One of the reasons may be, autism has no biological marker hence very difficult for the parents to accept the condition. Some parents experience confusion and helplessness as child with autism are mostly physically normal and healthy at birth and initial years but then child experiences a regression with social nonresponsive and aloofness. After diagnosis of ASD, parents become distressed and hopeless when they need educational, social and professional support and find very little help specific to autism and patients have no space in the broader society on their own, which becomes very much challenging for the parents16. As many children with autism look normal and people often mistake that the behavioral problems and social inappropriateness is blamed on parent’s carelessness or unable to handle the child, which make parents extremely frustrating and stressed than other disabilities 24. There is no significant depression in mothers of both the groups. This may suggest that the patients recruited for the study have positive perception or hope for the improvement, as they are in continuation of institution based therapy25.

In this study CBCL & PRSS is significantly positively correlated which indicates that child behavioural problem is directly proportional to parents’ stress and there is a bidirectional relationship exists between behavior problems and parenting stress16. The elevations in behavior problems of children lead to increase in parenting stress over time, and high parenting stress leads to increase in behavior problems in children26.

**Limitations & Future Implications**

Longitudinal research and specific intervention may be synthesized on child specific behaviours influencing on parental distress.

**Conclusion**

Parenting stress in mothers of children with ASD reported higher levels of stress and anxiety than mothers of children with CP and child problem behavior was associated with elevation in parenting stress.

**Conflict of Interest:** NIL

**Source of Funding:** self

**References**

Management of Low Back Pain Through Ball and Balloon Activity in Peri-Menopausal Women: A Community Based Pilot Study

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\textsuperscript{1}Assistant Professor (OT), \textsuperscript{2}Associate Professor (OT), Department of Rehabilitation Sciences, Faculty of Nursing and Allied Health Sciences, Jamia Hamdard, New Delhi, \textsuperscript{3}Assistant Professor, D/o TST(SUMER), Jamia Hamdard

Abstract

Background: Musculoskeletal complaints like Low Back Pain (LBP) are usually associated with faulty posture, suboptimal breathing pattern and trunk stability.

Objective: To study the effect of Ball and Balloon activity in the management of LBP in peri-menopausal women.

Method

Material: Ball (6 inches), balloon, mattress

Design: Prospective, experimental group control group, community based pilot study

Setting: Community

Participants: 20 subjects were taken for study and allotted into experimental and control group (N=10 in each group). Age: Between 40-50 yrs.

Intervention: Balloon blowing activity was performed by experimental group in supine position with the feet on a wall, hips and knee at 90-90 position and a ball between the knees. Activity was done four times and repeated for four times twice a day for 3 weeks. Control group was given ergonomic advice and precautions related to LBP.

Outcome measures: Modified Oswestry Low Back Pain Disability Questionnaire (MOLBPDQ), Visual Analogue Scale (VAS) and Spirometry.

Result: Statistical analysis showed significant improvement ($p< 0.05$) in MOLBPDQ (pretest mean 40.1, SD±1.13 and posttest mean 19.7, SD ±0.64) and VAS (pretest mean 8.6, SD±0.50 and posttest mean 4.9, SD±0.89) in experimental group. Spirometry scores were also improved.

Conclusion: Integrated co activation of deep abdominal muscles with pelvic floor, diaphragm and lumbo-pelvic stabilization through Ball and Balloon Activity was found to be effective in managing LBA.

Keywords: Ball and Balloon activity, Ergonomic, LBP, Trunk stability, Spirometry

Introduction

Many muscles like diaphragm, Transvers Abdominis (Tr A) and muscles of the pelvic floor, are responsible for both postural control and respiration\textsuperscript{1,2}. It is difficult to maintain an optimal balance of these muscles for their roles in respiration and postural stability\textsuperscript{3,4}. The pain that occurs between 12\textsuperscript{th} rib and gluteal fold is defined as Low Back Pain (LBP)\textsuperscript{5}. Musculoskeletal conditions like Low Back Pain (LBP) is associated with suboptimal respiration and suboptimal posture. Faulty posture like increased lordosis and over lengthened / weak abdominals are usually associated with LBP\textsuperscript{6,7}. Chronic LBA patients have reported to have defects in posture and motor control\textsuperscript{8}.
Richardson et al (2004) described coordinated action of Tr A and the diaphragm in respiration during tasks in which stability is maintained by tonic activity of these muscles. He concluded that during inspiration, the diaphragm contracts concentrically, whereas the Tr A contracts eccentrically. The muscles function is reverse during exhalation with the diaphragm contracting eccentrically while the Tr A contracts concentrically. Hodges et al (2001) noted that during respiratory disease the coordinating function between the Tr A and diaphragm was reduced. O’ Sullivan et al (2002) studied subjects with LBP (attributed to SIJ pain) and compared them to control subjects without pain. Comparing the respiratory rate, diaphragm and pelvic floor movement using the Real time ultrasound during Straight Leg Raising Test, he noted that subjects with pain had increased respiratory rate, descent of pelvic floor and a decrease in the diaphragm excursion as compared to normal subjects. O’Sullivan concluded that an intervention program focused on integrated control of deep abdominal muscles with normal pelvic floor and diaphragm function may be effective in managing LBP.

The Ball and Balloon Activity is a conservative activity in which person can obtain optimal posture and respiration. It helps in restoring Zone of Apposition (ZOA) and spine to a proper position so that diaphragm performs at its optimal ability.

The ZOA is the area of the diaphragm covering the cylindrical or dome shaped portion which relates to the posture directly apposed to the inner aspect of the lower rib cage. ZOA is controlled by abdominal muscles and directs diaphragmatic tension. When ZOA is suboptimal it leads to 1. inefficient respiration and 2. weakened action of Tr A. The Ball and Balloon activity or 90 – 90 Bridge with Ball and Balloon Technique is developed by the Postural Restoration Institute, Nebraska. It is designed to refurbish the ZOA and spine to a suitable position in order to permit diaphragm’s finest ability to perform it’s both roles (postural and stability) . This activity is performed in supine lying with feet on the wall and hip and knee in the 90-90 position and a ball (4”-6”) between the knees. This passive 90-90 position places the spine in relative flexion, posterior pelvic tilt and rib internal rotation. This position augments ZOA. Having a ball between the knees encourages adductor muscle activation and co contraction of pelvic floor muscles.

In this paper the researcher has attempted to utilize this technique on peri-menopausal subjects. This phase is characterized by irregular periods, increased weight gain and also constant low back pain. The most noteworthy thing regarding this technique is that it can be accomplished by subject in home setting.

**Objective of the Study**

- To study the effect of Ball and Balloon activity in the management of LBP in perimenopausal women

**Inclusion Criteria**

- Normal healthy women with Low back pain since last three months
- Subjects who were willing to take part in the study.

**Exclusion Criteria**

- Any pathology or surgery for LBA
- Those who were taking any other treatment for LBA

**Material and Method**

Ball (5 inches), Balloon, Mattress

**Design:** Community based, pretest posttest experimental, prospective study

Outcome Measures used: Visual Analog Scale (VAS), Modified Oswestry Low Back Pain Disability Questionnaire (MOLBPDQ), Spirometry (Incentive)

Twenty female subjects of LBP, were taken for the study (N- 20) from the health center of a community center of south Delhi. They were randomly allotted in experimental and control groups (N-10 in each group). Age group-40 to 50 years. They were explained the intent and content of the study and informed written consent was taken.

Experimental group was given Ball and Balloon activity.

Position of the subject: Subject was made to lie on her back with feet flat on a wall. Hip and knees were in 90-90 angle. 5 inches ball was placed between the knees. Left arm was placed above the head and balloon was held in the Right hand. Subject was asked inhale through nose and as she exhale she was asked to perform posterior pelvic tilt so that low back touches the mattress. Feet should not press the wall. Subject should feel the thighs and inner thighs contract. Subject was asked to maintain this position throughout activity.
Ball and Balloon Activity: Subject was asked to inhale through nose slowly and exhale through her mouth into the balloon. At the end of exhalation, tongue was pressed on the roof of the mouth to prevent the backflow of air in the balloon. After the pause of three seconds, subject was asked to again inhale through nose and exhale through mouth, stabilizing the neck of the balloon with the right hand. After the end of third breadth, the balloon was taken out of the mouth and the neck of the balloon was pinched with the right hand and air was out in the air. This activity was repeated for four times.

Subjects practiced this activity in the Health center of the Community center many times. Once they learn the activity correctly they were advised to do at their homes for three weeks twice a day. They were asked to visit researcher once a week for follow up.

The controlled group was given Ergonomic advice and precautions regarding LBP.

Pretest scores of VAS, MOLBPDQ and Spirometer (inspiratory volume) were taken on first day. Posttest scores were taken at the end of third week.

**Statistical Analysis**

Statistical analysis was done using SPSS software. Two tailed paired t-test was done to test significance for VAS and MOLBPDQ outcome measures.

<table>
<thead>
<tr>
<th>Graph I showing pre-test and post-test mean of experimental and control group of VAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>VASExPrT</td>
</tr>
<tr>
<td>VASPoT</td>
</tr>
<tr>
<td>VASCPrT</td>
</tr>
<tr>
<td>VASPoT</td>
</tr>
</tbody>
</table>

**Interpretation**

Graph 1: The pretest mean of VAS of experimental group reduced from 8.6 to 4.9 whereas there was very little difference was noted in pretest and posttest mean of control group (8.5 to 07). This means that there was improvement in pain in the experimental group.

The following table (Table Ia) is showing the comparison of pretest and posttest VAS scores in experimental group (paired, within group)

| Mean | 8.60 (pretest) | 4.90 (postest) |
| SD | +-.516 | +-.876 |
| t score | -6.678 |
| p value | .000 (<.01) (Significant) |

<table>
<thead>
<tr>
<th>Table Ib showing the comparison of pretest and posttest VAS scores in control group (paired, within group)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>SD</td>
</tr>
<tr>
<td>t score</td>
</tr>
<tr>
<td>p value</td>
</tr>
</tbody>
</table>

The p value of pretest and posttest mean of experimental group is .000 which is < .001 hence the results are significant. But the p value of pretest and posttest mean of control group is .473 which is > than .001 hence the results are not significant.

The 95% confidence interval of the difference is between-1.439 and-2.761.

Graph II showing pre-test and post-test mean of experimental and control group of MOLBPDQ

Graph II: The pretest mean of MOLBPDQ of experimental group reduced from 40.1 to 19.7 whereas there was little difference was noted in pretest and posttest mean of control group (39.9 to 31.3). This means that there was much improvement in disability in the experimental group.
The following table (Table IIa) is showing the comparison of pretest and posttest MOLBPDQ scores in experimental group (paired, within group)

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>t score</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>pretest</td>
<td>40.10</td>
<td>1.197</td>
<td>-20.723</td>
<td>.000 (Significant)</td>
</tr>
<tr>
<td>posttest</td>
<td>19.70</td>
<td>.675</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The following table (Table IIb) is showing the comparison of pretest and posttest MOLBPDQ scores in control group (paired, within group)

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>t score</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>pretest</td>
<td>39.90</td>
<td>.994</td>
<td>.406</td>
<td>.689 (. 01) (NS)</td>
</tr>
<tr>
<td>posttest</td>
<td>31.30</td>
<td>1.636</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The p value of pretest and posttest mean of experimental group is .000 which is < .001 hence the results are Significant. But the p value of pretest and posttest mean of control group is .406 which is > than .001 hence the results are Not Significant.

The 95% confidence interval of the difference is between-10.424 and-12.776

Graph III showing pre-test and post-test mean of experimental and control group of expiratory volume

Interpretation: Graph III is showing that inspiratory volume has increased from 660 cc to 1050 cc in the experimental group. There was very negligible increase in inspiratory volume in the control group.

Discussion

Ball and Balloon is a simple, but not easy activity. All the subjects in the experimental group needed 2 or 3 practice sessions to learn this activity correctly and perfectly. All the subjects of this pilot study, in the experimental group were from urban background and educated up to minimum 12th standard. Two subjects were working and the rest were housewives.

Lumber instability is the major cause of LBA (Sapsford RR, 1994). Core muscles are responsible for trunk and spine stabilization regardless of movement of extremities. Diaphragm, Tr A, multifidus muscle and PFM act as one unit at the center of functional kinetic chains (Richardson C, 2004).

In the comparison of the intensity of LBP and disability in subjects in the experimental group showed significant improvement (VAS pretest mean =8.6, sd =+.504 and posttest mean= 4.9, sd=+.894) (MOLBPDQ pretest mean = 40.1, sd = +1.136, posttest mean = 19.7, sd = +.646) (Ostello RW, 2005). As well as in the control group there was slight improvement in VAS score (pretest mean = 8.5, posttest mean = 7), and MOLBPDQ score (pretest mean = 39.9, posttest mean = 31.9).

The incentive spirometer was used to measure the inspiratory volume. The tool had markings of 600 ml, 900 ml and 1200cc. Every subject was asked to practice once and then on the second time inspiratory volume was recorded. The mean pretest score of SIV improved from 660 ml to 1050 cc (sd +121.356, 156.669 respectively) in the experimental group (Koughlin CJ, 2005). Whereas there was negligible improvement in the control group.

None of the subject of experimental group reported any complaint like neck pain, headache, or any other discomfort during the period of study.

Limitations of the Study

1. Study could not be done on large number of subjects.
2. Daily monitoring of subjects could not be done

Future Recommendations

1. Study can be done on male subjects and also on all age groups.
2. Real time ultrasound can be used for measuring abdominal thickness and diaphragm length.
3. Proper spirometric tests can be done for measuring breathing parameters like inspiratory volume, expiratory volume, total lung capacity etc.
4. Study can be done to study the effect of BB activity in COPD, posture and incontinence.

5. Study can be done in Hospital setting.

**Conclusion**

The Ball and Balloon activity is a perfect example of integrating co activated action of deep abdominals with pelvic floor and diaphragm. It was found to be effective in managing LBP and improving function in peri menopausal women.

**Ethical Clearance:** Informed consent taken from all subjects (It was a community based study)

**Conflict of Interest:** Nil

**Funding:** Not required

**References**


2. Hodges P, Gandevia S, Richardson C. Contractions of Specific Abdominal Muscles in Postural Tasks are Affected by Respiratory Maneuvers. J Appl Physiol. 1997;83(3)


Comparison of Cardiovascular Fitness in Elite and Recreational Runners Using Multi Stage Shuttle Test: A Pilot Study

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Abstract

Background: Performance in long distance running has been associated with cardiovascular endurance of individuals. Elite runners can be categorized as individuals with high oxygen uptake capacities. Recreational runners are those who run to improve health and for fun.

Materials and method: Forty runners from Bardoli and Surti Runners groups were assessed for maximum \( \text{O}_2 \) uptake. Individual were bifurcated into two Groups. Group A included twenty Elite runners and Group B included twenty Recreational runners. A value of \( \text{VO}_2 \text{max} \) was assessed through multi stage shuttle test. The blood pressure and pulse rate was taken before and after the multi stage shuttle test. Unpaired t test was carried out for analysis of outcomes.

Results: All the runners were assessed for multistage shuttle test parameters. The level of shuttle, total no of shuttle and \( \text{VO}_2 \text{max} \) showed extremely significant difference in elite and recreational runners.

Conclusion: It can be concluded that elite runners have higher cardiovascular fitness than recreational runners using multi stage shuttle test

Keywords: Cardiovascular Fitness, Multistage Shuttle test, Elite and Recreational runners.

Introduction

Performance in long distance running has been associated with cardiovascular endurance of individuals although other factors may also contribute. Elite runners can be categorized as individuals with high oxygen uptake capacities and good performance in terms of distance and time. Maximal oxygen uptake reflects the ability of the cardiovascular system to deliver oxygen to the working muscles. Thus, individuals with high \( \text{VO}_2 \text{max} \) values have been regarded traditionally as possessing “endurance fitness” or “cardio-respiratory fitness”. Various complex, expensive and time-consuming laboratory-based tests to measure \( \text{VO}_2 \text{max} \) are available. One such test, the 20-meter multi-stage shuttle run requires little equipment (principally a tape recorder) and is suitable for mass testing.

Recreational runners can be categorized as individual who run to improve health. It is also defined individual who run for the fun. Thus, present study was carried out to compare maximum \( \text{O}_2 \) uptake in Elite and recreational runners through multi stage shuttle test.

Materials & Methodology

A total 40 individuals screened for the present study and as per inclusion and exclusion criteria they were allotted in Group A and Group B. 20 participants were included in Group A and group B consist of 20 participants. Inclusion criteria for the present study were: 1) Both male and female elite and recreational runners 2) Age: 20-40 years and 3) participating in running for 1 year at least. Subjects were excluded from the study if
they had a history of cardio-respiratory disease in past 1 year, any personal history such as cigarette smoking or tobacco, any lower extremities injury or diseases in last 1 year, Subjects having Heart Rate (HR) < 50 BPM or > 100 BPM at restand Subjects having Blood Pressure (BP) > 140/90 mm hg. Participants of both the groups were recruited from the runners of Bardoli and Surat Runners group, Gujarat, India. Participants were briefly explained about the study with detailed idea of evaluation and procedure. A written consent was obtained accordingly from each. The study was approved by the ethical committee of Shrimad Rajchandra College of Physiotherapy, UTU.

The base line assessment of the subject was done prior to the start of the study by evaluating the parameter such as: Blood Pressure (systolic and diastolic by sphygmomanometer), Pulse rate.

The Multi Stage Shuttle Test involved continues running between two lines 20-m apart in time to recorded beeps. The participants stand behind one of the lines facing the second lines, turning when signals by the recorded beeps. After about one minute, a sound indicates an increase in speed and the beeps was closer together. This continued each minute (level). When the lines were reached before the beep sounds, the subjects must wait until the beep sounds, the subjects were given a warning and must continue to run to the line, then turn and try to catch up with the pace within two more ‘beeps’. The test was stopped when the subject failed to reach the line (within 2 meters) for two consecutive ends after a warning.

Result

All statistical analysis was performed using specific software (SPSS trial version) and the statistical significance level was kept at \( P < .05 \). To analyze cardiovascular fitness within the groups the student’s t-test was used. The demographic characteristics of the participants were analyzed using statistics such as mean and standard deviation. Table 1 shows demographic characteristics of both groups. The mean difference of all data was statistically not significant (\( P > 0.050 \)) baseline demographic and clinical data was comparable.

Table 1: Illustrates Demographic and Clinical Data of the participants in Group A and Group B

<table>
<thead>
<tr>
<th>Demographic Data</th>
<th>Elite Runners (Group A)</th>
<th>Recreational Runners (Group B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Years)</td>
<td>22.34±3.32</td>
<td>24.35±4.59</td>
</tr>
<tr>
<td>Gender (M:F)</td>
<td>11:9</td>
<td>14:6</td>
</tr>
<tr>
<td>Height (Cm)</td>
<td>169.95±6.97</td>
<td>164.10±8.20</td>
</tr>
<tr>
<td>Weight (Kg)</td>
<td>58.05±.31</td>
<td>63±10.89</td>
</tr>
<tr>
<td>BMI (Kg/M²)</td>
<td>20.57±3.04</td>
<td>23.41±3.86</td>
</tr>
</tbody>
</table>
*Data are Mean±SD (95% Confidence Intervals)

All runners were analyzed for the multistage shuttle test parameters (Level of shuttle, Total number of shuttles and VO₂ max). Data analysis showed that Level of Shuttle in Group A (11.05 ± 1.31) was higher than the Group B (4.45 ± 1.09), Total number of shuttles in Group A (98.05 ± 12.12) was more than Group B (31.95 ± 10.12). The level of shuttle and the total number of shuttles showed extremely significant difference between Group A and Group B. Data analysis showed that value of VO₂ max in Group A (51.64 ± 4.31) was higher than Group B (29.59 ± 4.22). The value of maximum oxygen uptake showed significant difference in Group A and Group B. (Table 2)

Table 2: Illustrates comparison of VO₂ max of participants in Group A and Group B

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>Elite Runners (Group A)</th>
<th>Recreational Runners (Group B)</th>
<th>( p ) Value</th>
<th>( t ) Value</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>VO₂ max</td>
<td>50.99(46.83-61.96)</td>
<td>29.20 (23.41-37.76)</td>
<td>&lt;0.0001</td>
<td>16.32</td>
<td>Significant difference</td>
</tr>
</tbody>
</table>

Discussion

The aim of the present study was to compare the cardiovascular fitness in elite runners (Group A) and recreational runners (Group B) and to assess the cardiovascular fitness multistage shuttle test was used.

In the present study, elite and recreational runners were assessed for their running parameters (running experience and running distance per week). The results of the study have shown that there was extremely significant difference in running distance when compared between elite and recreational group. Various studies
have already defined elite runners with a weekly training distance of 60-150 kilometers.\(^9\) Hence, elite group had a higher weekly running distance than recreational group. In present study, the weekly running distance is fifteen times more than recreational runners.

There was no significant difference found between elite and recreational group when compared for running experience. Hence, possible effects of running experience on elite and recreational runners in terms of cardiovascular fitness have been eliminated here.

A significant difference was found in level of shuttle and total no of shuttle completed between elite and recreational group. A median value for elite runners was 11 which are three times higher than recreational runners when calculated for level of shuttle. Similarly, there was a significant difference of median value for elite and recreational group in terms of total no of shuttles, 96.5 (median) and 31 (median) respectively.

Several studies have already documented that there is a linear relationship between oxygen consumption and running velocity.\(^{10,11,12}\) Hence, it is not surprising that elite runners have significantly higher \(\text{VO}_2\max\) than recreational runners as they have performed higher shuttle level and no of shuttles.

Literature states that maximizing \(\text{VO}_2\max\) through training increases the running speed.\(^{13,14}\) Hence, for competitive elite runners, it is recommended to enhance their cardiovascular fitness through training as it will result in increased running speed and performance.

**Limitations of the Study**

Present study was conducted with a smaller sample size.

**Suggestion for Further Study**

Further study addressing cardiovascular fitness in elite and recreational runners as per the category of 10 kilometer, half marathon and full marathon participants can be studied.

Similar study on runners with other outcome measure than multi stage shuttle test can be used to assess cardiovascular fitness.

**Clinical Implications**

From the result of the study, we can state that recreational runners have low cardiovascular fitness when compared to elite runners. Hence, it is recommended to educate and train recreational runners to enhance their performance.

**Conclusion**

It can be concluded that elite runners have higher cardiovascular fitness than recreational runners using multi stage shuttle test.

**Conflict of Interest:** Nil

**Source of Funding:** Nil

**Ethical Clearance:** Institutional Ethical committee, Shrimad Rajchandra College of Physiotherapy, UTU, Bardoli, Gujarat, India.

**References**


Association Between Smartphone Addiction and Sleep Quality along with Objectively Measured Sleep

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Abstract

Background: Smartphones and social media have expanded our universe. Electronic media use has a profound effect on development in adolescents. It has been reported that sleep quality deteriorates with increased use of technology.

Methodology: 220 adults from Dr. A.P.J. Abdul Kalam College of Physiotherapy, PIMS, Loni were randomly selected. The participants included were between the age group of 18-25 years and those who were using smartphone for more than 3 years. Participants who denied to participate were excluded. Participants were evaluated for smartphone addiction and subjective quality of sleep using Smartphone Addiction Scale (SAS) and Pittsburgh Sleep Quality Index (PSQI). Objective measurement of sleep was carried out on these participants using Fitbit Charge 2 for 5 nights and then results were obtained.

Results: The result obtained suggested that Mean and Standard deviation value of SAS for 220 samples was 82.92 ± 24.47 and PSQI was 4.9 ± 1.97. 54% were found to be addicted to smartphone. Percentage of awake time during night-sleep in these individuals was more and their sleep quality was poorer than non-addicted users.

Conclusion: The study concluded that there is a significant correlation between smartphone addiction with sleep quality and awake time.

Keywords: Technology, Smartphone Addiction, Poor quality of sleep, Polysomnography, Fitbit Charge 2™.

Introduction

The term Smartphone was first invented in 1997, when Ericsson described its GS 88 “Penelope” concept as a smartphone with advanced features.¹ The Smartphone is willingly carried by a large segment of people, throughout the world. It provides integrated services from communication, computing and mobile sectors such as voice communication, messaging, personal information management applications, wireless communication ability as well as entertainment.¹ Although mobile phones have a lot of positive effects their overuse can cause many problems and can cause harmful effects on our body as well as mind.², ³ Wide spread use of technology can lead to dependence.³ There are adverse effects of overuse of smartphones which are observed in today’s world. Turel and Serenko claimed that smartphone addiction might be a type of non-substance addiction. Kim et.al noted that smartphone overuse can be a sign of smartphone addiction. Reported effects of smartphone addiction include damaging fingers and forearms, injuries of the vertebrae of the neck and spine, as well as psychological and physiological disorders including depression, stress and anxiety.⁴

Up till now, there are studies related to electronic media use and sleep in adolescents. It has been reported that subjective insomnia and poor sleep quality is associated with increased use of technology. Also, Song et al. (2010) suggested that adolescents’ Internet addiction was correlated with sleep-related problems respectively.⁵ Poor quality of sleep can lead to sleep disorders like insomnia, hypersomnia, narcolepsy and cataplexy, sleep apnea syndrome, nightmare, night terror, somnambulism, nocturnal enuresis etc.⁶

Increasingly studies have found that poor quality of sleep is associated with impaired daytime functioning.
The degree of smartphone addiction in an individual can be evaluated by using Smartphone Addiction scale (SAS) which is a valid and reliable tool in research that could distinguish smartphone addicted persons. It is a 48 item scale which is divided into 6 subscales-daily-life disturbance, positive anticipation, withdrawal, cyberspace-oriented relationship, overuse, and tolerance. The internal-consistency test of SAS result (Cronbach’s alpha) is 0.97.  

There are various subjective and objective ways to evaluate sleep. Subjectively, the Pittsburg sleep quality index (PSQI) (Buysse, Reynolds III, Monk, Berman &Kupfer, 1989), is a widely used tool which can measure sleep quality. It comprises of 19 self-rated questions and 5 questions rated by the bed partner and can distinguish between good sleeper and a poor sleeper. A PSQI global score >5 resulted in a sensitivity of 98.7 and specificity of 84.4 as a marker for sleep disturbances in insomnia patients. Laboratory based- Polysomnography is considered the gold standard method to measure sleep objectively. However, since the device is very expensive, difficult to use and resource-intensive, other method or devices which are less cumbersome can be introduced to objectively measure sleep. In recent years a variety of mobile apps, wearable technologies and embedded systems have emerged that allows individuals to track the amount and the quality of their sleep in their own beds. It is now easy to track one’s sleep through consumer wearable devices like Fitbit from the comfort of one’s home. These smart wearables provide continuous, modest, and cost-effective collection of data. Although multipurpose wristworn devices present some limits with respect to accuracy, they are reasonable options for collecting data related to sleep. Long-term motion and biological data that patients generate in their living environment can be collected through device in-built sensors (accelerometer, gyroscope, and heart rate sensors) in an operator-transparent way, by wearing this device. One of these devices named Fitbit Charge 2™ has 0.96 sensitivity (accuracy to detect sleep), 0.61 specificity (accuracy to detect wake), 0.81 accuracy in detecting N1+N2 sleep (“light sleep”), 0.49 accuracy in detecting N3 sleep (“deep sleep”), and 0.74 accuracy in detecting Rapid-Eye-Movement (REM) sleep. Therefore, Fitbit Charge 2™ sports band shows promise in detecting sleep-wake states and sleep stage composition and can be used as an alternative to measure sleep objectively.

Since smartphone addiction takes a toll sleep, this study was aimed at correlating smartphone addiction with subjective quality of sleep. Along with this objectively measured sleep was also evaluated with Fitbit Charge 2™ and the differences between the sleep parameters of addicted and non-addicted individuals were compared.

**Materials and Method**

A total of 220 adults, aged between 18 to 25 years, participated in this study. Participants were students from Rural Medical College, Pravara Institute of Medical Sciences, Loni, located in Maharashtra, India. The participants included in the study were those with age between 18 to 25 years and those who were using smartphones for more than 3 years. The exclusion criterion for participation in study was the participants who did not use smartphones. Before data collection, necessary permissions for the study were taken from ethical committee of institution (PIMS/CPT/IEC/2018/585), and complied with the Helsinki declaration. All participants were informed about details of study and gave their written informed consent. After providing the necessary information about the study, screening forms, SAS and PSQI were given to the participants. In this study, the participants had to mark respective scores on the questions asked on the overall daily usage of smartphone. SAS has a total score ranging from 48-288 respectively. Higher the score more serious is the smartphone addiction. Sleep quality was assessed using the PSQI (Buysse, Reynolds III, Monk, Berman &Kupfer, 1989), which measures subjective sleep quality. It consists of 19 self-rated questions and 5 questions rated by the bed partner. The 19 items are grouped into scores with the seven following components: subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. The component scores were added to a global PSQI score with a range of 0 to 21, with higher scores indicating worse sleep quality. Participants with score more than or equal to 5 were considered poor sleepers while those less than 5 were considered good sleepers.
The participants were further assessed for objective measurement of sleep using sports band i.e. Fitbit charge 2 in the study. In the objective measurement of sleep, each participant had to wear Fitbit Charge 2™ for 5 weekdays while sleeping. Evaluation of sleep during weekend was excluded due to varied nature of sleep during these days. Every day the participant’s deep sleep, light sleep, rapid eye movements sleep (REM sleep), awake time was monitored and noted down for 5 days. The information and the results of SAS and PSQI were further recorded and correlated to receive positive outcomes of association between them.

**Findings**

Out of total 220 participants 24% samples were between age group of 18 to 20 years, 25% samples were between age group of 21 to 23 years and 1% samples were between 24- 25 years of age. In this study, there were 125 (56.81%) females and 95 (43.18%) males.

The statistical analysis was done using Microsoft Excel 2010 and Instat software. Various statistical measures such as mean, standard deviation (SD), Karl Pearson’s Correlation Coefficient (r) and Student’s t-test (t), unpaired t-test (t) were utilized to analyze the data. Mean and Standard deviation (SD) value of Smartphone Addiction Score (SAS) for 220 samples was 82.92 ± 24.47 and Pittsburgh Sleep Quality Index (PSQI) was 4.9 ± 1.97. Accordingly, 120 samples had high smartphone usage while 100 had low smartphone usage. Also, 134 samples were poor sleepers and 86 samples were good sleepers.

When SAS was correlated using Pearson’s Correlation Coefficient (r) and Student’s t-test (t) with PSQI considering all the 220 samples, the result obtained was; r = 0.5088 and t = 42.571. The result was concluded to be extremely significant with, the P value is <0.0001. There was a positive correlation between SAS and sleep score.

When smartphone addicted users group (SA) was compared with non-smartphone addicted users (NSA) group to analyze objective measurement of sleep using unpaired t-test, considering awake time, t = 2.286 and its P value is 0.0232. The result was concluded to be significant. Other parameters like Light sleep (LS), Deep sleep (DS), Rapid eye movements (REM) showed insignificant results.

### Table I: Mean and SD of SAS and PSQI correlating it with SA and NSA.

<table>
<thead>
<tr>
<th></th>
<th>MEAN AND SD</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SA</td>
<td>N-SA</td>
</tr>
<tr>
<td>SAS</td>
<td>101.60 ± 11.86</td>
<td>59.43 ± 114.29</td>
</tr>
<tr>
<td>PSQI</td>
<td>5.60 ± 1.84</td>
<td>4.07 ± 1.56</td>
</tr>
</tbody>
</table>

In this study, 60.9% had poor sleep quality. The prevalence of poor sleep quality in young adults was found to be similar to other studies. The present result of the study suggested that there is positive correlation between smartphone addiction and quality of sleep in young adults. Also, it was found that there were more male participants who were addicted to smartphones and had poor quality of sleep. This result was similar to that obtained in a study by Kurugodiyavar M D et al., who studied impact of smartphone use on quality of sleep among medical students which concluded that in medical students smartphone addiction affects sleep quality considerably and males are particularly additionally at risk of having poor sleep quality due to too much smartphone use. This result can be attributed to the fact that dependence or overuse of smartphone can cause ill effects on sleep as they lead to exposure of either bright light of the screens or electromagnetic radiations or both. In a study done by Loughran et al., it has been reported that there are changes in sleep electroencephalogram if a person gets exposed to smartphone before sleeping. It has been suggested by different studies that production of melatonin is reduced on acquaintance to electromagnetic fields especially in the evening, reduced melatonin is the reason for impaired sleep quality.

Few mechanisms regarding the relationship between electronic media use and poor sleep are as follows: 1) Electronic media use may displace sleep; 2) using electronic media devices may be associated with cognitive, emotional or physiological arousal; 3) light emission of the screen of devices may affect sleep; and 4) mobile phone use in the bedroom may disturb sleep in that received messages may awake adolescents at night. Also, Huber et al. (2002) reported that more smartphone use in the evening impacts on many physiological factors like quality of sleep and the melatonin regularity, maybe by impacting the brain activity –especially of the pineal gland which may also cause altered cerebral blood flow and brain electrical activity. Study done by Demirci K et al., showed that daytime dysfunction, which is a component of sleep quality, was higher in the...
high smartphone use group than in the low smartphone use group. The study also found positive correlations between subjective sleep quality, sleep disturbance, daytime dysfunction, and sleep quality global scores and SAS scores. 14

It was studied by Hysing et al that both during daytime and bedtime use of electronic devices can lead to short sleep duration, long sleep onset latency and sleep insufficiency and in turn reduced daily work engagement. 20 Smartphone use for work at night increased depletion the next morning with its effects on sleep, was reported by Lanaj et al. 21

Furthermore in the present study, out of the objective parameters measured our study found that, the smartphone addicted users had significantly more awake time after sleep onset than non-addicted users. Participants who had higher scores of smartphone addiction reported to be more lethargic and inactive because of poor quality of sleep. It was observed in our study that addicted users generally slept late at night than the non-addicted ones and did not get sound and peaceful sleep which further resulted in sleepiness the next morning and lead to inactive lifestyle. This may lead to a vicious cycle leading to reduced physical activity and poor quality of sleep which can take a toll on professional as well as personal lives of youngsters.

**Conclusion**

There was a positive correlation between smartphone addiction and sleep quality concluding that Smartphone addicted users had poorer sleep quality than non-addicted users. Also, addicted users had more awake time after sleep onset than non-addicted users.


**Source of Funding:** SELF

**Conflict of Interest:** NIL

**References**


Effect of Different Density Foams on Balance Training in Geriatric Population-A Comparative Study

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Abstract

Purpose: The purpose of this study is to determine the appropriate density of foam that is best for improving balance in community dwelling geriatric population. Hence this study was conducted with low, medium and high density foams to determine which is more effective.

Materials and Method: The study included 30 participants randomized to 3 groups of 10 each. Group A was treated with low density foam, Group B was treated with medium density foam and Group C was treated with high density foam. The intervention protocol included double limb standing, single leg standing, neck hyperextension, heel and toe raises, trunk rotations, walking in place, tandem standing and walking sideways. Pre and Post intervention Berg Balance Score was noted and results were obtained.

Results: The intra group comparison in Group A pre test value was 45.60±2.67 and post test was 54.40±1.95 and mean difference was 8.80±2.34 and \( p \) value (\( p = 0.000 \)). In Group B pre test values was 46.00±2.01 and post test was 52.00±2.05 and mean difference was 5.40±0.69 with \( p \) value (\( p = 0.000 \)). In Group C pre test value was 48.50±1.58 and post test value after 1 month of intervention was 51.40±1.26 and mean difference was 2.90±0.87 with \( p \) value (\( p = 0.000 \))

Conclusion: Balance training with Low density foam is more effective followed by medium density foam followed by high density foam in geriatric patients with balance impairment.

Keywords: Balance training, Different density foam, Unstable surface

Introduction

Balance is the ability to maintain the centre of gravity within the base of support.[¹] Day to day activities such as maintaining static posture, remaining stable while moving from one place to another and performing activities of daily living require the body to maintain balance.[²]

Various systems in our body work in an integrated manner to maintain balance.[³] First is the afferent system that is important for identifying the body position and function, it consists of the visual system, somatosensory system and the vestibular system. Second is the efferent system which is responsible for maintaining the balance and performing the preventive strategies when balance is disturbed. The last is the CNS integration processes. This system is responsible for integrating the sensory information to produce desirable outcome by the motor system.[³]

Aging is an ongoing process that is time determined which mostly reflects the person’s chronological age and the process is unique to every individual. Geriatric population are termed as those who are aged above 60 years and constitutes about 7.4% of the total world population.[⁴] It has been stated that roughly 30% of geriatric population have a fall at least once a year. [⁵] With aging, common problems seen are, loss of bone density specially in women, degenerative bone diseases, arthritic conditions, muscle weakness, atrophy of muscle, visual impairment, hearing impairment and many more.[⁶] Due to one or more impairments, the elderly are at a risk of loss of balance.[⁷]

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¹0.5958/0973-5674.2019.00140.0
With aging the acuity of vision reduces along with reduced depth perception, glare-contrast sensitivity, and accommodation. The loss of depth perception and due to loss of contrast sensitivity people fail to cross hurdles and trip and fall. With advancing age, there is deterioration of the vestibular function and the sense of perception is reduced.\[^8\] With advancing age there is gradual decline in lean body mass, muscle strength and bone density.

With respect to central nervous system, slight decline in cognition is observed with aging which is more prominent in individuals with illness such as dementia, Alzheimer’s, Parkinson’s etc. Even a minor fall at this age can lead to serious damage such as fractures, cerebral hemorrhages, dislocations, soft tissue impairments and so on which often lead to serious limitations in functional activities.\[^9\]

Many researches done in sports medicine have stated that training on unstable surface is more effective as compared to training on stable surface. While standing on unstable surface, more number of skin receptors on ventral aspect of the foot and mechanoreceptors in the joints and muscles are activated.\[^9\] Due to increased recruitment of these receptors caused by postural sway on unstable surface, proprioception and body awareness in space is enhanced.\[^10\]

Similarly balance training on foam pad produces similar effects as above by increasing the afferent input from these receptors to enhance the postural reactions.

The foam cushions are available in variety of sizes, shapes and densities. The size and shape do not determine the stability of the foams. It is the density measured in gm/cm\(^3\) that determines how stable the foam will be. Low density foams are very soft and highly unstable where as higher density foams are more stable. The present study is intended to compare the effect of three different density foams (low density (23gms/cm\(^3\)), medium density (32gms/cm\(^3\)) and high density (40gms/cm\(^3\))) on balance training and determine which is the appropriate density for attaining maximum improvement in balance\[^4\] Our research comprised of balance training programme for adults above 65 years of age which included performance-based exercises like double limb stance, single limb stance, neck hyperextension, tandem standing, trunk rotations, heel and toe raises, walking in place and side walking these exercises integrate two or more systems.

While various tools are available to assess balance, Berg Balance Scale is considered as a gold standard tool for assessment of balance in any given population. Berg Balance Scale has many variants like Modified Berg Balance Scale and Pediatrics Berg Balance scale. In this study we have administered the standard Berg Balance Scale. It comprises of 14 tasks which were divided into 6 static and 8 dynamic tasks that are performed in our routine activities and progress from easy to more difficult tasks. The tasks are as follows, sit to stand, standing unsupported, sitting with back unsupported, stand to sit, transfers, standing with eyes closed, standing with feet together, reaching forward with outstretched hand, picking object from the floor, turning to look behind, turning 360 degrees, stepping, tandem standing, and single leg standing.\[^11\] Each of the task is scored on 5 points scale that is 0-4 where 0 means unable to perform and 4 means patient can perform the activity independently within the time and distance criteria. The total score is 56 in which score of 41-56 is low risk of fall, 21-40 moderate risk of fall and 0-20 is high risk of fall.\[^12\]

This tool takes 20-25 minutes to administer. The inter rater reliability is 0.99 with internal consistency (cornbach \(\alpha=0.96\)). The concurrent validity correlation with Tinetti balance sub test =0.91, with Barthel mobility =0.67.\[^14\] Previous studies have proven to increase balance and reduce the risk of fall significantly with the help of foam pads. Hence this study was intended to find the exact density of foam required to gain maximum improvement in balance.

**Method**

**Participants and Data collection:** This is a randomised clinical study to compare the effects of different densities of foam on balance training in geriatric population after a balance training period of one month after the intervention. Sample size calculation was performed sample size was set to 30 subjects randomly allotted into 3 groups of 10 each. The participants were recruited from community old age homes in Belgavi Karnataka using Non- probability sampling. The eligibility of participants were decided according to following inclusion criteria: Community dwelling older adults, age group 65 years and above, Older adults able to walk without support, Subjects willing to participate in the study and Subjects with moderate to low risk of fall according to Berg Balance Scale. Exclusion criteria were the following: impaired comprehension, history of...
clinical depression or progressive neurological disorder, lower extremity fracture or joint replacement and high risk of fall according to Berg Balance Scale.

**Intervention:** Randomisation was performed by the participants themselves drawing an allocation slip from a sealed envelope with group allocation, that is, one Group A the low density foam group, Group B the medium density foam group and Group C the high density foam group. All 3 groups received balance training protocol for a period of one month performed in the old age home. The balance training was supervised by a physiotherapist to ensure safety. There was 100% attendance at the training sessions.

The balance programme consisted of the following exercises. double limb standing, single leg standing, neck hyperextension, heel and toe raises, trunk rotations, walking in place, tandem standing and walking sideways. It also included performing the exercises with eyes open first and then with eyes closed. Each exercise was repeated 3-5 times and consumed 15-20 minutes for administration.

**Outcome measure:** Berg Balance Scale was used as an outcome measure as it is considered a gold standard for assessing balance. It comprises of 14 tasks which were divided into 6 static and 8 dynamic tasks that are performed in our routine activities and progress from easy to more difficult tasks. The total possible score on the Berg Balance Scale is 56, which is supposed to indicate excellent balance. The Berg Balance Scale has been shown to yield measurements with excellent inter-rater and test-retest reliability (intra class correlation coefficient [ICC]=0.98 and 0.97, respectively) and good internal consistency (Cronbach alpha=0.96)\(^{10}\). Pre and post intervention scores were recorded and subjected to statistical analysis to obtain results.

**Results**

The results were analysed based on improvement in Balance. The statistical analysis for the study was done using statistical product and service solution (SPSS version 23). Various statistical measures such as mean, standard deviation and test for significance such as paired ‘t’ test were used. Nominal data from patients demographic data i.e. age sex distribution were analysed using ANOVA with 10% level of significance. Comparison of pre and post intervention outcome within the three groups was done using ANOVA procedures.

**Demographic Profile:** The total number of participants in the study were 30 and total number of males were 6 and total number of females were 24. The mean age of the participants in group ‘A’ was 76.90±5.48 years, mean age of participants in group ‘B’ was 77.30±6.66 and mean age of participants in group ‘C’ was 72.30±4.03. The mean BMI of Group A was 23.00±3.77, mean BMI of Group B was 23.40±3.37 and mean BMI of Group C was 24.00±3.83.

**Table 1. Comparison of Group A, Group B and Group C with respect to mean age**

<table>
<thead>
<tr>
<th>GROUPS</th>
<th>MEAN-AGE</th>
<th>SD-AGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROUP A</td>
<td>76.90</td>
<td>5.48</td>
</tr>
<tr>
<td>GROUP B</td>
<td>77.30</td>
<td>6.66</td>
</tr>
<tr>
<td>GROUP C</td>
<td>72.30</td>
<td>4.03</td>
</tr>
<tr>
<td>TOTAL</td>
<td>75.50</td>
<td>5.78</td>
</tr>
<tr>
<td>P-value</td>
<td>0.097**</td>
<td></td>
</tr>
</tbody>
</table>

**Table 2. Comparison of Group A, Group B Group C with respect to BMI distribution**

<table>
<thead>
<tr>
<th>GROUPS</th>
<th>MEAN-BMI</th>
<th>SD – BMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROUP A</td>
<td>23.00</td>
<td>3.77</td>
</tr>
<tr>
<td>GROUP B</td>
<td>23.40</td>
<td>3.37</td>
</tr>
<tr>
<td>GROUP C</td>
<td>24.00</td>
<td>3.83</td>
</tr>
<tr>
<td>TOTAL</td>
<td>23.47</td>
<td>3.56</td>
</tr>
<tr>
<td>P-value</td>
<td>0.829</td>
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</tr>
</tbody>
</table>

**Outcome Measure**

The intra group comparison in Group A pre test value was 45.60±2.67 and post test after 1 month’s session was 54.40±1.95 and mean difference was 8.80±2.34 and p value (p=0.000).

Which was a significant improvement in balance in Group A. In Group B pre test values was 46.00±2.01, and post test value after 1 month of intervention was 52.00±2.05 and mean difference was 5.40±0.69 with p value (p=0.000). Which was significant improvement in balance in Group B. In Group C pre test value was 48.50±1.58, and post test value after 1 month of intervention was 51.40±1.26 and mean difference was 2.90±0.87 with p value (p=0.000) which was improvement was improvement in balance in Group C. When subjected to statistical analysis for inter group comparison Group A was better than Group B and Group B was better than Group C with p value (p=0.000) showing statistical significance.
### Table 3. Comparison of Balance scores in Group A, Group B and Group C; pre and post intervention effects, mean difference, correlation and p-value

<table>
<thead>
<tr>
<th>Groups</th>
<th>Pretest Mean</th>
<th>Pretest SD</th>
<th>Posttest Mean</th>
<th>Posttest SD</th>
<th>Difference Mean</th>
<th>Difference SD</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>45.60</td>
<td>2.67</td>
<td>54.40</td>
<td>1.95</td>
<td>8.80</td>
<td>2.34</td>
<td>0.017*</td>
</tr>
<tr>
<td>Group B</td>
<td>46.60</td>
<td>2.01</td>
<td>52.00</td>
<td>2.05</td>
<td>5.40</td>
<td>0.69</td>
<td>0.002*</td>
</tr>
<tr>
<td>Group C</td>
<td>48.50</td>
<td>1.58</td>
<td>51.40</td>
<td>1.26</td>
<td>2.90</td>
<td>0.87</td>
<td>0.000*</td>
</tr>
</tbody>
</table>

### Conclusion

This one month balance training protocol with different densities of foam for older people with balance impairment and fear of fall assessed with Berg Balance scale as an outcome measure concluded that balance training is most effective on low density foam followed by medium density foam, followed by high density foam according to statistical analysis. Therefore low density foam (23 gms/cm³) is suitable for improving balance scores in older people.

### Conflict of Interest: Nil

### Source of Funding: Self

### Ethical Clearance: This study was endorsed by institutional Ethical committee. Informed consent was obtained from all the participants prior to enrollment in study.

### References

A Nonrandomized Trial of Comprehensive Body Mechanics for Staff Nurses with Low Back Pain and Disability

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Abstract

Purpose: To assess the effectiveness of comprehensive body mechanics on pain and disability among staff nurses with low back pain.

Method: Quantitative, pre experimental one group pretest posttest design was used. Among 211 staff nurses working in male, female surgical and orthopaedic wards, adult ICU and postoperative ICU, 144 nurses with mild and moderate level of low back pain and disability were selected using consecutive sampling technique. The outcome variables were measured using Numerical Pain intensity scale and Oswestry low back pain disability questionnaire.

The intervention was comprehensive body mechanics in which the researcher provided video assisted teaching on ideal body mechanics for 5 minutes followed by demonstration of lower back rehabilitation exercises by video for 15 minutes. Return demonstration and practice of lower back rehabilitation exercises was carried out by the nurses daily for 15 minutes for 10 days, under the supervision of the researcher. On the 3rd day, a pamphlet was distributed followed by assessment of the effectiveness of the intervention on the 10th day.

Results: There was a statistically significant difference before and after the intervention on pain (t = 17.18; p< .001) and on disability (t = 17.71; p< .001) among staff nurses with low back pain.

Conclusion: Lower back condition is a complex problem for certain occupational groups, such as nursing personnel. Comprehensive body mechanics is effective in reducing pain and disability among staff nurses with low back pain.

Keywords: Pain, nurses, low back pain, exercises.

Introduction

Musculoskeletal disorders are one of the most common public health problems. Work-related musculoskeletal disorder (WMSDs) is a major health problem among many professionals in the developing countries. Historically, back pain has been a major complaint, and nursing professionals are one at the highest risk due to their job related tasks. Low back pain is identified as one of the most common complaints in nurses with an estimation of 38%-67% in the American nurses, 73%-76% in German nurses. The lifetime prevalence of non-specific low back pain is estimated at 60% to 70% in industrialized countries (one-year prevalence 15% to 45%, adult incidence 5% per year). The prevalence rate for children and adolescents is lower than that seen in adults but is rising. Prevalence increases and peaks between the ages of 35 and 55.

The Prevalence rate of low back pain among 248 nurses in Saudi Arabia was 53.2% and the factors related to high prevalence were physical work demand, shortage of qualified nurses and poor scheduling of work. A positive relationship was found between intensity of low back pain, total working hours of the nurses, patient handling activities and work stress. The major three risk factors that led to low back pain were manual transfer of patients between bed/wheelchair and bath cart, perceived physical exertion, and psychological demands.
A self-instructional module on knowledge and practice regarding body mechanics among nurses was found to be effective in improving the knowledge from 60% average to 100% with good knowledge and in the same manner, practice of body mechanics was also improved from 60% of average practice to 100% of good implementation of proper body mechanics\textsuperscript{5}. The impact of ergonomic intervention on nurses’ low back pain was found to have some improvement in the risk factors associated with low back pain\textsuperscript{6}. Comparing the effect of proprioceptive neuromuscular facilitation (PNF) programme and core stabilization exercises on functional ability of nurses with chronic low back pain showed a significant improvement among those who underwent core stabilization exercises\textsuperscript{7}. Back strengthening exercises reduces low back pain among nurses from 5.50 to 0.03 at p<0.05 after 30 days of practice\textsuperscript{8}. Stretching Exercise Program was significantly effective, comfortable, relaxing and reducing low back pain among Taiwan nurses with significant reduction in visual analogue scale for pain and exercise self-efficacy scale before and 2, 4 and 6 months after the exercise\textsuperscript{9}.

Hence the hypothesis: There will be significant difference in the level of pain and disability among nurses before and after comprehensive body mechanics was tested in the current study.

**Materials and Method**

**Study design:** Quantitative, pre experimental one group pretest posttest design.

**Setting:** The study was conducted in the male and female surgical wards, male and female orthopaedic wards, adult and postoperative intensive care units, Sri Ramachandra Hospital, Porur, Chennai.

**Samples:** Nurses who were either male or female, willing to participate, had mild and moderate intensity low back pain and disability with scores between 1 and 6 on numerical pain scale, working in adult and postoperative ICU, surgical and orthopaedic wards were selected as samples using non probability purposive sampling technique.

Nurses who were not available, pregnant, practicing back strengthening exercises or on any treatment for backache, have more than 40% disability in Oswestry low back pain disability questionnaire and who have back pain associated with pathological conditions were excluded.

**Ethical considerations:** The study was conducted after the approval from the Institutional Ethics Committee, Sri Ramachandra University (CSP/16/JAN/45/78). Participants were explained clearly about the study purpose and a written informed consent was obtained from all the participants before conducting the study. Confidentiality of the responses were assured and maintained throughout the study.

**Instruments:** Information obtained on their background variables, numerical pain rating scale and Oswestry low back pain disability questionnaire before and after the comprehensive body mechanics. The reliability of the tool was established by the Cronbach’s alpha method and the ‘r’ value obtained was.722.

**Data collection procedure:** The data collection period was one month from 11/07/16 to 7/08/16. The data were collected through self-administered questionnaire method. The data collection procedure was carried out in four phases. They are as follows:

**Phase I:** The total staff nurses in the selected wards and ICUs were 211 out of which, 150 were available and willing to participate. The remaining were not willing, antenatal, and on CL, LOP, week OFF.

**Phase-II:** The purpose and procedures of the study were explained to the participants and a written informed consent was obtained from them before conducting the study. Pretest was administered to assess the low back pain and disability among 150 nurses using numerical pain rating scale and Oswestry low back pain disability questionnaire through self-administered questionnaire method. At the end of pretest, 144 nurses were selected for the intervention as per sample selection criteria and 6 nurses who had severe level of pain and disability were not given the intervention.

**Phase-III:** The total sample of 144 nurses were divided into three groups, each group consisting of 50, 50, 44 samples respectively. The first sample of 50 nurses were further subdivided into group of 5-7 nurses per day from the six areas depending on their shift and their availability. They were asked to assemble in the classroom available in each ward and demonstration of comprehensive body mechanics and return demonstration was observed in the class rooms of the respective wards.

On the first day, video assisted teaching on ideal body mechanics such as positioning of the legs, stretching of the back, bending at knees, sliding movement of the
legs during shifting the patient from bed to stretcher, stretcher to bed and within the bed, sitting and standing erect with the spinal cord straight was given for 5 minutes. After teaching, the researcher demonstrated the lower back rehabilitation exercises such as single and both knee flexion, pelvic bridges, straight leg raise, trunk rotation, extension exercise, quadruped arm and leg raise, alternate arm and leg raise, prone leg lift, rear lift and standing back extension by video for 15 minutes followed by return demonstration by individual nurses with observation and corrections were given by the researcher. The teaching and demonstration was given in English language.

A pamphlet containing specific images of ideal body mechanics and demonstration of lower back rehabilitation exercise was given to all on the third day of intervention. The reason for issuing the pamphlets on the 3rd day was to make the nurses thorough with the exercises on the first 2 days and obtaining a return demonstration after which the pamphlet was given to them on 3rd day.

In this way 50 nurses were covered for the first ten days followed by 50 nurses for the second ten days and 44 nurses for the third ten days.

**Phase-IV:** Posttest was conducted on the 10th day to assess the effectiveness of comprehensive body mechanics on low back pain and disability using numerical pain rating scale and Oswestry low back pain disability questionnaire.

**Findings**

The study found that among 150 nurses, 42% had mild level of pain, 54% had moderate level of pain and 4% had severe level of low back pain. With regard to disability, 73% had mild disability, 23% had moderate disability, 3% had severe disability and 1% had crippled level of disability. The 4% who had severe low back pain, 3% with severe level of disability and 1% with crippled level of disability were excluded from the study.

The comprehensive body mechanics was found to be effective in reducing low back pain and disability among nurses. There was a statistically significant difference (p<.001) in the mean scores of low back pain and disability before and after the comprehensive body mechanics intervention. After the intervention, the proportion of the nurses in the mild level of pain has been improved from 43.8% to 73.6%, and the 56.2% of the nurses in the level of moderate pain has been reduced to 26.4%. Similarly, 76% of the nurses who had mild disability has been improved to 97.2% and 24% of the nurses who had moderate disability has been reduced to 2.1%.

Statistical significant positive correlation was found between low back pain and disability in pretest (r=.35 and p<.001) and in posttest (r=.43 and p<.001). Hence, as the pain increases, disability also increases among nurses.

Statistical significant association was found between low back pain and age (p<.05), duration since last delivery (p<.05) and area of posting (p<.01). Also there was a significant association between disability and gender (p<.05), area of posting (p<.01) among staff nurses.

**Conclusions**

The study concludes that the comprehensive body mechanics is effective in reducing the intensity of low back pain and disability among staff nurses. It is also concluded that there is a positive correlation between low back pain and disability. Low back pain among staff nurses and disability is also influenced by age, gender, duration since last delivery, and area of posting.

**Conflict of Interest:** Nil

**Source of Funding:** Self funding

**Ethical Clearance**

Approved by the Institutional Ethics Committee, Sri Ramahandra University (CSP/16/JAN/45/78).

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Effect of Task Oriented Activity Training on Improving Balance and Self Efficacy in Sub Acute Stroke

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Abstract

Many interventions have been practiced and used for the rehabilitation of balance in stroke patients among which one of the approach is the task oriented activity. In the present study this approach has been used to evaluate its effectiveness on improving balance, self- efficacy and functional status in sub acute stroke. Thirty individuals were selected and divided into two groups of fifteen each, one group was administered conventional therapy and the other group was administered conventional therapy alongwith task oriented activity approach for four weeks (five days per week). Berg Balance Scale, Activity-specific Balance Confidence Scale, Timed Up and Go and Barthel Index were used prior before starting the therapeutic intervention and on last day of the intervention to assess the changes between the baseline and the post intervention. Independent t-test was used for comparing means between all the two groups. Paired t- test was used to compare the difference within the groups at two time periods –baseline and after 4 weeks. The results showed significant improvement in both the group administered with conventional therapy along with task oriented approach. With the mean difference found between the pre and post therapeutic measurements was much more in the experimental group in balance, self- efficacy (p > 0.00%) and functional status (p > 0.04%). So it concludes, that the present study provides evidence for the effectiveness of task oriented approach on improving balance, self-efficacy and functional status.

Keywords: Stroke, neuroplasticity, balance, self-efficacy, task oriented activity approach, Berg balance Score, Activities Specific Balance Scale, Timed Up and Go, Barthel Index.

Introduction

. Stroke has been defined as ‘rapidly developing clinical signs of focal (or global) disturbance of cerebral function, with symptoms lasting 24 hours or longer, or leading to death, with no apparent cause other than of vascular origin’.[1]

Balance is disturbed following stroke with impairments in steadiness, symmetry, and dynamic stability common. Problems may exist when reacting to a destabilizing external force (reactive postural control) or during self-initiated movements (anticipatory postural control). Disruptions of central sensorimotor processing lead to an inability to adapt postural movements to changing task and environmental demands and impair motor learning. Patients with stroke typically demonstrate asymmetry with most of the weight in sitting or standing shifted toward the stronger side. They also demonstrate increased postural sway in standing. Delays in the onset of motor activity, abnormal timing and sequencing of muscle activity, and abnormal co-contraction result in disorganization of postural synergies. Patients with hemiplegia typically fall in the direction of weakness. [2] Self-efficacy is defined as a judgment of one’s ability to organize and execute given types of performances. [3] Due to the impairments leading to difficulty in day to day activities, the individual loses his confidence in doing them which would again lead to deterioration of the motor function.

The rate and extent of recovery post stroke depends largely upon the initial degree of impairment, on an intact cortex adjacent to the lesion, and on the timing and intensity of the rehabilitation. Improvement of motor activity may occur post stroke because of the
recovery of marginally functional neurons and later due to reorganization or relearning of neural functions (i.e., neuroplasticity).[4]

Various therapeutic approaches can be applied after stroke based on neurophysiological, motor learning or orthopaedic principles. However, they do not specifically target balance, and there is no evidence that any of these approaches is more effective than another in promoting the recovery of postural control.[5] Among some approaches the below mentioned approaches are used for the stroke rehabilitation, they are as follows — treadmill along with backward walking, ground backward walking, proprioceptive activities, range of motion, stretching activities, strengthening activities, coordination tasks, and motor reeducation, aerobic exercises, visual feedback with rhythmic balance training (weight shifting) on a force platform, balance training using equipments like Smart Balance Master, task oriented activity approach[6,7,8,9,10]. Recently, evidence was found on improved walking ability not being associated with improved motor control of the paretic lower limb,[11,12] but rather with the development of compensation movement strategies,[13],[14] and improved coping with loss of function in enhancing the ability to maintain balance over the non-paretic lower limb.[14,15]

Task-oriented approach, movement emerges as an interaction between many systems in the brain and is organized around a goal and constrained by the environment. Task-related practice is advocated during stroke rehabilitation to improve functional performance of daily activities such as walking and reaching to grasp objects.[16]

Many of the studies show that the Task Oriented Activity Training is helpful in improving in balance and self efficiency in chronic post stroke patients. But due to paucity of literature found on whether this training given to sub acute stroke patients helps to overcome balance related issues, reduce risk of falls and increase individual’s self efficacy. Also most of the studies done have targeted one of the activities like sit to stand, gait, etc, but very few literature is found on the overall parameters of the lower limb function such as walking in different ways such as obstacle walking, lateral walking, backward walking, walking with different speeds, stepping up and down, stair climbing, also balance was challenged in activities like close standing, reach out for targets while standing at the same position, maintaining balance on a wobble board, etc.

The present study was designed to determine the add on effect of task oriented activities training along with the conventional therapy on sub acute stroke patients for improving their balance and functional status.

**Method and Materials**

30 patients with subacute stroke were selected on the basis of the inclusion criteria like first occurrence of stroke diagnosed by CT or MRI or diagnostic medical reports by a neuro physician, age between 35 to 65 years, duration after stroke between 4 weeks to 6 months, mini mental scale score of more than 24, Brunnstrom voluntary control (BRS) grade 3 or more, participant ambulatory before stroke and doesn’t have any medical contraindication to walking. The patients having any other neurological disease or musculoskeletal disorders and any other sensory issues affecting balance were excluded.

Institutional Ethics Committee of The Sarvajanik College of Physiotherapy approved the study.

30 patients (25 males and 5 females), who met the inclusion criteria were allocated randomly into one of the two groups using quasi randomization procedure. The patients were informed about the study and a written consent was taken prior to this study. The patients were blinded of the intervention provided to them.

Pre test measurements of balance using Berg Balance scale (BBS) for balance, Activities-Specific Balance Confidence scale (ABC) for self efficacy, Timed Up and Go (TUG) for functional task and Barthel Index (BI) for activities of daily living were taken on Day 1 before the intervention started.

Group A was administered conventional therapy and Group B was administered conventional therapy along with task oriented approach.

**Table 1: List of activities that were a part of task oriented approach given to the patients of Group B**

<table>
<thead>
<tr>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting and reach out for targets</td>
</tr>
<tr>
<td>Standing and reach out for targets</td>
</tr>
<tr>
<td>Close standing</td>
</tr>
<tr>
<td>Speed walking</td>
</tr>
<tr>
<td>Transfer from chair to chair</td>
</tr>
<tr>
<td>Balancing on a wobble board</td>
</tr>
<tr>
<td>Step up and step down activity</td>
</tr>
<tr>
<td>Lateral walking</td>
</tr>
</tbody>
</table>
The intervention training for each individual of both the Group A and Group B was administered for 4 weeks with 5 days intervention in each week. The treatment session was of 60 minutes.

At the end of 4th week, all outcome measures were recorded as post test measurements using the same method as for pre test measurements.

**Results**

Descriptive statistics of mean and standard deviation for continuous variable were used. Independent t-test was used for comparing means between the two groups. Paired t-test was used to compare the difference within the groups, at baseline and after 4 weeks. Results were considered to be significant at p<0.05 and confidence interval was set at 95%. All statistical analysis was performed using SPSS version 20.

Paired t-test values of control group and experimental group

**Table 2: Pre and post comparisons of BBS**

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>42.0</td>
<td>2.13</td>
<td>23.482</td>
<td>0.00</td>
</tr>
<tr>
<td>Post</td>
<td>46.26</td>
<td>1.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>41.4</td>
<td>1.84</td>
<td>33.31</td>
<td>0.00</td>
</tr>
<tr>
<td>Post</td>
<td>49.66</td>
<td>1.95</td>
<td></td>
<td></td>
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</tbody>
</table>

**Table 3: Pre and post comparisons of TUG**

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>control</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>20.56</td>
<td>1.09</td>
<td>8.374</td>
<td>0.00</td>
</tr>
<tr>
<td>Post</td>
<td>17.57</td>
<td>1.64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>21.05</td>
<td>0.731</td>
<td>22.27</td>
<td>0.00</td>
</tr>
<tr>
<td>Post</td>
<td>13.40</td>
<td>1.093</td>
<td></td>
<td></td>
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</tbody>
</table>

**Table 4: Pre and post comparisons of ABC**

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
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</thead>
<tbody>
<tr>
<td>control</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>9.748</td>
<td>0.65</td>
<td>11.79</td>
<td>0.00</td>
</tr>
<tr>
<td>Post</td>
<td>12.29</td>
<td>1.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>9.66</td>
<td>0.66</td>
<td>46.63</td>
<td>0.00</td>
</tr>
<tr>
<td>Post</td>
<td>17.29</td>
<td>0.65</td>
<td></td>
<td></td>
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</tbody>
</table>

**Discussion**

The purpose of the study was to assess the effectiveness of task oriented activity approach given along with conventional therapy for improving balance and self efficacy among sub acute stroke patients.

The results showed significant improvement in both the groups i.e group administered with conventional therapy and group administered with conventional therapy along with task oriented approach. But the mean difference between the pre and post therapeutic measurements was found much more in the Group B.

Van de port et al conducted a systematic review including 21 high-quality RCTs. The results showed medium-sized, statistically significant effects in favour of task-oriented circuit class training for walking distance and gait speed and the TUG. No statistically significant effects were found for the step test or balance control measured by the BBS. The findings of this present study contrast to the study mentioned above, support the increase in the gait speed and the TUG. But it does not support the no change in BBS. As there was significant increase in the score of BBS found in the study.

Wevers Lotte et al conducted a systemic review on effects of task-oriented circuit class training on walking competency after stroke which included 6 studies. This systematic review demonstrated medium-sized, statistically significant effects in favour of task-oriented circuit class training for walking distance and gait speed. No statistically significant effects were found for the step test or balance control measured by the BBS. Also most patients that were recruited for circuit class training showed relatively high scores on the BBS at baseline, which limits further significant change on this scale. The present study is in agreement with the results with an outcome of increase gait speeds.

Though studies mentioned above have very less difference or change in their outcomes after the interventions as contrast to the present study, but the

**Table 5: Pre and post comparisons of BI**

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>control</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>53.00</td>
<td>3.16</td>
<td>15.199</td>
<td>0.00</td>
</tr>
<tr>
<td>Post</td>
<td>64.00</td>
<td>3.38</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>51.33</td>
<td>0.66</td>
<td>20.917</td>
<td>0.00</td>
</tr>
<tr>
<td>Post</td>
<td>68.00</td>
<td>0.65</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The present study highlights some of the features which were included in the studies that would justify the change in their outcomes of the intervention. The present study included many activities in the form of task which were a part of the BBS which would might be the probable reasons for the improvements that were found in it, also the intervention that consist of additional task oriented approach consisted of activities such as Sit to stand’, ‘Transfer from chair to chair’, ‘Balancing on wobble board’, ‘Reach out task’ along with these activities like walking with various speeds, obstacle walking, backward walking, stair climbing, step up and step down. These activities were goaled towards improving the balance of the patients with sub acute stroke in their day to day activities which were not much included in the studies discussed above. Also the improvement found in the conventional group was due to the therapeutic intervention administered to them, which was a holistic approach that included strengthening, stretching, walking and mat exercises in which their balance is challenged unlike the studies discussed above where one group were upper extremity activities as in the study of Salbach N. In studies by Van De Port, et al, Lotte Wevers, et. al, their baseline data of the patients with sub acute stroke chosen were already found to be higher therefore no significant change could be found but in the present study there were patients with sub acute stroke who had initially a low baseline data therefore a significant change was found in their improvement.[20]

Though both the groups showed improvement, but the group that received conventional therapy along with the task oriented approach showed its improvement in the scoring of the BBS which included tasks like ‘standing feet together unsupported’, ‘picking up an object from the ground’, ‘turning 360 degrees’, ‘placing alternate foot on step or stool’, ‘tandem standing’ and ‘standing on one leg’, which was found to be 49.26 as compared to the mean obtained prior intervention which was 41.44. This improvement was seen more in this group because the exercises more focused on activities like reaching out, balancing on wobble boards, stepping up and down. Also the patients with sub acute stroke’ gait speed measured by TUG was found to be increased more in this group because there were many tasks that focused on the gait of the subject like walking, speed walking, lateral walking.

**Conclusion**

Based on the results of the present study it can be concluded that the improvement found in the group who received conventional exercise therapy along with Task oriented activity approach in balance, self efficacy and functionality is unclear, as not a larger change has been found in functionality of the patient as compared to the statistical significance that has been shown above. Thereby, further studies are required to prove its clinical significance.

**Limitations**

Limited sample size

Longer duration for treatment can be taken under consideration

**Source of Funding:** Self financed

**Conflict of Interest:** none

**Ethical Clearance**

**References**


Effect of Modified Dynamic Orthosis on Foot Drop in Stroke

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Abstract

Stroke is an medical condition that causes brain damage, leading to disability and mortality. Walking impairment are the most common problems in stroke survivors, occurring in 39 to 90 of all cases. In stroke walking is more affected due to foot drop, Due to foot drop there is not proper clearance of foot and toes during walking .

Objective: To find the effect of combination of AFO and FES on foot drop in stroke individuals.

Materials and Method: 20 subjects diagnosed with foot drop in stroke survivors were taken in this study.10 subjects included in group A who received conventional physiotherapy with modified dynamic ankle foot orthosis, and other 10 subjects were included in group B who received only conventional physiotherapy.

Result: Walking speed was improved in group A who received modified dynamic orthosis with conventional physiotherapy (0.55± 0.2)

Conclusion: We found that Modified Dynamic orthosis is effective in improving walking speed performance in patients with foot drop in Stroke individuals.

Keywords: Functional electrical stimulation, ankle foot orthosis, dynamic ankle foot orthosis.

Introduction

Stroke is an medical condition that is mainly causing brain damage, leading to disability and mortality[1]

In most countries stroke is being considered as the major causes of disability[2]. Hemiplegia is the common problem caused by stroke, there is impairment of one side of body[3].Walking impairment is the most prevalent disabling problem in stroke individuals, which is 30 to 90% of all cases[4]. Walking is affected due to foot drop there is not proper clearance of foot and toes during walking[5]. There is loss in tone of dorsiflexor muscles and increase in tone of plantar muscle[6]. Ankle foot orthosis are frequently prescribed for correcting ankle joint alignment, and to reduce energy expenditure during ambulation, Conventional treatment currently used to correct foot drop in some of places are hinged or rigid plastic orthosis to eliminate foot dragging during the swing phase and allow contact during stance phase[7]. To compensate loss of function and to treat weak muscles Functional electrical stimulation is used, it may be applied over head of fibula where nerve is superficial and second electrode over tibialis anterior muscle group[8]. Currently it is believed that FES is most helpful invention towards enhancing motor abilities in patients with motor disabilities[9]. This devices are used for active foot and toe clearance during swing phase of walking by stimulating dorsiflexors which will decrease muscle atrophy, and improves gait pattern and walking velocity during walking[10]. In spite of the prospective advantages of FES system, however further studies are needed to make the use of FES system to stimulate dorsiflexors and improve walking and balance abilities[11]. Thus we are going to assess the individual by 10 meter walk test post assessment will be done after 2 months. Moreover
plantar flexors are not more affected, that is why most of the ankle foot orthotics are designed for foot drop prevention\textsuperscript{[12]} We found two types of literatures on ankle foot orthotic devices; one type focusing on design and construction and another type focusing on evaluation of gait wearing\textsuperscript{[13]} The literature available on effect of AFO limited, so in these study the research is to look the input of a model of dynamic ankle foot orthosis for therapeutic outcome in stroke with foot drop individuals

**Materials and Method**

This study was conducted in Krishna Institute of Medical Science Deemed to Be University, Karad, Maharashtra and a total of 20 cases selected according to the inclusion criteria were enrolled in the study from December 2018 to February 2019. All cases were diagnosed with foot drop in stroke survivors were taken. An informed consent form was signed by the subjects who were volunteering to participate in the study. These subjects were equally allocated into 2 groups i.e. Group A and Group B by simple random sampling method. Pre-treatment Speed of the individuals was carried out by 10 meter walk test\textsuperscript{[14]} Intervention period of 3 days/week for 4 weeks was carried out. All the exercises were performed and showed to the subjects before starting with the intervention. Group A subjects underwent Conventional physiotherapy along with modified dynamic ankle foot orthosis\textsuperscript{[11]} where Group B subjects were treated conventionally by giving exercises and electrical stimulation with 0-80 MA, at frequency of 40 hz\textsuperscript{[1]} After two months post treatment session assessment was done by 10 meter walk test

**Statistical Analysis**

Statistical analysis was done manually and by using the statistics software INSTAT so as to verify the results derived. The statistical analysis between the intra group was done by Paired ‘t’ test. Independent ‘t’ test was used for interpretation of post interventional values between Group A and Group B.

**Results**

Intra group analysis of all pre and post interventional values was done by Paired ‘t’ test. Inter group analysis of all values was done by using Independent ‘t’ test. Post intervention analysis of 10 meter walk test showed very significant difference between both groups (p = < 0.001).

<table>
<thead>
<tr>
<th>Variables</th>
<th>Velocity m/sec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameters</td>
<td></td>
</tr>
<tr>
<td>Conventional group (group b)</td>
<td></td>
</tr>
<tr>
<td>Maximum speed Mean±SD</td>
<td></td>
</tr>
<tr>
<td>Experimental group (group A)</td>
<td></td>
</tr>
<tr>
<td>Maximum speed Mean±SD</td>
<td></td>
</tr>
<tr>
<td>P-value</td>
<td></td>
</tr>
<tr>
<td>Walking speed m/sec</td>
<td>0.47±0.2</td>
</tr>
<tr>
<td></td>
<td>0.55±0.2</td>
</tr>
<tr>
<td></td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Data are expressed as mean ±SD, p< 0.001

Interpretation: Above table suggest that walking speed has been increased in experimental group as compared to conventional group, This suggest that modified dynamic orthosis is useful in improving walking speed.

**Discussion**

Stroke is an acute medical condition that mainly causes brain damage leading to disability and mortality\textsuperscript{[1]} The most common problem caused by stroke is impairment of one side of body which is called hemiplegia. In 2010, 30 individuals with sub-acute stroke were assigned to receive either physical therapy and functional electrical stimulation (FES group) or physical therapy alone control group both received conventional therapy for 60 min/day 5days a week for 12 weeks. The purpose of this study is to analyse the effect of modified dynamic orthosis on foot drop in individuals with stroke .In stroke individuals there is loss of motor control and there is difficulty to dorsiflex the ankle, The poor walking ability of stroke individuals is commonly caused by foot drop .There is difficulty in proper clearance of foot and toes during walking, leading to slapping of foot down on ground during the initial stance, instead of heal strike, and dragging of toes during the swing phase .To overcome these problem this research is conducted to examine the effect of modified orthosis in individuals with foot drop in stroke. Thus AFO and ELECTRICAL STIMULATOR were used for foot drop, but there a few literature study using combination of AFO and ELECTRICAL STIMULATOR for improving gait in foot drop individuals. According to inclusion criteria subjects will be taken in to this study, informed consent will be taken from the individuals who are willing to participate in this study Sample size of 20 subjects will be included in this study by random allocation method. Pre assessment will be done prior to the treatment
session by checking 10 metre walk test. Subjects will be divided in to two groups by lottery method that is Group A and Group B Group A [EXPERIMENTAL GROUP] and Group B [CONTROLLED GROUP]

Group A Was received conventional physiotherapy with modified dynamic orthosis, conventional physiotherapy will be for 1hr and gait training will be for another 1 hr. Group B was received only conventional physiotherapy that is STRETCHING, EXERCISES, ANKLE FOOT ORTHOSIS, ELECTRICAL MUSCLE STIMULATOR WITH PARAMETRES OF RECTANGULAR PULSE AT 300µs with intensity of 0-80 MA at frequency of 40HZ .Conventional treatment will be for 1hr. 3 Times a week for 2 months[1]. The participants may have experienced less distress and increase confidence while walking. After 2 months Post treatment session assessment was collected. We observed significant changes after giving modified dynamic orthosis in 3 weeks by 10 meter walk test. The result of this study support previous findings and indicate modified dynamic orthosis is useful in treating and increases speed in individuals in foot drop in stroke.

Conclusion
We found that modified dynamic orthosis were effective in improving walking speed performance in patients with foot drop in stroke.

Source of Funding: Self

Conflict of Interest: Nil

References
Comparison of the Effect of High Voltage Pulsed Current v/s Interferential Therapy on Pain and Womac in Patients with Knee Osteoarthritis

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Abstract

Background: Osteoarthritis (OA) is the most common joint disorder in a large number of people older than 65 years.

Aim: To compare the Effect of High Voltage Pulsed Current and Interferential Therapy on Pain & WOMAC in patients with Osteoarthritis of knee.

Methodology: 60 subjects were taken and divided into two groups- Group A-30 Subjects (HVPC & EXS) and Group B-30 Subjects (IFT & EXS). Subjects with Age group of 40-70 years, Unilateral Knee joint involvement, Diagnosed Case of osteoarthritis, Pain more than 4 weeks, WOMAC score more than 20 and NPRS Score more than 3 and less than 10 were included in this study. Western Ontario and McMaster University Osteoarthritis Index (WOMAC) and Numerical Pain Rating Scale (NPRS) were the outcome measures used.

Results: showed improved scores in both the groups with group B showing more improved values.

Conclusion: the intervention given to both the group was shown to be effective, where the intervention given in Group B was found to be more effective therefore IFT with EXS has shown more Effective in Treatment of Osteoarthritis knee in reducing pain and disability.

Keywords: High Voltage Pulsed Current (HVPC), Osteoarthritis, Knee, Pain.

Introduction

Osteoarthritis (OA) is the most common joint disorder in a large number of people older than 65 years. Knee OA is more commonly associated with disability than OA of any other joint¹. Prevalence increases with age, and radiographic abnormalities are present in more than 30% of persons older than 65 years, with approximately 40% of these persons being symptomatic². Many Cases with osteoarthritis knee render with knee pain and edema which leads difficulty in performing ADLs. Prevalence of OA in India is reported to be in the range of 17 to 60.6%³. In addition to this, impaired muscle function is frequently observed in patients with OA of the hip or knee⁴,⁵. Cartilage is an avascular tissue, and the chondrocytes within it depend on diffusion and convection for nutrition. The cyclic loading induced by everyday activities produces deformations, pressure gradients, and fluid flows within the tissues that enhance this process¹,²,⁵,⁶.

High Voltage Pulsed Current (HVPC) has been used in therapy for many years (machines have been available since the 1940’s), yet while in many countries it is highly popular, in other countries its use is minimal. It is sometimes called ‘Twin Peak Monophasic’ which is more like a description of the machine output, and some authors include it in the Microcurrent group on the basis that the average current flow is almost certainly in the microcurrent range. Although high-voltage pulsed current (HVPC) is one of the therapeutic modalities used in the treatment of edema and pain¹², its effectiveness in humans is not yet proven. This type of current is characterized by a twin-spark, monophasic waveform, generating a voltage greater than 150V and a low total
current (1.5 mA), with very short duration (5-100µs) and greater interpulse intervals.

The basic principle of Interferential Therapy (IFT) is to utilise the strong physiological effects of low frequency (<250pps) electrical stimulation of muscle and nerve tissues without the associated painful and somewhat unpleasant side effects of such stimulation. Interferential therapy utilises medium frequency currents, passed through the tissues simultaneously, where they are set up so that their paths cross & in simple terms they interfere with each other. This interference gives rise to an beat frequency which has the characteristics of a low frequency stimulation Therapeutic exercise in OA may prevent accelerated degeneration caused by disuse without causing further degeneration and pain as a consequence of joint deformity or incongruence. Several recent longitudinal studies conclude that carefully controlled exercise programs designed primarily to address OA of the knee are beneficial. IFT is been used in Daily Practice to Reduce Pain and it has been proved that it is beneficial. Even HVPC is been proved to be useful but there is no study done on comparison of these 2 Modalities to Analyze which one is better.

Hence, this need of the study is to observe that which current/modality i.e (HVPS and IFT) is more effective on pain & ADL’s in Osteoarthritis knee

**Methodology**

- Study design: Comparative Study.
- Sampling: Convenient Sampling
- Sample size: 60-Group A-30 Subjects (HVPC & EXS) and Group B-30 Subjects (IFT & EXS)

**Inclusion Criteria**

- Age group of 40-70 years
- Unilateral Knee joint involvement
- Diagnosed Case of osteoarthritis
- Pain more than 4 weeks
- WOMAC score more than 20
- NPRS Score more than 3 and less than 10.

**Exclusion Criteria**

- Patient with any Knee Fracture
- Open wounds or a dystrophic component
- Patient with Metal Implants
- H/O Rheumatoid Arthritis
- H/O any motor/sensory deficit in affected knee
- Patients with any other knee pathology.

**Outcome Measures**

1. Numerical Pain Rating Scale (NPRS)\(^{28}\) 
   (Reliability: \( r = 0.96 \) and 0.95)
2. Western Ontario and McMaster University Osteoarthritis Index (WOMAC) (ICCs ranging from 0.75 to 0.93)

**Procedure**

- A Convenient sample of 60 subjects between the age of 40 to 70 years were recruited for this study after screening the subjects according to the inclusion and exclusion criteria. The subjects in Group A received High voltage pulsed current for 30 minutes, 5 times a week for about 4 weeks. The high voltage stimulator was used with a direct monophasic pulsed current and twin spikes of 5 µs. Separate by an interpulsed interval of 75µs, monopolar stimulation was used with electrode placed around Knee and the current intensity was at submotor level i.e. too weak to elicitate a visible motor response. The frequency was 120pps.
- The subjects in group B received Interferential Therapy for 20 minutes, 5 times a week for about 4 weeks. The interferential therapy Unit was used with frequency 4000Hz, Beat Frequency of 80-100 Hz, Base-60Hz, Sweep- 40Hz and using Rectangular waveforms. Gradually the IFT output intensity was increased until the ‘normal’ tingling is encountered by the patient.
- Both the above Groups Received Exercises under supervision for 4 weeks after receiving respective currents. The exercises were progressed in every week. All exercises were given for 3 sets and 10 repetitions.

**Week-1:**

1. Isometric hamstring contraction
2. Terminal knee extension

**Week-2**

Week 1 Exercises were discontinued And following exercises were continued with Progression till Week 4.
1. Dynamic quadriceps
2. Hamstring curls
   - Week- 3
   1. Dynamic quadriceps with adding 0.5 kg weight.
   2. Hamstring curls with 0.5 kg weight
   3. Mini squats\(^{32}\):
   - Week- 4
   1. Weight was increased to 1 kg in above exercises.
   2. Partial lunges

**Results**

- Table 2 shows the Intragroup Analysis of mean of variables using paired t-test pre & post intervention in Group A (HVPC) indicating that there was significant difference observed in all the variables pre and post intervention (p < 0.05)
- Graph 2b shows Intrigual analysis of mean WOMAC score pre & post intervention in Group A. indicating the intragroup comparision of Mean values of WOMAC score. There was significant difference observed with p < 0.05
- Table 3 show the Intragroup analysis of mean of variables using paired t-test pre & post intervention in Group B (IFT).The above data indicates that there was significant difference in all variables intervention (p < 0.05) in Group B
- Table 4and graph 4a shows inter group comparison of mean difference (Pre and Post value) of NPRS in both the groups using unpaired t- test which was Significant with p value < 0.05 And Table 4 and graph 4b shows inter group comparison of mean difference (Pre and Post value) of WOMAC in both the group using unpaired t- test which was insignificant with p value > 0.05.

**Discussion**

- The present study was done to Compare the effect of Interferential Therapy (IFT) and High Voltage Pulsed Current (HVPC) on pain and WOMAC in patients with Osteoarthritis knee where Group A was given (HVPC + EXS) and Group B was given (IFT + EXS). A total number of 60 subjects with chronic and Diagnosed case of Osteoarthritis knee Pain was Quantified using Numerical Pain Rating Scale (NPRS) Whereas Pain, Stiffness and Physical Function was assessed using WOMAC in subjects of both the Groups.
- The possible mechanism in reducing Pain could be decrease inflammation.A study conducted by Anna Polak et.al in 2013 suggest that the Mechanism that may promote healing is cellular electrotaxis of macrophages, neutrophils, and fibroblasts to the wound. Electrical stimulation (ES) activates the production of ATP and DNA, makes fibroblasts generate more collagen, and increases blood flow and capillary density.\(^{40-42}\) A study conducted by Griffin suggest that HVPC promotes wound healing in the early stages of treatment. HPVC applied for 5 days contributed to a significantly greater rate of healing in the HVPC group (p = 0.03).\(^{43}\) The possible mechanism by which pain is reduced is activation of pain gait mechanism or improved blood flow therefore removal of waste metabolites or improved muscle strength or joint mobility. The exact mechanism of HVPC in relieving pain is still under research. Also a study conducted by Akarcali et al in 2002 to evaluate its use for Patellofemoral pain which concluded that it is effective as a pain management and there was a significant advantage in the HVPC group in terms of pain management early in the treatment phase at 3 weeks. A possible reason for increase of WOMAC Score could be decrease in pain or improved muscle strength, So Patients were able to perform their ADL’s without discomfort.
- In Subjects treated with IFT, Pain reduction could be due to analgesic effect produced due to its action on gate control mechanism.\(^{33-36}\) Shah et al. in 2007 Suggested that IFT could stimulate local nerve cells that can have a pain reducing/anaesthetic effect due to potentially blocking the transmission of the pain signals or by stimulating the release of pain reducing endorphins.\(^{44}\) Interferential therapy is widely used for pain control. The rationale for this was provided by gate control therapy of pain proposed by Melzack and Wall.\(^{37}\) The input of mechanoreceptors reduces the excitability of nociceptor responsive cells to pain generated stimuli, thus producing a presynaptic or segmental inhibition. Noble et al. demonstrated vascular changes i.e. vasodilatation, the most likely mechanism therefore is via muscle stimulation effects (IFT causing muscle contraction which brings about a metabolic and vascular changes) which helps to reduce pain.\(^{38}\)
reason for increase of WOMAC Score could be decrease in pain and muscle spasm or improved muscle strength So Patients were able to perform their ADL’s without discomfort. A Study Conducted by Pallab Das, Manas K Dan in 2017 to Compare IFT versus Ultrasound To reduce Pain and Improve Functional Ability in Osteoarthritis of Knee And they Found IFT to be beneficial than Ultrasound and they suggest that Pain reduction could be due to analgesic effect produced due to its action on gate control mechanism\(^{33-36}\).

• The pain reduction in group A can be due to decrease inflammation and or due to its action on Pain gait mechanism or this would have increased pain threshold level. The pain reduction in group B can be due to analgesic effect produced due to its action on gate control mechanism\(^{33-36}\). And even The penetration of IFT is deeper as it is a medium frequency current hence it is more effective than HVPC\(^{39}\) There was an equal effect on WOMAC because the exercises Given were same in both the groups because of which the muscle strength would have increased or joint mobility is improved or stiffness is reduced in both the groups and also there was reduction in pain in both groups hence patients were able to perform their ADL’s without discomfort. Increased muscle strength may have a positive effect on pain and function Bischoff and Roos recommend both aerobic and strengthening exercises to improve pain and function in patients with OA\(^{45}\).

**Conclusion**

Thus in the present study the intervention given to both the group was shown to be effective, where the intervention given in Group B was found to be more effective therefore IFT with EXS has shown more Effective in Treatment of Osteoarthritis knee in reducing pain and disability.

**Limitations and Recommendations**

**Limitations:**

• Lack of literature about High Voltage Pulsed Current in relieving pain.

• Strength was not been assessed Pre and Post intervention.

**Recommendations:**

• Future studies can be done using Strengthening Protocol.

• Future studies can be done by using more different outcome measures.

**Source of Funding:** Self

**Conflict of interest:** nil

**References**


The Effects of Kinesio Taping and Isometric Exercises on Pain in Primary Dysmenorrhea – A Comparative Study

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Abstract

Primary dysmenorrhea is the most common problem faced worldwide affecting majority of women. The present study is aimed to compare the effect of kinesiotaping and isometric exercises on pain in females with primary dysmenorrhea.

Materials and Method: In this randomized controlled clinical trial, 40 students females aged between 18-25 years with primary dysmenorrhea were randomly assigned to kinesiotaping and isometric exercises group. Pain intensity was measured using Visual Analogue Scale (VAS) and premenstrual symptoms were assessed using Menstrual Distress Questionnaire (MDQ- C). Data were analyzed using paired and unpaired t-test. P<0.05 was considered statistically significant.

Results: Both kinesiotaping and isometric groups showed reduction in pain on VAS and MDQ (P<0.001). However in post treatment analysis, Kinesiotaping was proved to be better than isometric exercises.

Conclusion: Kinesiotaping seems to be an effective method for reducing pain in primary dysmenorrhea.

Keywords: Isometric exercises, Kinesiotaping, Pain, Primary dysmenorrhea.

Introduction

Dysmenorrhea is the occurrence of painful cramps during menstruation affecting quality of life. There are two types of dysmenorrhea namely primary and secondary. Prevalence of dysmenorrhea was reported as 84.2% in India.¹

Primary dysmenorrhea usually presents during adolescence, within three years of menarche. Pain usually starts in first menstrual cycle itself. Affected women experience sharp, intermittent spasms of pain, usually centred in the suprapubic area, which may radiate to the back of the legs or the lower back. There is no structural abnormality or pathology in Primary dysmenorrhea. It occurs due to increase in prostaglandin secretion resulting in increase in uterine activity thereby constricting the blood supply to tissue of endometrium, which in turn breaks down and dies. These uterine contractions continue as they squeeze the old, dead endometrial tissue through cervix and out of the body through vagina. Due to these uterine contractions and the resulting temporary oxygen deprivation to nearby tissues, pain or “cramps” are experienced during menstruation.²

The Premenstrual syndrome has been described as the commonest psycho-neuro-endocrine-stress related disorder and is a major clinical entity affecting large fraction of female population. Symptoms occurring during primary dysmenorrhea include at least one of the first four symptoms like depressed mood, tension or anxiety, lower back pain, decreased activity changes in appetite. Physical symptoms include breast tenderness, headaches, bloating or distension of abdomen, and muscle pain. Other symptoms includes nausea, vomiting, diarrhoea, fatigue, nervousness and dizziness. Females are dependant on medications for pain and complementary or alternative medicine include vitamins, supplements, Transcutaneous Electrical Nerve Stimulation (TENS), acupuncture, medicinal plants aromatherapy, reflexology, acupressure, massage therapy, and exercises.³
Dysmenorrhea is the most common complaint of young female disturbing their quality of life and absenteeism from their work. Despite ongoing medical advances, many women still depend on medications to cope up with menstrual pain, which may result in drug addiction. A study by Sara et al showed that Isometric exercises helped in reducing Primary dysmenoorheal pain. A study done by Jung Hyug et al showed that Kinesio Taping and Hot Pack helps in premenstrual syndrome. Another study revealed that Kinesio taping had significant effects on menstrual pain. No study was done to compare the effects of Isometric exercises and Kinesio-taping on menstrual pain. Thus, the aim and objectives of this study were to study compare the effects of kinesiotaping and isometric exercises on pain in primary dysmenorrhea. It was hypothesised that there is no significant difference (H0) or a significant difference (H1) between the effectiveness of Kinesio Taping and Isometric exercises on the pain and premenstrual symptoms in primary dysmenorrhea.

Materials and Method

The study design was experimental-clinical trial that was conducted on 40 subjects as calculated by formula through purposive sampling in PCMC area, Pune for 6 months. The inclusion criteria for this study were females between age group of 18-25 years, having regular menstrual cycle with menstrual pain score on VAS minimum 5. The exclusion criteria were subjects suffering from secondary dysmenorrhea that is associated with structural abnormality like any pathology, infection (like fibroid, endometriosis and ovarian cysts etc.), complaints of low back pain due to any other pathology, any skin infection, sensitive skin or allergic to Kinesio Tape and subjects on medication to reduce dysmenorrhea. The materials used for this study were Kinesio Tape (5cm x 5m) and Scissors.

Outcome Measures

Visual analogue scale (VAS)–is a unidimensional measure of pain intensity, determined by measuring the distance (mm) on 10cm line. A higher score indicates greater pain intensity. Menstruation distress questionnaire (MDQ) Form C- is a standard method for measuring perimenstrual symptoms. It is a 46-item self-report inventory. Permission to access to use the scale taken from author Rudolf Moos through MINDGARDEN by info.mindgarden.com.

Procedure

Ethical committee approval was obtained. Subjects with primary dysmenorrhea fulfilling the inclusion criteria were selected. Written consent was taken from the selected subjects. 40 subjects were selected on basis of inclusion and exclusion criteria. Random allocation was done in 2 groups using chit method namely Group A which included 20 subjects that underwent Kinesio Taping and the Group B which included 20 subjects that underwent Isometric Exercises. Pre-treatment assessment of pain was done by taking menstrual history of each subject and pain intensity was scored using outcome measures, Visual analogue scale (VAS) and Menstruation distress questionnaire (MDQ).
Subjects in group A underwent taping a total of six times twice a week for about three weeks starting from 14 days before menstruation until its end. For this group, a piece of Kinesio tape, with corners cut in round, 5 cm in width and 7–8 cm in length was applied right from below the navel and reached to where the pubic hair began (Figure 2), and another piece of tape 10 cm in length was applied to make a cross shape with the first piece. Another piece of tape was applied to low back (Figure 3). Subjects in group B performed isometric exercises since the third day of their menstrual cycle 5 days a week, two sessions a day, and 10 times per session for 8 weeks.

The protocol of Isometric Exercises were 1) Sleeping in supine position, facing feet to each other, pressing feet on each other, holding for 5 sec, and relaxing. 2) Sleeping in supine position, putting feet crossed and pressing them on each other, holding for 5 sec, and relaxing. 3) Sleeping in supine position, bending knees and thighs, putting a pillow between two knees, pressing knees to each other, holding for 5 secs, and relaxing. 4) Going back to the third position, putting hand below waist and pressing waist to the ground, holding for 5 sec, and relaxing. 5) Sleeping in supine position, bending knees and thighs and trying to raise head and neck above the ground level, holding for 5 sec, and relaxing. 6) Sleeping in supine position, bending knees and thighs and trying to move head and neck toward the right thigh, holding for 5 sec, and relaxing. After Completion of interventions post assessment of pain was done using VAS and MDQ.

Findings

Analysis of the experimental data was made possible by means of statistical tests. Statistical analysis was performed by using Graph Pad instat3 and Microsoft excel. Descriptive statistics was to find out Mean, Standard Deviations for outcome variables. Paired t-test was used to analyse significant difference in pre post treatment VAS and MDQ values within the same group. Unpaired t-test was used to analyse the level of significance between the post mean values of VAS and MDQ of both the groups. Unpaired t-test was used to analyse the pre-treatment values between both the groups to check if they were comparable or not. Microsoft Excel was used to generate graphs and tables.

Table 1: Showing pre and post treatment values of Group A and Group B on VAS and MDQ

<table>
<thead>
<tr>
<th>Outcome Measures</th>
<th>Group</th>
<th>Pre Treatment (Mean ±SD)</th>
<th>Post Treatment (Mean ±SD)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAS</td>
<td>A (Kinesio Taping)</td>
<td>7.7900 ±1.0398</td>
<td>5.8000 ±1.10596</td>
<td>&lt;0.0001*</td>
</tr>
<tr>
<td></td>
<td>B (Isometric Exercises)</td>
<td>8.3050 ±0.92763</td>
<td>7.1500 ±1.30243</td>
<td>0.0002*</td>
</tr>
<tr>
<td>p value</td>
<td>0.106</td>
<td>0.018*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MDQ</td>
<td>A</td>
<td>85.7000 ±23.94533</td>
<td>74.2500 ±23.32578</td>
<td>&lt;0.0001*</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>94.4000 ±21.92907</td>
<td>88.2400 ±23.3005</td>
<td>&lt;0.0001*</td>
</tr>
<tr>
<td>p value</td>
<td>0.238</td>
<td>0.0768*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1 shows pre and post treatment VAS values of group A (p value<0.0001), extremely significant and of group B (p value=0.0002), significant. The post mean value between group A and group B (p value=0.018), considered extremely significant on pain using VAS. Difference of group A was more than group B, which showed that the intensity of pain reduced more in kinesiotaping. The pre and post treatment MDQ values of group A (p value<0.0001), extremely significant and of group B (p value<0.0001) were extremely significant. The post mean value between group A and B (p value=0.076) were extremely significant on pain using MDQ. Difference of group A is more than group B, which shows intensity of pain was reduced more in kinesiotaping.
Discussion

Primary Dysmenorrhea causes significant pain and discomfort in majority of females. The increase in uterine production and release of prostaglandins at menstruation gives rise to abnormal uterine activity, causing uterine hypoxia and pain. Prostaglandins such as prostaglandin E2 and cyclic endoperoxides hypersensitise pain fibers in the pelvis and uterus. A reduction in prostacyclin may enhance uterine activity and vasoconstriction, which gives rise hypoxia and pain.

The first objective of this study was to study the effect of Kinesio-taping on menstrual pain. Kinesio taping is used for treating various musculoskeletal problems, created by Dr. Kenso Kase in 1970’s. It is based on use of special elastic strips, which mimics the density and elasticity of human skin. It is an auxiliary treatment that maximizes natural recovery ability and corrects the balance of the human body by adjusting electromagnetic flows on the skin, indirectly stimulating muscles or organs right under the skin using non chemically-treated tape. When the muscle is inflamed, the space between skin and muscle is constricted and outflow of lymphatic fluid is compromised. Kinesiotaping normalizes muscular function, increases lymphatic and vascular flow resulting in expansion of skin interstitial space. Kinesio tape applied to the lower abdomen would have stimulated the tactile fibres in the skin suppressing the pain sensitizing action of prostaglandin in the spinal cord, thereby reducing menstrual pain. Kinesiotaping applied, helps in reducing tension of pelvic area and thus reducing the compression by uterine contractions. Application of kinesio tape increases the blood supply to the area applied by vasomotor reflex, causing vasodilation of arteriole. Kinesiotaping helps in facilitating bleeding and excretion of wastes containing prostaglandin which causes contraction.(10)

The second objective of this study was to study the effect of Isometric exercises on menstrual pain. Isometric exercises strengthens pelvic muscles, facilitating bleeding, and facilitates excretion of wastes containing prostaglandin which causes contraction. Isometric exercises activate constant muscles which are of A-delta type and C fibres and reduce pain via inhibitory effects on pain.(4) The third objective of this study was to compare the effects of Isometric exercises and Kinesiotaping on menstrual pain. It was found that Kinesiotaping helped reduce the pain better than isometric exercises. Kinesiotaping increases proprioception by providing constant cutaneous afferent stimulation through the skin and decreasing pain through neurological suppression. It helps in realigning fascial tissue function by normalising muscle tension.(7) All these factors contribute in reducing pain.

Limitations and Scope of the Study

There is limited opportunity for long term follow-up as well as there are large number of questions in menstrual distress questionnaire which might have caused subjects not to properly answer the items. Further studies could involve kinesiotaping with other intervention for better effect.

Conclusion

Considering the results of this study shows that Kinesio Taping is more effective on pain in primary dysmenorrhea as compared to Isometric Exercise. This study indicates the benefits of kinesiotaping on pain in primary dysmenorrhea which can be applied in severe pain, for immediate effect.

Conflict of Interest: Nil

Source of Funding: Self

Ethical Clearance: Taken from ethical committee.

References

Effect of Rhythmic Stabilization Exercise v/s Conventional Physiotherapy on Pain and Disability with Patients of Chronic Mechanical Low Back Pain

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Abstract

Purpose: The purpose of this study was to find out the effect of rhythmic stabilisation (RS) on pain and disability on chronic mechanical low back pain (CMLBP). 60 individual who had complaints of CMLBP were randomly assigned to one of the two groups: the RS group (n=30) and conventional group (n=30). The exercise program of the experimental group consisted of RS. The control group performed back muscle strengthening exercises. Over the course of four weeks, the groups participated in or performed strengthening exercises for 30 minutes, 5 times per week. Subjects were assessed a pre-test and post-test using Visual Analogue Scale (VAS) and Modified Oswestry Low Back Pain Disability (MOD) Questionnaire.

Results: The results showed that low back pain significantly improved in the experimental group, and that the MOD questionnaire significantly decreased. However, there were no significant changes in the control group.

Conclusion: This study showed that RS can be used to improve low back pain and disability. The findings indicate that the experimental group experienced greater improvement than the control group by participating in the rhythmic stabilization program.

Keywords: Chronic low back pain, rhythmic stabilisation, pain, disability

Introduction

Low back pain is an extremely common symptoms in the general population affecting up to 85% and is the most common disability in those under the age of 45. It is tiredness, discomfort, or pain in the low back region, with or without radiating symptoms to the leg or legs¹. Population is facing number of obstacles in their daily life. The main causative factor that can cause low back pain is poor posture while sitting, standing, and lifting heavy weights². Low back pain may be mechanical or non-mechanical in nature, and mechanical condition related with chronic low back pain. Mechanical pain is the general term that refers to any type of back pain caused by placing abnormal stress and strain on muscles of the vertebral column³. A number of interventions used to treat low back pain include the use of physical exercise aiming to activate abdominal and/or back extensor muscles with the goal of reducing pain and disability⁴. Exercise can be prescribed for patients with chronic low back pain with three distinct goals. The first and most obvious goal is to improve back flexibility and strength, and to improve performance of endurance activities. The second goal of exercise is to reduce the intensity of back pain. The third and most important goal of exercise is the reduction of back pain–related disability⁵. Neurophysiologic studies have linked pain development in the lumbar spine region with disturbances in the mechanoreceptors and probably with impairment of the superior proprioception centres. Therefore, exercise programs that enhance proprioception may be beneficial for managing chronic low back pain. Proprioceptive neuromuscular facilitation (PNF) exercises are designed to enhance the response of neuromuscular mechanisms by stimulating proprioceptors. The primary goal of proprioceptive neuromuscular facilitation treatment is to help patients achieve their highest level of function⁶. Rhythmic stabilisation is one a proprioceptive neuromuscular facilitation technique. Indications for rhythmic stabilisation include Limited range of motion, Pain particularly when motion is attempted. The rhythmic stabilisation technique uses alternating isometric
contractions against resistance, no motion intended. The therapist applies multidirectional resistance by placing manual contact on opposite sides of the body. As the patient holds the selected position applies resistance simultaneously in opposite direction7.

**Methodology & Materials**

**Study Design:** Experimental study.

**Study Population:** Patients having Low back pain for more than 3 months of duration were included as per the inclusion criteria.

**Study Setting:** Out-patient department of Physiotherapy, M.A. Rangoonwala College of Physiotherapy & Research Centre, Pune.

**Sample Size:** 60 subjects aged between 20 to 40 yrs.

**Group A:** Rhythmic stabilization (n=30)

**Group B:** Conventional therapy (n=30)

**Study duration:** 4 weeks

**Inclusion Criteria:**
1. Age 20-40 years.
2. Both male and female.
3. Back pain more than 3 months.
4. Non-specific low back pain i.e mechanical
5. Pain intensity 1 to 6 on visual analogue scale

**Exclusion Criteria:** (Any history of)
1. Sign of nerve root pain.
2. Spine pathology.
3. Spondylosis and spondylolisthesis.
4. Past history of vertebral fracture.
5. Systemic disease like tuberculosis of spine
6. Abdominal surgery
7. Renal disease
8. Spondylitis

**Outcome Measure**
1. Visual analogue scale
2. Modified Oswestry Low Back Pain Disability Questionnaire

**Study Method and Procedure**

**Study Participants**

A convenient sample of 60 subjects between the age of 20 to 40 years included for this study after screening the subjects according to the inclusion and exclusion criteria. The subjects then divided equally into 2 groups by chit method:

1. Group A received rhythmic stabilisation exercise
2. Group B received conventional therapy

**Study Design**

Subjects are evaluated at the beginning of the therapy and re-evaluated after 4 weeks. This is done to note the changes after the treatment.

**Method:** Subjects selected randomly following the inclusion and exclusion criteria, and evenly divides into 2 groups:

**Group A: (rhythmic stabilization)**

30 subjects randomly selected in this group. They received rhythmic stabilisation exercises 5 times a week for 4 weeks with supervisions.

**Rhythmic Stabilization**

- Participants performed 3 sets of 15 repetitions at maximal resistance hold it for 8 sec for both lumbar flexors and extensors.
- Rest interval between the repetitions was for 30 secs and between sets was for 1 min.
- Total treatment was taken 30 mins

**Procedure**

- Resist an isometric contraction of the patient’s trunk flexor muscles. “Stay still, match my resistance in front”.
- Next, take all the anterior resistance with left hand and move right hand to resist trunk extension. “Now start matching me in back, hold it.”
- As the patient responds to the new resistance, move left hand to resist trunk extension. “Stay still, match me in back.”
- The direction of contraction may be reversed “Now hold in front again. Stay still. Now start matching me in the back.”
**Group B: (Conventional Therapy)**

**Procedure**

- 30 subjects randomly selected in this group. They received conventional back exercises 5 times a week for 4 weeks with supervisions for 2 weeks and 2 weeks unsupervised.
- Group B regard as the control group which include conventional back exercises.
  1. Cat and camel
  2. Single Knee to Chest Stretch for both legs
  3. Abdominal curl ups (one with only cervical flexion and second with half curl up)
  4. Bridging
  5. Unilateral straight leg lowering for both legs
- Each exercises performed for 10 repetition of above exercises with 5 second hold.
- Rest interval between the repetitions was for 30 secs and between sets was for 1 min.
- Total treatment time is taking 30 mins.

**Progression**

<table>
<thead>
<tr>
<th>Group</th>
<th>1st and 2nd Weeks</th>
<th>3rd Week</th>
<th>4th Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROUP A</td>
<td>3 sets of 15 repetition with 8 sec hold</td>
<td>4 sets of 15 repetition with 10 sec hold</td>
<td>5 sets of 15 repetition with 12 sec hold</td>
</tr>
<tr>
<td>GROUP B</td>
<td>10 repetition and 5 sec hold each exercise</td>
<td>13 repetition and 8 sec hold each exercise</td>
<td>15 repetition and 10 sec hold each exercise</td>
</tr>
</tbody>
</table>

**Statistical Analysis**

**Rhythmic stabilization group**

**Table 1: Comparison of the pre and post VAS and ODI scores in rhythmic stabilization group using paired t test**

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>t value</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAS</td>
<td>PRE</td>
<td>30</td>
<td>4.53</td>
<td>1.224</td>
<td>27.625</td>
</tr>
<tr>
<td></td>
<td>POST</td>
<td>30</td>
<td>1.20</td>
<td>0.805</td>
<td></td>
</tr>
<tr>
<td>ODI</td>
<td>PRE</td>
<td>30</td>
<td>13.33</td>
<td>3.809</td>
<td>33.202</td>
</tr>
<tr>
<td></td>
<td>POST</td>
<td>30</td>
<td>4.80</td>
<td>3.167</td>
<td></td>
</tr>
</tbody>
</table>

Table demonstrate comparison of the pre and post VAS and ODI scores in rhythmic stabilization group using paired t test. After 4 weeks intervention of rhythmic stabilization shows significant result (p=0.001)

**Conventional group**

**Table 2: Comparison of the pre and post VAS and ODI scores in conventional group using paired t test**

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>t value</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAS</td>
<td>PRE</td>
<td>30</td>
<td>4.13±1.383</td>
<td>16.089</td>
</tr>
<tr>
<td></td>
<td>POST</td>
<td>30</td>
<td>2.50±1.196</td>
<td></td>
</tr>
<tr>
<td>ODI</td>
<td>PRE</td>
<td>30</td>
<td>12.80±3.210</td>
<td>23.084</td>
</tr>
<tr>
<td></td>
<td>POST</td>
<td>30</td>
<td>8.60±2.699</td>
<td></td>
</tr>
</tbody>
</table>

Table 2 demonstrate comparison of the pre and post VAS and ODI scores in conventional group using paired t test. After 4 weeks post intervention control group shows significant results (p=0.001)

**Table 3: Comparison of the mean difference (pre-post) VAS & ODI scores among both the groups using unpaired t test (N=60)**

<table>
<thead>
<tr>
<th>Mean difference</th>
<th>Group</th>
<th>Mean</th>
<th>t value</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAS</td>
<td>Conventional</td>
<td>1.63±0.556</td>
<td>10.781</td>
<td>&lt;0.001**</td>
</tr>
<tr>
<td></td>
<td>Rhythmic stabilization</td>
<td>3.33±0.660</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ODI</td>
<td>Conventional</td>
<td>4.20±0.996</td>
<td>13.761</td>
<td>&lt;0.001**</td>
</tr>
<tr>
<td></td>
<td>Rhythmic stabilization</td>
<td>8.53±1.407</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3 demonstrate comparison of the mean difference pre and post VAS & ODI scores among both the groups using unpaired t test. There was a significant improvement post 4 weeks of intervention.

**Discussion**

The aim of study was to find out the effect of rhythmic stabilization exercise in nonspecific low back pain. It primarily aimed to assess the effect of 4 weeks rhythmic stabilisation on pain and disability. There was statistically significant difference in VAS score readings of the 2 groups when analysed using paired t-test but clinically it was found that group A, which received rhythmic stabilization showed better results than group B which received conventional exercises.

This study showed a considerable decreased in VAS score in group A. Muscles are made up of fibres that
stretch and contract in order to do something. Myotatic stretch reflex that gives signal to the muscle to contract if it senses that it is being overstretched. A Golgi tendon organ which signals the muscles to relax when your tendons are stretched too far\textsuperscript{8,9}. Proprioceptive Neuromuscular Facilitation (PNF) utilizes both of these sensory responses in its approach to improving pain, flexibility, range of motion and even strength. When PNF exercises are performed correctly, the client will eventually adapt them into their everyday movements, thereby sloppy postures and habits putting chronic strain on the muscles, causing soreness, stress and eventually leading to injury will be corrected and their muscle spasms and pain will decrease greatly\textsuperscript{1}.

Rhythmic stabilization group also showed an improvement in functional ability could be seen as a direct result of reduction in pain and improving flexibility thereby providing further support for the effectiveness of rhythmic stabilization exercises for chronic low back pain treatment\textsuperscript{7}.

Rhythmic stabilization exercises are based on co contraction of antagonistic muscle groups to maintain trunk and whole body position, we can assume that this technique improved significantly static strength of the associated musculature and perhaps muscle co-ordination. Trunk stabilization is a necessary requirement for performing several everyday tasks such as rising from a chair or carrying an object. In these movements, the trunk muscles work almost in an isometric fashion to maintain trunk integrity\textsuperscript{4}.

The present study showed a considerable decrease in VAS score in Group B also, where intervention was given in the form of conventional back exercises. This is supported by the Systematic Review based on Exercise Therapy for Low Back Pain, done by Maurits van Tulder, which shows significant reduction of pain after conventional exercises in chronic low back pain. As there is pain reduction due to exercises there is improvement in functional ability in daily life.

As the study shows difference in VAS and ODI in both groups but statistically group A that is rhythmic stabilization shows better improvement in both outcome measures. When rhythmic stabilization are performed, the ability of skeletal muscles to trigger tensile force that is obtained at an early period greatly contributes to neural responses, not adaptive changes in the muscles themselves. Such proprioceptive responses to stimuli lead to repetitive contraction of the muscles, causing concurrent contraction of the rectus abdominis, oblique abdominal, and transverse abdominis muscles. Consequently, concurrent contraction of the spinal stabilization muscles occurs, and muscle strength is increased, raising internal abdominal pressure and strengthening the trunk, helping functional movement of the human body, greatly effecting an increase in lumbar flexibility and a reduction of low back pain. This leads to greater ability to perform day to day activity, leads to improvement in disability\textsuperscript{10}K.Yong Park, KyoChul, Seo. (2014). The Effects on the Pain Index and Lumbar Flexibility of Obese Patients with Low Back Pain after PNF Scapular and PNF Pelvic Patterns. Journal of Physical Therapy And Science, 26(10), pp 1571-1574.

The results of Oswestry disability index (ODI) when analysed with paired t-test showed significant difference (p ≤ 0.05) in all the 2 groups but clinically it was found that group A, which received rhythmic stabilisation showed better results than group B which received conventional exercises. Kumar, Zutshi and Narang (2011) did a study to examine the efficacy of trunk proprioceptive neuromuscular facilitation (PNF) training on chronic

Hence based on our present study, Experimental group showed significant improvement in pain and disability in chronic low back pain patient as compared to conventional group.

Conclusion

Present study concludes that the Rhythmic stabilization reduces pain and improves disability after 4 weeks of intervention when compared with Conventional treatment.

Limitations

- No follow-up was taken to see the durability of the effects of the treatment.
- Only chronic cases were taken.

Recommendations

- Investigation of long term effect of rhythmic stabilization programme with large number of sample and longer session can be assessed.
- Other age group criteria should be include.

Ethical Clearance
This study was approved by ethical committee of our institute.

Source of Funding: self

Conflict of Interest: NIL

Reference


Comparison of Sensory Threshold in Healthy Adult Feet Using Semmes Weinstein Monofilament: A Cross Sectional Study

Smitha D\textsuperscript{1}, Muhammed Arshad\textsuperscript{2}

\textsuperscript{1}Associate Professor, \textsuperscript{2}Post Graduate, Yenepoya Physiotherapy College, Yenepoya (Deemed to be University), Mangaluru, Karnataka

Abstract

\textbf{Background:} Sensory threshold is defined as the point at which increasing stimuli triggers the start of an afferent nerve impulse. Semmes-Weinstein Monofilament testing is a useful tool in predicting the diabetic patients at risk for ulceration of the feet. So the purpose of this present study is to document the sensory threshold of healthy adult feet covering all the points of dorsum and plantar aspect using 20 piece monofilament kit.

\textbf{Method:} A cross sectional study was conducted among the healthy adults in the age group 18-24 years using Semmes-Weinstein Monofilaments. The participants were blindfolded in long sitting position, 19 points were marked on the plantar and dorsal aspect of the foot. Each filament of Semmes-Weinstein Monofilament was applied on the marked point’s perpendicular to the skin till the pressure could bend it in a ‘c’ shape for 1-2 seconds. Order of application of the Semmes-Weinstein Monofilament was from 1.65 to 6.65 (stiffness of Semmes-Weinstein Monofilament), then it was done in reverse order.

\textbf{Results:} The results of this study revealed that Semmes Weinstein Monofilament sensory threshold ability in the lower extremity varies with the area of skin tested. In the upward direction, R5 and R3\textsuperscript{rd} toe showed more sensitivity for females and males respectively. R5 and L5 showed highest sensitivity for females and males respectively while testing in the reverse order. Comparison between males and females showed significant difference at all points except left medial heel.

\textbf{Conclusion:} The study concluded that there is a significant difference in sensory threshold between males and females and their left and right feet but no significant difference was found in changing the direction of monofilament order.

\textbf{Keywords:} Semmes Weinstein Monofilament, sensory threshold, sensitivity, stiffness order.

Introduction

Sensory threshold is defined as the point at which increasing stimuli triggers the start of an afferent nerve impulse. Sensory examination is one of the most common parts of the clinical neurological evaluation. The main elements in the sensory examination consist of segmental and peripheral nerve testing of the cutaneous sensibility. The purpose of the sensory examination is to localize neurologic pathology by looking for distributions of sensory loss.\textsuperscript{1}

While the target sites of examination are spread to the whole body, the examination for a particular part of the body contributes to a diagnosis of a specific pathology or the assessment of a specific physical performance. Plantar sensation appears to play an important role to regulate stepping during human gait and is also known to contribute to certain aspects of postural control.\textsuperscript{1}

The dorsum and the plantar aspect of the foot are supplied by different nerves.\textsuperscript{2} Various methods exist for determining cutaneous sensibility like testing for fine...
touch using cotton swab, two point discrimination using aesthesiometer, tactile localization etc., among which Semmes Weinstein monofilament test is also used which has a greater reliability.3

The Semmes-Weinstein Monofilaments are single fiber nylon threads attached to a rod that generate buckling stress. Each monofilament is of different thickness, representing a logarithmic force on a base 10, with a range of 1.65 (the lowest) up to 6.65 (the highest), needed to bend the monofilament.3 Three monofilaments commonly used to diagnose peripheral neuropathy are the 4.17, 5.07 and 6.10. Forces required to bend these monofilaments are 1, 10, and 75g, respectively.4

Semmes-Weinstein Monofilament testing is a useful tool in predicting the type of diabetic patients at risk for ulceration of the feet. Literature suggests 5.07 to be the threshold for protective sensation. Based on the normal values stated in the literature, the inability to feel a Semmes-Weinstein Monofilament of 5.07 (as in diabetic neuropathy) represents a sensory threshold that is more than 50 times greater than normal. This means that roughly 98% of the sensory ability has been lost.5, 10

Although several studies in the literature have evaluated the abnormal sensory thresholds of diabetic feet to Semmes-Weinstein monofilament testing, there is very limited data on the sensory thresholds of individuals without diabetes or peripheral neuropathy.6, 8, 9

To the authors knowledge only one study on Indian population has been reported in which the normal sensory threshold of very few points on the dorsum of foot has been documented using 6 monofilament kit.7 So the purpose of this present study is to document the normal sensory threshold of healthy adult feet covering all the points on the dorsum and plantar aspect using 20 monofilament kit.

Materials and Method
Method of data collection

Prior to the study, the participants were explained about the study and an informed consent was obtained. Participants were screened based on the inclusion and exclusion criteria. The participants who were between age group 18-24 years of either gender were included in the study. The participants were excluded if they had history of any significant injury or previous surgery of the foot or ankle and any known medical condition associated with decreasing foot sensation (diabetes, leprosy, syringomyelia, myelomeningocele, hereditary neuropathy). 72 males and 72 females were recruited for the study by purposive sampling method. The sample size was calculated at 5% level of significance and 80% power.

Procedure: This study was done using Semmes-Weinstein Monofilament 20 piece kit. The participants were blindfolded and 19 points were marked on the plantar and dorsum aspect of the foot.6 Each filament of Semmes-Weinstein Monofilament was applied on the marked points perpendicular to the skin till the pressure could bend it in a ‘c’ shape for 1-2 seconds and participant response was asked. Order of application of the Semmes-Weinstein Monofilament was from 1.65 to 6.65, then it was done in reverse order. A positive threshold response was recorded when the participant felt the filament and accurately located where on the foot, the stimulus had been applied.1

Location of testing area7

Statistical analysis: Data was expressed in terms of mean and SD using paired and unpaired ‘t’ test. P<0.05 was considered to be statistically significant.

Findings

When the monofilaments were tested on the right feet in the downward direction for the females(Graph 1), more sensitivity (less sensory threshold) was observed at R 5 and less sensitivity (more sensory threshold) at R14 (right sole of heel). In the left leg, maximum sensitivity was observed over L 5 (little toe) and minimum sensitivity over L 14. The results showed significant change at three positions R4-L4, R11-L11, R12-L12 (p <0.05).
For the males, it was found that the maximum sensitivity for the right feet was at 3\textsuperscript{rd} toe and minimum sensitivity was at R 14. In the left leg, 3\textsuperscript{rd} toe had maximum sensitivity and minimum sensitivity was at L14. The results showed significant change at the level R 11 - L 11, R 12 - L 12, R 5th MT – L 5th MT. (Graph 2)

For males the maximum sensitivity was over Right 3\textsuperscript{rd} toe and minimum sensitivity over R 14, of right leg of the participants. The left leg showed maximum sensitivity over L 3\textsuperscript{rd} toe and minimum sensitivity over L 14. The results showed significant change at the level R 11 - L 11, R 12 - L 12 and R 5\textsuperscript{th} MT- L 5\textsuperscript{th} MT.
### Table 1: Comparison between mean value of male and female foot sensitivity using monofilament in downward direction (n=144)

<table>
<thead>
<tr>
<th>Position&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Mean ± SD</th>
<th>P</th>
<th>Mean ± SD</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Right&lt;sub&gt;F&lt;/sub&gt;</td>
<td>Right&lt;sub&gt;M&lt;/sub&gt;</td>
<td>P</td>
<td>Left&lt;sub&gt;F&lt;/sub&gt;</td>
</tr>
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<td>1</td>
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<td>3.88 ± 0.30</td>
<td>&lt;0.001</td>
<td>3.64 ± 0.34</td>
</tr>
<tr>
<td>2</td>
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<td>3.86 ± 0.30</td>
<td>&lt;0.001</td>
<td>3.64 ± 0.35</td>
</tr>
<tr>
<td>3</td>
<td>3.64 ± 0.31</td>
<td>3.84 ± 0.31</td>
<td>&lt;0.001</td>
<td>3.65 ± 0.31</td>
</tr>
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<td>4</td>
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<td>3.59 ± 0.32</td>
</tr>
<tr>
<td>6</td>
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<td>&lt;0.001</td>
<td>3.73 ± 0.29</td>
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<td>7</td>
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<td>&lt;0.001</td>
<td>3.79 ± 0.25</td>
</tr>
<tr>
<td>8</td>
<td>3.82 ± 0.22</td>
<td>3.97 ± 0.22</td>
<td>&lt;0.001</td>
<td>3.83 ± 0.22</td>
</tr>
<tr>
<td>9</td>
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<td>4.01 ± 0.22</td>
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<td>4.04 ± 0.20</td>
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<td>3.86 ± 0.21</td>
</tr>
<tr>
<td>11</td>
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<td>3.96 ± 0.24</td>
<td>&lt;0.000</td>
<td>3.86 ± 0.20</td>
</tr>
<tr>
<td>12</td>
<td>3.87 ± 0.19</td>
<td>3.98 ± 0.23</td>
<td>0.002</td>
<td>3.90 ± 0.19</td>
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<tr>
<td>13</td>
<td>3.95 ± 0.17</td>
<td>4.08 ± 0.22</td>
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<td>3.97 ± 0.18</td>
</tr>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; W</td>
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<tr>
<td>3&lt;sup&gt;rd&lt;/sup&gt; T</td>
<td>3.62 ± 0.22</td>
<td>3.73 ± 0.23</td>
<td>0.007</td>
<td>3.64 ± 0.22</td>
</tr>
<tr>
<td>5&lt;sup&gt;th&lt;/sup&gt; MT</td>
<td>3.66 ± 0.21</td>
<td>3.77 ± 0.25</td>
<td>0.009</td>
<td>3.68 ± 0.21</td>
</tr>
<tr>
<td>M-h</td>
<td>3.83 ± 0.20</td>
<td>3.92 ± 0.20</td>
<td>0.010</td>
<td>3.86 ± 0.21</td>
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<tr>
<td>L-h</td>
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<td>0.002</td>
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</tr>
</tbody>
</table>

<sup>a</sup> Each position represents points on the foot.

The data showed highly significant difference (p<0.05) for all areas except left medial heel.

### Table 2: Comparison between mean value of male and female foot sensitivity using monofilament in upward direction (n=144)

<table>
<thead>
<tr>
<th>Position&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Mean ± SD</th>
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<td>3</td>
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<td>3.84 ± 0.31</td>
<td>&lt;0.001</td>
<td>3.65 ± 0.31</td>
</tr>
<tr>
<td>4</td>
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<td>3.81 ± 0.31</td>
<td>&lt;0.001</td>
<td>3.67 ± 0.31</td>
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<td>3.76 ± 0.29</td>
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<td>13</td>
<td>3.96 ± 0.17</td>
<td>4.09 ± 0.21</td>
<td>&lt;0.001</td>
<td>3.97 ± 0.18</td>
</tr>
</tbody>
</table>
Table 2: Comparison between mean value of male ...

<table>
<thead>
<tr>
<th>14</th>
<th>4.04 ± 0.16</th>
<th>4.15 ± 0.23</th>
<th>0.003</th>
<th>4.04 ± 0.16</th>
<th>4.14 ± 0.19</th>
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<tbody>
<tr>
<td>1st W</td>
<td>3.61 ± 0.23</td>
<td>3.76 ± 0.24</td>
<td>&lt;0.001</td>
<td>3.62 ± 0.24</td>
<td>3.75 ± 0.21</td>
<td>&lt;0.000</td>
</tr>
<tr>
<td>3rd T</td>
<td>3.61 ± 0.22</td>
<td>3.74 ± 0.24</td>
<td>0.002</td>
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<td>5thMT</td>
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<td>3.77 ± 0.25</td>
<td>0.005</td>
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<td>3.81 ± 0.19</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>M-h</td>
<td>3.83 ± 0.21</td>
<td>3.92 ± 0.20</td>
<td>0.006</td>
<td>3.86 ± 0.21</td>
<td>3.93 ± 0.21</td>
<td>0.058</td>
</tr>
<tr>
<td>L-h</td>
<td>3.86 ± 0.21</td>
<td>3.98 ± 0.21</td>
<td>0.001</td>
<td>3.90 ± 0.18</td>
<td>3.99 ± 0.19</td>
<td>0.006</td>
</tr>
</tbody>
</table>

1st W= 1st web space, 3rd T= 3rd toe, 5th MT= 5th metatarsal, M-h= medial heel, L-h= lateral heel, F= female, M= male, a= each position represents points on the foot.

The above data shows highly significant difference (p<0.05) for all points except Left-Medial heel. (Table 2)

Discussion

This study provides information about the sensory threshold in healthy adult feet covering all the points of dorsum and plantar aspect using 20 monofilament kit. The study was done on 144 healthy adults of which 72 were males and 72 females. None had any history of significant injury or previous surgery to the foot or ankle or any other medical conditions associated with decreased foot sensation.

Most of the current literature regarding Semmes Weinstein monofilaments has concentrated on validating the 5.07 monofilament as a test to distinguish the presence or absence of protective sensation in patients with diabetes mellitus. Lower thresholds would always cause more sensitivity and can be useful in earlier disease identification through loss of sensation.

A study by Clifford Jeng showed that the lesser toes and the arch were the most sensitive followed by the hallux and the plantar metatarsal heads. The least sensitive site was the heel. The present study showed that more sensitivity for the right and left leg was shown at R5 (lesser toe) and L5 and less sensitivity at L14 (left sole of heel) and R14 in the healthy adult females feet. For the males more sensitivity was at right and left 3rd toe and less sensitivity at R14 and L14 using monofilament stiffness position downward and upward. A study by Clifford Jeng also supports the result of this study that there are significant differences between sites, between subjects, and in some instances, between right foot and left foot values. Jeng et al had concluded that there were significant changes among the increasing and decreasing monofilament stiffness order which is not supportive for this study.

The finding in the study by Collins et al concluded that the right foot was significantly more sensitive than the left, because the left foot was always examined second, but this difference was not considered probably clinically significant for any individual patient. The present study also found that the sensitivity is more in right when compared to left foot.

The values for the females ranged between 3.56 ± 0.314 to 4.03 ± 0.168 for the right leg and 3.59 ± 0.320 to 4.04 ± 0.160 for the left leg (monofilament target forces of 0.16 to 1g). The values for right leg of males ranged from 3.73 ± 0.237 to 4.14 ± 0.241 and for the left leg it ranged from 3.75 ± 0.233 to 4.14 ± 0.192 (monofilament target forces of 0.4 to 1.4 g). A study done by B. Forest Plucknette et al developed age specific threshold values in the feet of healthy subjects of 18-34 age group which was 3.61(0.4g target force). This difference seen of higher threshold values in Indian population could be due to reduced use of footwear. A study by James A Birke suggested that sensory threshold was lower in females than males. The current study also found that sensory threshold value for females is lesser compared to males.

Conclusion

The study concluded that there is varied sensory threshold in healthy adult feet among men and women using Semmes Weinstein monofilament. The sensory threshold is higher among men as compared to women and the left has higher threshold as compared to the right foot. There were no significant changes found in sensory threshold monofilament stiffness order upward and downward.

Conflict of Interest: None

Source of Funding: Self

Ethical clearance: Yenepoya Ethics Committee, Mangalore
References


Comparison of Respiratory Function in Smokers and Non-smokers Using Peak Flow Meter: A Cross-Sectional Study

Snehal Patel1, Nidhi Parmar2

1Assistant Professor, Shrimad Rajchandra College of Physiotherapy, Bardoli, Gujarat, India, 2Clinical Therapist, Asian Physiotherapy Clinic, Surat

Abstract

Background: Smoking, especially cigarette smoking, is one of the main causes that lead to preventable deaths all over the world. As per an estimate drawn by World Health Organization, there are around 94 million smokers in India and amongst them 14 million are suffering from COPD. With the highly addictive nature of nicotine in cigarettes, smoking cessation is extremely difficult. It is the major cause of decline in respiratory functions and physical fitness in terms of both performance and endurance.

Aims of the study: The aim of this study is to evaluate and compare respiratory function in smokers and non-smokers.

Objectives: To improve the health status of community by inculcating the knowledge about hazards caused by smoking.

Materials and Method: After baseline assessment, the Peak Flow Meter was used to measure the PEFR and then the subject’s PEFR value was compared with the predicted PEFR value obtained from the PFM calculator from an android phone app. Percentage of those at a risk of respiratory dysfunction was obtained.

Results: Results revealed that on the basis of the difference in the PFM values, 32% of the population was at no risk of respiratory dysfunction and 68% population was at the risk of respiratory dysfunction. From which 39% population is in the Group B that is smokers.

Conclusion: The overall result of the present study suggest that an individual who is a smoker are prone to be at a risk of COPD as more percentage of smokers are suffering from respiratory insufficiency.

Keywords: Respiratory Dysfunction, PEFR.

Background

By the early 2030, tobacco related death would increase to about 10 million a year.

Among adults most deaths are from respiratory, vascular or neo-plastic disease or from tuberculosis; the death rates can be increased by smoking.


Smoker: Someone who, at the time of the study, smokes any tobacco product either daily or occasionally.

Non-smoker: Someone who, at the time of the study, does not smoke at all.

Ex-smoker: Some one who was formerly a daily or occasional smoker but currently does not smoke at all.

Once smoking has caused a disease, the disease is largely irreversible and progressive. The death toll from tobacco use is projected to rise from 5.4 million in 2004 to 8.3 million in 2030.

Introduction

In recent years, large household surveys have shown that in middle age, more than one third of men and a few percent of women smoke tobacco in India.

Globally, approximately 1.3 billion people currently smoke cigarettes or other products. Although cigarette consumption is leveling off and even decreasing in some countries, in India, the smoking population is still on rise and has been reported to be 26%.
Further, the number of smokers of any kind of smoking tobacco product in rural areas is higher than in urban areas. Further, a quarter of smokers develop chronic obstructive pulmonary disease.

It is the major cause of decline in respiratory functions and physical fitness in terms of both performance and endurance.

PEFR is a simple index of pulmonary function used in both research and clinical practice. It is effort dependent and reflects the status of the large airways. PEFR can be measured rapidly and easily even with the use of a portable light instrument called Wright’s peak flow meter, weighing about 100 grams. PEFR provides a good objective index to confirm diagnosis, control medication and monitor response to treatment.

During the last few decades, lung function tests have evolved from tools for physiological study to clinical investigations in assessing status of the respiratory tract. Narrowing of the airways reduces the ability to move air in and out of the lungs. The narrower the tubes, the lower will be the PEFR.

**Research Question**

Is respiratory function affected in smokers and nonsmokers?

**Objectives of the Study**

**Primary objective**

1. The aim of this study is to evaluate and compare respiratory function in smokers and non-smokers.

**Secondary objective**

1. To study the effect of tobacco smoking on the respiratory system.
2. To establish a correlation between chronic tobacco smoking and its effects on the parameters which were studied.
3. To create awareness in tobacco smokers about the effects of tobacco on their health.
4. To improve the health status of the community by inculcating the knowledge about hazards caused by smoking.

**Materials and Method:**

**Source of Study:** Villages near Bardoli.

**Study Design:** Cross-sectional Design.

**Sample size:** Approximately 100 subjects

**Participants**

- Smokers and non-smokers will be selected on the bases of inclusion and exclusion criteria mentioned below.

**Sampling Method:** Convenient Sampling.

**Materials used:**

- Peak Flow Meter
- Peak flow Meter prediction calculator on android phone.
- Consent form
- Subject Performa
- Pen & paper
- Sanitizer

**Inclusion criteria:**

**Group A:**

- Healthy male subjects with no past or present history of smoking
- Male subjects with the age between 25 to 55 years and BMI of 18.5 to 24.9

**Group B:**

- Healthy male subjects with the history of smoking for more than two years
- Male subjects who smokes five or more than five cigarettes per day
- Male subjects with the age between 25 to 55 years, with the BMI of 18.5 to 24.9

**Exclusion criteria:**

- Female subjects
- Male subjects with acute/chronic illness or any respiratory illness or those who work in places where lungs are affected by dust or fumes.
Male subjects with musculoskeletal, neuromuscular, allergic, or endocrine disorders or any kind of history of cardiac or respiratory surgery in past 6 months

Outcome measures:

- Peak Flow Meter. (Sensitivity: 90.3%, Specificity: 75.4%, Efficiency: 78.2%)

**Procedure:**

- The project was submitted to the local research committee. After approval from research committee and the university, the study was started.
- Subjects were screened for the inclusion and exclusion criteria from villages near bardoli.
- Before starting the study, the purpose of conducting the research and the general procedure was explained to the subjects and their doubts were cleared.
- Written consent was taken from all the subjects.
- Thereafter, gathered demographic data of the participant were put into Peak flow meter prediction calculator which predicted the normal value of the participant.
- Next, Peak Flow Meter was used as follows:
  - Instruction was given as follows:
    - Stand Straight & take a deep breath and fill lungs all the way.
    - Hold your breath while you place the device in your mouth, and close your lips around the mouthpiece.
    - Do not put your tongue inside the hole.
    - Blow out as hard and as fast as you can for 1-2 seconds.
    - You have to move the marker as far as you can.
  - The number where indicator stops is the peak measurement.
  - Each subject is given 3 chances to repeat the points from 1 to 5, with the duration of 10 seconds in each and the highest of the 3 numbers is recorded along with the zone that it belongs to.
  - After the collection of Subject’s PFR value, the difference between the estimated and the subject’s PFR was taken and the percentage was calculated:
    - If the Reading: 100L/min lower than predicted, was considered normal for Men.
  - Based on the percentage calculated for each participant, they were divided into various zones:
    - Green zone-(80-100%)
    - Yellow zone-(50-80%)
    - Red zone-(<50%)

**Statistical Analysis**

After collecting data, analysis was done to derive conclusion regarding the comparison of respiratory function in smokers and non-smokers using peak flow meter:

Subjects were analyzed on the basis of their peak flow rate.

Thereafter, the subject’s PFR value was compared with the predicted PFR value of PFM calculator.

Data was analyzed by using SPSS version 16. Data was expressed as mean and standard deviation for continuous variable or mean and standard deviation for categorical variables. The unpaired t-test was applied to compare the means of different groups of the study. This study has a p-value of <0.05, which is highly statistically significant.

**Table 1: Statistical analysis of PEFR between both groups.**

<table>
<thead>
<tr>
<th></th>
<th>Non-Smokers</th>
<th>Smokers</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>457.05</td>
<td>390.8</td>
<td>0.00038</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>78.72</td>
<td>107.97</td>
<td></td>
</tr>
<tr>
<td>Variance</td>
<td>6321.17</td>
<td>11897.30</td>
<td></td>
</tr>
</tbody>
</table>

Above table shows that there is a significant difference between both groups as the p-value is <0.05.

**Chart 1: Comparison of Total Percentage of study population at the risk of respiratory insufficiency on the basis of Peak Flow Meter between Group A and Group B.**
Results

This study shows that there is a significant difference of PEFR value between both the groups.

For normal distribution statistical analysis was done for their baseline demographic data, which includes the mean and standard deviation of physical parameters like height, weight, BMI, observed PEFR value, preferred PEFR value and percentage of pulmonary function in both groups.

The present study shows a significant difference in respiratory function between non-smokers and smokers, i.e. In non-smokers the mean value of observed PEFR is 457.05 l/min and in smokers it is 390.8l/min with respect to mean value of observed PEFR standard deviation in non-smokers is 78.72 and in smokers it is 107.97.

Comparing both the groups there is a vast difference between both the values in smokers. That is in non-smokers the mean value of predicted PEFR is 624.49 l/min and in smokers it is 624.44 l/min with respect to mean value of predicted PEFR standard deviation in non-smokers is 9.03 and in smokers it is 11.77.

By using PEFR and Peak Flow Calculator this study had also included about the respiratory insufficiency based on three different zones. In which, smokers are more prone for respiratory insufficiency. There is a significant difference between both the groups for all three zones.

The overall result of the present study suggest that an individual who is a smoker are prone to be at a risk of COPD as more percentage of smokers are suffering from respiratory insufficiency.

Discussion

The results revealed that on the basis of the difference in the PFM values, 32% of the population was at no risk of respiratory dysfunction and 68% population was at the risk of respiratory dysfunction.

From which 39% population is in the Group B, which is smokers.

Therefore, keeping in mind the result of our study we can say that there is considerable effect of smoking on a peak flow meter.

One possible reason for the decrease in PEFR could be inflammation, which is common and constant pathological finding in cigarette smokers. Earlier studies have reported that airway flow limitation occurs due to bronchial constriction caused by mediators of inflammation. Inflammation either directly or by increasing smooth muscle tone, indirectly, may cause airway fibrosis. All these changes promote wall thickness leading to airway narrowing and flow limitation. In addition, inflammation causes destruction of the alveolar walls attached to the airway contributing further to airflow limitation by deforming and narrowing the airway lumen.

All the following study co-related to our study

Hussain G et al who found that the mean value of PEFR was 379 L/min in non-smokers while it was 285 L/min in smokers. A.G.F. Brooks et al also showed that the PEFR was reduced in smokers when compared to non-smokers.

C.I. Backhouse who showed that the PEFR value is inversely proportional to the daily amount of cigarette smoked.

K.A. Qureshi et al has compared PEFR between smokers and non-smokers in Gujar and non Gujar population of Kashmir valley. They found that the values of smokers significantly lower than the non-smokers. They used both male and female smokers for study, which is contrary with my study.

Barbara et al showed no significant difference of PEFR between diabetic smokers and non-smokers, which is contrary to the present study.

K.M. Padmavathy found that significant reduction of PEFR in smokers than in non-smokers, which is consistent with the present study.

Conclusion

Peak Flow Meter is one of the non-invasive types of pulmonary function test that provide measurable feedback about the function of the lungs. It is a cost effective and easily available investigation for screening and detection of early changes in asymptomatic smokers, since symptoms due to smoking may appear late.

Therefore, it is concluded that value of PFM parameters are lower in active tobacco smokers than tobacco non-smokers. Lower pulmonary functions are associated with greater risk for lung disease, cardiovascular disease, cancer and other disease.
There is a significant difference between both the groups for all three zones. In which, smokers are more prone for respiratory insufficiency.

The overall result of the present study suggest that an individual who is a smoker are prone to be at a risk of COPD as more percentage of smokers are suffering from respiratory insufficiency.

So, aggressive tobacco control program aimed to inform the public about the hazards of tobacco use and to provide restriction on the use of or purchase of tobacco must be started.

**Conflict of Interest:** There is no conflict of interest involved.

**Source of Funding:** Uka Tarsadia University

**Ethical Clearance:** Approval by ethical committee was taken.

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Comparative Study of Percussor vs Hand Held Vibrator in the Treatment of Myofascial Trigger Point on Upper Trapezius Muscle

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Abstract

Background: Myofascial trigger point (Mtrpt) is associated with a nodule which is hypersensitive in nature on palpation in a taut band. During sitting and standing, upper trapezius undergo many low level activities which are related to the posture of the head. This frequent cause of strain in neck is seen in persons working at desk and computers or drives for prolong hours. Ergonomically due to poor posture most of the times upper trapezius is placed in a shortened position which led to decrease in the length of the muscle.

Objectives: To investigate whether there is difference in the effectiveness of Percussor and hand held vibrator in the treatment of Mtrpt on upper trapezius muscle on VAS and Pain Pressure Threshold.

Materials and method: Experimental trial in which 30 Mtrpt patients were randomly allocated to either Group A (Percussor) and Group B (Hand Held Vibrator). Outcome measures were Visual Analogue Scale (VAS) and Pain Pressure Threshold (PPT).

Result: There was significant difference seen in both the groups individually (p<0.05,CI=95%) but on comparison Group A was more effective than Group B in reducing the intensity of pain and increasing pain threshold.

Conclusion: This study conclude that both Percussor and Hand Held vibrator are effective individually in reducing the pain and increase the pain pressure threshold. But Percussor is more effective than Hand Held vibrator in the treatment of Myofascial trigger point in upper trapezius muscle.

Keywords: Myofascial trigger point, Percussor, Hand Held Vibrator, Pain Pressure Threshold, Trapezius.

Background

A hyperirritable spot in skeletal muscle is called as myofascial trigger point (Mtrpt). It is associated with a nodule which is hypersensitive in nature on palpation in a taut band. On compression Mtrpt may show typical referred pain, motor dysfunction, tenderness and autonomic phenomena. It can create weakness in muscle, reduce its flexibility and distort proprioception.¹ Myofascial pain symptoms arise after trauma that can be insidious on onset. These painful sensations felt by the patients can be rated in the form of intensity from mild-moderate. This induces muscle pain particularly known as “trigger” or “tender” points. Mtrpts of muscles ensure its particular pattern of pain; hence, muscles which might contain the responsible Mtrpts can be identified with the help of this pain pattern.¹

Mtrpts are commonly related with autonomic dysfunction which includes unusual sweating, dermal flushing, lacrimation, temperature and vasomotor fluctuation. Myofascial pain from cervical region can also led to neurologic symptoms like dizziness, improper balance and tinnitus. Apart from these symptoms functional complaints for instance reduced work tolerance, joint stiffness, fatigue, weakness and

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diminished muscle contraction. Paraesthesia, twitches, trembling, numbness and blurred vision are also some neurological symptoms which can be seen.\textsuperscript{2} Further more along with these symptoms disturbance in sleep, mood swings and stress can be observed. Chronic patients of Mtrpts must be examined carefully for perpetuating factors like abnormal posture, factors associated with ergonomics or hypothyroidism.\textsuperscript{2}

Classification of trigger points could be done as active and latent trigger points. Active trigger point generates pain without any compression. Extremely tender on palpation and produces characteristic referred pain pattern for the respective muscle, either with ischemic compression or without. It not only weakens muscle and its flexibility but also elicits local twitch response with compression or needle stimulation.\textsuperscript{1, 2} Latent trigger point is clinically silent with respect to sudden pain, it is painfull only on palpation. It has all the characteristics of an active trigger point and always has a taut band which increase muscle tension.\textsuperscript{3}

Palpation is the only method used for identification of Mtrpts which is currently been recommended and its reliability depends upon skilled expertise and clinicians. In flat palpation, application of pressure is done directly by using finger or thumb, which is at right angle to muscle fibre. In upper trapezius muscle, pincer grip is used for this palpation where the muscle fibres are held within therapist’s fingers & thumb where the muscle fibres are perpendicular to the direction of the pull. These fibres are rolled up in the grasp to examine the tissue.\textsuperscript{4}

Trigger point sites and pattern for pain referral

The most commonest and frequently occurring trigger point is found in upper region of the trapezius muscle and is seen along the upper part of the shoulder griddle about half way between the spine of scapula and the tip of the shoulder.\textsuperscript{5} Any activity of trigger point in this area, is the main cause of pain which is being referred up the side of the neck and from there to the base of the skill. Sometimes this pain can also be referred to the side of the head which may reach temple and back of the eye. In rare condition, there can also be another trigger point which is immediately below the previous one in the same muscle.\textsuperscript{5}

The other causes which end up in myofascial pain are structural inadequacies, uncomfortable tight garments, inflammatory diseases, alcohol toxicity and deficiency in growth hormone. Various treatment modalities are used in the treatment of myofascial pain which includes manual therapy, hot fermentation, electro therapy, ergonomics, stress reduction, dietary advice along with external supplements.\textsuperscript{6}

Out of this vibration therapy (VT) which is low in magnitude high in intensity (LIV) stimuli represents a safe way of delivering relevant mechanical signals to patients who find it difficult to exercise and built musculoskeletal power. A wide spectrum of frequency and settings can be applied by using vibration which will show its different effects on healthy and pathological tissues. VT is majorly being used for controlling pain, enhancing the muscle power and its flexibility, decreasing the onset of fatigue, rehabilitation acceleration along with improvement in bone density.\textsuperscript{7}

Repeated eccentric and concentric contractions caused by the VT changes the muscle tissue by increasing the blood flow, increased muscle temperature; improve pain threshold levels, visco elasticity and also neural efficiency.\textsuperscript{8}

The GK-3 Percussor is a prevailing, electro-mechanical soft tissue manipulation devise which has been used to treat myofascial trigger point, muscle spasm, muscle stiffness, postural drainage and has cushioning mob which covers a large area.\textsuperscript{9,10} The stroking action in multiple directions allows the therapist to reach both deep and superficial muscles in addition with the powerful motor gives a unique effective treatment; by delivering different rate cycles of transverse friction to the area of treatment which might be impossible by using hands.\textsuperscript{11}

A hand held vibrator is a therapeutic massager which applies vibration to the surface of the skin. Like other vibration therapy this vibrator also relieves muscular strain and encourage relaxation.\textsuperscript{12} There are only few literatures presently available which describes about the specification for vibrational therapy protocol; thereby increasing the uncertainties regarding the most effective vibration parameters. This study aim to compare the effect of Percussor Vs hand held vibrator in the treatment of Mtrpt on upper trapezius muscle.

\textbf{Materials and Methodology:} This experimental study was conducted on 30 patients having trigger point in upper trapezius muscle in Dr. D. Y. Patil College of Physiotherapy, Pimpri, Pune. Ethical clearance was obtained from institutional ethical committee board. Patients where included according to the eligibility
criteria; minimum one unilaterally palpable trigger point in upper trapezius muscle, pain duration > 1 month, individuals aging between the age group of 20 – 40 years and positive jump sign characterized by patient vocalization or withdrawal. Patients were excluded if they had any history of neck and upper back region fracture, referred pain due to cervical pathology, dermatitis over upper back region or taking corticosteroids. A written consent was obtained from all the participants. Patients were allocated to group A and group B by using chit method as it was simple random sampling. The purpose of this study was explained in detail to all the patients; any doubts regarding the same were answered by the therapist.

Procedure: The participants were made well versed with the sensation of algometer on unaffected part of the body before applying on the affected area. The therapist then palpated and examined upper trapezius muscle and marked the trigger points. The therapist placed the pressure algometer on the respective trigger point in such a manner that it will be perpendicular to the area to be tested. This pressure was increased steadily at a rate of 1Kg /second and 25N of weight was delivered over the respective trigger point. Patient was then asked to mark the intensity of pain on visual analogue scale (VAS). The pressure algometer was again placed in the same manner as earlier on the respective trigger point; pain pressure threshold (PPT) was measured. The treatment was given for 3 days once in a day on alternate bases. First assessment was done on day 1 prior to the treatment and last assessment was done on day 5 after the commencement of therapy. The Percussor group was given vibration which was set on 50Hz frequency for 5 minutes of duration. Patients were asked to exposed the tretament area during the time of assessment and treatment .The Hand Held Vibrator group received vibration for 5 minutes which was already set at 50 Hz.

Statistical Analysis: The data collected were analysed using PRIMER software (version 7). Total 30 participants were recruited in the study (GROUP A – 15; GROUP B -15) and statistical analysis was obtained from the observational values obtained from these participants before and after the treatment. The pre and post readings of each component of one group was compared with the respective component of the other group. Intra-group (within) comparison was done by using the paired t-test whereas for the inter-group (between) was done by using the unpaired t test. The level of significance was determined by p < 0.05 at 95% confidence interval. The normality of the data was analysed using Shapiro Wilk test using Win Pepi Software and determined as a normal distribution if the p > 0.05.

Result: The demographic distribution of gender and mean in Group A included 6 males (40%) and 9 females (60%) and in Group B, 2 males (13.33%) and 13 females (86.66%). The pre-treatment score of VAS was 9.493 and post score was 1.09 which suggests that there was statistically high significance (p<0.05) in the intensity of pain in Group A whereas in Group B was pre treatment score was 9.16 and post treatment was 6.10 which shows that there was statistically high significance (p<0.05) in the intensity of pain. The level of pain pressure threshold in Group A pre-treatment was 0.433 and post treatment was 2.24 whereas in Group B pre-treatment was 0.40 and post treatment was 1.06, which shows that there was statistically high significance (p<0.05) On comparing both the groups Group A was more effective than Group B in reducing the pain and increasing pain pressure threshold.

Comparison of differences of mean score between Group – A and Group –B
<table>
<thead>
<tr>
<th></th>
<th>Group A Pre</th>
<th>Group A Post</th>
<th>Group B Pre</th>
<th>Group B Post</th>
<th>P value</th>
<th>T value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual analog scale</td>
<td>9.5</td>
<td>1.09</td>
<td>9.1</td>
<td>6.1</td>
<td>0.001</td>
<td>17.198</td>
</tr>
<tr>
<td>Pain pressure threshold</td>
<td>0.43</td>
<td>2.24</td>
<td>0.4</td>
<td>1.06</td>
<td>0.001</td>
<td>9.915</td>
</tr>
</tbody>
</table>

**Discussion**

A better way of giving mechanical signals to the patients can be done by vibrational therapy (VT) having low magnitude and high intensity. A wide spectrum of frequency can be used for this application on both healthy and pathological tissues.\(^7\) Dnanielle Enrique (2015) in his study said that VT therapy increases both muscle function and flexibility. Also he told that the repeated eccentric and concentric contractions caused by the VT effect changes the muscle tissue, including increase blood flow, temperature, visco-elasticity and pain threshold.\(^8\)

The present study can be corellated from this result where the intensity of pain reduced drastically. Also mean VAS in Group A was found to be 8.4 whereas in Group B it was 3.05, which states that there was statistically high significance (p<0.05) between the respective groups.

In the present senario, on comparing both the vibratory modalities; Percussor group was proved to be highly significant in both the outcome measures i.e. by reducing the intensity of pain and by increasing pain threshold. There might be high possibility that the sponge cushioning around the applicator had covered more area during the intervention period and reduced the intensity of pain by its vibrational effect.\(^9\) Percussor also has multi-directional stroking effect, which creates both vertical and horizontal vibrations which leads to its efficient working. Also low frequency vibrations penetrate deeply into the muscles than high frequencies.\(^10\)

Many of the previous literature have used low to medium frequency which have given positive effect of vibrational therapy. The major mechanism behind it is the gate control theory where it showed how the activation of large nerve fibres took place and passes signals generated from muscle spindles and receptors. This muscle spindles and receptors helps activated vibrations to block the transmission of pain to the brain at the level of spinal cord. Some studies have also demonstrated the pathways by which modalities such as vibrational stimuli can actually drown out painfull stimuli at the level of the thalamus Cortex of the brain.\(^11\)

According to this study, Percussor and Hand Held Vibrator was individually effective. But on comparing, Percussor group prove to be more efficient in the trigger point treatment than Hand Held Vibrator. This might be because Hand held Vibrator has unidirectional pattern of stroking. It was also noisy during the time of application thereby reducing the sedative effect, which might have physcologically affected the alleviation of pain.\(^12\) Both the groups where individually effective, but on comparing Percussor group was more effective than hand Held vibrator.

**Conclusion:** Both Percussor and Hand Held vibrator are effective individually in reducing the pain and increase the pain pressure threshold. But Percussor is more effective than Hand Held vibrator in the treatment of Myofascial trigger point in upper trapezius muscle.

**Conflict of Interest:** Nil

**Source of Funding:** Self

**Ethical Clearance:** Taken from Institutional Sub-Ethics Committee of Dr. D. Y. Patil College of Physiotherapy, Pune.

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Matrix Rhythm Therapy as a Part of Early Intervention in Burn Patients to Improve their Quality of Life: A Systematic Narrative Review

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Abstract

This is a narrative review consists analysis of evidences on Matrix Rhythm Therapy (MRT). MRT is an advanced electrotherapeutic modality works on mechanical and magnetic vibrations which deliver physiological rhythmical oscillations, whose frequency changes according to the individuals’ tissue requirement. MRT is designed by Dr. Ulrich G. Randol for effective treatment and prevention of further disability of several orthopaedical and neurological conditions such as burns, scar healing, oedema, adhesions, fractures etc. Previous literature supports that MRT has a magnificent effect to improve quality of life in burn patients. Hence this present research review on MRT for the treatment of burn patients may be high-yielding for the physiotherapists to rehabilitate them as early as possible.

Keywords: Oscillation; Rehabilitation; Vibromassage.

Introduction

Matrix Rhythm Therapy (MRT) is an electrotherapeutic modality used most commonly in post-burn complications such as scar, contractures and skin flexibility majorly in post-traumatic second and third degree burn conditions.¹ MRT is a new encroachment which uses the concept of vibromassage in physical therapy and rehabilitation centres.² This therapeutic modality was developed by Dr. Ulrich G. Randoll (MD), which include the concept of vibromassage.² It pass mechanical and magnetic vibrations according to the body’s own characteristic.³ Compatibility of MRT with the natural vibration frequency of muscles is considered as its therapeutic effect.⁴

MRT restores the good tissue resonance. This technique is implemented to surrounding of scar tissue.¹ MRT combined with Stretching exercises provide better results in improving joint ROM. This therapeutic modality also improves sensory functions. Despite its evidence of usefulness, till date very limited literature is available on MRT.

Available articles from 2008 to 2018 were reviewed from various databases such as Pub-med, Springer, and Cochrane library using keywords: “MRT” and “MRT in burn rehabilitation”. Total No. of twenty-three articles were reviewed in this systematic narrative review (SNR).

Historical Background of MRT

The origin of MRT was in Germany by Dr. Ulrich Randoll at University of Erlangen, Munich, Germany. This therapeutic modality is a new invention of 21st century for management of pain and restricted mobility. Till now, to the best of our knowledge this was an only modality which varies its frequency according to tissue. Between the periods of 1989-1997, researcher discovered that cells of warm blooded animals oscillate rhythmically between the frequencies of 8-12 Hz. He also state that muscle also shiver between 8-12 Hz, which is a physiological frequency. MRT works on dynamic
biological frequency which was required for healing dynamic biological body.\textsuperscript{5} It was proved to be effective in conditions related to disturbance in microcirculation. It is used for various conditions such as perioperative domains, trauma surgery, for rehabilitation. This modality also works for pain management as well as treatment of chronic diseases of the nervous system, skeletal and locomotor system. The main aim of MRT is to convert pathology into physiology which is required for healing of tissues.\textsuperscript{5} Following study suggests that MRT is effective in curing post-complications to rehabilitate burn patients to improve their quality of life.

**Improve Range of Motion and Reduce Inflexibility**

Post-burn complications leads to reduction of flexibility and decreased joint ROM due to formation of contractures. This hampers the activities of daily living of burn patients. MRT is applied on the affected surface area to improve post-burn conditions. Stretching exercises combined with MRT implemented on affected joints to improve the ROM. This combination also helps to maintain flexibility in scar tissue which leads to increase joint ROM.\textsuperscript{1}

**Improve Sensory Functions and Muscular Strength**

Previous studies concise that MRT is effective in restoring sensory functions. In burn injury, patient’s sensory functions and muscular strength are also impaired. MRT is more effective than LASER treatment in restoration of sensations of affected parts. Muscular strength is also effectively improved with the application of MRT over the impaired region.\textsuperscript{9}

**Scar Contracture Correction**

MRT has been used to reduce scar contractures in burn patients. In post-burn complications, scar contractures and adhesions cause difficulty in performing ADL’s. Complications leads to restricted joint movements. MRT applied as longitudinal stroking by pushing the probe of device into the soft tissues around the scar and contractures.\textsuperscript{1}

**Discussion**

MRT is known to be an effective therapeutic modality in post-burn rehabilitation.\textsuperscript{1} It is a vibromassage method which pass mechanical and magnetic vibration according to the body’s own characteristic.\textsuperscript{3} Micro-vibrations onto the body surface that is being massaged is applied with an hand-held device.\textsuperscript{3} The application of MRT is based on longitudinal stroking by pushing the probe of device an electrically powered oscillator comprising an asymmetric head into the soft tissues.\textsuperscript{1,2} MRT is effectively used in case of post-burn injuries to improve scars, contractures and other complications related to burns. Burn injuries are one of the major problem in developing countries and causes global public health crises.\textsuperscript{6}

Most common etiological factors of burn are flame-fire, electricity, thermal injuries, automobile accidents, chemical substances, playing with the matches, improper handling of firecrackers and scalds caused by kitchen and bathroom accidents.\textsuperscript{7} Majorly female suffered from accidental thermal injuries from stove blast, pressure cooker blast, clothes catching fire accidentally and kitchen gas leaks.\textsuperscript{6} Burn incidences decreased in developed countries mainly in adult population because they are more aware about the management and prevention from burns.\textsuperscript{8} Mechanism of thermal injury may not closely correlate with child’s age.\textsuperscript{7}

Children continue to be vulnerable to burns in nuclear families due to lack of parental supervision and awareness of surrounding is a major reason for high accidental incidence of burns in children.\textsuperscript{7} Followed by burn injuries, scar tissues majorly affect hands in 83% of burn patients.\textsuperscript{1} Scar formation is a result of the wound-healing process in burn patients.\textsuperscript{1} Quality of life is compromised in burn patients with both physical and psychosocial aspect. Burn injuries cause some limitations in ADL’s. Physical limitations tend to improve after three months whereas, psychological distress persist over long period of time.\textsuperscript{10}

Women are more psychologically affected than men. Because, generally women are more concerned about cosmetic disfigurement, often caused by burn injury.\textsuperscript{10} This attitude of women reflects on their emotional field, sleeping area and general quality of life. Emotional distress is only strong predictor of QoL.\textsuperscript{10} According to some previous researches, MRT was found to be an effective part in burn rehabilitation. Various studies were done with second and third degree burn patients to analyse the effect of MRT. Majorly affected body part in burn injuries are hands because they are used as protection.\textsuperscript{1}

Skin and joint flexibility is decreased with scar formation in burns. The immediate goal of physiotherapy
is to maintain ROM and function of hand. Zübeyir Sari et al. said that stretching exercises combined with MRT helpful in maintaining ROM and provide elongation in scar tissue instead of improving muscle strength. MRT is beneficial because it accelerates cell regeneration in scar tissue. Application of MRT is widely used for musculoskeletal problems such as frozen shoulder, carpal tunnel syndrome, planter fasciitis etc. This modality is compatible with the natural vibration frequency of muscle which helps in creating therapeutic effectiveness of MRT.

Natural vibration of MRT helps in increasing blood circulation of skeletal muscles and provides oxygen and adenosine triphosphate (ATP) which helps to gain ROM and reduce pain. A comparative study of three different physiotherapy modalities used in burn was visualised. Total 39 patients selected for participation in this study. Pre-treatment and post treatment data was evaluated in terms of pain, pressure sense, discriminative sense, ROM, muscle force and skin elasticity. It was evaluated between intra-group and inter-group. In intergroup comparison, MRT-UT; MRT-LT; UT-LT were made of these three significant parameters.

PROM was increased in MRT and UT group more than LT group. Loss of motion and pain were common symptoms after scar and contracture development in burn patients. Increase in PROM in MRT group was result from micro-stretching characteristic of the treatment of scar. There was an increase in PROM in the UT group compared with LT group, results of non-thermal effect of the ultrasound. On examination of parameters, pain and sense was evaluated and significant difference was observed.

MRT has a positive effect on restoring sensory function. This modality rebalances the microprocesses upon which cell regeneration and cellular healing depend. In case of pain, it was significantly reduced in LT group than in UT group at the end of 15-session treatment program. Result of muscle force show a significant increase only in MRT group. Though, MRT was more effective in restoring muscle strength compared with other treatment modalities. There was no significant difference was observed on skin elasticity with all three different treatment modalities.

Conclusion

The studies performed on MRT provide significant evidence on efficacy of MRT in post-burn injuries as an early intervention for treatment of burn patients. Physiotherapists can use MRT to rehabilitate them as early as possible to improve their quality of life. MRT combined with stretching and conventional massage therapy gave better results in improving ROM in post-burn complications and other conditions. MRT was found to be more effective in restoration of sensory functions than LASER in burn patients. The effects of MRT in post-burn complications and detailed review of MRT application in burn rehabilitation are explained in this study. In limitation several contraindication of MRT in various pathological and medical conditions has not explained and we have found less number of evidences on MRT in post-burn rehabilitation.

Acknowledgement

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Conflict of Interest: The authors declare no conflict of interest

Funding: Nil

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4. Derya Celik, Nilgun Turkel ACA. COMPARISON OF MATRIX RHYTHM THERAPY AND STRETCHING EXERCISES ON FROZEN


A Correlational Study of Grip Strength Using Handheld Dynamometer and Rapid Upper Limb Assessment Score in Asymptomatic Bank Employees

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Abstract
In a randomized correlational trial 35 asymptomatic Bank employees of 30-50 age group, working atleast 6-8 hours a day in sitting posture doing desk job, were taken. Firstly, the subjects were observed assessed in their desk at their workplace by using RULA scoresheet. Later they were instructed, demonstrated the use of handheld dynamometer and an average of 3 readings was taken of the dominant hand. On Statistical analysis there was a strong correlation between the hand grip strength and Rapid Upperlimb Assessment Score found.

Keywords: Correlational, asymptomatic, Rapid upperlimb Assessment Score, hand grip strength.

Introduction and Background
Banking sector has gained immense workload as well as introduction of computers in the system for data entry, recovery; leading to increase in employment thus increase in upper limb musculoskeletal disorder incidents reported in last 3 decades.

Rapid technological development in the use of electronic data has affected both the employees and the workplace. In recent years rapid use of computers has changed the work environment drastically[3].

Asymptomatic individuals fall under the pre -clinical spectrum and thus, don’t visit a doctor or therapist for the same. In long term, these pre-clinical symptoms can manifest as serious musculoskeletal hazards and thus are to be handled as a priority.

Various factors like personal factors, work related factors, psychosocial factors can result in many health hazards like musculoskeletal disorder. From the literature review it is observed that musculoskeletal disorder is very common among bank employees

- Bank employees who do a desk job and frequently are associated with customers and video display terminals, computers such as bankers, data entry operators, general office clerks etc usually experience pain in neck, shoulder, back and wrist[10].
- Bank workers maintain a static position for more than 6 hours a day which leads to a higher stress on the upperlimb of the employees. Repetitive motion and continuous stress are the main causes of decreased upperlimb strength[10].
- The gold standard for measuring the strength of forearm muscle is by grip strength[8].
- Among the various work-related musculoskeletal disorders, tendon related disorders are most common followed by muscle related, nerve entrapment and joint related problems[3].
- Various method are now for assessing exposure including observational, instrumental or direct method self-reports and other psychosocial method.

Rapid Upper Limb Assessment Scale
RULA is a survey method developed for the use in ergonomics investigations of workplaces where work related upper limb disorders are reported. This tool requires no special equipment in providing a quick assessment of the postures of neck, trunk, and upper
limbs along with muscle functional and external load on the body\(^1\).

- The method uses diagrams of body postures and then scoring tables to provide evaluation of exposure to risk factors.
- The risk factors also include the external loads as described by McPhee\(^2\). These include:
  1. Number of movements.
  2. Static muscle work.
  3. Force.
  4. Work postures determined by equipment and furniture.
  5. Time worked without a break.
- As RULA is done without using any equipment it is feasible, easy to asses and assessment can be done in confined work places without disruption to the work force\(^1\).
- There are 2 groups, Group A includes upper arm, lower arm and wrist; Group B includes neck, trunk, and legs which might influence the position of upper limb.
- The range of motion of each body part is divided into section according to criteria derived through literature. The sections are numbered so that the number 1 represent minimum risk. Higher numbers are for parts with extremes f range and more of risk factors.
- Score A + muscle use and force score of group A = Score C
  Score B + muscle use and force score of group B = Score D
  Score C+ Score D = number score
  Number score is between: 1-7
  - Score 1 or 2 – posture is acceptable if not maintained or repeated for long periods
  - Score 3 to 6 – further investigations and changes may be required
  - Score 7 – immediate change in posture or work as there is high risk of upperlimb musculoskeletal disorder\(^2\).

### Grip Strength and Handheld Dynamometer

- The power of grip is the result of forceful flexion of all finger joints with a maximal voluntary force that the subject is able to exert under normal bio kinetic conditions.
- Nearly 35 muscles are required for hand grip, flexors bringing about the movement whereas extensors stabilizing the wrist. Grip strength is one of the main components tested while evaluating hand function and also provides an objective index of the functional integrity of the upper extremity\(^12\).
- Grip strength measurements are easy to calculate, but they are sensitive enough to detect even the smallest of changes in hand strength, which makes them especially useful when tracking the progress of a patient going through physical therapy. Grip strength is one of the main components tested while evaluating hand function and also provides an objective index of the functional integrity of the upper extremity\(^12\).
- Hand grip strength can be quantified by measuring the amount of static force that the hand can squeeze around a dynamometer. The force has most commonly been measured in kilograms and pounds, but also in millilitres of mercury and in Newton.
- The dynamometer handle is usually adjusted (if possible) to fit the hand or set at the same setting for everyone. The same setting should be used when retesting. The strength of the left and right hand can also vary, so the tests should be either be conducted on the same side, on the dominant side, or done on both sides and averaged. Several attempts are usually required to get the maximum score\(^5\).

### Objectives of the Study

- To assess the posture adapted by the bank workers using RULA scale (Rapid Upper limb Assessment).
- To assess the grip strength using hand dynamometer of the dominant side of bank employees.
- To study a correlation between Rapid Upperlimb Assessment score and Hand grip strength.

### Inclusion Criteria

- Asymptomatic individuals working in a Multinational bank.
- Age-30 to 50 years.
Exclusion Criteria

Individuals with:

- Known cardiovascular/ neuromuscular dysfunction.
- Any pain related to trauma or recent fractures (within 2 years).
- History of pre-existing metabolic, endocrine disorder or infection that might affect the musculoskeletal system.

Outcome Measure

- RULA SCORE IN NUMBER (1-7)
- HAND GRIP STRENGTH IN Kg (Position of use is in elbow 90 degree flexed and wrist in neutral in mid prone and wrist unsupported and squeeze around the dynamometer.

Methodology

· Institutional ethics committee approval was taken.
· Sample Selection (N=35) was done based on appropriate sampling technique.
· The procedure and need to conduct such a study was explained to the patient and informed consent was taken.
· RULA Score was found out using the scoresheet and observation of the components by the therapist in the working site that is the bank.
· The grip strength was measured using a handheld dynamometer, an average of the three readings were taken after demonstrating the procedure of how to handle the instrument.
· Data was collected and analysed using appropriate statistical method.
· Results and conclusions were drawn

Material and Method Used

· Rula (Rapid Upper Limb Assessment) score sheet.
· Hand grip dynamometer (reliability-99.72).\(^3\)
· Pen and paper.

Findings

Table 1: Descriptive Analysis

<table>
<thead>
<tr>
<th>Descriptive Analysis</th>
<th>Hand Grip strength</th>
<th>Final Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>21.64</td>
<td>5.305</td>
</tr>
<tr>
<td>Standard Error</td>
<td>1.30</td>
<td>0.228</td>
</tr>
<tr>
<td>Median</td>
<td>21.5</td>
<td>6</td>
</tr>
<tr>
<td>Mode</td>
<td>15</td>
<td>6</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>7.80</td>
<td>1.369</td>
</tr>
<tr>
<td>Sample Variance</td>
<td>60.84</td>
<td>1.875</td>
</tr>
<tr>
<td>Range</td>
<td>29.3</td>
<td>5</td>
</tr>
<tr>
<td>Minimum</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Maximum</td>
<td>35.3</td>
<td>7</td>
</tr>
<tr>
<td>Sum</td>
<td>779.04</td>
<td>191</td>
</tr>
<tr>
<td>Count</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>Confidence Level (95.0%)</td>
<td>2.639</td>
<td>0.463</td>
</tr>
</tbody>
</table>

Graph 1: Rapid Upperlimb Assessment Score

Interpretation of the Graph

Rula Score

It is observed from the above readings that the maximum population (n=12) of asymptomatic bankers fall in the RULA score reading of 6 that is considered to be investigated further and to change it as soon as possible. Which also interprets as the posture is harmful when continued for a long time.
Graph 2: Hand Grip Strength (Kg)

Interpretation of the Graph

Grip Strength

According to the graph maximum population had grip strength ranging from 10 to 15 which is way lower than the normal values of 27 for females and 33 for males.

Graph 3: Correlation between Score A and Hand grip strength (Kg)

Pearson’s correlation coefficient (r) = -0.830
n = 35

Pearson’s test of correlation was run to determine the correlation between 35 asymptomatic bank employees. There was a negative correlation between Score A on RULA score sheet (which specifies the position of upper limb) and Hand grip strength measure.

Graph 4: Correlation between Final RULA SCORE and Hand grip strength (Kg)

Pearson’s correlation coefficient (r) = -0.546
n = 35

Pearson’s test of correlation was run to determine the relationship between 35 asymptomatic bank employees. There was a negative correlation between the Final Score or RULA score sheet and the Hand grip strength measure.

Picture 1: At the site of study
Conclusion

The purpose of this study was to find a correlation between the Rapid upper limb assessment score and Hand grip strength using hand held dynamometer in asymptomatic bank employees. There were a very few studies those focussed on the pre-clinical spectrum of patients and checked the hand grip strength of the same.

According to statistical analysis it is found that the maximum population had a RULA score of 6 (n=12) which suggests there needs for further investigation and change it as soon as possible.[1] Similar studies have been done by Mrunal S. Baxi1 & Dr. Deepali N. Hande in Bank workers of Loni.[11]

The average Hand grip strength of the population is found out to be 21.64Kg which is lower than the normative values suggested by the studies done by Rajani P Mullerpatan, Gayatri Karnik, Rebecca John, which was found out to be 30.2Kg.[10]

From the study it was found out that there is negative correlation between the final RULA Score and hand grip strength which suggests that more the RULA score lesser is the hand grip strength.

There was also a negative correlation between score A and Hand grip strength.

The tasks that required continuous static position of the forearm at a greater angle than neutral, twisting of wrist, and repetition of terminal movements of neck and back have shown the maximum effect on the hand grip strength.[8]

Out of which the score of wrist extension and twisting at the wrist had a major impact on the RULA score; thus, may be believed to have affected the Hand grip strength.

The posture of wrist probably affects the length tension relation of the muscles of forearm mainly the long flexors of forearm as the wrist is kept in extension with elbow flexion to hold the mouse which probably stretches the actin myosin junction in the muscles for an extended period of time which may lead to an imbalanced length tension relationship.[15] Small muscle of hand such as intrinsic muscle of hand are constantly recruited for clicking of mouse and typing purpose.[6]

The imbalance in length tension relation of such long flexors of forearm and overuse of intrinsic hand muscles may lead to decrease in the force produced by them leading to decrease in the hand grip strength.[15]

As well as the relation of scapulohumeral misalignment due to long static posture of arm in shoulder flexion and protraction with unsupported forearm in the work environment may be considered as a cause of mechanical disadvantage for the force production by the muscles of upper limb as a whole.

Factors like use of keyboard, handling mouse for most of the time of work, using computer screen which are below eye level, maintaining static posture for longer time and infrequent breaks may pose serious threats for bankers not only related to the symptomatic pain regions like neck back and elbow.[6] but also the pre clinical decrease in hand grip strength.

To Summarize:

• The final Rapid Upper limb Assessment score and hand grip strength is negatively correlated in asymptomatic bank employees.
• The average Hand grip strength of asymptomatic bank populations is lowered as compared to the normative data of Indians.
• From this study we conclude that the tasks performed by the bankers posses a risk of decrease in hand grip strength requiring further investigation and ergonomic intervention as soon as possible.
• Ergonomic advice like:
  Lumbar support, padding below the wrist, frequent breaks and stretches for upper limb, neck and back after every 45 min should be administered at the institute level as this asymptomatic population will not approach a medical care centre.

Conflict of Interest: None

Source of Funding: Self

Ethical Clearance: It is by institutional ethical committee and Clinical trial registry-India.

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5. Hogrel JY. Grip strength measured by high precision dynamometry in healthy subjects from 5 to 80 years. BMC Musculoskelet Disord 2015;16:139.


Effects of Neural Mobilization on Electrophysiological Measures – A Quasi Experimental Design

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Abstract

The objective of the study was to identify effects of neural mobilization on electrophysiological measures of nerve (latency, velocity and amplitude) during and after neural mobilization in normal healthy individuals having normal neurodynamics and in patients diagnosed with median nerve entrapment neuropathy around the wrist joint (in altered neurodynamics of peripheral nerves). 30 normal healthy individuals and 30 patients with entrapment neuropathy of median nerve around the wrist joint were taken in the study. Pre neural mobilization, Motor and sensory nerve conduction studies of median nerve were performed and electrophysiological measures like distal latency, amplitude and velocity were taken. Median nerve mobilization – ULLT 2 was performed on participants. During neural mobilization and after neural mobilization (immediate after neural mobilization, after 10 minutes and 30 minutes) electrophysiological measures of median nerve were taken again. The results of the study shows that neural mobilization has no significant effects on all electrophysiological measures of nerve during and after neural mobilization in normal healthy individuals having normal neurodynamics and in patients diagnosed with median entrapment neuropathy around the wrist joint. Hypothesized effects of neural mobilization, in promoting physiological functions of nerve, have no effects in promoting electrophysiological measures of nerve.

Keywords: Neural mobilization, Entrapment neuropathy, Electrophysiological measures

Introduction

Neural mobilization techniques are passive or active movements that focus on restoring the ability of the nervous system to tolerate the normal compressive, friction and tensile forces associated with daily and sport activities. It consists of gliding and sliding techniques. Gliding techniques or ‘sliders’, are neurodynamic maneuvers that attempt to produce a sliding movement between neural structures and adjacent non-neural tissues and they are executed in a non-provocative fashion. Tensile loading technique restores the physical capabilities of nervous tissues to tolerate movements that elongate the corresponding nerve bed. It is important to emphasize that tensile loading techniques are not stretches; these neurodynamics maneuvers are performed in an oscillatory fashion so as to gently engage resistance to movement that is usually associated with protective muscle activity.

The nervous system is capable to adapt mechanical loads regardless of its underlying construct, and it needs to undergo various mechanical events like compression, elongation, angulation, sliding and cross-sectional change. Failure of these protective mechanism make nervous system vulnerable to neural oedema, ischaemia, fibrosis and hypoxia, which may cause further alteration in neurodynamics.

Neural mobilization is used for treatment of adverse neurodynamics, to restore the dynamic balance between...
the relative movement of neural tissues and surrounding mechanical interfaces, thereby allowing reduced intrinsic pressures on the nervous tissue and thereby maintaining physiologic function.4-6 The benefits of these techniques are facilitation of nerve gliding, dispersion of noxious fluids, reduction of nerve adherence, improvement of axoplasmic flow and increased neural vascularity.4-9

Carpal tunnel syndrome is caused by elevated pressure in the carpal tunnel; this elevated pressure produces ischaemia of the median nerve, resulting in impaired nerve conduction and attendant paraesthesia and pain. Early in the course, no morphological changes are observable in the median nerve, neurologic findings are reversible, and symptoms are intermittent. In carpal tunnel syndrome, prolonged or frequent episodes of elevated pressure result in segmental demyelination and constant and severe symptoms, occasionally with weakness. When there is prolonged ischaemia, axonal injury ensues, and nerve dysfunction may be irreversible.10

Nerve conduction studies are an important part of the complete electrodiagnostic examination. It includes recording electrode, reference electrode and ground electrode. A recording electrode is placed on the muscle innervated by that nerve and information about the impulse can be recorded including its latency, the distance traveled and the nerve conduction velocity can also be computed.11 These measures are a sensitive indicator of nerve damage and looks specifically integrity of the myelination of the nerve.12, 13 These measures are a sensitive indicator of nerve damage and looks specifically integrity of the myelination of the nerve.12, 13 The amplitude of muscle contraction provides information about number of functioning neurons within the nerve and can be measured and compared to the initial size of the signal. An isolated specific site of injury can be determined by stimulating the nerve in various points along its course. Both sensory and motor nerves may be tested.12, 13

The electrophysiologial changes of the motor and sensory axons during and after neural mobilization (stressing activities) are unknown in normal healthy individuals having normal neurodynamics of peripheral nerves and in altered neurodynamics like entrapment neuropathy of peripheral nerves. Hence, the purpose of the study is to identify direct effect of neural mobilization on motor and sensory axons as measured by electrophysiologial testing (distal latency, conduction velocity and amplitude) in normal healthy individuals having normal neurodynamics of peripheral nerves and in altered neurodynamics like entrapment neuropathy of peripheral nerves and thereby providing evidence to include neural mobilizations as a therapeutic intervention in altered neurodynamics of the peripheral nerves.

**Method**

A Quasi experimental study was carried out at Department of Electrodiagnosis and Electrotherapy, Ashok & Rita Patel Institute of Physiotherapy. Participants of the study were divided into two groups. Group A consisted of normal healthy individuals (n=30) while Group B consisted of patients diagnosed with median nerve entrapment neuropathy around the wrist (n=30).

Normal healthy individuals between age 18 – 25 years and having normal neurodynamics of peripheral nerves were recruited in Group A. Participants having any recent surgery of neck, shoulder, elbow or wrist, subjects with neurological symptoms, any systemic disease affecting nerves, musculoskeletal conditions causing restriction of cervical spine, shoulder, elbow, wrist and hand or inability to comply with the study protocol due to cognitive impairment were excluded from Group A.

Patients diagnosed with median nerve entrapment neuropathy around the wrist joint and age between 30-50 years were recruited in Group B. Patients having any recent surgery of neck, shoulder, elbow or wrist, any systemic disease affecting nerves, musculoskeletal conditions causing restriction of cervical spine, shoulder, elbow, wrist and hand or inability to comply with the study protocol due to cognitive impairment were excluded from Group B.

**Procedure**

On the day of testing a brief screening examination was performed and the participants were allocated in group A and B based upon inclusion and exclusion criteria. Signed informed consent were taken from the participants and oriented to the testing protocol.

Pre neural mobilization, Motor and sensory nerve conduction studies of median nerve were performed and electrophysiologial measures like distal latency, amplitude and velocity were taken. Median nerve mobilization – ULTT 2 was performed on participants. During neural mobilization and after neural mobilization...
(immediate after neural mobilization, after 10 minutes and 30 minutes) electrophysiological measures of median nerve were taken again.

**Statistical Analysis**

Data were tested for normality (Kolmogorov–Smirnov distance method). The pre neural mobilization data of electrophysiological measures were compared to that obtained during and after neural mobilization, using paired $t$ test for both groups using SPSS software version 16. Statistical significance was assumed if the $p$ value was $< 0.05$.

**Results**

A total of 30 (n=30) participants participated in Group A and 30 (n=30) patients with entrapment neuropathy of median nerve around wrist participated in Group B.

Descriptive analysis of electrophysiological measures in Group A is shown in Table 1 and comparison of means using paired $t$ test in Group A is shown in Table 2. Descriptive analysis of electrophysiological measures in Group B is shown in Table 3 and comparison of means using paired $t$ test in Group A is shown in Table 4.

**Table 1: Descriptive Analysis of Latency, Velocity (Elbow – Wrist Segment) and Amplitude in Group A**

<table>
<thead>
<tr>
<th>Measure</th>
<th>Distal Latency (in ms)</th>
<th>Proximal Latency (in ms)</th>
<th>Velocity (Elbow – Wrist Segment (in m/s)</th>
<th>Distal Amplitude (in mV)</th>
<th>Proximal Amplitude (in mV)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
</tr>
<tr>
<td>Pre Neural Mobilization</td>
<td>2.50 ± 0.46</td>
<td>6.50 ± 0.61</td>
<td>57.52 ± 6.84</td>
<td>13.40 ± 5.40</td>
<td>10.92 ± 4.84</td>
</tr>
<tr>
<td>During Neural Mobilization</td>
<td>2.47 ± 0.42</td>
<td>6.80 ± 0.62</td>
<td>53.93 ± 5.53</td>
<td>12.61 ± 5.40</td>
<td>11.01 ± 5.17</td>
</tr>
<tr>
<td>Immediate Post Neural Mobilization</td>
<td>2.68 ± 0.42</td>
<td>6.72 ± 0.60</td>
<td>57.30 ± 6.98</td>
<td>12.09 ± 4.59</td>
<td>10.81 ± 4.97</td>
</tr>
<tr>
<td>10 Minutes Post Neural Mobilization</td>
<td>2.68 ± 0.38</td>
<td>6.81 ± 0.72</td>
<td>56.44 ± 7.96</td>
<td>12.48 ± 5.52</td>
<td>10.94 ± 5.06</td>
</tr>
<tr>
<td>30 Minutes Post Neural Mobilization</td>
<td>2.79 ± 0.43</td>
<td>6.93 ± 0.68</td>
<td>55.67 ± 5.82</td>
<td>13.05 ± 5.60</td>
<td>11.55 ± 5.41</td>
</tr>
</tbody>
</table>

**Table 2: Comparison of Means of Latency, Velocity (Elbow – Wrist Segment) and Amplitude in Group A**

<table>
<thead>
<tr>
<th>Measure</th>
<th>Pair</th>
<th>t value (with df = 29 and 95% Confidence Interval)</th>
<th>p value (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distal Latency</td>
<td>Pre NM-During NM</td>
<td>0.762</td>
<td>0.452</td>
</tr>
<tr>
<td></td>
<td>Pre NM-Immediate Post NM</td>
<td>-3.61</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>Pre NM-10 Min Post NM</td>
<td>-3.107</td>
<td>0.004</td>
</tr>
<tr>
<td></td>
<td>Pre NM-30 Min Post NM</td>
<td>-4.385</td>
<td>0</td>
</tr>
<tr>
<td>Proximal Latency</td>
<td>Pre NM-During NM</td>
<td>-5.399</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Pre NM-Immediate Post NM</td>
<td>-3.836</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>Pre NM-10 Min Post NM</td>
<td>-4.079</td>
<td>0</td>
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<td></td>
<td>Pre NM-30 Min Post NM</td>
<td>-5.696</td>
<td>0</td>
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<tr>
<td>Velocity (Elbow – Wrist Segment)</td>
<td>Pre NM-During NM</td>
<td>4.789</td>
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<tr>
<td></td>
<td>Pre NM-Immediate Post NM</td>
<td>0.237</td>
<td>0.814</td>
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<tr>
<td></td>
<td>Pre NM-10 Min Post NM</td>
<td>1.09</td>
<td>0.285</td>
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<td></td>
<td>Pre NM-30 Min Post NM</td>
<td>2.306</td>
<td>0.028</td>
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<td>Distal Amplitude</td>
<td>Pre NM-During NM</td>
<td>1.542</td>
<td>0.134</td>
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<tr>
<td></td>
<td>Pre NM-Immediate Post NM</td>
<td>2.223</td>
<td>0.034</td>
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<td></td>
<td>Pre NM-10 Min Post NM</td>
<td>1.662</td>
<td>0.107</td>
</tr>
<tr>
<td></td>
<td>Pre NM-30 Min Post NM</td>
<td>0.642</td>
<td>0.526</td>
</tr>
<tr>
<td>Proximal Amplitude</td>
<td>Pre NM-During NM</td>
<td>-0.232</td>
<td>0.818</td>
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<tr>
<td></td>
<td>Pre NM-Immediate Post NM</td>
<td>0.267</td>
<td>0.792</td>
</tr>
<tr>
<td></td>
<td>Pre NM-10 Min Post NM</td>
<td>-0.035</td>
<td>0.972</td>
</tr>
<tr>
<td></td>
<td>Pre NM-30 Min Post NM</td>
<td>-1.192</td>
<td>0.243</td>
</tr>
</tbody>
</table>
Table 3: Descriptive Analysis of Latency, Velocity (Elbow – Wrist Segment) and Amplitude in Group B

<table>
<thead>
<tr>
<th>Measure</th>
<th>Distal Latency (in ms)</th>
<th>Proximal Latency (in ms)</th>
<th>Velocity (Elbow – Wrist Segment (in m/s)</th>
<th>Distal Amplitude (in mV)</th>
<th>Proximal Amplitude (in mV)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
</tr>
<tr>
<td>Pre Neural Mobilization</td>
<td>5.47 ± 1.52</td>
<td>9.58 ± 1.65</td>
<td>51.83 ± 5.32</td>
<td>9.65 ± 3.22</td>
<td>9.65 ± 3.22</td>
</tr>
<tr>
<td>During Neural Mobilization</td>
<td>5.55 ± 1.54</td>
<td>9.84 ± 1.76</td>
<td>49.71 ± 5.87</td>
<td>10.03 ± 3.69</td>
<td>10.03 ± 3.69</td>
</tr>
<tr>
<td>Immediate Post Neural Mobilization</td>
<td>5.55 ± 1.84</td>
<td>9.82 ± 1.81</td>
<td>49.82 ± 4.31</td>
<td>10.50 ± 2.33</td>
<td>10.50 ± 2.33</td>
</tr>
<tr>
<td>10 Minutes Post Neural Mobilization</td>
<td>5.48 ± 1.53</td>
<td>9.72 ± 1.76</td>
<td>50.38 ± 6.20</td>
<td>9.2 ± 3.36</td>
<td>9.20 ± 3.36</td>
</tr>
<tr>
<td>30 Minutes Post Neural Mobilization</td>
<td>5.50 ± 1.55</td>
<td>9.715 ± 1.69</td>
<td>50.48 ± 4.96</td>
<td>9.03 ± 2.32</td>
<td>9.03 ± 2.32</td>
</tr>
</tbody>
</table>

Table 4: Comparison of Means of Latency, Velocity (Elbow – Wrist Segment) and Amplitude in Group B

<table>
<thead>
<tr>
<th>Measure</th>
<th>Pair</th>
<th>t value (with df = 29 and 95% Confidence Interval)</th>
<th>p value (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distal Latency</td>
<td>Pre NM-During NM</td>
<td>-1.548</td>
<td>0.219</td>
</tr>
<tr>
<td></td>
<td>Pre NM-Immediate Post NM</td>
<td>-0.403</td>
<td>0.714</td>
</tr>
<tr>
<td></td>
<td>Pre NM-10 Min Post NM</td>
<td>-1</td>
<td>0.391</td>
</tr>
<tr>
<td></td>
<td>Pre NM-30 Min Post NM</td>
<td>-1</td>
<td>0.391</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proximal Latency</td>
<td>Pre NM-During NM</td>
<td>-4.028</td>
<td>0.028</td>
</tr>
<tr>
<td></td>
<td>Pre NM-Immediate Post NM</td>
<td>-2.447</td>
<td>0.092</td>
</tr>
<tr>
<td></td>
<td>Pre NM-10 Min Post NM</td>
<td>-1.039</td>
<td>0.375</td>
</tr>
<tr>
<td></td>
<td>Pre NM-30 Min Post NM</td>
<td>-1.216</td>
<td>0.311</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Velocity (Elbow – Wrist Segment)</td>
<td>Pre NM-During NM</td>
<td>4.507</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>Pre NM-Immediate Post NM</td>
<td>1.223</td>
<td>0.309</td>
</tr>
<tr>
<td></td>
<td>Pre NM-10 Min Post NM</td>
<td>0.989</td>
<td>0.396</td>
</tr>
<tr>
<td></td>
<td>Pre NM-30 Min Post NM</td>
<td>1.385</td>
<td>0.26</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distal Amplitude</td>
<td>Pre NM-During NM</td>
<td>-0.597</td>
<td>0.592</td>
</tr>
<tr>
<td></td>
<td>Pre NM-Immediate Post NM</td>
<td>-0.645</td>
<td>0.565</td>
</tr>
<tr>
<td></td>
<td>Pre NM-10 Min Post NM</td>
<td>0.87</td>
<td>0.448</td>
</tr>
<tr>
<td></td>
<td>Pre NM-30 Min Post NM</td>
<td>1.092</td>
<td>0.355</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proximal Amplitude</td>
<td>Pre NM-During NM</td>
<td>-1.318</td>
<td>0.279</td>
</tr>
<tr>
<td></td>
<td>Pre NM-Immediate Post NM</td>
<td>0.441</td>
<td>0.689</td>
</tr>
<tr>
<td></td>
<td>Pre NM-10 Min Post NM</td>
<td>-0.324</td>
<td>0.767</td>
</tr>
<tr>
<td></td>
<td>Pre NM-30 Min Post NM</td>
<td>1.226</td>
<td>0.308</td>
</tr>
</tbody>
</table>

**Discussion**

The findings of this study showed that neural mobilization has no significant effects on all electrophysiological measures (latency, velocity and amplitude) of nerve during and after neural mobilization in normal healthy individuals having normal neurodynamics and in patients diagnosed with median entrapment neuropathy around the wrist joint having altered neurodynamics.

In normal healthy individuals having normal neurodynamics, there is only significant effects of neural mobilization occurs in latency (except in distal latency during neural mobilization compared to distal latency of pre neural mobilization) and in velocity of
elbow – wrist segment during and after 30 minutes of neural mobilization compared to velocity of pre neural mobilization and in distal amplitude immediately post neural mobilization compared to distal amplitude of pre neural mobilization.

In patients diagnosed with median entrapment neuropathy around the wrist joint, neural mobilization has no effects on electrophysiological measures of nerve during and after neural mobilization except in proximal latency during neural mobilization compared to proximal latency of pre neural mobilization and in velocity of elbow – wrist segment during neural mobilization compared to velocity of pre neural mobilization.

Review of literature shows that neural mobilization is used for treatment of adverse neurodynamics, to restore the dynamic balance between the relative movement of neural tissues and surrounding mechanical interfaces, thereby allowing reduced intrinsic pressures on the neural tissue and thus promoting optimum physiologic function.4-6 The hypothesized benefits from such techniques include facilitation of nerve gliding, reduction of nerve adherence, dispersion of noxious fluids, increased neural vascularity and improvement of axoplasmic flow.4-9 But these hypothesized effects of neural mobilization in promoting physiological functions of nerve do not match with findings of this study in promoting electrophysiological measures of nerve.

Ginanneschi F et al (2015)14 in their study concluded that in entrapment neuropathies, neural mobilization during nerve elongation may generate conduction failure in peripheral nerve. During anatomical stress across the median nerve in elongation, compressive forces may exert mechanical traction on the median nerve, since it is ‘tethered’ at the carpal tunnel, resulting inactivation of Na(+) channels at the wrist, or impairment of energy-dependent processes which affect axonal conduction block. Findings of their study match with the findings of our study which shows significant changes in velocity of elbow – wrist segment during neural mobilization compared to velocity of pre neural mobilization in normal healthy individuals and in patients with entrapment neuropathy of median nerve around the wrist.

The amplitude of nerve conduction velocity study provides information about the number of neurons that are functioning within the nerve. No significant changes in amplitude in both groups of our study suggest that neural mobilization has no effects on number of neurons within the nerve during or after neural mobilization in normal healthy individuals and in patients with entrapment neuropathy of median nerve around the wrist.

Findings of this study need to be considered in relation to median nerve mobilization in normal healthy individuals and in patients with entrapment neuropathy of median nerve around the wrist. These findings cannot be generalized with other peripheral nerves and in other altered neurodynamic conditions or systemic axonal or demyelinating neuropathies. Sensory nerve action potential (SNAP) were not elicited in patients with entrapment neuropathy of median nerve around the wrist, so electrophysiological measures of compound motor action potential (CMAP) were only taken in this study. Sample size of the study was also small and as this was a feasibility study, the results cannot be considered accurate.

**Conclusions**

Neural mobilization has no significant effects on all electrophysiological measures (latency, velocity and amplitude) of nerve during and after neural mobilization in normal healthy individuals having normal neurodynamics and in patients diagnosed with median nerve entrapment neuropathy around the wrist joint.

**Ethical Clearance:** Taken from Institutional Ethical Committee.

**Source of Funding:** Self

**Conflict of Interest:** Nil

**References**


Unstable Surface is More Effective than Stable Surface to Improve Trunk Control in Post-Stroke Patients

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²Assistant Professor, Amity Institute of Physiotherapy, Noida

Abstract

Introduction: Stroke is the most common cause of morbidity worldwide, mainly affecting elderly population. As a consequence of stroke, it becomes difficult to have trunk control because of sensory and motor impairment of trunk muscles, while sitting and standing in doing everyday activities. Therefore trunk muscle exercises are indeed important and should be the part of rehabilitation in post-stroke patients. Alteration in exercise platform with small BOS enables the patient to engage many more trunk muscles together. This study is aimed to analyze the effect of Swiss ball activities on trunk control in post-stroke patient.

Methodology: A total of 30 post-stroke patients in the age group of 35 to 60 years participated in the study. The participants who met the inclusion criteria were selected and randomly assigned into two groups. The experimental group (Group A) received conventional physiotherapy along with Swiss ball protocol and the control group (Group B) receives only conventional physiotherapy, 4 times per week for 3 weeks. Trunk impairment scale was used to evaluate the trunk control.

Outcome Measure: Trunk Impairment Scale (TIS)

Results: Post intervention, both the groups improved on trunk control but the experimental group (Group A) improved more significantly than the control group (Group B). The mean difference of pre and post intervention in TIS score of Group A was 4.30 and Group B was 2.87 which is significant (p<0.05) in both the groups. The mean difference of post intervention TIS score of Group A and Group B was 1.36 with p value <0.05, which is significant

Conclusion: This study revealed a significant improvement in both the groups but experimental group (Group A) showed more improvement than the control group (Group B).

Keywords: Swiss Ball, Stroke, Trunk Control, Trunk Exercises, Trunk Impairment Scale, Postural Assessment Scale for Stroke.

Introduction

Stroke is the most common cause of morbidity around the world, mainly affecting elderly population. But nowadays, middle aged people are also getting affected because of the lifestyle and work load. The seriousness of a stroke relies upon the area and size of the deterrent which harms cerebrum tissues. Hemiplegia results in weakness of trunk muscles due to paralysis or nonuse of affected side.

Trunk plays a vital role to keep the body erect and gives base to the pelvis and spinal cord. The trunk act as a fulcrum which provide degree of freedom for distal limb movement, control, balance and functional activities¹, ². However, stroke patients lose control on balance and posture due to the weakness of trunk and reduced proprioception³, ⁴, ⁵. In addition, postural sway
increases in the sitting position\textsuperscript{6}, and subject unable to shift weight on either side\textsuperscript{7} and reduces the ability to coordinate functional activities.

These patients then move their limbs in unusual pattern to complete the action which results in much wastage of energy. After stroke, asymmetric weight distribution in sitting position with broad base of support and decreased degree of freedom, due to sensory-motor impairment of trunk, and is more likely to have early compensation\textsuperscript{8}.

Contrary to common belief that only one side is involved in stroke, trunk muscles are affected bilaterally because of the bilateral innervation\textsuperscript{9, 10}. Earlier studies reported the impairment of trunk flexors, extensors and trunk rotators of both sides which is measured by isokinetic dynamometer, when compared to the same aged healthy population\textsuperscript{11}. Transcranial magnetic stimulation and electrical stimulation studies have revealed that the trunk muscles are innervated by fibers from both brain hemispheres\textsuperscript{12, 13}. According to one of the recent studies on trunk control, it has been identified that trunk control is an important way out to predict the functional outcome post-stroke\textsuperscript{14, 15}.

Most researches and clinical practice of rehabilitation post-stroke target on more affected extremities without giving much attention to trunk control. Unlike upper and lower limb muscles, abdominals need pelvis, thorax and central aponeurosis as a stable base, depending upon the part of trunk which is moving. Counter-rotation between the upper and lower trunk, requires contraction of opposite side muscles work on the concept of mobility over stability. This movement is essential for all the functional movements in our daily activities. The rotation of the trunk allows the shortening of antagonist which draws the pelvis and thorax forwards. In addition the trunk rotators cannot work efficiently when there is approximation of origin and insertion when there is side flexion of spine. A recent study on dynamic posturographic analysis suggested that movement of trunk in post-stroke are executed mainly by upper trunk with reduced anterior tilting of pelvis which implies impairment of mobility over stability skills of the trunk\textsuperscript{16}.

Therefore trunk muscle exercises are indeed important and should be the part of rehabilitation in post-stroke patients. A randomized trial that added 10 hours additional trunk exercises to regular rehabilitation had a beneficial effect in improving trunk control, particularly the dynamic sitting postural control\textsuperscript{17}. In turn better trunk control improves the pelvic movement, balance and reduces the risk of fall.

An unstable surface, Swiss ball plays an important role in strengthening the trunk muscles by recruiting many muscles together without increasing the total load. An unstable surface increases activation of the rectus abdominis and increases degree of freedom per exercise when compared to a stable surface\textsuperscript{18}. Although many physiotherapists working with post-stroke patients focus on improving their postural control and balance using Swiss ball, but there are very few studies found, which emphasize specifically on trunk control with Swiss ball. Most of the studies have been done in acute phase. Therefore we conducted the research to find out the effect of Swiss ball activities on trunk control in subacute phase (4 weeks – 12 weeks). This is the best phase to get the maximum recovery and gives the opportunity to reach the highest level\textsuperscript{19}.

There are evidences of significant improvement in core muscle strength with Swiss ball activities in normal individuals so the same may be applied for post-stroke patients to train their trunk muscles. Trunk muscles are innervated by fibers from both the hemispheres, like the facial muscles so because of the intact ipsilateral innervation they are trainable muscles. The trunk muscles recovery was mediated by the unaffected hemisphere and probably by a compensatory activation of preexisting uncrossed pathways rather than cortical reorganization, unlike extremities\textsuperscript{20}. The aim of the study is to study the effect of Swiss ball activities on trunk control in post-stroke patients. We hypothesized that there is a significant effect of Swiss ball activities on trunk control as measured by trunk impairment scale in post-stroke patients.

**Subjects and Methodology**

The current experimental study was conducted in the neurological rehabilitation center of Jain Hospital, Karkardooma, Delhi. 30 patients within the age group of 40-65 years of both genders participated in the intervention. The participants were post stroke patients up to 3 months, both ischemic or hemorrhagic with first onset of unilateral lesion, medically stable, able to understand and follow simple verbal instruction, scoring $\geq24$ on MMSE, could sit unsupported for 1 minute on a stable surface with feet touching the ground, $>13$ PASS(TC), $>8$ TIS. Patients were excluded if they had
any neurological disease and musculoskeletal disorders affecting trunk control other than stroke, history of surgery due to musculoskeletal diseases affecting motor control.

Table 1: Swiss Ball Exercises

<table>
<thead>
<tr>
<th>Position</th>
<th>Swiss Ball Exercises</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supine</td>
<td>Bridging, Unilateral Bridging, Lower Trunk Rotation</td>
</tr>
<tr>
<td>Sitting</td>
<td>Static Sitting balance, Trunk Flexion – Extension, Trunk Lateral Flexion, Trunk Rotators-Upperm Trunk, Lower Trunk, Weight Shifts, Forward Reach, Lateral Reach</td>
</tr>
</tbody>
</table>

48 patients were screened out of which 30 meeting inclusion and exclusion criteria were invited for the study. Physiotherapy assessment of the selected 30 patients was performed. The study intention was explained to all the participants and they were requested to sign the written informed consent. PASS-TC and TIS score were used to measure trunk control. Patients were equally divided in group A and Group B. Experimental group (A) received conventional physiotherapy along with Swiss ball protocol. Control group (B) received only conventional physiotherapy. Exercise protocol was followed 4 sessions /week for a period of 3 weeks. The number of repetitions was determined on the basis of earlier pilot study. Practice trial was provided on Swiss ball before performing the exercise protocol to experimental group. Exercise protocol started from next day which included Swiss ball exercise protocol for 20 minutes. Trunk exercises on Swiss ball was initiated with mild assistance and further progressed to no assistance. These exercises were to be performed with adequate rest period in between. PASS-TC and TIS score was taken at 2 weeks and 3 weeks post intervention. During the course 2 participants discontinued interventions in experimental group.

Outcome Measure
- Trunk Impairment scale (TIS)

Data Analysis

Statistical analysis was done for within and between the group analysis. Windows Excel 2007 was used to analyze in this study. Paired t-test was used for within the group analysis. Unpaired t-test was used for inter group analysis.

Results

No significant differences between the groups were found for the demographic variables, “p values” for age (0.178), gender (0.723), affected side right/left (0.716). There was no significant differences in stroke related parameters and outcome measures between the groups, “p values” for TIS(0.717) PASS(1.0) and MMSC (0.481).

Post intervention, both the groups improved on trunk control but the experimental group (Group A) improved more significantly than the control group (Group B). The mean difference of pre and post intervention in TIS score of Group A was 4.30 and Group B was 2.87 which is significant (p<0.05) in both the groups. The mean difference of post intervention TIS score of Group A and Group B was 1.36 with p value <0.05, which is significant (Table-2).
Table 2: Table showing pre and post intervention scores of TIS

<table>
<thead>
<tr>
<th>Groups</th>
<th>TIS(Pre/Post) Mean(SD)</th>
<th>Mean Difference</th>
<th>'t' value</th>
<th>'p' value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Pre 17.47±0.51</td>
<td>4.30</td>
<td>2.17</td>
<td>p&lt;0.05</td>
</tr>
<tr>
<td></td>
<td>Post 21.76±0.72</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Pre 17.53±0.52</td>
<td>2.87</td>
<td>2.14</td>
<td>p&lt;0.05</td>
</tr>
<tr>
<td></td>
<td>Post 20.40±0.63</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A&amp;B</td>
<td>PreA &amp; PreB 0.06</td>
<td>2.06</td>
<td></td>
<td>p&gt;0.05</td>
</tr>
<tr>
<td></td>
<td>PostA &amp; PostB 1.36</td>
<td></td>
<td></td>
<td>P&lt;0.05</td>
</tr>
</tbody>
</table>

Discussion

The study showed significant improvements in both groups but experimental group gave better result than control group. The possible reason for better results may be due to the postural perturbation provided to patient on Swiss ball, reacted to which muscles of trunk contract in order to achieve the desired postural stability. Lumbo-sacral, erector spine as well as deep abdominal stabilizers are more involved during exercises on an unstable base. An optimal control of good posture is necessity for daily activities as well as for the prevention of injuries. Stabilization of posture is got by motor and sensory neurons of the somatosensory system, by getting feedback from visual, vestibular and somatosensory. The vestibular system is the main control system for erect posture. If there is any disturbances in sensory (processed in brainstem and cerebellum) or motor feedback loop which happens in stroke, result in increased body sway and muscle activity. The main role of a CNS is to coordinate the focal movement and helps to achieve the goal of a given task. When we move we are not aware of neuromuscular processes which control our posture automatically. So, whenever there is any disturbance in either of the pathways, it will imply incorrect posture adjustment during movement.

The study results had shown that trunk exercises performed on a Swiss ball resulted in a greater improvement in lateral flexion, lateral reach and symmetrical rotation as measured by dynamic sitting balance and the coordination subscales of TIS. The overall effect size index (1.36) observed in the study is in favor of the experimental group, Swiss ball provide a challenging environment with more degree of freedom than stable surface during task specific trunk exercises.

An interesting finding was the improvement in trunk rotation in experimental group as measured by coordination subscale of TIS. Coordination of the trunk is the mobility over stability task which require counter-rotation of upper and lower trunk. During the study we found that the subjects were able to rotate the upper trunk but had difficulty in rotating the lower trunk. During the rotation of upper trunk subjects were asked not to move the feet away from the ball, thighs and legs should be in contact with the ball. This engages the whole trunk in order to keep the back straight and maintaining 90-90 position of knees and ankle.

Clinically it was found that there was asymmetrical weight distribution on both feet while sitting on the stable surface. Contrary weight distribution on both feet while sitting on the Swiss ball is better, patient tried to take weight on the affected side in order to maintain the erect posture. During the reaching activities subjects instructed not to take step forward or sideways.
Conclusion

The result showed significant improvement in both the groups but experimental group (Group A) showed more improvement than the control group (Group B). Hence, the study accepts the alternate hypothesis i.e. there is significant effect of Swiss ball activities on trunk control as measured by trunk impairment scale in post-stroke patients. LIMITATIONS-There was a lack of long term follow up of patients to find out the carry over effects of the interventions.

Ethical Clearance: Study protocol was approved by the ethical committee of Amity Institute of Physiotherapy, Noida.

Source of Funding: Self Funded

Conflict of Interest: None

References
Wearing Out Pattern of Sports Shoes and Muscle Imbalance in Lower Limb among Athletes – A Correlation Study

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Abstract

Background: Muscle imbalance prevails among a lot of athletes. The most common muscle imbalances are seen in the lower limb. The muscle imbalances affect footwear. There are certain set of patterns which are seen in athletes. Hence we are trying to co-relate muscle imbalance and wearing out pattern of the shoes in athletes.

Aim/Objectives: To determine the correlation between pattern of wearing out of sports shoe and its relation with muscle imbalance in lower limb among athletes.

Method: Both male and female athletes between the age groups 18-35 years from various sports in the study. Wearing out pattern of the shoes will be noted down and athletes’ range of motion and strength of lower limb will be obtained.

Results: One way ANOVA was used for statistical analysis. The results showed that hip flexion ROM was significant with 81.59±4.47 (P<05) and external rotation with 0.24 9 (Fig 2) in relation with the wearing out pattern of the shoes. In ankle ROM, only dorsiflexion of right foot was significant with 7.50±3.82 (P<05). Muscle length of hamstring showed significance i.e. 81.02 (p<05). In case of strength of hip muscles, the internal rotation right and extensors left side were statistically significant i.e. 16.5±50 (P<.05).

Conclusion: Present study concludes that there is no single pattern of wearing out of footwear, it is the combination of two or more patterns that are seen in athletes with or without musculoskeletal problems.

Keywords: Muscular endurance, push-up test, athletes, fitness

Introduction

Muscle balance is defined as equality between agonist and antagonist in terms of length and strength. It is required because of reciprocal movements which have to be coordinated, where in opposite muscle group play an important role.¹ Some studies have said that specific muscle imbalance can lead to injuries in athletes.² There are two types of muscle imbalances, namely Functional imbalance and Pathological imbalance. Many injuries are said to have direct connection with either muscle weakness or muscle imbalance.²,³

Sports shoes designs have evolved a lot in last 100 years and are now engineered and crafted for different types of sports. There has been change in support cushioning, weight and shape of the shoes.⁴ Studies have been done that have tried to relate injuries with sports shoes and its condition.⁵⁶⁷⁸

There are 6 different wearing out patterns of shoes. 1) Wear on the ball of the foot 2) Wear on the inner side of the foot 3) Toe-shaped ridges on the upper 4) Outer shoe wear 5) A bulge and wear to the side of the big toe 6) wear on the upper above the toes.⁹

The muscle imbalance and wearing out of shoes changes the kinematics of the joints of lower limb which
leads to injuries. Muscle imbalance is a major cause in many sports related injuries\(^5\). This may develop in the later stages even if it is functional imbalance and may hamper the functionality and progress of an athlete. If diagnosed earlier, there are better chances of correcting the imbalance. Muscle imbalance causes change in the kinematic chain of the body which can lead to injuries which is associated with pain and vice versa.\(^1\)

Patterns of wearing out of shoes indicate or predict the deformity or the injury. It can be helpful in diagnosing and preventing certain patterns of injuries. Studies done on athletes to find out major factors which lead to injuries made a correlation to wearing out and shoe age to current and prevent injuries\(^9\).

This study will help to correlate the pattern of wearing out of shoes with muscle imbalance and will help the physiotherapist and other medical professionals to know about the relation between them. Hence we need to find out if there is correlation between the wearing out of shoes with muscle imbalance. Hence there is a need for screening and correlating muscle imbalance and wearing out of shoes in athletes.

**Materials and Methodology**

Ethical clearance was obtained from the Institutional Ethical Committee of KAHER Institute of Physiotherapy, Belagavi. A written informed consent was obtained from all the participants before the commencement of the study. Both male and female athletes between the age group of 18-35 year from various sports institutions and clubs in Belagavi, Karnataka were included.

<table>
<thead>
<tr>
<th>Inclusion Criteria</th>
<th>Exclusion Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Individuals who participate in competitive sports</td>
<td>• Subjects with congenital foot deformity</td>
</tr>
<tr>
<td>• Age 18-35 years</td>
<td>• Subjects with lower limb surgeries in last 1 year</td>
</tr>
<tr>
<td>• Subjects willing to participate</td>
<td>• Recreational subjects</td>
</tr>
<tr>
<td></td>
<td>• Traumatic sports injuries</td>
</tr>
</tbody>
</table>

**Procedure:** Ethical clearance from the institutional ethical committee was obtained.

After meeting the inclusion and exclusion criteria, written informed consent was obtained from the participants.

Brief demographic data was obtained from the athletes that included their name, age, gender, height, weight, BMI, sports history.

The wearing out pattern and the history of shoe use was noted down. (see dig 1)

![Wearing Out Pattern of the Shoe](image)

To check muscle imbalance the following was noted down. The range of motion of hip flexion, extension, abduction, adduction, internal rotation and external rotation, in knee flexion, extension, ankle dorsiflexion, plantar flexion, inversion and eversion was noted down.\(^10\) Muscle length test was done for iliopsoas, rectus femoris, hamstrings and gastrocnemius.\(^10\) Testing position for strength assessment for hip flexors was with the participant seated and hips and knees flexed at 90\(^0\). Dynamometer was held on the anterior aspect of the thigh, proximal to the knee joint. Hip extensors with the participant lying prone and hips and knees extended. Dynamometer placed on the posterior aspect of the shank, proximal to the ankle joint. The subject was asked to do the movement or the action of the muscle we are trying to find out. Hip abductors with the participant lying supine and hips and knees extended. Dynamometer placed on the lateral aspect of the shank proximal to the ankle joint. Hip adductors with the participant lying supine and hips and knees extended. Dynamometer placed on the medial aspect of the shank, proximal to the ankle joint. Knee extensors with the participant seated and hip and knees flexed at 90\(^0\). Dynamometer was held on the anterior aspect of the shank proximal to the ankle joint. Knee flexors with the participant seated and hips and knees flexed at 90\(^0\). Dynamometer was held on the posterior aspect of the shank proximal to the ankle joint.
Ankle plantar flexors with the participant lying supine with the ankle in plantar grade and hips and knees extended. Dynamometer was held over the metatarsal heads on the sole of the foot. Ankle dorsiflexors with the participant lying supine with the ankle relaxed and hips and knees extended. Dynamometer placed over the metatarsal heads on the dorsum of the foot.11

Results

44 participants were recruited in this study of which 37 were male and 7 were female athletes. The mean age was 21.33±2.43 among which 18 total showed only 1 wearing out pattern (40.91%) in comparison with the combination of 2 patterns which were 20 (45.45) and combination of 3 patterns were 6 (13.64).

One way anova has used to compare age BMI and age of shoes where only age of shoes had a significant deviate with 0.62±0.79 (P<05). Age (21.07±2.49) Height (165±10.43) weight (64.66±12.73) BMI (23.53±3.52) was not significant.

One way ANOVA was used for parametric measurements. Which showed that hip flexion ROM was significant with 81.59±4.47 (P<05) and external rotation with 0.24 9 (Fig 2) in relation with the wearing out pattern of the shoes.

In ankle ROM, only dorsiflexion of right foot had a significant 7.50±3.82 (P<05)

One way ANOVA of muscle length showed that hamstring values were 81.02(p<05)

One way ANOVA of strength of hip muscles revealed that the internal rotation right and extensors left side showed significance i.e 16.5±50 (P<.05).

Discussion

The results of the evaluation showed that athletes had either one type of wearing out pattern of the shoes or combination of two or more types of wearing out patterns.

Athletes showed not much significance with the variables of age, height and BMI. Age of shoes was significant, especially when compared with the combination of three or more patterns.

The study done by P. W. Kong et al.12 indicate that the wearing out of shoes and the age of shoes had an impact on kinematic chain. Our findings confirm that the combination of wearing out patterns increases as the age of the shoes increases. This is the result of overuse of one set of muscles over the other. Some of the sports which are unilateral in nature may require a particular set of muscles or only one side of the muscles may result in imbalance and may result in injuries.5,13

J E Taunton, M B Ryan et al. studied about the shoe age where it was a factor for decreased ROM and injuries.14 This present study reflects the same, Flexion and external rotation of the hip on the right side was affected significantly especially in the combination of 3 or more patterns of worn out shoes. Knee ROM did not show any significant change. Although ankle’s dorsiflexion on the right side showed much significant change in regard with combination of 3 or more wearing out pattern of the shoes.

Many authors have conducted studies on strength of lower limb and over use of hamstring which led to injuries because of shortening of the muscle.15,16 Our results indicated that the right hamstring showed adherence to the study. This again can be because of the nature of the sport which an athlete plays due to which we can see that the dominant side i.e the right has been affected13

Joseph J Knapik et al. indicated about flexibility and muscle strength imbalance, our findings reflect the same with muscle shortening of hamstrings on the right side and decreased strength in internal rotators on the same side, and decreased extensor strength on the left side.3 Although combination of 3 or more patterns of wearing out of shoes showed much significance in comparison with knee and ankle strength, it did not have much significance as whole.

Ulfin Rethnam et al studied about the age of shoes and injury and suggested that age of shoes and constant change of shoes let to injuries, which brings in the question of when to change the shoes which does not lead to an injury.17 In our study there was variation in usage of shoes regarding age. Even though there were wearing out patterns noticed there were no history of injury this leads to further scope for research where through biomechanical analysis should be done to determine the relation between the age of shoes, constant change of shoes in regard with the type of sports played.

In summary, muscle imbalance in athletes was seen in the combination of 3 or more wearing out patterns of the sports shoes. The wearing out of shoes and age of the
shoes contributed to disruption of kinematic chain which further affected the muscle balance.

**Conclusion**

The study concluded that, there was positive correlation between wearing out pattern of sports shoes and muscle imbalance of lower limb. The study also concludes that the combination of wearing out pattern shows increased muscle imbalance.

**Conflict of Interest:** None

**Source of Funding:** Self

**Ethical Clearance:** Ethical clearance was obtained by Ethical committee of KAHER institute of physiotherapy

**References**

Effects of Shoe Height on Footwear Comfort, Physiological Cost Index and Cardiorespiratory Indices among Young Female Adults in University of Nigeria, Enugu Campus

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¹Department of Medical Rehabilitation, University of Nigeria, Enugu Campus, Nigeria

Abstract

Background: Musculoskeletal and gait alterations have been associated with prolonged wearing of high-heeled shoes and has prompted several preventive measures. For further recommendations on safe foot wear practices, there is need for empirical evidences on the cardiorespiratory and energy costs of various shoe heights. Objectives: This study therefore evaluated the effects of shoe height on perceived footwear comfort, Physiological Cost Index (PCI) and cardiorespiratory indices of young Nigerian females.

Method: Eighty consenting female undergraduate students (mean age = 21.5 ± 1.86 years) with no history of spinal or gait disorders participated in this quasi-experimental study. Participants walked at self-selected walking speeds on a flat surface for 2 minutes while wearing flat shoes and high-heeled shoes, respectively. Pre- and post-intervention heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean arterial pressure (MAP) as well as gait parameters were measured. Subsequently, PCI [(MeanHR at work-MeanHR at rest)/Walking speed] and perceived footwear comfort (PFC) were obtained. One way ANOVA and paired T-tests were used to compare results across trials. Alpha level was set at 0.05.

Results: There were significant differences (p < 0.001) in the HR, RR, SBP, DBP, MAP, PCI, and walking distance, step frequency, stride length, step length and walking velocity of the participants between flat-shoe and high-heeled shoe-walking trials. However, there was no significant difference (p = 0.120) in the perceived footwear comfort between the two trials.

Conclusion: For improved cardiorespiratory, locomotory and metabolic efficiency during walking, wearing of flat shoes should be adopted.

Keywords: Shoe-height, cardiorespiratory, footwear comfort, physiologic cost index

Introduction

Modern day women’s fashion trends continue to promote the design and popularity of high heeled footwear. Surveys have shown that up to 59% of American women and 78% of British women wear high heels on a daily basis. (¹) Wearing high heeled shoes has become a dress behavior adopted by 37 to 69% of women in the world. (²) The reasons for wearing this style of footwear vary greatly from the feeling of confidence and glamorous from the extra height gained (³) to looking professional or staying with the trend of fashion. (⁴) However, walking in high heeled shoes have been reported to be associated with musculoskeletal problems like back pain, neck pain, arthritis and foot deformities. (⁵) High heeled footwear is frequently linked as a cause or aggravating factor of pain and symptoms in the lower back, hip, knee, ankle and foot (⁶,⁷) thereby leading to decreased overall comfort of the footwear, heel and forefoot cushioning. Additionally, high-heeled shoes have been associated with increased risk of falls (⁸,⁹) which is a major cause of immobility and fractures.
as well as other health problems. Despite the uncomfortable feeling some women experience while walking in high heeled shoes, most women still sacrifice their comfort at the altar of fashion trend.

Efficient walking is achieved by forward transmission of one limb to the next using the least amount of energy. Low-heeled footwears are thought to conserve energy by providing a normal heel strike and smooth forward transmission of the limb thereby improving energy efficiency, perceived footwear comfort and minimize pain and discomfort. Walking in high heeled shoes, due to the difference in orientation and design may likely require more effort by the individual to maintain balance and orientation. As a result, more attention is paid to staying balanced and maintaining appropriate gait pattern which may likely have resultant effects on the cardiorespiratory system, causing fatigue in the individual.

Several studies have focused on lower extremity mechanics, metabolic cost of walking and gait in heels. Nwankwo et al evaluated the effects of different heel heights on selected gait parameters and concluded that as heel height increases, gait parameters such as stride length and step length shorten while the cadence increases and the stride width widens so as to achieve postural stability and kinematic adaptation. Odebiyi et al reported that barefoot walking required less effort than walking in high heeled shoes of different heel heights. Another study by Hardin et al focused on kinematic adaptations both in wearing heels in walking and running shoes in running. However there is paucity of evidence on the effects of different heel heights on the cardiorespiratory system. Evaluation of the cardiorespiratory responses to high heeled shoes and their correlations with footwear comfort may further help in structuring guidelines for appropriate choices of shoe heel heights. This study therefore investigated the footwear comfort, physiological cost index, cardiorespiratory responses (heart rate [HR], mean arterial pressure [MAP], respiratory rate [RR], systolic blood pressure [SBP], diastolic blood pressure [DBP]) and the perceptual responses of footwear comfort to high heeled shoes.

Material and Method

This quasi experimental study was carried out in University of Nigeria Enugu Campus. Eighty (80) conveniently selected non-pregnant undergraduate female students between the ages of 18 and 30 years, with no history of musculoskeletal deformities participated in this study. Prior to commencement of the study, an ethical approval letter was sought and obtained from the Health Research and Ethics Committee, University of Nigeria Teaching Hospital, Ituku Ozalla, Enugu. Informed consent was also obtained from the participants after the experimental procedure was fully explained to them.

The demographic and anthropometric characteristics of the participants were obtained and the experimental procedure fully explained to them. Baseline cardiorespiratory measurements (BP, HR, RR, MAP) were taken with the participants in relaxed positions. This study comprised of two trials and shoes of the same UK model with varying sizes were used. In the first trial, participants were fitted into a flat shoe of their appropriate sizes and asked to walk at self selected walking speeds on a flat straight terrain (measuring approximately 125 meters) for two minutes. They were instructed to walk along a straight path in the open field. On completion of the two minutes flat shoe ambulation trial, the distance covered was read off from a pedometer (OMRON HJ-325), attached to the right upper limb during the task. Subsequently, post-test measurements of the cardiorespiratory parameters were obtained. Participants were also asked to rate the perceived footwear comfort on a Visual Analogue Scale, rating 0 to 10 (0 represented the most comfortable point and 10 the least comfortable point). The physiological cost index (PCI) was calculated as \( \frac{\text{Walking heart rate (beats/minute)} - \text{resting heart rate (beats/minute)}}{\text{Walking speed (meters/minute)}} \).

After a 30 minutes rest period, participants performed the second experimental trial which involved undergoing similar procedures as in the first trial while wearing shoe 10.5cm heel height. At the end of this experiment, a post high-heeled shoe ambulation measurement of cardiorespiratory responses, perceived footwear comfort and PCI were obtained. Post-trial assessments were as explained for the first trial.

Descriptive statistics of mean, standard deviation, frequency and percentages were used to summarize data while one way repeated ANOVA and paired t-test were used to test for statistical differences between variables. Data were analyzed using Statistical Package for Social Sciences (SPSS) version 21.
Results

The demographic characteristics of the participants are presented in Table 1. The participants’ mean age and BMI are 21.5±1.86 years and 22.8±3.17 kg/m².

Table 2 shows the participants’ cardiorespiratory responses, perceived footwear comfort and PCI values at baseline and during both trials. HR and RR increased slightly after walking on flat shoes while SBP, DBP and MAP slightly reduced. However, all the cardiorespiratory parameters (HR, RR, SBP, DBP, MAP) showed substantial increase in mean values after walking in high heeled shoes. PCI mean values increased from 0.52±0.11 post flat shoe ambulation to 0.54±0.13 post high heeled shoe ambulation. Significant differences existed in the heart rate (p = 0.000), respiratory rate (p = 0.000), SBP (p = 0.000), DBP (p = 0.022) and MAP (p = 0.000) between both trials.

Paired t-test results comparing the PCI, footwear comfort and selected gait parameters across trials are presented on Table 3. There was a significant (p = 0.000) difference in PCI after walking in both shoes of different heel heights. Significant differences also existed in the distance covered (p = 0.000), number of steps (p = 0.000), stride length (p = 0.000), stride frequency (p = 0.000) and velocity (p = 0.000) of the participants between both trials. However, there was no significant difference in the perceived footwear comfort of the participants after walking in both flat and high heeled shoes (p = 0.120).

Table 1: General Characteristics of the Participants (n = 80)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean ± standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>21.50 ± 1.86</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>63.40 ± 9.12</td>
</tr>
<tr>
<td>Shoe size</td>
<td>40.30 ± 1.00</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>22.80 ± 3.17</td>
</tr>
</tbody>
</table>

Key: BMI = Body Mass Index, Shoe sizes used were UK sizes 39, 40, 41 and 42.

Table 2: Cardiorespiratory responses, footwear comfort and PCI of the Participants at rest, post flat shoe ambulation and post high heeled shoe ambulation (n = 80)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Baseline</th>
<th>Post flat shoe</th>
<th>Post high heel</th>
<th>F-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart rate (bpm)</td>
<td>78.80 ± 9.38</td>
<td>83.10 ± 9.15</td>
<td>85.94 ± 10.87</td>
<td>37.49</td>
<td>0.000*</td>
</tr>
<tr>
<td>Respiratory rate (cpm)</td>
<td>18.80 ± 3.65</td>
<td>25.20 ± 4.41</td>
<td>30.58 ± 4.51</td>
<td>39.80</td>
<td>0.000*</td>
</tr>
<tr>
<td>SBP (mmHg)</td>
<td>107.50 ± 9.89</td>
<td>105.86 ± 10.60</td>
<td>111.98 ± 9.96</td>
<td>38.97</td>
<td>0.000*</td>
</tr>
<tr>
<td>DBP (mmHg)</td>
<td>75.80 ± 7.94</td>
<td>75.04 ± 7.35</td>
<td>77.23 ± 8.26</td>
<td>3.92</td>
<td>0.022*</td>
</tr>
<tr>
<td>MAP (mmHg)</td>
<td>86.40 ± 7.81</td>
<td>85.31 ± 7.54</td>
<td>88.81 ± 7.57</td>
<td>16.72</td>
<td>0.000*</td>
</tr>
</tbody>
</table>

Key: Values are presented as mean ± Standard Deviation, SBP - Systolic Blood Pressure, DBP - Diastolic Blood Pressure *indicates statistical significance at p < 0.05

Table 3: Paired Sample T-Test Results comparing the energy cost of locomotion and gait parameters between the two trials

<table>
<thead>
<tr>
<th>Variable</th>
<th>Flat shoe</th>
<th>High heeled shoe</th>
<th>t-value</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCI</td>
<td>0.52 ± 0.11</td>
<td>0.54 ± 0.13</td>
<td>-6.47</td>
<td>0.000*</td>
</tr>
<tr>
<td>PFC</td>
<td>2.30 ± 3.80</td>
<td>54.40 ± 16.60</td>
<td>-28.44</td>
<td>0.120</td>
</tr>
<tr>
<td>Distance</td>
<td>122.60 ± 13.18</td>
<td>102.50 ± 15.85</td>
<td>14.79</td>
<td>0.000*</td>
</tr>
<tr>
<td>Stride length</td>
<td>1.20 ± 0.10</td>
<td>1.10 ± 0.12</td>
<td>12.28</td>
<td>0.000*</td>
</tr>
<tr>
<td>Number of steps</td>
<td>99.30 ± 5.42</td>
<td>94.40 ± 8.35</td>
<td>7.21</td>
<td>0.000*</td>
</tr>
<tr>
<td>Stride frequency</td>
<td>0.83 ± 0.05</td>
<td>0.80 ± 0.07</td>
<td>7.21</td>
<td>0.000*</td>
</tr>
<tr>
<td>Velocity</td>
<td>1.02 ± 0.11</td>
<td>0.90 ± 0.13</td>
<td>14.79</td>
<td>0.000*</td>
</tr>
</tbody>
</table>

PCI- Physiologic Cost Index, PFC- Perceived Footwear Comfort, *indicates statistical significance at p < 0.05
Discussion

This study investigated the effects of shoe height on footwear comfort, Physiological Cost Index (PCI) and cardiorespiratory indices of apparently healthy young females within the ages of 18 and 30. This study showed that walking in high-heeled shoes elicited higher cardiorespiratory responses (HR, RR, MAP, SBP, DBP) and PCI in the participants, compared to walking in flat shoes. This corroborates a previous study(5) which found a significant difference in VO$_2$ max and energy expenditure between walking barefooted and walking in high heeled shoes of various heel heights among undergraduate students of University of Lagos. Curran et al(1) also corroborates this finding and reported significant increases in HR, RR, VO2 and PCI after walking in high heeled shoes. This increase in cardiorespiratory responses may be attributed to the increased workload imposed on the muscles by the high heeled shoes. These muscles are constantly overworking to maintain the upright posture distorted by the shoe height and to prevent fall. The HR increases as a result of sympathetic discharge to the heart which leads to increase in blood pressure. The RR also increases to take in enough oxygen so as to meet up with the demands of the working muscles.(15) Thus, walking in high heeled shoes may cause further unnecessary demands on the metabolic and cardiorespiratory systems of the participants.

The findings of the present study showed significant decrease in the distance covered, number of steps, stride length, stride frequency and walking velocity of the participants while walking in high heeled shoes compared to walking in flat shoes. Previous studies(13,16-18) which compared the effect of different heel heights on gait parameters of individuals corroborate this finding. They all reported a reduction in stride length, step length and increased walking cadence in individuals in the individuals on high heeled shoes. This may be attributed to a cautious walking pattern which tries to adjust to the forward shift of the centre of gravity and distorted foot biomechanics associated with high heeled shoes in an attempt to prevent fall and stabilize posture.(13) In order to compensate for the altered gait, the body increases the metabolic activities of primary plantar flexor muscles (gastrocnemius and soleus) as well as that of the rectus femoris thereby increasing the energy expenditure (PCI). (1,16) This consequently increases the heart rate and respiratory rate to provide the needed oxygen to the overworking muscles.

Surprisingly, there was no significant difference found between the perceived footwear comfort of the participants after walking in flat shoes and high heeled shoes. This is contrary to the researchers’ expectations bearing in mind the great discomfort that may result from the prolonged increased plantar flexion of the ankle and subsequent increase in arch height as well as the increased pressure of the ball of the foot while walking in a high heeled shoe.(19) In contrast to this finding, Hong et al (20) and Curran et al (1) reported that high heeled shoes result in decreased comfort as revealed by the female participants in their studies. A major limitation of this study is not ascertaining if the participants were habitual wearers of high heeled shoes before involving them in this study. It’s possible that some of them may have been conditioned to the task of high heel walking and this may have led to the lack of significant difference in perceived footwear comfort after both trials.

Conclusion

Walking in flat shoes is less demanding on the cardiorespiratory, locomotory and metabolic functions of young females, as compared to high-heeled walking. However the young females in this study perceived high-heeled walking as a more comfortable task, compared to walking in flat shoes. For improved cardiorespiratory, locomotory and metabolic efficiency during walking, wearing of high-heeled shoes should be discouraged.

Statement of Informed consent

All authors declare that written informed consent was obtained from the participants for publication of this survey. A copy of the written consent is available for review by the Editorial Board members of this journal.

Statement of Human and Animal Rights

All authors hereby declare that an ethical approval with number NHREC/05/01/2008B-FWA0002455-1RB00002323 was obtained from the Health and Ethics Research Committee of University of Nigeria Teaching Hospital, Ituku-Ozalla, Enugu before the commencement of the study.

Conflict of interest statement

The authors have declared that no conflict of interest exists.
Source of Funding

No funding was obtained for this study. This study was fully funded by the authors.

References


Effect of Aerobic Exercises and Resistance Exercises on Inflammatory Biomarkers and Fatigue in People Living with HIV Infection Undergoing Highly Active Antiretroviral Therapy; A Systematic Review

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Abstract

Background: Elevation of inflammatory biomarkers markers among persons living with HIV (PLWH) is a serious side effect of highly active antiretroviral therapy in people living with HIV (PLWH), which has consequences in their overall health outcomes. Also, while HAART favours decreases in mortality and morbidity in PLWH, chronic HIV illness results in fatigue which also hampers patient health outcomes. This review therefore sought to evaluate the effect of exercise on inflammatory biomarkers (CRP, IL-6 and IL-β) and on fatigue in HIV patients receiving Highly active anti-retrovirus therapy (HAART).

Method: Relevant medical databases were searched from years 1990 to 2018. Reference lists of identified studies were also searched. RCTs, quasi-RCTs and controlled clinical trials that investigated the effects of aerobic and /OR resistance exercises on inflammatory biomarkers and fatigue in PLWH (adults only) were included. Two reviewers assessed the methodological quality of identified studies independently; and extracted relevant data based on predefined criteria. Using available data, meta-analyses were performed for each outcome using random effects model.

Results: Eleven studies were included in this review (n=490 participants). Five studies included only male participants (n=227), the rest had a combination of both males and females. Meta-analysis findings showed that aerobic and resistance exercise interventions have a significant effect in lowering IL-6 levels in the intervention group compared to the control group (Z=2.77, p=0.006). While these exercise interventions may also have lowering effects on CRP, IL-β and fatigue, meta-analysis showed a statistically non-significant effect (IL-β: Z=0.46, p=0.65, fatigue: Z=1.40, p=0.16).

Conclusion: Exercise interventions are beneficial in lowering inflammatory biomarkers and fatigue among PLWH undergoing HAART. Further research however should take note to include larger and more homogenous samples, minimize risk of bias and make use of valid, comprehensive tools for outcome assessment.

Keywords: Aerobic exercises, resistance exercises, HAART, biomarkers, fatigue.
infection and highly active antiretroviral therapy (HAART) with specific side effects, which includes elevation of inflammatory biomarkers, for example C-reactive protein (CRP) and interleukin-6 (IL-6) \(^2\)-\(^3\). CRP, an acute phase protein, has been earmarked by both the American Heart Association and Centers for Disease Control as an independent predictor of increased coronary risk, and they recommended using 3.0mg/l as the minimum threshold for high risk classification \(^4\). Fatigue has been recorded as a common symptom in individuals with chronic disease including HIV infection, and has been associated with a significant effect on employment \(^5\), self-care \(^6\), and overall quality of life \(^7\). Some identified risk factors of fatigue in HIV-infected individuals include aging\(^8\), female gender\(^9\), injection drug use, malnutrition, HIV myopathy\(^10\), pain\(^11\), and anemia\(^12\).

Exercise training, which has been currently used in managing signs and symptoms of several chronic illnesses and is widely used in health promotion as well as rehabilitative programs, may be an effective approach in mitigating the several signs and symptoms associated with HIV infection and HAART use \(^13\). Several studies have reported significant declines in CRP levels following exercise interventions among older individuals \(^14\), obese women \(^15\) and breast cancer survivors \(^16\). Several studies have equally shown a significant reduction of IL-6 and CRP following an aerobic exercise training \(^17\),\(^18\). An observational data in young and elderly persons have shown an association between greater physical activity with reduced CRP and IL-6 levels \(^19\), which is suggestive of a potential benefit of exercise in reducing inflammation in subjects. However, a recent meta-analysis of randomized controlled trials reported a non-significant decline in CRP levels among respondents in an aerobic exercise intervention \(^20\). Recent studies investigating the effects of aerobic exercise intervention on circulating inflammatory biomarkers have produced inconsistent results \(^21\). Exercise has also been reported to safely cause a decline in fatigue in a population of HIV-1 infected individuals \(^13\).

Giving to the inconsistencies in reported outcomes in previous studies, a systematic review is necessary to definitively determine the effectiveness of aerobic exercise and resistance exercises in the management of increased risk of cardiovascular diseases (marked by elevation of circulating inflammatory biomarkers) and fatigue in patients with HIV infection undergoing HAART. The review will address the following questions; 1. What is the effectiveness of aerobic exercises and resistance exercises in reducing CRP and interleukin-6 levels in patients with HIV infection undergoing HAART? 2. What is the effectiveness of aerobic exercises and resistance exercises in reducing fatigue in patients with HIV infection undergoing HAART?

**Materials and Method**

This systematic review is reported according to the Preferred Reporting Items for Systematic reviews and Meta-analysis (PRISMA) 2015 guideline \(^22\).

**Information sources and search strategy:**

Five databases, the Cochrane Library, PubMed (MEDLINE), EMBASE, PEDRO and CINAHL were searched by three authors (EMA, IIN and CNO) using controlled vocabularies and keywords. Additionally, searches were performed from the reference lists of identified studies.

**Data collection process**

**Risk of bias assessment in individual studies:**

Utilizing the Cochrane Collaboration Tool for Risk of Bias Assessment (Table 8.5a of the Cochrane Handbook for Systematic Reviews of Interventions), risk of bias for each of the included studies were evaluated by two authors (UE and OAE).

**Data analysis**

A meta-analysis was conducted to explore the effect of the exercise interventions on the reported outcomes; inflammatory biomarkers (C-reactive protein, Interleukin-6 and Interleukin-β) and fatigue.

**Findings**

**Study inclusion**

The search conducted with regards to the primary outcomes (inflammatory biomarkers) initially identified 125 studies, of which seven studies providing data on 353 participants were included in the final analysis. The search conducted for the secondary outcome yielded 56 studies, of which four studies providing data on 206 participants were included in the final analysis. Therefore, a total of eleven studies were included in the review.
Characteristics of included studies

Study design, participants, and quality appraisal:
Ten of the included studies were randomized controlled trials (RCTs)\textsuperscript{23-32}, while one study\textsuperscript{33} was a pilot study without randomization. The participants in each study were adults (≥18 years) diagnosed with HIV infection undergoing HAART. The clinical characteristics between the intervention and control groups were similar at baseline for all studies included. Overall, six\textsuperscript{25-30} of the eleven trials were rated as high quality, others were rated as low-quality trials\textsuperscript{23,24,31-33}.

Meta-analyses: This review conducted three meta-analyses, which included meta-analyses of various exercise interventions on inflammatory biomarkers (IL-6 and IL-β) and fatigue.

Interleukin-6 (IL-6): Five (45.45\%) of the eleven included studies evaluated the effect of exercises (both aerobic and resistance) on IL-6. The five studies\textsuperscript{23,24,27,31,32} were included in the meta-analyses.

There was an overall statistically significant (Z=2.77, p=0.006) change in IL-6 between comparison groups. Results demonstrated a statistically significant trend towards a decrease in IL-6 in subjects in the exercise group compared with normal activities control group (See figure 1).

Interleukin-β: Three (27.27\%) of the eleven included studies\textsuperscript{23,24,32} evaluated the effect of exercises on IL-β and were included in the meta-analyses.

Results demonstrated a statistically non-significant (Z=0.46, p=0.65) trend towards a decrease in IL-β in subjects in the physical exercises group compared with normal activities control group (See figure 2).

C-reactive protein (hs-CRP): Two (18.18\%) of the eleven included studies\textsuperscript{26,33} evaluated the effect of exercises on CRP. However, only one study\textsuperscript{26} had a control non-exercising group. Therefore, a narrative synthesis was used to analyze the findings of the included studies.

Two studies provided data on hs-CRP\textsuperscript{26,33}. One high-quality trial\textsuperscript{26} reported no statistically significant difference in mean hs-CRP between groups. Also, a low-quality trial\textsuperscript{33} reported no statistically significant difference in mean hs-CRP between groups.

Fatigue: Four studies\textsuperscript{25,28-30} reported outcomes on fatigue. Due to a substantial discrepancy in the outcome measure tool used in evaluating fatigue, only
two studies\textsuperscript{25,30} that used time to fatigue on treadmill as outcome measure where included in the meta-analysis. A narrative synthesis was used to analyze the findings of the other two studies.\textsuperscript{28, 29}

Results of the meta-analysis demonstrated a statistically non-significant \((Z=1.40, \ p=0.16)\) trend towards an increase in time spent on treadmill before fatigue in subjects in the exercise group compared with normal activities control group (i.e. in favor of the intervention). (See Figure 3).

![Fig. 3: Effect of aerobic and resistance exercises on Fatigue](image)

One high quality RCT\textsuperscript{29}, reported a non-significant \((p<0.05)\) difference between the mean fatigue level of exercising group compared with the control group. One other high quality RCT \textsuperscript{28}, reported a significant improvement in fatigue level using the Subjective Exercise Experiences Scale \((p<0.05)\) in both exercising study groups.

**Conclusion**

Evidence regarding the effect of aerobic and resistance exercise interventions on IL-6 points to the fact that exercises may be beneficial in reducing serum concentration of IL-6 thereby reducing the risk of cardiovascular events in PLWH. The result on the effect of exercise interventions on IL-\(\beta\), CRP and fatigue in PLWH is inconclusive due to multiple factors obscuring findings such as inadequate sample size, variations in outcome tools utilized, limited time point for outcome assessment and high risk of bias in some included studies. However, the result suggests potential beneficial effect of intervention on IL-\(\beta\), CRP and fatigue in PLWH. The recruitment of larger homogenous sample size powered enough to detect small effect size, the utilization of more comprehensive, valid tools for fatigue assessment and the minimization of risk of bias in subsequent trials is recommended by this current review.

**Conflict of Interest:** The authors report no conflict of interest.

**Source of Funding:** None

**Ethical Clearance:** Not applicable

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Elderly on the Move: Level, Barriers, and Motivation to Physical Activity

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Abstract

Background of Study: Physical inactivity is associated with many chronic diseases, impaired cognitive health and increased mortality rate. Therefore, understanding the level of physical activity, the underlying motivations, and barriers to physical activity among older adults is important.

Materials and Method: This quantitative, descriptive survey involved 34 older adults aged 65 and above from Johor Bahru, Malaysia. Respondents were asked to complete questionnaires about levels of physical activity over the last seven days, barriers, and motivations to physical activity.

Results: Results imply that majority of elderly adults (50%) have a moderate level of physical activity. Lack of skills (90.58 ± 12.04), fear of injury (90.29 ± 9.36), and lack of energy (89.70 ± 11.41) were the major barriers in participating to physical activity. In addition, intrinsic motivation (18.42 ± 9.53) and identified regulation (18.35 ± 9.48) represents the main types of motivation that encourage older adults to engage in physical activity.

Conclusion: The findings of this research provide an insight when developing interventions that promote higher level of participation and minimize barriers of physical activity among older adults.

Keywords: Barriers to Physical Activity, Elderly, Motivation, Levels of Physical Activity.

Introduction

Malaysia has a rapidly increasing aging populace anticipated to reach 16.3% of the total population by year 2040¹. Physical inactivity and non-communicable diseases (NCDs) that comes along with aging affect productivity and increase healthcare expenditure. Physical inactivity is the fourth leading risk factor for premature death and NCDs worldwide². Globally, it is estimated that there will be a total output loss of US$47 trillion over the next two decades due to NCDs. In Malaysia, 43.7% of adults are in the physical inactive group³.

In recent years, numerous studies support the benefits of physical activity (PA) among elderly, both physically and psychologically. Moderate to high levels of PA helps in prevention and reduction of NCDs such as heart diseases, stroke, hypertension, diabetis, and joint diseases⁴ personalized medicine, and co-twin physical activity. PA is important for cognitive health, depression and anxiety, and lowers risk of dementia and Alzheimer’s disease⁵,⁶. The WHO recommends those above 65 need to have at least 150 minutes of moderate aerobic PA or 75 minutes of vigorous PA in a week or a combination of moderate and vigorous PA to reduce risk of NCDs⁷.

In spite of the numerous evidences about the benefits of PA awareness of the recommended level of PA remains relatively low. In the United Kingdom (UK), only half of all people and a quarter of elderly population meet the minimum activity level⁸duration, fre-
quency and type of physical activity required across the life-course to achieve general health benefits. It is aimed at the NHS, local authorities and a range of other organisations designing services to promote physical activity. The document is intended for professionals, practitioners and policymakers concerned with formulating and implementing policies and programmes that utilise the promotion of physical activity, sport, exercise and active travel to achieve health gains. It is aimed at the NHS, local authorities and a range of other organisations designing services to promote physical activity. The document is intended for professionals, practitioners and policymakers concerned with formulating and implementing policies and programmes that utilise the promotion of physical activity, sport, exercise and active travel to achieve health gains.

Whereas, only 43% of Australian are able to identify the recommended daily PA. Awareness to PA also decreases with age which may be due to the increasing disability. Lack of awareness of PA level lead to less desire to increase or modify activity level. Therefore, lack of awareness may act as a barrier for elderly to carry out PA that meets the recommended guidelines.

Most common barriers to PA include lack of facilities, too tired, already active enough, too lazy, lack of companion, lack of interest, lack of motivation, lack of transport, and lack of opportunities. Among Malaysian adults, lack of time (26.7%), health issues (26.7%), was already fit (26.7%), no companion (13.3%), and insufficient knowledge about the exercises (6.7%) are some of the reported barriers.

One important key in improving awareness about PA is to understand the determinants that may influence it. Self-determination theory (SDT) showed that intrinsic motivation is important in promoting long-term participation to exercise which in turn is associated with important health outcomes. Accordingly, research on exercise motivation from the perspective of self-determination theory (SDT). Weight related motivation was found to be a dominant determinant in participating to PA, especially among the females. The underlying motivation and barriers to whether or not an individual engages in physical activity is of critical public health importance. This study examines the National Heart Foundation of Australia Heart Week Survey conducted in March 2015. A total of 894 (40% female). Other motivations to keep elderly be physically active include to look nice, increase physical attractiveness, to have fun, and to prevent poor health condition. Environmental-related factors include presence of facilities, sidewalks, shop and services, good weather, safety, and less traffic/busy roads.

Numerous studies have explored the barriers and motivation to PA among elderly in other countries but fewer studies has been done in Malaysia. In addition, most research mainly focused on young and middle-aged adults. Therefore, the main aim of this study is to determine the levels, barriers, and motivation to PA among elderly Malaysians and use it as a basis for more comprehensive physical activity plan for health maintenance and disease prevention program.

Materials and Method

Research Design and Sampling

A cross sectional study was used to determine the level of awareness, barriers, and motivations to PA among elderly in Johor Bahru, Malaysia. Subjects were recruited if they were 65 years old and above, has no cognitive impairment, community dwelling, able to carry out activities of daily living independently, and able to comprehend written and spoken English. Subjects with severe physical impairments and disability, serious conditions like stroke and cardiovascular disease, and severe cognitive impairments were excluded.

Ethical clearance was obtained from the research ethics board of INTI International University. All subjects were properly briefed about the research and were asked to sign an informed consent form (IFC).

Research Instruments

International Physical Activity Questionnaire (IPAQ)

IPAQ is a valid and reliable tool in assessing and measuring the level of PA. It has 0.80 for reliability and 0.30 for validity. It consists of 27 items related with activities related to daily living, work, and leisure domains.

IPAQ assesses the duration, frequency, and intensity of the PA carried out in the last 7 days. Low, moderate
and high levels of PA are based on total volume and the number of days of PA in one week. Vigorous intensity for more than 3 days with minimum total PA of 1500 MET-minutes/week or combination of moderate, vigorous and walking for 7 days with minimum total PA of 3000 MET-minutes/week considered as high level of PA. Moderate PA is having three or more days of vigorous of PA for at least 20 mins per day or five or more days of moderate intensity/walking for at least 30 minutes per day or five or more days of combination of walking, moderate, and vigorous intensity with minimum total PA of 600 MET-minutes/week. The PA is classified low if criteria for high and moderate is not met.

Behavioural Regulation in Exercise Questionnaire-2 (BREQ – 2)

BREQ – 2 was used to measure the motivation to PA. It is consisting of 19 items rated from 0: not true for me to 5: very true for me. It is used to measure the 5 regulations which are amotivation (no need to exercise), intrinsic (exercising is fun), identified (benefits of exercise), introjected (guilty when not exercising), and external (motivation from other people) regulations. BREQ – 2 is proven valid in assessing the motivation to exercise. BREQ – 2 was translated into many languages and was found to be reliable with Cronbach α > 0.7 and an ICC>0.8.

Barriers to Physical Activity (BPAQ)

BPAQ consists of 24 items to measure barriers to PA among elderly. It is rated from no barrier whatsoever to major barrier. For all the items in BPAQ, the items who get score of above eight (8) are considered as major barriers to exercise. BPAQ demonstrated moderate to good internal consistency from 0.792 to 0.935 people with disabilities are more likely to be inactive when compared to people without disabilities. Previous questionnaires that measure barriers physical activity for people with disabilities do not measure barriers from an ecological perspective.

Data Gathering Procedure

After obtaining clearance from the ethical board of the INTI International University, questionnaires were distributed to subjects who met the inclusion and exclusion criteria. Informed consent form was given and the purposes of the study were explained. Subjects who were able to complete the questionnaires about their demographics, level of PA, barriers and motivations were sent for data tabulation, analysis, and interpretation.

Data Analysis

All the variables were analysed using mean, standard deviation and frequency distribution. Barriers and motivations were described in mean and standard deviation. Level of PA among elderly was expressed in frequency and percentage.

Findings

A total of 40 subjects were initially screened for their eligibility but only 34 subjects passed the sampling criteria. The demographic characteristics of the subject is shown in Table 1.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>65-75 years old</td>
<td>15 (44.1%)</td>
</tr>
<tr>
<td>76-85 years old</td>
<td>11 (32.4%)</td>
</tr>
<tr>
<td>86 years old and above</td>
<td>8 (23.5%)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>19 (55.9%)</td>
</tr>
<tr>
<td>Females</td>
<td>15 (44.1%)</td>
</tr>
<tr>
<td>Race</td>
<td></td>
</tr>
<tr>
<td>Chinese</td>
<td>17 (50%)</td>
</tr>
<tr>
<td>Indian</td>
<td>7 (20.6%)</td>
</tr>
<tr>
<td>Malay</td>
<td>10 (29.4%)</td>
</tr>
</tbody>
</table>

Majority of the subjects are males (55.9%), Chinese (50%) and between 65 – 75 years old (44.1%). This is somewhat different compared to the other age group in Malaysia who are generally inactive. Awareness on the benefits of PA is negatively correlated with a person’s age. As a person becomes older, risk of disability and reduced level of PA increases. Greater age was associated with the declining of the physical health, cognitive health and decrease in quality of life.

The level of physical activity among older adults is shown in Table 2.
Table 2. Level of Physical Activity among Elderly

<table>
<thead>
<tr>
<th>Variables</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Activity Level*</td>
<td></td>
</tr>
<tr>
<td>High Physical Activity</td>
<td>8 (23.5%)</td>
</tr>
<tr>
<td>Moderate Physical Activity</td>
<td>17 (50%)</td>
</tr>
<tr>
<td>Low Physical Activity</td>
<td>9 (26.5%)</td>
</tr>
</tbody>
</table>

*measured using IPAQ

About 50% of subjects have moderate PA, 23.5% with high PA and 26.5% were physically inactive. Majority have moderate level of PA that is slightly higher from other studies where most of elderly had a lower level of PA. Moderate levels of PA is important in the prevention and reduction of risk for NCDs personalized medicine, and co-twin physical activity. Awareness on PA level may influence a person’s desire to change or modify their activity level.

The types of motivation among elderly is shown in Table 3.

Table 3. Motivation to Physical Activity

<table>
<thead>
<tr>
<th>Variables</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motivation Style* (Mean, SD)</td>
<td></td>
</tr>
<tr>
<td>Amotivation</td>
<td>5.62 ± 10.63</td>
</tr>
<tr>
<td>External Regulation</td>
<td>15.75 ± 7.60</td>
</tr>
<tr>
<td>Introjected Regulation</td>
<td>8.91 ± 6.17</td>
</tr>
<tr>
<td>Identified Regulation</td>
<td>18.35 ± 9.48</td>
</tr>
<tr>
<td>Intrinsic Motivation</td>
<td>18.42 ± 9.53</td>
</tr>
</tbody>
</table>

*measured using BREQ-2

Majority of the subjects reported external regulation (15.75 ± 7.60), identified regulation (18.35 ± 9.48) and intrinsic motivation (18.42 ± 9.53). Subjects had moderate to higher level of external regulation, identified regulation, and intrinsic motivation to PA. Self-determination theory (intrinsic and identified regulation) which in turn is associated with important health outcomes. Accordingly, research on exercise motivation from the perspective of self-determination theory (SDT states that those who are knowledgeable about benefits of exercise are more motivated to long-term participation to PA. However, subjects have low introjected which was correlated strongly with the more self-determined. The barriers to physical activity among elderly is shown in Table 4.

Table 4. Barriers to Physical Activity among Elderly

<table>
<thead>
<tr>
<th>Variables</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous negative experience with physical activity</td>
<td>25.29 ± 11.34</td>
</tr>
<tr>
<td>Lack of time</td>
<td>57.05 ± 23.55</td>
</tr>
<tr>
<td>Cost of activity</td>
<td>46.17 ± 13.48</td>
</tr>
<tr>
<td>Lack of energy</td>
<td>89.70 ± 11.41</td>
</tr>
<tr>
<td>Lack of knowledge</td>
<td>88.82 ± 8.07</td>
</tr>
<tr>
<td>Lack of motivation</td>
<td>74.41 ± 14.18</td>
</tr>
<tr>
<td>Lack of skills</td>
<td>90.58 ± 12.04</td>
</tr>
<tr>
<td>Feeling uncomfortable (intimidated in exercise surroundings)</td>
<td>55.00 ± 18.78</td>
</tr>
<tr>
<td>Fear of injury (or re-injury)</td>
<td>90.29 ± 9.36</td>
</tr>
<tr>
<td>Fear of making an existing illness worse</td>
<td>81.17 ± 11.74</td>
</tr>
<tr>
<td>How I see my body</td>
<td>60.58 ± 21.87</td>
</tr>
<tr>
<td>Failure to achieve goals in previous attempts to become active</td>
<td>47.35 ± 19.27</td>
</tr>
<tr>
<td>Know that I can’t achieve the results I want so why bother</td>
<td>59.41 ± 21.73</td>
</tr>
<tr>
<td>Lack of access to opportunities such as nearby facilities</td>
<td>44.70 ± 19.10</td>
</tr>
<tr>
<td>Keep talking myself out of it</td>
<td>27.35 ± 9.94</td>
</tr>
<tr>
<td>Lack of safe places</td>
<td>35.29 ± 19.73</td>
</tr>
<tr>
<td>Lack of child care</td>
<td>17.05 ± 8.35</td>
</tr>
<tr>
<td>Lack of a partner</td>
<td>39.41 ± 17.91</td>
</tr>
<tr>
<td>Lack of available and suitable programs at my level</td>
<td>62.64 ± 14.83</td>
</tr>
<tr>
<td>Lack of support from others</td>
<td>49.70 ± 20.37</td>
</tr>
<tr>
<td>Lack of transportation</td>
<td>34.11 ± 16.53</td>
</tr>
<tr>
<td>Have other areas in my life that I feel must take priority in my day</td>
<td>23.82 ± 15.57</td>
</tr>
<tr>
<td>Don’t feel that I have the ability to exercise at a sufficient level for it to be worthwhile</td>
<td>52.94 ± 25.52</td>
</tr>
<tr>
<td>Pain when I exercise</td>
<td>73.23 ± 19.80</td>
</tr>
</tbody>
</table>

*measured using BPAQ

Lack of skills of exercise was the major barrier to PA among elderly (90.58 ± 12.04). Fear of injury during exercise ranked second (90.29 ± 9.36) while Lack of energy (89.70 ± 11.41) ranked third. Barriers to PA among Malaysian elderly were a frequent cited barriers in previous studies. Elderly with lack of knowledge and skills feel unsafe without guidance and instruction. This can affect their confidence of engaging in PA that will improve their balance, strength, and reduce their risk of fall. Another barrier among Malaysian elderly is
fear of injury, which confirms that it is one of the major causes of physical inactivity. Reduced self-efficacy results in less confidence leading to further inactivity. Lack of energy is the third most common barrier, which may be attributed to increasing age and other factors associated with it. Determining the potential causes of lack of energy will minimize this barrier.

Conclusion and Recommendations

In conclusion, there is moderate level of PA among Malaysian elderly. Self-determined motivation was reported to be the main driver in engaging to PA. Lack of skills and lack of knowledge, fear of injury, and lack of energy were the most common barriers to PA.

Interventions focusing on proper education, confidence to engage in PA, and exercises that will improve exercise tolerance should be considered during planning. Barriers to should be assessed in an individualized approach considering physical capabilities, perceived barriers, and motivation.

Conflict of Interest: The author declares no conflict of interest at any point during the conduct of this research.

Funding: This author did not receive any funding from both local and international organization to conduct this research.

Ethical Clearance: Ethical clearance was obtained from Ethics Review Board of INTI International University. Data collection and handling were done in accordance with the World Medical Association Declaration of Helsinki.

References

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Variation in Spatio-Temporal Gait Parameters among Patients with HIV-Related Neurocognitive Impairment

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Abstract

Neurocognitive impairment is a common complication of HIV that predisposes to gait abnormalities and risk of falls. Understanding the impact of this complication on gait is important to strategies directed at reducing risk of falls among adults living with HIV. The study sought to evaluate the influence of cognitive impairment on spatiotemporal gait parameters of HIV-seropositive Individuals. A purposive sample of 120 HIV-seropositive individuals with modal age of 30-39 years participated in this cross-sectional survey. Assessment of cognitive impairment was executed with the aid of the HIV Dementia Scale respectively. Severity of cognitive impairment was classified using the Lawton Instrumental Activities of Daily Living scale. Recent history of falls was reported and documented. Spatiotemporal gait parameters were evaluated using the Shore footprint method of analysis. Data was summarized using descriptive statistics of mean and standard deviation. One-way analysis of variance was used to test for differences in gait parameters among participants with mild cognitive impairment, dementia and normal cognition. The prevalence of mild cognitive impairment and dementia were 67.5% and 28.4% respectively. Nine participants reported recent history of fall. The mean stride length, step length, walking speed and width of support were 117.02±14.74cm, 79.89±9.87cm, 1.58±0.25m/s and 10.96±5 respectively. History of fall was significantly associated with dementia (p<0.05). Significant differences in step and stride lengths and walking speed were found between participants with dementia and those with normal cognition (p<0.05). In conclusion, HIV-dementia predisposes to gait deficits, with consequent tendency for falls.

Keyword: HIV, cognitive dysfunction, dementia, gait, falls.

Introduction

Cognitive Impairment is one of the most common neurological complications of Human Immune Virus (HIV) infection1. It is a common reason for consultation by HIV-seropositive persons is cognitive impairment which is characterized by poor memory, confusion, anxiety, learning difficulty2. Cognitive impairment is said to affect as many as 40% of people living with HIV (PLHIV) in the combined antiretroviral therapy (cART) era2-3. Prior to the widespread use of cART, 20–30% of individuals with advanced HIV infection displayed symptoms of the most severe HIV-associated neurocognitive disorder (HAND)3, 4 and it affects quality of life, treatment adherence and life span. In Africa, HAND prevalence rate ranges from 30% to 50% and areas of impairment have not changed significantly over the years2. In Nigeria, prevalence of 21.5% and 28% has been recently reported5, 1. Generally, cognitive impairment usually begins with mild changes though can cause severe forms of neuronal and psychosocial dysfunction such as imbalance, poor self-efficacy and heightened perceived susceptibility to fall which could pose challenge to gait6, 7, 8.

Gait as a complex brain process involves integration of motor, sensory, and cognitive inputs, including memory, attention, and executive functions9. It is a strong indicator of health, and poor gait has been linked to mortality, morbidity, and risk of falls10, 11. Gait parameters could be useful in predicting risk of falls in people with balance problem12, and deficit in these parameters is among the leading predictors of falls in both community dwelling and institutionalized adults13. Dysfunctional gait has been linked to cognitive

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deterioration bordering on attention, executive function and/or memory and it’s a common risk for falls and fracture. However, among people living with HIV, there is paucity of literature especially in our locality on the possible impact of cognitive impairment on gait. As a strategy directed at reducing risk of falls and possible fracture in PLHIV, this study intends to evaluate the variation in spatiotemporal gait parameters among of cognitive impairment on gait parameters.

Materials and Method

A convenient sample of HIV-seropositive adults with at least primary 6 education participated in this cross sectional survey. Participants excluded were PLHIV who were pregnant, older than 65 years, had osteoarthritis of the lower limb joints, recent head injury, psychosis or diabetic mellitus. Considering the degree of freedom for a three groups (df3), from Cohen table, a prior power analysis showed that to get a large effect size (f = 0.40), at a power of 0.9 and 0.05 level of significance, a minimum sample of 113 subjects would be required. However, a total of 122 HIV-seropositive individuals were recruited into the study. Informed consent was sought and obtained from each participant. Sociodemographic and anthropometric characteristics were obtained. Ethical clearance was obtained from the Research Ethical Review Committee, Oyo state, Nigeria.

Assessment of Cognitive Impairment

Cognitive impairment was assessed using the modified HIV Dementia Scale (HAD) (19). HAD is a neuropsychological instrument with objective subtests measuring psychomotor processing speed, verbal memory, constructional ability and executive function (response inhibition, set shifting)19. Its score is based on performance for each subtest. The modified HAD20, in which anti-saccadic subtest was eliminated was used in this study. Its cut-off point is < 10 for persons with formal education. The modified HAD has been shown to be a sensitive screening tool for PLHV in this setting20. Further classification of cognitive impairment was facilitated by use of the Lawton Instrumental Activities of Daily Living (IADL) scale21, in line with Psychiatry Department, University College Hospital (UCH) Ibadan. The IADL scale was used to differentiate mild cognitive impairment from dementia. It contains 8 items that are rated with a summary score from 0 (low functioning) to 8 (high functioning). A total score < 8, in the presence of cognitive impairment, is predictive of dementia while score of 8 is diagnostic of mild cognitive impairment.

Gait Assessment and Analysis

Gait was analyzed following the Shore footprint manual for gait analysis22. Participants were instructed to walk, barefooted, along a 10-meter paper walkway at his regular speed looking straight ahead. The walkway was divided into three portions namely the initial 2meters to allow participants get started, the middle 6meters, and the final 2meters which was used to rule out slowing down at the end of the timed sequence deceleration. The procedure ended as soon participant reached final 2 meters line. Walking speed in meters/second was obtained by divide the total distance covered by the elapsed time. Cadence, the number of steps taken during the timed sequence by the elapsed time was calculated as number of steps divided by the elapsed time. The two sets of values for foot angle, base of support, stride, and step lengths were combined to obtain the average points following procedures of analysis described in the manual22.

Data Analysis

Descriptive statistic of frequency, and mean and standard deviation were used to summarize the data. Chi square was used test possible association between cognitive impairment and each of age, sex and education in the participants. Also, Chi-square was used to test for association between self-reported history of fall and sex, age, cognitive impairment and walking speed. One way Analysis of Variance was used to test for difference in spatiotemporal gait parameters among HIV-seropositive persons with mild cognitive impairment, dementia and those intact cognitive functioning.

Findings

Results

A total of 120 (91 females and 29 males) PLHIV participated in this study. Over half of the participants were married, 39% had secondary education while a few had tertiary education. Nine of the participants reported history of fall (Table1). More than half of the participants had cognitive impairment, of which most of them were mildly impaired (Figure 1). Self-reported history of falls was significantly associated with cognitive impairment (p<0.05) (Table 1).
Table 1: Sociodemographic characteristics of the study participants

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>MCI</th>
<th>Dementia</th>
<th>Normal Cognition</th>
<th>X2</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEX</td>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Male</td>
<td>19</td>
<td>2</td>
<td>8</td>
<td>0.728</td>
<td>0.695</td>
</tr>
<tr>
<td>Female</td>
<td>62</td>
<td>3</td>
<td>26</td>
<td></td>
<td></td>
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<tr>
<td>AGE</td>
<td></td>
<td></td>
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<tr>
<td>20-29 years</td>
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<td>1</td>
<td>5</td>
<td>6.119</td>
<td>0.906</td>
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<td>30-39 years</td>
<td>27</td>
<td>10</td>
<td></td>
<td></td>
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<tr>
<td>40-49 years</td>
<td>21</td>
<td>2</td>
<td>11</td>
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<tr>
<td>50 and above</td>
<td>13</td>
<td>-</td>
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<td>Missing</td>
<td>13</td>
<td>2</td>
<td>5</td>
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<tr>
<td>MARITAL STATUS</td>
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<td></td>
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<tr>
<td>Married</td>
<td>43</td>
<td>3</td>
<td>20</td>
<td>3.416</td>
<td>0.906</td>
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<td>Single</td>
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<td>-</td>
<td>3</td>
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<tr>
<td>Separated</td>
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<td>1</td>
<td>3</td>
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<td>3</td>
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<td>Missing</td>
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<td>Primary</td>
<td>20</td>
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<td>5</td>
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<td>Secondary</td>
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<td>2</td>
<td>7</td>
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<td>Post-SNU</td>
<td>12</td>
<td>-</td>
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<td>University</td>
<td>10</td>
<td>-</td>
<td>10</td>
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<tr>
<td>Missing</td>
<td>8</td>
<td>2</td>
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<td>BMI CATEGORY</td>
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<tr>
<td>Underweight</td>
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<td>2</td>
<td>5</td>
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<td>2</td>
<td>14</td>
<td></td>
<td></td>
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<tr>
<td>Overweight</td>
<td>19</td>
<td>-</td>
<td>9</td>
<td></td>
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<tr>
<td>Obesity</td>
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<td>1</td>
<td>57.496</td>
<td>0.000*</td>
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<tr>
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<td>-</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*: significant at α=0.05

Figure 1: distribution of cognitive impairment in the participants

The mean stride length, step length, walking speed, and width of support were 117.3±14.2cm, 79.6±9.5cm, 1.58±0.86m/s, 10.56±3.98cm, 2.66±0.46s and 1.33±0.23s respectively (Table 2).

Table 2: Descriptive statistics of the gait parameters

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step length(cm)</td>
<td>79.63</td>
<td>9.52</td>
</tr>
<tr>
<td>Stride length(cm)</td>
<td>117.28</td>
<td>14.23</td>
</tr>
<tr>
<td>Width of support (cm)</td>
<td>10.56</td>
<td>3.98</td>
</tr>
<tr>
<td>Cadence(steps/minutes)</td>
<td>99.17</td>
<td>12.03</td>
</tr>
<tr>
<td>Walking speed(m/s)</td>
<td>1.58</td>
<td>0.86</td>
</tr>
</tbody>
</table>
Analysis of variance reveals significant difference in step length, stride lengths, walking speed, double support among participants with mild cognitive, dementia and healthy control (p<0.05). However, post hoc test shows that the differences were between participants with dementia and those with normal cognitive functioning (p<0.05) (Table 3).

Table 3: One-way analysis of Variance and Post hoc (Turkey test) multiple comparison of gait parameters among participants with normal cognition, mild cognitive impairment and dementia

<table>
<thead>
<tr>
<th>Gait Parameters</th>
<th>Normal Cognition (n=34)</th>
<th>MCI (n=81)</th>
<th>Dementia (n=5)</th>
<th>F</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stride Length (cm)</td>
<td>121.93±12.23a</td>
<td>116.73±13.31a</td>
<td>94.30±19.93b</td>
<td>9.604</td>
<td>0.000*</td>
</tr>
<tr>
<td>Step Length (cm)</td>
<td>83.27±6.56a</td>
<td>79.26±8.20a</td>
<td>60.88±21.02b</td>
<td>15.150</td>
<td>0.000*</td>
</tr>
<tr>
<td>Cadence (step/min)</td>
<td>98.74±13.07a</td>
<td>99.80±11.05a</td>
<td>92.01±19.56a</td>
<td>1.016</td>
<td>0.365</td>
</tr>
<tr>
<td>Walking speed (m/s)</td>
<td>1.63±0.17a</td>
<td>1.59±0.22a</td>
<td>1.04±0.53b</td>
<td>14.500</td>
<td>0.000*</td>
</tr>
<tr>
<td>Width of Support(cm)</td>
<td>10.62±3.89a</td>
<td>10.45±3.92a</td>
<td>12.12±5.93a</td>
<td>0.418</td>
<td>0.660</td>
</tr>
</tbody>
</table>

NB: Sameness of superscript shows no significant difference while variance of superscripts represents significant difference

Discussion

The fact that participants with HIV-dementia had shorter stride lengths and slower walking speed is consistent with findings of Gilles et al.\textsuperscript{16}, Montero-Odasso et al.\textsuperscript{23} and Boripuntakul et al.\textsuperscript{24}, in which stride length and walking speed declined with moderate dementia when compared to cognitive healthy adults. This is an indication of the tendency for limited community ambulation and falls\textsuperscript{16, 17} and has been described as cautious gait attributed to frontal lobe inhibition which is common in patients with dementia\textsuperscript{11}. The frontal lobes have shown to participate in functions considered to be executive, and this is paramount in cortical control of gait\textsuperscript{11, 25}. Inhibition of the frontal lobe leads to deficiency in aspects of cognition such as executive function, memory and recall, attention and orientation\textsuperscript{25, 26} thereby resulting in delayed deceleration or involuntary acceleration. This is further supported by our finding that all the participants with dementia experienced falls since last visit to the clinic. The short step length in addition to decreased walking speed may precipitates prolonged double support which further indicates unsteadiness and likelihood of fall\textsuperscript{9}. Therefore, we viewed this as strategy deployed by the demented to cautiously guard against falls.

The lack of difference between mildly impaired and cognitively healthy individuals in terms of step length stride length and walking speed is contrary to works of Boripuntakul et al.\textsuperscript{24}, Verghese et al.\textsuperscript{27}, Muir et al.\textsuperscript{28} and Gillain et al.\textsuperscript{29} in which decreased walking speed was found in older adults with mild cognitive impairment. This discrepancy, however, may be due to differences in age (the mean age for this study is 30-39 years while older adults constituted the populations for the previous studies), and instrument used for assessment of cognition. This variation may support the fact that age is a important confounder in assessment of cognition. Nonetheless, we are inclined to hold that mild cognitive impairment may not pose significant limitation to gait in PLHIV; we need demographically controlled gold standard neuropsychological test scores to validate this assertion.

A recognized limitation in this study was the fact that participants’ inclusion as regards age, and education was not standardized. This is expected to influence the individual participant’s cognitive score and gait respectively. However, this limitation was addressed by the use of age, sex and educationally matched control. Also, classifying dementia in this study following the unpublished guidelines of the Psychiatric department UCH, Ibadan, may have constituted a limitation to the study. Hence, the study was limited not to make an inference of causality.

Conclusion

HIV-associated dementia precipitates cautious gait pattern characterised by short step and stride lengths and slow walking speed. We recommend that further study on the subject of this paper employ prospective study design and demographically controlled
neuropsychological battery tests score in classifying HIV-associated cognitive disorder.

Acknowledgement

The authors hereby acknowledge Prof O. Baiyewu of Psychiatry department, UCH Ibadan for his providing the guideline used in classifying cognitive impairments in this study.

Source of Funding: Self

Conflict of Interest: Nil

References


Strength and Functional Deficits Following Total Hip Replacement in Individuals with Avascular Necrosis of Femoral Head

Ananya Mehta1, Neha Mukkamala2, Niketa Patel3, Lata Shroff Parmar3, Paresh Golwala1

1 PG student, 2 Assistant Professor, 3 Professor and Principal, 4 Professor & Head, Department of Orthopaedics, Smt. B.K. Shah Medical Institute and Research Centre, Sumandeep Vidyapeeth, Vadodara, Gujarat

Abstract

Background: AVN commonly affects femoral head causing pain, joint stiffness, muscle wasting and physical disability. THR, commonly done for AVN improves mobility, strength and physical functions by reducing pain and improving functions.

Methodology: Total 32 subjects, 16 age & gender matched healthy adults and 16 with AVN of femoral head were included. Muscle strength of hip muscles by modified sphygmomanometer, self reported Harris hip score and TUG test were taken preoperatively in subjects with AVN scheduled for a THR. All subjects underwent physiotherapy during hospital stay. Again all outcome measures were taken post hip replacement on the day of discharge. In healthy adults, only hip muscle strength was measured.

Results: 32 subjects, 28-males and 8-females. Mean age-36.88 years in both groups. Isometric muscle strength preoperatively in AVN subjects of hip flexors-76.75±50.67 mm of Hg, abductors-54.56±30.74 and extensor apparatus 75.38±37.32 was significantly reduced (p<0.001) compared to healthy adults,(hip flexors-188.42±15.69, abductors 112.67±21.66 and extensor apparatus-171.71±25.60). Postoperatively strength of hip flexors-93.12±52.58, abductors-63.62±33.74 and extensor apparatus-88.94±41.22 was reduced compared to healthy adults. Postop significant improvement (p<0.05) seen at discharge in strength compared to preop values.

Conclusion: Muscle strength of hip muscles in subjects with AVN preoperatively and post replacement was significantly reduced compared to normals. Postoperatively improvement was seen at discharge in strength compared to preoperative values.

Keywords: Avascular necrosis, muscle strength, total hip replacement.

Introduction

Avascular necrosis (AVN) also known as osteonecrosis, ischemic bone necrosis or aseptic necrosis is a disease that most commonly affects femoral head. 1,2,3 AVN occurs due to blood flow obstruction to the femoral head leading to death of bone-forming cells, bone tissue collapse and articular surface deformities.4

Primary or idiopathic AVN occurs without any cause. Secondary AVN is seen in subjects with sickle cell anaemia, fracture or dislocation of hip, Gaucher’s disease, excessive alcohol intake, and prolonged systemic steroid use in high doses.2,5,6,7 Although initially the condition is painless, the subject’s main complain is pain with limitation of motion. Pain is deep, intermittent and throbbing and is localized to the groin area. It exacerbates with weight bearing and relieves on rest. Joint deformity and muscle wasting may be present and it might present bilaterally.1,8,9,10 Radiographically, AVN of femoral head has been classified by Ficat and Arlet into 4 stages as below: 11,12

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Email: neha.cop@sumandeepvidyapeethdu.edu.in
<table>
<thead>
<tr>
<th>Stages</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage I</td>
<td>Normal imaging</td>
</tr>
<tr>
<td>Stage II</td>
<td>Normal femoral head contour, but with evidence of bone-remodeling, such as cystic or osteosclerotic regions.</td>
</tr>
<tr>
<td>Stage III</td>
<td>Evidence of subchondral collapse, or flattening of the femoral head</td>
</tr>
<tr>
<td>Stage IV</td>
<td>Narrowing of the joint space with secondary degenerative changes in the acetabulum, such as cysts, osteophytes, and cartilage destruction</td>
</tr>
</tbody>
</table>

Hip replacement is commonly undertaken to decrease pain and disability arising out of AVN of femoral head.\(^2,13\) Most common surgical approaches for hip replacement are posterolateral, anterolateral and direct lateral.\(^14\)

Hip replacement, depending on number of components, is of two types: Total hip replacement (THR) and hemi hip replacement. On the basis of the type of fixation of the implant it is either cemented or uncemented.

AVN causes physical disability whereas THR brings improvement in muscle strength and physical functions.\(^2,11,15,16,17\) Thus this study aimed to see strength and functional deficits preoperatively and postoperatively in individuals with Avascular necrosis of femoral head.

**Methodology**

After getting approval from Sumandeep Vidyapeeth Institutional Ethical Committee, this observational study on subjects with AVN scheduled for THR, as well as healthy adults was carried out at Sumandeep Vidyapeeth affiliated Dhiraj general hospital, Piparia, Vadodara.

Males and females of \(\geq 18\) years with avascular necrosis scheduled for THR were included in the study. Subjects with lower extremity orthopaedic pathology, hip osteoarthritis scheduled for replacement, neurological disorders that impaired daily functions were excluded from the study.

A total of 32 Subjects, 16 age and gender matched healthy adults as well as 16 with AVN of femoral head were recruited on the basis of inclusion and exclusion criteria. Those fulfilling the inclusion criteria and willing to participate signed a written informed consent. Patient information sheet given to the subjects explained the study. Subjects with AVN of femoral head (grades I-IV) were assessed preoperatively and postoperatively after undergoing hip replacement on the day of discharge. They were assessed for muscle strength of hip muscles, Timed up and go test and self-reported Harris Hip score. For muscle strength, the cuff of the sphygmomanometer was folded on the therapist’s palm and inflated to a set pressure of 60mm of mercury (Hg). The therapist placed the cuff on the limb to be tested and asked the subject to perform the movement. The therapist applied resistance such that no movement occurred. The maximum reading was of 300mm of Hg. Subject was asked to perform 3 trials for each muscle strength. An average of 3 trials was considered for analysis.

**Figure 1 – Modified sphygmomanometer**

For hip flexors and hip abductors, the subject’s position was supine lying. The cuff was positioned at distal thigh on the anterior aspect for resisting hip flexors and at distal thigh on the lateral aspect for hip abductors. The subject was asked to perform the movement and the therapist applied resistance such that no movement occurred.

**Figure 2 – Method to measure strength of hip flexors**
Figure 3 – Method to measure strength of hip abductors

For extensor apparatus, the subject’s position was supine lying and the cuff was positioned under the heel. The subject was asked to press the heel down against the resistance of cuff.

Figure 4 – Method to measure strength of extensor apparatus

The Timed up and go test was performed as per standard protocol and self reported Harris hip score was taken on one-to-one basis. All the subjects received standard Physiotherapy program post hip replacement. Outcome measures were taken after hip replacement on the day of discharge. In healthy adults, only muscle strength was measured.

Statistical Analysis

Data was analysed with IBM-SPSS version 16. The data was normally distributed. Independent t-test was used to see the difference between the groups and paired t-test to see the difference within the groups. The level of significance was kept at p<0.05.

Results

Total subjects – 32

Subjects with AVN - 16, 4 females and 14 males.

Age and gender matched healthy subjects - 16, 4 females and 14 males.

Table: 1 Comparison of hip muscle strength (mmHg) values in subjects with AVN and healthy adults.

<table>
<thead>
<tr>
<th>Muscle strength (mmHg)</th>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip flexors</td>
<td>Subjects with AVN</td>
<td>16</td>
<td>76.75</td>
<td>50.67</td>
<td>12.67</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Normals</td>
<td>16</td>
<td>188.42</td>
<td>15.69</td>
<td>3.92</td>
<td></td>
</tr>
<tr>
<td>Extensor apparatus</td>
<td>Subjects with AVN</td>
<td>16</td>
<td>75.38</td>
<td>37.32</td>
<td>9.33</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Normals</td>
<td>16</td>
<td>171.71</td>
<td>25.60</td>
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<tr>
<td>Hip abductors</td>
<td>Subjects with AVN</td>
<td>16</td>
<td>54.56</td>
<td>30.74</td>
<td>7.69</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Normals</td>
<td>16</td>
<td>112.67</td>
<td>21.66</td>
<td>5.42</td>
<td></td>
</tr>
</tbody>
</table>

Table: 2 Comparison of hip muscle strength (mmHg) values in subjects post THR at discharge and healthy adults.

<table>
<thead>
<tr>
<th>Muscle strength (mmHg)</th>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip flexors</td>
<td>Subjects with THR</td>
<td>16</td>
<td>93.12</td>
<td>52.58</td>
<td>13.15</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Normals</td>
<td>16</td>
<td>188.42</td>
<td>15.69</td>
<td>3.92</td>
<td></td>
</tr>
<tr>
<td>Extensor apparatus</td>
<td>Subjects with THR</td>
<td>16</td>
<td>88.94</td>
<td>41.22</td>
<td>10.31</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Normals</td>
<td>16</td>
<td>171.71</td>
<td>25.60</td>
<td>6.40</td>
<td></td>
</tr>
<tr>
<td>Hip abductors</td>
<td>Subjects with THR</td>
<td>16</td>
<td>63.62</td>
<td>33.74</td>
<td>8.44</td>
<td>&lt;0.001</td>
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<tr>
<td></td>
<td>Normals</td>
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<td>112.67</td>
<td>21.66</td>
<td>5.42</td>
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</tbody>
</table>
Table 3 Comparison of hip muscle strength (mmHg) in subjects with AVN preoperatively and after THR.

<table>
<thead>
<tr>
<th>Muscle strength (mmHg)</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip flexors pre op</td>
<td>16</td>
<td>76.75</td>
<td>50.67</td>
<td>12.67</td>
<td>0.017</td>
</tr>
<tr>
<td>Hip flexors post op</td>
<td>16</td>
<td>93.12</td>
<td>52.58</td>
<td>13.15</td>
<td>0.004</td>
</tr>
<tr>
<td>Extensor apparatus pre op</td>
<td>16</td>
<td>75.38</td>
<td>37.32</td>
<td>9.33</td>
<td></td>
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<tr>
<td>Extensor apparatus post op</td>
<td>16</td>
<td>88.94</td>
<td>41.22</td>
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<tr>
<td>Hip abductors pre op</td>
<td>16</td>
<td>54.56</td>
<td>30.74</td>
<td>7.69</td>
<td>0.015</td>
</tr>
<tr>
<td>Hip abductors post op</td>
<td>16</td>
<td>63.62</td>
<td>33.74</td>
<td>8.44</td>
<td></td>
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</tbody>
</table>

The value of TUG test was 19.4±5.58 seconds preoperatively and 56.16±44.82 seconds postoperatively with p-value of 0.042.

**Discussion**

The present study tried to look at the strength and disability of subjects with AVN preoperatively and postoperatively on the day of discharge compared to healthy adults. In our study, 4 subjects had grade III AVN and 12 subjects had grade IV AVN. All subjects with AVN underwent uncemented THR: 6 were allowed weight bearing as tolerated, 2 were on non-weight bearing ambulation.

Isometric muscle strength of hip flexors, abductors and extensor apparatus in subjects with AVN preoperatively was 56.3% less compared to healthy adults. Two subjects with unilateral involvement were 29.5% weaker on affected side compared to unaffected side. Average NPRS on movement was 5.6 preoperatively which led to physical dysfunction and restricted weight bearing causing disuse atrophy.15 Due to pain the subjects are inhibited and do not put their full effort during functions which reduces the muscle strength significantly compared to normals. Nazarov E. in 1989 found a direct correlation between the stages of the disease process and the degree of femoral muscular atrophy.18

Isometric muscle strength of hip muscles after total hip replacement in the same subjects was 48.04% less compared to normals. Muscle strength of hip abductors was maximally reduced. Similarly, studies have reported decrease in muscle groups associated with hip abduction, adduction, flexion and extension after THR. One of the reasons for this decrease could be ‘arthrogenic muscle inhibition’ which is the central nervous system’s failure to activate muscles close to the operated hip joint due to intra-articular swelling, inflammation, pain, joint laxity or structural joint damage leading to atrophy of the muscles.17,19

In the present study, only 6 subjects were allowed weight bearing on first post-op day by the operating surgeons. Hip abductors and extensor apparatus are anti-gravity muscles. In non-weight bearing subjects, strength of hip abductors was 58.64 mm of Hg and 84.18 mm of Hg in extensor apparatus and in subjects who were weight bearing hip abductor strength was 71.8 mm of Hg and extensor apparatus was 96.85 mm of Hg. This decrease could be attributed to decreased muscle loading due to insufficient activity in the form of weight bearing exercises.16 According to a study, adults with end-stage hip OA were 10–38% weaker in their arthritic lower extremity and performed 28–50% poorer on functional tests.20 In our study, subjects with AVN were 56.3% weaker than normals and two subjects with unilateral involvement were 29.5% weaker than non-affected side. THR is generally done after AVN or hip OA in which muscle strength is already decreased preoperatively due to disease process.11,15,18 So, after replacement, this reduced muscle strength takes time to recover.

Strength significantly improved post replacement on the day of discharge compared to preoperative status of AVN subjects. During hospital stay all of them performed strengthening and mobility exercises twice a day from first post-op day. In 6 subjects weight bearing as tolerated was begun on the first post-op day. This could have led to improvement in muscle strength after THR. The subjects received analgesics postoperatively. The average NPRS preoperatively was 5.6 on movement which reduced to 3.5 postoperatively at discharge which could also have led subjects to apply more effort during strengthening exercises. This increase in muscle strength in the initial post-op period is in agreement with several studies.15,16,17,19,21
In self reported HHS the component ‘Support used’ and ‘distance walked’ did not improve post surgery. Before THR, all the subjects were walking without support although with pain and limp and after surgery, only 6 were allowed weight bearing with frame, 2 were allowed non-weight bearing ambulation. There are conflicting studies available for weight bearing status in subjects with uncemented THR, where some studies support delayed weight bearing and some support immediate weight bearing after surgery. In our set up weight bearing was at the discretion of operating surgeon depending on bone quality and diameter of the medullary canal.

‘Limp’ probably improved/unobservable in subjects who were allowed for weight bearing post surgery as they were walking with a frame. Pre-op limp was present due to pain, muscle weakness and limb length discrepancy. All the subjects underwent a posterolateral approach which itself is associated with low rate of postoperative limp as the abductor muscles are not cut during surgery. The subjects had reduced pain and improved strength post replacement due to which subject was able to bear weight on operated limb.

TUG test was assessed in 6 subjects who were allowed weight bearing. It increased considerably post-operatively as the subject was guarded/inhibited due to pain and took more time manoeuvring the walker. According to a study, walking with walker takes 30 seconds more time than walking with crutches.

**Conclusion**

The muscle strength of hip flexors, abductors and extensor apparatus of subjects with AVN before and after surgery was significantly lesser as compared to normals. There was significant improvement in muscle strength of hip muscles post-surgery compared to pre-surgery.

A therapist should consider these results while formulating an exercise program and emphasize on strengthening of hip muscles both, in subjects with AVN and post hip replacement.

**References**


The Effectivity of Dry Needling and Friction Massage Application on Pain Scale Changes in Upper Trapezius Myalgia Patients

Djohan Aras¹, Ibtisam Mangputri Al-Ihsan¹, Erfan Sutono¹

¹Department of Physiotherapy, Faculty of Nursing, Hasanuddin University

Abstract

Background: Upper trapezius myalgia is one of the most common symptoms in adults. This can be treated by using dry needling and friction massage. Objective. This study aims to determine the effectivity of dry needling and friction massage to improve pain in upper trapezius myalgia patients. Method. The study was conducted at Inco Hospital, Sorowako, South Sulawesi, Indonesia, involving 20 subject who meet the inclusion and exclusion criteria of having upper trapezius myalgia and 20 – 65 years old. Pain was measured using NPRS at baseline and after 3 times therapy for 5 weeks. Result. At the end of therapy (3 times), both of groups showed decrease of pain scale compared to baseline. The pain was improved significantly better in the dry needling with friction group compared to friction alone.

Keywords: Dry needling, friction massage, upper trapezius myalgia, pain.

Introduction

Myalgia or muscle pain is the pain that originates from one of the muscles of the body which can be caused by injury, overuse, soft tissue infection or inflammation¹. Clinical research has shown that neck/shoulder pain that is common in computer users is related to muscle pain, commonly known as myalgia. About 20% of the European population reports severe chronic pain, with a high prevalence in women and people with low economic levels. The most common chronic pain conditions are neck/shoulder pain including trapezius myalgia².

Andersen et.al stated that from the clinical examination of 653 study participants, 198 office workers were reported neck/shoulder pain, and more than 2/3 of these workers experienced tenderness in the upper trapezius muscle³.

One of the common symptoms of myalgia is pain for several days or even weeks. This pain is associated with stiffness, muscle spasm, headaches, trigger points, and tenderness in the suffered area. Other symptoms that can emerge are nausea, vomiting, fever, anxiety, depression, vertigo, numbness and tingling. The clinical presentations include pain, spasm, and upper trapezius tenderness⁴.

A case study shows that the application of deep friction to muscles will help eliminate muscle pain caused by spasm and prevent symptoms from reoccurring⁵. In a study conducted by Ramos et al in patients with chronic neck pain, it is showed that a decrease in pain and increase in function and range of motion of the cervical joints after the application of friction. Friction, either deep friction massage or cross fiber massage is applied to remove adhesion or minimize rough surfaces on tendon. It is also used to increase the mobility of muscle scar tissue when healing process occurs⁶.

Dry needling is a method used by inserting needles in the areas that have problems. Unlike acupuncture that uses Eastern science (Traditional Chinese Medicine) by focusing on “chi” and “meridians”, dry needling uses Western science with neuromusculoskeletal sciences⁷.

Material and Method

This study was conducted at Inco Hospital, Sorowako, South Sulawesi, Indonesia, from January to June 2018. Patients with upper trapezius myalgia were invited to take part in a randomized, controlled study. A total of 40 patients were randomly divided equally into 2 groups. One group was given dry needling and friction, and the other group was given friction only. Both groups were given intervention three times a week for 5 weeks.
Measurement of pain was using Numeric Pain Rating Scale (NPRS). Measurement were made twice; at baseline and after 5 weeks of the interventions. Pre and post treatment was analyzed using paired sample t test. Comparison between groups was analyzed using independent sample t test. Significance value was set as 0.05. Ethical approval for this study was obtained from The Ethics Committee for Health Research, Hasanuddin University, Makassar, Indonesia.

Results

General characteristics of the subjects are presented in the Table 1,

<table>
<thead>
<tr>
<th>Age /Gender</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>20–29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>Male</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>30–39</td>
<td></td>
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<tr>
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<tr>
<td>Male</td>
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<tr>
<td>50≤</td>
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<tr>
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<td>5</td>
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<tr>
<td>Male</td>
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<td>5</td>
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<tr>
<td>Total</td>
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<td>100</td>
</tr>
</tbody>
</table>

Table 2. Comparison between Dry needling with Friction and friction on decreasing pain in patients with myalgia upper trapezius

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>independent sample t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry needling + Friction</td>
<td>10</td>
<td>6,10</td>
<td>1,564</td>
<td>0,004</td>
</tr>
<tr>
<td>Friction</td>
<td>10</td>
<td>4,05</td>
<td>1,075</td>
<td></td>
</tr>
</tbody>
</table>

Table 2 describes the statistical analysis which shows that there are significant differences in the dry needling and friction group compared with friction alone group. The decrease in pain after 3 times of dry needling and friction for 5 weeks in subject of upper trapezius myalgia was 6.10. While the decrease in the pain in the friction alone group was 4.05. The statistical results obtained p <0.05 which means that the combination of dry needling and friction massage were more effective in improving pain in patients with upper trapezius myalgia compared to friction only.

Discussion

The distribution of respondents based on the characteristics of age and sex in table 1 shows that women aged 40-49 years were more than men. This is consistent with what was stated by Dannecker et al. That women are more likely to experience muscle pain than men. In addition, women have a higher pain response to muscle pressure than men with the exception of a certain point11. Research conducted by Wang et al states that the prevalence of gender ratios shows a higher prevalence of pain in women for headache, migraine, temporomandibular pain, burning mouth pain, neck pain, shoulder pain, back pain, knee pain, abdominal pain, and fibromyalgia. It was also said that women showed a perception of pain with a low threshold that was more likely to be sensitive to pain8.

This study is in line with the research conducted by Begovic et al who find that friction massages, especially deep transverse massage can reduce pain. This is due to a decrease in neuromotor excitability and a decrease in muscle stiffness monitored using ultrasonography. This decrease can be caused by afferent Ia type of muscle spindles and slowly decreases the excitability of alpha-motor neurons. This can be caused by a central inhibitor from a higher motor center. Therefore, friction massage can help reduce pain9.

Based on Table 2, there were significant differences between the groups. The dry needling and friction group experienced a decrease in the pain measurement with the average of 6.1. As a comparison, the friction only group experienced a decrease of 4.05 in pain improvement. This is because dry needling has the local twitch response (LTR) effect, resulting in a decrease in inflammation and nociceptive concentration. The results of this study are consistent with the research conducted by Ramos et al and Kietrys et al which showed a reduction in pain after the application of dry needling.23,30 In a study conducted by Ramos et al., The number of subjects studied was 94 people, 47 people were included in the dry needling group and 47 people were included in the manual therapy group10.

The dry needling procedure is conducted by inserting a needle at the point of pain (trigger point) using the deep dry needling technique so that the needle is moved and pulled pushing until the twitch response is felt to the trigger point or LTR. Some studies have concluded that if this LTR is achieved at the time of dry needling, the effect of reducing pain and increasing ROM tends...
to be greater. This LTR can reduce pain because when the trigger point is punctured by a needle, stimulation of type A-delta nerve fibers occurs which then activates the enkephalin interneuron inhibitor dorsal horn cell which causes pain suppression. This is closely related to the gate control theory by Melzack and Wall which was later developed by Furlan et al in its journal entitled Acupuncture and dry-needling for low back pain: an updated systematic review within the framework of the co-collaboration. It was explained that dry needling inhibits type C nerve fibers that deliver muscle band myofascial trigger point pain impulses.

Conclusion

The combination of dry needling and friction is more effective on improving pain in upper trapezius myalgia patients compared to friction alone.

Conflict of Interest: The authors certify that they have no affiliation with organization that may benefit from the subject discussed in this study

Source of Funding: This study was funded by the Physiotherapy Department, Faculty of Nursing, Hasanuddin University, Makassar, Indonesia

Conflict of Interest: None

Ethical Clearance: Obtained from Medical Faculty, Hasanuddin University

References

HIV/AIDS Control Program in Health Office of Jayawijaya District: Empowerment and Logistic Study

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Abstract

Lack of community empowerment and gaps in the availability and use of logistics reflect different levels of local capacity, follow-up mechanisms, and local cultural norms and attitudes towards HIV/AIDS prevention program. This research aims to examine the human resources in HIV/AIDS prevention programs in Jayawijaya Regency. This research uses a qualitative research design with a case study approach. Data were collected by in-depth interviews on 18 information and 1 group of Focus Group Discussion (FGD). Determination of research informants with purposive procedures, consisting of District Health Officer, Regional AIDS Commission, Head of Public health services, HIV/AIDS Program Holder and Non-Government Organization. The results of this study indicated that community empowerment in the context of the HIV/AIDS prevention program in Jayawijaya District was the involvement of local NGOs to support the success of the program and the presence of Posyandu cadres who also played an active role in HIV/AIDS prevention programs. While the logistics of the HIV/AIDS prevention program in Jayawijaya Regency originated from the Central Government, procurement by the Health Office and international NGO assistance. The logistics distribution of HIV/AIDS at all levels starting from the Provincial Health Office to the service units in Puskesmas and hospitals were carried out through provincial decentralization. This study recommends an integrated response in community empowerment and equitable distribution of logistics among people with HIV/AIDS in Papua.

Keywords: Empowerment, Logistic, HIV/AIDS, Jayawijaya.

Introduction

Papua in 2011, with a population of only 1.5% of Indonesia’s population, contributed more than 15% of all new HIV cases in Indonesia¹. The Papua Province includes those facing health problems, especially HIV/AIDS²,³. Based on provincial data up to March 2016, there are 1,836 of 15,871 AIDS sufferers and 9,362 people with HIV who died. Based on regions, the most affected areas were in Jayawijaya Regency about 5,293 cases, and followed by Mimika Regency (4,162 cases), Nabire Regency (4,162 cases), Jayapura City (3,762 cases), Jayapura District (1,813 cases) and Merauke (1,807 cases)⁴. Various efforts have been made by the government in overcoming the problem of HIV/AIDS. But the HIV/AIDS epidemic continues to remain along with the rampant drug use in Indonesia⁵.

Sporadic control to HIV/AIDS has begun since the first case was discovered in 1987, which was formally responded to by the establishment of the 1994 AIDS Commission and followed by various international cooperation, both bilateral (USAID, Australian Aids and DfID) and multilateral cooperation (GFATM, UN, Indonesia Partnership funds, and non-government institutions⁶). In general, HIV and AIDS policymaking is intended to strengthen and sharpen the response to socio-political conditions that changed from the transition of the New Order era (from 1987 to 1998) to the era of decentralized autonomy (from 1999 to present)⁷.

The Jayawijaya DHO in carrying out its duties oversees 13 Health Centers. In the organizational structure, the part that oversees HIV/AIDS prevention is the Eradication of Communicable Diseases and the TB / HIV Control Sub-Sector. All Health Centers provide HIV/AIDS services totaling 5,293 cases in 2017 with the highest number of cases occurring in the Wamena City Health Center Working Area totaling 1,682 cases and
followed by Hom Hom Puskesmes and Elekma Health Centers in the second and third positions. Wamena Hospital and Kalvari Clinic are reference centers for patients with HIV/AIDS.

Capacity constraints (human resources and infrastructure), attitudes and culture influence efforts to prevent mother-to-child transmission and promote follow-up care for couples of mothers and infants. According to previous study, there was a relationship of knowledge \((p= 0.001)\), attitude \((p= 0.006)\), husband’s role \((p= 0.000)\), and the role of health workers \((p= 0.001)\) with the effort of pregnant women in prevention of HIV transmission to infants. Gaps in availability and use reflect different levels of local capacity, mechanisms for follow-up, and local cultural norms and attitudes towards HIV/AIDS. Based on the explanation above, the researcher argues that there is a need for research related to the implementation of decentralization in the HIV/AIDS prevention program in Jayawijaya District Health Office (DHO) which is focused on aspects of empowerment and logistics.

**Materials and Method**

**Study Design**

This study uses a qualitative research approach with a case study design in Jayawijaya District, Papua Province. This is based on the consideration that qualitative research is very well used to explore and understand the meanings of a number of individuals or groups.

**Data Sources**

Primary data was sourced from 18 informants consisting of DPRD officials, Provincial Health Service, District Health Office, Bappeda, Village Child Protection Group/ KPAD, Puskesmas, Non-Governmental Organizations (NGOs) and ODHA Communities. While secondary data is legislation related to HIV/AIDS and other credible written data sources that can be used in this study.

**Data Collection**

Data collection through in-depth interviews, observations, document review, and focus group discussions. Participants involved in the FGD of this study researched informants who were considered to have information relating to the topic of the research.

**Data Analysis and Validity**

Qualitative data analysis as an effort carried out by working and data, organizing data, sorting into manageable units, synthesizing them, looking for and finding patterns, discovering what is important and what is learned and interpreting the results of research themes. The validity of data by triangulation of sources, method, and theories.

**Results**

**Community Empowerment**

Community empowerment has been established in various central and regional government policies as a form of mechanism for community participation from the lower levels in supporting access to health and social services from those infected. Community empowerment is an important strategy to eliminate discrimination against people infected with HIV/AIDS. Community participation in the context of non-governmental organizations (NGOs), at the operational level, is the role of KPAD. KPAD conducts guidance and empowerment in local non-governmental organizations.

"... KPA’s role is to empower local non-governmental organizations. Those local NGOs are supported more by KPA Jayawijaya district ... - GYA informant, Head of AIDS, TB and Malaria Section of Health Office."

At present, there are several NGOs engaged in HIV/AIDS prevention programs in Jayawijaya District, namely Yukemdi, Tangan Peduli, YPKN, YTHP and Yuhumi Inane and 4 groups of street children. Empowerment activities carried out by NGOs are training, assistance in taking medicines, distribution of condoms, counseling on HIV, Reproductive Health and others. The Health Office, in this case, took part to provide material for training activities carried out by NGOs.

"... the provision of activity support in the form of funds that they have to hold accountable every year, each NGO is given a million assistance, then they are accountable every year. Then there are also possible empowerment activities such as training. LKB sulfa training involving also cadres, then there is also empowerment at any level of NGOs such as them and this health office also provides materials during the activity - activities in these local NGOs ... - GYA informants, Head of AIDS, TB and Malaria Section for Health Services."
Some NGOs carry out activities that have been carried out by other NGOs. Overlapping activities also occur between NGOs and Puskesmas. There have been activities that have been carried out by NGOs which have been carried out by the Puskesmas or vice versa. For example, visit mobile activities carried out by NGOs and budgeted funding, it turned out that these activities had been carried out by the Puskesmas. So that coordination is needed and sit together between NGOs and also with Puskesmas to determine who does what. Empowerment was also carried out on the PLWHA community by forming Peer Support Groups.

**Logistic Program of HIV/AIDS in Jayawijaya Regency**

The HIV/AIDS program logistics is a prevention service activity which comes from 2 (two) sources, 1) the procurement from the Province and 2) the State Budget and the Health Office of the Jayawijaya Regency.

..... the first is clear from national procurement for ARV drugs and also for the rapid availability of HIV testing from the national level. Then the regency held the consumables, consumables and also what the name for the cform cartridge, this was carried out by the district itself, and also later for the adequacy for firalot examination assisted by donors ... - FGD results, HIV/AIDS Programmer Health Service.

Management of ARV logistics is carried out with a system of 1 (one) door in the Provincial Health Office through the Health Pharmacy Installation. This system is called decentralized logistics. Pharmaceutical installations in the Papua Province have very strong networks up to the district level to the Puskesmas. The Provincial Health Office regulates the distribution of ARVs to the district level by ensuring the distribution chain reaches districts/cities. The distribution process to the service level is the DHO authority.

The distribution of HIV Logistics to service units is carried out by the Pharmacy Installation of DHO. Before 2017, the decentralization of logistics from the Province was channeled to districts/cities through hospitals. Since 2017, the logistics of HIV originating from the Provincial Health Service has been submitted to the Pharmacy Installation of DHO. Hospitals and health centers as HIV/AIDS service units every month make logistical requests for HIV/AIDS to the Pharmacy Installation of DHO by entering LBPHA reports¹⁰.

The dissemination of mass media is done in collaboration with other government agencies and NGOs. It is expected that the decentralization of logistics can also be carried out at the District level by the DHO. District decentralization gives the District authority to regulate drug needs, regulate reserves, distribution and monitor records and reporting¹¹.

**Discussion**

**Community Empowerment**

The current community empowerment in the implementation of the HIV/AIDS prevention program at the Jayawijaya DHO is the involvement of Posyandu cadres. Posyandu cadres are trained and given monthly incentives. In addition to carrying out their duties at the Posyandu, some cadres also carry out activities related to the HIV/AIDS program. This happened to the cadre of the working area of the Polebaga Health Center, where cadres acted as PMOs for HIV sufferers. This effort was successful where the Polebaga Health Center reached zero for HIV sufferers who were lost to follow-up. Community activity is also shown in the Asokobal health center work area, where there are groups of mothers who routinely provide information to the public about HIV/AIDS under the direction of the church pastor.

However, the community empowerment model that took place in Pelebaga and Asolokobal Health Centers was not carried out by other Puskesmas in the working area of the Jayawijaya District Health Office. Some Puskesmas do not encourage cadres to be actively involved in HIV/AIDS programs. In fact, the presence of cadres from the local community is needed to assist patients who are undergoing HIV counseling and testing until the treatment stage.

The results of this study also found that the community had not been involved in the HIV/AIDS program planning process. The cultural approach is one of the factors that must be considered in HIV/AIDS prevention programs¹². Cultural approaches must be encouraged in health development in Papua, including HIV/AIDS prevention programs. The tracking process of people with HIV/AIDS who lost to follow-up cannot be done without involving community leaders and religious leaders in the community/village environment. So, this needs to be considered in order to increase patient retention of treatment.
How far the commitment of regional governments not to tackle HIV/AIDS cannot be separated from the interaction and communication between stakeholders in Jayawijaya District, both government and non-government sectors. This must be a concern because the commitment and policies of the local government are basically the results of the communication process over the HIV and AIDS problems faced by the Jayawijaya Regency government. Communication between stakeholders will influence other needs such as financing, provision of human resources, and others. Sectoral ego is still an obstacle in HIV/AIDS prevention programs.

Logistic

The logistics management of the program includes planning, procurement, storage, distribution, use and supervision of drugs and medical equipment for prevention, diagnostics, and therapy. Logistics management in the health system is carried out by the Ministry of Health and DHO.

The procurement of drugs and medical equipment for HIV/AIDS prevention and therapy is currently still dependent, especially from foreign aid, except ARVs and some reagents prepared entirely by the Ministry of Health. In general, policies related to pharmaceutical preparations are regulated in Government Regulation No. 72/1998 concerning Safeguarding of Pharmaceutical Preparations and Medical Devices, which mandates the procurement of methadone and ARVs prepared by the central government.

Knowledge, access to ARVs and compliance are very important in maintaining the quality of PLWHA. In a previous study, there were differences in knowledge, access to ARVs and compliance before and after the provision of ARV-based health education interventions and compliance of the Support Group (CAASG) in PLWHA in Bulukumba. In addition to procurement by the Central Government, HIV/AIDS logistics was also conducted by the Jayawijaya District Health Office. The types of logistics held by the Department of Health are consumables, consumables, and CD4 cartridges. Some types of logistics are also assisted by foreign donors to back up the types of logistics that are lacking or not available.

Jayawijaya District Health Office implements SOP for distribution to service units. Each Puskesmas is required to submit LBPHA reports on the 25th of each month for logistical requests tailored to the number of HIV/AIDS sufferers at each Puskesmas. The problem that arises in connection with the distribution of logistics to the Puskesmas is the delay of the Puskesmas in entering LBPHA reports. This delay is caused by more workloads held by HIV/AIDS program holders at the Puskesmas.

Some HIV/AIDS program holders not only handle and prepare reports for HIV/AIDS, but also for other diseases such as tuberculosis and malaria. The problem of storage, supervision and the process of using logistics is still a problem in some Puskesmas. This was found in several health centers whose reagent logistics for diagnostic tests reached the expired date. The problem is that the reagent is still stored in the pharmaceutical drug storage rack that will be used. This shows that the logistics of HIV/AIDS has not been carried out by the Health Office to ensure the logistics available for use by Puskesmas are in accordance with HIV/AIDS service standards. The presence of expired reagents also shows the presence of unused reagents with two reasons, the number of reagents requested is not in accordance with the estimated number of cases and the level of reagent used by Puskesmas staff was low. This is also influenced by the high number of HIV/AIDS patients who are lost to follow-up.

Conclusion

Community empowerment, in the context of the HIV/AIDS prevention program, involved local NGOs to support the success of the program. Some NGOs routinely carry out activities of HIV/AIDS with financial assistance from KPAD.

The logistics of the HIV/AIDS prevention program in Jayawijaya originates from the Central Government, procurement by the Health Office and international NGO assistance. Logistics distribution of HIV/AIDS starting from Provincial level to the public health center and hospitals is run through a one-stop system based on patient data and proposed needs, and routinely distributed every month.

Ethical Clearance: Taken from Ethics committee at the Faculty of Public Health, Hasanuddin University Indonesia.

Fund Resources: Self-funded.

Conflict of Interest: Nil.
References


Effect of a Single Bout Interval Aerobic Exercise on Blood Glucose Level in Type 2 Diabetes Mellitus Patients

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Abstract

Long term aerobic exercise is beneficial for combating hyperglycaemia in T2DM patients, however, little is known about the immediate effect of aerobic exercise on hyperglycaemia in this populace. Ascertaining this might be useful in managing sudden rise in blood glucose level seen in poorly managed T2DM patients in our environment. This is an interventional study in which sex and age-matched T2DM patients participated. Subjects were randomly allocated into groups, and were on prescribed oral hypoglycemics and diabetes exchange diet, which provided about 50-60% of calories from carbohydrates, 10-20% of calories from protein and < 30% of calories from fat, while the intervention group had exercise in addition. We used three different measures of blood glucose level: FBG, HbA1c and fructosamine. Subjects’ aerobic capacities were determined prior to the intervention, which constituted interval aerobic exercise performed at sub-maximal intensity for 48 minutes at work-rest ratio of 1:1. A total of 40 (20 male and 20 females) T2DM patients, with mean age and body mass index of 56±8 years and 26±4Kg/m² respectively participated in the study. At baseline, the intervention and control groups had similar anthropometric, cardiovascular characteristics (P>0.05), and blood glucose level measured by HbA1c and fructosamine (P>0.05), while the intervention group had higher FBG. Results reveal significant decrease in blood glucose level measured by FBG (P<0.05) and fructosamine (P<0.05) in the exercise group. Single bout aerobic exercise reduces blood glucose level in T2DM patients but the reduction is small and short-lived.

Keywords: T2DM, hyperglycaemia, exercise, therapy, physical activity.

Introduction

The diabetes mellitus is currently a major cause of cause of death especially in developing nations like ours. Its prevalence has quadrupled in the past three years, with type 2 diabetes mellitus (T2DM) constituting most cases of diabetes. T2DM is caused by insulin resistance resulting in hyperglycaemia. Uncontrolled and prolonged hyperglycaemia is associated with complications such as diabetic neuropathy, nephropathy and retinopathy, peripheral arterial disease, stroke to mention but a few. To mitigate these complications and associated mortality, glycemic control remains the mainstay objective in management of T2DM (Jay and Skyler, 2004). Therefore every hand must remain on desk until the fight against T2DM is won, and the importance of protecting the body from hyperglycaemia through glycemic control cannot be overemphasized.

No threshold of blood glucose within T2DM patients has been termed risk of diabetic complications, hence the primary aim in treatment of T2DM is to reduce and keep blood glucose level within normal or near normal range.

Several efforts have beamed towards achieving glycaemic control among diabetes patients as proved by the invention and approval of Bydureon BCise (exenatide) in the year 2017. Similarly, several measures of monitoring hyperglycaemia have evolved.
over the years including the familiar fasting blood glucose, oral glucose tolerance test and random blood glucose, glycated haemoglobin, fructosamine, with each being unique in what it measures. For example, glycated haemoglobin test is a measurement of glycated haemoglobin indicating average blood glucose over the past two to three months, while fructosamine test measures glycated protein indicating average blood glucose level over the past two or three weeks. Although efforts to achieving glycaemic control through medications are appreciable, persistent and fluctuating hyperglycaemia seen in poorly managed T2DM patients continues to demand for complementary intervention and lifestyle modification.

Regular exercise is currently of the mainstay in management of vascular risk factors including diabetes. In fact, an epidemiologic study indicates that an active physical is protective of impaired glucose tolerance and non-insulin dependent diabetes. According to Praet and Van loon, physical activity is one of the most important factors in the treatment of T2DM, and studies have shown that increasing level of physical activity is effective for reducing insulin resistance. Specifically, aerobic exercise has been found to decrease subclinical, chronic inflammation and improves endothelial function owing to reduction in visceral obesity thus improving insulin sensitivity and attenuating hyperglycaemia. There is no doubt that aerobic exercise is beneficial in achieving glycemic control in type 2 diabetes mellitus through improving insulin sensitivity, however, little is known about the acute effect of aerobic exercise on hyperglycaemia in this populace. Ascertaining this might be useful in managing acute rise in blood glucose level seen in poorly managed type 2 diabetes patients in our environment. The main objective of the study is to determine the effect of single bout interval aerobic exercise on blood glucose level in T2DM patients.

**Materials and Method:** A sample of sixty six T2DM patients participated in this interventional study. Ethical approval was obtained from the Health Research and Ethics Committee of the University of Nigeria Teaching Hospital, Enugu. Subjects were recruited based on the following inclusion criteria: being medically and mentally stable, referred to attending outpatient physiotherapy clinic, on prescribed oral hypoglycemics and diabetes exchange diet, and blood pressure <140/0mmHg. Subjects who were pregnant, on antidepressant, had chest pain or insufficient aerobic capacity following exercise testing were all excluded. A simple random sampling without replacement was used in allocating subjects into exercise group (A) and control group (B). Subjects were asked to pick a number from a box which contained equal numbers allocated to groups A and B. The number they chose decided their assignment into either A or B. Sample size was computed using Cohen’s sampling table. At effect size of 0.4, degree of freedom of 1 and power (β) of 0.9, minimum sample size of 40 subjects was obtained. The procedure for data collection involved explaining the aims of the research to each participant after which the consent for participation was sought and obtained. Socio-demographic characteristics such as age and sex were assessed thereafter.

**Assessment of blood glucose level:** Three measures of blood glucose level of glycaemic control were used namely HbA1c, FGB, and fructosamine. Both HbA1c and fructosamine tests were conducted with the Spectrum Lab Enugu Nigeria following standard laboratory procedures. Specific protein analyzer was used to assess HbA1c whole color spectrophotometry was used to quantify fructosamine. We measured FBG using the Accucheck glucometer following standard practice. The assessment was done before and after the intervention. HbA1c is the gold standard test in monitoring long-term control of diabetes mellitus. HbA1c reflects the average blood glucose level over the past 3 months, while fructosamine relates to average levels of glucose during the preceding 1 to 3 weeks.

**Exercise stress test:** The Young Men Christian Association (YMCA) sub-maximal cycle ergometer test protocol was used to assess subjects’ aerobic capacity. The YMCA protocol uses two to four 3-minutes stage of continuous exercise, two Heart Rate (HR)-power output data points needed (steady state HR) of between 110 and 150 beats/min. However, in this study, we used four 6-minutes stage of continuous exercise. Exercise test started with a five minute warm up at zero resistance in order to acquaint the subjects with the cycle ergometer. The test was done following the aforementioned protocol. At the end of the test, five minute recovery period (cool down) at zero resistance pedalling was administered. Post exercise BP and HR were monitored and recorded.

**The intervention procedures:** The intervention constituted cycle ergometer interval aerobic exercise performed at sub-maximal intensity of between 50-70% of subjects’ HRmax. The work/rest ratio was 1:1.
The intervention was interspaced with warm-up and cool-down periods of 5 minutes each during which subjects pedalled at a slow speed and zero resistance. The starting workload was 100kgm (17 watts), which was increased at a pedal speed of 50rpm-100rpm to obtain 50-70% of subject’s specific HRmax. The exercise duration was 48 minutes (four 6-minute work interspaced with 6 minute rest). The training session was concluded with a cool-down period of 5 minutes. At rest intervals, subjects pedalled at zero resistance. The trainings were done in the morning hours between 8.00am and 11am.

Data analysis: Descriptive statistic of frequency, mean and standard deviation were used to summarize the data. Independent t-test was used to test for difference in blood level glucose between the exercise and control groups before and after exercise. Multivariate analysis was conducted to control for the baseline difference in age and FBG between the exercise and control groups. Data was analyzed using SPSS version 23, with α set at 0.05.

Findings

Results: A total of 40 age and sex matched T2DM patients participated in this study. The mean weight, body mass index were 74.40±11.24kg and 26.15±3.91Kg/m² respectively. Results show there was significant difference in age between experimental and control group (P< 0.05) thus underscoring the need for its modulating effect to be controlled appropriately. There was no significant difference in baseline values of each of anthropometric and cardiovascular characteristics between the exercise and control groups (P> 0.05) (Table 1).

Table 1: Anthropometric and cardiovascular characteristics of the subjects

<table>
<thead>
<tr>
<th>Anthropometrics</th>
<th>Group</th>
<th>Mean ± SD</th>
<th>P-value</th>
<th>Grand Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>Exp</td>
<td>53.20±8.17</td>
<td>0.022*</td>
<td>56.00±7.86</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>58.80±6.60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight (Kg)</td>
<td>Exp</td>
<td>76.00±12.05</td>
<td>0.373</td>
<td>74.40±11.24</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>72.80±10.43</td>
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<tr>
<td>Height (meters)</td>
<td>Exp</td>
<td>1.68±0.07</td>
<td>0.671</td>
<td>1.69±0.10</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>1.69±0.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body Mass Index</td>
<td>Exp</td>
<td>26.67±3.43</td>
<td>0.410</td>
<td>26.15±3.911</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>25.64±4.37</td>
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<td></td>
</tr>
<tr>
<td>SBP</td>
<td>Exp</td>
<td>125.10±18.66</td>
<td>0.256</td>
<td>128.20±17.07</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>131.5±15.12</td>
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</tr>
<tr>
<td>DBP</td>
<td>Exp</td>
<td>82.45±8.15</td>
<td>0.351</td>
<td>81.25±8.02</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>80.05±7.92</td>
<td></td>
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<tr>
<td>PR</td>
<td>Exp</td>
<td>83.50±11.11</td>
<td>0.478</td>
<td>82.48±9.00</td>
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<tr>
<td></td>
<td>Control</td>
<td>81.45±6.37</td>
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</table>

*= significant (P<0.05)

Regarding baseline values of the selected measures of blood glucose level, the exercise group had significantly higher blood glucose level as measured by FBG (P< 0.05) (Table 2).

Table 2: Baseline values of markers of glycaemic control

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group (Without Adj)</th>
<th>Mean±SD (Age-Adj value)</th>
<th>P</th>
<th>Mean±SD</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting Blood Sugar</td>
<td>Exp</td>
<td>144.50±44.25</td>
<td>0.000*</td>
<td>142.12±8.65</td>
<td>0.004*</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>101.90±15.96</td>
<td></td>
<td>106.67±12.60</td>
<td></td>
</tr>
<tr>
<td>HbAc1</td>
<td>Exp</td>
<td>6.53±1.70</td>
<td>0.986</td>
<td>6.49±0.40</td>
<td>0.891</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>6.52±1.83</td>
<td></td>
<td>6.39±0.58</td>
<td></td>
</tr>
<tr>
<td>Fructosamine</td>
<td>Exp</td>
<td>15.01±5.90</td>
<td>0.474</td>
<td>15.17±1.39</td>
<td>0.53</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>13.58±6.56</td>
<td></td>
<td>12.12±2.03</td>
<td></td>
</tr>
</tbody>
</table>

*= significant at p<0.05, HbAc1 = Glycated Hemoglobin; adj=adjusted
To control for this difference observed in Table 2, we used a non-radical approach by calculating post-exercise treatment effect (PTE) i.e difference between pre and post-exercise score. Results showed that the exercise group had significantly lower blood glucose level as measured by FBG and fructosamine (P< 0.05) (Table 3).

Table 3: Effects of single bout interval aerobic exercise on blood glucose level

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group (48min Post)</th>
<th>Mean±SD</th>
<th>P</th>
<th>Mean±SE (48min PTE)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Exp</td>
<td>117.85±33.46</td>
<td>0.642</td>
<td>-26.65±31.54</td>
<td>0.003*</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>112.90±33.43</td>
<td>9.00±39.70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FBS</td>
<td>Exp</td>
<td>6.49±1.35</td>
<td>0.696</td>
<td>-0.40±0.21</td>
<td>0.367</td>
</tr>
<tr>
<td>Hba1c</td>
<td>Control</td>
<td>6.70±1.89</td>
<td>0.18±0.47</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fructosamine</td>
<td>Exp</td>
<td>328.05±190.68</td>
<td>0.247</td>
<td>28.80±57.53</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>396.50±177.17</td>
<td>-33.15±29.8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*= Significant (P<0.05)

Discussion

In this study, single bout interval aerobic exercise reduced blood glucose level measured by FBG. The lower FBG found in exercise group suggests that single bout interval aerobic exercise effectively attenuates the level of circulatory non protein-bound blood glucose T2DM patients. Similar non-Nigerian study have revealed that single bout of moderate aerobic exercise lasting for 15minutes, 30minutes or 60minutes resulted in declined FBG in T2DM. Exercise increases glucose uptake by the muscles and enhances the ability to store glucose. Aerobic exercise is known to enhance cellular respiration in skeletal muscles, and this may explain the decrease in blood glucose level found in this study. According to Sirisha, factors involved in the mechanism of improved glucose uptake during and after exercise include increasing rate of blood flow to the exercising muscle, a change in energy status of the muscle and increase in insulin binding. In addition to a few similar previous findings on the subject of this study, it might suffice to opine that a single bout interval aerobic exercise could act a useful adjunctive first-aid for sudden rise in blood glucose level seen in poorly managed T2DM patients in our environment.

Unlike FBG, the fructosamine measures average blood glucose level over the past two or three weeks. The fact that single bout interval aerobic exercise decreased fructosamine level in T2DM patients indicates that single bout interval aerobic exercise could mobilize glycated protein. The mechanisms through which aerobic exercise reduce glycated proteins are proposed to include biochemical adaptations (regulating mitochondrial proteins involving respiratory system, increasing glucose production and Glut4 protein), skeletal muscles structural adaptations and systemic effects on physical activity. The resistance component of interval exercise is an important determinant of the study output by stimulating skeletal muscles for glucose uptake.

Finally, that single aerobic interval aerobic exercise of 48minutes duration did not result in change in blood glucose measured by Hba1c shows that the reduction in blood glucose level recorded by FBG and fructosamine is small or perhaps the exercise effect on concerned systems is short-lived. This supports the theory that Hba1c is a measure of average blood glucose level over the past 3 months, and cannot detect small difference in blood glucose level.

Conclusion

In conclusion, interval aerobic exercise reduces blood glucose level but the reduction small. We recommend single bout interval aerobic exercise as a first aid adjunct therapy in management of acute rise in blood glucose level.

Acknowledgement: We would like to express our gratitude to Mr Uduonu Ekezie for his assistance during the course of data collection.

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Competing interest: nil
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Effectiveness of Neuromuscular Therapy and Active Release Technique in Young Adults with Piriformis Tightness

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Abstract

Aim: To compare the immediate effects between Neuromuscular therapy, Active release technique and Stretching among the individuals with piriformis tightness.

Method: A total of 42 male subjects between the age group 18-25 years with piriformis tightness were equally allocated to receive Neuromuscular therapy (Group A), Active release technique (Group B) and Stretching as conventional management (Group C). Outcome assessment for piriformis tightness included Visual analogue scale (VAS) for pain measurement, Oswestry disability index (ODI) and Hip internal rotation ROM (range of motion).

Result: All the interventions significantly improved VAS, ODI and Hip IR ROM immediately post treatment within groups whereas the inter group analysis showed significant difference in Hip IR ROM between groups but no significant difference was found in VAS and ODI.

Conclusion: Neuromuscular therapy and Active release technique both were effective than Stretching, but the mean difference of Neuromuscular therapy is superior in treatment of piriformis tightness followed by Active release technique and Stretching respectively.

Keywords: Piriformis tightness, Piriformis syndrome, Myofascial release, Muscle energy technique, Active release technique, Stretching, trigger points.

Introduction

The prevalence of piriformis tightness in healthy sedentary workers of Kolkata, India, was found to be present in 79.5%1. Occupations which deals with prolonged sitting work are prone for piriformis muscle tightness2. There are various factors responsible for piriformis muscle tightness which are as follows: Piriformis is the postural type of muscle which is overactive in nature1, Overactivity leads to weakness as well as tightness of muscle1, The muscle is composed of type-1 fibers. Which has property of shortness or tightness when the muscle become abnormally stressed. The synergistic activation of piriformis may also result in piriformis tightness1. Tightness may results in restricted hip joint range of motion and reduced flexibility. This may leads to limit the activities of daily living of an individual3.

When the muscle becomes taught it creates pressure on sciatic nerve, resulting in compression of sciatic nerve6,7 and causes buttock and leg pain5. This condition is known as piriformis syndrome, which is up to 36% among the patients with low back pain4. Piriformis syndrome can be caused due to occurrence of myofascial trigger points in piriformis muscle which is present at the level of greater sciatic notch or on the belly of the piriformis muscle8.
Hip internal rotation range of motion was significantly lesser than hip external rotation range of motion\(^9\). The normal hip internal rotation ROM is 35°-40°, whereas external rotation is 45°-50° \(^{26}\). A study showed that low back pain patients showed limited active hip internal rotation of dominant side\(^{10}\).

Physiotherapy management for piriformis pathology includes application of heat therapy and ultrasound therapy in conjunction with stretching of piriformis muscle shows good effect on treatment. Also manual therapy approaches like myofascial release (MFR), muscle energy technique (MET), Active release technique are also shows beneficial effect on the treatment of soft tissue.

Neuromuscular therapy comprises of combination of MFR with MET. MFR is a soft tissue mobilization technique. This technique involves specifically guided low load, long duration mechanical forces to manipulate the myofascial complex, intended to restore optimal length, decrease pain and improve function\(^{23}\). MET is a soft tissue manipulation that incorporate precisely directed and controlled, patient initiated, isometric and/or isotonic contractions, designed to improve musculoskeletal function and reduce pain\(^{19}\).

The Active release technique (ART) is a manual therapy used to recover function of soft tissue and in many ways similar to traditional ‘Pin and stretch’ techniques\(^{11}\). Technique works on a variety of muscle, tendon, ligament, fascia and nerve tissues. In this technique deep pressure is applied over the tender point (trigger point) in a shortened position of the muscle and then patient is asked to actively take it in an opposite lengthened position. This will break the adhesions and restores the proper texture, elasticity and functions of soft tissues\(^{24}\).

Individually both ART and NMT were found to be effective in different conditions but No studies till date have compared the effect of ART with Neuromuscular therapy in individuals with piriformis tightness. The aim of the study was to examine whether the Active release technique, Neuromuscular therapy or Stretching would lead to better clinical outcomes in the management of piriformis tightness.

**Materials and Methodology**

The Experimental study was conducted at physiotherapy department of Krishna college of physiotherapy. After getting ethical clearance from the institutional ethics committee informed consent were taken from all the participants. 42 male participants of age 18-25 years who had piriformis tightness of dominant side were recruited for the study. Participants having Tenderness over buttock, Limited hip IR ROM and Positive FAIR test\(^8\) with positive stretch test were included and participants with recent fracture and surgery of lower extremity, inflammatory joints and joint instability or any soft tissue injuries past 6 months were excluded from the study. The demographic information of the subjects were taken. By using random sampling method the participants were divided into 3 groups by chit method; Group A received NMT (Fig.1 a & b), group B received ART (Fig. 2 a & b) and group C received stretching of the piriformis muscle (Fig. 3).

For application of NMT, The patient was positioned in prone lying, close to the edge of the table, knee was flexed at 90 grasping the ankle and hip joint was brought to internal rotation. The therapist placed his elbow tip gently on to the central area of the muscle belly, where an active trigger point was common. A degree of compression was applied via the elbow for 5-7 sec while the muscle was kept at a reasonable but not excessive degree of stretch. Contact was maintained on the point but pressure was eases and patient was asked to introduce an isometric contraction for 5-7 secs to piriformis by bringing the lower leg towards external rotation against resistance. After the cessation of contraction patient was asked to relax, the lower limb was taken to its new resistance barrier and same procedure was repeated. The procedure was repeated 5-7 times until no further gain was achieved\(^{25}\). ART was also applied with patient in prone lying, knee was flexed at 90. The therapist placed his elbow tip on trigger points and direct pressure was applied, patient was then asked to do internal rotation of hip, in order to achieve lengthening of the muscle. This was repeated 5-7 times\(^{11}\).
Fig. 1(a) Neuromuscular therapy

Fig. 1(b)

Fig. 2(a) Active release technique

Fig. 2(b)

Fig. 3 Stretching
VAS, ODI and hip IR ROM were used as the outcome measures and assessment was taken pre as well as immediately post treatment. VAS was taken by asking the subjects to mark their pain level on the 10 cm line which indicates starting point as no pain and ending point as a worst pain. For ODI, the questionnaire was given to the subjects and they were asked to submit it after filling it, and the hip IR ROM was measured by goniometer and patient’s position was in prone lying. The fulcrum of the goniometer over the anterior aspect of patella, proximal arm placed perpendicular to the floor and distal arm over the anterior midline of the lower leg.

Materials used: VAS scale, ODI questionnaire, Universal Goniometer.

Results/ Findings

- Descriptive data of outcomes are shown in table no. 1 & 2. The intra group analysis was done by using paired- t test. The inter group analysis was done by using ANOVA test & for post test comparison between 3 groups, Dunn’s multiple comparison test was used. p< 0.05 with 95% confidence interval was considered statistically significant and p<0.0001 considered as extremely significant.

<table>
<thead>
<tr>
<th>Outcome measures</th>
<th>NMT Mean±SD</th>
<th>ART Mean±SD</th>
<th>Stretching Mean±SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre treatment</td>
<td>Post treatment</td>
<td>p- value</td>
</tr>
<tr>
<td>VAS</td>
<td>3.84±2.44</td>
<td>2.46±1.476</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>ODI</td>
<td>2.14±1.29</td>
<td>0.50±0.51</td>
<td>0.0016</td>
</tr>
<tr>
<td>Hip IR ROM</td>
<td>25.28±5.82</td>
<td>14.07±2.973</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

Table 2: Inter group analysis of NMT, ART & Stretching groups.

<table>
<thead>
<tr>
<th>Outcome measures</th>
<th>NMT Mean±SD</th>
<th>ART Mean±SD</th>
<th>Stretching Mean±SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre treatment</td>
<td>Post treatment</td>
<td>p- value</td>
</tr>
<tr>
<td>VAS</td>
<td>3.84±2.44</td>
<td>1.45±1.27</td>
<td>0.7204</td>
</tr>
<tr>
<td>ODI</td>
<td>4.14±2.17</td>
<td>1.21±0.99</td>
<td>0.0214</td>
</tr>
<tr>
<td>Hip IR ROM</td>
<td>25.28±5.82</td>
<td>14.07±2.973</td>
<td>0.0003</td>
</tr>
</tbody>
</table>

Discussion

In this study, Mean Age of Groups A, B and C were 21.5, 22 and 21.21 respectively, which was not significant.

Within group analysis of NMT group showed the mean difference in VAS 2.464±1.476 (p <0.0001), Mean difference in ODI 0.500±0.5189 (p= 0.0016) and Mean difference in Hip IR ROM 14.071±2.973 (p <0.0001) (Table.1). Similarly, study by Mane, demonstrated extremely significant improvement in VAS score with mean difference 1.1±1.258 (p <0.0001), and ROM with mean difference is 36.933±4.148 (p <0.0001), when MFR was given to the patient with upper trapezitis18. Another study by Sehgal, also demonstrated improvement in shoulder IR ROM with p value is extremely significant when muscle energy technique was given to the athletes with glenohumeral internal rotation deficit19. The probable reason for improvement in joint ROM and reduce pain could be due to decrease in overactivity of myofascial tissue this could be because of application of pressure to the trigger points causing the Golgi tendon organs to elicit an inhibitory effect on the muscle, allowing it to become less tense and ultimately leading to increased joint ROM and decrease pain sensation12.

ART group showed the mean difference in VAS 2.929±1.426 (p<0.0001), Mean difference in ODI 0.5000±0.5189 (p=0.0016) which was very significant and Mean difference in Hip IR ROM 8.714±1.490 (p<0.0001) (Table 1). Study by Robb, demonstrated immediate improvement of muscle pressure pain threshold with mean difference is 5.3±0.99 (p <0.0001), when ART was used to treat 9 male ice hockey players with adductor strain13. Similarly, in a study by Tak, ART on gluteus medius of a patient with low back pain for 3 weeks resulted in significant improvement of the patient’s VAS score and pressure pain threshold (p<0.05)14. Additionally, a study by Kim, ART on
patients with chronic neck pain resulted in the significant improvement of ROM, Neck disability index and VAS (p<0.05)\(^20\). Although our target area differed from these studies, significant improvement was observed in the VAS score and ROM after using ART to treat the piriformis muscle in the present study. Probable reason for increase ROM and reduce pain could be due to breakdown of scar tissue adherent to the soft tissue which is responsible for limitations of movement\(^15\).

Stretching group showed the mean difference in VAS was 2.864±1.065 (p<0.0001), The mean ODI decreased from1.92 to 0.92. The mean difference in Hip IR ROM was 4.714±1.139 (p <0.0001) (Table 1). Similarly, study by Mullar, also found the extremely significant results by stretching of piriformis muscle. He found decrease in pain and increase in the joint ROM by applying stretching on the tight piriformis muscle (p <0.0001)\(^16\). Probable reason for increase ROM and reduce pain could be due to the facilitation of the Golgi tendon organ which may produce inhibition of the muscle that is stretched, occurs due to slow static stretch.\(^17\)

Inter group analysis as shown in table 2. revealed not statistically significant value of VAS with p=0.8863 and ODI with p=0.1907. Only Hip IR ROM was found to be significant with p =0.0003. A study by Kage., revealed extremely significant values of VAS (p<0.0001) on subjects with plantar fasciitis\(^21\). Another study shows extremely significant results of VAS, NDI and Cervical ROM, when comparing ART with MFR given to the patients with upper trapezius spasm for 7 days \(^22\). Additionally, previously mentioned study demonstrated significant results in shoulder IR ROM on comparing effect of MET with stretching, MET was found to be better than stretching.\(^19\) It could be stated that long term protocol and follow up may be more effective. Post test comparison between the 3 groups showed not statistically significant results of VAS and ODI except Hip IR ROM. Comparison of group A with B shows not statistically significant result with p> 0.05, Comparison of group A with C shows extremely significant result with p< 0.0001 whereas, comparison of group B with C shows significant result with p< 0.05. In the present study mean difference of NMT was found to be greater than ART in increasing ROM, the reason apart from its physiological effect, may be because in NMT we have given MFR along with MET and this technique was given passively whereas, in ART subjects compression was applied at the trigger points and subjects have actively involved themselves in movement.

We observed that all the three techniques were equally effective and there was no statistical significance seen in VAS and ODI whereas, for hip IR ROM, Neuromuscular therapy and active release technique where equally effective and shows not statistically significant result but both the techniques were found to be statistically significant and more effective than Stretching.

**Conclusion**

Neuromuscular therapy and Active release technique both were effective than Stretching, but the mean difference of Neuromuscular therapy is higher in treatment of piriformis tightness followed by Active release technique and Stretching respectively. However, study with larger population may prove the significant difference in NMT and ART.

**Conflict of Interest:** The authors declare that there are no conflict of interest concerning the content of present study.

**Source of Funding:** Self-funded.

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Effects of Bilateral Upper Limb Task Training on Upper Limb Function in Acute Stroke: A Randomized Controlled Trial

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Abstract

Objective: To determine the effect of bilateral upper limb task training on a hemiplegic upper limb in early rehabilitation after stroke.

Study Design: Single blinded, Randomized controlled trial.

Method: 100 stroke patients were screened for eligibility. 30 patients were eligible and randomized equally into intervention group and control group. Both the groups received standard care treatment for 30 minutes once a day. Intervention group received bilateral upper limb task training for 20 minutes once a day for a week with 10 repetitions of 2 sets of each task.

Outcome measures: The action research arm test, nine-hole peg test and functional independence measures. Measurements were taken on admission and discharge.

Results: Difference (discharge-admission) in ARAT, FIM were higher for intervention group (16.400.72, 35.3310.21) and Difference (admission- discharge) in NHPT was higher for intervention group (12.667.13). Between the group comparison of ARAT, NHPT were not found to be statistically significant (p=.608, p=.787) whereas FIM (p=.001) is considered to be highly significant statistically. Highly significant effect size of 1.335 is obtained for FIM score, but a non- significant effect size of 0.189, 0.009 is obtained for ARAT and NHPT scores respectively.

Conclusions: Bilateral upper limb training shows improvement in achieving functional independence in the activities of daily living, but no significant improvement in the grasp, grip, pinch, gross movements and fine dexterity.

Keywords: Bilateral upper limb training, stroke, early rehabilitation. Functional independence measure (FIM), Action research arm test (ARAT), Nine-hole peg test (NHPT).

Introduction

In India, the overall age adjusted prevalence rate for stroke was estimated to lie between 84- 262 per 1,00,000 in rural areas and for urban areas it was estimated to be from 334-424 per 1,00,000. The adjusted annual incidence per 1,00,000 of stroke was 124 in rural areas and 145 in urban areas.1

Bilateral upper limb task training is a non-specific phrase for a number of different training techniques which uses both upper limbs to complete a task. Peter Langhorne et al. did a systematic review of motor recovery after stroke. The study concluded that the bilateral upper limb task training improved dexterity and grip strength in patients with arm dysfunction.2

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While many patients recover ambulatory functions after severe hemiplegia, restoration of arm motor skill has been often incomplete. Bilateral upper limb task training can improve the upper limb motor function and this is of great importance because lack of arm movement control directly affects independence in the activities of the daily living which is the primary goal of neuro-rehabilitation in patients with the stroke.

**Objective of the Study:** To determine the effect of the bilateral upper limb task training on the hemiplegic upper limb in early rehabilitation after stroke.

**Method**

This study was a single blinded, randomized controlled trial. 100 stroke patients were screened for eligibility from a private general hospital in Mangalore, India. 30 stroke patients were randomized equally into the intervention group and control group based on computer generated; randomization procedures using a concealed opaque envelop method. Selected patients had signed an informed consent form.

The patients included in the study were between 45 to 85 years old, male and female, both ischaemic and haemorrhagic type of stroke, acute unilateral stroke confirmed on computed tomography scan and ability to participate in 30 minutes of physiotherapy sessions.

The patients excluded in the study were having severe hemi neglect, aphasia, cognitive impairment, previous stroke related disability, pre-morbid ipsilateral arm impairment, hemiplegic shoulder pain and those patients who were not willing to give consent.

Bilateral upper limb task training (Intervention group) lasted for 20 minutes per day other than the standard care, 6 days per week or till their hospital stay having 10 repetitions of 2 sets of each task once a day.

In bilateral upper limb task training group, the participants practiced 5 tasks like the bilateral proprioceptive neuromuscular facilitation activities, patient moving his clasped hands to mouth, elevation of the arms with clasped hands, patient clapping the hands and turning towards sound side keeping shoulder well forward as well as patient clapping the hands and turning towards affected side keeping shoulder well forward other than the standard care treatment explained below.

The standard care treatment (Control group) involved the proprioceptive neuromuscular facilitation stretch, the proprioceptive neuromuscular diagonal patterns unilaterally, active and passive range of motion exercises, positioning, bridging, rolling, sitting, side sitting, standing and walking.

Data was collected using the action research arm test, nine-hole peg test and functional independence measure on the day of admission and discharge for both intervention as well as the control group.

Action research arm test (ARAT) assess the ability to handle objects with 19 items divided into 4 subscales of grasp, grip, pinch and gross movement by using a 4-level ordinal scale ranging from 0 to 3. A total score of maximum 57 indicates normal performance. Nine-hole peg test (NHPT) is a time test of manual dexterity. Participant’s place 9 pegs in nine holes and then remove as quickly as possible. The time is measured in seconds and a lower score indicates better dexterity. Functional independence measure is a data set designed to assess functional independence, which includes 18 items, each with a maximum score of 7 and a minimum score of 1. The area examined includes self-care, sphincter control, transfer, locomotion, communication and social cognition making it a total score of 126.

**Statistical analysis:** Data were normally distributed so mean and standard deviation was used for descriptive statistics.

1. Descriptive statistics, including the mean, standard deviation and percentages were done for basic characteristics of acute stroke patients. The chi square test was used to calculate the significance between the sex and the side affected.

2. Inferential statistics
   - Paired t test was used to compare within the group difference of the intervention group and a control group of ARAT, NHPT and FIM.
   - Independent student t test was used to compare between the group difference of intervention and control group of ARAT, FIM and NHPT.
   - Effect size was calculated using Cohen’s d formula
     \[
     d = \frac{M_1 - M_2}{S_{\text{pooled}}}
     \]
     Where \(M_1\) = Intervention group, \(M_2\) = Control group
     \(S_{\text{pooled}}\) = pooled standard deviation.
p value less than 0.05% probability was considered to be statistically significant.

Statistical analysis was done using the SPSS 16.00.

Sample Size: The sample size was calculated along with these estimates for the effect of interest and the variability. A total of 15 patients were needed for each group with a two-sided significance of 0.05 (alpha 5%) and a power of 0.8 (80%).

Table 1: Descriptive statistics of age, sex, hand dominance, side affected and the type of stroke of the Intervention group and the control group.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Intervention (n=15) n (%)</th>
<th>Control (n=15) n (%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>60(9.35)</td>
<td>60.86(9.96)</td>
<td>.808(^a)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>10(66.7)</td>
<td>10(66.7)</td>
<td>1.00(^b)</td>
</tr>
<tr>
<td>Female</td>
<td>5(33.3)</td>
<td>5(33.3)</td>
<td></td>
</tr>
<tr>
<td>Hand dominance (Right)</td>
<td>15(100)</td>
<td>15(100)</td>
<td>NA</td>
</tr>
<tr>
<td>Side Affected</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right</td>
<td>8(53.3)</td>
<td>6(40)</td>
<td>0.464(^b)</td>
</tr>
<tr>
<td>Left</td>
<td>7(46.7)</td>
<td>9(60)</td>
<td></td>
</tr>
<tr>
<td>Type of stroke (Thrombotic)</td>
<td>15(100)</td>
<td>15(100)</td>
<td>NA</td>
</tr>
</tbody>
</table>

SD=Standard Deviation, \(a\)= Analyzed by Independent Student ‘t’ test, \(b\)= Analyzed by Chi Square test

Table 2: An independent student test used to compare between the group differences of ARAT, FIM and NHPT.

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Mean Difference</th>
<th>95% Confidence Interval of the Difference</th>
<th>t</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARAT Difference (Discharge-Admission)</td>
<td>15</td>
<td>16.40</td>
<td>9.61</td>
<td>2.60</td>
<td>-7.65 to 12.85</td>
<td>.519</td>
<td>.608</td>
</tr>
<tr>
<td>Control</td>
<td>15</td>
<td>13.80</td>
<td>16.84</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FIM Difference (Discharge-Admission)</td>
<td>15</td>
<td>35.33</td>
<td>16.74</td>
<td>22.73</td>
<td>9.99 to 35.47</td>
<td>3.656</td>
<td>.001</td>
</tr>
<tr>
<td>Intervention</td>
<td>15</td>
<td>12.60</td>
<td>17.30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>15</td>
<td>12.66</td>
<td>55.54</td>
<td>4.00</td>
<td>-2.60 to 34.06</td>
<td>.273</td>
<td>.787</td>
</tr>
<tr>
<td>NHPT Difference (Discharge-Admission)</td>
<td>15</td>
<td>8.66</td>
<td>12.08</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intervention</td>
<td>15</td>
<td>12.66</td>
<td>55.54</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>15</td>
<td>12.66</td>
<td>12.08</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ARAT= Action research arm test, FIM=Functional independence Measure, NHPT= Nine-hole peg test, S D= Standard Deviation, p < 0.05

Results

Both the groups are equally distributed in terms of age, gender and the side being affected. The intervention group as well as control group had 100% right hand dominant and patients were affected with the thrombotic type of stroke.

The mean difference between the groups of Action Research Arm Test was 2.60 with the p value of 0.608 which suggest that the difference between ARAT from discharge to admission is not significant.

The mean difference between the groups of Nine-Hole Peg Test was 4.00 with the p value of 0.787 which suggest that the difference between NHPT from admission to discharge is not significant.

The mean difference between the groups of Functional Independence Measure was 22.73 with the p value of 0.001 which suggest that the difference between FIM from discharge to admission is significant.

Highly significant effect size of 1.33 is obtained for FIM score, but non-significant effect size of 0.189, 0.009 is obtained for ARAT and NHPT scores respectively.

Discussion

The present study, results show that there is no significant difference between the intervention group and the control group for an action research arm test.
(p=0.608) and nine-hole peg test (p=0.787) which shows no significant improvement in the grasp, grip, pinch and gross movements as well as the fine dexterity. This study shows that the functional independence measure shows the significant difference (p=0.001) between the intervention group and the control group which suggests improvement in the functional independence in the activities of daily living. As per our results, we reject our experimental hypothesis and accept our null hypothesis which suggests that there may not be differences in the task performance in the paretic limb as the effect of bilateral upper limb task training on hemiplegic arm in the early rehabilitation of stroke.

Coupar et al. did a systematic review including 14 studies which involved 421 participants. Four of fourteen studies compared the effects of bilateral training with usual care, whereas eleven out of fourteen studies compared the effects of bilateral training with the other specific upper limb interventions. The results were not statistically significant for the performance of the activities of daily living for both the studies. This review suggests that bilateral training may be no more effective than usual care or other upper limb interventions for performance in the activities of daily living, the functional movement of the upper limb or motor impairment outcomes. The current study favours the findings of Coupar et al. 13

A comparative study was done by Stacey D et al. between unilateral versus bilateral upper extremity task performance following stroke and no evidence was found for an immediate improvement in paretic limb performance of a reach-grasp-lift-release task when patients with mild-to-moderate hemiparesis moved bilaterally instead of unilaterally. The present study supports the findings of Stacey D et al. 14

This study is a single blinded, parallel group randomized controlled trial. Functional independence was achieved for patients with bilateral upper limb task training. The homogeneity of variance was achieved for age, sex and side of the hemiplegia. There was no drop out present in the study. These are the strength of the study.

This study cannot be generalized for a large stroke population due to the small sample size. This study is also limited to ischaemic type of stroke. Five patients who were randomized into the control group received recombinant tissue plasminogen activator drug from the medical section which instantly improved their arm function. This study did not exclude those patients. Moreover, the severity of arm impairment taken into the study was not classified. These are the limitations of the study.

Similar studies can be carried out with a large sample size to study the effectiveness of bilateral upper limb task training in patients with acute stroke.

The present study concludes that bilateral upper limb task training is equally effective as standard care treatment to improve the upper limb function in early rehabilitation of stroke.

**Clinical message:**

- Bilateral upper limb task training uses both the upper limbs to complete a task.
- Bilateral upper limb task training improves the task performance in the paretic limb in early rehabilitation of stroke.

**Conflict of Interests:** The investigators testify that there is no possible conflict of interest with respect to the research, authorship, and/or publication of this article.

**Source of Funding:** This trial did not receive any financial support from any funding agency in the public, profitable, or not-for-profit sectors.

**Ethical Clearance:** Ethical clearance was obtained from the Central Ethical Committee of NITTE (Deemed to be University) {Ref: NU/CEC/ P.G.-04(NIPT) /2014 & Ref: NU/CEC/ P.G.-02(NIPT) /2015}.

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- Findings • Conclusion
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