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Indian Journal of Physiotherapy and Occupational Therapy. April - June 2009, Vol. 3, No. 2

INDIAN JOURNAL OF PHYSIOTHERAPY AND OCCUPATIONAL THERAPY

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“Indian journal of physiotherapy and occupational therapy” An essential indexed peer reviewed journal for all Physiotherapists & Occupational therapists provides professionals with a forum to discuss today’s challenges - identifying the philosophical and conceptual foundations of the practices; sharing innovative evaluation and treatment techniques; learning about and assimilating new methodologies developing in related professions; and communicating information about new practice settings. The journal serves as a valuable tool for helping therapists deal effectively with the challenges of the field. It emphasizes articles and reports that are directly relevant to practice. The journal is now covered by INDEX COPERNICUS, POLAND. The journal is indexed with many international databases.

The journal is registered with Registrar on Newspapers for India vide registration DELEN/2007/20988

Website : www.ijpot.com

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Comparative study of post-operative pulmonary mechanics between subcostal and midline laparotomy
Anuprita Thakur*, Sujata Yardi**
*Assoc. Prof, **Professor & Dean, Dr D.Y. Patil Institute of Physiotherapy, Navi Mumbai

Abstract

Background
Commonly two incisions are used in Upper Abdominal Surgeries (UAS): Midline and Subcostal. Following either of the surgeries patients develop significant alteration in breathing pattern due to the restrictive type of pulmonary dysfunction.

Aims & objectives
To compare the effects of both the incisions on pulmonary mechanics, assess which of the two incisions affect the pulmonary mechanics more than the other and to accordingly modify the post-operative Chest Physiotherapy treatment plan.

Materials and methods
10 subjects in each group (subcostal and midline incision) were selected. Parameters like diaphragm excursion on U.S.G., Peak Expiratory Flow Rate (PEFR) and chest expansion at three levels were measured pre-operatively, post-operatively on the 3rd and 7th day.

Results
There was a decrease in the diaphragm excursion, PEFR and chest expansion at umbilical level on post-operative day 3 but the decrease was much more in the midline group than the subcostal group. The above parameters improved on post-operative day 7 as compared to post-operative day 3 in both the groups but the improvement was much more in the subcostal group than the midline group. Both the results were statistically significant.

Conclusion
The study shows that the pulmonary mechanics are affected post-operatively in both the groups, the affection being more in the midline group than in the subcostal group. Also the return of function to the pre-operative values was earlier in the subcostal group as compared to the midline group.
Hence administration of Chest Physiotherapy post-operatively should be modified accordingly to improve the function especially in the midline group.

Key words
Upper Abdominal Surgery, Median Laparotomy, Subcostal Laparotomy, Diaphragm, PEFR, Chest Expansion

Introduction and background
The two common Laparotomies performed in Upper Abdomen include mainly the Midline and Subcostal incisions. Patients undergoing Upper Abdominal Surgery develop a restrictive pattern of Pulmonary Dysfunction and significant alteration in breathing pattern mainly due to abnormal diaphragm mechanics in the immediate post-operative period. These can lead to certain respiratory complications post-operatively.
Conventional Chest Physiotherapy includes techniques like breathing exercises, coughing & huffing techniques, postural drainage etc. and is an established mode of treatment for pulmonary complications following abdominal surgery.
The following study compares effects of both the incisions on post-operative pulmonary mechanics and accordingly decides an effective Chest Physiotherapy treatment approach.

Anatomy of respiratory apparatus
Chest wall is considered to consist of 3 parts:
1. Rib cage or thoracic cavity with its musculature
2. Diaphragm
3. Abdomen and its musculature
Rib cage
The rib cage provides rigid protection to the thoracic structures and comprises of manibruiosternum, 12 pairs of ribs, costal cartilages and 12 thoracic vertebrae and their intervertebral discs.
Ventilatory muscles
Diaphragm: Fig 1
It is the primary muscle of respiration and accounts for 70% of the inspired tidal volume. It is a dome shaped muscle with 3 origins namely-Costal, Sternal and Crural All these fibres converge and insert into the central tendon, which lies immediately below the pericardium and blends with it.
The other inspiratory muscles (depending on whether inspiration is forced or at rest) are Internal intercostals, External intercostals, Scalenes, Sternocleidomastoid, Pectorals, Serratus anterior, Latissimus dorsi.
Expiratory muscles
These are the abdominal muscles: rectus abdominus, internal and external obliques, transverse abdominus. These muscles also play an important role in inspiration.
Zone of apposition
This is that part of the diaphragm that is apposed to the inner aspect of the rib cage.
Biomechanics of normal respiration

Action of diaphragm
Its inspiratory action has three components:
1. When the diaphragm contracts, the central tendon is pulled down increasing the vertical diameter of thorax.
2. Appositional component: When the diaphragm contracts, it descends to compress the abdominal components increasing the intra-abdominal pressure. This increased pressure is transmitted via the zone of apposition to cause lower rib cage to expand (pump handle mechanism).
3. Insertional component: The contraction of costal fibres is facilitated by the abdominal muscle tone which increases the intra-abdominal pressure and this provides a fulcrum for the diaphragm to lift the lower ribs upwards and outwards thus increasing the transverse diameter of lower rib cage (bucket handle mechanism).

Thus the diaphragm increases all the three diameters of the rib cage.

Action of expiratory muscles
Contractions of the abdominals decrease the size of rib cage and cause expiration. The abdominals push the abdominal contents cranially, decreasing lung volumes and lengthening the diaphragm at end-expiration.
These muscles also facilitate diaphragmatic contraction during inspiration as mentioned above.

Thus the abdominal muscles play an important role during both inspiration and expiration.

Incisions
The commonly used incisions in the upper abdominal surgeries are Subcostal and Midline incisions. Fig 2 Subcostal incision starts in the midline just below the xiphoid process and runs downwards and laterally about 2cms below and parallel to the costal margin. All the muscles including the Rectus Abdominus are divided along the line of incision. Midline incision extends vertically from below the xiphoid process and divides the linea alba vertically.

Materials and methodology

Materials
1. U.S.G. machine
2. Gel
3. Wright’s Peak Flowmeter
4. Measure tape

Selection of subjects
Total 20 subjects between age group of 45-65 years who had undergone Upper Abdominal Surgery in B.Y.L. Nair Ch. Hospital, Mumbai, 10 with Midline incision and 10 with Subcostal incision were selected. A written consent was taken from all the patients to carry out the study. None of the subjects had any previous history of cardiac or respiratory (either restrictive or obstructive) illness. None of the subjects had history of smoking, hypertension, diabetes mellitus.

Methodology
A) Pre-operative diaphragm excursion on U.S.G., Peak Expiratory Flow Rate (PEFR) and Chest Expansion measurements were recorded.

For diaphragm excursion (Fig 3)
Subject lies supine. The level of hepatic vasculature structure is recorded at the end of forced expiration and then at the end of forced inspiration. The cephalo-caudal displacement of the hepatic vasculature structure is measured in centimeters, which is considered as the diaphragm excursion. (Fig 4) during inspiration.

For PEFR (Fig 5)
Subject is asked to take a deep inspiration and then blow as hard and as fast as possible into the peak flowmeter. This records the peak expiration in litres/minute.

For chest expansion (Fig 6)
Measurements are done at 3 levels: 2 inches above
umbilicus, nipple level and axillary level. Subject is asked to expire completely. Then take a deep inspiration and expire completely. Measurement is done from complete expiration to complete inspiration using a measure tape.

B) The above parameters were checked again post-operatively on day 3.

C) The above parameters were checked again post-operatively on day 7.

**Results**

The results of both the groups were compared. Results show a decrease in diaphragm excursion, PEFR and chest expansion at umbilical level on post-operative day 3 compared to pre-operative values in both the groups. However, all the parameters are more affected in midline group as compared to the subcostal group and the results were statistically significant.

Also the results show that all 3 parameters on post-operative day 7 have considerably improved and have come close to normal values in subcostal group which is not so in the midline incision group. The results were statistically significant.

Results also show an increase in the post-operative values at the nipple and axillary levels in both the groups on post-operative day 3.

**Discussion**

The results confirm alterations in the post-operative pulmonary mechanics in both the groups. All the parameters

---

**Table 1:** Comparison of diaphragm excursion in both groups.

<table>
<thead>
<tr>
<th></th>
<th>Pre-op</th>
<th>Post-op Day 3</th>
<th>Post-op Day 7</th>
<th>% Difference between Pre-op and Post-op Day 3</th>
<th>Pre-op and Post-op Day 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subcostal</td>
<td>3.74 (+/-0.625)</td>
<td>2.31 (+/- 0.47)</td>
<td>3.48 (+/- 0.614)</td>
<td>62%</td>
<td>94%</td>
</tr>
<tr>
<td>Midline</td>
<td>3.77 (+/- 0.93)</td>
<td>1.8 (+/- 0.33)</td>
<td>2.78 (+/- 0.515)</td>
<td>48%</td>
<td>65%</td>
</tr>
</tbody>
</table>

---

**Table 2:** Comparison of PEFR in both groups.

<table>
<thead>
<tr>
<th></th>
<th>Pre-op</th>
<th>Post-op Day 3</th>
<th>Post-op Day 7</th>
<th>% Difference between Pre-op and Post-op Day 3</th>
<th>Pre-op and Post-op Day 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subcostal</td>
<td>312 (+/-72.5)</td>
<td>188 (+/- 64.77)</td>
<td>288 (+/- 74.98)</td>
<td>61%</td>
<td>93%</td>
</tr>
<tr>
<td>Midline</td>
<td>316 (+/- 74.47)</td>
<td>134 (+/- 36.81)</td>
<td>226 (+/- 65.99)</td>
<td>48%</td>
<td>72%</td>
</tr>
</tbody>
</table>
Table 3: Comparison of chest expansion in both groups.

<table>
<thead>
<tr>
<th></th>
<th>Pre-op</th>
<th>Post-op Day 3</th>
<th>Post-op Day 7</th>
<th>% difference between Pre-op and Post-op Day 3</th>
<th>% difference between Pre-op and Post-op Day 7</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subcostal</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2&quot; above umbilicus</td>
<td>2</td>
<td>1.05</td>
<td>1.85</td>
<td>53%</td>
<td>93%</td>
</tr>
<tr>
<td>Nipple level</td>
<td>1.75</td>
<td>1.95</td>
<td>1.75</td>
<td>11% increase</td>
<td>No change</td>
</tr>
<tr>
<td>Axillary level</td>
<td>1.75</td>
<td>2</td>
<td>1.6</td>
<td>14% increase</td>
<td>2% increase</td>
</tr>
<tr>
<td><strong>Midline</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2&quot; above umbilicus</td>
<td>1.95</td>
<td>0.4</td>
<td>1.1</td>
<td>32%</td>
<td>57%</td>
</tr>
<tr>
<td>Nipple level</td>
<td>1.75</td>
<td>2.2</td>
<td>2.2</td>
<td>25% increase</td>
<td>22% increase</td>
</tr>
<tr>
<td>Axillary level</td>
<td>1.75</td>
<td>2.2</td>
<td>2.15</td>
<td>25% increase</td>
<td>22% increase</td>
</tr>
</tbody>
</table>

Table 4: Comparison of all three parameters in Subcostal and Midline group.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Post-op Day 3</th>
<th>Post-op Day 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diaphragm excursion</td>
<td>t=2.2</td>
<td>t=2.134</td>
</tr>
<tr>
<td>PEFR</td>
<td>t=2.29</td>
<td>t=2.15</td>
</tr>
<tr>
<td>Chest expansion at 2&quot; above umbilicus</td>
<td>t=3.3</td>
<td>t=5.17</td>
</tr>
<tr>
<td>Nipple level</td>
<td>t=1.5</td>
<td>t=2.6</td>
</tr>
<tr>
<td>Axillary level</td>
<td>t=1.5</td>
<td>t=2.3</td>
</tr>
</tbody>
</table>

Fig. 7: Comparison of Diaphragm excursion in both the groups.

Fig. 8: Comparison of PEFR in both groups.

(except chest expansion at nipple level and axillary levels) were decreased on post-operative day 3 in both the groups. However, the decrease was more in the midline group as compared to the subcostal group and the return to the pre-operative values was much better in the subcostal group.

The alterations in pulmonary mechanics in the post-operative groups can be attributed to the fact that:

The distracting force on an incision during activity in the post-operative period leads to stretching kind of pain, which limits diaphragm excursion. During normal diaphragmatic breathing the abdomen moves out and this outward movement stretches the incision and leads to pain. This leads to reduced diaphragmatic excursion, PEFR and thoracic expansion at umbilical level.

It is observed that the parameters are more affected in the midline group as compared to subcostal group. This could be attributed to the following additional factors—

A reflex mechanism wherein the midline incision impinges on and transects the abdominal visceral afferents which inhibit inspiratory motor neurons and leads to phrenic nerve inhibition resulting in diaphragm dysfunction despite normal intrinsic diaphragm contractility.

Also the distracting force on the midline incision during post-operative period is nearly as twice as great as on that on a transverse (subcostal) incision, thus the associated pain is also more.

The integrity of the linea alba is important for the efficient functioning of the Rectus Abdominus muscle. Once the linea alba is cut due to midline incision, functional impairment of the Rectus Abdominus on both the sides may contribute to alteration in diaphragm mechanics.

The contraction of the abdominal muscles causes closing of the subcostal incision and hence less pain. This is the reverse of normal diaphragmatic breathing where the abdominal wall is stretched. This is confirmed in a study by Sloan.

Also studies have shown that the analgesia required post-operatively was more in the midline incision group as compared to the subcostal group suggesting more pain experienced by the patients undergone midline incision.

Thus all the factors namely altered diaphragm...
mechanics, surgical muscular injury and pain lead to impaired ability to deep breath, cough and sigh, more so in the midline group than in the subcostal group. This makes the patient vulnerable to complications of atelectasis and pneumonia especially in the lower lobes of the lungs as the diaphragm is largely responsible for ventilation of the most dependent portions of the lungs. Post-operative diaphragm dysfunction produces shift of ventilation away from lower lung fields. In the present study also it was observed that the chest expansion at the umbilical level was drastically reduced and was compensated by expansions at nipple and axillary levels. The study by Tahir et al also supports this.

Identical Chest Physiotherapy is conventionally practiced for patients with both the types of incisions. However, the present study suggests the need for a revised approach of Physiotherapy to midline incision group including additional measures to relieve pain using electrical modalities like TENS, Ultrasound, guarding of the muscle and also strengthening of abdominals should be emphasized upon. This will facilitate diaphragmatic excursion and promote abdominal muscle as an efficient expiratory muscle.

Conclusion

The study shows that the pulmonary mechanics are affected post-operatively with both the incisions. However, the affection is more in the midline group than in the subcostal group. Also, the return of function after a week is near about pre-operative values in the subcostal group while it still remains reduced even in the midline group. Hence the Physiotherapy approach towards midline incision group should be modified.

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Comparison of helium neon laser with gallium arsenide laser therapy on pain and functional ability in patients with trigger points (Upper trapezius muscle)

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Abstract

Key words/ Abbreviations

Purpose

The efficacy of low level laser therapy (LLLT) in myofacial trigger points seems controversial. The aim was to clarify the effect of Helium Neon or Gallium Arsenide Laser on pain and functional ability in patients with trigger points in the upper trapezius muscle.

Methodology

The study has an experimental design.
Thirty subjects (14 female, 16 male) with myofascial pain in the upper trapezius muscle were taken and randomly assigned to one of the three groups.

Based on inclusion and exclusion criteria, subjects were included in the study.
Convenient sampling with random allocation to the three groups (A, B, & C).

Group A (Experimental Group) received Helium Neon Laser therapy for 3 min followed by stretching exercises for 30 sec twice a day for 10 days during a period of 2 weeks.

Group B (Experimental Group) received Gallium Arsenide laser therapy followed by stretching exercises in the similar way as group A.

Group C (Controlled Group) received only stretching exercises as

The patients filled the VAS and NDI scale on zero, fifth and tenth day respectively to check the level of improvement.

Results

The data was analysed using the software SPSS 12.0.
No significant difference was seen in VAS and NDI from 0 to 2nd week between the 3 groups.

In result between the groups, Group C was found more effective than the other two groups. Stretching alone has positive, therapeutic effect on the underlying musculoskeletal trigger points.

Within the groups, group B i.e. He-Ne laser with Stretching showed significant results from 0 to 2nd week and from 1st to 2nd week.

Group A i.e. Ga-As with stretching showed significant improvement from 0 to 2nd week.

Conclusion

The study concludes that no significant difference in the effects of He-Ne laser application with stretching and Ga-As laser with stretching when compared to stretching alone.

This study does not conclude that stretching is an effective intervention as significant difference in the rate of improvement was found in group which received He-Ne laser with stretching.

The duration over which accumulation of rate of improvement took place was small.

Clinical significance

No significant rate of improvement in patients receiving (He-Ne + Stretching) and (Ga-As + Stretching). Thus, both the modalities are not beneficial for the treatment of myofascial trigger points. However, stretching is the main stay as the treatment of myofascial trigger point. It can be given as an auto therapy to patients as home programme.

Introduction

The myofascial pain syndrome constitute the largest group of unrecognized and misunderstood acute and chronic medical problems in clinical practice and are among the most common over looked causes of chronic pain and chronic disability in clinical medicine. Myofascial trigger point is a characteristic of myofascial pain syndrome (MPS) which is the most common muscle pain disorder. MPS is pain arising from one or more trigger points (TP) which are hyperirritable spots in skeletal muscle that are associated with hypersensitive palpable nodule in taut bands. The spots are painful on compression and can give rise to characteristic referred pain, tenderness, motor dysfunction and autonomic phenomena. There are lot of perpetuating factors for it like postural, mechanical, environmental stresses, emotional stresses and external compression. MPS has a high prevalence among individuals with regional pain complaints. The prevalence varies from 21% of patients seen in general orthopaedic clinic to 30% of general medicine clinic patients with regional pain, to as high as 85% to 93% of patients presenting to pain management centres.

Trigger points can arise in virtually any muscle group however the trapezius muscle appears to be the most frequently cited in clinical settings. 12 Four muscles trapezius, levator scapulae, infraspinatus and scalenus accounts for 84.7% of TP. Out of these muscles, trapezius account for 34.7% and levator scapulae constitute 19.7% of TP. The major goal of MTP therapy is to relieve pain and decrease TP sensitivity. Common treatments consist of drugs, non steroidal anti-inflammatory drugs (NSAID) and epidural...
injection. Various physical modalities include intermittent cold and stretch, thermotherapy, massage therapy, post isometric relaxation, dry needling, trigger point injections, ischemic compression, TENS, ultrasound, laser and elimination of causative factors.

Currently used treatments include complementary methods of which LLLT is one of the most common method. One of the most fascinating development within the field of electrotherapy in recent years has been introduction of low power lasers Since then lasers have become a popular therapy modality.

In a double blind controlled trial conducted by Gur A. et al on patients with chronic myofascial pain syndrome in neck evaluated the effects of infrared low level 904 GA-As laser therapy on clinical and quality of life. He revealed that LLLT is effective in pain relief and improvement of functional ability and quality in patients with myofascial pain syndrome.

F. Ceccherelli et al in his study on diode laser in cervical myofascial pain confirmed that diode laser is effective and result in pain attenuation. On the contrary, Altan L. et al who investigated the effect of Ga-As laser therapy in cervical myofascial pain syndrome with a placebo controlled double blind prospective study. He did not find any superiority of Ga-As laser therapy over placebo. A double blind controlled on low energy laser treatment and exercise for chronic low back pain conducted by Robin G. Klein et al concluded that low energy laser stimulation under short term conditions does not appear to provide any advantage over exercise alone.

The study undertaken by Synder-Mackler et al, to ascertain the effects of He-Ne laser on resistance of skin resistance overlying musculoskeletal trigger point, showed significant increase in skin resistance and assumed to accompany the resolution of pathological condition. In a double blind study, repeated irradiation with a low power helium neon laser produced relief in subjects with chronic pain as concluded by J. Walker whereas no statistical difference was found when subjects were treated with low output He-Ne laser therapy against placebo for chronic myofascial pain.

Ali Gur et al advocated that there are differences in technology and in the devices, and differences between the geometry of the laser beam, the divergence of the beam and the system of collimation of the diode laser equipment. Because of the large number of positive reports and the innocuous nature of the therapies, further clinical evaluation of laser therapy is warranted. Therefore, as mentioned above many researches have been done on Helium Neon laser and Gallium Arsenide laser individually. Thus, a need arises to follow up the already acclaimed treatment in a comparative study.

Methodology

30 subjects (14 female, 16 male) with myofascial pain in the upper trapezius were taken for this experimental study to see the efficacy of LLT in releasing pain and increasing functional ability in patients with Myofascial trigger points. Subjects recruited randomly.

Selection on the basis of inclusion and exclusion criteria.

Inclusion criteria

1. Both male and female.
2. Age group 18-55 years.

Exclusion criteria

1. Fibromyalgia.
2. Neoplasias.
3. Neck or shoulder surgery in past one year.
5. Degenerative joint disease.
6. Fracture or dislocation in the cervical vertebrae.
7. Cardiac conditions.

Design

The design is experimental comparing He-Ne laser with Ga-As laser therapy on pain and functional ability in patients with trigger points in the upper Trapezius muscle.
Instrumentation
2. Gallium Arsenide Laser.
3. VAS.
4. NDI.

V.A.S

Visual Analogue Scale (VAS) has been shown to be an effective and reliable instrument for measuring patients subjective interpretation of pain. Pain intensity has been measured by subjects using 0-10 cm scale, in which 0 indicates no pain and 10 indicates worst pain. VAS provided a reliable, responsive measurement and was easily understood by patients.

Example of a VAS

N.D.I

Neck Disability Index (NDI) is a questionnaire designed to give us information as to how subject neck pain has affected his ability to manage in everyday life. For each section, the total possible score is 5 if the first statement is marked the section score is zero, if the last statement is marked score is 5. If all 10 sections are completed the score is calculated over 50. If anyone section is missed or not applicable the score is calculated over 45.

Protocol

Based on inclusion and exclusion criteria, subjects were included in the study, convenient sampling with random allocation to the three groups (A, B, & C). Group A (Experimental Group) received Helium Neon Laser therapy and stretching exercises. Group B (Experimental Group) received Gallium Arsenide laser therapy and stretching exercises. Group C (Controlled Group) received only stretching exercises.

Clinical examination

Before starting the treatment, patient’s upper Trapezius muscle was palpated for the trigger point with the help of pincher grip and flat palpation L.T.R. and jump sign were recorded. Subjects having more than one active trigger point. The most hypersensitive point was selected and marked by using a permanent marker. The patients filled the VAS and NDI scale on zero, fifth and tenth day respectively to check the level of improvement.

Group A (Experimental Group)

All patients in this group received Helium Neon laser therapy for 3 min followed by stretching exercises of the upper trapezius muscle. The treatment was given twice a day for 10 days during a period of 2 weeks.

Stretching exercises of the upper trapezius had a scanner with 0.1 cm beam diameter and emitted laser beam with 632.8 nm wavelength. For 3 minutes, He-Ne laser was applied over the trigger point in the upper trapezius at a maximum intensity of 0.75 mw producing a low level output of (14-29 mJ) and no tissue heating.

Group B (Experimental Group)

All the patients in this group received gallium Arsenide laser therapy followed by stretching exercises for the upper trapezius muscle in the similar way as group A.

The patient is either in prone lying or in sitting position to obscure view of laser with skin at right angle. Gallium Arsenide laser device emitted laser beam of 905 nm wavelength at frequency of 3000 Hz with 11.2 mw average power for 3 min twice a day for 10 days during a period of 2 weeks.

Stretching exercises for the upper trapezius muscle was given in the similar way as for group A.

Group C (Controlled Group)

All subjects received stretching exercises for the upper trapezius muscle as described above.

Data analysis

Data analysis was done using SPSS software version 12.0.

All variables of age, weight, height, VAS and NDI were analyzed using One way ANOVA between Group A, B and C.

Analysis of variance was used to determine the VAS and NDI at 0, 1 and 2 week between the groups A, B and C.

Variables of VAS and NDI were analyzed using One way ANOVA between 0, 5 and 10th day within the group A, B and C.

Post Hoc test using LSD was done for pair wise comparison of the variables of VAS and NDI between 0, 5 and 10th day within the group A, B and C. Level of significance was set as 0.05.

Results

Analysis of age between groups A, B and C using One way ANOVA showed significance difference (p < 0.05).

Analysis of weight and height between the group showed no significance difference (p > 0.05) (Table 5.1)

Analysis of variance for VAS and NDI at 0, 1 and 2nd week showed no significance difference between the groups. (p > 0.05) (Table 5.2)

Variables of VAS and NDI using One way ANOVA between 0, 5 and 10th day within the group (p < 0.05) (Table 5.3).

Post Hoc analysis using LSD showed significant difference between 0, 5 and 10th day within the group (p < 0.05) (Table 5.4).

Results showed no significant difference in VAS and NDI from 0 to 2nd week in all the three groups i.e. group A, B and C indicating that rate of improvement in all the three groups
was alike. Hence, concluding a minimal contribution of therapeutic modalities for pain relief and increasing functional ability.

On analyzing the data within the groups A, B and C, VAS showed significant results only in group A and B whereas NDI showed significant results in all the three groups A, B and C.

In Group A (He-Ne + Stretching) VAS score showed significant improvement from 0 day to 5th day and 0 day to 10th day but there was no significant improvement from 0 day to 5th day.

Group B (Ga-As + Stretching) showed no significant improvement in VAS score from 0 to 5th day and 5th to 10th day, but significant improvement was seen from 0 to 10th day.

Group C showed no significant improvement in VAS score.

Whereas on analyzing NDI significant improvement was seen from 0 day to 10th day in all the three groups A, B and C.

**Discussion**

Myofascial pain syndrome is a common source of discomfort and disability for many patients. However it is generally ignored or misdiagnosed leading to chronic painful conditions. The aim of the treatment in MPS is to decrease trigger point sensitivity till date, a lot of treatments methods has been introduced and practiced.

Various physical modalities such as ice, heat, spray, Ultrasound, TENS, Ischemic Compression, dry needling and massage have been used to treat trigger points. Despite of the wide use of therapeutic modalities, Hanten et al claimed that the quality of the studies on the efficacy of these modalities were low and the supporting results reported only temporary relief from any modality. Simunovic reported functional recovery and decrease of spontaneous pain with LLLT on trigger points. In the past many researches have been done on He-Ne and Ga-As laser for the treatments have been proved effective individually thus, a need arises to follow up the already acclaimed treatments in comparative study.

Implication of the present study is that no significant difference was found in VAS and NDI from 0 to 2nd week between the three groups i.e. group A (He-Ne + stretching), group B (Ga-As + stretching) and group C (stretching alone).

On analyzing the results between the groups, Group C was found more effective than the other two groups i.e. Group A and B, concluding a minimal contribution of therapeutic modalities in pain relief and increasing functional ability.

Thus, stretching alone has positive, therapeutic effect on the underlying musculoskeletal trigger points. Stretching exercises form the basis of exercise treatment of myofascial pain by addressing the muscle tightness, shortening that are closely associated with pain in this disorder and permits

**Table 5.1: Comparison of Age, Weight and Height between Group A, B and C.**

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>F Value</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>WEIGHT</td>
<td>0.143</td>
<td>0.868</td>
</tr>
<tr>
<td>HEIGHT</td>
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<td>0.068</td>
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**Table 5.2: Comparison between VAS and NDI at 0 day, 5th day and 10th day between the groups.**

<table>
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<tr>
<th>VARIABLES</th>
<th>DAYS</th>
<th>F Value</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAS</td>
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<td>0.766</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>0.135</td>
<td>0.875</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>0.245</td>
<td>0.785</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>1.763</td>
<td>0.191</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>2.013</td>
<td>0.153</td>
</tr>
<tr>
<td>NDI</td>
<td>0</td>
<td>1.293</td>
<td>0.291</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>1.293</td>
<td>0.291</td>
</tr>
</tbody>
</table>

**Table 5.3: Comparison of VAS and NDI within group A, B and C on 0, 5th and 10th day.**

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>F Value</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAS A</td>
<td>3.194</td>
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</tr>
<tr>
<td>VAS B</td>
<td>4.904</td>
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</tr>
<tr>
<td>VAS C</td>
<td>1.946</td>
<td>0.162</td>
</tr>
<tr>
<td>NDI A</td>
<td>6.039</td>
<td>0.007</td>
</tr>
<tr>
<td>NDI B</td>
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</tr>
<tr>
<td>NDI C</td>
<td>3.365</td>
<td>0.050</td>
</tr>
</tbody>
</table>

**Table 5.4: Comparison of rate of improvement in VAS and NDI within Group A, B and C from 0 day to 10th day.**

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>DAYS</th>
<th>MEAN DIFFERENCE</th>
<th>STANDARD ERROR</th>
<th>P VALUE</th>
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</thead>
<tbody>
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<td>VAS A</td>
<td>0 to 5th day</td>
<td>0.7500</td>
<td>0.7573</td>
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</tr>
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<td></td>
<td>5th to 10th day</td>
<td>1.1500</td>
<td>0.7573</td>
<td>0.141</td>
</tr>
<tr>
<td></td>
<td>0 to 10th day</td>
<td>1.9000</td>
<td>0.7573</td>
<td>0.018</td>
</tr>
<tr>
<td>VAS B</td>
<td>0 to 5th day</td>
<td>0.4500</td>
<td>0.456</td>
<td>0.333</td>
</tr>
<tr>
<td></td>
<td>5th to 10th day</td>
<td>0.9500</td>
<td>0.456</td>
<td>0.047</td>
</tr>
<tr>
<td></td>
<td>0 to 10th day</td>
<td>1.4000</td>
<td>0.456</td>
<td>0.005</td>
</tr>
<tr>
<td>VAS C</td>
<td>0 to 5th day</td>
<td>0.6500</td>
<td>0.5605</td>
<td>0.256</td>
</tr>
<tr>
<td></td>
<td>5th to 10th day</td>
<td>0.4500</td>
<td>0.5605</td>
<td>0.429</td>
</tr>
<tr>
<td></td>
<td>0 to 10th day</td>
<td>1.1000</td>
<td>0.5605</td>
<td>0.005</td>
</tr>
<tr>
<td>NDI A</td>
<td>0 to 5th day</td>
<td>0.1020</td>
<td>0.6365</td>
<td>0.121</td>
</tr>
<tr>
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<td>5th to 10th day</td>
<td>0.1190</td>
<td>0.6365</td>
<td>0.072</td>
</tr>
<tr>
<td></td>
<td>0 to 10th day</td>
<td>0.2200</td>
<td>0.6365</td>
<td>0.002</td>
</tr>
<tr>
<td>NDI B</td>
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<td>0.6803</td>
<td>0.293</td>
</tr>
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<td>0.1760</td>
<td>0.6803</td>
<td>0.015</td>
</tr>
<tr>
<td>NDI C</td>
<td>0 to 5th day</td>
<td>0.0850</td>
<td>0.5763</td>
<td>0.152</td>
</tr>
<tr>
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<td>5th to 10th day</td>
<td>0.0640</td>
<td>0.5763</td>
<td>0.277</td>
</tr>
<tr>
<td></td>
<td>0 to 10th day</td>
<td>0.1490</td>
<td>0.5763</td>
<td>0.015</td>
</tr>
</tbody>
</table>
gradual restoration of normal activity. The contracture of the sarcomeres in the contraction knots of the TrP must be released. Lengthening of these contracted sarcomeres by gentle sustained stretch with augmentation techniques apparently induces a gradual reduction in the overlap between actin and myosin molecules and reduces the energy being consumed. This breaks an essential link in the energy crisis vicious circle. The key to treating TrP is to lengthen the muscle fibres that are shortened by TrP mechanism. When the muscle is being stressed golgi tendon organs (GTO) promotes the stretch in the muscle and in turn lengthening occurs. A controlled, blind study by Hanten et al compared the effects of 5 day home programme of muscle stretching exercises and self massage with an active ROM programme for neck and back myofascial pain. Stretching programme showed significantly more improvement than subjects in active ROM concluding that stretching of the effected muscle is believed to be an integral part of TP therapy.

On the other hand, when analyzing the results within the groups, group A i.e. He-Ne laser with stretching showed significant results from 0 to 2nd week and from 1st to 2nd week of treatment period. The findings substantiate the previous findings of Synder-Mackler et al demonstrating a reduction in pain due to increase in the latency of the superficial radial nerve in healthy subjects that correspond to a decrease in sensory in nerve conduction velocity after application of He-Ne laser. Walker et al suggested that this type of laser may effect serotonin metabolism, because of large increase in urinary excretion of 5 hydroxyindoleacetic acid (5 HIAA) and better oxygenation of tissue resulting from increased local circulation hence leading to reduction of pain. According to the literature, minimum three treatments has been suggested for assessing the efficacy of laser treatment and a 10 session course has been recommended for those patients who seems to benefit from the treatment. The slight carry over effect noted in the present study i.e. from 1st to 2nd week of group B was augmented to the point of statistically significance when a 10 session paradigm is used. Similarly, analyzing within the group, Group B i.e. Ga-As with stretching showed significant improvement from 0 to 2nd week which could be due to decrease in muscle spasm , increase in ATP production and other possible mechanisms predicted are effects on endorphin level gate control of pain given by Melzack and Wall. Ali Gur et al advocated that significant and clinically useful effects in management of chronic neck pain related to MPS is due to reduction in local tenderness. In support to this Fernendo Sornano in his study on LBP suggested that the therapy with Ga-As diode laser can release pain in 70-90% of the cases. Similarly, Sarac et al found significant improvement in patients when treated with Ga-As laser with respect to parameters such as pain, functional ability and Quality of life (QoL) which is in accordance to present study.

Conclusion

Result of the present study reported no significant difference in the effects of He-Ne laser application with stretching and Ga-As laser with stretching when compared to stretching alone on pain relief and functional ability. But this study does not conclude that stretching is an effective intervention as significant difference in the rate of improvement was found in group which received He-Ne laser with stretching. Since the duration over which accumulation of rate of improvement took place was small thus it could not produce any significant difference over all at the end.

References

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Comparative evaluation of physiotherapy and pharmacotherapy in the management of temporomandibular joint myofascial pain

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*Professor and Head, **Assistant Professor, ***Former Post-graduate, ****Former Professor, Department of Oral Medicine and Radiology, SDM College of Dental Sciences and Hospital, Dharwad 580 009

Abstract

Objectives

The present study is a prospective study carried out to evaluate the efficacy of physiotherapy methods like ultrasound, transcutaneous electrical nerve stimulation, low intensity light amplification by stimulated emission of radiation and compare the same with pharmacotherapy comprising of analgesics and muscle relaxants, in the management of temporomandibular joint myofascial pain.

Methods

A total of 40 patients included in the study. Subjects were randomly assigned to one of the two groups, each group consisting of 20 subjects. Subjects of Group A received a combination of muscle relaxants and analgesics and Group B subjects received, ultrasound, transcutaneous electrical nerve stimulation, or light amplification by stimulated emission of radiation. All the patients were evaluated for subjective and objective symptoms at baseline and then following one, four, eight, and 16 weeks post treatment. All the subjects were evaluated with visual analog scale, Global Pain Impact scale scores, number of tender muscles, and maximum comfortable mouth opening.

Results

The parameters evaluated revealed significant improvement in Group B following treatment and also during the follow period as compared to Group A subjects.

Conclusion

Physiotherapy, having the advantages of better patient compliance and lack of adverse side effects, can be considered as primary treatment modality of patients with myofascial pain.

Key words

Myofascial pain, physiotherapy, pharmacotherapy, Ultrasound, LASER, TENS.

Introduction

The term “temporomandibular disorder” [TMD] was suggested by Bell1. It is a collective term embracing a number of clinical problems that involve the masticatory musculature, the TMJ, and associated structures, or both2.

Temporomandibular joint disorders have been recognized as the most common non-tooth related chronic orofacial pain conditions that confront dentists3. Symptoms associated with TMDs are common in general population with 20 to 85 percent of the population known to present with symptoms like pain in the TMJ and masticatory muscles, and restricted mouth opening4. To date, there have been many synonyms for myofascial pain, including facial arthromyalgia, TMJ dysfunction syndrome, myofascial pain dysfunction syndrome, craniofacial joint disorder, and myofascial pain dysfunction5. Currently the preferred term, according to the Research Diagnostic Criteria developed by Dworkin and co-workers6 is “Myofascial pain”. Myofascial pain [MFP] is the most common disorder causing chronic pain in head7. Accordingly MFP is pain of muscle origin including a complaint of pain as well as pain associated localized areas of tenderness to palpation in muscle7.

The dentist plays a significant role, in the diagnosis and management of such patients, as most patients present with variety of symptoms ranging from pain in and around the orofacial region to restriction of mouth opening. Appropriate diagnosis is essential to differentiate pain of dental origin from that of TMJ and masticatory muscles to chart out the appropriate treatment plan fro such patients. Many times an interdisciplinary approach will be required.

The conservative treatment modalities to manage such patients include occlusal splints, analgesics, muscle relaxants, tranquilizers, exercises, joint and muscle injections, physical therapy, psychological counseling, and placebo8. Irrespective of the chosen modality of treatment, the goal of treating would be to decrease pain, reduce loading of the masticatory system, and restore mandibular movements and oral function8.

Physiotherapy is chosen for the treatment of dysfunctions in the orofacial region for its unique reasons; it is relatively simple and non-invasive, has a low cost as compared with other treatments, and allows for an easy self-management approach which means that the patient is actively involved in his own treatment, being responsible for his or her well-being. It allows good communication with the patient, improving the patient’s confidence in the care provider, being the basis of a positive coping2. The various forms of physiotherapy include rest, thermal modalities [superficial heat and cryotherapy], ultrasound, shortwave diathermy, transcutaneous electrical nerve stimulation [TENS], transcutaneous muscle stimulation, biofeed back training,
massage, active movements [exercise], passive movements, acupuncture, and low intensity light amplification by stimulated emission of radiation [LASER].

The present study was aimed to assess the effectiveness of physiotherapy methods like TENS, ultrasound, low intensity LASERS and exercises, massage, and hot compresses in myofascial pain patients and to compare same with pharmacotherapy comprising of a combination of muscles relaxants and nonsteroidal anti-inflammatory drugs [NSAID].

**Materials and methods**

**Subject selection**

The prospective study was conducted in the Department of Oral Medicine and Radiology SDM Dental college and Department of Physiotherapy SDM Medical college Dharwad. The experimental protocol for this study underwent review and approval by the ethical committee of the institution. Each patient was fully informed about the condition consent was obtained before inclusion in the study.

Subjects to participate in the study were to have a primary diagnosis of MFP of masticatory muscles according to RDC TMD. Patients diagnosed with myofascial pain, approaching the outpatient department, were selected for the study from the period of November 2004 to March 2006. Patients having the condition for at least three months were included in the study. All the patients presented with three or more of the following signs and symptoms: pain on palpation of associated muscles [muscles of mastication, sternocleidomastoid, trapezius muscles], limited mouth opening, intermittent clicking of the joint, and absence of radiographic changes in the TMJ.

Patients excluded from the study were those with occlusal disharmony, were undergoing orthodontic treatment and/or occlusal corrections, had undergone treatment for the same within six months of present diagnosis, had any form of arthritis affecting the TMJ, or failed to attend regular follow-up.

**Screening Procedure**

A detailed history regarding onset, duration, and progress of symptoms was recorded at the time of diagnosis. The data also included type of pain, its severity and pain response to chewing, speech, and swallowing. Intensity rates of pain were recorded on a visual analog scale of 100mm long continuum and the extremes were labeled as no pain and worst possible pain. The impact of pain on the global functional ability related to jaw use was assessed using a six-point Global Pain Impact [GPI] scale. This was followed by a thorough examination of the TMJ, muscles of mastication, and neck muscles, recording of Maximum comfortable mouth opening. Temporomandibular joint examination included assessment of clicking, tenderness at rest and during various jaw movements and deviation of the jaw during opening and closing movements. Tenderness of muscles of mastication and the neck muscles was assessed by means of digital palpation, resistance testing, and functional manipulation of muscles. The tenderness in the muscle was recorded as being present or absent.

40 patients meeting the criteria were randomly assigned into two groups, Group A or Group B. Group A patients received a drug combination of muscle relaxants and analgesics comprising of ibuprofen 400mg, paracetamol 325mg, and chlorzoxazone 250 mg, orally as twice daily dosage for a period of five days. Following which the patients were asked to terminate the intake of medication. During the follow up weeks, patients reporting with episodes of pain were advised to continue the same medication with prior consent from the clinician. All patients received the same combination of medication.

Group B patients were treated with either one or combination of the three treatment modalities, TENS, ultrasound, or LASER. The appropriate modality to be instituted was decided by the physiotherapist. Four patients received TENS, four received ultrasound, 11 received helium-neon [He-Ne] LASER therapy, and one of them received a combination of ultrasound and TENS.

**Transcutaneous Electrical Nerve Stimulation**

The TENS unit with four electrode attachments was employed. Electrodes were placed over the area of maximum muscle tenderness. The current frequency set at 2Hz and pulse duration of 0.02ms. The pulse strength was increased slowly, until the patient could tolerate without pain. Maximum benefit was obtained after 25 to 30 minutes at which time the treatment was terminated.

Ultrasound: 0.8W/cm² of frequency in pulsed mode of 3MHz was applied for four minutes. The applicator was moved in smooth overlapping sweeps or circles at rates of few cm/sec over areas of 25 to 40cm² it was applied for three most tender points.

**Helium-Neon LASER**

The trigger points were identified by palpation. The wavelength of LASER was 632.8nm which was used in a pulsed mode of 30-40HZ. The dose range was between 2-4J/cm². The head of the instrument was held perpendicular to and in slight contact with skin. The treatment was applied over three or more Trigger points (TrPs).

The treatment duration was five days for all the modalities following which the patients were advised to practice exercises, massaging of muscles and to apply moist heat to the affected regions during exacerbations of symptoms.

**Massage Therapy**

Self-massage was limited to the painful or tense masseter and temporalis muscles [ease of accessibility]. The patients were also asked to apply moist heat pads on the painful area when the symptoms exacerbate. Heat application [moderately warm] was advised to be applied bilaterally for 20 minutes once a day.

The oral physician who diagnosed the condition was instrumental in the follow-up, and the prior mentioned parameters were assessed at baseline, one week [following completion of treatment session], four, eight, and 12 weeks following treatment sessions, for all the subjects.

**Statistics**

The statistical evaluation of data was performed with data program stat 9.2 version. All the data was analyzed by one blinded researcher.

First means and standard deviations of VAS, GPI scores, and number of tender muscles were determined [Table 1]. The baseline values of maximum comfortable mouth opening between the two groups were tested by one way analysis of variance [Table 2a]. Analysis of co-variance was used to assess significant difference between the two groups taking baseline scores as covariance [Table 2b]. Student’s t-test [paired and unpaired] was used to compare the treatment
outcome between the two groups. The level of statistical significance was set as a two-tailed P value of 0.05. P<0.05 was considered to be significant. The values are presented in Table 1.

Results

The mean age of the patients was 35.85 and 33.67 years in Group A and Group B, respectively. Group A comprised of 40% males and 60% females. Group B comprised of 45% males and 55% females.

The comparison of mean VAS and GPI scores between the two groups showed significant reduction in Group B during the follow-up period [Fig 1 and 2, respectively]. The Group B patients showed significant reduction in number of tender muscles and significant improvement in mouth opening during post treatment follow-up period [Fig 3, 4].

Discussion

The various treatment modalities for TMDs mainly aim to relieve the symptoms of the patient as treatment aimed at correction of the exact cause is questionable. Selecting an appropriate treatment option for an individual patient poses great challenge to the clinician and depends on various factors.

Table 1: Comparison of Mean Scores Between Two Groups at Various Time Intervals.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean VAS scores</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
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<td>1 week</td>
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</tr>
<tr>
<td>4 weeks</td>
<td>4.8500</td>
<td>3.5500</td>
</tr>
<tr>
<td>8 weeks</td>
<td>4.8500</td>
<td>3.4000</td>
</tr>
<tr>
<td>12 weeks</td>
<td>5.0500</td>
<td>3.3000</td>
</tr>
<tr>
<td>Mean GPI scores</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>1.9500</td>
<td>2.1500</td>
</tr>
<tr>
<td>1 week</td>
<td>1.0000</td>
<td>1.0000</td>
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<tr>
<td>4 weeks</td>
<td>1.4000</td>
<td>0.5500</td>
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<tr>
<td>8 weeks</td>
<td>1.4000</td>
<td>0.7500</td>
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<tr>
<td>12 weeks</td>
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<tr>
<td>Mean of number of tender muscles</td>
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<tr>
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<td>1 week</td>
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<td>1.5</td>
<td>0.9</td>
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<td>8 weeks</td>
<td>1.55</td>
<td>0.85</td>
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<td>12 weeks</td>
<td>1.45</td>
<td>0.82</td>
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<tr>
<td>Baseline</td>
<td>2.4</td>
<td>2.25</td>
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Table 2a: F- Test and ANCOVA for comparison of mouth opening between two groups at various time intervals.

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean VAS scores</th>
<th>Mean GPI scores</th>
<th>Mean of number of tender muscles</th>
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</thead>
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<td>Group A</td>
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<td>1.9500</td>
<td>2.4</td>
</tr>
<tr>
<td>Group B</td>
<td>4.4250</td>
<td>2.1500</td>
<td>2.4</td>
</tr>
</tbody>
</table>

Table 2b: Analysis of covariance (ANCOVA) with baseline as a covariate.

<table>
<thead>
<tr>
<th>Time interval</th>
<th>Effect</th>
<th>Error</th>
<th>F-value</th>
<th>P value</th>
<th>Significance</th>
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<tr>
<td>1 week</td>
<td>20.9457</td>
<td>104.6726</td>
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<td>7.4039</td>
<td>0.0099 S</td>
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<tr>
<td>4 weeks</td>
<td>33.6901</td>
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<td>9.3650</td>
<td>0.0041 S</td>
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<tr>
<td>8 weeks</td>
<td>34.0816</td>
<td>132.6569</td>
<td>34.0816</td>
<td>9.5059</td>
<td>0.0039 S</td>
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<td>132.6569</td>
<td>34.0816</td>
<td>9.5059</td>
<td>0.0039 S</td>
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</table>
and later it was substituted with ultrasound. None of the patients in the present study have reported any discomfort or adverse effects due to TENS therapy. The switching over from TENS to ultrasound in one of the patients in the present study was due to non responsiveness to treatment but not due to any adverse effect.

In the present study eleven patients received He-Ne LASER therapy in a pulsed mode of 30 to 40HZ over the TrPs continuously for five days with significant improvement in symptoms and there was no adverse effects caused by LASER therapy. Similar to our study Simunovic et al.26 have reported pain relief, restored mobility, and decreased rigidity in myofascial pain patients with He-Ne laser treatment. None of the patients did require any repetition of treatment sessions.

Non steroidal anti-inflammatory analgesics are known to be effective in the management of mild-moderate inflammatory conditions, particularly of the musculoskeletal system24. Muscle relaxants are administered to reduce skeletal muscle tone and are often administered to patients with muscle tone with chronic orofacial pain to help prevent or alleviate the increased muscle activity25. They act by decreasing the muscle tone without impairment of motor function by depressing the central polysynaptic reflexes. Literature review shows that very few studies have used muscle relaxants solely or in combination with analgesics for the treatment of TMD. Greene and Laskin26 have used meprobamate in the treatment of myofascial pain dysfunction syndrome and have concluded that drugs like meprobamate can reduce or eliminate the psychic tension and muscular spasm. Singer et al.27 in their randomized double blind controlled clinical trial have evaluated Ibuprofen and Diazepam for chronic orofacial muscle pain and their study supports the efficacy of diazepam in the short–term management of chronic orofacial pain.

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In the present study patients in pharmacotherapy group have reported with reduction in symptoms [VAS and GPI scores] initially following five days of treatment, but there was no significant improvement during the follow-up period. This is in accordance with Talaat et al. report that the muscle relaxant group had only a mild reduction of pain and muscle spasm, but no effect on TMJ clicking as compared to ultrasound short wave diathermy groups. In contrast to absence of side effects in the physiotherapy group, five patients of the pharmacotherapy group reported with mild gastrointestinal symptoms during the follow-up, but these symptoms did not persist after discontinuation of drugs. The present study being a follow-up study enables the assessment of improvement in myofascial pain treated with physiotherapy and pharmacotherapy. Group A subjects had significant reduction in VAS and GPI scores and reduction in number of tender muscles only following a course of anti-inflammatory and muscle relaxant treatment. But the same results did not continue during the follow-up as compared to Group B. The practice of appropriate exercises with massaging of the muscles following the various physiotherapy modalities indicates the persistent improvement in symptoms of the GroupB during the follow-up period also.

To our knowledge there are very few studies comparing physiotherapy and pharmacotherapy in the management of TMD. Earlier studies indicate that ultrasound, TENS, and LASERS exercises prove to be effective in the management of myofascial pain. In the current study the physiotherapist made the decision about the mode therapy for individual patient based on patient compliance and economic feasibility. Hence physiotherapy modalities were considered as a single group and its efficacy of treatment compared with pharmacotherapy.

The present study, infers that physiotherapy one of the conservative treatment modalities is useful in reduction of pain, tenderness in muscles, and improvement in mouth opening in patients with myofascial pain.

Commonly observed adverse effects with the use of NSAID group of drugs include nausea, dyspepsia, ulceration, enteropathy, strictures, bleeding, and perforations. It has to be noted that if an NSAID is administered concomitantly with an anticoagulant, the potential for bleeding increases markedly. Furthermore this group of drugs may be contraindicated in patients on diuretics and in patients with severe renal disease. Therefore the clinician should not overlook benefit versus risk while administering these drugs, especially for a longer period of time. Appropriate motivation of patients to practice mouth opening exercises or simple methods like hot compresses might have great benefits to the patients. This can ensure frequent change of therapies and also saves the patient from suffering with the adverse effects of the drugs.

Conclusion

The treatment outcome with any form of therapy for TMD is not completely predictable. In view of the adverse effects caused by long term use of various NSAIDs, it is advisable to choose a safer form of therapy in the management of patients with chronic musculoskeletal pain. The advantages of physiotherapy observed in the present study were better long-term results, fewer side effects, cost effectiveness, and a better patient compliance. This does not totally preclude this modality from certain limitations such as, lack of total effectiveness in inaccessible muscles like lateral and medial pterygoid. Despite this limitation physiotherapy still remains as a better and safe treatment option in patients with chronic pain condition like myofascial pain. But furthermore randomized controlled trials are necessary to validate the effectiveness physiotherapy in a larger sample.

Acknowledgements

The authors would like to acknowledge Dr. C Bhasker Rao, Principal SDM College of Dental Sciences Dharwad for his encouragement, Ms Kiran Bhat Principal and Ms Sharmila Dudhani former post graduate SDM College of Physiotherapy Dharwad for the help rendered towards the study.

References

Comparative analysis on the efficacy of G.D. Maitland’s concept of mobilization & muscle energy technique in treating sacroiliac joint dysfunction

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Study design
A randomized experimental study.

Objective
The following study is a comparative analysis to check the efficacy of Muscle energy technique & G.D. Maitland’s concept of mobilization in decreasing pain and improving functional ability in patients with sacroiliac joint dysfunction. Hence prove the effectiveness of either technique as a treatment option to treat Sacroiliac Joint Dysfunction.

Methods and measures
A total of 45 subjects with chronic low back pain were recruited in the study, with total mean age of 22.82. Subjects were randomly grouped into 3 group’s viz. Group I (n=15) Muscle energy technique and exercises, Group II (n=15) G. D. Maitland mobilization and Exercises and Group III (n=15) control. The 2 experimental groups participated in a 6 session of Muscle energy technique and G. D. Maitland mobilization respectively. The outcome measures were based on self evaluated pain (thermometer pain rating scale), disability (Oswestry disability index) and hip range of motion (Goniometry)

Results
Mean±SD decrease of visual analogue thermometer at base line for group treated with muscle energy technique was from 3.53±0.51 at base line to 0.20±0.41 post 6 sessions. Similarly for Group II decreased from 3.73±0.7 at baseline to 0.33±0.48 post 6 sessions.

The mean Oswestry disability index score within the three groups at base line are, Group I=0.296±0.05, Group II=0.27±0.05, Control= 0.28±0.05, the mean decrease post 6 sessions was 0.024, 0.067 and 0.23.

Medial rotation of hip was significantly improved in subjects in Group I from 21.27±4.5 at base line to 37.93±2.05 post 6 sessions of treatment.

Conclusion
The results of this study showed that along with active exercises Muscle energy technique (MET) is moderately significant over the G.D.Maitland’s technique of mobilization in improving functional ability and increasing the medial rotation of hip joint in mechanical chronic low back pain caused due to sacroiliac joint dysfunction, while both the experimental groups were highly significant in decreasing pain and improving functional ability.

Key words
Sacroiliac joint dysfunction, Muscle Energy Technique, G.D. Maitland Mobilization.
Sacroiliac joint has been known as an under appreciated pain generator1. Therefore SI joint itself and the specific diagnosis of SI joint dysfunction are both under appreciated causes of pain in low back, pelvis and the proximal lower extremities2.

In the 1st part of the 20th century SI joint syndrome was the most common diagnosis for LBP, or lumbago. Before 1932, SI joint dysfunction was a particularly popular diagnosis. It was actually called “Era of SI joint” because so many physicians felt that the SI joint was the cause of most back problems. Any pain in the low back, buttock or adjacent leg was usually referred to as SI joint syndrome.

In 1932, the discovery of the herniated (or ruptured) disc led many physicians to assume that most pain in the back was the result of this new problem. Thus, was born the “Dynasty of the disc” the SI joint some what for gotten3.

In late 1980’s, many physicians “rediscovered” the SI joint as a possible source of back pain.

Lately SI joint has been considered as a significant source of pain in patients with chronic low back pain4.

In the process of evolution and transition from quadruped to biped, appeared to be an evolutionary weakness. In the quadruped most weight is taken on front legs, e.g. In the horse the distribution is about 65:35 front to hind. Thus, quadruped SI joint takes a good deal less than half the animal’s weight, while in man the SI joint takes 100%4.

Studies have validated the use of ‘Manual therapy’ as treatment for SI joint dysfunction. The purpose of this study is to investigate the efficacy of 2 different manual therapy techniques i.e. Muscle energy technique & G.D.Maitland’s concept of mobilization in different subgroups of patients with SI joint dysfunction5.

Over the past decade there has been considerable attention and debate about the sacroiliac joint and its role in LBP and pelvic pain. Through multidisciplinary discussion and research, a consensus is arising as to the causes and treatment of sacroiliac joint dysfunction.

The integrated approach of the joint function presented by Lee and Vleeming (1998) has 4 components
- Form Closure (structure)
- Force Closure (forces produced by myofascial action)
- Motor Control (specific timing of muscle action during loading)
- Emotions

The proposal is that joint mechanics can be influenced by multiple factors including articular, neuromuscular and emotional factors and therefore management of dysfunction requires attention to all these elements.
So therefore the aim of the following study a comparative analysis to check the efficacy of Muscle energy technique & G.D. Maitland’s concept of mobilization in decreasing pain and improving functional ability in patients with sacroiliac joint dysfunction. Hence prove the effectiveness of either technique as a treatment option to treat Sacroiliac Joint Dysfunction.

Materials and methods

Study design
It was a randomized controlled study with a total of 45 subjects with chronic low back pain, of mean age 22.82±2.9 were recruited in the study. Patients, who agreed to participate after being explained about the aim of the study and the procedure they would be undergoing, were asked to sign an informed consent document approved by the Institutional Review Board, Amity Institute of physiotherapy. All patients meeting the inclusion and exclusion criteria, eligible for participation i.e.

Inclusion criteria
• Age group 18-30 years.
• Chronic low back pain for more than 3 months.
• There should not be any associated neurological symptoms.
• Disability scoring on the Oswestry disability index above 20% but below 80%.

Exclusion criteria
• Traumatic conditions
• Infectious conditions
• Tumors

Were randomly assigned into three groups, Group A (Muscle energy techniques + Exercises), Group B (Maitland’s mobilization + Exercises), Group C (Exercises) consisting of 15 subjects each.

Procedure
All examination was carried out by a physical therapist and manual therapist. Demographic data, including age, sex, employment status, and sports and leisure activities, were recorded at baseline. A history was taken concerning the duration of complaints (months), previous treatments (injections, physical therapy, etc.), and current pain medication. Concomitant diseases and the use of medications were registered.

Subjects in Group A were treated using Muscle Energy Techniques for the type of Dysfunction the subject was diagnosed for. Group B was treated with Maitland’s concept of mobilization for the particular diagnosed sacroiliac joint dysfunction. Group C, the Control group was given exercises designed to gently move the sacroiliac joint. The same set of exercises are performed for ‘group A’ and ‘group B’ post applying the techniques respectively assigned for that group i.e. Muscle energy technique and G.D.Maitland’s mobilization techniques.

The above treatment protocol was given for a total of 6 sittings. The readings of all dependent variables were recorded at the base line and after the 6th sitting.

Active ROM and passive ROM were measured with a conventional Goniometer for flexion, abduction, adduction, internal rotations, external rotations for hip joint and spinal range of motion were taken using a measuring tape for flexion, extension, and side flexion.

Disability was measured by means of ‘Oswestry disability index’. The ODI is a self administered questionnaire including, pain intensity, personal care, lifting, walking, sitting, standing, sleeping, sex life (if applicable), and social life.

Pain was measured using the ‘Thermometer Pain rating Scale’.

Statistical analysis
To assess changes within each group after the intervention period and between groups, the raw data were used and analyzed with the student’s-test and One Way Analysis of Variance (ANOVA). For statistical analysis, the
Results

The descriptive statistics of the visual analogue thermometer of the three groups, the mean of the Experimental Group (1) =3.53, Experimental Group (2)=3.73, Control Group(3)=3.53, at the baseline.

Post 6 sittings the mean of all three groups are 0.20, 0.33, and 3.67 respectively.

The mean of the Oswestry disability index within the three groups at the base line are as following; Experimental group (1): 0.29; Experimental group (2): 0.27; Control group (3): 0.28

The mean changes after the 6 sittings are: 0.02, 0.06, and 0.23 respectively.

Table 1, one way ANOVA of Hip Flexion ROM (HFROM), Hip Medial Rotation ROM (HMRROM), Hip Lateral Rotation ROM (HLRROM) within three groups describes the level of significant changes in Hip Flexion ROM with base line value of 0.712 which is comparable to significant change with significance value of 0.00 post 6 sitting, which is highly significant.

Similarly, for Hip Medial Rotation ROM, baseline value 0.83 which is comparable and significant change post 6 sittings with significance value of 0.00.

For Hip Lateral Rotation ROM, baseline value of 0.02 which is significant at baseline itself and value of high significance of 0.00 post 6 sittings.

Discussions

Sacroiliac joint has been known as an under appreciated pain generator. Therefore SI joint itself and the specific diagnosis of SI joint dysfunction are both under appreciated causes of pain in low back, pelvis and the proximal lower extremities.

Lately SI joint has been considered as a significant source of pain in patients with chronic low back pain. Over the years the sacroiliac joint dysfunction have been ignored, forgotten and missed.

Mechanical dysfunction can be caused by one or more of the following: acute strain, motion restriction, muscle, imbalance, compensatory strain, hyper mobility, or positional faults.

Dysfunction at the sacroiliac joint is common in females. They have a smaller joint surface and a gentle topography within the joint. The hormone relaxin influences this joint by relaxing the ligaments on a monthly basis and by relaxing and allowing the ligaments to stretch prior to the child birth. It is interesting to note that relaxin continues to be released in the system as long as the mother is breast feeding. Females have the strains of child birth, habitual unilateral standing, and also intercourse strains.

The basic response of body to trauma is inflammation which causes nociceptors to fire and this bombards the cord with arrant stimulus resulting in an efferent response of increased muscle tension.

The mean significant decrease in the pain intensity in experimental Group (1) and experimental Group (2) shows the efficacy of the manual therapy techniques i.e. Muscle energy technique and G.D.Mailtland’s concept of mobilization, in treating sacroiliac joint dysfunction caused due to mechanical causes.

The Oswestry disability index readings were found to be highly significant of both the experimental groups compared to the control group, while moderate significance was found between experimental Group (1) over experimental Group (2), hence proving efficacy of muscle
energy technique over G.D.Maitland’s concept of mobilization in improving functional ability.

Solonen\textsuperscript{11} noted that the sacroiliac joint is normally in a state of stable equilibrium and that much force is required to disturb this equilibrium. He further pointed out that the strongest muscle in the body surround the sacroiliac joint but that none have the primary function of moving it. Thus, he concluded, there are no voluntary movements do occur are weight changes and postural influences. Such movements are referred to by some as joint play motion\textsuperscript{12,13} or accessory joint motions\textsuperscript{14}.

Some authorities\textsuperscript{14,15,16} believe that the following muscles or muscle group can impart forces on the sacroiliac joint, either through their primary actions or by their reverse actions, depending on the points of fixation: the iliopsoas, rectus femoris, hip abductors, and adductors, sartorius, external rotators and piriformis, gluteus maximus, hamstrings, abdominals, quadrates lumborum, and multifidus.

Agreeing similarly with the above studies the muscle energy technique proved to be moderately significant over G.D.Maitland’s concept of mobilization.

While comparing the “hip range of motion” i.e. hip flexion range of motion, hip medial rotation range of motion, hip lateral rotation range of motion, the improvement was highly significant in the experimental groups compared to the control group, while comparing both the experimental group, there was moderate significant change in the values of ‘medial rotation range of motion’ in the experimental Group (1) treated by muscle energy technique to experimental Group (2) treated by G.D.Maitland’s concept of mobilization.

Michael Cibulka\textsuperscript{15} in 1998 found that there is unilateral hip rotation range of motion asymmetry in patients with sacroiliac joint regional pain. It was evident in the base line values in the study too, where a significant loss of range of motion in medial rotation and lateral rotation was found.

According to Diane Lee excessive compression of the joints of the pelvis can be caused due to inappropriate muscle forces. The specific muscles that are weak must be strengthened; those which are tight must be lengthened\textsuperscript{17}.

Further studies on the effect of newer manual therapy techniques such as MET (Muscle Energy Technique), Myofascial Release, mobilization techniques on chronic low back pain due to sacroiliac joint dysfunction and their comparison with conventional physiotherapy is required. Since this study was done on a very small population more number of subjects can also be incorporated. The effects of the techniques can be analyzed on more objective variables such as electromyography changes. Also, treatment with more follow up may be necessary to comment on the functional outcome and to establish that the improvement was a permanent one. Researches on the optimal dosage of these manual therapy techniques can also be done. In addition, further studies can be done which address the duration of pain relief associated with the control, of contributing factors. These areas could form the basis of future research project.

**Relevance to clinical practice**

Chronic low back pain constitutes the largest group of chronic medical problems in clinical practice, and sacroiliac joint dysfunction is among the most overlooked causes of chronic low back pain and disability. This study resulted in benefits of manual therapy techniques such as, Muscle Energy Technique, G.D.Maitland’s concept of mobilization in improving the pain and functional ability and increasing the hip range of motion’s, in chronic low back pain caused due sacroiliac joint dysfunction so that the most effective treatment plan can be extracted from this study.

**References**

Activity, participation and quality of life after stroke: A 6-month follow-up of community-dwelling Nigerian stroke survivors

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Abstract

Background

Stroke outcomes are best understood through follow-up assessments of the survivors, yet limited longitudinal data exist on stroke survivors in Nigeria.

Aims

This study therefore assessed the trend of activity, participation and quality of life (QoL) of Nigerian stroke survivors over a period of 6 months post-onset and the relationship among the 3 constructs were explored at the 1st and 6th months post stroke onset.

Methods

Consecutive stroke survivors were recruited from a tertiary hospital in Nigeria. Activity, participation and QoL of participants were assessed monthly with the Modified Rankin Scale (mRS), London Handicap Scale (LHS) and World Health Organization’s WHOQoL-BREF questionnaire respectively monthly for 6 months after stroke onset. Friedman’s ANOVA was used to explore the trend of each variable across the study period, while their relationship was computed with the Spearman’s correlation coefficient.

Results

Nine males and 7 females completed the study (mean age; 60.68 ± 9.76). Activity and participation of stroke survivors improved progressively over the study period while quality of life displayed an inconsistent pattern of improvements and deteriorations across six months post stroke onset. Activity and participation were also found to correlate poorly with quality of life over the study period.

Conclusion

It may be important to consider other factors that may positively influence the QoL of stroke survivors since improved activity and participation did not result in improved QoL in this group of people.

Key words

Stroke survivors; activity, participation; quality of life; Africans

Introdution

Individuals who survive a stroke often have impairments that impede independent performance of the basic activities of daily life. It is in view of this that the quantification of stroke outcome should include information on functional status of the victims which broadly covers their ability to perform activities of daily living and participate in societal activities.

The World Health Organization (WHO) described activity as the execution of a task or action by an individual while participation refers to an individual’s involvement in life situations. These two constructs are defined in the context of learning and applying knowledge; general tasks and demands; communication; mobility; self-care; domestic life; interpersonal interactions and relationship; major life areas; community, social and civic life. Over the years, the impact of stroke has been under-estimated by clinicians and researchers who merely used measures of activity thus causing non-availability of information necessary to characterize the well-being of stroke survivors in terms of participation and quality of life. Quality of life (QoL) is an important outcome which may facilitate a broader description of stroke recovery.

A number of studies have been carried out on activity, participation and QoL of stroke survivors. Hartman-Maier et al reported that community-dwelling stroke survivors demonstrated long-standing dissatisfaction one-year post onset, and this was found to correlate with activity limitation and restricted participation. Quality of Life of stroke survivors was observed to deteriorate over a period of time post stroke, with such deterioration occurring in spite of stable functional ability. In a study where the effect of reduction of lower limb spasticity on activity, participation and QoL in hemiparetic stroke survivors was investigated, activity (walking) was found to improve while participation and QoL remained unchanged. Deficits in general physical functioning, participation and QoL were observed by Lai et al among stroke survivors who were considered to have improved activity. Deterioration in physical functioning and QoL of stroke survivors at 3rd, 6th and 12th month post stroke was also reported by Suenkeler et al. Reports of studies exploring the interrelationships of activity, participation and QoL among African stroke survivors are however not available.

Aims

The aims of this study were: (a) to assess the patterns of activity, participation and quality of life among community-dwelling Nigerian-African stroke survivors over a 6-month period;
(b) evaluate the relationships among the 3 constructs (activity, participation and quality of life) at the 1st and 6th month post stroke onset.

Methods

Participants
Twenty consecutive male and female patients who had suffered a stroke for not more than 4 weeks as at the time of this study and receiving health care at the University College Hospital (UCH), a tertiary health facility in Ibadan, Nigeria took part in this study. They were those with first incidence unilateral stroke and who did not have cognitive impairment assessed using Mini Mental State Examination and co-morbidities affecting functioning, and who granted informed consent to participate in the study. They also met the criterion of being those residing within Ibadan, an urban community in South-Western Nigeria. This was to ensure easy follow-up by the researchers.

Procedure
Ethics of the study was approved by the Joint Institutional Review Committee of the University of Ibadan/University College Hospital, Nigeria. The protocol for the study was explained to all consenting patients. The age, gender, stroke laterality, type of stroke and residential addresses (for the purpose of follow-up) were documented as clinical and demographic information. Activity, Participation and Quality of Life were assessed using the Modified Rankin Scale (mRS), the London Handicap Scale (LHS) and the World Health Organization’s Quality of Life BREF questionnaire (WHOQoL-BREF) respectively at baseline (within 4 weeks of stroke onset) and monthly for 6 months post stroke onset. Follow-up monthly evaluation took place at each patient’s place of abode, and all measurements were carried out by the same assessor.

The Modified Rankin Scale (mRS) was used to measure the overall functional independence of the patients. It is a scale that allows comparison between patients with different kinds of neurologic deficits which adds a further dimension by referring to previous activities. It contains 7 items, graded 0 to 6, with a score of 6 indicating patient is dead and lower scores reflect better functioning.10 The mRS is an interviewer administered scale which is widely used in clinical trials; it possesses good inter- and intra-rater reliability and is a good scale for differentiating between changes in mild to moderate disability.11 The London Handicap Scale (LHS) has six items on dimensions of handicap (participation restriction): mobility, physical independence, occupation, social integration and economic self-sufficiency. There are six response options for each item. Respondents completed the questionnaire by selecting one option per item indicating their perceived level of handicap (on a 6-point scale from “none” to “extreme”). The LHS scoring could be by un-weighted simple summation of scores or use of weighted scoring.12,13. The un-weighted scoring system was used in this study to calculate the total handicap score with obtainable values ranging from 0 (maximum disadvantage) to 100 (no disadvantage). This simple summation procedure has a construct validity of 0.81 reported to be similar to that of the traditional weighted scoring.13 For the LHS, a higher score indicates higher level of functioning and it is self-administered, acceptable and easy to understand by patients.14

Quality of life was assessed using the WHOQoL-BREF. This is a self-reported 26- item scale rated on a 5-point Likert -response scale. The first 2 items are labeled as over-all Quality of Life and over-all health while the remaining 24 items are grouped into 4 domains namely Physical health, Psychological health, Social relationship, and Environment.14 In cases where participants are unable to write due to disability, the scale could be interviewer-assisted.

Data analyses
Clinical and socio-demographic data were summarized with descriptive statistics of mean, standard deviation and percentages. The pattern of activity, participation and QoL of stroke survivors were analyzed with Friedman’s ANOVA to test the null hypothesis that there would be no significant change in these constructs across the 6-month period. Where significant difference was observed, the Wilcoxon’s Signed Rank test was computed to identify the pair that was significantly different. Relationships among the mRS, LHS and WHOQoL-BREF scores were analyzed with the Spearman’s Correlation Coefficient and the alpha level was set at 0.05. Statistical analysis was performed using the SPSS version 13.0 for Windows.

Results
Twenty stroke survivors consented to take part in the study over the 9 month recruitment period out of which 16 (60.68 ± 9.76 years) completed the 6 months follow-up. For the 4 individuals who did not complete the study; one each died, developed cognitive deficits; refused further involvement in the study, while one changed his place of abode and could not be located for follow-up. The mean age of the 16 (9 males and 7 females) people that completed the 6 months follow-up was 60.68 ± 9.76 years.

Based on the statistical analysis carried out, the Friedman’s ANOVA of 39.38 (p= 0.00) and 41.87 (p= 0.00) indicate significant differences in the mean rank of each of the mRS, and LHS scores respectively across the six-month study period. Further analysis of multiple comparisons between pairs of the means across six months showed that there was significant difference in mRS between each pair of months (p< 0.05) except between the 2nd and 3rd, and between the 4th and 5th month. For the LHS significant difference was observed between LHS scores for each pair of months except between 4th and 5th; 4th and 6th and between 5th and 6th .time frames. For the QoL scores, significant change in score was observed only in the overall health item of the WHOQoL-BREF while the scores of the overall quality of life item and the remaining 4 domain did not change significantly over the six-month study period (Table 1).

Results of correlation analysis showed statistically significant correlation at baseline (1st month post stroke) between activity (mRS) and participation (LHS); and between activity (mRS) and each of psychological health and environment domains of the WHOQoL-BREF and between participation (LHS) and environment domain of the WHOQoL-BREF. At the 6th month post-stroke, there was no significant correlation among the 3 constructs except between participation (LHS) and physical health domain of the WHOQoL-BREF.
Table 1: Analysis of Trend of Quality of Life across Six Months.

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<tr>
<td>Domain 4 (Environment)</td>
<td>2.92</td>
<td>3.04</td>
<td>3.08</td>
<td>4.38</td>
<td>3.79</td>
<td>3.79</td>
<td>6.69</td>
</tr>
<tr>
<td>0.24</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Key:
MH: Month.
WHOQoL Items and Domains: The 2 items and 4 domains of the WHOQoL-BREF Questionnaire.
* - Significant at p< 0.05
X2-Friedman's Analysis of Variance

Discussion

Activity, participation and Quality of Life are important outcomes used to track recovery after a stroke. The peculiarities of these constructs to characteristics of stroke victims such as race and place of residence suggest a need to investigate their pattern among stroke survivors in different communities. It is however challenging to carry out a longitudinal study in Ibadan, Nigeria due to many limitations including difficulties in locating patients for follow-up after discharge from hospital. This is as a result of poor house identification system and reluctance of patients to have their routine distorted at home by researchers. However this study assessed how activity, participation and QoL changes, if at all over a 6 month period among community-dwelling Nigerian-African stroke survivors living in Ibadan, an urban settlement in South-Western Nigeria. Gender distribution in this study showed a preponderance of males, a pattern that is similar to that reported in previous prospective studies7,9,15.

Activity pattern of the stroke survivors showed a progressive improvement throughout the 6 months period. This result is comparable to the outcome of a longitudinal study which compared functional recovery of stroke survivors in four different European rehabilitation centres where a consistent pattern of improvement of activity in the first 6 months following stroke was recorded16. Although assessment of a stroke survivor’s activity often provides information on tasks and actions executed by the individual3, such assessment does not specifically test recovery from hemiplegia. Therefore, improvement in activity performance could be attributed to behavioural compensation strategies such as performance of self care with one hand (unaffected arm) and might not specifically reflect the performance of the side of the body affected by stroke16. Nevertheless, activity is considered a more important outcome of stroke and stroke survivors have been reported to place more relevance on their activity performance than on motor function status post-stroke11.

Table 2: Relationship among Activity (mRS), Participation (LHS) and Quality of Life (WHOQoL-BREF) at the 1st and 6th month Post Stroke using Spearman Rank Order Correlation (n=16).

<table>
<thead>
<tr>
<th>Variables</th>
<th>WHOQoL-BREF Items</th>
<th>WHOQoL-BREF Domains</th>
</tr>
</thead>
<tbody>
<tr>
<td>mRS</td>
<td>LHS</td>
<td>Q1</td>
</tr>
<tr>
<td>1st Mth</td>
<td>0.77*</td>
<td>0.19</td>
</tr>
<tr>
<td>6th Mth</td>
<td>0.06</td>
<td>0.11</td>
</tr>
<tr>
<td>LHS</td>
<td>0.68*</td>
<td>0.08</td>
</tr>
<tr>
<td>6th Mth</td>
<td>0.10</td>
<td>0.58*</td>
</tr>
</tbody>
</table>

*Significant at p< 0.05
mRS: Modified Rankin Scale
LHS: London Handicap Scale
Q1 - Item on overall Quality of Life
Q2 - Item on overall health
WHOQoL-BREF Domains
1 - Physical Health
2 - Psychological Health
3 - Social Relationship
4 - Environment
WHOQoL-BREF- WHO Quality of Life Abbreviated Version
Mth: Month
The findings of this study showed improvement in the over-all participation level of the stroke survivors over a 6-month period. Post Hoc analysis revealed that the statistically significant improvement observed occurred during the first 4 months post stroke. The non-significant difference in participation from the 4th to 6th month suggests a plateau in recovery of this ability or stagnancy in adjustment to the community life after stroke among the survivors. Participation has been reported to deteriorate with advancing age and considering the mean age of the stroke survivors who took part in this study (mean age 60.68 ± 9.76 years), deterioration of participation following a stroke may be expected. The findings of this present study as regards participation however, is comparable with the report of Desrosiers et al which indicated a significant increase in participation of stroke survivors in the first 3 months after hospital discharge.

Many investigators have studied Quality of Life (QoL) of stroke survivors across different time frames and have reported varying findings. In this present study, looking at the values obtained for the WHOQoL-BREF, the QoL domains of Physical health, Psychological health, Social relationship and Environmental domains and items on overall quality of life and overall health varied over time and showed alternate deteriorations and improvements across the six months study period. This implies that there was no consistency in the trend of QoL across the study period. However, the overall health item showed a statistically significant improvement across six months. This finding is similar to that of a study of stroke survivors exposed to optimal care in stroke units which were characterized by early treatment and rehabilitation and yet the results showed no improvement in QoL.

It is noteworthy that while activity and participation improved among stroke survivors in this present study, the improvement did not result in corresponding improvement in QoL. In a study where stroke survivors experienced good recovery in activities of daily living, social activities, and return to work, Carod-Artal et al reported that significant deleterious effects persisted in the QoL of these patients because they did not achieve the level of function they enjoyed before the stroke. A follow-up study at the 3rd, 6th, and 12th month post stroke onset also reported a deterioration of QoL of stroke survivors while Sturm et al reported that stroke patients experienced substantially poor QoL 2 years after stroke. Conversely, a study reported improvement in some domains of QoL post-stroke in which such recovery trends were attributed to adaptation of the stroke survivors to their new life situation. These divergent reports may in literature be due to the different time points of assessment of QoL by the various researchers.

Findings of this study showed that while a non-statistically significance correlation existed among the 3 constructs except between participation (LHS) and over-all health item of the WHOQoL-BREF at the 6th month post stroke, a positive correlation between activity and participation only at the 1st month post stroke onset. This contrasts with the report of an earlier study which showed a strong correlation between activity and participation at 6th month post stroke. Significant correlations between activity and each of the Psychological Health and the Environment domains of WHOQoL-BREF were observed at the 1st month only while a significant correlation was observed between participation and the overall Quality of life item at the 6th month post stroke onset. A trend similar to the findings of de Haan et al who reported handicap (participation restriction) as being the closest determinant of stroke survivors’ Quality of Life when compared to impairment and disability.

From the findings of this study, it could be inferred that improved functioning in terms of activity and participation did not result in improved Quality of Life of stroke survivors. This is a pointer that among community-dwelling Nigerian African stroke survivors, factors other than activity and participation are probably influencing their quality of life.

Although all the stroke survivors who took part in his study satisfied the eligibility criteria for the study and thus were similar in characteristics at the point of enrolment, the fact that the type of medical and rehabilitation (e.g. physiotherapy) services received by these patients while the study lasted were not standardized could have significantly affected the findings of the study. This is an important limitation of the study, aside the relatively small sample. The strength of the study however includes the fact that we could not find evidence in literature of any longitudinal study involving stroke victims receiving physiotherapy in Nigeria.

References

Effect of strength training using one’s own body weight in sarcopenia-a single blind study

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Abstract

Background and Purpose: Sarcopenia is partly reversible with appropriate exercise interventions. Most of the exercise interventions have focused only on Strength training using external resistance prescribing the intensity of exercise based on 1 RM (Repitition Maximum). In this procedure too, there may arise a risk of aggravating a pre-existing health condition while basing the intensity of exercise on 1 RM and adverse effects of 1 RM testing on elderly people have been well documented which includes exacerbation of osteoarthritis, minor strains, tendonitis, and inguinal hernia. So, the purpose the study is to find out the effectiveness and safety of strength training using one’s own body weight on sarcopenia.

Methodology

Thirty six healthy older adults were recruited and randomly assigned to either one’s own body weight training group or non training group. Subjects trained thrice per week for twelve weeks using one’s own body weight.

Results

Parametric’t’ test was used to analyze the effect of exercise on muscle strength, lower body strength & gait speed. In training group, the post test mean value of all the variables were improved than the pretest mean value at p<0.05 than the control group.

Conclusion

The results demonstrate that the training group showed a significant improvement in muscle strength of quadriceps and calf strength, lower body strength and gait speed. Thus, suggesting that this exercise protocol is effective and easy to implement to reverse the sarcopenia.

Key words

Sarcopenia, strength training using one’s own body weight

Introduction

Sarcopenia is defined as age related loss of muscle mass, strength, and function1, 2. This condition appears to begin in the fourth decade of life; adult loses 3% to 5% of muscle mass per decade3, rate of decline that increases to 1% to 2% per year after age 50 years4. Although there is no specific level of lean body mass or muscle mass to indicate presence of sarcopenia5, any loss of muscle mass is of importance because there is a strong relationship between muscle mass and strength6.

Sarcopenia causes less force production, less precise control of movements and slowing of muscle mechanics7,8. Although this strategy is found to be effective in retarding the progress of sarcopenia, the adverse effects of Testosterone, Growth Hormone, Estrogen, Strength training and adequate nutrition9. Although this strategy is found to be effective in retarding the progress of sarcopenia, the adverse effects of Testosterone, Growth Hormone & oestrogen therapy are worrisome and deserve some serious considerations; the adverse effects of testosterone comprise of fluid retention, gynaecomastia, worsening of sleep aponea, polycythemia and acceleration of benign or malignant prostatic tumour and those of Growth hormone comprise of carpal tunnel syndrome, fluid retention, arthralgia, orthostatic hypotension and lower body oedema10. In view of these reports, exclusive schedule of Resistance training remains the most effective and highly safer intervention for increasing muscle mass and strength in older people10, 11.

Sarcopenia is partly reversible with appropriate exercise interventions11. Exercise interventions are not only useful to prevent the scaropenia but also to reverse the sarcopenia12. Most of the exercise interventions have focused only on Strength training using external resistance prescribing the intensity of exercise based on 1 RM (Repitition Maximum). In this procedure too, there may arise a risk of aggravating a pre-existing health condition while basing the intensity of exercise on 1 RM12. Recently, it was found that the adverse effects of 1 RM testing on elderly people have been well documented which includes exacerbation of osteoarthritis, minor strains, tendonitis, and inguinal hernia13.

It is to be notified that strength training using external resistance is expensive and requires a lot of direct technical assessment and supervision and lack of these facilities might prove to be a deterrent, in applying it to a rural population. On the other hand, strength training using one’s own body weight is inexpensive and easily practicable and can be done in any setting when compared to strength training using external resistance. It has been found that strength training using one’s own body weight is effective to improve Calf muscle strength among elderly women with osteoporosis.

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by using BIODEX 2 isokinetic dynamometer\(^4\).

The objective of the present study is to investigate the efficacy and safety of the procedure of strength training using one’s own body weight in retarding the progressive sarcopenia in elderly people. If the training group is found effective, this procedure can be advocated as an inexpensive and easily practicable procedure to the aging population in rural areas which forms a significant segment of population in developing countries like India. Thus, this study is based on premise that this procedure shall prolong the active life of the elderly by improving their health status which may eventually prove to be of great public health relevance and contribute to the economic progress of developing country.

Methodology

Study Design

This study was a controlled trial in which participants were randomly allocated either to training or to a non-training group and was conducted in old age home for a period of 12 weeks.

Study Population

Seventy seven subjects were interested to participate in the study and undergone a thorough assessment by geriatrician to rule out the contraindications to exercise, forty four subjects were fit to participate in the exercise program. Inclusion criteria were: Both sexes, Age of the individual from 70 to 80, Subjects who are independent in activities of daily living and not affected by neurological disease and heart problems, gait speed less than 1m per second. Exclusion Criteria were; Depression, dementia and delirium, Pain in the lower limb joints and low back at the time of study and Cachexia. Each participant were explained and agreed to participate and study was approved by Meenakshi University Human Ethics Committee.

Testing procedure

Testing of all outcome measures were conducted before participate in exercise program and after 12 weeks of exercise program by a two physiotherapist. They were trained to measure the lower body strength, muscle strength of quadriceps and calf muscle and gait speed and blinded about the study.

Isometric Knee Extensors Strength (IKES) and plantar flexors strength

The modified sphygmomanometer was used to measure the IKES. It consists of a sphygmomanometer folded bladder inside a sewn bag as described by Helewa et al. The sphygmomanometer was inflated to a baseline reading on the aneroid scale (20 mmHg) and the tester placed the sewn bag on the subjects leg and stabilized until the reading shows 40 mmHg in aneroid scale to minimize the reading variation among the subjects during stabilization and taken as a baseline value. The subject was asked to attempt to induce movement by exerting force against the tester. A “break” in movement or a tremor indicated maximal isometric contraction. Strength was recorded three times and average of three measures was taken as muscle strength.

Lower body strength

Participants were instructed to sit in an adult chair and fold their arms across the chest. Participants were asked to do sit to stand as fast as possible for a period of 30 sec and stop watch was used to measure a 30 seconds. The subjects had done a three times sit to stand at an interval of 2 minutes and highest value was taken as lower body strength. The 30 sec chair stand test provides a reasonably reliable and valid indicator of lower body strength in older adults\(^15\).

Gait speed

The subjects were asked to walk at a normal pace and fast pace as fast as possible across an eight meter. The pace timed from two to eight meter was taken as gait speed in order to exclude the speed variation during acceleration and measured using stop watch. Gait speed has been shown to be a reliable and valid measure of monitor mobility and to screen for falls in older adults\(^16,17,18\).

Training Intervention

Training group subjects were received a strength training using one’s own body weight for a period of three months. Control group subjects didn’t receive exercise training. The training group subjects had undergone a progressive strengthening exercise to strength the quadriceps and calf muscles i.e., intensity of body weight passed through the lower limb is gradually increased which was presented in a tabular column.

<table>
<thead>
<tr>
<th>Quadriceps &amp; Calf Strengthening Exercise</th>
<th>Period of exercise</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Basic chair squat,</td>
<td>1-4 weeks.</td>
</tr>
<tr>
<td>• Heel rising with holding the chair</td>
<td></td>
</tr>
<tr>
<td>• Half Squatting</td>
<td></td>
</tr>
<tr>
<td>• Heel rising without holding chair</td>
<td>5-8 weeks.</td>
</tr>
<tr>
<td>• Static Lunges.</td>
<td></td>
</tr>
<tr>
<td>• Single leg standing, the heel will rise from the ground by holding the chair(^15)</td>
<td>9-12 weeks.</td>
</tr>
</tbody>
</table>

The subjects were trained 3 times per week, 4 sets per day\(^19\), 8-12 repetition per set\(^19\) and 1-2 minute rest was given between each set\(^19\). The subjects in the control group were instructed to maintain the usual activities of daily living. Questioner was used to document the adverse effect of strength training during the course of training and after twelve weeks of training.

Have you ever suffered knee and ankle pain during the period of exercise?

All the participants reported that no pain in lower limb joints during the period of exercise.

Statistical analyzes

All the statistical analysis was performed using SPS soft ware package, values were presented as means± standard deviation, student t test were used to analyze the effect of strength training using one’s own body weight an outcome variables. Statistical significance was accepted at p<0.05.

Results

Of the 44 subjects initially participated into the study, 8 subjects failed to complete the study and the data analyses done for 36 subjects. Mean value and standard deviation of variables before and after treatment was shown in table 1.
The comparison of these values reveals that the training showed an improvement in muscle strength, lower body strength & gait speed than the control group.

### Discussion

This study evaluated the effect of strength training using one's own body weight on sarcopenia. The statistical analyze found that the significant improvement obtained in the muscle strength, lower body strength and gait speed in training group than the control group and the participants in control group showed a little reduction in their performance.

The results showed that the rate of decline in muscle strength and functional strength and the accompanying loss of functional mobility can be reduced or reversed by exercise training.

The improvement obtained in this study might be because of increased production of strength probably occurs as a result of training the neural adaptations. It has been reported that these neural adaptations are primary source of gains in produced force observed over the first 8 weeks of training, whereas increase in muscle cross sectional area are produced force observed over the first 8 weeks of training, whereas increase in muscle cross sectional area are believed to be the primary source of gain observed thereafter.

The quadriceps and calf has been chosen to strengthen since this muscles plays a major role in getting from the chair and walking and also to progress the intensity of exercise might not be possible for the other muscles of the lower limb. In this study, the muscle mass was not included as an outcome measure because of lack of availability of muscle mass measuring instruments.

The position used to measure the strength of quadriceps and calf muscle as described by William Andrew et al (1996), while stabilizing the cuff of modified sphygmomanometer on a testing part, there was a rise in reading in aneroid scale while stabilizing the cuff of modified sphygmomanometer on a testing part, there was a rise in reading in aneroid scale and it was stabilized till the reading shows 40mmHg and taken as a baseline value for muscle strength measurement.

During the course of the study, there was a drop out of 8 subjects (4 in training and 4 in non-training group). In training group, the 3 subjects had relocated to other old age homes and 1 subject had a neck of femur fracture. In non-training group, the 2 subjects had neck of femur fracture due to fall on a slippery surface and 2 subjects had relocated to their native place.

The limitations of the study are small sample size and muscle mass not included as an outcome measure. This study suggest that muscle mass can be included as an outcome measure and may be done with large sample size in the future studies.

### Conclusion

The results demonstrate that the strength training using one’s own body weight is effective and safe to retard the progress of sarcopenia and this study suggest that the exercise using one’s own body weight can be used as an alternative for using external weights or equipment to reverse sarcopenia.

### References


Physiotherapy assessment findings may not correlate with MRI findings in neurologically impaired patient – A case report

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Abstract

Clinical Decision making makes an important part of neuro rehabilitation and requires cognitive and Meta cognitive skills of the therapist. Most of the time investigations may not correlate with the clinical findings. Appropriate selection of outcome measures also mandatory in designing the rehabilitation protocol.

Background

Physiotherapy assessment based on the sound clinical reasoning forms the central pillar of successful outcome of any neuro rehabilitation. In the recent past various approaches of clinical reasoning in neuro rehabilitation has been explained. Patient centered clinical decision making explained by Schenkman et al1 is found be useful in finding out the impairments, Activity limitations and participatory restrictions. Investigations used in the diagnosis of neurological deficits are accepted through the world. Magnetic resonance image (MRI), has been considered as one of the gold standard procedure. It has been recommended by the authorities that the findings of the investigations should be correlated with the clinical presentation. This case study explains the importance of clinical examination in a neurologically impaired patients and the lack correlation between the assessment findings and MRI.

Case description

45 year old female patient referred to physiotherapy with the chief complaints of inability to walk, loss of balance and difficulty to do daily activities since 3 days. Patient was apparently normal, when she experienced the sudden onset of giddiness while washing clothes, which forced her to sit down on the floor. On attempt to get up, she was unable to do so and called out for help. She was immediately taken to a local physician who referred her to a super specialty hospital, the MRI that followed the admission revealed a local physician who referred her to a super specialty hospital, the MRI that followed the admission revealed a normal study of the brain.

Past history

She had a First episode at the age of fifteen when she was doing work; suddenly she felt weak and had an episode of giddiness Second episode was at the age of 22, when she was pregnant at eighth month (patient was not a known case of hypertension) of pregnancy, felt giddy and had a fall due to which she was taken for emergency labor. Patient had a normal delivery and was uneventful. Since then she was leading a normal healthy life.

The therapist went into a detailed review of the systems. The systems were namely the cardiopulmonary, musculoskeletal, neurological and integumentary. The cardiopulmonary system review revealed stable vitals which were as follows - Vitals: - BP: 120 /80 mm Hg, RR: 20 times per minute, HR: 76 beat/ minute, Temperature: 98.6 F. musculoskeletal assessment showed no relevant findings. Integumentary system remained intact.

With the above subjective examination and systems review, therapist was directed to perform a detailed neurological examination which is as follows.

On observation the therapist found the trunk was deviated from midline towards left side during sitting and Standing with walker. Attitude of limbs were Normal.

On examination higher mental functions were assessed with mini mental score. Cranial nerve examination revealed transient diplopia and evoked horizontal nystagmus to right side with correction to the left, patient also presented with ptosis. This denoted the involvement of Brain stem. All dimensions of sensations were intact including the cortical sensations.

Motor examination commenced with tone evaluation using modified ashworth scale. Patient did not exhibit any tonal abnormalities and a detailed strength testing of the muscles revealed no strength deficits in the extremity but impaired in the trunk muscle strength. Reflexes were normal and no clonus was elicited.

Her balance and postural control2,3 was assessed using berg balance scale and the following problems were identified.

Static in sitting – patient is in left aligned with increased tendency to fall to left side but able to maintain the static balance. Patient exhibited delayed / slower protective reaction on left side compared to right side.

Standing able to maintain static balance but without consistency. Unable to take any form of challenge patient definitely requires assistance.

Co ordination was assessed using equilibrium and non equilibrium tests which revealed the patient with severe ataxia and was unable to stand without manual support.

As part of the evaluation of bed mobility patient was asked the following activities:
Rolling to right side was better when compared to the left side.

Supine to sit and sit to supine is independent.

Sitting to standing – moderate assistance with high guarding.

Transfer – maximal guarding and assistance required.

Impairment in the trunk was assessed with the help of trunk impairment scale and postural assessment scale for stroke patients and trunk control test.

Gait assessment of the patient revealed that she was unable to ambulate and needed maximal assistance (two therapists), she leaned heavily on her left side and had severe ataxia of the left lower limb. In addition she also required a walker for assistance.

Functional evaluation of patients revealed that patient requires maximal assistance for all her activities except for cognitive and social functioning.

**Impairment/problem list**

- Impaired bed mobility
- Abnormal sitting posture
- Impaired dynamic balance in sitting and static and dynamic in standing
- Deficits in equilibrium
- Severe ataxia

**Activity limitation**

Dependent in all activities of daily living

When the physiotherapy assessment was correlated with the MRI, there was no abnormality.

**Discussion**

This case was primarily referred for strengthening of bilateral lower limbs, physiotherapy assessment found no weakness in the lower limbs. But patient presented with impaired bed mobility, abnormal sitting posture, impaired dynamic balance in sitting and static and dynamic in standing, deficits in equilibrium, severe ataxia. The MRI reported normal study of the brain. A structured and detailed patient oriented clinical reasoning method proved to effective in identifying the neurological impairment. Appropriate selection of outcome measures will keep the therapist in designing the rehabilitation protocol, since the components of them addresses mainly functional impairments.

Berg Balance scale was used since it has five levels of measurements including the psychometric properties and it measures the balance during functional tasks. Trunk control has been shown to be valid predictor of stroke rehabilitation.
outcome and to correlate positively with established functional and motor assessment\textsuperscript{7,8,9}. Functional independence measure is an 18 item seven level ordinal scale which we used to assess dysfunction in, progressive, reversible or fixed neurological disorders. In addition to recognizing cognitive impairment it is also a good predictor of functional level\textsuperscript{12}.

This Case study emphasizes the importance of physical therapy examination with appropriate outcome measures\textsuperscript{13} to quantify the patient’s impairments and to plan out an individualized rehabilitation program.

References

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Appendix

<table>
<thead>
<tr>
<th>Outcome measure</th>
<th>Obtained/max.score</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mini mental scale</td>
<td>26/30</td>
<td>normal limits</td>
</tr>
<tr>
<td>2. Modified ashworth scale</td>
<td>1/4</td>
<td>no tonal abnormality</td>
</tr>
<tr>
<td>3. MMT Trunk flexors</td>
<td>2/5</td>
<td>able to lift scapula of the bed</td>
</tr>
<tr>
<td>Trunk extensors</td>
<td>3/5</td>
<td>able to lift sternum of the bed</td>
</tr>
<tr>
<td>4. Berg balance scale</td>
<td>10/56</td>
<td>wheelchair bound</td>
</tr>
<tr>
<td>5. Co ordination Romberg's test</td>
<td>1/4</td>
<td>Activity impossible</td>
</tr>
<tr>
<td>Tandem standing</td>
<td>1/4</td>
<td>Activity impossible</td>
</tr>
<tr>
<td>Standing in normal</td>
<td>1/4</td>
<td>Activity impossible</td>
</tr>
<tr>
<td>Posture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standing in narrow base of support</td>
<td>1/4</td>
<td>Activity impossible</td>
</tr>
<tr>
<td>6. Trunk control test</td>
<td>61/100</td>
<td>moderate impairment</td>
</tr>
<tr>
<td>7. Postural assessment for Scale for stroke patients</td>
<td>18/36</td>
<td>moderate impairment</td>
</tr>
</tbody>
</table>
Effect of a structured antenatal physiotherapy program on back pain
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Key words
Antenatal, physiotherapy, exercise, pregnancy, backpain.

Objective
To assess the effect of a structured, antenatal exercise program on low back pain during pregnancy, in primi and second gravidae.

Methods
Twenty-six low risk pregnancies with no previous or present history of back pain were identified at 20 weeks gestation and were randomly assigned into experimental and control group for 20 weeks. The experimental group received specific exercises and ergonomics. The control group received only ergonomic advice. Intensity of backpain was assessed at eight intervals during the course of pregnancy with Visual Analog Scale. Mann-Whitey test was used to assess the differences between both the groups.

Results
The specific exercise group, after intervention showed statistically and clinically significant lower pain intensity when compared to the group that received only ergonomic advice.

Conclusion
A structured antenatal exercise program begun early during pregnancy, and before the onset of backpain, can significantly reduce the intensity of pain experienced during the course of pregnancy and postpartum.

Introduction
Pregnancy is a time of increased vulnerability for the musculoskeletal system. Pre-existing dysfunctions are aggravated and new problems may be created by the changes that occur in a woman’s body during the child bearing years1. Changes in posture have often been implicated as a cause for the development of back pain. The gravid uterus places a lot of strain on the lower back. The pelvis tends to rotate about the sacrum. The sacroiliac ligament resists forward rotation and during pregnancy the tendency for rotation is increased as lumbar lordosis increases. This causes the centre of gravity to shift anteriorly causing strain on the low back and the sacroiliac joints4.

The main goal of physical therapy in this population is to restore optimal biomechanics. Lumbo-pelvic stabilization can be achieved with proper posture and enhanced muscle function. Very few studies have been done on the effectiveness of physical therapy interventions in low back pain during pregnancy and the postnatal period2. The main aim of the present study was to evaluate the effect of a structured antenatal exercise programme that would help in the reduction of pregnancy related low back pain.

Materials and methods
The study protocol was reviewed and approved by the institutional research committee of our University. Subjects were selected from the outpatient clinic of the Obstetrics and Gynecology department of the University hospital. Primi and second gravidae in the age group between 20 to 30 years, who were healthy and free of any medical complications, were included in the study. The subjects excluded for the study were women in whom congenital abnormalities in the fetus were detected in the anomaly scan, those who had preterm rupture of membranes, an incompetent cervix and any other complication determined by the obstetrician. Any subjects with pre-existing back pain were also excluded.

The procedure was explained in detail following which, a written informed consent was taken from the patients. Subjects were selected by convenience sampling and grouped into control and experimental groups by block randomization.

The subjects in the experimental group were given specific exercises and those in the control group received only ergonomic advice. A total sample size of 26 subjects were included, 14 in the study group and 12 in the control group.

The subjects were not blinded to the treatment they received. Emphasis was placed on blinding them from any expectation bias with regard to efficacy of the different treatments. All subjects were followed up routinely over a period of 20 to 22 weeks.

The treatment was started after the anomaly scan done between 18 to 22 weeks of gestation.
Subjects’ socio-demographic factors (e.g. age, height, weight, education, economic status) were taken. The main focus in the experimental group was on exercise and training. The program was based on specific exercises to improve core stability, endurance and flexibility. Exercises were done under supervision until the subjects’ demonstrated correct performance and then they were instructed to continue the same protocol at home. The subjects maintained a log. The subjects were seen at intervals when the exercises were reviewed and the subjects were encouraged to continue the exercises.

Subjects were asked to use the talk test and Borg’s rating of perceived exertion as their termination criteria for cessation of exercise. The exercise protocol is described in the appendix.

The control group received ergonomic advice alone during the 20th week of gestation. All parameters were measured for both the groups at the following time intervals:

a) Once a month till week 32 of gestation.

b) Once in two weeks from week 32 to week 36 of gestation.

c) Once in a week from week 36 until the time of delivery.

d) Post delivery after 6 weeks.

The outcome measure was back pain measured by Visual Analog Scale.

Data analysis of group differences at different points of assessment were done using the Mann-Whitney test. A two-tailed alpha error of 0.05 was taken, power of the study being 0.75. The software SPSS version 11.0 was used for all the analysis.

Results

Out of the 14 subjects in the study group, five were excluded. Of the five, one subject delivered prematurely, one was detected to have an HIV positive status at 35 plus weeks of gestation, one developed gestational diabetes, one had placenta previa in the last trimester and the other moved out of the study area. Out of the 12 subjects in the control group, one dropped out during the study. The subject demographic characteristics are as shown below in table 1.

There were no significant differences between groups in any of the outcome measures at the beginning of the trial. After the intervention and at follow up there was a statistically significant difference between the two groups in favor of the experimental group as can be seen in table 2. The women who underwent a supervised exercise program experienced significantly less low back pain clinically at all points of time during evaluation as can be seen in fig. 1. Statistically significant differences were seen at 34, 36 and 38 weeks of gestation with the experimental group reporting less pain. Clinically, decrease in pain was seen in the postpartum period in the subjects in the experimental group. However, this was not statistically significant.

| Table 1: Demographic details of the study group (n= 20). |
|--------------------------|--------------------------|--------------------------|
| **Group** | **Number of subjects** | **Age (Mean ± SD)** | **Gravida** |
| | | | Primigravida | Second gravida |
| Experimental | 9 | 26.88 ± 1.76 | 7 | 2 |
| Control | 11 | 26.27 ± 2.19 | 10 | 1 |

Table 2: Comparison of pain scores between the two groups at different intervals during the antenatal and the postnatal period.

<table>
<thead>
<tr>
<th>Time of evaluation</th>
<th>Experimental group (n=9)</th>
<th>Control group (n=11)</th>
<th>Z</th>
<th>P</th>
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<tr>
<td>Week 34</td>
<td>Median 0.00</td>
<td>3.00</td>
<td>-3.380</td>
<td>0.001</td>
</tr>
<tr>
<td>IQR</td>
<td>0-0</td>
<td>0-5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 36</td>
<td>Median 0.00</td>
<td>4.00</td>
<td>-2.536</td>
<td>0.011</td>
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<tr>
<td>IQR</td>
<td>0-0</td>
<td>0-5</td>
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<td></td>
</tr>
<tr>
<td>Week 38</td>
<td>Median 0.00</td>
<td>3.00</td>
<td>-2.290</td>
<td>0.022</td>
</tr>
<tr>
<td>IQR</td>
<td>0-2</td>
<td>0-5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 weeks postpartum</td>
<td>Median 0.00</td>
<td>2.00</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>IQR</td>
<td>0-2</td>
<td>0-4</td>
<td></td>
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</table>

Fig. 1: Pain patterns in the experimental and the control group.

Discussion

Our study was aimed at specific exercises and ergonomic advice during the antenatal period, without the use of any external aid to prevent low back pain in pregnancy. The main finding in our study was that, a treatment program having specific exercises was found to be more effective in reducing pain thus, improving the health related quality of life. The only other study to our knowledge that has evaluated the effect of exercise on the intensity of low back pain in the second trimester and the beginning of the third trimester was that done by Garshasbi and Faghih. The rationale behind the dosage of exercise was not explained in the study. Our study had a training period of 20 weeks which was in keeping with the guidelines from American College of Sports Medicine for increasing muscle strength and endurance which are considered to be important factors for improvement as well. It included general aerobic exercises, specific exercises for core strength and lower extremity flexibility, all of which contribute to reducing loads on the back, help in general fitness and ergonomics in improving proper body posture and simplifying work with work modification.

Wikmar et al evaluated three different physical therapy programs on pain and activity in pregnant women with a follow up at 3, 6 and 12 months postpartum. All groups showed beneficial results but their study found no additional value of exercises when treating pregnant women. Exercises were done twice a week and the average compliance was 16 times in the median time period of 16 weeks for intervention. Compliance was low and the training time was insufficient, which may have caused them to conclude that exercises had no greater effect than information given alone.
Compliance is a key factor for the effectiveness of any intervention program. Written logs given to the subjects in our study helped us measure the compliance and monitor the subjects which led to a positive outcome in our study. The subjects in the experimental group did, on an average 75% of the exercises three times a week either at home or in the hospital. This was considered higher than the previous study. The training period was longer and started earlier during pregnancy and may have contributed to an increase compliance and effect.

The timing of measurement of pain during pregnancy and pain location may influence results. Our study measured the pain intensity at eight intervals during pregnancy which has not been reported in any study before and hence better sensitivity to change in the pattern of pain with the effect of exercises could be detected. These findings may have been missed if other studies where pain measurement was done at one or two intervals during pregnancy and then followed at different intervals postpartum. Pain is also showed to have a decline in the last weeks of pregnancy.

The effect of antenatal exercises could be seen postnatally too in our study, when compared to the control group showing a carry over effect. Caution should be employed in interpreting this, as the follow-up period was short. Future studies investigating the long term effects should be employed to substantiate these findings. We were unable to do this due to loss of subjects to follow up beyond this time period.

Studies have investigated various therapies like acupuncture, diagonal trunk muscle exercises, water gymnastics, massage therapy, controlled progressive muscle relaxation therapy, back school programs, effect of pelvic belts all of which were said to be effective in reducing the pain intensity during pregnancy. None of the studies gave evidence in favor of a particular exercise program. Our protocol which is simple to follow and specific to the back appears to have been beneficial. Further studies are warranted before we comment on its efficacy over other established treatments.

In India, this study assumes more significance, as resources available for therapy are minimal. Most of the work involved is mainly active and physically demanding, both of which have been shown to be associated with an increased risk of low back pain and pelvic pain. Antenatal exercises are not yet a part of regular antenatal programs in India. This could either be due to lack of awareness among subjects and health professionals or due to cultural restraints of pain being considered a part of pregnancy.

The sample size in our study was small even though the duration of the study period was one and half years. Subjects agreeing for a long duration therapy when there were no symptoms of pain, cultural restraints, fear of developing complications and therapy not being a part of the antenatal program, made recruiting subjects for the study difficult. There was also reluctance on the part of health professionals for referring the subjects for antenatal programs. Future studies with a larger sample size would help in a more conclusive outcome.

Frequency

Three times a week.

Time and duration of exercise

Aerobic exercise: 20 minutes of brisk walking with 10 minutes of warm up and 10 min of cool down. The duration of the exercise was decided based on the following criteria:

- 12-14 on Borg’s rating of perceived exertion (12 to 14 “somewhat hard” which approximately equals a heart rate of 120 to 140 beats per minute)
- Talk test – At any point of time during the exercise, the subject should be comfortable and be able to carry out a conversation.

Exercise was terminated if any signs of discharge from the vagina, sudden swelling of the ankles, face or hands, persistent headache, pain and redness in the calf of one leg, excessive fatigue, palpitation, insufficient weight gain (less than 1 Kg per month during the last two trimesters) were noted.

References


Appendix

<table>
<thead>
<tr>
<th>EXERCISES</th>
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<tbody>
<tr>
<td>1. Deep breathing exercises</td>
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<tr>
<td>2. Ankle toe movements</td>
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<td>3. Kegel’s exercises</td>
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<tr>
<td>4. Leg slides</td>
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<tr>
<td>5. Stretching</td>
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<td>6. Strengthening of hip abductors</td>
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<td>7. Strengthening of hip adductors</td>
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<td>8. Strengthening of quadriceps</td>
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<tr>
<td>9. Pelvic tilts</td>
</tr>
<tr>
<td>10. Ergonomic advice</td>
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<tr>
<td>11. Brisk walking</td>
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</tbody>
</table>
The regulatory mechanism for all allied health care disciplines was being considered by the Ministry since its way back in 1995 with the setting up of Dr. S. D. Sharma Committee, which proposed to set up an Omnibus Council Act for all paramedical disciplines which was endorsed in a meeting of Health Secretaries held on the 28th May, 1995. The Act was proposed to be an umbrella Act under which there was to be a number of independent Central Professional Councils with uniform constitution for all. The proposal to constitute the Omnibus Council was delayed due to various reasons. Meanwhile, the Ministry of Social Justice and Empowerment in exercise of the powers conferred by Section 2 of the Rehabilitation Council of India Act, 1992 issued a notification dated the 13th October, 1998 including Physiotherapists under this Act. The Indian Association of Physiotherapists (IAP) took serious objection to inclusion of Physiotherapists under the Rehabilitation Council of India Act. After prolonged efforts, the Ministry of Social Justice and Empowerment rescinded the said notification through their Notification dated the 25th June, 1999. After which with all due diligence and consultations with all the stakeholders, the Centre proposed a Paramedical Council Bill, 2001 which was sent to the Department of Legal Affairs for their concurrence. Ministry of Law was of the opinion that the profession of physiotherapy should not be covered within the meaning of the term ‘paramedical’. The Indian Association of Physiotherapists had also been representing themselves and through other channels to the Ministry to be excluded from the proposed Paramedical Council.

The present Paramedical and Physiotherapy Central Councils Bill-2007 was introduced in the Lok Sabha on the 4th December, 2007 by Union Minister of Health & Family Welfare, Dr. Anbumani Ramadoss and the Speaker of Lok Sabha Sh. Somnath Chatterjee referred to the Department-related Parliamentary Standing Committee on Health and Family Welfare on the 14th December, 2007 for examination and recommendations. The main objectives of this Bill are to provide for the constitution of Central Councils of the Paramedical (Medical Laboratory Technology), Paramedical (Radiology Technology) and the Physiotherapy, the coordinated development in the education of paramedical and physiotherapy with a view to regulating and maintaining standards of such education, maintenance of Register of Paramedics and Physiotherapists and for matters connected therewith or incidental thereto. In view of the objectives behind the proposed legislation and also its impact on diverse categories of ancillary professions associated with health sector, the Committee decided to acquaint itself with all shades of opinion on the Bill. The Committee, accordingly, gave wide publicity to the Bill through a Press Release, inviting views/ suggestions from all the stakeholders and general public. An overwhelming response to the Press Release was received by the Committee (thanks to all enthusiastic Physios). A very large number of organizations/ stakeholders/ individuals/ associations/forums submitted memoranda containing their views. The Committee held extensive interactions with representatives of associations/ organizations as well as renowned experts/ professionals from physiotherapy and made the following observations & recommendations:

1. This Act may be called the Allied Health Professions Central Councils Act, 2007.
2. The physiotherapy education over the years has made significant advancements and has evolved as a distinct profession seems to be well established. This is strengthened by the considered opinion of Ministry of Law that physiotherapy profession should not be equated with the paramedical professions.
3. A definition should only describe the profession enumerating its different characteristics and not its administrative part thus; the definition given in the Delhi Council of Physiotherapy and Occupational Therapy Act, 1997; may be included with the replacement of the words ‘physiotherapeutic system of medicine’ by the word ‘therapy’ or ‘health care profession’.
4. An independent profession with entirely different course of study, mode of treatment and approach in treatment and rehabilitation of patients cannot be included under another profession, hence recommended to form Occupational Therapy Central Council as a separate body altogether.
5. A specific and categorical provision is to be made in the Bill itself that, after the term of the first Council i.e. two years expires, the next Council coming into existence will be an elected body.
6. The Chairperson and the Vice Chairperson of the next Councils shall be elected by the members of the respective Councils from amongst themselves and the person so elected and his qualifications should be directly relevant to the discipline of the concerned Council in such a way that he should be eligible to be enrolled on the register of the concerned Council.
7. The Clause 3(4) (i); (j); (k) & (l) be amended to ensure that the members of the first Councils appointed under these clauses should be from amongst the qualified professionals of eminence and after the expiry of the term of the first Council, appointments under these Clauses should be made from amongst the qualified professionals of eminence, who are enrolled on the register of the concerned Council.
8. A provision to be made in the present Bill to nominate two MPs from Lok Sabha and one M.P. from Rajya Sabha elected by the respective Houses.
9. It would not be in the larger public interest to allow a wholly nominated body to continue for five years. The Committee is of the considered view that tenure of two years should be sufficient for the first Council to lay down and frame requisite rules and regulations thus suggests that a member of the first Council shall hold office for a term of two years and thereafter the term of Member of an elected Council shall be five years.

10. The provisions to be made in the Bill, specifically indicating the powers and duties of the Executive Committees, so that there is complete clarity about the role of the Executive Committee and occasions for overlapping of powers and duties of the Executive Committee with other Committees of the Council do not arise.

11. In view of the yawning mismatch between demand and supply of health care services in the country, the Committee feels that the Central Councils could play a vital role in terms of acquainting the Government with requirements of allied health professionals in the country; as the Delhi Council for Physiotherapy and Occupational Therapy Council Act, 1997 mandates the Delhi Council to inter alia advise the Government in matters relating to the requirements of manpower in the field of physiotherapy.

12. A detailed provisions, as made in the Indian Medical Council Act, 1956 and the Delhi Council for Physiotherapy and Occupational Therapy Act, 1997 regarding establishing an institution, opening a new or higher course of study or training, increasing admission capacity in any course of study or training, procedure for submission of an application for grant of permission etc, to be made in the said act also.

13. The proposed provision in the Bill does not make any reference to a schedule (where-under all the recognized qualifications of relevant professions are to be included), very vital aspects like non-recognition of qualification in certain cases, time for seeking permission for certain existing colleges/institutions in the Bill, upgrading the skills of professionals through in service/ education/training programmes and most important the fate of the Councils/ Board in existence in few States.

We all will be happy to know that the learned committee observed & documented that, there is a lot of dissatisfaction among the allied health professionals particularly physiotherapists with regard to their pay scales as the entry into Government service after completion of four and a half years degree course in Physiotherapy is not addressed properly. The report also states that “General perception was that discriminatory treatment was being meted out to them as their pay scales did not commensurate with their status and responsibility”. Considering the fact that, the Physiotherapists plays a crucial role in the field of medicine and physical rehabilitation the Committee, therefore, strongly recommended that our legitimate interests should be taken care of and the existing pay structure may be revised according to qualifications and duration of the course Physiotherapists have to put in before entering into a Government Jobs.

Let’s pull our muscles to get the support from maximum numbers of Members of Parliament, for getting this report of the Department-related Parliamentary Standing Committee on Health and Family Welfare accepted by the Union Ministry of Health & Family Welfare and making the necessary changes in the Bill.
Effect of neurodevelopmental therapy in gross motor function of children with cerebral palsy

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*MPT Student, **Assistant Professor, Department of Paediatric Physiotherapy, PSG Hospitals, Coimbatore, ***Head and Professor, Department of Neurology, PSG Hospitals, Coimbatore

Abstract

Background: Neurodevelopmental therapy (NDT) refers to those activities that enable the child to practice the perfect skills. These types of exercises are used to improve movement and postural reactions; thereby it improves gross motor function in children with cerebral palsy. The specific objective of the study is to evaluate the effect of NDT in gross motor function of children with cerebral palsy.

Methods

This study is a one group pre test post test design. 10 children with cerebral palsy were selected and assigned in one group. Pre-test value of gross motor function was measured on first day of the NDT program. NDT was given three sessions a week, for three months. At the end of the NDT program, post-test gross motor function was measured.

Major findings

A mean improvement in gross motor function after NDT was 10.84 with SD of 6.84 and the t value of 5.012 was observed in this study. The obtained t value was significant at the level of p<0.001.

Introduction

Cerebral palsy is defined as “a disorder of movement and posture due to a defect or nonprogressive lesion of the immature brain” (Bax M C O, 1964).

“Cerebral palsy describes a group of disorders of the development of movement and posture, causing activity limitation that is attributed to non-progressive disturbances that occurred in the developing foetal or infant brain. The motor disorders of cerebral palsy are often accompanied by disturbances of sensation, cognition, communication, perception, and/or behaviour, and/or by a seizure disorder” (Martin C O Bax, 1980).

Cerebral palsy lesion is non progressive and causes variable impairment of the co-ordination of muscle action, with resulting inability of the child to maintain normal postures and perform normal movements (Martin C O Bax, 1980).

Cerebral palsy is classified clinically in terms of the part of the body involved likely monoplegia, hemiplegia, diplegia, quadriplegia and by the clinical perceptions of tone and involuntary movement like spastic, ataxic, athetoid (Robert B. Shepherd, 1995).

The heterogeneous spectrum of clinical syndromes characterized by alteration in muscle tone, deep tendon reflexes, primitive reflexes, and postural reactions (Blasco PA, 1994).

The range of gross motor skill outcomes for specific types of cerebral palsy with the gross motor function classification system (GMFCS) is a better indicator of gross motor functional impairment than the traditional categorization of cerebral palsy that specifies the number of limbs with neurologic impairment (Betty R. Vohr et al, 2005).

Among the scales available for assessing gross motor function in paediatric population, the gross motor functional measure scale is a useful and reliable instrument for assessing motor function and treatment outcome in cerebral palsy (Nordmark E, Hagglund G, Jamlo GB, 1997).

Lack of isolated or discrete movements and fine motor coordination are delayed in younger able – bodied children as well as in older children with spastic type of cerebral palsy (Sophie Levitt, 2004).

Neurodevelopmental/Bobath therapy (NDT) was developed by Dr.Karel Bobath and Mrs. Berta Bobath as a “living concept”. The NDT approach is not a set of techniques but more an understanding of the developmental process of motor control and the motor components which make up functional motor tasks. (Davis S, 1997).

Large diameter firm ball made of heavy rubber and provide mobile surface that aid in facilitating postural control and postural preparation of the child. The direction in which ball moved and the position of the child on ball can be varied to facilitate movement (Jane Styer Acevedo, 1992).

Methods

3.1 Study design

One group pre test post test design – A quasi experimental design.

A group of subjects was selected and pre tests for the gross motor function measures were taken. After that the children would undergo NDT program. After 3 months following NDT post test values for the gross motor function measures were taken. The values before and after the intervention were compared.

3.2 Study setting

The study was conducted in the Department of Pediatric rehabilitation, P.S.G.Hospitals an 810 bedded multi specialty health care system, P.S.G.Urban health centre, Ramakrishna mission vidhyalaya (IHRDC), Coimbatore among the children with cerebral palsy for experimental group.
3.3 Population and sampling
The totality or aggregate of all individuals with the specified characteristic is known as population. Sampling refers to the choosing of a sample from a population.

In this study sample children were selected from the cerebral palsy population of Department of Paediatric Physiotherapy, P.S.G.Hospitals, P.S.G.Urban health centre, Ramakrishna mission vidhyalaya (IHRDC), Coimbatore. Sampling method used is sampling free technique.

3.4 Criteria for sample selection
3.4.1 Inclusive criteria
Age 1 year to 8 years.
Spastic cerebral palsy.
Children with monoplegic, hemiplegic, diplegic, quadriplegic types of cerebral palsy.
Gross motor function measure scale system levels I, II and III.

3.4.2 Exclusive criteria
Children with contractures and deformities.
Severe mental retardation.
Uncontrolled epilepsy.

3.5 Instrument and tool for data collection
The gross motor function measure scale is a disease specific measure for child, consisting of 88 items in five domains (lying & rolling, sitting, crawling & kneeling, standing, walking running & jumping). It scores from 0 to 3 for each item. Total score is calculated by percentile of dimensional score.

3.6 Technique of data collection
In this study, the selected subjects were evaluated for gross motor function measure during the first visit. Following the first assessment the patients were administered NDT program (Annexure 5) which aims at improving gross motor function.

After 3 month follow up, assessments were taken at the end of 3 months after the first visit. The treatment duration for a child was 3 session per week into 3 months. The measures of gross motor function were compared before and after the administration of NDT program.

3.7 Technique of data analysis and interpretation
Data collected were analyzed using paired ‘t’ test to measure the changes between the pre and post test values within the group.

Data analysis and interpretation
Ten children received NDT was assessed with gross motor function measure scale before and after 3 months of treatment. The data are presented in the table and mean, standard deviation and t test were calculated.

In this study 4 female, 6 male children participated and age ranged from 1 to 8 years.

Data interpretation
Paired ‘t’ test was used to analyze the significant difference between the mean of the pre test values and mean of the post test values to determine the outcome of the NDT program given after a period of 3 months. The statistical analysis was done for the measures collected by gross motor function measure scale.

From the Table 1, Graph 1and 2 it is inferred that there was gradual improvement in the gross motor function covered by the children after the NDT program. On analyzing the pre test and the post test values by paired ‘t’ test, there is significant mean difference of 10.84 with Standard Deviation of 6.84 and the t value of 5.012 at p<0.001.

Results and discussion
The study aims to evaluate the effect of NDT program on the children with cerebral palsy. Among the 10 selected subjects 4 are female and 6 are male children.

The selected outcome measures are gross motor function measure scores. Data are collected at the baseline and 3 months after NDT program. The obtained data is analyzed by using the paired ‘t’ test.

Results shows that there is significant improvement in the gross motor function capacity as the calculated t value (5.012) for the gross motor function measure is in the table value at p<0.001.

The overall score of the gross motor function measure scale also shows similar trends of improvements. This indicates the change in gross motor function of children after NDT program.

Evidence shows that large number of cerebral palsy children experience gross motor function impairments due to the abnormal movement and postural reactions. This abnormal movement and postural pattern is referred as motor dysfunction. We also know that there are effective interventions for these abnormal movement and postural reactions.

NDT aimed at correcting the abnormality of movement and posture pattern in children with cerebral palsy is being advocated. Effect of such an intervention on health related motor functional capacity is being evaluated in the study. With the obtained results, it is evident that health related gross motor functional capacity is significantly improved.

The gross motor functional measure test is a simple yet an effective measure of gross motor functional capacity. It has been shown that even a unit in cerebral palsy gross

<table>
<thead>
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<th>S No</th>
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<tr>
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Mean=10.84 S.D=6.84 t value=5.012
motor function is clinically significant.

A significant improvement in gross motor function capacity of cerebral palsy children is evident after 3 months of NDT program in this study.

Improvements in gross motor function measures noticed in this study may be due to the reason that NDT program would have helped to reduce the disease symptoms and thereby improving the gross motor functional status in children with cerebral palsy.

5.1 Limitations
Small number of participants
Other activities in school, family and therapy schedule were not controlled.

5.2 Recommendations
Based on the outcome of the statistical analysis, it is suggested that the future studies can be modified to accommodate the following changes
To use same form of treatment for other types of cerebral palsy.
Other forms of motor function scales can be used for assessment.
EMG can be used for assessment.
Possible neural mechanism can be studied after NDT.
This study can be done for children with mental retardation also.

Summary and conclusion
Based on the analysis of data it can be interpreted that NDT produces significant improvement. In correlating with literature and statistical analysis, this study concludes that NDT has produced significant improvement in gross motor function in children with Cerebral palsy.

It is evident that such an intervention is effective and it helps in reducing disease symptoms and improves the general functional well being among these children with cerebral palsy.

In the future, further studies regarding NDT program will definitely strengthen growing body of knowledge. Therefore, from the literature available and statistical analysis of the data, it accepted and stated as, “There is significant effect of Neurodevelopmental therapy in gross motor function of children with cerebral palsy”.

References
13. Harris SR. Early intervention: does developmental therapy make Coronary Heart Disease difference Topics in Ear 4 Childhood Education. 1988; 7:20-32.


Effect of exercise on non-exercising premenopausal and postmenopausal women – A comparative study
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Abstract

Purpose: This study examined the effect of aerobic exercise on blood pressure and heart rate in premenopausal and postmenopausal women.

Methods

Sedentary women (n=32) who were 35 to 55 years of age were participated in exercise training protocol (20 minutes of moderate-intensity aerobic activity, 2 times a day for 2 weeks). Blood pressure, heart rate, weight, height, and B.M.I. were measured at baseline and after 2 weeks.

Results

Using a paired sample t-test, significant changes (p<0.05) was observed from pre- to post- training in blood pressure, and heart rate. In Premenopausal females, systolic blood pressure averaged 124.88 +/- 10.01 mmHg and decreased to 121.38 +/- 8.02 mmHg at post-training. Diastolic blood pressure averaged 82.63 +/- 6.47 mmHg and decreased to 80.75 +/- 6.20 mmHg. In Postmenopausal females, systolic blood pressure averaged 137.75 +/- 9.60 mmHg and decreased to 136.38 +/- 8.86 mmHg at post-training. Diastolic blood pressure averaged 86.13 +/- 5.91 mmHg and decreased to 85.13 +/- 5.21 mmHg. An inverse correlation was identified between age at menopause and systolic blood pressure or diastolic blood pressure and a positive correlation was found between postmenopausal period and either systolic or diastolic blood pressure. The B.M.I. of both the samples was decreased after 2 weeks of exercise. An inverse correlation was identified between B.M.I. of both the samples and the distance walked by them.

Conclusion

Two-weeks of aerobic exercise training are effective and can elicit changes in the cardiovascular variables of premenopausal and postmenopausal women. Our results suggest that aerobic exercise is an important strategy for prevention and treatment of high blood pressure. The blood pressure and heart rate were found to be reduced more in premenopausal females as compared to postmenopausal females.

Key words

Blood pressure; heart rate; body mass index; aerobic exercise; menopause.

Introduction

Menopause is a sudden event in most women’s lives as it marks the end of a woman’s natural reproductive life. Menopause normally occurs between the ages of 45-50 years (average 47 years)1-2. During the Climacteric Period, which is defined as “the stage of transition from the reproductive period to the sterile period”, the so called Climacteric disorder appears3.

The perimenopausal and early Postmenopausal period is typically characterized by falling levels of endogenous estrogen, which can give rise to symptoms that are severe and disruptive. Estrogen deficiency leads to decrease in level of high density lipoprotein (HDL) and increase in low density lipoprotein (LDL) and triglycerides. Therefore, can cause increase risk of atherosclerosis, ischaemic heart disease, myocardial infarction and hypertension. The protective effect of estrogens on cardiovascular and neuroendocrine responses to mental stress reduces in postmenopausal women4. Postmenopausal women have larger increase in heart rate and systolic blood pressure than the premenopausal women.

Moderate exercise has been known to be effective in alleviating and preventing postmenopausal osteoporosis and heart diseases5. Aerobic exercises provide cardiovascular conditioning. It strengthens the heart and lungs and improves the body’s ability to use oxygen. Overtime, aerobic exercise can help to decrease heart rate, blood pressure and improve breathing. The previous studies suggested that aerobic exercise can result in improvement in blood pressure, coronary risk factors, body composition and climacteric symptoms in postmenopausal women5-9. Therefore, the main aims of this study were to determine the changes in cardiovascular variables (Blood pressure & Heart rate) that may occur after a two-week aerobic exercise training programme in females and to compare the changes in cardiovascular variables (Blood pressure & Heart rate) in premenopausal and Postmenopausal women after a two-week aerobic exercise training programme.

Physical activity help in lowering blood pressure, cholesterol, triglycerides, BMI, skin folds & fasting insulin10. Forjaz et al has found the post exercise ambulatory blood pressure fall observed in normo-tensive and hypertensive humans depends on individual characteristics. Moreover in both normotensive & hypertensive humans post exercise ambulatory hypotension is greater in subjects with higher initial blood pressure levels11.

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Subjects and methods

It was an experimental and non-randomized controlled analysis of the effect of aerobic exercise on the blood pressure and heart rate of the premenopausal and postmenopausal women of age group 35-55 years.

Subject description

A total of thirty-two premenopausal (n=16) and postmenopausal (n=16) women between the ages of 35-55 years participated in the study. In order to qualify to participate in the study, the participants had to meet the following inclusion criteria: aged 35 to 55 years; able to understand English or Hindi, as the medium of instructions & communications; Sedentary lifestyles; ready to take physical tests, during the course of study; absence of medication that influence cardiovascular system; Non-smokers; no medication known to influence biological risk factors under study e.g. estrogen, insulin, antihypertensive and psychotropic medications; absence of all other known diseases that affect blood pressure; women who have spontaneous (natural) menopause.

The primary reasons for exclusion were current use of menopausal hormone therapy; perimenopausal women; having any habits of substance abuse such as cigarette, smoking or tobacco use in any form; having lower limb joint injuries; having any respiratory disease; with history of gynecological cancer; stage 3 of hypertension and the subject must not be previously declared unfit for any type of exercise or physical activity.

To determine their physical activity the PAR-Q Questionnaire was used.

Exercise training protocol

The Exercise Training Protocol consisted of twenty minute sessions, two times in a day for two weeks. Blood pressure, heart rate, weight and height were recorded as a pre-exercise testing. The exercise began with a 5 minutes of warm-up by walking slowly followed by 10 minutes of aerobic exercise i.e. walking at the intensity of 60-80% of their individually determined maximal heart rate and then 5 minutes of cool down by decreasing the intensity of exercise. Blood pressure, heart rate and weight were measured after a week at rest i.e. after 5 hours of exercise and then measure again after a week of exercise as a post-exercise testing.

Study measures

At baseline, data were collected on demographic information, personal history and information, past medical history, gynecological history, obstetrical history, and medication use. Weight and height were measured. The Menopause type Questionnaire was used to determine the climacteric symptoms of postmenopausal women.

Statistical analysis

The changes in cardiovascular variables from pre-aerobic exercise training protocol to post-aerobic exercise training protocol were analyzed using a paired samples t-test. All descriptive statistics are expressed as means +/- standard deviation. Pearson correlations were used to determine the similarity between the B.M.I. (body mass index) and walking distance; blood pressure and age at menopause; and blood pressure and postmenopausal period. The level of significance was set at P<0.05.

Results

Subject Characteristics

16 premenopausal and 16 postmenopausal females of mean age 40.00 and 50.56 respectively participated in this study. At baseline, the mean value of B.M.I. of premenopausal and postmenopausal females is 25.23 kg/m² and 24.31 kg/m² respectively. Systolic blood pressure was significantly higher in postmenopausal females than premenopausal females. Heart rate & blood pressure both in pre & post menopausal females before & after exercise were summarized in table 1. In postmenopausal females, systolic blood pressure averaged 137.75 mmHg and diastolic blood pressure averaged 86.13 mmHg. Both systolic and diastolic blood pressures changed significantly with menopausal status. An inverse correlation was identified between age at menopause and systolic blood pressure or diastolic blood pressure (r = -0.119, -0.032 respectively), and a positive

<table>
<thead>
<tr>
<th></th>
<th>Premenopausal Females</th>
<th>Postmenopausal Females</th>
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<tbody>
<tr>
<td></td>
<td>Pre-Exercise Evaluation</td>
<td>Post-Exercise Evaluation</td>
</tr>
<tr>
<td>Heart Rate (beats/min)</td>
<td>79.06 +/- 5.14</td>
<td>79.25 +/- 5.28</td>
</tr>
<tr>
<td>Systolic Blood Pressure (mmHg)</td>
<td>122.88 +/- 10.111</td>
<td>137.75 +/- 9.60</td>
</tr>
<tr>
<td>Diastolic Blood Pressure (mmHg)</td>
<td>82.63 +/- 6.47</td>
<td>86.13 +/- 5.91</td>
</tr>
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Fig. 1 a & b): Comparison of the Mean Blood pressure & Heart rate between Pre-exercise values and Post-exercise values of Premenopausal females and post menopausal females respectively.

Table 1: Heart rate & blood pressure both in pre & post menopausal females before & after exercise.
correlation was found between postmenopausal period and either systolic or diastolic blood pressure ($r = 0.062, 0.475$ respectively).

**Exercise intervention**

The changes were observed in pre-training and post-training in two variables in both the groups as demonstrated in figure 1a & 1b. In premenopausal females fig 1a, systolic blood pressure averaged 124.88 +/- 10.01 mmHg and decreased to 121.38 +/- 8.02 mmHg at post-training. Diastolic blood pressure averaged 82.63 +/- 6.47 mmHg and decreased to 80.75 +/- 6.20 mmHg. Heart rate averaged 79.06 +/- 5.14 beats/min and decreased to 75.88 +/- 3.97 beats/min at post-training. In postmenopausal females Fig 1b, systolic blood pressure averaged 137.75 +/- 9.60 mmHg and decreased to 136.38 +/- 8.86 mmHg at post-training. Diastolic blood pressure averaged 86.13 +/- 5.91 mmHg and decreased to 85.13 +/- 5.21 mmHg. Heart rate averaged 79.25 +/- 4.28 beats/min and reduced to 77.94 +/- 4.57 beats/min at post-training. However, there were also three subjects where increase in blood pressure occurred either in systolic or diastolic from pre- to post-training.

It was observed from Fig 2 that the B.M.I. of both the samples was decreased after 2 weeks of exercise. The B.M.I. of premenopausal females was reduced from 25.23 kg/m$^2$ to 24.31 kg/m$^2$. The B.M.I. of postmenopausal females was reduced from 26.85 kg/m$^2$ to 26.22 kg/m$^2$. The mean distance walked by premenopausal females in 20min was 2187.5 +/- 3.15 m and the mean distance walked by postmenopausal females in 20min was 1875 +/- 1.85 m. as demonstrated in Fig 3. An inverse correlation was identified between B.M.I. of both the samples and the distance walked by them ($r = -0.075, -0.044$ respectively).

**Discussion**

The key findings from the present investigation were that the healthy postmenopausal females have elevated blood pressure and this may be due to an estrogen deficiency that may affect cardiovascular system. Reduced level of estrogen mediates changes in body fat distribution. Results clearly demonstrated that higher blood pressure levels in postmenopausal women depends on age at menopause and postmenopausal period. Yoichi Izumi et al demonstrated that higher blood pressure levels in post menopausal female depend on age at menopause & postmenopausal period but not on subject’s age, suggesting that a longer absence of female gonadal steroids represents a major contributing factor to increased blood pressure in elderly women$^{12}$. Postmenopausal females (62%) are found to be more obese...
than premenopausal females (50%). In the present study some postmenopausal females have climacteric symptoms. They experience physical and mental changes which include:- hot flushes, sweating, insomnia, headache, skin dryness, psychological (mood swings, lack of concentration, irritability, depression) and hypertension.

The aerobic exercise training lowers blood pressure and heart rate in both hypertensive and normotensive females. The results of this study provide evidence that healthy but sedentary females who take up a programme of regular brisk walking improves several known risk factors of cardiovascular disease such as hypertension. The blood pressure and heart rate were found to be reduced more in premenopausal females as compared to postmenopausal females. Consequences of the hormonal changes of menopause lead to dramatically impact on long-term health. Therefore, estrogen levels decreased and since, it is not affected by exercise so the decrease in blood pressure in postmenopausal females is less as compared to premenopausal females. Cornelissen et al concluded aerobic exercise training decreases blood pressure through a reduction of vascular resistance, in which the sympathetic nervous system & rennin angiotensin system appear to be involved, and favourably affects the concomitant cardiovascular risk factors.

Conclusion

The purpose of this study was to use an aerobic exercise-training program to elicit hemodynamic response and to determine the changes in cardiovascular variables that may occur after a two-week aerobic exercise training programme in females. Our results suggest that aerobic exercise is an important strategy for prevention and treatment of high blood pressure. Exercise can decrease the risk of cardiovascular disease that occurs as women experience the cessation of menstrual and beyond. Exercise results in a significant reduction in systolic and diastolic blood pressure and heart rate in postmenopausal females and premenopausal females. The aerobic exercise training lowers blood pressure and heart rate in both hypertensive and normotensive females. The blood pressure and heart rate were found to be reduced more in premenopausal females as compared to postmenopausal females.

The results of this study provide evidence that an aerobic physical activity should be considered an important component of lifestyle modification for prevention and treatment of high blood pressure. Aerobic exercise extends lifespan, maintain mobility and help to stay independent. It helps to lose weight or maintain a healthy weight. It helps to improve blood flow to all parts of the body more efficiently.

Some limitations of the study were that socioeconomic factors and dietary factors of the subjects were not taken into account. Time and date of menstruation cycle was not controlled and therefore, were unable to demonstrate true heart rate values and Climacteric symptoms in postmenopausal women were not observed after exercise.

References

Efficacy of dynamic muscular stabilization techniques (DMST) over conventional techniques in patients with chronic low back pain

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Abstract

Background: The low back pain (LBP) is a multifactorial, its treatment varies considerably. It includes medication, physical therapy modalities and exercise therapy with each having several interventions. In spite of their effectiveness, their head-to-head comparisons are limited. This study was aimed for one such comparison.

Methods

A total of 77 patients, 20-40 years of age, with sub-acute or chronic LBP were randomized in two groups and treated either by Conventional treatment a combination of two electro therapy (ultrasound and short wave diathermy) and one exercise therapy (lumbar strengthening exercises) and dynamic muscular stabilization techniques (DMST) an active approach of stabilizing training.

Results

The average demographic characteristics such as Age, Weight, Height, Waist circumference, Hip circumference, Body mass index, Blood pressure systolic, Blood pressure diastolic, Duration and Rest due to LBP at baseline of two groups were found to be similar (P>0.05). The average level of pain, back pressure changes, abdominal pressure changes, walking, stair climbing, stand ups and quality of life improved more (P<0.01) in DMST than CONV. The DMST also improved sexual frequency (14.97%) and decreased recurrence (55.12%) more than conventional.

Conclusion

Study concluded that both treatments are effective in the management of LBP but recommends DMST intervention in their daily clinical practices.

Keywords

Back pain, Abdominal Muscle pressure, Physiotherapy, Stabilization, Strengthening Exercises

Clinical significance

The clinical significance of DMST intervention over Conventional treatment is that it restores pain, physical strength, quality of life and sexual frequency more in the management of low back pain. The rate of recovery was also high in DMST than the Conventional. The reason may be due to the contraction, strength, co-ordination and timing of Transversus Abdominis (TA) and Multifidus (M) muscles which are important in stabilizing the low back improves more, and particular muscles may be one of the factors capable of preventing and reducing LPB in general population.

Introduction

Low back pain (LBP) is a major health issue due to its high prevalence in the general population and adverse effects on health. Low back pain is a general term characterized by acute (< 6 weeks), sub acute (6-12 weeks) or chronic (> 12 weeks) which are duration dependent and location specific. In health care profession LBP is known by various names and their treatment differs accordingly Refshauge K M and Mahar C G. (2006).

The LBP is a multifactorial disorder with many possible causes. Treatment for LBP varies considerably. It includes medication, physical therapy modalities and exercise therapy (Scheer SJ, et al., 1996) with each having several interventions. Practice guidelines recommended various types of exercises and manipulative therapy for chronic LBP but there have been few head-to-head comparisons of these interventions (Manuela LF, et al., 2007). In recent years, multidisciplinary pain programs were seen to successfully treat patients by basing treatment on a combination of physical exercise and psychological interventions (Pfingsten M, et al., 1997). However, in spite of their effectiveness, it still remains to be clarified exactly which features of these programs were responsible for patient improvement (Pfingsten M, et al., 1997). Interventions such as the application of heat, short wave and massage alone have insufficient evidence to support their effectiveness at present, but found to be effective and less cost effective than no intervention.

Due to injury the deep stabilizing muscles of the lower back will remain impaired for 4-6 weeks until pain subsides. In LBP impaired deep stabilizing muscles provide poor segmental stiffness, and thus predisposes back to re-injury and return to pain. Therapeutic exercise, as part of rehabilitation for patient with LBP, is one of the treatment modalities most commonly used by physiotherapist (Martin P, et al., 1986). In the management of such cases, the dynamic muscular stabilization techniques (DMST) were also found to be effective (Lucy JG, et al., 2006). In DMST, adequate dynamic control of lumbar spine forces is achieved which reduces the repetitive injury to the structures of the
spinal segments and related structures. Specific stabilizing exercises with cocontraction of deep abdominal (transversus abdominis) and lumbar multifidus muscles enhance the spinal segmental support and control Richardson CA and Jull CA (1995). In recent clinical trials, physical exercises have proved effective in the management of LBP both in short term and long term Hides JA, et al., (2001).

There has been no randomized comparisons of the effects of general exercises and spinal manipulative therapy specifically for the management of chronic LBP and so it was not clear which of the treatment is most effective (Manuela LF, et al., 2007). There is, still no evidence as to which exercises or which training is best for different sub groups (Mannion AF, et al., 2001, Nordin M, and Campello M 1999). In clinical reality, modalities and training are often used in combination, to relieve pain and better function. Patients often get better but the pain recurs frequently and many patients are to undergo treatment again and again even surgery.

Keeping the above facts in mind and with best of our knowledge, for the first time in general population, the combination of two electro therapy (ultrasound and short wave diathermy) and one exercise therapy (lumbar strengthening exercises) was named as “Conventional” and compared with “DMST” is an active approach of stabilizing training. We hypothesized that DMST may be more effective than Conventional in the management of sub-acute or chronic low back pain.

**Methods**

**Subject**

A total 105 LBP patients from Department of Physical Medicine and Rehabilitation, CSM Medical University, Lucknow, aged 20-40 years who were diagnosed clinically by the physicians with no neurological involvement but having symptomatic (overuse, overload or overstrecthing) nonspecific, sub-acute or chronic low back pain (CLBP) were included for this study. After randomization, in group A (Conventional) and Group B (DMST) only 38 in conventional and 39 in DMST were completed follow up, considered for the analysis. The present study has the approval of the Institutional Review Board and informed consent was obtained from all the subjects.

**Approach**

The subjects were randomized equally in two groups by lottery method. For this, two hundred folded papers of same shape and size were marked either Conventional or DMST were kept in a box and mixed thoroughly before and after withdrawing a paper from the box. Marking on the paper drawn by the patients allocate their mode of treatment. The Age, Weight, Height, Waist circumference (WC), Body mass index (BMI), Blood pressure (BP) systolic, BP diastolic, Pulse rate, Duration of LBP and Rest taken due to LBP of the two groups were assessed at baseline. Outcome variables such as pain, back pressure changes (BPC), abdominal pressure changes (APC), walking, stairs climbing, stand ups, quality of life (QOL) were observed by same tester and same physiotherapist supervising the test procedure at base line as well as on day 10, 20, 90 and 180. Sexual frequency was taken at baseline and day 180 whereas recurrence was taken at day 180 only. Test and retest of the two groups were conducted in the same place and environment and at same time of the day. Before experimentation, all subjects were well taught about the measurement variables and their outcomes. The patients were also informed about the experimental risks, if any.

**Procedure**

After group allocations, respective subjects were treated either with Conventional (CONV) or DMST. Both the treatment was given as individual treatment by the same physiotherapist with the same intensity and capacity on 20 regular days and follow up for 180 days. The duration of each individual treatment session was about 40 minutes per day. The subjects did not allow getting any other treatment including pain killers. The brief description of both the treatments used as follows:

**Conventional treatment:** Ultrasound, Short wave diathermy and the lumber strengthening exercises.

**Ultrasound (US):** For the purpose of this study as a treatment for chronic condition a frequency of 1 MHz was used rather than 3 MHz which penetrates least and absorbed superficially (Forster A, and Palastanga N 1985). Continuous pattern ultrasound is recommended for use in chronic condition at intensity 1.2W per cm square for a period of 5 minutes for 20 sitting in 20 regular days. Ultrasound equipment was used from Medichem Electronics which has International standard certification.

**Short Wave Diathermy (SWD):** It is a deep heating modalities used in pain relieving. It is also used to enhanced flexibility, blood flow, and inflammation. Short wave forms are used for selected patients without neurological lesion (Chahade WH, et al., 2001). Continuous mode of SWD is used for 15 minutes with 20 sitting in 20 regular days. The SWD was used from Medichem Electronics which has International standard certification.

**Lumbar strengthening exercises (LSE):** The use of LSE are well documented (Kraus H. 1994) which consist spinal extension exercises and strengthen trunk extensor muscles exercise. The LSE were given 10 repetitions each exercises (prone lying leg elevation, prone lying chest elevation and supine lying bridging) for days.
**Dynamic muscular stabilization treatment (DMST):** In DMST, muscles with direct attachment to lumbar spinal segments are stabilize the joints ‘neutral zone’ and prevent excessive deflection (Crisco JJ III and Panjabi MM 1990).

Exercise is given in four stages (Fig. 1) in the following order:

i. **1st Week - isolation and facilitation of target muscles -**
   Verbal instruction such as drawing in and hollowing the lower abdomen, drawing the naval up and in towards the spine or feeling the muscle tighten at the waist. From the beginning patient learn to breathe normally while activating or holding the muscular contraction (Miller MI and Medeiros JM 1987). The patient is in supine hook lying position and instructed to perform abdominal hollowing (in which the patient is instructed to make the lower abdomen cave in) or abdominal bracing (in which the patient is instructed to contract the abdominals by actively flaring out laterally in the region of the waist just above the iliac crest) (Fig. 1.1).

ii. **II nd Week- training of trunk stabilization under static conditions of increased load –**
   The patient position and maintain the concentration pattern same as 1st week, the individual is then asked to hold the position while load is added via the weight of the lower limbs being moved passively into a loaded position (Fig. 1.2).

iii. **III rd Week- development of trunk stabilization during slow controlled movement of the lumbar spine.** Once stability trained through static procedure, the movement of the trunk with appropriate activation of the supporting muscle. The first step is to produce and explore lumbopelvic movement and learn abdominal hollowing or bracing in a variety of position: sitting, quadruped, standing, supine, kneeling and inclination by degree to control loading (Fig. 1.3).

iv. **4-5th Week- lumbar stabilization during high speed and skilled movement –**
   High speed phasic exercises recommended to the patient along with abdominal hollowing or bracing in a variety of position.

**Outcome variables**

The level of Pain was assessed by Visual Analogue Scale (VAS: 0-10cm) (Jensen MP, et al., 2002). The BPC and APC were measured by pressure measuring device (Kumar S, et al., 2008) while functional ability (Walking, Stair climbing and Stand up) were measured according to Waddell functional evaluation test (Waddell G 1998). The measuring details of variables in brief are summarized as follows:

**Visual Analogue Scale (VAS):** This is a 10 cm calibrated line with 0 representing no pain and 10 representing worst pain. The subjects were asked to make a mark or point on the scale that best represents his intensity of pain experienced.

**5 minutes of Walking:** The distance walk up and down between marks 10 meter apart in 5 minute. The corridor was quiet and empty with non-slip surface or hard carpet. Patient can not use any walking aid but can use the walls for support or can sit down for a rest. Regular information about the time was given to the patient between walking.

**One minute Stair Climbing:** Climbing up and down of standard stairs with one handrail and opposite wall within easy reach were used. Stair climbing counts of a patient
was taken as total steps ups and downs completed in one minute for example a patient can up stairs 10 steps and down 18 steps, the total counts are 28.  

One minute Stand ups: The number of times the patient can stand up from a chair in 1 minute is his score. The chair was firm, upright with a back rest but no arm rest. The seat height of chair was 45 centimeter. During stand up there was no any support within reach so that patient can not use any support.

SF–36 quality of life: It is a multipurpose, self administered, short form (SF) health survey with 36 questions which measures generic health status in the general population. These questions consists physical functioning, role functioning, bodily pain, general health, vitality, social functioning, role functioning and mental health. Response choices are numbered from left to right, starting with 1. The maximum scores obtained from 36 questions were 151 represents worst QOL whereas minimum score 36 represents the best. In this study we considered the score of QOL of normal as 36.

Sexual Frequency (SF): It is a sexual activity questionnaire covering frequency of intercourse in a month. All subjects of this study were married and their age of marriage was more than one year. This study subjects were either husband or wife. The number obtained from subjects represents their SF value.

Statistical analysis

Demographic characteristics of two treatment groups are compared by Student’s independent t-test. Efficacies of two treatments on different days were compared by Student’s independent t-test. Before analysis, homogeneity of variance between groups was tested by Bartlett’s test. The variance of walking between groups was found to be heterogeneous and thus analyzed after transforming the observations by square root transformation. A two-tailed probability value less than 0.05 (P < 0.05) was considered to be statistically significant. Microsoft EXCEL (MS Office 97-2003), GraphPad Prism (version 5) and STATISTICA (version 7) were used for the analysis.

Results

The demographic base line characteristics of two groups were summarized in Table 1. On comparing, average characteristics of two groups at baseline did not differed significantly (P>0.05) i.e. found to be statistically the same.

The Pain, BPC, APC, Walking, Stair climbing, Stand ups and QOL at different days of two treatment groups are summarized in Fig. 2. On comparing, the average levels of all variables in two treatments at baseline were found to be similar i.e. did not differed significantly (P>0.05). All variables improved significantly (P<0.01) in all observed days (10, 20, 90 and 180) in DMST than CONV except Stair climbing and Stand ups which did not change in two treatments at day 10.

The sexual frequency and recurrence of LBP in two treatment groups were shown in Fig. 3. On comparing, sexual frequency in both the treatments improved significantly (P<0.01) after 180 days of post treatment as compared to base line but the improvement in DMST was found to 14.97 % more than CONV. The recurrence decreased significantly

| Table 1: Summary (Mean ± SD) of demographic characteristics of two groups |
|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| **Demographic Characteristics** | **Conventional** | **DMST** | **t-value** |
| **Age (Year)** | 35.74 ± 5.71 | 35.77 ± 5.31 | 0.03* |
| **Weight (Kg)** | 65.88 ± 11.48 | 69.09 ± 11.62 | 1.22* |
| **Height (cm)** | 161.98 ± 8.57 | 165 ± 9.93 | 1.43* |
| **WC (cm)** | 88.20 ± 10.59 | 89.60 ± 9.22 | 0.62 |
| **HC (cm)** | 48.50 ± 6.34 | 49.94 ± 5.18 | 0.99* |
| **BMI** | 25.10 ± 3.93 | 25.34 ± 3.44 | 0.29* |
| **BP Systolic** | 130.26 ± 8.46 | 128.08 ± 9.00 | 0.10 |
| **BP Diastolic** | 85.92 ± 5.68 | 84.18 ± 6.40 | 1.26* |
| **Pulse Rate** | 78.03 ± 6.06 | 80.54 ± 7.54 | 1.61* |
| **Duration (Month)** | 24.95 ± 32.43 | 23.46 ± 21.04 | 0.24* |
| **Rest due to LBP (Days)** | 10.79 ± 19.24 | 10.05 ± 12.91 | 0.73* |

(P<0.01) in DMST than conventional and the decrease was observed 55.12% more in DMST than CONV.

Discussion

In the present study both therapies (Conventional and DMST) are found to be effective in the early recovery of patients with sub-acute or chronic low back pain especially in pain control. The hypothesis that the treatment DMST is more effective than the Conventional was found to be true. The mechanism by which these treatments improved LBP is not clear. We think that in Conventional treatment, limited muscle groups were involved and not aimed at improving the strength. In DMST the more improvement may be due to restore muscle strength in combination with balance, posture, position and coordination in presence of pain and functional disability.

Previously comparative study among stabilizing training with manual treatment shows that the individual of stabilizing group more improved than the manual treatment group (Eva RB, et al., 2003). A systematic review of efficacy of McKenzie therapy also results in a greater decrease in pain and disability in the short term than other standard therapies (Clare H, et al., 2004). In one comparative study, the manipulative treatment with stabilizing exercises was found more effective in reducing pain intensity and disability than the physician consultation alone (Niemisto L, et al., 2003). In another study, pulsed SWD was compared with continuous SWD in LBP and pulse SWD was found to be more effective than continuous SWD (Mintaze K, et al., 2004). A study was done to compare cognitive intervention and exercise in patients with chronic LBP and the effect of both the treatments were found similar (Brox JI, et al., 1990). A study which compares manipulative therapy with massage and SWD, the effect of manipulative therapy was slightly better than placebo therapy, no treatment, massage and SWD (Manuela LF, et al., 2007). A comparative study was done on manipulation and stabilization exercises in patients with LBP suggests that patients with lumbar hypo mobility experienced grater benefit from manipulation and those having hyper mobility were more benefited by stabilization exercises (Fritz JM, et al., 2005). One study showed that patients with chronic low back pain demonstrated a reduction in performance of trunk extensor and flexor muscles when compared with control group while using conventional trunk strengthening exercises. This study also suggests back extensor muscles deficiency should be considered in
planning rehabilitation programs for chronic low back patients and recommends that if passive modalities fail to restore function in 1 month then active care or stabilizer muscle activation through stabilization exercises is needed (Mayer TG, et al., 1985).

All guidelines consistently report that acute LBP typically has an excellent prognosis because most cases (up to 90%) recover within six weeks (Refshauge KM and Maher CG, 2006, Waddell G, et al., 1996). Musculoskeletal physiotherapy has been an increase in the prescription of exercise to rehabilitate spinal stability in patients with chronic low back disorder Richardson CA and Jull CA (1995). However, the prognosis for acute low back pain during play activity has been investigated and has been confidently reported as excellent in all current clinical practice guideline for the management of acute low back pain (Koes B, et al., 2001).

Physiotherapy programme have shown efficacy in patients with chronic low back disorder (Furlan AD, et al., 2001). The spinal physiotherapy programme was concerned

Fig. 2: Figures shows average level of Pain (a), BPC (b), APC (c), Walking (d), Stair climbing (e), Stand ups (f) and QOL (g) in patients treated with Conventional and DMST. Asterisk shows comparison between days and are significantly different at respective days either at P<0.05 or P<0.01.
with the physiotherapy of muscles, and the progression of implementation contraction of these muscles into every day postures and positions, especially those associated with pain or functional disability. As a component of musculoskeletal physiotherapy, the spinal stabilization programme is more effective than manually applied therapy or an education booklet in treating low back disorder over time (Lucy JG, et al., 2006).

Correct and timely rehabilitation is a vital component of the treatment of LBP patients. The goals of rehabilitation include restoring function, restoring pain free full range of motion, and achieving full muscle strength and endurance. This paper discuss the rehabilitation of LBP with the application of DMST special focus on the transverses abdominus (TA) and multifidus (MF) muscles which is necessary part of Physical Therapy for low back pain. Literature review suggests that there is need of this type of comparative study for in LBP rehabilitation. Exercise programs may play an important role in muscle strengthening and prevention of future or recurrent injuries, which may have psychologic benefits also. Lumbar stabilization exercises are aimed at sensorimotor reprogramming of spine stabilizer muscles intended to improve their motor control skill and delay of response and consequently to compensate for weakness of the passive stabilization system. Our results can be generalized to LBP patients. Before implementing on general population it should be confirmed on more subjects, which is our future objective.

Acknowledgement

Authors thankful to Dr. R. Tully, Director, CDRI, for giving permission to author (MPSN) to analyze the data and considering this as a collaborative work. We acknowledge Mr. Vishal and Mr. Lal Bahadur for their help during different phases of work. Authors want to acknowledge all the participants who participated in the study. Author (SK) acknowledge to ICMR, New Delhi for providing fellowship as Senior Research fellow (letter no. 3/1/2/1/ADR/2007-NCD-I). This study has no conflict of interest.

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Study of the level of fitness in under – 16 male football players & effects of puberty on fitness

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Abstract

Objectives

The purpose of this study was:
1. To find the fitness levels in under 16 male football players.
2. To compare the fitness levels between children of same age group & the team players.
3. To find the effects of puberty on fitness.

Method

60 Students were included–30 undergoing training for soccer & 30 not undergoing any training. The age group selected was 14 – 15 years.

Inclusion criteria

1. Players with regular training.
2. Children playing football as a recreational activity.

Exclusion criteria

1. History of sports injury in the last 3 months.
2. Underlying medical and surgical condition.
3. Performance enhancing drug consumption.

Their fitness levels were assessed based on the following parameters
Aerobic–Harvard step test Anaerobic – 35 meter Sprint test
Agility – T test Flexibility test – Sit and Reach test
Co-ordination test for Goalkeepers – Alternate wall hand toss
Strength test – Squat test Equilibrium/ Balance test– Stork test.

The outcome was measured in terms of the fitness scores of each test. A comparison was done between the trained & untrained individuals & effects of puberty on fitness were noted.

Results

The data was analyzed, the results observed were – Poor aerobic scores, Very Good anaerobic scores, Good agility scores, Fair flexibility scores, Excellent co-ordination & Strength scores & Average Static balance scores in training group.

Comparison between students undergoing training & those not trained showed that the untrained group had lower fitness levels. Pubertal effects played an important role in improvement of the functions of the various parameters involved in fitness.

Conclusion

The study confirms the fact that training plays an important role in the fitness levels of the students.

The students undergoing training showed a great increase in their fitness levels compared to those not undergoing any training.

But among the team players, there is a marked decrease in their Aerobic capacities whereas the other parameters range between fair to excellent scores. Hence, Aerobic fitness training should be emphasized upon.

Fitness levels cannot be used to judge a player’s performance in the game, as other factors such as Team work, Skill, Psychological & Mental Spirit, Tactics & a small amount of Good Fortune plays a very important role to determine the winner.

Key words

Fitness Assessment, Football, Puberty

Introduction

Football / Soccer- is the world’s most popular sport. The game’s most famous international competition, World Cup, is held every four years watched by millions on television. FIFA {Federation Internationale de Football Association} is the governing body for world football, organizing the matches4.

Game – two teams of 11 players take part in the match attempting to send the round ball into their opponents’ goal. A successful attempt is called ‘scoring a goal’. Team scoring most goals in two 45-min periods (full time) with an interval of 5 min (half time) wins the game. Players use their feet, head, or any other part of the body except hands & arms to propel or control the ball. Only the goalkeeper can handle the ball, but restricted to the goal area4.

Football pitch / Field – is rectangular & marked by lines. Corners are marked by flags; goals stand on the center of goal line (7.32m wide & 2.44m high). Ball is spherical having a circumference of 68-71cm & 396 -435 gm in weight4.

Positions in a soccer game

Goalkeeper: plays a significant role during the game. He requires sharp reflexes, agility, speed, ball handling ability etc. to prevent the other team from scoring4.

Defence: is an important asset to the goalkeeper. Defenders help to keep the opponents away from the goal area by tackling opponents or intercepting their passes4.

Midfield: is the place of maximum play. Midfielders attack & also defend thus requiring highest amounts of endurance.
There are generally 3-4 midfielders—the Anchorman, who wins the ball, Midfield general / strategist, through runners & withdrawn wingers (right / left)4.

**Attack:** consists of central striker & winger who help to score a goal against the other4.

**Fitness in football**

Physical fitness is a set of attributes a person has in regards to a person's ability to perform physical activities that require aerobic fitness, endurance, strength, or flexibility and is determined by a combination of regular activity and genetically inherited ability3.

The components that comprise to the definition of physical fitness:

**Aerobic fitness:** Football player has to run and fro on the field for an entire period of 90 minutes, with very less time given for rest, thus the athletes aerobic capacity is taxed. Aerobic fitness refers to the ability to sustain work for prolonged period, Greater the aerobic fitness, lesser fatigue is experienced³.

**Anaerobic fitness:** is determined by the ability to exert maximum muscular contraction instantly in an explosive burst of movements (sprint starting). A footballer requires sudden, fast movements while passing the ball, dribbling, shooting towards the goal etc. The players frequently sprint in order to control the ball for scoring, feinting, or even for defense⁶.

**Agility:** is the ability to perform a series of explosive power movements in rapid succession in opposing directions (Zigzag running or cutting movements). The ability to quickly change direction is very important in soccer⁶.

**Co-ordination:** is the ability to execute smooth, accurate, controlled motor responses. Co-ordinated movements are characterized by appropriate speed, distance, direction, timing & muscle tension extremely important for goalkeepers to prevent opposing team from scoring⁶.

**Flexibility:** The ability to achieve an extended range of motion without being impeded by excess tissue, i.e. fat or muscle. Flexibility is important in terms of being injury free and being able to move freely around the court⁸.

**Strength:** : The extent to which muscles can exert force by contracting against resistance (holding or restraining an object or person). in basketball there is equal involvement of upper limb and lower limb and a considerable amount of strength is involved to through and control the ball⁹.

**Indian football**

The Indian Football teams are formed from the teams originating from schools & colleges. Players from these teams are then picked up to form the District, State & National teams. The teams are formed with age groups of under 10, under 12, under 14, under 16, under 18, senior groups etc. There is also an increased prevalence of injuries in Indian Footballers related to decreased physical fitness in the athletes.

The training of players is also influenced by experiences & coaching techniques which plays an important role in maintaining the overall fitness.

**Puberty in males**

**Stages**

- **Stage One** (approximately between ages nine and 12): No visible signs of development occur, but, internally, male hormones become a lot more active. Sometimes a growth spur begins at this time.
- **Stage Two** (approximately between ages nine to 15): Height increases and the shape of the body changes. Muscle tissue and fat develop at this time. The areola, the dark skin around the nipple, darkens and increases in size. The testicles and scrotum grow
- **Stage Three** (approximately between ages 11 and 16): Pubic hair is getting darker and coarser and spreading to where the legs meet the torso. The penis starts to grow during this stage. Also, boys continue to grow in height, and even their faces begin to appear more mature. The shoulders broaden, making the hips look smaller. Muscle tissue increases and the voice starts to change and deepen. Finally, facial hair begins to develop on the upper lip.
- **Stage Four** (approximately 11 to 17): The testicles and scrotum continue to grow. Underarm and facial hair increases as well. Skin gets oilier, and the voice continues to deepen.
- **Stage Five** (approximately 14 to 18): Boys reach their full adult height. Pubic hair and the genitals look like an adult man’s do. Some young men continue to grow past this point, even into their twenties

**Methodology**

**Sample size:** 60 students from Don Bosco School, Matunga, and O.L.P.S, Chembur.
- 30 Students undergoing training for soccer.
- 30 Students not undergoing any training.

**Age group:** 14 – 15 YEARS OF AGE.

**Date:** The study was conducted in the month of November and December 2007.

**Inclusion criteria**

- a. Players with regular training.
- b. Children playing football as a recreational activity.

**Exclusion criteria**

- a. History of sports injury in the last 3 months.
- b. Underlying medical and surgical condition.
- c. Performance enhancing drug consumption.

**Selection of the test**

Following are the tests on which the football player has been evaluated:

**AEROBIC FITNESS:** HARVARD STEP TEST.
**ANAEROBIC TEST:** 35 METER SPRINT TEST.
**AGILITY TESTING:** T – TEST.
**CO – ORDINATION:** ALTERNATE WALL – HAND TOSS.
**FLEXIBILITY TESTING:** SIT AND REACH TEST.
**STRENGTH:** SQUAT TEST.
**EQUILIBRIUM / BALANCE:** STORK TEST.
Results

Of the tests conducted are as follows:

AEROBIC FITNESS

<table>
<thead>
<tr>
<th>AEROBIC FITNESS SCORE</th>
<th>PLAYERS(30)</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Good</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>High Average</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Low average</td>
<td>2</td>
<td>6.66%</td>
</tr>
<tr>
<td>Poor</td>
<td>28</td>
<td>93.33%</td>
</tr>
</tbody>
</table>

INFERENCE: Aerobic fitness score is poor.

ANAEROBIC FITNESS

<table>
<thead>
<tr>
<th>ANAEROBIC SCORE</th>
<th>PLAYERS(30)</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Good</td>
<td>9</td>
<td>30%</td>
</tr>
<tr>
<td>Good</td>
<td>8</td>
<td>26.66%</td>
</tr>
<tr>
<td>Average</td>
<td>3</td>
<td>10%</td>
</tr>
<tr>
<td>Fair</td>
<td>5</td>
<td>16.66%</td>
</tr>
<tr>
<td>Poor</td>
<td>5</td>
<td>16.66%</td>
</tr>
</tbody>
</table>

INFERENCE: Anaerobic test score is very good.

AGILITY TEST:

<table>
<thead>
<tr>
<th>AGILITY TEST SCORE</th>
<th>PLAYERS(30)</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>4</td>
<td>13.33%</td>
</tr>
<tr>
<td>Good</td>
<td>13</td>
<td>43.33%</td>
</tr>
<tr>
<td>Average</td>
<td>7</td>
<td>23.33%</td>
</tr>
<tr>
<td>Poor</td>
<td>6</td>
<td>20%</td>
</tr>
</tbody>
</table>

INFERENCE: Agility test score is good.

CO-ORDINATION TEST:

<table>
<thead>
<tr>
<th>CO-ORDINATION TEST SCORE</th>
<th>PLAYERS(4)</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>2</td>
<td>50%</td>
</tr>
<tr>
<td>Good</td>
<td>2</td>
<td>50%</td>
</tr>
<tr>
<td>Average</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Fair</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Poor</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

INFERENCE: Alternate wall hand toss test for goalkeepers is excellent & good.

FLEXIBILITY TEST:

<table>
<thead>
<tr>
<th>FLEXIBILITY TEST SCORE</th>
<th>PLAYERS(30)</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Super Excellent</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Excellent</td>
<td>5</td>
<td>16.66%</td>
</tr>
<tr>
<td>Good</td>
<td>7</td>
<td>23.33%</td>
</tr>
<tr>
<td>Average</td>
<td>7</td>
<td>23.33%</td>
</tr>
<tr>
<td>Fair</td>
<td>11</td>
<td>36.66%</td>
</tr>
<tr>
<td>Poor</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Very Poor</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

INFERENCE: Flexibility of the players is fair.

STRENGTH TEST:

<table>
<thead>
<tr>
<th>SQUAT TEST SCORE</th>
<th>PLAYERS(30)</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>10</td>
<td>33.33%</td>
</tr>
<tr>
<td>Good</td>
<td>8</td>
<td>26.66%</td>
</tr>
<tr>
<td>Above Average</td>
<td>8</td>
<td>26.66%</td>
</tr>
<tr>
<td>Average</td>
<td>2</td>
<td>6.66%</td>
</tr>
<tr>
<td>Below Average</td>
<td>2</td>
<td>6.66%</td>
</tr>
<tr>
<td>Poor</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

INFERENCE: Strength of the players is excellent.

EQUILIBRIUM TEST:

<table>
<thead>
<tr>
<th>STORK TEST SCORE</th>
<th>PLAYERS(30)</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Good</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Average</td>
<td>16</td>
<td>53.33%</td>
</tr>
<tr>
<td>Fair</td>
<td>14</td>
<td>46.66%</td>
</tr>
<tr>
<td>Poor</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

INFERENCE: Static balance of the players is average.

Comparision between students undergoing training & those not being trained

Aerobic test scores

![Aerobic test scores graph]

* On comparing the Aerobic fitness scores, there is marked difference in the scores. 93.33% of the team players have POOR aerobic fitness, whereas 46.66% of other students were unable to complete the test.

Anaerobic test scores

![Anaerobic test scores graph]

* On comparing the levels of Anaerobic fitness it reveals that in team players about 30% players have the score of Very Good as compared to 13.33% of others with a score of Good.

Agility scores

![Agility scores graph]

* On comparing the graphs between the team and other players there is marked evidence of 13.33% of team players scoring excellent scores, whereas the other players have 30% in the Good score.
• On comparing the flexibility results both the team & other players have a 16.66% Excellent and 13.33% good level of flexibility respectively.

Discussion
The Fitness test results highlighted the areas of higher test scores in certain variables and areas of deficits in others. The fitness levels obtained are an impression of the kind of training a player achieves. The physical conditioning a player has undergone reflects in the player’s physical fitness parameters.

The aerobic levels have been demonstrated to be in a majority poor; due to lack of training in aerobic capacity. There is no formal recording of the heart rate or any kind of formal aerobic training in the athletes. There is no concept involving achievement of target heart rates.

The anaerobic capacity, agility, strength & balance skills vary from very good, good, excellent to average respectively.

The flexibility of the players is fair due to the pubertal changes & growth spurts occurring.

Co-ordination of goalkeepers ranges between excellent & good.

Effects of puberty

Aerobic Capacity: Aerobic power increases with age during childhood in both sexes and is quite similar. From the age of 14 years on, aerobic power in boys is significantly higher by about 15%. The maximal aerobic performance capacity in boys increases up to the age of 18 years. Thus, even though the aerobic capacity is fully developed aerobic performance continues to improve. That is because other growth factors, such as larger levers, greater musculature, etc. are still developing and govern the effectiveness and mechanical efficiency of aerobic activities. There is an increased trainability of the heart and circulatory system around puberty in males5.

Anaerobic Capacity: Unlike aerobic capacity, the anaerobic capacity of children expressed per Kg of body weight is much smaller than adults. It is lowest in children and increases progressively with age in both boys and girls5.

Strength: In the prepubescent age, muscle weight is about 27% of the total body weight and the effect of training on muscle hypertrophy is small so that strength gains are more the result of an improvement in co-ordination. After sexual maturation [the onset of the adolescent growth spurt], muscular development is influenced by androgenic
hormones and the percentage of muscle weight then increases to over 40%. Testosterone influences development of muscles in terms of strength\(^5\).

**Flexibility:** There is a gradual increase in flexibility with age as measured on the sit-and-reach test. However, generalization is not clear because of the absence of studies and data that take into account growth spurts and anthropometrical size changes (e.g., longer arms produce a better sit-and-reach measure)\(^5\).

**Coordination and Skill Learning:** The sensitive skill learning period is between 9 and 16 years\(^5\).

**Conclusion**

The study confirms the fact that training plays an important role in the fitness levels of the students. The students undergoing training showed a great increase in their fitness levels compared to those not undergoing any training.

But among the team players, there is a marked decrease in their Aerobic capacities whereas the other parameters range between fair to excellent scores. Hence, Aerobic fitness training should be emphasized upon.

Fitness levels cannot be used to judge a player’s performance in the game, as other factors such as Team Work, Skill, Psychological & Mental Spirit, Tactics & a small amount of Good Fortune plays a very important role to determine the winner.

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2. www.pubmed.gov
Comparison between straight leg raise & bent leg raise stretching techniques for increasing hamstring flexibility

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Faridabad Institute of Technology, Faridabad, Haryana

Introduction

The ability of an individual to move smoothly depends on his flexibility, an attribute that enhances both safety and optimal physical activities. Hamstrings are an example of those muscle groups that have a tendency to shorten. Many people suffer with tight hamstrings. Usually it does not cause a problem but can be more prone to tears and also limit the sporting activity and predispose to postural problems and back pain as they tend to pull the pelvis out of normal position.

The relationship between hamstring injury and hamstring flexibility is another area of great debate. Worrel et al (1991), stated that hamstring flexibility is the single most important feature in the hamstring injury player.

Hamstring strains are a common athletic injury with a tendency to recur. Lack of flexibility has been suggested as a predisposing factor to hamstring strain. Clinicians have generally considered flexibility training to be an integral component in the prevention and rehabilitation of injuries as well as a method of improving one’s performance in daily activities and sports.

Flexibility is an important physiological component of physical fitness, and reduced flexibility can cause inefficiency in the workplace and is also a risk factor for low back pain (Worrel et al,1994). Young patients with lumbar disc herniation sometimes show hamstring tightness on straight leg raising with no associated pain.

Despite the widespread use of stretching techniques in sports and rehabilitation, limited knowledge exists with respect to mechanism and efficacy of stretching of the human muscle tendon unit in vivo. Various stretching techniques are known namely ballistic stretching, static stretching, contract-relax stretching and contract-relax agonist contract the latter two of which are commonly referred to as proprioceptive neuromuscular facilitation (PNF) stretch techniques. PNF stretch techniques have been shown to bring about greater improvement in joint range of motion by reducing the EMG activity & thereby the resistance in the muscle undergoing stretch.

Contract relax stretch method was used in this research to perform bent leg raise technique. “Brian Mulligan” has advocated the use of Bent Leg Raise for stretching hamstring to improve flexibility by increasing the range of motion. This intervention consists of contract relax cycles applied to hamstrings that provides peripheral somatic input by the way of contracting muscles and the cutaneous contact of the therapist. Changes in alpha and gamma motor neuron activity (influencing the hamstring muscles) at a segmental level are likely following this technique that are similar to those effects observed following the implementation of PNF techniques and this may affect the subject’s perception of their straight leg raise limit.

Mulligan’s Bent Leg Raise (BLR) technique is a painless technique, when indicated and can be tried on any patient who has limited or painful straight leg raise (SLR). It can be tried even if patient feels leg pain above the knee, and can be extremely useful when therapist is confronted with one of those patients who have a great bilateral limitation of straight leg raise. If BLR cannot be executed without pain then it is not to be used.

Another method used here was static stretching in which the muscle is slowly elongated to tolerance and the position held with the muscle in its greatest tolerated length. Literature supports the fact that static stretching increases flexibility of muscles. A great deal of variability exists, concerning the length of time a static stretch should be sustained.

Both isometric contraction and passive stretching increases the joint range of motion. Passive stretching however appears to be the safest and best stretching method. Considering the discrepancy in the outcomes of many studies, it still seems unclear whether or not it is possible to lengthen the short hamstrings by performing stretching exercises. Moreover the mechanism responsible for achieving lengthening of short hamstring muscles is still unclear.

The purpose was to find out the more effective technique between Straight Leg Raise and Bent Leg Raise technique for increasing hamstring flexibility.

Method

30 healthy female subjects ranging from 18 – 25 years, volunteered to participate in this study. Subjects were selected from Faridabad Institute Of Technology (FIT) and Manav Rachna Educational Society (MRES) hostel, Faridabad. Subjects included in the study were normal females with tight hamstring muscles (inability to extend the knee up to terminal 20° of extension with hip stabilized at 90° flexion).

Subjects were excluded from the study if there was history of low back ache, neurological symptoms involving lumbar spine and lower extremity, soft tissue and bony pathology around lumbar spine, hip and knee region or knee joint flexion contracture. Instruments used were a standard double – armed universal Goniometer with full circle protractor for hamstring flexibility measurement and hip positioning for the active knee extension test and knee motion.

Measurement, a cross bar was used to maintain the proper placement of hip and thigh during active knee extension measurement. Straps were used to prevent any movement of contralateral limb and a stop watch to measure the duration of treatment.

Subjects were selected on the basis of screening process to establish hamstring tightness and were randomly allocated...
to both the experimental groups – Group A (Straight Leg Raise) and Group B (Bent Leg Raise). Subjects in the study participated voluntarily. Aim and procedure of the study were explained and informed consent was taken from all subjects. Pre-intervention measurement of active knee extension was taken. The baseline knee extension deficiency was measured using a double armed Goniometer. Each subject was positioned supine on the plinth and the hip of the lower limb being assessed was flexed to 90°. The distal part of anterior surface of the thigh was placed in contact with cross-bar of a specially constructed wooden frame; the subject was instructed to actively extend the knee to the point where they started feeling a stretch. The knee extension deficiency was measured using the goniometer (90° of knee flexion was recorded as 0° i.e. starting position). Zero degree was considered to be full extension of the knee. During testing procedure, patients were instructed to maintain the lumbar spine flat against the table and slowly extend the knee.

Stretching protocol: After determining the baseline value, subjects were taken through the stretching exercise training specified to them i.e. Group A (Straight Leg Raise) or Group B (Bent Leg Raise).

For SLR stretching technique, the subject assumed full supine lying position on a plinth with his feet pointing upwards. The contralateral lower limb was securely strapped to the plinth across the thigh and over the anterior superior iliac spine to stabilize the pelvis. The lower limb being stretched was passively moved into flexion up to the limit where the subject felt a stretch at the posterior aspect of the thigh. This placed the hamstring muscle at a stretched length. Straight Leg Raise stretch was performed for an equal duration of single Bent Leg Raise procedure followed by 2 minute rest, repeated for 3 times. This was followed by Post intervention measurement. Stretching was performed 3 days in a week i.e. alternate days for 4 weeks. ROM measurements were taken at both pre and post 1st, 7th and 14th interventions.

For BLR stretching technique, after taking baseline measurement, the subject’s lower limb was passively flexed at hip joint and extended at knee joint till subject reported mild stretch sensation and held for 7 seconds, then subject maximally isometrically contracted the hamstring for 7 seconds by attempting to push his leg against the resistance of the therapist. After the contraction, the subject relaxed for 5 seconds. The therapist then passively stretched the muscle until a mild stretch sensation was again reported and held for another 7 seconds. This sequence was repeated 5 times in the experimental group (BLR group). The duration was noted followed by 2 minute rest and this whole procedure was repeated for 3 times. Post intervention measurements were taken same as for SLR group.

Six readings were taken as pre and post scores of range of motion during 1st, 7th and 14th interventions.

**Results**

Pre and post intervention scores of ROM were analyzed by using mean, standard deviation and ANOVA test. Paired‘t’ test was used to find out any significant difference between pre and post test scores to assess which intervention significantly increased the hamstring flexibility. The mean baseline value of SLR group was 121.5° where as that of BLR group was 123.0° and their comparison gave a non significant value of 0.228. Straight Leg Raise stretching group showed a mean improvement of 2.92° between pre and post intervention after 1st, 7th, 14th sessions, in knee extension range of motion, where as Bent Leg Raise stretching showed a mean improvement of 5.06°. Total improvement in range of motion after SLR stretching following 14th intervention on alternate days were 33.6° where as that of BLR group was 47.4° which indicates that both SLR and BLR improves hamstring flexibility to a great extent but BLR is definitely better.

With in group analysis was done to observe the gain in the range of motion either by SLR stretching technique or BLR stretching technique. Results obtained showed improvements in range of motion, when compared baseline measurement (121.5±2.9) with Post intervention of 1st, 7th, and 14th (i.e. 125.0±3.0,140.0±3.6,155.1±5.1 respectively) for SLR group and found a significant value of 0.000. For BLR group, when baseline measurement (123.0±3.7) was compared with post intervention of 1st, 7th and 14th (i.e. 129.2±3.3, 147.2±7.1, 170.4±7.1), obtained a highly significant value of 0.000.

The results of ANOVA test for SLR group was, F= 409.77 which showed highly significant value i.e. p=0.000 and results for group BLR was, F=237.83. The result obtained for BLR group was also significant i.e. p=0.000.ANOVA calculated to assess if any difference existed across the Pre and Post test scores, with in two groups. Post hoc analysis was done for multiple comparisons with in groups and results obtained indicated that values obtained were highly significant (0.000).

The percentage value showing overall improvement in SLR group was 27.6% and BLR group was 38.5%. When these percentage values were compared a highly significant difference (0.000) showing that the improvement in Active knee extension Range of motion in BLR group was greater in comparison to SLR group.

**Conclusion**

Bent Leg Raise stretching technique is better than Straight Leg Raise stretching technique for improving hamstring flexibility immediately when both of them are administered at the same duration and frequency.
The effectiveness of mobilization with movement along with phonophoresis and exercises in subacute phase of tennis elbow

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Faridabad Institute of Technology, Faridabad, Haryana

Introduction

Tennis elbow originally called lawn tennis elbow was first described by Runge as 'Writer's Cramp' (Gellman 1992, Verhaar et al 1993). It is one of the most frequent lesions of the arm. The origin of Extensor Carpi Radialis Brevis (ECRB) is the most commonly affected structure. Tennis elbow is defined as a pathologic condition of the wrist extensor muscles at their origin on the lateral humeral epicondyle and is a degenerative or failed healing tendon response characterized by vascular compromise with force overload causing angio-fibrotic changes. The dominant arm is commonly affected, with a prevalence of 1% in men and 4% in women. The peak prevalence of tennis elbow is between 35-50 years.

The main symptoms are pain on the lateral side of the elbow and posterior aspect of forearm, sometimes referred to the wrist and into dorsum of the hand that is aggravated with movements of the wrist or by contraction of the extensor muscles of the wrist. Point tenderness is present over lateral epicondyle and reduction in grip strength may also be present. Diagnosis can be confirmed by tests that reproduce similar pain, such as resisted wrist extension.

However, many therapeutic interventions have been used in the treatment of the tennis elbow. These include surgical procedure, drug therapies, physical therapies and strategies to correct factors which are presumed to contribute to the etiology of the disorder. To date no specific interventions have been proved efficacious.

One of the physiotherapy treatments for tennis elbow is Mulligan’s mobilization with movement, which is a system of manual therapy interventions. The concept involves manual application of forces which guide the motion segment in such a manner that superimposed functional movement, with previously produced pain, can occur without pain. Therein lays the fundamental rule of this approach that is the technique should reduce pain if it is to be successful. In case of tennis elbow, the functional active movements which produce pain are usually either gripping or wrist/finger (middle finger) extension. The manual force applied to the medial aspect of the proximal forearm to produce a lateral glide of elbow joint can be applied during the performance of a pain producing functional movement. Some clinicians recommend the use of phonophoresis for 5 minutes and exercises along with mobilization with movement. To our knowledge, there have been no studies of the latter. The aim of this study was to compare the clinical results of the use of phonophoresis and exercises along with mobilization with movement with those of phonophoresis and exercises alone in patients during subacute phase of tennis elbow.

Methods

A controlled, monocentre trial was conducted in a clinical setting to assess the effectiveness of phonophoresis and exercises alone or with mobilization with movement in patients of tennis elbow. A randomized clinical trial design was used. The investigator evaluated the patients to confirm tennis elbow diagnosis, performed 1st, 7th, 14th session pre and post intervention assessments and obtained informed consent.

Patients between 18 to 65 years of age with lateral elbow pain were examined and evaluated in a private outpatient Arya Samaj Physiotherapy Centre, Sector-15 in Faridabad. All patients were either self referred or referred by their doctor or physiotherapist.

Patients were included in the study if, at the time of presentation, they had been evaluated as having clinically diagnosed tennis elbow for more than 3 weeks. Patients were included in the study if they were Cozen’s test positive.

Patients were excluded from the study if they had one or more of the following conditions: (a) Bilateral tennis elbow; (b) lateral elbow pain due to pain originating from neck, shoulder and wrist; (c) Previous fracture of the arm, forearm- causing limitations in upper limb function; (d) had received a corticosteroid injection in the last 12 months before inclusion; (e) Rheumatoid arthritis; (f) Malignancy; (g) Neurological abnormalities;(h) Pregnancy.

The exercise program consisted of slow progressive eccentric exercises of the wrist extensors and static stretching exercises of the extensor carpi radialis brevis tendon. Phonophoresis with Volini Gel via pulsed ultrasound (1:1) at 1MHz frequency and intensity of 1.5 watts/cm² for a period of 5 minutes was applied. In experimental group, along with phonophoresis and exercise program, mobilization with movement, consisting of a laterally-directed manual pressure to proximal medial forearm was applied while patient performed comparable sign motion.

Pain, pain free grip strength (PFGS) and maximum grip strength (MGS) were measured in this study. Each patient was evaluated at 1st, 7th, and 14th session both pre and post intervention. Differences between groups were determined using the Mann-Whitney test. Wilcoxon –Signed Rank test was used for within-group analyses.

Results

28 patients met with the inclusion criteria. When both groups were compared for pain score, pain free grip strength and maximum grip strength at baseline, there was no
significant difference. But there was significant difference when both groups were compared for pain score (p=0.000), pain free grip strength (p=0.000) and maximum grip strength (p=0.001) after the completion of treatment.

When within-group analysis was done, there was statistically significant difference among all variables i.e. pain score, pain free grip strength and maximum grip strength immediately after the intervention on the same session in experimental group but not in another group. When overall improvement was observed, both groups showed improvement in all variables but experimental group had greater improvement.

**Conclusion**

Mobilization with movement reduces pain and improves pain free and maximum grip strength in patients with tennis elbow immediately after the intervention on same session and also at the end of overall treatment.
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