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Original article

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Compare the Effect of Mckenzie Protocol & Back School Program in Mechanical Low Back Pain Individual

Shefali Pushp*, R.K. Meena**

Abstract

Background and Purpose: Mechanical Low Back Pain is a common musculoskeletal disorder which interfere with quality of life and work performance. There is no specification of which exercise has to be followed according to patient requirement. Mckenzie protocol has been prescribed in past few decade in a large scale even the Back School Program. But there is no proper clarification of which exercise has to be given in Back School Program apart from ergonomic advice. So the purpose of study is to compare the Mckenzie protocol and Back School Program in mechanical low back pain individual.

Method : 35 subjects randomly assigned into two group – Group A Mckenzie protocol and Group B Back School Program. The baseline variable for pain intensity is Visual Analog Scale and functional limitation is Modified Oswestry Disability Index were taken on 1^{st}, 12^{th} and 21^{st} day of treatment session for 3 week of duration.

Result: Using one way ANOVA there was significant improvement in Visual Analog Scale and Modified Oswestry Disability Index score for both groups.But unpaired t-test did not show any significant difference in exercise program between groups.

Conclusion: On statistical basis there is no significant difference in Mckenzie protocol and Back School Program exercises, but patient felt better relief in their functional limitation by following Back School Program exercises.

Key words: Mechanical Back Pain; Back School Program; Mckenzie Protocol; Modified Oswestry Disability Index.

Introduction

According to World Health Organization low back pain(LBP) is a leading cause of disability. It occurs in similar proportions in all cultures, interfere with quality of life & work performance. It usually a self limiting that tends to improve spontaneously over time. [1, 2]

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Mechanical low back pain consist of unspecific injury of lumbar colum, could be related to other causes of lumbar pain. It affect 60-90% of population at any time in their lifes. [3]

Exercise therapy is found to be more effective in treating LBP. Two potentially useful treatment for patient are Mckenzie & Back School Program. These programs have good biological plausibility & have modest cost so that patient are better able to understand their condition & how to change their behaviour towards an episode of LBP.[4]

In 1981 Robin Mckenzie proposed a classification system & individualized treatment regimen for low back pain. It is a method based on movement pattern of spine with sustained position performed in specific direction. For any condition certain movement aggravate pain and other movement relief pain. [5]

Back school method was developed in 1969 in Sweden by Mariane, Zachrisson, Forssin, with goal of preventing and avoiding recurrent episode of LBP. The program is composed of theoretical component which include : anatomy & spinal biomechanics, epidemiology, physiopathology of most frequent back disorder, posture, ergonomic, common treatment modalities & a practical component i.e. exercise for maintenance of healthy back.[6]

The aim of the study is to compare Mckenzie protocol and Back School Program for treating patient to reduce pain and get healthy back and thus improve quality of life.

Objective

To find out the effect of Mckenzie protocol in decreasing functional limitation in mechanical low back pain individual.

To find out the effect of Back School Program in decreasing functional limitation in mechanical low back pain individual.

To compare the effectiveness of the Mckenzie and Back School Program exercises.

Scope

Studies on Mckenzie protocol & Back School Program for mechanical low back pain are limited in Indian patient population. Based on this study, exercise which are more effective can be practiced for better out come in LBP patient.

Methodology

35 no. of subjects recruited from Subharti College of Physiotherapy OPD & Subharti Medical College and Hospital.

Inclusion criteria

1. Age 18 to 40 years
2. Gender : both (M & F)
3. History of back pain more than 3 month
4. Modified Oswestry Disability index (MODI)> 10% [7,8]

Exclusion criteria

1. History of any inflammatory spinal disease
2. Severe Deformity of spine – scoliosis, kyphosis
3. History of spinal surgery
4. History of spinal malignancy
5. Any sign of nerve compression
6. Hypertension.
7. Pregnancy /breast feeding
8. Referred pain from viscera.

Sampling

The study included 35 individuals whom informed consent was obtained. On the basis of inclusion criteria patient were randomly assigned into two groups. The subject were informed in detail with the specific sets of exercises. Group A – Mckenzie protocol, Group B – Back School Program.

MODI and Visual Analog Scale(VAS) was collected as a baseline data on 1st day, 12th day and 21st day of treatment session with the total duration of treatment is 3 weeks.

Procedure:

On the basis of inclusion criteria 35 participants were taken in that 20F and 15M. The protocol was followed according to week wise.The patient were asked to come thrice a week. Out of 35 patient 3 patient did not turn back after 1 week of treatment session, so out of 32 participants 15 attended Back School Program and 17 attended Mckenzie protocol. All the participants were given instruction to follow exercise at home daily and report the change in pain or discomfort on next treatment session. [6,9,10]

Detail exercise program has given in table 1A and 1B with description of exercise in table 2A & 2B.

Statistics

SPSS software version 16.0 was used to analyze the result. One way ANOVA was done to get the mean value for both group at 1st, 12th and 21st day for VAS and MODI. Unpaired t-test was used to compare MODI and VAS in Mckenzie and Back School Program.

Result

Out of 35 patients only 32 were participated in this study they divided into two groups. Group A – Mckenzie Protocol and Group B – Back School Program.

Table 1A: General information about Mckenzie method, basic assessment, strengthening exercises and home care advice

Mckenzie Protocol	
1st week	- History & general information about Mckenzie method - Indication of preference of exercise i.e. flexion, extension - Educational component basic information about lower back and its structure - How and why to do exercise. - Guidance of completing exercise at home - Principal treatment modalities.
2nd week	- Progression of exercise after 1st week towards other position in line with response of patient - Educational component basic information about common cause of LBA - Emphasize posture when seated for prolong time and maintain back lordosis in its position. - Guidance continue exercise at home
3rd week	- Progress exercise after 2nd week towards other

Table 1B: Basic guideline about the back anatomy,ergonomic advise at work station,strengthening exercise and home care advice

Back School Program	
1st week	- General information about back school method - Anatomy & biomechanical concept of spine - Muscle function & its influence on spine - Pathology of main disorder that affect back - Principle treatment modality
2nd week	- Guidance on position in back ergonomics Posture correction advice in lifting object, Sitting, standing & sleeping. Proper working environment i.e. use of proper chair, kitchen standing habit, mattress. - Exercise like isometric abdominal strengthening Stretching of erector spine muscle Stretching of quadriceps & hamstring - Guidance on completing exercise at home twice/day
3rd week	- Practical application of all exercise and learned technique.

Table 2A: Description of exercise in flexion as well as extension type with number of repetition

Exercise	Procedure	Duration
Flexion exercise	1. Lying down : Supine position with knee & hip flexed & feet supported on plinth. The patient is instructed to raise knees towards the chest applying extra pressure with hands towards knee.	Beginning 5 to 6 repetition for 5to 10 seconds hold.
	2. Seated : seated in chair with knees and hip at 90^0 patient shifts forward until head in between knees & hands are as close as possible to floor.	Progress 3 sets for 10 repetition
	3. Standing : with feet placed shoulder - width apart, the patient placed his hands on front of thigh gliding them as much as possible in direction of floor keeping knee extended	
Extension exercise	1. Prone lying : lie on patient stomach with arms along both the sides and head turned to one side	5 to 10 minutes hold with 10 repetition
	2. Prone lying on elbow : lie prone position with the weight both elbows and forearm and the hip straight and touching the floor. Relax the lower back remain this position for few minutes and repeat the exercise.	5 to 10 minutes hold with 10 repetition
	3. Prone full press up : lying in prone position slowly push the shoulder up keeping hips on the surface and letting the back and stomach sag fold it for few seconds and then repeat	Beginning 2 seconds hold with 10 repetition Progress 5 to 10 second hold
	4. Standing extension: while standing placed the hands in the corner of back and lean backward maintained it for few seconds and return back	20 seconds hold with the 10 repetition

Table 2B: Stretching and strengthing exercise for back and abdominal muscle with appropriate duration

Exercise	Procedure	Duration
Stretching of erector spina muscle	Supine position with flexed knees & supported feet, bring 1^{st} one knee and then other towards thorax, joint hands across thigh, push them in direction of thorax.	30 second with 10 repetition.
Stretching of posterior lower limb muscle	Supine position with one of leg supported on mattress and other flexed approximately 90^0 at hip and knee extended maintain with help of other therapist or against the wall.	30 second with 10 repetition.
Strengthening of abdominal muscles	In supine position with both hip and knee is band and a towel roll is placed under the patient's low back and then asked to press the towel with the back and hold the position for few seconds.	10 second with 10 repetition.
Kinesthetic training	In Seated, move pelvic making a front & back pelvic inclination at comfortable range	One set for 10 repetition.

Statistical analysis of data revealed that initial analyses done with one way ANOVA to see the F value within the group and between the group for VAS and MODI at deferent time period givn in table 3 shows significant improvement in pain and disability index.

Further using one way ANOVA mean value ± S.D. was done at different days i.e. 1^{st}, 12^{th} & 21^{st} day (table 4 and figure 1 & 2. As a result shows there was not much difference in VAS score between 12 & 21 day though it was significant, but MODI score was much batter by the end of 21 day.

Comparison of group were done using unpaired t-test showed in table 5. In which VAS and MODI score was compared for justifying that the MODI was highly significant than VAS.

Table 3 shows one way ANOVA at different time point for F and P-value which is significant in both groups for VAS and MODI.

Table 4 shows mean and standered deviation for VAS and MODI in each group. MODI shows better result in Back School group as compared to Mckenzie group.

Table 5 shows unpaired t-test to comparison of groups for VAS and MODI score at different days. At the end of 12th and 21st day VAS was significant and not much changes in score, where as MODI showed excellent recovery.

Table 3: One way ANOVA F value for significant difference in Mckenzie & Back School Program for VAS and MODI at different time point

Group	Variable	Source of Variation	SS	DF	MS	F	P-value
Mckenzie Protocol	VAS	Between group	88.5454	2	44.2727	67.6388	7.6489 P<.05 (sig.)
		Within group	19.6363	30	0.6545		
	MODI	Between group	2363.879	2	1181.939	47.427	5.1378 p<.05 (sig.)
		Within group	747.6364	30	24.9212		
Back School Program	VAS	Between group	121.0769	2	60.5384	57.5853	6.0677 P<.05 (sig.)
		Within group	37.8461	36	1.0512		
	MODI	Between group	4424.205	2	2212.103	83.5429	2.99 P<.05 (sig.)
		Within group	953.2308	36	26.4786		

Table 4: Mean & S.D. for VAS and MODI at different days in Back School Program and Mckenzie Protocol

Group	Variable	1st day	12th day	21st day
Mckenzie protocol	VAS	6.4545 ± 1.0357	4.7272 ± 0.7862	3.5909 ± 1.333
	MODI	32 ± .0605	22 ± .0535	17 ± .0665
Back School Program	VAS	6 ± 1.2247	3.615 ± 1.043	2.6538 ± 1.3249
	MODI	34 ± .0647	18 ± .0552	13 ± .0657

Table 5: Using probable value of unpaired t-test

Variable	1st day	12th day	21st day
VAS	.3353 (p>.05)NS	.0071 (p<.05) sig	.0081 (p<.05) sig
MODI	.6090 (p> .05) NS	.0906 (p>.05)NS	.0044 (p<.05) sig

Discussion

Mechanical back pain is a common feature which originate from abnormal functional pattern of soft tissue that could be mechanical, biomechanical, psychological and neurological. Once low back pain occurred it will impact on quality of life of the individual in family. Popularity of Mckenzie method since past few decade has made it known throughout spine community and most surgeon and physical Physiotherapist. Previous study has shown that Back School Program is not very effective chronic back pain but in mechanical back pain it has shown a positive result.

Andrade et al evaluated the efficacy of Back School Program for non specific base. They evaluated 3 baseline variable i.e. pain intensity (VAS), functional disability (Roland Morris disability questionnaire) and spinal mobility. On the basis of analysis they observe statistically significant difference in functional disability and spinal mobility. [11]

Some other author claimed that using Back School Program which included brief education and active back exercises in comparison with medical assistance observe significant improvement in disability score along time (p<.001) in back school group. Moreover pain perception on VAS score showed a reduction in both groups but it was significantly lower in back school group. [12]

The perception of a exercise as a conservative treatment for lumber pain are effective but prescribed without adequate evaluation of the individual characteristic like posture, muscular force and extensibility. The divide in two group with similar age, weight and gender characteristic and found that group who received specific exercise significantly reduce their level of pain and disability. Thus clinician should prescribe on basis of individual muscular deficit rather than most commonly prescribe exercise program. [13]

Another study also done on the same theory, they said that Mckenzie method is grounded

Figure 1 & 2: ANOVA applied for comparing the initial, mid and last reading of VAS and MODI

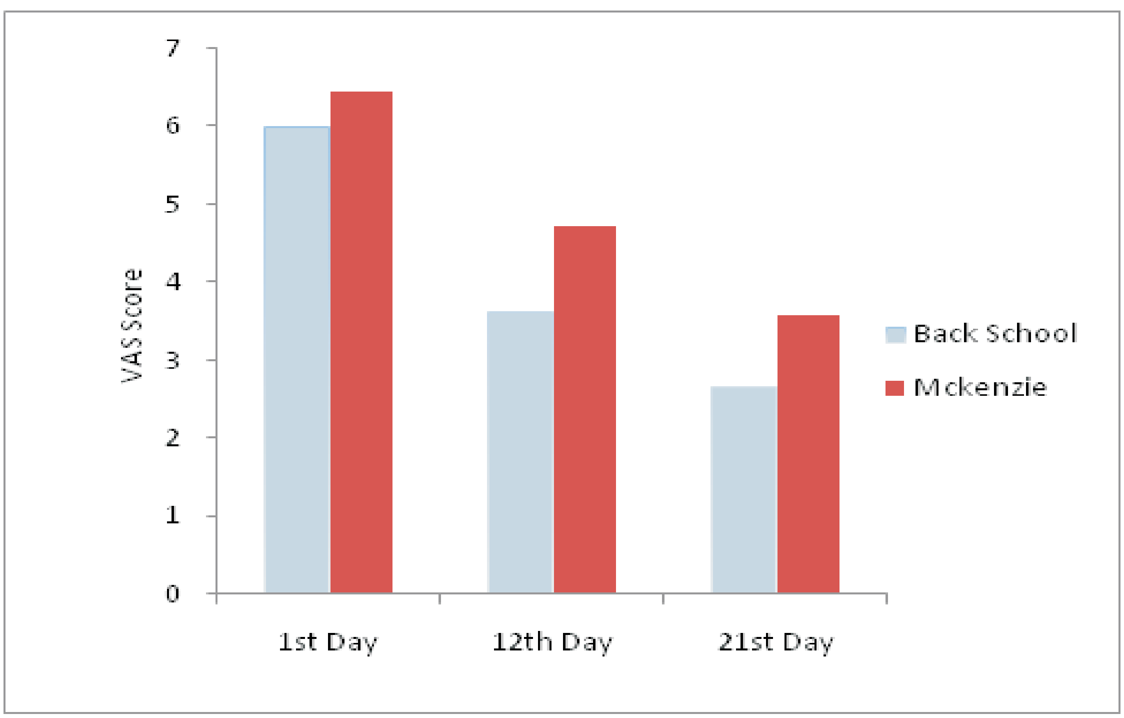
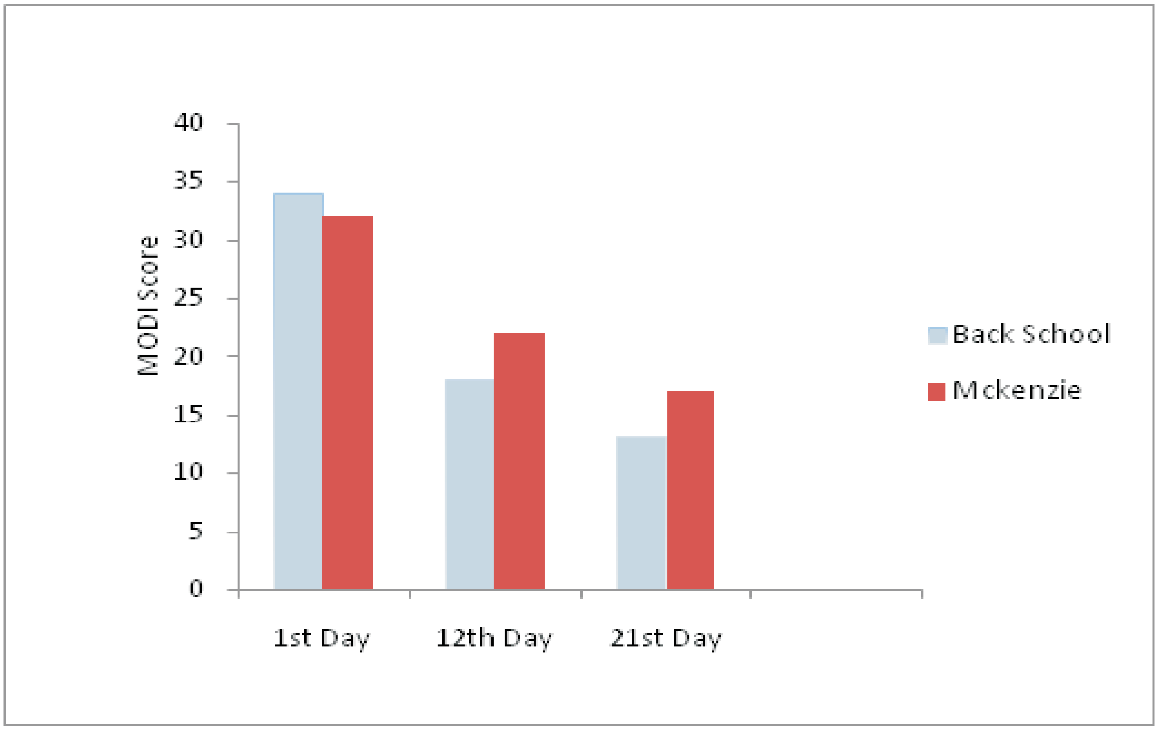


Figure 1 both the group shows improvement in VAS

Figure 2 In Back School Program MODI score shows more Improvement as compare to Mckenzie group



in finding a cause effect relationship between position of the patient usually assume while sitting, standing or moving and generation of pain as a result of those position and attitude or activity. The therapeutics approaches require a patient to move through series of activities and test movement to gauge the patient response. The approach then uses information to develop an exercise protocol design to centralize or alleviate pain. [10]

Many studies claim the suitability and usefulness of using active back school management which include health education, skill development, theoretical session to minimize the recurrency of episode of LBA. And improvement pain, vitality and mental health which improve total quality of life. [14, 15]

Another study in which subject were assign into two groups - back school and control group. In which back school included cognitive learning strategies and practice correct lifting. There were a significant difference between the group which indicated that Back School Program is an effective tool for influencing lifting posture but it may not be effective means of preventing low back injury. [16]

Julia et al compared Modified Oswestry Disability Index and the Quebec back pain disability scale. The test retest reliability over a four week period was higher for Modified Oswestry disability scale than for Quebec disability scale. [17]

Two randomized trial was done by Nwguga found that Mckenzie therapy provide better result than Back School Program in respect of less sick leave, fever reoccurrence and medical consults with increase ROM of lumbar spine. [18]

Mckenzie is successful with treating acute low back pain with benefit is that it is standardized approach to both assessment and treatment of LBP which is simply a set of exercise to define algorithm that serve to classify the spinal problem so that it can be adequately treated. [19]

Our study bear the same idea to introduce such exercises which suitable according to person need and lifestyle with respect of either Mckenzie or Back School Program.

Limitation of study

1. Limited trial of three weeks where undertaken; a longer duration of trial phase is required in future.
2. Study was done on a small sample size.

Future Scope

1. Prolong study duration may yield a significant result of same study.
2. The study address the requirement of correct exercise prescription.
3. Study can be done in large group of patient to have a better result.

Conclusion

While comparing Mckenzie and Back School Program it emerged that both program has significantly improved. But improving functional limitation on basis of MODI score was better gain by Back School Program in mechanical back pain individual which further help in reducing functional limitation and thus improving quality of life.

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A Correlation Between Core Stability and Athletic Performance: An Electromyographic Study

Daljeet Singh*, Saurabh Sharma*, M. Ejaz Hussain**

Abstract

Study Design: Correlation study.

Objectives: To objectively evaluate the relationship between core stability and athletic performance measures in male collegiate athletes.

Background: The relationship between core stability and athletic performance has yet to be quantified in the available literature. The current literature does not demonstrate whether or not core strength relates to functional performance. Questions remain regarding the most important components of core stability, the role of sport specificity, and the measurement of core stability in relation to athletic performance.

Methods: A sample of 30 volunteer student athletes from Jamia Millia Islamia provided informed consent. Participants performed two tests: single arm raising experimental (core stability test) and a backward overhead medicine ball throw (power performance). Each participants performed tests in randomized order.

Results: Correlations between the core stability test and performance test was determined using Karl's Pearson correlation coefficient. Medicine ball throw positively correlated to the core stability test ($r = 0.71$, $p = 0.023$). Coefficient correlation minutely changed in between top and bottom performers. Gender was the most strongly correlated variable to core strength, males with a mean measurement of double leg lowering of 47.43 degrees compared to females having a mean of 54.75 degrees.

Conclusions: There appears to be a strong link between a motor control of core stabilizers and athletic performance tests. Performance test used in study needed precise timing of core muscles so that explosive power created in legs and core can be efficiently transferred to the throwing arm. More research is needed to determine if there are specific sub-categories of athletic performance (other than power) which can correlate with motor control of core. However, future studies should seek to correlate more tests of athletic performance with motor control of core stabilizers.

Keywords: Core stability; BOMB-throw; Performance; Power.

Introduction

In most of sports activities, the human body acts in the form of a kinetic chain and the core serves as the center of this functional kinetic chain. The kinetic chain is the coordinated, sequenced activation of body segments that places the distal segment in the optimum position at the optimum velocity with the optimum timing to produce the desired athletic task. For optimum functioning of kinetic chain, two aspects of it i.e. stability and mobility should work together in harmony. Mobility is required at distal segment of limb to complete athletic task. On the other hand, stability is required at proximal part of kinetic chain i.e. core. For the kinetic chain to function at its maximal capability, athletes must maximize the relationship between providing sufficient stability while producing forceful motions of sport performance. Since the core is central to almost all kinetic chains of sport performance tasks, control of core stability,

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core strength, and motion will maximize upper and lower body extremity function.[1]

Success in a majority of sports is dependent upon producing external forces while maintaining dynamic stability. Balance is maintained by keeping the body's center of gravity over its base of support. External forces have the potential to disrupt balance by altering the center of gravity.[17] While external loads are acting on the body, internal forces, particularly in the lumbo-pelvic-hip complex, are utilized to maintain equilibrium of the body.[18] Communication between the musculature of the core and the neuromuscular system is what enables the body to regain this new equilibrium state[19], and allow for core stability to occur.

Figure 2: Electrode Placements

Anticipatory postural adjustments of the core are determined by pre-programmed muscle activations.[1] Ebenbichler et al[20] demonstrated this concept in showing that other muscles contract before the limb agonist when stability is challenged due to limb movement. These postural adjustments allow the body to increase proximal stability and allow distal mobility. A model for evaluation of motor control strategies for stabilization of spine would necessarily involve identification of the coordination of muscles contributing to spinal stiffness generation. On the basis of previous argument, Tr.A should be included. Garry et al[21] were the first to show that the feedforward response of Tr.A is clearly directionally specific to the side of the arm movement, and is not bilaterally symmetrical.

Particular attention has been paid to the core because it serves as a muscular corset that works as a unit to stabilize the body and spine, with and without limb movement. In short, the core serves as the centre of the functional kinetic chain. In the alternative medicine world, the core has been referred to as the "powerhouse," the foundation or engine of all limb movement. This relationship may prove challenging to define because functional and core demands are typically sport or position specific and many questions, such as which element of core stability is most essential to performance, remain unanswered.

Role of core in athletic performance has given a task to physical trainers, coaches, and physical therapists to properly train the core. Proper assessment precedes the proper training of core. Core stability is thought to have many components like core strength, endurance, power, coordination, balance etc. There has many tests for different components of core stability but previous studies were unable to establish a correlation between these components and measures of athletic performances. Core strength as a component of core stability was used by Sherrock et al[2] & Shinkle et al[3] .Similarly, core endurance was used by Nesser el al[4], Stanton et al[5] Sato & Mokha[6] Scibek et al[7] and they also failed to explain its relation with sports performance. Because of these results, relation between core stability and performances remained theoretical only.

Present study is addressing the power component of performance. This component along with strength is considered the assert for athletes in a number of sports. These athletes require high amount of energy to perform sporting activities. This high force cannot be created locally but need entire body to work as a single unit. For efficient execution of athletic tasks this single unit needs to have a stable base to work upon. Apart from creating a foundation, core has responsibility of creating, transferring, and finally controlling these forces towards limbs.

Above mentioned fundamental functions of core require core to be stable. On the other hand, repetitive limb movements of an athlete (during sporting activities) always endanger core stability. During a particular event repetitive movements of athletes challenges the core stability. Thus in sports, core has to

Figure 3: EMG showing muscle onset of Tr. A

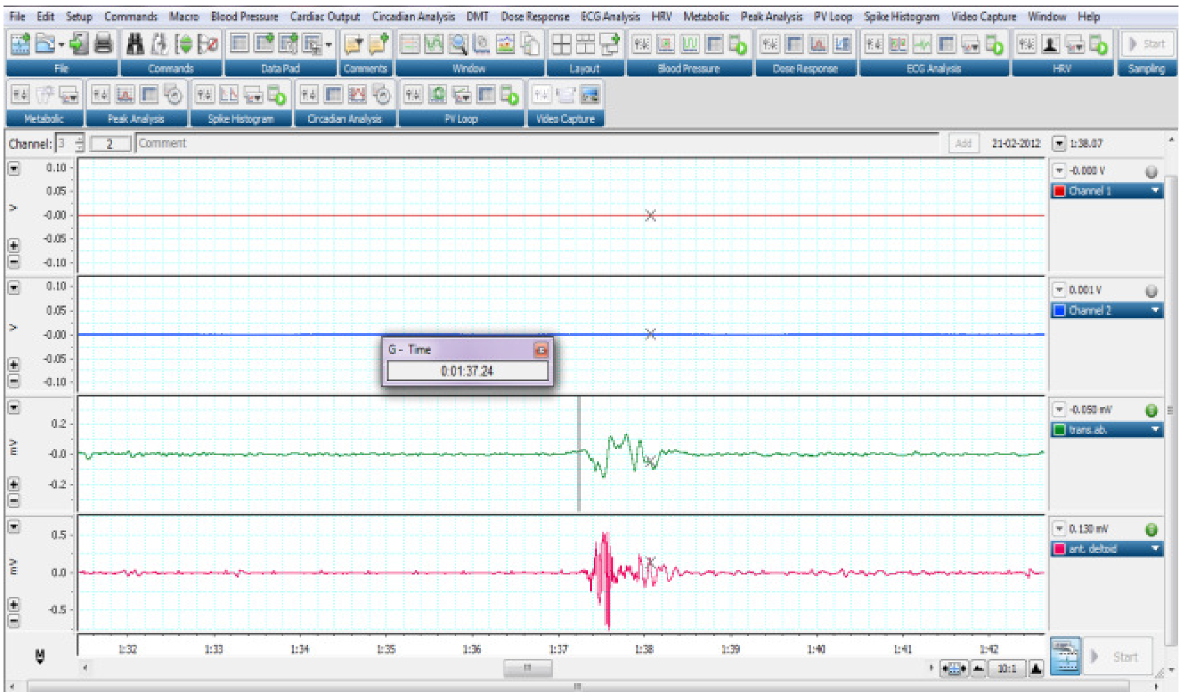
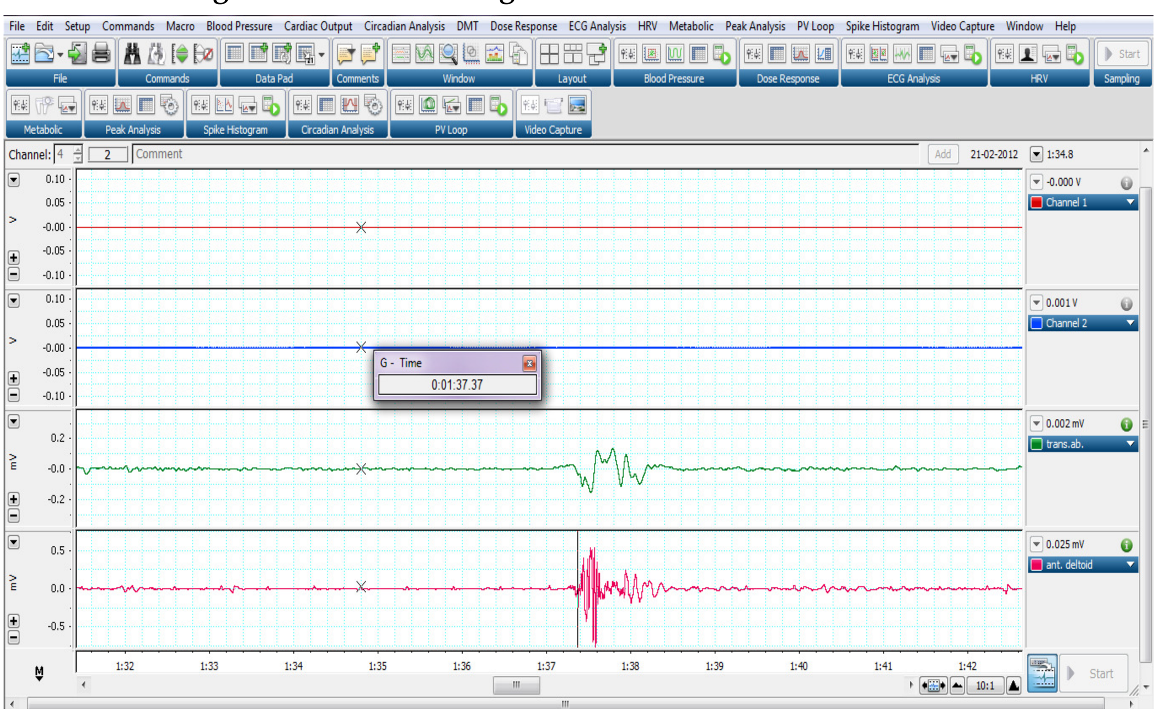


Figure 4: EMG showing muscle onset of Anterior deltoid



maintain its stability against these perturbations along with performing its other fundamental functions. These added demands further increase the importance of core stability. Several trunk muscles (especially Tr.A) work in anticipation to cancel out deteriorating effects of these perturbations.

Table 1: Descriptive statistics for entire group (n=30)

Parameter	Minimum	Maximum	Mean	SD
Age (yrs.)	18	25	20.6	1.77
Weight (kg.)	48.9	78.2	62.59	7.44
Height (m.)	1.5	1.8	1.7	0.065
BMI	18.99	24.65	21.60	1.75
Latency period (msec.)	23.25	18.05	53.16	18.72
BOMB – score (ft.)	88.85	40.3	30.87	5.38

SD= standard deviation

Table 2: Correlation matrix for entire group (n=30)

Parameter	r-value	p-value
Age (yrs.)	-0.121	0.525**
Weight (kg.)	0.636	0.000*
Height (m.)	0.486	0.006**
BMI	0.474	0.008**
Latency period (msec.)	0.772	0.000**
BOMB –score (ft.)	1	

*Statistically significant (p<0.05)

**Statistically significant (p<0.01)

Table 3: Correlation between core stability and performance (n=30)

Sports	n	r-value	p- value
Cricket	12	0.8936	0.00*
Hockey	5	0.7179	0.172*
Badminton	4	0.6409	0.359
Football	3	0.6996	0.507
Sprint	6	0.9398	0.005**

*Statistically significant(p<0.05)

**Statistically significant (p<0.01)

Previously many efforts have been made to establish correlation between measures of athletic performance and core stability, with most of them failing. This is the first study that is using motor control of core stability to relate it with athletic performance Author of present study is hypothesizing that motor control of these trunk muscles could be one of determinant of power performance.

Results of these studies made present author to think of other core components as a measure of sports performance. Previous literature of rehabilitation field has a done a lot of work on motor control of core muscles in LBA populations. They have confirmed the role of precise timing of Tr.A in core stability. Feed forward mechanism of Tr.A in response to sudden limb movements has given a new measure of core stability i.e. latency period. This latency period is the time difference between recruitment of Tr.A and prime mover. It was the purpose of this study to examine the relationship between latency period and bomb throw among college aged males.

Table 4: Correlation between core stability and performance (n=30)

Performance	n	r-value	p- value
Top	15	0.6666	0.007**
Bottom	15	0.6646	0.007**

*Statistically significant(p<0.05)

**Statistically significant (p<0.01)

Table 5: Correlation between core stability and performance (n=30)

Performance	n	r- value	p- value
BOMB Ist	12	0.8768	0.000**
EMG Ist	18	0.7090	0.001*

*Statistically significant(p<0.05)

**Statistically significant (p<0.01)

Materials and method

Subjects

It was a correlation study which was conducted on 30 collegiate male athletes who were in age group of 18-26 years. The participating players in this study had means height (170cm±6.5), mean weight (62.59±7.44kg), mean age (20.6±1.77) and mean BMI (21.6±1.75). Subjects were excluded if they had neurologic symptoms or pathological conditions in the back, shoulder, elbow, wrist. The study was approved by the Institutional Medical Research Ethics Committee.

Experimental design

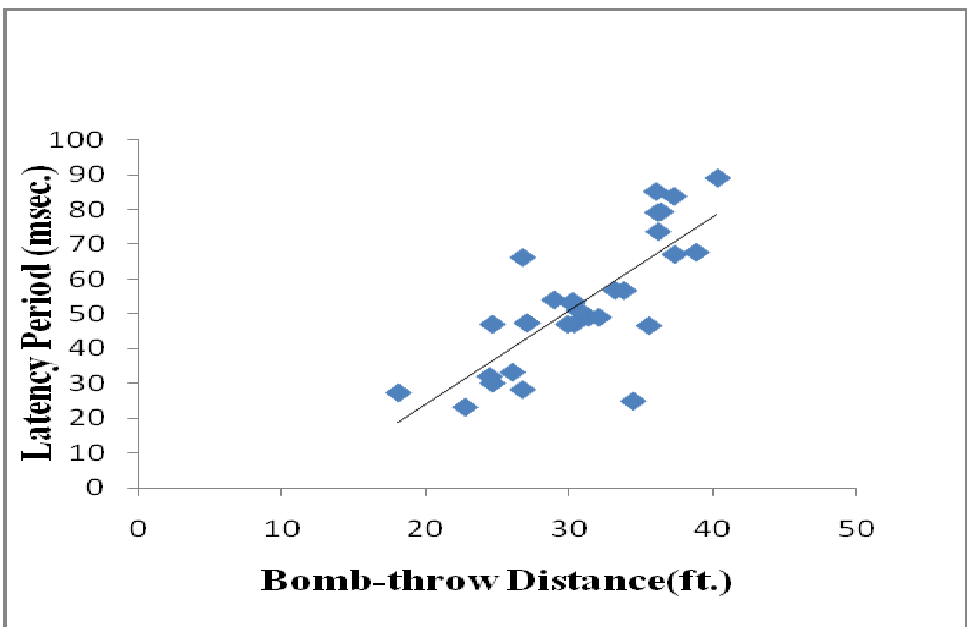
Standing subjects performed rapid unilateral upper limb movement at the shoulder in flexion. Measurements were made of electromyographic activity (EMG) of the Tr.A and deltoid muscles. Analyses concerned primarily the perturbation provoked by the initiation of limb movement.

ASIS and for anterior deltoid it was on the centre muscle belly.

Procedure

The EMG activity of the muscles evaluated was monitored throughout the procedures, and the subjects were encouraged to relax consciously if the degree of muscle activity increased above a resting level. Subjects stood relaxed with the feet comfortably spaced shoulder width apart and were encouraged to maintain equal weight bearing. Ten consecutive repetitions of rapid upper limb movement in flexion were performed as fast as possible in response to a verbal command with the emphasis on speed of movement rather than distance moved. At the completion of each movement the limb was immediately returned to the start position. Each repetition

Figure 1: Scatter Plot showing relationship between latency period and BOMB-throw score



Electromyographic Recordings

Surface electromyography (EMG) electrodes were used. Ag/AgCl surface electrodes were placed over the anterior portion of the left deltoid & right Tr.A. Surface electrodes were placed in parallel with the muscle fibers with an interelectrode distance of 32mm. The Tr.A electrode was placed 2 cm infero-medial to

was separated by a rest period until EMG activity was at resting level. Shoulder flexions were performed to approximately 180° from the initial position with the arms resting by the side.

Due to the role of the Tr.A in respiration[8], the command to move was timed to coincide with the end of expiration. In order to achieve this timing, the examiner continually monitored the subjects' breathing cycle by observation of the chest wall and abdominal movement. Comman to move was given just prior to the end of expiration. The subjects were not informed of this coordination of the stimuli and phase of respiration. A trial was not considered if the subject was attempting to laugh, cough, and talk, and so on.

Data processing

EMG data were sampled at 1,000Hz, bandpass filtered between 20 and 1,000 Hz, and stored on computer for analysis (AD Instrument, Australia). Following data processing the onsets of EMGs were identified visually as the point where the EMG activity exceeded the background level of activity. EMG onsets identified in this manner earlier have been compared with onsets using Matlab software values and found to be accurate[9]. All EMG onsets were checked visually to ensure that they were valid and not interrupted by artifact from movement or the ECG.

The latency between the onset of EMG of anterior deltoid and Tr.A muscles formed the basis of the analysis. The trunk muscle activity was regarded as "feedforward" if its onset occurred between 100msec before to 50msec after that of deltoid. This period provides insufficient time for a response of the trunk

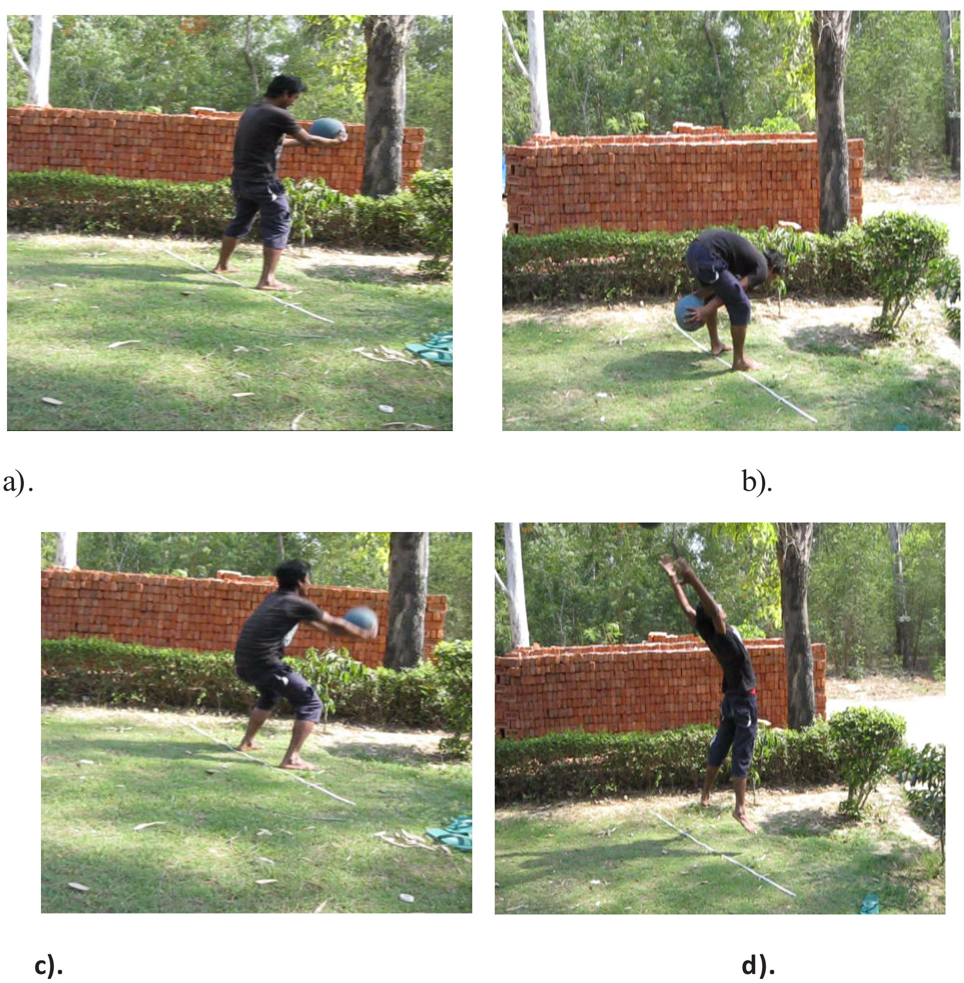


Figure 3.5. Backward overhead medicine ball throw from lateral view. a) Preparatory phase. b) Countermovement phase. c) Upward acceleration phase. d) Deceleration phase.

muscles to be mediated as a result of even the fastest monosynaptic reflex.[10]

Performance test (Backward, Overhead Medicine Ball Throw)

Before any testing, the protocol was explained to the participants. This was followed by a demonstration of the backward, overhead medicine ball throw. The backward, overhead medicine ball throw was then performed individually by each participant in accordance with recommended protocols previously outlined by Stockbrugger & Haennel.[11] Participants performed the protocol 6 times, using a 3 kg rubber medicine ball.[11] Out of 6 throws first 4 were warm up throws to reduce incidence of injury and to familiarize participant. Each trial was measured for distance (ft.) to the nearest 0.1 ft, and each trial was followed by approximately 2 min of passive rest before the subsequent trial. This time interval was measured manually by stopwatch and was selected as restoration of ATP-PC stores following short burst alactic anaerobic exercise takes place in approximately 2 minutes.[12]Incorrectly performed trials were repeated.

Data Analysis

Correlation tests was used in order to determine whether relationships existed between core stability (latency period) and core power tests (Backward Overhead Medicine Ball test). All data were entered into SPSS 20.0 for statistical analysis. Descriptive statistics, including age, height (m.), weight (kg.), BMI and mean scores for core stability and performance tests were calculated for all subjects. A two-tailed Pearson Correlation analysis was performed to determine if relationships existed between core stability (latency period) and performance (BOMB-throw).

Results

All 30 subjects successfully completed the testing procedures. Descriptive variables including both the mean and standard deviations of subject characteristics and the test scores are presented in Table 1.

Recall that latency period was selected as a measurement of core stability. Correlation data results showed positive correlations between latency period and BOMB- throw (r=0.772). A strong positive correlation was discovered between performance test and subject's descriptive variables i.e. weight(r =0.636), height(r =0.486), BMI(r =0.474) too. However performance measure had a negative correlation with age (r = -0.121). As most general statistical descriptors of relationship require greater than 0.5 to begin the moderate to strong rankings. The medicine ball throw was shown to have strong correlation with latency period along with descriptive parameters of subjects with exception of age. See Tables 2 for data

When the results were divided into different categories according to sports they play, the medicine ball throw was still strongly correlated to core stability. Sports wise categorized data was still found to have statistically significant strong correlations (0.640–0.939) with best correlation seen in cricketers and lowest with badminton (table 3).

To determine if there was a difference in correlation between test values in those who had higher performance scores and those who had lower performance scores, the data were halved. The median performance score (BOMB-throw) was used to divide the participants. Both top and

bottom performers showed the strong and significant correlation between the medicine ball throws and core stability. The top performers showed a very close correlation with bottom performer i.e. 0.666 and 0.664 respectively (table 4).

Further categorization of data was done to see if correlation (between core stability and performance) changes test order. So, data was again bifurcated according to testing procedure performed first (BOMB-throw or EMG). Although in both situations, correlation was still strong positive, but performance test done first (r =0.876) showed higher correlation than EMG done first (r =709). See Tables 5 for data.

Figure 1 is showing scatter plot showing relationship between latency period and BOMB-throw score.

Discussion

The purpose of the study was to determine the correlation between dynamic core power test (BOMB-Throw) and core stability (i.e. latency period). There was strong positive correlation between these two attributes (r=0.772, *p*-value <0.0001). This could be because of specificity of tests being used in the study.

Function of core during BOMB- throw can be summarized as generation of force, transfer of force to throwing shoulder & formation of stable foundation for execution of a power throw. These fundamental functions require core to be stable.[1] On the other side, fast moving body segments (while throwing) would cause spinal perturbations compromising core stability. So subject having higher latency period would be able to negotiate spinal perturbations in better manner that in turn would lead to stable core finally leading to better scoring in power throw.

Although power throw with medicine ball are designed in three ways i.e. forward abdominal power test (FAPT), side abdominal power test (SAPT) & BOMB throw. Nikoleno et al[13]suggested that FAPT & SAPT tests are easy to perform in the field but not specific to the power measures used in his study. Nikoleno further suggested that in order to properly evaluate the core musculature or its role in performance, sports-specific core tests need to be utilized. Furthermore, the BOMB-throw has been suggested as an appropriate method to assess total body explosive power in athletes[11] as it assesses integrated movement and is specific to sports performance.[14]

Similar kind of study was performed by Shinkle et al[3] The results of the medicine ball throws were compared with several athletic performance measurements: 1 repetition maximum (1RM) squat, squat kg/bw, 1RM bench press, bench kg/bw, countermovement vertical jump (CMJ), 40-yd dash (40 yd), and proagility (PrA). The results indicated that core strength does have a significant effect on an athlete’s ability to create and transfer forces to the extremities.

To properly measure the core and its role in performance, sport and skill-specific tasks (throwing velocity, club or bat velocity, tennis serve velocity, etc.) may need to be evaluated.[15] Although some previous studies have focused on some sport-related tasks, such as the 100-yard swim[7] and 2000-m rowing[15], significant results were not found, either because the core training protocols were not specific to performance or the performance tests focused more on cardiovascular fitness and muscle endurance. One study[16] that looked at a specific task and how it was affected by an 8-week training program was that of, who looked at club head speed in golfers. They found that the experimental group had an increase in club head speed of 4.9%, while the control group slightly decreased.

Conclusion

The results of present study indicated that a significant strong positive correlation exits between latency period as a measure of core stability and medicine ball throw. These results consolidated importance to core as a mean of transferring force from core itself to distal segments. This study also gives importance to specificity of test for measuring attributes of core stability or athletic performance. Although present study showed strong positive correlation between motor control of core stabilizers and athletic performance, but some limitations were observed during tests procedures. Equal weight bearing on feet, speed of arm during EMG measurement and motivational component of the participants’ performance during couldn’t be assured. It would be beneficial to examine relationship between latency period and additional athletic performance tests. Future researcher should also seek to correlate latency of Tr.A during lower extremity with athletic performance. Additional researcher should focus on specific sports performance e.g. points per game, goal scored etc.

Prior to this study, relation between core stability and athletic performance remained hypothetical & theoretical in nature. This is the first study that is establishing strong correlation between these two attributes.

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Original article

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Comparison of Effects of Specific Stabilization Exercise and Conventional Back Extension in Management of Chronic Disc Prolapse

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Abstract

Purpose of study: To evaluate the effect of the two exercises, Specific Stabilization exercise and Conventional Back Extension exercise on relieving chronic disc prolapse pain. In addition, this study attempts to draw a conclusion as to which exercise is more effective for chronic low back pain.

Materials and Methods: 20 patients with chronic disc prolapsed were divided into two groups. 10 patients in Group A received Specific stabilization exercise and 10 patients in Group B received conventional back extension exercise.

Pain perception was measured using the Visual Analogue Scale (VAS), a responsive pain scale that yields reliable and valid data. Disability was measured using the Ronald – Morris Disability Questionnaire (RMDQ). Both the intervention periods were for 4 weeks at a frequency of 5 times / week for 30-45 min. Each exercise consists of 3 sets and 10 repetitions (10 sec hold) in each set. Progression was made when a patient was able to perform three sets of 10 to 15 repetitions of an exercise with ease.

Results: In the study there was a decrease in the pain status in patients who were given conventional back extension exercise but there was a more marked relief in patients who were given Specific stabilization exercises according to paired sampling.

Conclusion: Training of the specific stabilization exercise in study group A showed a significant improvement in decreasing pain and in improving functional ability when compared to strengthening exercise in group B after a treatment protocol of four weeks.

Key Words: Chronic disc prolapse; Conventional back extension exercise; Specific stabilization exercises.

Intorduction

Therapist have known for long time that performing knee rehabilitation without first training the vastus medialis oblique (VMO) which is a local stability muscle can lead to patellofemoral problems and the same concept is being used on patients with low back pain.

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This concept of retraining the local stability system in people with low back pain has made its way into the physical therapy setting within the last four to five years and is not altogether a new way. The concept is to create stiffness in the spine before load is placed on the spine, thus controlling mid range or neutral zone. Control of this mid range helps to reduce shear force and compression during movement and spinal loading. When working properly, the local intrinsic musculature fibers works before the actual motion of an extremity or of the trunk occurs. Thus pre-contraction of the intrinsic musculature can become delayed or inhibited in the presence of pain or pathology. This delay, or inhibition of the stability system, decreased a patient's ability to control a joint neutral position during movement or under load.

A prolapsed disc was defined as one that protruded beyond the vertebral body margin but contained within an intact annulus. In adult disc herniation is common and often caused by trauma.

Local stabilizing musculature activation occurs automatically in a preparatory manner prior to movement. Failure of this preparatory stabilizing mechanism is identified as primary cause of persistence low back pain. Literature that has developed from and is supportive of the "segmental stabilization/motor control" model has generated research highlighted by the following:

A) Transverse abdominis contrast separately from the other abdominal muscles and its contraction precedes that of primary mover. This preparatory spinal stabilization contraction is lacking in subject with LBP.

B) The lumbar multifidus muscle function in a similar, preparatory manner in normal subjects to provide segmental stability and movement guidance between segments.

The typical back exercise programs, like gym based rehabilitation program, pool therapy, and Pilates are too advanced for low back pain patients prior to retraining the tonic holding capacity and isolated co-contraction of multifidus (MF) and transverses abdominis (TrA).

The co-contraction of the TrA and the MF muscles occurred prior to any movement of the limbs. Back injury patients were unable to recruit their TrA and MF muscles early enough to stabilize the spine prior to movement. Furthermore, the MF muscle showed poor recruitment in back injury patients, again showing how the recruitment of these deep trunk muscles is very important.

The aim of this study was to investigate whether specific stabilization exercises or conventional back extension exercises are effective in people with chronic intervertebral disc prolapse. Our experimental hypothesis was that training programs consisting of specific stabilization exercises or conventional back extension exercises would be effective in reducing patient self-reported pain, disability and improving activity of deep stabilizing muscles (TrA and MF) as these muscles undergo atrophy after injury.

WEEK	EXPERIMENTAL GROUP A	EXPERIMENTAL GROUP B
I	1) TrA Contraction in crook lying Position (Drawing in)	1) Prone with single arm/leg lifts
	2) 4 point kneeling and trying to Hollow the lower abdominal	2) Prone with alternate arm and leg lifts
II	3) TrA Contraction in sitting and standing	3) Prone on elbows
	4) Heel slides with transverses abdominis contraction	4) Prone with double – arm / leg lifts
III	5) Abdominal hollowing with legs Supported and hips and knees at 90°	5) Prone on hands
	6) Bridging	6) Quadruped position and extend one arms / leg
IV	7) Abdominal hallowing with legs unsupported and hips and knees at 90°	7) Quadruped position and extend alternate arm and leg
	8) Single leg bridging with spine n neutral position	8) Prone with both double arm and double leg lifts

Methodology

The study was conducted in MGMs Institute of Physiotherapy, Aurangabad from July 2011-December 2011. This was a randomized clinical trial study design. Consent to carry out the study was granted by the Institutional ethical clearance committee. Both male and female (20 subjects) individuals suffering from chronic PIVD were enrolled for that study.

Inclusion criteria

1. Patient having complaint of disc prolapse for more than 12 weeks.
2. Age between 20 and 40 years old.

Exclusion criteria

1. Back pain attributed to any specific pathology: e. g., disc to any specific pathology, tumor, infection or fracture etc.
2. Patient is unable to walk without a walking aid.

Table 1: Age-wise and sex-wise distribution of patients.

Age Group (yrs)	Male		Female		Total
	Group A	Group B	Group A	Group B	
20 -25	0	2	2	1	5
26 -30	5	1	3	6	15
Total	5	3	5	7	20

Table 2: Distribution of patients in groups according to duration of pain:

Duration of pain	Group A	Group B	Chi-square value	P-value
0 – 6mths	3	2		
7 – 12mths	5	4		0.81
13 – 18mths	1	2	0.978	NS
19 – 24mths	1	2		
Total	10	10		

Material

Ronald and Morris disability questionnaire

Visual analogue scale

Sample techniques

Simple random sampling

Both experimental groups followed two different exercise regimens separately.

Table 3 : Inter-Group Comparison of VAS in Group A and Group B at Week 1, Week 2, Week 3, Week 4: (unpaired t-test)

VAS	Group	N	Mean±S.D.	95% Confidence Limit	t-value	p-value
Week 1	Group A	10	5.44±1.51	4.52 to 6.37	0.758	P=0.46 NS
	Group B	10	5.90±1.10	5.02 to 6.77		
Week 2	Group A	10	3.50±0.85	2.93 to 4.06	2.63	P=0.017 S
	Group B	10	4.50±0.85	3.93 to 5.07		
Week 3	Group A	10	1.90±0.738	1.287 to 2.51	3.64	P=0.0019 S
	Group B	10	3.40±1.07	2.79 to 4.01		
Week 4	Group A	10	0.80±0.789	0.126 to 1.47	2.43	P=0.026 S
	Group B	10	1.90±1.20	1.26 to 2.57		

Statistical analysis

The statically analysis was performed using paired t test for intra group comparison and unpaired t test for inter group comparison.

Table 4: Intra-Group comparison of VAS in Group A at Week 1, Week 2, Week 3, Week 4: (paired t-test)

	VAS	Mean Difference	t-value	p-value
Group A	Week 1 vs. Week 2	1.94	5.460	P=0.000 S
	Week 1 vs. Week 3	3.54	10.247	P=0.000 S
	Week 1 vs. Week 4	4.64	11.500	P=0.000 S
	Week 2 vs. Week 3	1.60	6.000	P=0.000 S
	Week 2 vs. Week 4	2.70	10.371	P=0.000 S
	Week 3 vs. Week 4	1.10	3.973	P=0.003 S

Table 5: Intra-Group comparison of VAS in Group B at Week 1, Week 2, Week 3, Week 4: (paired t-test)

	VAS	Mean Difference	t-value	p-value
Group B	Week 1 vs. Week 2	1.40	6.332	P=0.000 S
	Week 1 vs. Week 3	2.50	9.303	P=0.000 S
	Week 1 vs. Week 4	4.00	18.974	P=0.000 S
	Week 2 vs. Week 3	1.10	6.128	P=0.000 S
	Week 2 vs. Week 4	2.60	11.759	P=0.000 S
	Week 3 vs. Week 4	1.50	6.708	P=0.000 S

VAS: Visual Analogue Scale

RMDQ: Ronald and Morris disability questionnaire

Result

The results of this study were analyzed in terms of pain relief by VAS and functional ability by RMDQ.

Gender wise distribution

Out of 20 patients 8 were male and 12 were female (Table No. I)

Age wise Distribution

Out of 20, 5 were under the age group of 20-25 yrs and 15 were under 26-30yrs (Table No. 1)

Duration of pain

Out of 20 patients 5 were having pain since 6 months, 9 since 7-16 months, 3 since 13-18 months, 3 since 19-25 months (Table No.2)

Visual analogue scale

The mean and S.D of VAS at week 1 of group A was 5.44±1.51 with 95% Confidence Limit as 4.52 to 6.37, of group B was 5.90±1.10 with 95% Confidence Limit as 5.02 to 6.77, at week 2 of group A was 3.50±0.85 with 95% Confidence Limit as 2.93 to 4.06, of group B was 4.50±0.85 with 95% Confidence Limit as 3.93 to 5.07, at week 3 of group A was 1.90±0.738 with 95% Confidence Limit as 1.287 to 2.51, of group B was 3.40±1.07 with 95% Confidence Limit as 2.79 to 4.01, and at week 4 of group A was 0.80±0.789 with 95% Confidence Limit as 0.126 to 1.47,of group B was 1.90±1.20 with 95% Confidence Limit as 1.26 to 2.75.

Inter-Group Comparison of VAS in Group A and Group B at Week 1 was statically not significant.(p=0.46), at Week 2 was statically

Table 6: Inter-Group Comparison of RMDQ in Group A and Group B at Week 1, Week 2, Week 3, and Week 4 :(Unpaired t-test)

RMDQ	Group	N	Mean±S.D.	95% Confidence Limit	t-value	p-value
Week 1	Group A	10	12.1±2.47	10.49 to 13.71	0.00	P=1.00 NS
	Group B	10	12.1±2.38	10.49 to 13.71		
Week 2	Group A	10	8.20±2.04	7.03 to 9.377	1.14	P=0.27 NS
	Group B	10	9.10±1.45	7.92 to 10.20		
Week 3	Group A	10	5.60±1.35	4.67 to 6.54	1.90	P=0.074 NS
	Group B	10	6.80±1.48	5.86 to 7.74		
Week 4	Group A	10	3.40±1.35	2.39 to 4.41	2.21	P= 0.04 S
	Group B	10	4.90±1.66	3.89 to 5.91		

Table 7: Intra-Group comparison of RMDQ in Group A at Week 1, Week 2, Week 3, And Week 4: (paired t-test):

	RMDQ	Mean Difference	t-value	p-value
Group A	Week 1 vs. Week 2	3.90	6.450	P=0.000 S
	Week 1 vs. Week 3	6.50	10.498	P=0.000 S
	Week 1 vs. Week 4	8.70	13.737	P=0.000 S
	Week 2 vs. Week 3	2.60	7.005	P=0.000 S
	Week 2 vs. Week 4	4.80	13.370	P=0.000 S
	Week 3 vs. Week 4	2.20	6.34	P=0.000 S

Table 8: Intra-Group comparison of RMDQ in Group B at Week 1, Week 2, Week 3, And Week 4: (paired t-test):

	RMDQ	Mean Difference	t-value	p-value
Group B	Week 1 vs. Week 2	3.00	3.558	P=0.006 S
	Week 1 vs. Week 3	5.30	6.005	P=0.000 S
	Week 1 vs. Week 4	7.20	8.072	P=0.000 S
	Week 2 vs. Week 3	2.30	5.129	P=0.001 S
	Week 2 vs. Week 4	4.20	9.498	P=0.000 S
	Week 3 vs. Week 4	1.90	6.862	P=0.000 S

significant.(p=0.017),at Week 3 was statically significant.(p=0.019),at Week 4 was statically significant.(p=0.026). (Table 3)

The mean difference of VAS in group A at week 1 versus week 2 was 1.94, at week 1 versus week 3 was 3.54, at week 1 versus week 4 was 4.64, at week 2 versus week 3 was 1.60, at week 2 versus week 4 was 2.70, at week3 versus week 4 was 1.10.

Intra-Group comparison of VAS in Group A at Week 1 versus week 2 was statically significant(P=0.000), at Week 1 versus week 3 was statically significant(P=0.000),at Week 1 versus week 4 was statically significant(P=0.000), at Week 2 versus week 3 was statically significant(P=0.000), at Week 2 versus week 4 was statically significant(P=0.000), at Week 3 versus week 4 was statically significant(P=0.000)(Table 4)

The mean difference of VAS in group B at week 1 versus week 2 was 1.40, at week 1 versus week 3 was 2.50, at week 1 versus week 4 was 4.00, at week 2 versus week 3 was 1.10, at week 2 versus week 4 was 2.60, and at week3 versus week 4 was 1.50.

Intra-Group comparison of VAS in Group B at Week 1 versus week 2 was statically significant(P=0.000), at Week 1 versus week 3 was statically significant(P=0.000),at Week 1 versus week 4 was statically significant(P=0.000),at Week 2 versus week 3 was statically significant(P=0.000),at Week 2 versus week 4 was statically significant(P=0.000), at Week 3 versus week 4 was statically significant(P=0.000)(Table 5)

The mean and S.D of RMDQ at week 1 of group A was 12.1±2.47 with 95% Confidence Limit as 10.49 to 13.71, of group B was 12.1±2.38 with 95% Confidence Limit as 10.49 to13.71 and at week 2 of group A was 8.20±2.04 with 95% Confidence Limit as 7.03 to 9.377, of group B was 9.10±1.45with 95% Confidence Limit as 7.92 to 10.20 and at week 3 of group A was 5.60±1.35 with 95% Confidence Limit as 4.67 to 6.54, of group B was 6.80±1.48 with 95% Confidence Limit as 5.86 to 7.74 and at week 4 of group A was 3.40±1.35 with 95% Confidence Limit as 2.39 to 4.41,of group B was 4.90±1.66 with 95% Confidence Limit as 3.89 to 5.91.

MASTER CHART											
GROUP A											
Sr. No.	**Age**	**Sex**	**Duration of Pain**	**Pain on VAS**				**RMDQ**			
				1	2	3	4	1	2	3	4
1	24	F	4 months	7	5	2	1	10	5	3	2
2	26	M	12 months	7	4	3	0	12	7	6	3
3	27	M	3 months	6	3	2	1	9	7	6	2
4	30	M	24 months	4	2	1	0	15	10	7	4
5	26	M	11 months	6	3	2	1	15	7	5	3
6	28	F	18 months	5	4	2	2	12	9	5	3
7	24	F	10 months	3	3	2	0	14	11	7	5
8	30	M	4 months	4	3	1	0	8	6	4	2
9	30	F	7 months		4	1	1	14	10	7	4
10	30	F	12 months	7	4	3	2	12	10	6	6
GROUP B											
11	24	M	24 months	7	5	5	3	15	10	9	7
12	30	F	12 months	5	5	4	2	10	8	8	6
13	26	F	7 months	7	6	5	3	11	9	7	5
14	30	M	11 months	5	4	3	2	14	10	8	7
15	27	F	6 months	7	5	4	3	10	8	7	4
16	24	F	18 months	5	4	2	0	14	10	7	4
17	29	F	14 months	7	5	3	3	12	10	6	6
18	25	M	6 months	6	4	3	2	15	9	5	3
19	28	F	22 months	6	4	3	1	8	11	7	5
20	30	F	12 months	4	3	2	0	12	6	4	2

Inter-Group Comparison of RMDQ in Group A and Group B at Week 1 was statically not significant.(p=1.00), at Week 2 was statically not significant.(p=0.27),at Week 3 was statically significant.(p=0.074),at Week 4 was statically significant.(p=0.04). (Table 6)

The mean difference of RMDQ in group A at week 1 versus week 2 was 3.90, at week 1 versus week 3 was 6.50, at week 1 versus week 4 was 8.70, at week 2 versus week 3 was 2.60, at week 2 versus week 4 was 4.80, at week3 versus week 4 was 2.20.

Intra-Group comparison of RMDQ in Group A at Week 1 versus week 2 was statically significant(P=0.000), at Week 1 versus week 3 was statically significant(P=0.000),at Week 1 versus week 4 was statically significant(P=0.000),at Week 2 versus week 3 was statically significant(P=0.000),at Week 2 versus week 4 was statically significant(P=0.000), at Week 3 versus week 4 was statically significant(P=0.000)(Table 7)

The mean difference of RMDQ in group B at week 1 versus week 2 was 3.00, at week 1 versus week 3 was 5.30, at week 1 versus week 4 was 7.20, at week 2 versus week 3 was 2.30, at week 2 versus week 4 was 4.20, at week3 versus week 4 was 1.90.

Intra-Group comparison of RMDQ in Group B at Week 1 versus week 2 was statically significant(P=0.000), at Week 1 versus week 3 was statically significant(P=0.000),at Week 1 versus week 4 was statically significant(P=0.000),at Week 2 versus week 3 was statically significant(P=0.000),at Week 2 versus week 4 was statically significant(P=0.000), at Week 3 versus week 4 was statically significant(P=0.000)(Table 8)

Discussion

This study is based on the current trends in exercise management for chronic low back pain: comparison between specific stabilization exercise and conventional back extension exercise.

The objective is to investigate the effect of the two exercises i.e. specific stabilization exercise and the conventional back extension exercises on relieving chronic low back pain. To analyze the above objective in this study we took visual analogue pain scale, Ronald and Morris disability questionnaire as outcome measures in terms of pain and functional status. The reliability and validity of the above measurement scales and questionnaire are well established.

Pain as an outcome

Study group A shows significant improvement in VAS then group B.

Functional improvement as an outcome

Study group A shows significant improvement in Ronald and Morris questionnaire value then group B this is because majority of patients with chronic disc prolapsed have lumbar instability specific stabilization exercise target the muscles which gives stability to the spine like multifidus and transverse abdominis muscle as the strength and improves the lumbar instability reduces.

Conclusion

Training of the specific stabilization exercise in study group A showed a significant improvement in decreasing pain and in improving functional ability when compared to strengthening exercise in group B after a treatment protocol of four weeks.

Limitations and suggestions

1. Sample Size is small so study with large sample is needed.
2. Age group for the study is 20 – 30 years so it should be expanded.

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The Roland-Morris Low Back Pain and Disability Questionnaire

Patient name:..
Date:.....................

Please read instructions: When your back hurts, you may find it difficult to do some of the things you normally do. Mark only the sentences that describe you today.

- I stay at home most of the time because of my back.
- I change position frequently to try to get my back comfortable.
- I walk more slowly than usual because of my back.
- Because of my back, I am not doing any jobs that I usually do around the house.
- Because of my back, I use a handrail to get upstairs.
- Because of my back, I lie down to rest more often.
- Because of my back, I have to hold on to something to get out of an easy chair.
- Because of my back, I try to get other people to do things for me.
- I get dressed more slowly than usual because of my back.
- I only stand up for short periods of time because of my back.
- Because of my back, I try not to bend or kneel down.
- I find it difficult to get out of a chair because of my back.
- My back is painful almost all of the time.
- I find it difficult to turn over in bed because of my back.
- My appetite is not very good because of my back.
- I have trouble putting on my sock (or stocking) because of the pain in my back.
- I can only walk short distances because of my back pain.
- I sleep less well because of my back.
- Because of my back pain, I get dressed with the help of someone else.
- I sit down for most of the day because of my back.
- I avoid heavy jobs around the house because of my back.
- Because of back pain, I am more irritable and bad tempered with people than usual.
- Because of my back, I go upstairs more slowly than usual.
- I stay in bed most of the time because of my back.

Immediate Effect of Therapeutic Patellar Taping on Pain and Disability in Patellofemoral Osteoarthritis

Garg Chaya*, Arora Nupur**

Abstract

Background and purpose: Patellar taping is an inexpensiveintervention with minimal side-effects for Patellofemoral Osteoarthritis with evidence both in favor and against it. Therefore the purpose of our study is to find out immediate effect of patellar taping on pain and disability in individuals with patellofemoral osteoarthritis.

Material and Methods: Male and female subjects with age > 50 yrs, referred to physical therapy centers for treatment of Patellofemoral Osteoarthritis (n=30) were included. All subjects underwent the Step test and Timed up and go test twice first without tape and then with the therapeutic tape. During each of the test pain was evaluated using VAS.

Results: Using a paired sample T-test the results demonstrated a significant improvement in the step test and timed up and go test along with significant reduction in pain.

Conclusion: The finding of this study supports the experimental hypothesis that therapeutic taping reduces pain and observed disability in patients with patellofemoral osteoarthritis.

Keywords: Patellar taping, patellofemoral osteoarthritis

Introduction

Osteoarthritis also known as Osteoarthrosis/Degenerative joint disease is a chronic joint disorder in which there is progressive softening and disintegration of articular cartilage accompanied by new growth of cartilage and bone at the joint margins (osteophytes) and capsular fibrosis[(1)]. Osteoarthritis comprises 20% of a Rheumatologist's workload with the knee the most common joint affected [(2)]. It is most common degenerative disease affecting thousands of Indian citizens [(3)]and is the major cause of pain and disability in older people[(4)].

Osteoarthritis of the knee is characterised by structural joint changes including joint space narrowing and osteophyte formation[(5)]. There is great number of personal and social consequences of osteoarthritis. In osteoarthritis, the knee is the joint most commonly associated with clinical symptoms and disability [(6)]. Pain and disability are apparent in almost half of the patients with radiographic disease [(6, 7)]. Thirty-three percent of persons 63 to 94 years of age are affected by knee osteoarthritis, which often limits the ability to rise from a chair, stand comfortably, walk, and use stair [(6)]. Much of the disability associated with knee osteoarthritis is attributed to quadriceps weakness and pain rather than radiographic changes[(7, 8, 9)].

The knee is a complex tricompartmental joint [(10)] - lateral tibiofemoral compartment, the medial tibiofemoralcompartment and the

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patellofemoral compartment. Although isolated patellofemoral osteoarthritis is relatively rare [11], patellofemoral joint (PFJ)is one of the most commonly affected compartments[12]. Disease of this compartment of knee joint can cause severe pain when the patient is using stairs, squatting or kneeling[3]. Malalignment of the patella, with consequential abnormal force distribution on the lateral facet, is thought to be the cause of these symptoms [3]. Patellofemoral joint lesions have been found to be lateral in 89% of all of patellofemoral osteoarthritis [10].

There is no permanent cure for OA, thus conservative treatmentaims to reduce pain and limit functional impairment. Inexpensiveinterventions with minimal side-effects are desirable [13]. Jenny Mc Connell in 1986 developed an easy, painless safe and inexpensive alternative. The treatment involved a unique method of taping the painful knee to realign the patella within the femoral trochlea, as well as stretching of lateral soft tissues, VMO strengthening and close kinematic chain training[14].

Extensive research has been done to evaluate the effects of patellar taping. Several studies suggested that pain associated with Patellofemoral Joint is significantly reduced with patellar taping with evidence to suggest that patellar tape improves patella alignment measured radiographically and improves quadriceps function (torque production and extensor moments) [14]. Cushnaghanet al (1994) [4] in 14 patients with patellofemoral joint (PFJ) OA, found medial patellar taping significantly reducedpain compared with neutral and lateral taping.Rana S Hinman et al in 2003[15] concluded thattherapeutic taping was found as an efficacious treatment for the management of pain and disability in patients with knee osteoarthritis. Kay M. Crossley[16] study on 28 individuals, 14 with patellofemoral joint OA and 14 asymptomatic concluded that patellar tape may reduce malalignment and pain associated with patellofemoral joint OA.

However, some other studies have failed to find a difference. It appears unlikely that mechanical changes produced by application of tape can specifically produce the clinical effects seen, as a number of studies have failed to find significant changes in patella position with taping [17].Giganteet.al. (2001) [18] used a CT scan to assess patellofemoral mechanics and showed that patellar taping didn't affect the patella orientation and concluded that this approach doesn't improve patellofemoral incongruence by changing patella position. Further research by R. S. Hinman, K. M. Crossley(2004)[19] showed that application of therapeutic tape worsened joint position sense at a knee angle of 40 and concluded that neither immediate application nor continuous use of tape (for 3 weeks) appears to influence sensorimotor function in people with symptomatic knee OA.

Due to this mixed evidence of patellar taping our aim of study is to find out immediate effect of patellar taping on pain and disability in individuals with patellofemoral osteoarthritis.

Methodology

Both males and females subjects with age > 50 yrs, referred to physical therapy centers for treatment of Patellofemoral Osteoarthritis (n=30) were included in the study if they had pain on climbing stairs[13] and had a Minimum 4 out of 7 following clinical features[20].

(a) Pain on griding of patella
(b) Crepitation on griding of patella
(c) Crepitation on knee motion
(d) Peripatellar tenderness
(e) Pain on compression of patella
(f) Limitation of patellar mobility
(g) Clarke's test-positive

Those with Bilateral Knee involvement-more painful knee was considered [13]. Subjects were excluded from the study if they had undergone Physiotherapy treatment for knee injury or pathology in previous 12 months, had any history of Lower limb joint replacement, Knee Intra articular steroid injection during previous 6 months, allergic tape reaction, underlying Systemic arthritic condition, severe medical condition precluding safe testing, fragile skin around the knee [13], cognitive, mental, neurological, cardiac, vascular or sensory problems [21].

Potential subjects were apprised of the procedure and its potential risks and benefits and the evaluation was done. Subjects who fulfilled the inclusion and exclusion criteria and gave their informed consent were included in the study. All the subjects were familiarized with the testing procedures during the trial session.

All subjects underwent the Step test and Timed up and go test. During each of the test pain was evaluated using a 10-cm horizontal VAS. A rest of 5 minutes was given between the test conditions. After the testing was over therapeutic tape was applied. The subjects were again tested with the therapeutic tape for the dependant variables. Participants rested for 5 minutes between test conditions.

Pain Measurement

Pain experienced during each of the 2 disability tasks was evaluated using a 10-cm horizontal Visual Analogue Scale (VAS). Results were scored from 0-10 cm in increments of 1 cm[22] with 0 representing no pain and 10 worst pain.

Step Test

The step test is a functional, dynamic test of standing balance with known reliability and validity [23]. In this subjects were asked to stand on the most painful knee i.e Osteoarthritic limb. While other knee was kept over the stool of height 15cm. Subject stood barefooted on the osteoarthritic limb, whilst stepping the opposite foot on and off the step as many times as possible over 15sec.The number of times the participant could place the foot on to the step and return it to the floor was recorded, with higher scores indicating better balance [13].

Timed Up and Go Test

The timed up and go test measures the time it takes a subject to stand up from an arm chair, walk a distance of 3 meters, turn, walk back to the chair and sit down. A chair of 46 cm of height was used for the study. A 3 meter distance was marked on the floor in front of the chair. The test began with each subject sitting, back against chair, arms resting on the lap and feet supported on the ground. The subject was instructed that on the word "GO"; he should stand up, walk comfortably and safely to the mark on the floor, turn around, come back and sit on the chair. The subject was informed that the trial would be timed. Timing began at the word "GO" and ended when the subject's back rested against the chair upon returning [24].

Taping

Therapeutic tape was applied in a standardized manner by the same investigator, regardless of clinical presentation. Skin was shaved prior to tape application[13].Subjects were made to lie down on a plinth and the knee was exposed. Two pieces of rigid tape were applied to provide the medial patellar glide and correct the lateral and AP tilt according to Mc Connell taping technique[25] and two further pieces of tape applied distal to the patella to unload the infrapatellar fat pad. Participants were asked to report any adverse symptoms whilst wearing tape.

Results

The study was done on 30 subjects out of which 30% were males and 70% were females. The basic characteristics of the group are summarized in Table 1. The test results are summarized in Table 2.

Step test

- *Number of steps in 15 sec*

There was a test condition*test score interaction with t=-11.486, p<0.001 indicating a statisticallysignificant increase in the number of steps taken with the therapeutic tape. (Fig 1)

- *VAS*

There was a test condition*test score interaction with t=12.960, p<0.001 indicating a statistically significant decrease in the VAS score with the therapeutic tape. (Fig 2)

Timed up and go test

- *Time taken*

There was a test condition*test score interaction with t=8.706, p<0.001 indicating a statistically significant decrease in the time taken with the therapeutic tape. (Fig 3)

- *VAS*

Table 1: Basic characteristics of subjects (N=30)

CHARACTERISTIC	MEAN	S.D
AGE	60.03	9.33
HEIGHT	157.56	6.77
WEIGHT	68.65	10.55

S.D=Standard Deviation

Table 2: Comparisons of test scores

VARIABLE	NO TAPE MEAN (S.D)	THERAPEUTIC TAPE MEAN(S.D)	% DIFFERENCE
Step test (no of steps in 15 sec)	7.47 (2.54)	9.30 (2.85)	24.5%
VAS (during Step test)	5.8 (1.58)	3.9 (1.99)	32%
TUG (time taken in sec)	16.55 (8.08)	14.19 (7.4)	14%
VAS (during TUG test)	4.9 (1.63)	3.17 (1.51)	35%

VAS-Visual Analogue Scale

TUG test-Timed up and go test

S.D=Standard Deviation

Fig 1: Number of steps taken during Step Test

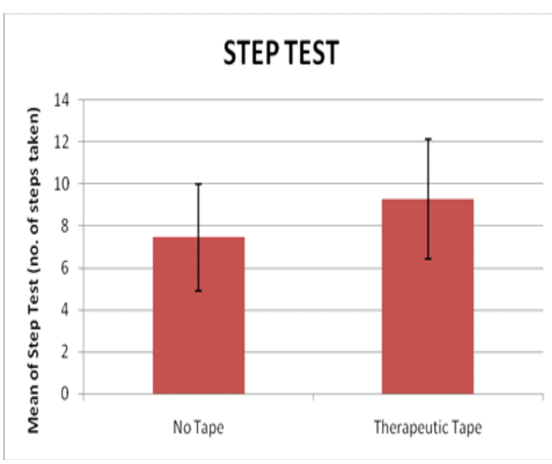
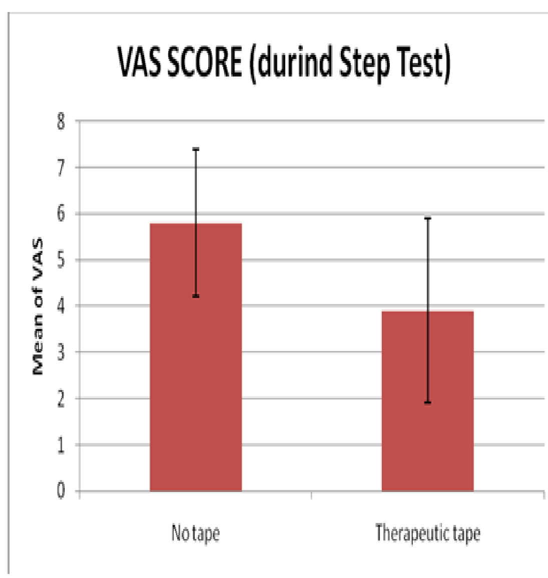


Fig 2: VAS Scores during Step Test



There was a test condition*test score interaction with t=12.835, p<0.001 indicating a statistically significant decrease in the VAS score with the therapeutic tape. (Fig 4)

Fig 3: Time Taken during TUG Test

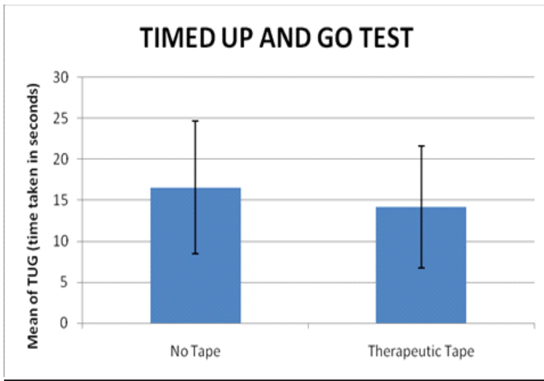
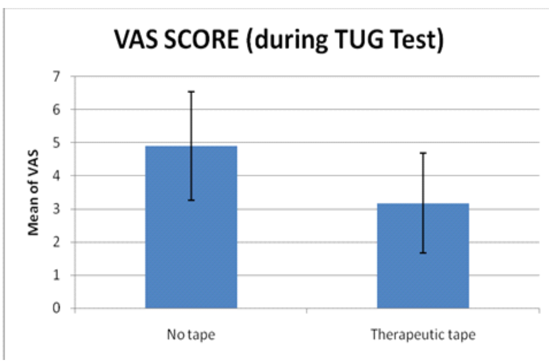


Fig 4: VAS Scores during TUG Test



Discussion

This study provides an evidence to support the use of Mc Connell taping in managing painful Patellofemoral osteoarthritis. Our results suggest that patellar taping reduced pain and observed disability in patients with Patellofemoral Osteoarthritis.

Pain level

An immediate reduction in pain level, as quantified by the Visual Analogue Scale(VAS), with the application of patellar taping was seen.Several mechanisms may explain the pain-relieving effect oftherapeutic tape. Many studies suggest that tape can improve patellar alignment in healthycontrols and those with PFPS[26-28]. It has been seen that Patellofemoral joint degenerationis present in most people with knee OA [2,29], predominantlyaffecting the lateral compartment [30,31]. Radiographic PFJ OAhas been correlated with patellar malalignment[32], and this in turnis associated with increased peak patellofemoral contact pressuresand loading of the lateral facet [33]. Therapeutic tape maythus ease pain by improving patellar alignment by the repositioning of the patella within the trochlear groove (McConnell 1996) thereby relieving pressure on the damaged lateral facet of the patellofemoral joint and improving tracking of the patella and function of the quadriceps mechanism [34,35]. Radiological studies of Larsen et al.(1995) [36] and Roberts (1989) and the MRI study of Davies (1998), which have all shown taping to have a positive effect on patella alignment [37,38] . However a number of studies have failed to find significant changes in patella position with taping. For instance, in a radiographic study by Bockrath et al., although patella taping was found to contribute to a dramatic reduction in pain, it was not associated with change in patella position. Somes et al found that taping reduced pain by 45% and improved medial tilt of the patella, but had no effect on patella glide. Thus the pain relief from taping may be due to mechanisms other than mechanical or positional changes[17]. It is seen that infrapatellarfat pad is a pain-sensitive soft tissue, often inflamed secondarily to otherknee joint pathology and is proposed as a source of pain inknee OA[13]. Pain relief is also probably achieved by unloading painful, inflamed infrapatellar fat pad[19]. It is proposed in some studies that therapeutic tape, by shortening the softtissue of the fat pad, may relieve pain based on the principlethat inflamed soft tissue does not respond well to stretching[39].

Alternatively some studies suggested pain relief may be due to cutaneous effect of patellar tape by eliciting neural inhibition by facilitating large afferent fiber input. Changes in neural input through afferent receptors, such as cutaneous mechanoreceptors and Messnercorpuscles, from the patellar tape application may have been enough to block nocioceptive input and cause neural inhibition via the large afferent fibers, thus causing pain relief[40].

Observed disability

The step test is a functional, dynamic test of standing balance [23] and showed significant improvement in our study. A study reported that dynamic standing balance(step test) improved with therapeutic tape, but was notattributable to concurrent pain reduction. As participants reporteda sense of 'support' when wearing therapeutic tape, improved confidence in the knee may have resulted in more stepswith the contralateral limb whilst standing on the symptomaticlimb[13].

It was found that the weakness of the quadriceps is most commonly associated with knee osteoarthritis [41]. Several studies provide evidence to suggest that while VMO and VL onset occurs simultaneously in asymptomatic subjects, there is a delay in VMO onset relative to VL in subjects with PFP during the performance of functional tasks. A number of studies have investigated the effect of taping on temporal and spatial characteristics of vasti muscle activity. For example, Cowan et al reported a change in timing of vasti muscle activity during a stair stepping task following the application of tape.Gilleard et al (1998) found that during the step up task the onset of the VMO activity occurred earlier with the taping but there is no change in VL activity and because of the early activation of the VMO as compared with VL activity allows more optimal positioning of the patella into the trochlea. Also this early activation of VMO as compared with VL activity during step down task helps to improve the timing of force distribution and decrease the pressure placed on a particular portion of articular cartilage. The change in onset of muscle activity may change the relative excitation of the VMO and VL[42].

The percentage improvement of 14% was apparent in Timed up and go test. This could be attributed to concurrent pain relief, improved patellar tracking, increased quadriceps peak torque and improved proprioception.

Some studies have reported an increase in overall quadriceps peak torque or force generating ability and improved functional performance[37, 38, 44]. There are two main explanations for this: The most commonly reported one is due to reduction in arthrogenic inhibition of the quadriceps (Herrington, 2004)[37]. Plausible hypothesis being that taping reduces the inhibition of the quadriceps causing increase in quadriceps peak torque. Reflex inhibition of the quadriceps and its contribution to weakness following trauma have long been established (Stokes & Young 1948). The reduction in muscle activation being due to abnormal afferent input (sensory information),decreasing alpha motor neuron excitability, via a reflex loop at the dorsal horn of the spinal cord (Hurley 1997)[44]. This in turn decreases the activation of the muscle. Taping possibly brings about a change in afferent input into the dorsal horn decreasing the inhibition placed upon alpha motor neuron excitability. Alternatively, the taping unloads the mechanically irritated and swollen periarticular soft tissues, such as the synovium, instantaneously relieving pain (Dye et al. 1999)[45].An alternative explanation suggest that the repositioning of the patella by patellar taping brings about a change in the leverage offered to the quadriceps by the patella, maximizing the mechanical advantage of the quadriceps. The larger the mechanical advantage, the less the quadriceps force (and therefore less patellofemoral joint compression) required to produce the same torque (Norkin&Levangie 1992)[46].Conway et al. (1992)proposed that the distal displacement of the patelladuring knee flexion is limited by anchoring thepatellar tape to the medial aspect of the femur. Thiswould maintain the knee extensor moment arm in amore advantageous position, thus accounting forthe increase in quadriceps function [47].

Proprioceptive deficits have been found in osteoarthritic knees[48]. Callaghan suggested that patellar taping improve proprioception and the sense of mechanical stability of the patella to promote normal knee function[48]. Under the influence of patellar taping, altered afferent input from the muscular, ligamentous and cutaneous structure in and around the patellofemoral joint may improve proprioceptive function in patients with PFPS [43,49]. One study evaluated tape's effects on knee proprioception in 52 healthy volunteers using a taping procedure similar to our technique and found that no change in JPS was demonstrated. However, when participants with good and poor proprioception were compared, taping improved poor proprioceptive acuity, suggesting that tape only benefits individuals with poor acuity at the outset[(49)]. On the contrary a study on immediate and short-term effect of continuous (3 weeks) application of knee tape on quadriceps sensorimotor function in individuals with symptomatic knee osteoarthritis (OA) did not observe beneficial effects of tape on proprioception. Plausible reason cited being (a) immediate, increased input from cutaneous afferents, triggered by contact and movement of rigid tape on the skin, may 'confuse' the nervous system, rather than enhance, and may explain the greater inconsistency in JPS , (b) given that muscle receptors play a primary role in mediating proprioceptive information and the relatively small area of skin covered by tape, it is probable that enhanced cutaneous sensation with tape is insufficient to result in positive changes in JPS[19.] Conflicting findings are reported about external knee supports and proprioception in OA.

Many studies have also suggested an increase in knee loading response with patellar taping permitting increased shock absorption and quadriceps activity. Crossley et al (2002) found that patellar taping cause a small but a significant increase in loading response in knee flexion during the taped condition while walking at two speeds, up and down ramps and up and down stairs. The magnitude of this change was very small (average) about ¾ degrees. It indicates an ability to load the knee joint with confidence during all gait conditions also stride length is improved following the taping during the ascending ramp condition[34].

Conclusion

The finding of this study supports the experimental hypothesis that therapeutic taping reduces pain and observed disability in patients with patellofemoral osteoarthritis.

Therefore it is suggested that therapeutic taping is of clinical value in knee osteoarthritis.

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Comparison between the Effects of Cervical Therapeutic Exercise Programme and Myofascial Release Techniques on Cervicogenic Headache in a Randomized Controlled Trial

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Abstract

Background and Introduction: Cervicogenic headache is a very common condition which leads to significant disability. Cervicogenic headache was first introduced by Sjaastad in 1983 and is defined by the World Cervicogenic Headache Society as referred pain perceived in any part of the head caused by a primary nociceptive source in the musculoskeletal tissues innervated by cervical nerves. A number of studies have been conducted to find the effects of various therapeutic techniques on cervicogenic headache. In this study, comparison has been done between Cervical Therapeutic Exercise Programme for cervicogenic headache and Myofascial Release Techniques to find out the technique more effective in reducing cervicogenic headache parameters.

Method: 30 subjects selected according to the inclusion and exclusion criteria were randomly divided into 3 groups: Conventional group, Exercise group and MFR group to which Conventional treatment for Cervicogenic Headache, Cervical Therapeutic Exercise Programme and Myofascial Release Techniques respectively are administered. Pre and post treatment readings were recorded for Neck Disability Index score, Visual Analog Scale score, Headache Duration, Headache Frequency.

Results: After one week of treatment it was found that all the three treatment approaches were effective in reducing the Cervicogenic headache parameters. However on comparing three treatment approaches, Myofascial Release Techniques were the most effective in reducing the above parameters. ($p<0.05$)

Conclusion: Myofascial Release Techniques are more effective than Cervical Therapeutic Exercise Programme in reducing Cervicogenic Headache symptoms.

Key words: Cervicogenic Headache; Cervical Therapeutic Exercise Programme; Myofascial Release.

Introduction

Cervicogenic headache is referred pain perceived in the head and caused by musculoskeletal tissues innervated by cervical nerves.[1] Several cervical structures, such as cervical muscles and their attachments to the bone; as well as the capsule of the intervertebral joints and discs, ligaments, nerves and nerve roots, fascia, dura matter[2], sustained faulty neck postures like forward head posture[3] are thought to be pain generating candidates in CEH.[4] The neuroanatomical basis for CEH is the "trigemino- cervical nucleus" in the spinal grey matter of the spinal cord at the C1-C3 level, where there is a convergence on the nociceptive second order neurons receiving both trigeminal and cervical input.

Cervicogenic headache manifests itself as a unilateral head or face pain without side shift.[5] The pain starts at the posterior part of the head and/or neck spreads to the front following the scalp, over or around the ear, or through the upper part of the mandible and/or the zygomatic area.[6] The most widely used diagnostic criteria for many years were those

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proposed by Sjaastad in 1990 and subsequently updated in 1998[7]

A number of treatment techniques are in use clinically for its cure. Among them are the Cervical Therapeutic Exercise Programme and Myofascial Release Techniques. The aim of the study is to find that which among the Cervical Therapeutic Exercise Programme and Myofascial Release is more effective in reducing cervicogenic headache parameters namely Neck Disability Index score, Visual Analog Scale score, Headache Frequency, Headache Duration in 30 patients with cervicogenic headache.

Methods

The study was performed on 30 subjects within the age group 16-60 years taken from the patients of cervicogenic headache coming in the physiotherapy OPD, Sardar Bhagwan Singh Post Graduate Institute of Biomedical Sciences and Research, Balawala, Dehradun, Gurudwara O.P.D, Bala Pritam Dispensary and Physiotherapy O.P.D, Patel Nagar, Dehradun and Prayas Rehabilitation and Physiotherapy centre, Dehradun. Study was performed in accordance with ethical considerations of the institute and their consent was taken prior to the study. The subjects were selected on the basis of random sampling according to the inclusion and exclusion criteria and divided into 3 groups- Conventional, Exercise and MFR groups (n=10). The inclusion criteria was pain localized to the neck and occipital region and projecting to forehead, orbital region, temples, vertex or ears, limitation of cervical movements, abnormal tenderness on palpation of neck muscles, Unilateral headache with no side shift, pain precipitating or aggravating by neck movements or sustained pressure, homolateral shoulder or arm pain, stiffness and pain of the neck, patients between age group 16-60 years. The exclusion criteria was patients with other type of headache like tension headache, migraine, patients who underwent any recent surgery in the neck region, patients with vertebrobasilar insufficiency, patients with side shifting of pain, patients in whom pain is relieved by NSAID'S, analgesics, patients with continuous, unrelieving pain, nocturnal pain, patients with musculoskeletal injuries in the neck, patients with psychological problem and patients with hypo or hyper sensitivity.

The subjects were explained about the whole procedure in detail prior to starting the procedure and the pre treatment readings

Table 1: Mean and Standard Deviation of Age

Group	Mean	SD
Conventional	32.1	11.68
Exercise	27.2	9.36
MFR	29.9	11.42

Table 2: Comparison of means of pre and post protocol readings of Neck Disability Index (NDI) score, Visual Analog Scale (VAS) score, Headache Frequency (HF), and Headache Duration (HD) of each group

Variables	Pre protocol	Post protocol	t-value
CONVENTIONAL GROUP			
NDI	44.77±10.06	21.17±7.64	0
VAS	6.67±1.51	3.35±1.84	6.335
HF	6±2.16	3.2±2.20	0
HD	13.10±15.86	4.5±5.19	0
EXERCISE GROUP			
NDI	35.83±14.59	20.31±10.03	0
VAS	6.41±1.40	3.29±1.44	9.381
HF	5±2.11	2.4±1.90	0
HD	26.9±12.60	7.2±10.22	0
MFR GROUP			
NDI	40.33±17.01	11.82±4.50	0
VAS	5.85±1.68	1.25±0.82	8.615
HF	5±2.11	1±0.00	0
HD	32.40±8.10	1.8±1.23	0

were noted. The subjects in the conventional group were first given hydrocollator packs followed by TENS, manual cervical traction, cervical spine mobilization, kneading and in the stretching of trapeius and suboccipital muscles were performed. Subjects in exercise group were given the conventional same as that given to the subjects in the conventional group. Apart from this, they were made to follow a Cervical Therapeutic Exercise Programme. Subjects in the MFR group received apart from the treatment given to the subjects of exercise group additional myofascial release techniques- Cranial Base Release, Cervical Laminar Release, Bilateral Gross Stretch of Upper Trapezius. Post treatment readings were recorded on the 7^{th} day after the treatment.

Results

Table 1 shows mean and standard deviation of age of the subjects in the three groups. Each group consisted of 10 subjects. The mean and standard deviation of age for the Conventional, Exercise and MFR were 32.1±11.68 years, 27.2±9.36 years and 29.9±11.42 years respectively.

Table 2 compares the means and standard deviations of the pre and post protocol readings of cervicogenic headache parameters in each group using dependent t test for Visual Analog Scale score and Wilcoxon signed rank test for Neck Disability Index score, Headache Frequency and Headache Duration.

For the Conventional Group, the t value for the comparison of mean values of Neck Disability Index score on Day 0 (44.77±10.06) and on day 7 (21.17±7.64) was 0 and was statistically significant. The mean values of Visual Analog Scale score on Day 0 (6.67±1.51) and on day 7 (3.35±1.84) had a significant difference with a t value of 6.335. The mean values of Headache Frequency on Day 0 (6±2.16) and on day 7 (3.2±2.20) and that of Headache Duration on Day 0 (13.10±15.86) and on day 7 (4.5±5.19) were with significant difference. The t value for both the variables was 0.

Similarly with the Exercise Group, the mean values of Headache Frequency on Day 0 (5±2.11) and on day 7 (2.4±1.90), Headache Duration on Day 0 (26.9±12.60) and on day 7 (7.2±10.22) and that of Neck Disability Index score on Day 0 (35.83±14.59) and on day 7

Table 3: Comparison of the pre and post protocol readings of NDI, HF and HD between the Conventional, Exercise and MFR groups

Variables	Pre H- value	Post H values
NDI	1.7238	9.5674
HF	1.1861	8.6587
HD	7.3149	

Table 4: Comparison of the mean difference of headache duration readings (0-7 session) between the conventional, exercise and MFR groups

Variable	H value	p value
HD	14.340	**p<0.05**

Table 5: Comparison of the improvement of mean difference for Headache Duration between the conventional, exercise and MFR groups

Variable	J value	p value
HD	3.998	p<0.05

Table 6: Jonckheere Trent Test for the post protocol readings of Neck Disability Index (NDI) score and Headache Frequency of the three groups

Variables	J Value
NDI	-2.803
HF	-3.130

Table 7: ANOVA for the comparison between the post protocol readings of Visual Analog Scale (VAS) score of the Conventional, Exercise and MFR groups.

Variable	F-value
VAS	6.968

Table 8: Post – Hoc Scheffe's Analysis for the post protocol readings of VAS scores

Dependent Variable	(I) Variable 00001	(J) Variable 00001	Mean difference (I-J)	Std. Error	Sig.	95% Confidence	
						Lower Bound	Upper Bound
VAS	Conventional	Exercise	.0600	.64048	0.996	-1.598	69.29
		MFR	2.1000(*)	.64048	0.011	0.441	147.76
	Exercise	Conventional	-.0600	.64048	0.996	-1.718	63.14
		MFR	2.0400(*)	.64048	0.013	0.381	144.68
	MFR	Conventional	-2.1000(*)	.64048	0.011	-3.758	-15.32
		Exercise	-2.0400(*)	.64048	0.013	-3.698	-12.24

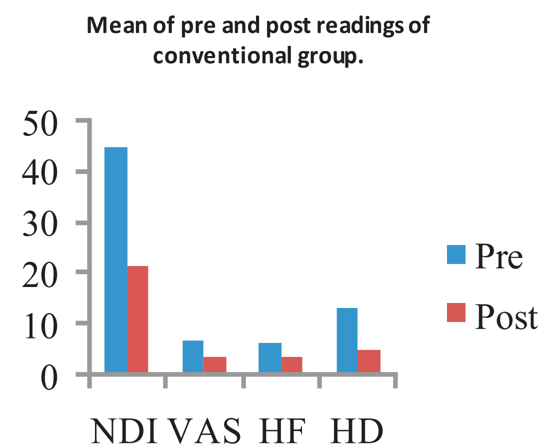
* The mean difference is significant at the 0.05 level

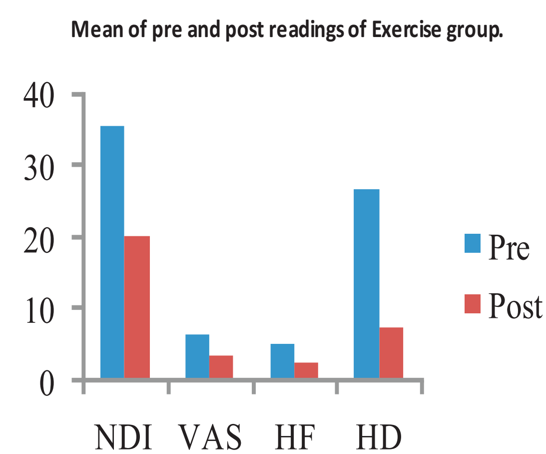
(20.31±10.03) were with significant difference. The t value for the above three the variables was 0 each. The t value for the comparison between the Visual Analog Scale score on Day 0 (6.41±1.40) and on day 7 (3.29±1.44) was 0 and were found to have a significant difference.

For the MFR group, the mean value of Neck Disability Index score on Day 0 (40.33±17.01) and on day 7 (11.82±4.50) was with significant difference (t=0). The mean value of Visual Analog Scale score on Day 0 (5.85±1.68) and on day 7 (1.25±0.82) was with significant difference (t=8.615). The mean value of Headache Frequency on Day 0 (5±2.11) and on day 7 (1±0.00) was with significant difference (t=0). The mean value of Headache Duration on Day 0 (32.40±8.10) and on day 7 (1.8±1.23) was with significant difference (t=0).

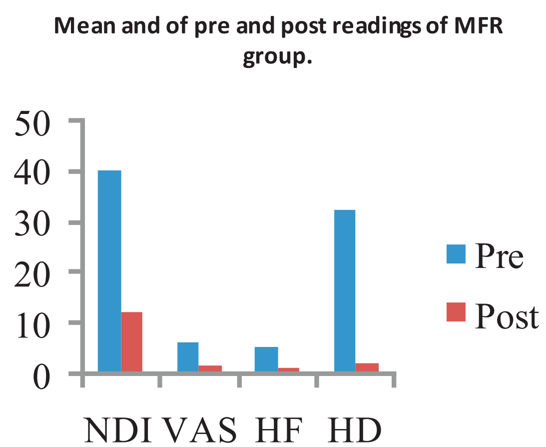
The above analysis reveals that all the three treatment approaches viz Conventional, Cervical Therapeutic Exercise Programme and Myofascial Release Techniques are effective in reducing the cervical headache parameters.

Table 3 compares the pre and post protocol readings of Neck Disability Index (NDI) score, Headache frequency (HF) and Headache





Duration (HD) between the conventional, exercise and MFR groups using Kruskal Wallis Test. The H value of pre NDI score (1.7238) and post NDI (9.5674) both were of significant difference. Similarly The Pre H value of headache frequency () value of Headache Frequency (8.6587) was of significant difference. The H value of Headache Duration (7.8813) was of significant difference. The comparison revealed that the three treatment techniques i.e. Conventional Treatment, Exercise Protocol and Myofascial Release Techniques produced significant difference in the Neck Disability Index score, Headache Frequency and Headache Duration.



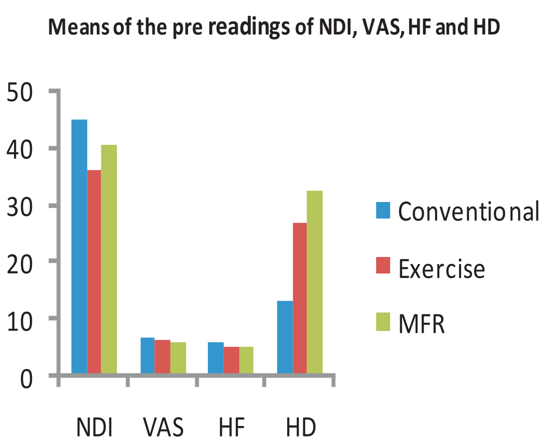


Table 4 compares the readings of headache duration at (0-7) session mean difference between the conventional, exercise and MFR groups. Its H value (14.340) was of significant difference. The comparison revealed that the three treatment techniques i.e. Conventional Treatment, Cervical Therapeutic Exercise Programme and Myofascial Release Techniques produced significant differences in the Headache Duration

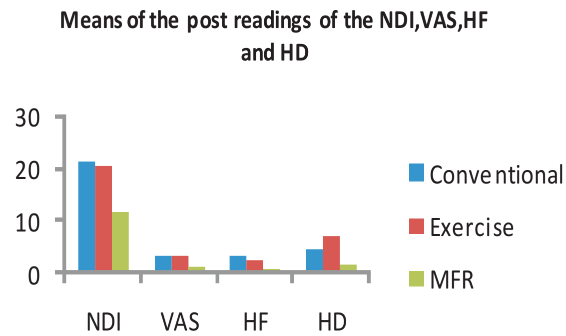


Table 5 compares results of Jonckheere Trend Test for the improvement of mean difference for Headache Duration (HD) between the conventional, exercise and MFR groups. The J value of HD (3.998) was of significant difference ($p<0.005$). The analysis reveals that there is a significant trend in the scores of improvement of mean difference for Headache Duration with MFR group having the maximum scores followed by Exercise group and with Conventional group having the least scores

Table 6 compares results of Jonckheere Trend Test for the post protocol readings of Neck Disability Index (NDI) score, Headache frequency (HF) and Headache Duration (HD) between the conventional, exercise and MFR groups. The J value of NDI (-2.803) was of significant difference. The J value of Headache Frequency (-3.130) was of significant difference. The J value of Headache Duration (-0.971) was non significant. The analysis reveals that there is a significant trend in the NDI scores and Headache Frequency with MFR group having the lease scores followed by Exercise group and with Conventional group having the highest NDI scores. The result also reveals that there is no trend in the values of Headache Duration of the three groups.

Table 7 compares the post protocol readings of Visual Analog Scale (VAS) score between the Conventional, Exercise and MFR groups.

The F-value of VAS (6.968) was of significant difference.

Table 8 shows the Post Hoc analysis of the post protocol readings of Visual Analog Scale (VAS) of the Conventional, Exercise and MFR groups using Scheffe's Test. The results indicate that there was no significant difference between the conventional and Exercise Group (p=0.996). The comparison between the Exercise and MFR Groups was significant (p= 0.013) with the MFR group having lower VAS scores. The comparison between MFR and Conventional groups was significant (p= 0.011) with the MFR group having lower VAS scores.

Discussion

The results revealed that treatment with the exercise protocol showed significant effect on all the cervicogenic headache parameters i.e. Neck Disability Index score, Visual Analog Scale score, Headache Frequency and Headache Duration. The results accord with those of Jull et al., 2002. They found in their study that exercise treatment significantly reduced headache frequency and intensity and the neck pain index immediately after treatment and the results were consistent.[8] These effects may be brought about by an improvement in the strength and endurance of the deep cervical extensor muscles. According to Jull 1999 dysfunction has been identified in general neck flexor strength and endurance in patients with neck pain and headache.[9] Furthermore Watson and Trott in their study found that cervical headache sufferers: (i) exhibit forward head posture; (ii) demonstrate weakness of the upper cervical flexor musculature; (iii) lack endurance of the upper cervical flexor musculature; and (iv) present with a forward head posture and concomitant lack of isometric endurance of the upper cervical flexor musculature.[3] This exercise program specifically addresses impairments in deep neck flexor and extensor muscles. The exercise approach is a motor relearning program where the emphasis is on rehabilitating the impaired coordination of the cervical and scapular muscle synergies and on retraining the endurance capacities of the deep neck flexor and extensor muscles and shoulder girdle muscles at low levels of load as is required for their function of support and control of cervical joints and posture. This exercise protocol is a specific low load exercise to reeducate muscle control of cervicoscapular region instead of muscle strengthening. The exercises directly address the muscle impairment found in cervicogenic headache patients.[8]

The results indicate that treatment with the Myofascial Release Techniques showed significant effect on all the cervicogenic headache parameters i.e. Neck Disability Index score, Visual Analog Scale score, Headache Frequency and Headache Duration. There is less literature available to explain the mechanism behind the changes in these variables. A number of mechanisms have been proposed explaining the mechanism by which these myofascial release techniques works: Viscoelastic, neurophysiologic, piezoelectric reactions[10]

Viscoelastic

The improvements seen after treatment with Myofascial Release techniques are probably due to stretching of the elastic component, a change in the viscosity of the ground substance from a more solid to a gel state.[11] Myofascial Release Techniques cause the thixotrophic gel to change to a more fluid state, allowing for decreased pressure on pain sensitive structures and increased motion, and allows the solidified, dehydrated thixotrophic gel to transition to a liquid state. This rehydration of the ground substance allows for a complete release all the way down to the cellular level.[12] The viscosity of the ground substance has an effect on the collagen since it is believed that the viscous medium that makes the ground substance controls the ease with which collagen fibers rearrange themselves. This is because a change in viscosity increases the production of hyaluronic acid and increases the glide of the fascial tissue.[11] This results in an increase in soft tissue flexibility which relieves tissue tension within the elastocollagenous complex. While the density and viscosity of the matrix (ground substance) decreases resulting in improved metabolism and health.[13]

Neurophysiologic

Fascia is densly innervated by interstitial tissue receptors. Slow and deep pressure as is applied in myofascial release techniques stimulates interstitial and Ruffinin mechanoreceptors, which results in an increase of vagal activity, which changes then not only local fluid dynamics and tissue metabolism, but also results in global muscle relaxation.[14] Furthermore, stimulation of interstitial mechanoreceptors triggers the autonomic nervous system to change the local fluid pressure in the fascial arterioles and capillaries. And these receptors if strongly stimulated, can also lead to extravasation of the plasma from the blood vessels into the interstitial fluid matrix. Such a change of local fluid dynamics means a change in the viscosity of the extracellular matrix. This first autonomic feedback loop is called Intrafascial Circulation Loop. Another Hypothalamus Loop was proposed according to which, stimulation of intrafascial receptors increases the vagal tone which leads to a more trophotropic tuning of the hypothalamus resulting in lowered overall tonus of the body musculature and , emotional, cortical and endocrinal changes that are associated with deep and healthy relaxation. Apart from this Fascial Contraction Loop was proposed. According to this loop, stimulation of intrafascial mechanoreceptors triggers the Autsonomic nervous system to alter the tonus of intra fascial smooth muscles. Thus to sum up, practitioner's manipulation stimulates intrafascial mechanoreceptors, which are then processed by central nervous system and autonomic nervous system. The response of the central nervous system changes the tonus of some striated muscle fibers. The autonomic nervous system response includes the altered muscle tonus, a change in local vasodialatation and tissue viscosity, and a lowered tonus of intrafascial smooth muscles.[15]

Piezoelectric reactions

This property establishes that when a crystal is subjected to a mechanical tension, potential differences and electrical load appears on its surface. The crystal deforms under the application of electrical forces when an electrical force is applied. The crystals in our body are liquid crystals. When a mechanical action is performed, for example, the stretching of a muscle tendon, the fascial system is activated and a tiny electrical pulsation is produced. This pulsation is electrically transmitted crossing the fundamental substance of the connective tissue.[10] This piezoelectric event changes the electrical charge of the collagen amd proteoglycans within the extracellular matrix affecting the ground substance (changing it from a sol to a gel state)[16]

It was found that significant differences was found in the scores of Neck Disability Index, Headache Frequency, Visual Analog scale with the group on which Myofascial Release techniques were applied showed lowest scores followed by the group on which exercise protocol was applied. However headache Duration did not show any trend in its scores. This shows that Myofascial Release Techniques are most effective in reducing Neck Disability Index scores, Visual Analog Scale scores and Headache Frequency. Fascia covers the muscles, bones, nerves, organs, and vessels down to the cellular level. Therefore, malfunction of the system due to trauma, poor posture or inflammation can bind down the fascia.[11] The myofascial system tends to dehydrate after trauma or inflammatory processes, turning the ground substance into the equivalent of glue or cement.[12] It is through that process that this binding down or restriction may result in poor or temporary results achieved by therapeutic treatments. This is because exercise programs affect only the muscular and elastic components of the fascial systems.[11] But they do not change the dehydration and resultant solidification of the ground substance.[12] Only MFR with its emphasis on using bioenergy and piezoelectric effect that occurs as we sustain the releases, barrier after barrier, affects the total fascial system.[11]

Conclusion

Thirty patients of cervicogenic headache were investigated to compare the effectiveness of an Exercise Protocol and Myofascial Release Techniques on Neck Disability Index (NDI) score, Visual Analog Scale (VAS) score, Headache Frequency (HF) and Headache Duration (HD) over a period of 7 days. From this study it is suggested that null hypothesis does not hold valid and so alternate hypothesis can be accepted. Thus we can conclude that the present study shows that both Exercise Protocol and Myofascial Release Techniques were effective in treating reducing NDI, VAS, HD, HF. However, on comparing both the treatment techniques Mofascial Release Techniques were more effective than the exercise protocol in reducing NDI, VAS, HD, HF.

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