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Original Research Article

Effect of Specific Lumbar Stabilization Exercise by Using an Unstable Training Device on Pain, Lumbopelvic Stability and Functional Disability in Subjects with Chronic Low Back Pain: A Randomized Controlled Study

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ABSTRACT

Background & objective: Chronic low back pain (CLBP) is one of the most serious health problems in musculoskeletal aspect and immediate non surgical remedies are needed. Objective of the study was to find the effects of specific lumbar stabilization exercise by using an unstable training device on pain, lumbopelvic stability, and functional disability on subject with CLBP.
Study design: A Randomized controlled study (double blinded)
Setting; Institutional based musculoskeletal physiotherapy outpatient department.
Outcome measures: Numerical pain rating scale (NPRS), lumbopelvic stability (LPS) by pressure biofeedback (PBU) & Modified Oswestery disability questionnaire (MODI)
Materials &Methods: 60 patients with chronic low back pain were randomly allocated in to either experimental and control group. Group A received specific lumbar stabilization exercises by using an unstable training device (n=30) and Group B (control group) received mat lumbar stabilization exercise (n=30). The therapy interventions were given with presetted protocol for total 6 weeks. The NPRS, LPS & MODI were taken outcome measures at baseline and post (6^{th} week).
Results: There was a significant decrease in pain, improvement in lumpopelvic stability and functional disability ($P<0.005$) in chronic low back pain. However, specific lumbar stabilization by using an unstable training device was greater effect on all outcome measures in CLBP patients.
Conclusion: The results of the study interprets that 6 weeks specific lumbar stabilization exercise by an using unstable training device was effective in improving lumbo pelvic stability, reduce pain and disability in chronic low back pain.

Key words: *CLBP, Specific lumbar stabilization exercise, NPRS, MODI, LPS with PBU.*

INTRODUCTION

Low back pain (LBP) is one of the widely seen in 70-85% of the population, with up to 80% of patients describing that at least one episode in their life and resolve symptoms within 3 months [1] but many of the sufferers reported that recurrence of the symptoms which becomes chronic and lead to absent from the work and activity. Chronic low back pain (CLBP) is one of the

most serious health problems in musculoskeletal aspect and immediate nonsurgical remedies are needed. [2]

The CLBP which consist of spinal instability and leads to faulty neuromuscular control. The subgroup classification of LBP which consist of ligamentous instability, muscular injury, fatigue, deformation, compression and over stretching of the soft tissues, facet joint, disc and intervertebral joint degeneration around the lumbar spine can compromise the stabilizing effect resulting in shearing forces that cause the pain. [3,4]

Investigator reported that individual with CLBP may have motor control deficit that affect their functional ability to engage the muscles that stabilize the spine. [5] Trunk global and local muscles which maintain intersegmental stability and these muscles reduce unwanted movement in the intersegment which risk of injury. The global muscles are superficial and fast twitch fibers which act to transfer loads and move the spinal column. Rectus abdominus and external oblique are example. Local muscles are smaller, deep and slow twitch fibers, close to the joints. These muscles help in proprioception and postural control and also contribute to maintaining stiffness along the spinal column. [6]

McKenzie therapy, the Pilates method and the conventional land-based gymnasium spinal stabilization exercises, SWD, intermittent lumbar traction, IFT, Transcutaneous electrical nerve stimulation (TENS) has been found to be effective therapy in chronic low back pain. [7] Panjabi spinal stabilization relies on the strength and control of multiple lumbar and abdominal muscles. So recent advanced program approach exists on specific lumbar stabilization exercises. [8] Recreational exercises are more enthusiastic then performing ground exercise by the CLBP patient.

Therapeutic exercise training device such as Swiss ball, air filled balls and foam roller, which can be used all regions of the body and which also require more extensive activity during exercise when compared with exercise performed on ground surface. Unstable surface exercise which increase contraction speed, intensity and muscle activity and coordination. [9,10]

The purpose of the present study is to find the effects of specific lumbar stabilization exercises by using unstable training device with respect to pain, lumbo pelvic stability and functional disability in patients with chronic low back pain. The working hypothesis is the specific Lumbar stabilization exercise by using unstable surface training device is effective on pain, lumbopelvic stability and functional disability on chronic low back pain. So the effective intervention could be followed in clinical practice and thereby greater benefits could be obtained by patients to lead a pain free life & improve her functional ability in daily activities.

MATERIALS AND METHODOLOGY

The subjects from an institutional based musculoskeletal physiotherapy outpatient department referred with chronic low back pain were screened. The study subjects were included if age 25 - 60 years, having the low back pain symptoms more than 3 months, Subjects with signs and symptoms of instability [radiological diagnosis of spondylosis (Kelegrans Lawrence grade 2), grade I Spondylolisthesis corresponding to a symptomatic spinal level; “catching,” “locking,” “giving way,” or “a feeling of instability” in one direction or multiple directions of spinal movements], [11] able to walk without assistance and/or assistive devices at least 4.7 meters. Pain rating level between 3 to 6(as per 0-10 point numerical pain rating scale) An initial Modified ODI

score of 20% to 60%, and a physical therapy diagnosis of low back pain without radiating symptoms over buttocks or lower extremities Only females. They were excluded any musculoskeletal system disorders, neurological diseases, any functional restriction on the upper and lower limbs, any fracture, tumors ,infection, inflammation especially at lumbo pelvic region, pregnancy, Severe overweight (body mass index, BMI > 32), any Spinal surgery, abdominal surgery within the past 12 months and limb surgery, Chronic corticosteroid use , severe osteoporosis, [12,13] unwillingness to attend all treatment sessions & assessments.60 diagnosed as CLBP were included in study that fulfills the inclusions and exclusion criteria after detailed assessment. Informed consent was obtained from all study subjects (Table-1). The study obtained ethical approval from institutional review board.

Table –I: Demographic details.

Variables	Specific LS Exercise Group (n=30)	Control Group (n=30)	p-value
	Mean ±SD	Mean ±SD	p > 0.05
Age (Y)	43.63(8.85)	42.93(10.10)	0.776
Body height(cm)	158.72(6.77)	158.73(6.76)	0.994
Body mass(kg)	61.88(6.71)	63.06(5.70)	0.140
BMI(Kg/m^2)*	24.19(2.59)	25.52(2.05)	0.310
Duration (month)	12.03(4.08)	12.03(4.08)	0.313
**BMI=Body mass index*			

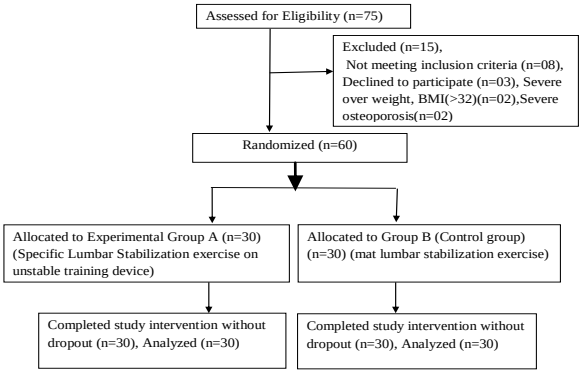

Figure no 1: Sampling Flow chart.

Sampling Techniques

All 60 subjects were randomly assigned to two groups; experimental Group A; specific lumbar stabilization exercises by using an unstable training device (n=30) and Group B (control group) received mat lumbar stabilization exercise (n=30) sample allocation was done by using random table method.

Intervention Program

Both groups were treated for 6 weeks by same physiotherapist. All subjects were taken intervention without dropout and baseline and post interventions outcome measures was taken by another physiotherapist and this intervention & evaluation physiotherapist were blinded to the both treatment groups. Group a & B subjects received SWD [14] for 10 minutes, coplanar method, site at lumbar region, position of the patient; crook lying and warm-up and cool down exercises was done with static bicycling for 10 minutes for each session and common for both the groups. Thrice a week for total 6 weeks. Followed by the specific exercise were given. The specific exercise taught with air filled ball with spherical diameter of 20cm, which are durable and suitable for weight bearing up to 150kg. [15] Because ball is narrow, their contact area with the floor is quite small, making them ideal as an unstable base of supporting first week all subjects were instructed and educated one by one by explained the purpose of the exercise and demonstrated the motions (for motor recruitment). Each exercise motion and the number of repetition & time been recorded.

Specific Stabilization Exercise (Group A) (experimental group) [6, 15,16]

The specific lumbar stabilization exercise group that used balls (unstable) performed as the following exercises: 1) In a ventral decubitus position, a ball placed below the neck and

subject bent the knees at 90°,then the subject performed slowly their right straight leg raise, then the same exercise was repeated for left lower limb 2) In a crook lying, the ball(unstable training device) placed below the pelvis, then subject performed pelvic bridge with pressing the ball, by maintaining spine to be straight 3) In a quadruped position, ball placed below one knee and kept the toes away from contact with the mat. The subject balanced first to stabilize the posture and slowly raised the right lower limb. Then the same exercise was done for left lower limb 4) In dorsal decubitus position, ball placed in front of the pelvis of the study subject. By pressing the ball, the subjects slowly raised the right lower limb, the same exercise was done for left lower limb 5) Lateral bridge, and the subject was positioned in right side lying, with right elbow directly beneath the shoulder and upper arm perpendicular to the ground. The ball placed under the feet. Then the subject raised the pelvis laterally and upwards. The same exercise was repeated in left side lying. 6) Hip abduction, here ask the patient to lie on her right side, the ball placed under the right leg, by maintaining spine in neutral, the patient ask to lift her left lower limb in sideward up to 45° by pressing the ball. The same exercise was repeated for right lower limb.7) SLR in supine, the ball placed under the left leg. Then ask the patient to do straight leg raise up to 90° by using her right lower limb. The same exercise was repeated for left lower limb. For all above exercise while raising the limb breath out, while dropping the leg breathes in was maintained. The subject performed all above exercise ten times, for 10 seconds each time for five sets, taking a rest of at least 15 seconds, thrice per week for total 6 weeks.(Figure number 2,3,4,5,6,7&8)

(Specific lumbar stabilization exercise-Group A) Figure (2 to 8).

Figure no: 2

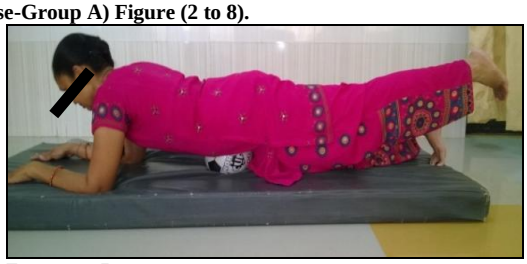

Figure no: 5

Figure no: 3

Figure no: 6

Figure no: 4

Figure no: 7

Figure no: 8

Figure no: 9 (LPS with PBU)

Group (B) (control group):

Group B subject was performed same motions on a mat. Thrice per week for total 6 weeks.

Outcome Measures

Pain was assessed by 0-10 Point NPRS, where the end points are extreme of no pain and worst pain. [17] Lumbo pelvic stability was measured with pressure biofeedback; here the subject was in supine crook lying position. PBU was placed beneath the lumbar spine from S1 to L1 and inflated to 40mmhg. The resting leg was placed on weighing scales ensuring that the subject was not pushing through this leg for stability and counter balance. Subjects were instructed to breathe in and out, and then hold the abdominal hollowing action throughout, beginning the test movement on the end of exhalation. An ability to maintain 40mmHg (±2mmHg) during maneuver indicated a successful performance (fig 9). [18] Functional Disability was measured with Modified Oswestery disability questionnaire (MODI), [19] a 10-item questionnaire designed to measure pain, personal care in patients with chronic low back pain. The LPS was reliable, reproducible, and sensitive instrument for assessment of CLBP [18] all outcome measures were used to assess baseline value and progressions at 6 week.

Statistical Analysis

All statistical analysis was done using SPSS 16 for windows software. The level of significant was set at p=0.05. Descriptive analysis was used to calculate mean and standard deviation. The inter group comparison of demographic details were performed using independent't' test & non parametric Mann Whitney 'U' test & for intra group comparison paired't'-test & Wilcoxon Signed Rank test was used.

RESULT

The demographic details (Age: P=0.776, Body Height: P=0.994,Body Mass :P=0.140,BMI: P=0.310 & Duration of the condition (P=0.313)of groups were homogenous with P>0.05(Table-I).pre treatment NPRS (P=0. 592),LPS(P= 0.491)and MODI (P= 0.904) shows no significant difference (P>0.05)and proves the pre treatment group homogeneity (Table-II) (Figure 10). Pre and post treatment comparison for NPRS (group A:P=0.000,Group B:P=0.001) and LPS(Group A:P=0.001,Group B:P=0.002) did shows significant difference & MODI (Group A:P=0.001,Group B:P=0.060) did not shows significant difference.(Table-III) (Figure 11 to 13).It indicates that both specific lumbar stabilization and control group was effective on pain, lumbopelvic stability & functional ability in CLBP subjects except functional disability in control group. Post treatment inter group comparison of NPRS(P=0.000), LPS(P=0.001) & MODI (P=0.001) shows highly significant difference (P<0.05)among groups(Table–IV) (Figure 14).The specific lumbar stabilization group proves more

significant improvement in NPRS,LPS and MODI compared to the control group.

Table-II: Pre treatment group comparison.

SPECIFIC LS EXERCISE GROUP (A)			CONTROL GROUP (B)		
Scales	Mean	±SD	Mean	±SD	P-value
NPRS	5.20	0.72	5.30	0.71	0.592
LPS	54.16	3.73	56.26	4.30	0.491
MODI	36.40	7.65	36.20	4.88	0.904

Table-IV: Post Treatment Group Comparison.

Specific lumbar stabilization group(A)			Control group(B)		
Scales	Mean	±SD	Mean	±SD	P-value
NPRS	1.30	0.80	2.60	0.77	0.000
LPS	43.86	1.59	50.03	3.95	0.001
MODI	10.73	3.48	19.23	4.20	0.001

Table –III: Inter& Intra Group NPRS, LPS & MODI Comparison.

Specific Lumbar Stabilization Group(A)					Control Group (B)		
Scales		Mean	±SD	P-Value	Mean	±SD	P-value
NPRS	Pre	5.23	0.72	0.592	5.33	0.71	0.592
	Post	1.34	0.85	0.000	2.60	0.89	0.001
LPS	Pre	54.16	3.73	0.049	56.26	4.32	0.049
	Post	43.86	1.60	0.001	50.03	3.95	0.002
MODI	Pre	36.40	7.65	0.904	36.20	4.88	0.904
	Post	11.06	3.25	0.001	19.23	4.20	0.060

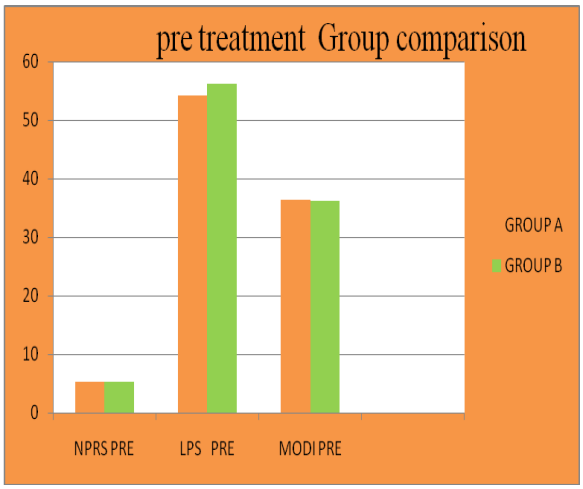

Figure: 10. Pre treatment group comparison.

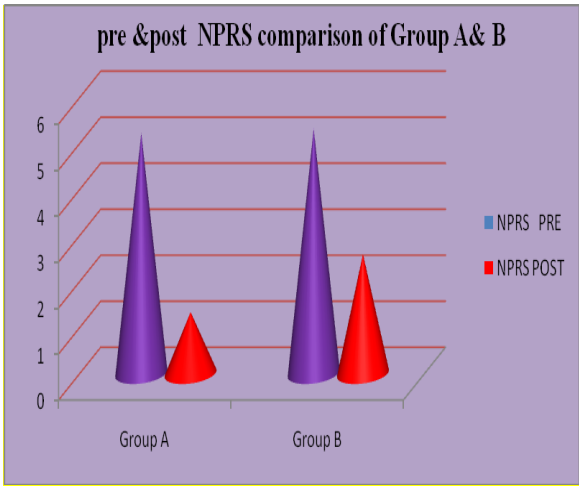

Figure: 11. Intra & inter Group NPRS comparison.

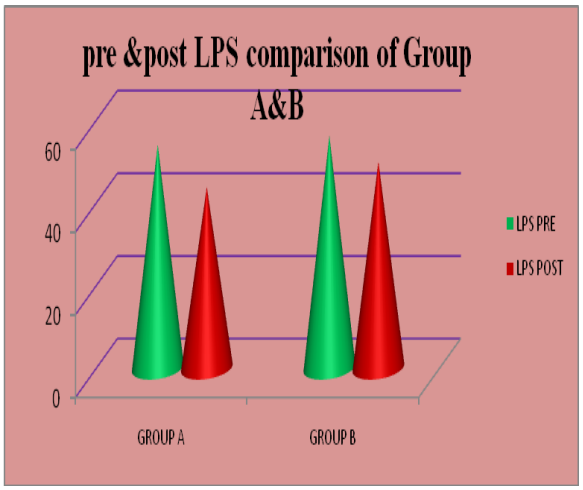

Figure: 12. Intra & Inter group LPS comparison.

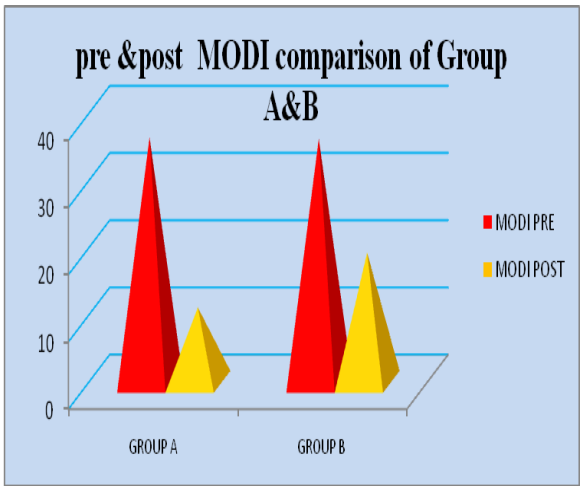

Figure: 13. Intra & Inter group MODI comparison.

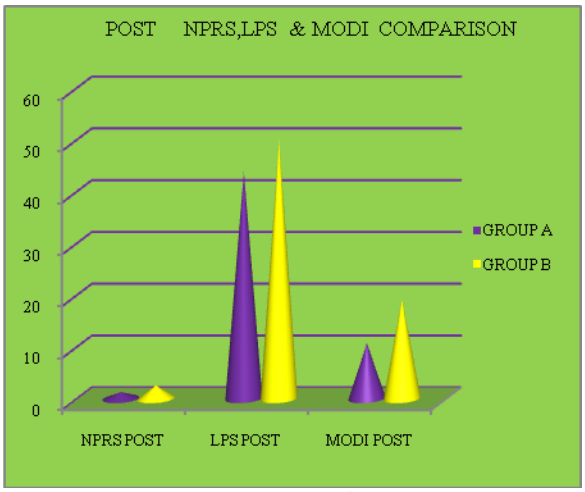

Figure: 14. Post treatment comparison of NPRS, LPS & MODI.

DISCUSSION

6 weeks of specific stabilization exercise with an unstable training device (ball) led to the findings that both treatments groups improved significantly in pain (NPRS) and lumbopelvic stability (LPS) & except functional ability in control group. After analysis of baseline data and post treatment scores, it reveals significant improvement ($P<0.05$) in both groups. There was significant difference ($P<0.05$) in post treatment comparison between lumbar stabilization with an unstable device group and control group. The findings of this study suggested that both lumbar stabilization training with unstable device and control group exercises are effective in the treatment of chronic low back pain. The lumbar stabilization training with an unstable training device group shows more effectiveness than that of control group in NPRS, LPS & MODI score.

The present study also showed that the ball exercise group had a more significant functional improvement (a decrease in pain from 5.23 to 1.34 points compared to 5.33 to 2.60 points for the control group) and improvement in LPS (from 54.16 to 43.86 and compared to 56.26 to 50.03 for the control group) and decrease in MODI (from 36.40 to 11.06 points compared to 36.20 to 19.23 points in the control group).

In CLBP patients, inappropriate proprioceptive senses are delivered to the central nervous system, which may reduce the ability to control postures. Mechanical receptors in soft tissues around the lumbar spine or synovial joints are affected by lumbar damage. After the initial damage, changes occur in the quantities or nature of proprioceptive inputs from the muscle spindles, Golgi tendon organs, and joint receptors. [20]

By performing stabilization exercise on unstable surface is the potential and great demand for muscular. [21] These exercises are resisted type, doing number of repetition which increases dynamic stability, balance of the local & weight bearing trunk muscles which naturally in conjunction with the development of other fitness components such as flexibility, strength & endurance which directly effect to decrease pain, functional disability. [3] The other mechanisms which related to pain reduction in CLBP due to improved appropriate deep muscle activation and neuromuscular control by specific stabilization exercise training which decrease reduction in the stress on the spinal inter segments. The superior effect of specific lumbar stabilization training with an unstable training device (destabilized environment) group compared to control group is similar to findings of previous authors. [22-31]

CONCLUSION

This study find the effects of specific lumbar stabilization exercise by using an unstable training device on pain, lumbopelvic stability and functional disability in patients with chronic low back pain who performed stabilization exercises using balls vs. control group exercises. The specific stabilization exercises resulted in increases in the lumbopelvic stability,

reduced functional disability and pain relief and recovery, were greater in the experimental group that performed exercises using unstable training device.

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Our best wishes to those valuable subjects & supporter of this study.

Conflict of Interest

We declare that there were no conflicts of interest in the entire journey of the study

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