Comparative Effect of Trunk Balance Exercise over Conventional Back Care Exercise in Patients with Chronic Mechanical Low Back Pain

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Abstract

Background: Mechanical low back pain refers to any type of pain caused due to abnormal stress and strain on muscles of the vertebral column. It can occur due to an acute traumatic event or cumulative trauma. The work place design is one of the major causes for Mechanical low back pain due to cumulative trauma. Mechanical low back pain also occurs due to poor posture, poorly-designed seating and incorrect bending and lifting habits.

Methodology: 40 patients with chronic mechanical low back pain were randomly divided into experimental group (group A, n= 20) that received trunk balance training exercises and hot packs, control group (group B n=20) received conventional back care exercises and hot packs for 3 days a week for 6 weeks. The single leg stance and star excursion balance test for static and dynamic balance assessed before and after treatment.

Results: Data analysis done using paired t- test showed there was a significant difference between pre and post analysis of both the groups. However when post analysis of both the groups were compared, experimental group showed higher difference as compared with control group.

Conclusion: Trunk balance training exercises was effective in improving static and dynamic balance in patients with chronic mechanical low back pain, and can be included in the treatment for patients with chronic mechanical low back pain.

Keywords: *Chronic mechanical low back pain, trunk balance training exercises, conventional back care exercises, single leg stance, star excursion balance test.*

Introduction

Back pain is an extremely common human phenomenon; a price mankind has to pay for their upright posture. Low back pain (LBP) is a most common public health problem, which involves muscles, nerves and bones of the back leads to disability.[1] [2] On the basis of duration low back pain is classified acute, sub-acute and chronic. It can be further classified as either mechanical, non-mechanical or referred pain on the basis of under lying cause.[3]

Mechanical low back pain is the pain in the lumbo-sacral region caused due to abnormal stress and strain on muscles of the vertebral column, where the pain increases due to physical activity with no radiation to foot or toes the common complaint in these.[4] The cause of mechanical low back pain may be an acute trauma or cumulative trauma. The work place design is one of the major causes for Mechanical low back pain due to cumulative trauma. The common clinical presentation shows that pain develops after movements that involve lifting, twisting or forward – bending. Multiple

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anatomical structures and elements of the lumbar spine (eg:-bones, ligaments, tendons and discs) are suspected to have a role. Educating patients on prognosis and incorporating psychosocial components of care such as identifying comorbid psychological problems and barriers to treatment are essential components of long-term management.[5]

Balance is a dynamic process by which the body's position is maintained in equilibrium, static or dynamic. Most of the balance intervention programs require a multisystem approaches. Balance exercises are exercises designed to improve balance or postural stability.[6] Postural balance is necessary to maintain normal daily life and physical activity, it involves active interactions of vestibular, visual and somato-sensory information. [7] Several studies have indicated that patients with LBP showed reduced postural control that is commonly manifested in balance problem. Maintenance and control of balance, under static or dynamic conditions, are essential for daily activities. Thus for patients with any musculoskeletal or neuromuscular disorders postural control is evaluated.

Assessment of balance is one of the essential parts in treatment of patients with low back pain as several studies have indicated that such patients have balance affection. Out of all the various methods available single leg stance and star excursion balance test are the test which are patient friendly and can be performed easily, thus these test were used for assessment of static and dynamic balance in this study.

The main purpose of the study was to find effectiveness of trunk balance training exercise in management of patients with chronic mechanical low back pain.

Materials and Method

The study conducted with 40 patients' aged between 18-45 years male and female subjects, diagnosed with chronic mechanical low back pain were recruited from outpatient department of physiotherapy, D.Y. Patil Hospital and Research Centre. Patients with inflammatory arthritis and chronic low back pain having surgical interventions were excluded from the study. Ethical clearance was obtained from institutional ethical committee. Informed consent was taken from the patients prior to evaluation and treatment sessions. The patients were then randomly divided into two groups using lottery method. The experimental group (group A, n=20) receiving trunk balance training exercises and control group (group B, n=20) receiving conventional back care exercises. Static and dynamic balance was assessed for pre and post interventions using single leg stance and star excursion balance test in patients of both the groups. Prior to treatment session the patients in both the groups were given hot packs for 15mins for pain relief. The patients were given exercises 3 sessions per week each lasting for 60 minutes with a total of 18 sessions over 6 weeks of treatment. The objective of this study was to see the effect of trunk balance exercise in patients with chronic mechanical low back pain on static and dynamic balance.

Table 1. Exercise Protocol for Experimental Group (Group A)

Sr.no	Exercise	Progression	Duration
1	Trunk, head & UL rotation from kneeling	Eye closure & head extension	30 secs each side 2 reps/ direction
2	UL flexion and extension with simultaneous head movement from kneeling	Eye closure	3 mins hold performing 6 reps of UL movements.
3	Pelvic bridging followed by raising one lower limb and extending knee.	Eye closure and ball under the foot resisting on couch	30 secs hold 2 reps for each LE.
4	Lifting opposite upper and lower limbs from quadrapued position.	Eye closure & pillows under LL	1 min maintaining for each combination of limbs.
5	Sitting on side of the couch with unilateral support.	Eye closure, crossing upper limbs across chest and pillow under LL.	1 mim hold.
6	Single limb kneeling on the edge of the couch.	Eye closure, head extension, crossing upper arm.	30 secs hold. 2c reps/ each limb.

Table 2. Exercise Protocol for Control Group (Group B)

Sr.no	Exercise	Progression	Duration
1	Supine lying –leg lifts	Unilateral leg lifts & both leg lifts	5 secs hold x 10 reps.
2	Crook lying- abdominal crunches	Crunches with rotation	5 secs hold x 10 reps.
3	Prone lying – leg lifts	Unilateral leg lifts & both leg lifts	5 secs hold x 10 reps.
4	Prone lying – trunk lifts	--------	5 secs hold x 10 reps.

Results and Analysis

The data analysis was done using SPSS software for windows version. Mean and standard deviation of all outcome measures were calculated. The significance level was set at $p<0.05$. The homogenesity of group was maintained. There were non- significant difference between both the groups at baseline measurement.

When pre and post mean values for single leg stance with eyes closed (SLSEC) for group A were compared the average difference was -1.305 secs with SD 0.546. The difference between mean SLSEC at pre and post level was statistically significant since p value=0.000 ($p<0.05$). When pre and post mean values for single leg stance with eyes closed (SLSEC) for group B were compared the average difference was -0.465secs with SD 0.79.The difference between mean SLSEC at pre and post level was statistically significant since p value=0.017. ($p<0.05$).

When pre and post mean values for single leg stance eyes open (SLSEO) for group A were comparison the average difference was -2.130 secs with SD 1.15. The difference between mean SLSEO at pre and post level was statistically significant since p value=0.000 ($p<0.05$). When pre and post mean values for single leg stance eyes open (SLSEO) for group B were comparison the average difference was -0.345 secs with SD 0.613. The difference between mean SLSEO at pre and post level was statistically significant since p value=0.021 ($p<0.05$).

Table 3. Comparison of pre and post mean values for star excursion balance test (Left Leg standing) for group A.

	Paired differences		t	SIG. (2-TAILED)
	Mean	Std. D		
*Presebtltant – postsebtltant	-3.575	1.462	-10.932	.000
*Presebtltam – postsebtltam	-4.525	5.485	-3.689	.002
*Presebtltal – postsebtltal	-4.950	6.076	-3.643	.002
*Presebtltmedial – postsebtltmedial	-4.900	3.615	-6.062	.000
*Presebtltlateral – postsebtltlateral	.625	7.868	.355	.726
*Presebtltpost – postsebtltpost	-5.475	7.280	-3.363	.003
*Presebtltpm – postsebtltpm	-5.875	6.943	-3.784	.001
*Presebtltpl – postsebtltpl	-5.225	6.122	-3.817	.001

Inference:

There was a statistically significant difference seen in parameters of SEBT (Left Leg standing) for group A since $p<0.05$ except for lateral ($p=0.726$) and anterorlateral ($p=0.442$) directions since $p>0.05$.

Table 4. Comparison of pre and post mean values for star excursion balance test (Right Leg standing) group A.

	Paired differences		t	SIG. (2-TAILED)
	Mean	Std. Deviation		
*presebtltant - postsebtltant	-4.800	2.098	-10.228	.000
*presebtltam - postsebtltam	-4.000	2.549	-7.016	.000
*presebtltal - postsebtltal	-4.825	2.504	-8.617	.000
*presebtltmedial - postsebtltmedial	-5.175	2.249	-10.289	.000
*presebtltlateral – postsebtltlateral	-4.925	3.613	-6.095	.000
*presebtltpost - postsebtltpost	-6.025	7.271	-3.705	.002
*presebtltpm - postsebtltpm	-5.250	7.826	-3.000	.007

Inference:

There was a statistically significant difference seen in parameters of SEBT (Right Leg standing) for group A since $p<0.05$.

Table 5 Comparison of pre and post mean values for star excursion balance test (left leg standing) for group B.

	Paired differences		t	SIG. (2-TAILED)
	Mean	Std. D		
*Presebtltant - postsebtltant	-1.050	.998	-4.702	.000
*Presebtltam - postsebtltam	-.950	1.700	-2.498	.022
*Presebtltal - postsebtltal	-.125	1.918	-.291	.774
*Presebtltmedial - postsebtltmedial	-.925	1.453	-2.846	.010
*Presebtltlateral – postsebtltlateral	-1.100	2.049	-2.400	.027
*Presebtltpost - postsebtltpost	-1.500	2.709	-2.476	.023
*Presebtltpm - postsebtltpm	-.800	2.567	-1.394	.179
*Presebtltpl - postsebtltpl	2.050	8.081	1.134	.271

Inference:

There was a statistically significant difference seen in all parameters of SEBT (left leg standing) for group B since $p<0.05$ except for anterorlateral, posterorlateral and posterormedial.

Table 6. Comparison of pre and post mean values for star excursion balance test (Right leg standing) for Group B.

	Paired differences		t	SIG. (2-TAILED)
	Mean	Std. D		
*Presebtltant - postsebtltant	-1.800	1.116	-7.208	.000
*Presebtltam - postsebtltam	-1.900	1.674	-5.073	.000
*Presebtltal - postsebtltal	-2.325	1.680	-6.188	.000
*Presebtltmedial - postsebtltmedial	-1.875	1.604	-5.225	.000
*Presebtltlateral – postsebtltlateral	-1.975	1.261	-7.001	.000
*Presebtltpost - postsebtltpost	-1.950	1.450	-6.014	.000
*Presebtltpm - postsebtltpm	-2.375	1.403	-7.567	.000
*Presebtltpl- postsebtltpl	-2.850	2.390	-5.332	.000

Inference:

There was a statistically significant difference seen in parameters of SEBT (Right leg standing) for group B since $p<0.05$

*SEBT- star excursion balance test, *ant- anterior, *am-anteriormedial, *al- anteriorlateral

*post-posterior, *pm- posteriormedial, *pl-posteriorlateral

Discussion

The main aim of the study was to compare the effect of trunk balance training exercises vs conventional back care exercises in patients with chronic mechanical low back pain. In this study 40 patients with chronic mechanical lowback pain were taken were randomly divided in to experimental group (group A- 20 patients) and control (group B – 20 patients). The subjects in experimental group were treated with trunk balance training exercises and control group were treated with conventional back care exercises. The results obtained in both the groups were statistically analysed.

The patients in experimental group had improvement in single leg stance (eyes closed with mean of 5.205 ± 0.97575 and eyes open with mean of 6.095 ± 2.18812). These patients also showed improvements in SEBT at $p<0.05$ pt in left leg standing at lateral and anterorlateral directions. The results were statistically significant since $p<0.05$.

The patients in control group had improvements in single leg stance (eyes closed with mean of 3.99 and eyes open with mean of 3.975). These patients also showed improvements in SEBT at $p<0.05$ except in left leg standing at anterorlateral, posterorlateral and posterormedial directions. The results were statistically significant since $p<0.05$. The pre and post analysis

of experimental group and control group showed improvements. But when post analysis of experimental and control group was compared, experimental group showed slightly higher difference as compared with control group. This shows that balance training exercises has significant improvement on static and dynamic balance of patients with chronic mechanical low back pain after 6 weeks of interventions.

This findings can be further supported by the study done by Hodges et al, Danneels et al Nourbakhsh et al, Anderson et al, Hides et al where trunk balance and strength training exercises were used in management of pain and disability of the patient and significant improvement was seen.[9],[11],[12],[13] Thus the study shows that there was significant improvement seen on static and dynamic balance in patients with chronic mechanical low back pain following trunk balance training exercises. [14],[15,[16]

Conflict of Interest: There was no conflict of interest to conduct this study.

Funding: This was a self funded study.

Conclusion

The study concludes that there was improvement in static and dynamic balance in patients with chronic mechanical low back pain following 6 weeks of trunk balance training exercises. Thus trunk balance training exercises can be included in the treatment of chronic mechanical low back pain.

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