A STUDY ON THE EFFECTIVENESS OF TRUNK BALANCE EXERCISES ON PATIENTS WITH CHRONIC MECHANICAL LOW BACK PAIN

Authors:

1.Ms.T.Arthi, Associate professor in Therapeutics,

National Institute for Empowerment of Persons with Multiple Disabilities (Divyangjan)(NIEPMD)
East Coast Road, Muttukadu, Kovalam Post Chennai - 603112,
Tamil Nadu, India.

Mail:arthignanam@gmail.com ,**Phone**:9840966905

2.Ms.S.Rajachitra, Lecturer in Physiotherapy,

National Institute for Empowerment of Persons with Multiple Disabilities (Divyangjan)(NIEPMD)
East Coast Road, Muttukadu, Kovalam Post Chennai - 603112,
Tamil Nadu, India.

Mail: rajachitraseenivasagan@gmail.com,**Phone:**9600453317

3.Dr.B.S.SanthoshKanna, HoDTherapeutics,

National Institute for Empowerment of Persons with Multiple Disabilities (Divyangjan)(NIEPMD)
East Coast Road, Muttukadu, Kovalam Post Chennai - 603112,
Tamil Nadu, India.

Mail:b2skanna@gmail.com,**Phone**:9840773284

3.Ms.Shruthi Mohan, BPT final year student,

National Institute for Empowerment of Persons with Multiple Disabilities (Divyangjan)(NIEPMD)
East Coast Road, Muttukadu, Kovalam Post Chennai - 603112,
Tamil Nadu, India.

Mail:shrutimohan001@gmail.com,Phone:9747219093

Abstract

Mechanical low back pain is a commonly occurring health problem. It refers to any type of pain caused due to abnormal stress and strain of vertebral column. It has been shown that patients with low back pain have poor postural stability than healthy subjects. This study intends to find the effects of trunk balance exercise in improving the static and dynamic balance in patients with chronic mechanical low back pain.

Methods

30 subjects diagnosed with mechanical low back pain and also with impaired balance as measured by Berg Balance Scale with a score of less than 46 were included in the study. An initial screening was done for each patient and their pre intervention Berg Balance score and Star Excursion Balance Test were measured. They underwent 4 weeks of intervention with balance exercises after which the post-test measures were done.

Results

There is a significant difference in both static and dynamic balance in subjects with chronic mechanical low back pain after 4 weeks of intervention with balance exercises.

Conclusion

The study shows that there was a significant improvement in static and dynamic balance of the individuals with chronic mechanical low back pain following four weeks of intervention with trunk balance training exercises.

Key words: mechanical back pain, trunk balance, static balance, dynamic balance.

Introduction

Mechanical low back pain is a commonly occurring health problem. Back pain most often affects people between the ages of 25 and 60 years and those aged between 50 to 60 years are likely to become disabled[3]. The occurrence of low back pain is alarming; nearly 60% of people in India have suffered from low back pain in their lifespan[1].Assessment of balance is one of the essential parts in treatment of patients with low back pain as several studies indicated that such patients have balance affections [10].

Personal health factors, such as smoking, overweight and lack of physical activity are often considered factors contributing to mechanical low back pain[7].In addition, low back pain patients experience a decrease in trunk activity because of pain, structural damage, and inhibition of reflex muscle contraction mechanism, and hence due to decrease of the activity of trunk for a long time and disuse, muscle atrophy and a decrease in muscle strength occur, which aggravate low back pain and bring about secondary lumbar segment damage and physical disability [1] It has been shown that patients with low back pain have poorer postural stability than healthy subjects[3].

Muscle endurance and weakness are associated with chronic low back pain and structural factors such as pelvic tilt, limb length discrepancy, and length of hamstrings, abdominal and iliopsoas muscle are associated with occurrence of low back pain. The maintenance and control of balance, in static or dynamic situations is an important requirement for physical and daily activities [8].So, well-functioning postural balance is essential to maintain normal daily life [1].The primary objective of this study is to find the effect of trunk balance exercises in improving static and dynamic balance in patients with chronic mechanical low back pain.

Methodology

This study used an interventional study design to determine the effectiveness of trunk balance exercises on individuals with chronic mechanical low back pain. 30 subjects were taken from the Department of Physiotherapy, National Institute for Empowerment of Persons with Multiple Disability,[NIEPMD] Chennai. They were explained about procedure involved in the study. Before enrollment in the study, institutionally approved written consent was obtained.

On the first visit a screening assessment was done. The pretest score of Berg Balance Test (BBS) was measured for each subject. Pretest score of Star Balance Excursion Test (SEBT) was measured for both the right and left leg of each subject in 3 directions, i.e anterior, lateral and posterior. Berg balance scale and Star excursion balance tests were the outcome measures used in the study to measure the static and dynamic balance respectively. The patients were given exercises, 3 sessions per week, with a total of 12 sessions over 4 weeks, and duration of 40 minutes for each exercise session. After 12 sessions of intervention the posttest BBS and SEBT scores were measured.

Inclusion criteria

- Subjects with history of low back pain for more than 6 months
- Both male and female subjects
- Age: 45 to 65
- Berg balance score: less than 46

Exclusion criteria:

- Patients with pathological low back pain
- Congenital conditions like spina bifida, scoliosis etc.
- Patients who underwent any surgical intervention.
- Any direct trauma.
- Low back pain due to psychological factors like depression and anxiety [1,4,10].

Outcome measures:

- Berg Balance Scale
- Star Excursion Balance Test

Intervention

Exercise 1

Patient position: Half kneeling on edge of the couch

Therapist position: Standing beside the patient, therapist supports both sides of the pelvis.

Procedure: Ask the patient to kneel on one leg and keep both hands on the thighs of the forward leg. Maintain the position for 30 seconds. Similarly do for the other limb. Each limb is given 2 repetitions. Progression is given asking patient to do closure of eyes and head extension.

Figure 1

Exercise 2

Patient position: kneeling on mat

Therapist position: kneeling behind the patient,supporting and holding the pelvis

Procedure: In kneeling ask the patient to rotate the trunk in each direction.in each direction ask patient to hold to count of 30 seconds.Progression is given by asking patient to close eyes and extend head

Figure 2

Exercise 3

Patient position: kneeling on mat

Therapist position:kneeling in front of patient

Procedure: Ask patient in kneeling to lift alternate extremities and turn head in opposite direction.Sixrepetitions are given for each limb. Progression is given by askingpatient to close eyes while doing the exercise.

Figure 3

Exercise 4

Patient position: supine lying

Therapist position: sitting beside the patient

Procedure: Ask the patient to lie on the back a and bend the knees, then ask to lift up the pelvis hold for a count of 10 and relax and then ask to raise one leg without bending the knees 2 sets of repetitions are given for each leg progression is given by increasing the hold time and placing a pillow under the foot placed on the couch

Figure 4

Exercise 5

Patient position: quadruped in mat

Therapist position: kneeling beside the patient, supporting and holding the pelvis

Procedure: Ask the patient to be in elephant position, straighten alternate upper and lower limb ask to hold the position the position for 10 seconds then relax, repeat for the other combination of limbs. Progression is given by asking to close the eyes.

Figure 5

Exercise 6

Patient position: long sitting

Therapist position: Standing beside the patient

Procedure: Ask the patient to sit on the edge of the couch with legs straightened out and handsinterlaced and kept on the edge of the couch. Ask to maintain this position for one minute. Progression is given by asking to close the eyes and cross the arms across the chest.

Figure 6

Data analysis and interpretation

Data was analyzed using SPSS software. Paired sample t test were used for the analysis which showed a significant difference in post test scores compared to pretest in both outcome measures that is Berg Balance Scale (BBS) and Star Excursion Test.

The difference between pretest and post test BBS score was highly significant ($p<0.05$)

The difference between pretest and posttest star excursion balance test as measured in three directions, anterior, posterior and lateral. The difference was of significant levels in anterior and lateral directions ($p<0.05$) but was not of significant levels in posterior direction as measured in SEBT.

These results showed that the subjects with chronic mechanical low back pain and balance impairment had significant improvement in their balance with trunk balance exercises, as measured by Berg Balance Scale and Star Excursion Test.

Statistics

Scale	Pre test Mean /sd	Post test Mean/ sd	Mean difference	t value	significance
BBS	42.3±1.442	50.50±2.255	-8.200±1.901	-23.626	.000
SEBT Rt.lat	55.477±1.27	56.18±1.17	-0.703±1.832	-2.102	.044
SEBT Rt.ant	58.887±1.34	60.85±1.28	-1.970±1.678	-6.427	.000
SEBT Rt.post	48.403±0.96	48.13±8.24	.2727±8.223	.182	.857
SEBT Lf.lat	57.980±1.31	61.26±2.41	-3.280±2.778	-6.465	.000
SEBT Lf.ant	51.95±1.17	55.06±1.04	-3.110±1.419	-12.003	.000
SEBT Lf.post	61.330±0.90	64.987±0.90	-3.656±0.995	-20.12	.000

P<0.05

BBS-Berg Balance Scale

SEBT-Star Excursion Balance Test

Rt ant-right anterior, Rt Lat-right lateral, Rt-post, right posterior, Lf-left

Discussion

The main aim of the study was to find the effectiveness of trunk balance exercises on patients with chronic mechanical low back pain. In this study patients with chronic mechanical low back pain were given trunk balance exercises. The results obtained were analyzed.

The values of both berg balance scale and SEBT showed improvements after the four weeks of intervention. The pre-test value for berg balance scale was 42, which was less than the score required for minimum functional balance. The post-test value showed improvement, a score of 50 was obtained, which is well above the minimum functional balance score (which is of 46). Meanwhile, both the left leg and right leg stance in star excursion test showed improvements after the period of intervention as seen in the statistical analysis. The values for SEBT also showed considerable amount of increase. The values for anterior and lateral reach in left leg stance showed considerable increase as compared to other reaches, meanwhile in right leg stance, the values of anterior, lateral and medial reaches showed considerable increase compared to the other reaches. This shows that trunk balance exercises have significant improvement on static and dynamic balance of patients with chronic mechanical low back pain.

In Berg Balance scoring, there was improvement seen in transfers, standing with feet together, reaching forward with outstretched arm, turning to look behind, placing alternate foot on stool and tandem stance. Improvement in the above said aspects indicates an improvement in the static balance and functional aspects of trunk muscles. In SEBT, there is a considerable increase in the reaches by each leg, which indicates an improvement in the dynamic balance of the patients and postural control.

The trunk balance exercises were aimed at improving the muscle strength and stability of the trunk muscles. Further progression was given increasing the hold time and by instructing closure of eyes. Improvement in the above said scales indicate an improvement in trunk muscles stability, strength and control.

Thus, trunk balance exercises helped in increasing the functional balance and in turn will help in reducing the risk of fall that occurs especially in the elderly due to postural instability and reduced trunk muscle strength.

This finding can be further supported by the study done by Hodges et al, Daneels et al, Anderson et al, hides et al where trunk balance and strength training exercises were used in management of pain and disability of patients and significant improvement was seen.

Another study that supports this finding was done by RuchiYogeshKhandar et al, where trunk balance exercises and conventional back care exercises were given to two groups, the group that was given the trunk balance exercises showed improvement.

Thus, the study shows that there was a significant improvement in static and dynamic balance of individuals with chronic mechanical low back pain following four weeks of intervention with trunk balance exercises.

Conclusion

This study concludes that there was improvement in static and dynamic balance in persons with chronic mechanical low back pain following four weeks of trunk balance training exercises, which was given for three days a week, each session lasting for duration of 40 minutes. The significant levels of improvement can be analyzed from the values interpreted from the descriptive statistical analysis .Thus it can be concluded that trunk balance training can be included in the treatment of patients with chronic mechanical low back pain.

Reference

1. SandeepKaur, ShyamalKoley (June 6, 2019). Effectiveness of trunk balance exercises and Wii fit balance exercises in managing disability and pain in patients with chronic mechanic low back pain.

2. Courtney M. Butowicz, Julian C. Acasio, Sheri Silfies (October, 2019). Chronic low back influences trunk neuromuscular control during unstable sitting among persons with lower limb loss.

3. Vishnu K Nair, Abhilash P.V, AryaHaridasan. (May 2022). Effect of lumbar stabilization exercises on mechanical low back pain

4. RuchiYogeshKhandar, Sathya.P, Jibi Paul (June, 2020). Comparison on effectiveness of conventional exercises and trunk balance exercises on patients with chronic mechanical low back pain

5. Gakhwangbo, Chae-woo Lee, Seong-gil Kim, Hyun-su Kim. (October 2015). The effects of trunk stability exercise and a combined exercise program on pain, flexibility, and static balance in chronic low back pain patients.

6. Dae-hyun Kim, Tae-ho Kim. (September 2018). Comparison of effectiveness of stability exercise and balance exercise on muscle activity in female patients with chronic low back pain.

7. Scott Will J, Bury D.C, Miller J.A, mechanical low back pain. American family physician. (October, 2018).

8. Nies. N, SinottP.L(may, 2016). variations in balance and body sway in middle aged adults. Subjects with healthy back compared with subjects with low back dysfunction.

9. Tsigkanos C, Gaskell L, Smirinotou (march, 2019). Static and dynamic balance deficiencies in chronic low back pain.

10. Kannabiran B, Nayak S, Nagarani R (July, 2017) Trunk balance exercises and strengthening exercises in the management of pain and disability among the chronic low back pain individuals.

11. Stephen Downs. The berg balance scale. Journal of physiotherapy, volume 61, issue 1. (January,2015).

12. Joseph L Laratta, Steven D Glassman. (December, 2019). The Berg balance scale for assessing dynamic stability and balance in the adult spinal deformity (ASD) population

13. Diego López-Plaza, Casto Juan Rico (march, 2016). Reliability of the Star Excursion Balance Test and Two New Similar Protocols to Measure Trunk Postural control.

14. Charles W. Armstrong, Stephen J Kinzy (august, 2019). The Reliability of the Star-Excursion Test in Assessing Dynamic Balance.

15. G Shankar Ganesh, Deepak Chhabra, K Mrityunjay. (March, 2015). Efficacy of the star excursion balance test in detecting reach deficits in subjects with chronic low back pain.

16. FarahnazEmam, Amin KordiYoosefinejad, Mohsen Razeghi. (October, 2018).Correlations between core muscle geometry, pain intensity, functional disability and postural balance in patients with nonspecific mechanical low back pain.

17. RafaellaStradiottoBernardelli, Eduardo Mendonça. (July, 2019). Effects of Kinesio Taping on postural balance in patients with low back pain, a randomized controlled trial

18. Beomryong Kim (July, 2020).Core Stability and Hip Exercises Improve Physical Function and Activity in Patients with Non-Specific Low Back Pain: A Randomized Controlled Trial

19. GulsahOzsoy (October, 2019).The Effects of Myofascial Release Technique Combined with Core Stabilization Exercise in Elderly with Non-Specific Low Back Pain: A Randomized Controlled, Single-Blind Study

20. Anastasia Mpeneka (October, 2014). Immediate Effects of Core-Stability Exercises and Clinical Massage on Dynamic-Balance Performance of Patients with Chronic Specific Low Back Pain.

21. Silvia Gianola (January, 2022). Effectiveness of treatments for acute and subacute mechanical non-specific low back pain: a systematic review with network meta-analysis.

22. Cedric Yves Barrey, Jean-Charles Le Huec (April, 2019). Chronic low back pain: Relevance of a new classification based on the injury pattern.

23. Natalia Aquaroni Ricci (may, 2019). Effectiveness of the Pilates method versus aerobic exercises in the treatment of older adults with chronic low back pain: a randomized controlled trial protocol.

24. Tobias Renkawitz (November, 2006). The association of low back pain, neuromuscular imbalance, and trunk extension strength in athletes.

25. PavelKolar (April, 2012). Postural function of the diaphragm in persons with and without chronic low back pain.

26. Ulrike Van Daele (may, 2019). Differences in balance strategies between nonspecific chronic low back pain patients and healthy control subjects during unstable sitting.

27. FrisoHagman (march, 2010). Decrease in postural sway and trunk stiffness during cognitive dual-task in nonspecific chronic low back pain patients, performance compared to healthy control subjects.

28. Marco Godi (February, 2013). Comparison of reliability, validity, and responsiveness of the mini-BESTest and Berg Balance Scale in patients with balance disorders.

29. MasoodMazaheri (January, 2010). Postural sway in low back pain: Effects of dual tasks.

30. C A Lima (December, 2018). The Berg Balance Scale as a clinical screening tool to predict fall risk in older adults: a systematic review.

31. Tobias Renkawitz (November, 2006).The association of low back pain, neuromuscular imbalance, and trunk extension strength in athletes.

32. MasoodMazaheri (January,2013).Low back pain and postural sway during quiet standing with and without sensory manipulation: A systematic review.

33. MohammadBagherShamsi, Maryam Mirzaei. (April,2020). Core Stability Exercise Versus General Exercise for Chronic Low Back Pain.

34. Wen-Dien Chang, Hung-Yu Lin, Ping-Tung Lai. (March, 2015). Core strength training for patients with chronic low back pain.

35. G Shankar Ganesh, Deepak Chhabra, K Mrityunjay. (March, 2015).Efficacy of the star excursion balance test in detecting reach deficits in subjects with chronic low back pain.

36. Satoshi Kato, Hideki Murakami. (June, 2019). Abdominal trunk muscle weakness and its association with chronic low back pain and risk of falling in older women.

37. M I Mientjes, J S Frank. (December, 2000). Balance in chronic low back pain patients compared to healthy people under various conditions in upright standing.

38. Rubens A da Silva, Edgar R Vieira, Karen B P Fernandes. (June, 2018).People with chronic low back pain have poorer balance than controls in challenging tasks.

39. Massimo Bovenzi, Marianne Schutz, Marcella Mauro. (November 2017). An overview of low back pain and occupational exposures to whole body vibration and mechanical shocks.

40. Alexander Ruhe, René Fejer. (December, 2011).Is there a relationship between pain intensity and postural sway in patients with non-specific low back pain?