International Journal of Health Sciences and Research
www.ijhsr.org ISSN: 2249-9571

Original Research Article

Effect of Activity Specific Spinal Stabilization Exercises on Pain and Spinal Mobility in Lumbar Spondylosis

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ABSTRACT

Background: Lumbar spondylosis is a leading cause of low back pain worldwide and is also considered as a socioeconomic burden to the society. A wide range of treatment options are present for the management of this degenerative joint disease.
Aim: To study and find out the effect of activity specific spinal stabilization exercises on pain and spinal mobility in lumbar spondylosis.
Methods: The study was an experimental study conducted at Krishna hospital, Physiotherapy OPD, Karad after being approved by the institutional ethical committee. The study included 64 subjects who were randomly divided into two groups with 32 individuals in each group. Group A received conventional physiotherapy and activity specific spinal stabilization exercises and Group B received conventional physiotherapy alone (Hot moist pack, TENS, static back exercises) for a period of 3 weeks.
Results: Statistical analysis was done by using paired t test and unpaired t test. Post intervention analysis of inter group for pain done by Visual analogue scale (VAS) showed very significant difference with p value= 0.001, for ROM flexion showed very significant difference with p value =0.004 as well as extension also showed significant difference with p value= 0.024 also right and left lateral flexion showed significant difference with p values 0.031 for lateral flexion towards right side and p value= 0.016 towards left side respectively. Oswestry low back pain disability index also showed significant difference between the group with p value= 0.026.
Conclusion: The present study concludes that activity specific spinal stabilization exercises have significant effect on pain and spinal mobility in lumbar spondylosis.
Keywords: Lumbar spondylosis, degenerative disease, pain, spinal mobility, activity specific exercises, spinal stabilization

INTRODUCTION

Lumbar spondylosis is a degenerative joint disease affecting the lumbar spine. The various terms used to denote the alteration that takes place in the spine and the disc includes lumbar osteoarthritis, disc degeneration, degenerative disc disease and spondylosis. In fact, the condition is termed as spondylosis whenever there is a co-occurrence of degeneration in the disc, lumbar spine, osteophyte formation and the associated changes in the nerves and the resulting symptoms of pain. These new bones (osteophyte) are responsible for the development of backache also dependent upon its frequency and size. The chances of getting this condition are high as the age increases. As the day passes, these newly

formed bones may compress the adjacent nerves and results in impingement. [1]

It can be of three types. Acute (mild) - no radiation, Sub acute (moderate) – with radiation above the knee, Chronic (severe) – with radiation below the knee.[1]Studies states that, degenerative changes are noted not only in above forty years but also between twenty to twenty nine years too. [2] In a typical case of lumbar spondylosis there exists a reduction in the space between the vertebral bodies. This is due to the degeneration of the intervertebral discs. This leads to pain, which may or may not be radiating, tingling, and numbness in the limbs. Radiating pain, tingling and numbness results from nerve impingement. Sometimes osteophytes can also impinge the nerve roots. As the disease progresses, the affected spinal segment becomes stiff and at the end it is get fused. [3] The degenerative changes in the spine will affect the spinal stability. The spine may receive excessive stress on loading while performing the activities. The muscles will be overloaded on activity. As a result of the condition there is pain, reduced movements and the functional activities are impaired.

Muscles provide stability to the spine by supporting the discs and joints. Degenerative changes occur mostly due to repetitive loading of the back, repeated movements and due to abnormal working positions. Low back pain which occurs as a result of the degenerative changes will affect the functional activities of the individual. [4,5] The present study is about the role of activity specific spinal stabilization exercises on reduction of pain and improving spinal mobility in subjects with acute and sub acute lumbar spondylosis. Activity specific spinal stabilization exercises are a set of exercises that are designed to improve the spinal muscle function.

Activity Specific Spinal Stabilization Exercises in Lumbar Spondylosis

This is a globalised exercise programme based on the core muscles. It focuses on two groups of muscles like deep (segmental) muscles and superficial (global) muscles. As in the name itself deep (segmental) muscles have direct attachments in the vertebra and a role in maintaining each segment in a stable position. Global muscles are superficial muscles and are spreaded widely. If the segmental muscles are not stable then the load transferred from the global muscles puts excessive stress on the secondary tissues. [4,6]

Only training the segmental muscles

↓

Training segmental muscles + global muscles for spinal stabilization

↓

Practicing various activities in neutral spine

This study contains a step wise program beginning with statics followed by dynamics and ending up in activities which caused pain before resulting in graded contraction of the muscles. These exercises will recruit the muscles in different positions like supine, side lying, prone, sitting, quadruped, standing and walking. The exercise programme focuses on the muscles of the diaphragm, shoulder, elbow, hands, trunk, abdomen, hips and knees. [4,6,7]

Objectives

- To determine the effect of activity specific spinal stabilization exercises on pain and spinal mobility in lumbar spondylosis.
- To determine the effect of conventional physiotherapy on pain and spinal mobility in lumbar spondylosis.
- To compare the effect of activity specific spinal stabilization exercises and conventional physiotherapy on pain and spinal mobility in lumbar spondylosis

MATERIALS AND METHODS

The present study was an experimental study which was started after being approved by the Institutional Ethical Clearance Committee of Krishna Institute of Medical Sciences Deemed to Be University, Karad. The present research comprised of 64 individuals who were randomly divided into Group A and Group B with 32 peoples

respectively by consecutive random sampling. Group A was the experimental group which received conventional and activity specific spinal stabilization exercises. Group B received conventional physiotherapy (Hot moist pack, TENS, static back exercises) alone.

The study duration was a period of one year at Krishna Hospital in the Physiotherapy outpatient department, Karad. Intervention was done for a period of 3 weeks. It included both male and female populations. The purpose of this study was explained and consent was taken from the subjects who were willing to participate. There were a total of 64 subjects participated after fulfilling the inclusion and exclusion criteria.

Inclusion criteria

- Age group 30-60 years
- Both genders
- Farmers in sugarcane industry
- Diagnosed with lumbar spondylosis in acute and sub acute phase
- Localized pain in the lumbar region
- Subjects who are willing to participate in the study

Exclusion criteria

- Age group above 60 years
- Radiating pain to legs
- Recent spinal surgeries
- Spinal fractures, TB spine
- Spondylolysis, spondylolisthesis
- Spinal canal stenosis
- Chronic lumbar spondylosis
- Subjects with orthosis
- Upper motor neuron lesions
- Recent traumas in which spinal fractures and instabilities have not been ruled out.
- severe pain
- Psychological distress
- Peoples not willing to participate

Outcome Measures

- Visual Analogue Scale (VAS) for pain

The VAS has shown greater sensitivity than discrete points of categorical scales. The pain rating scales allow the subject to visually guage the amount of pain along a solid 10 cm line where 0 represents no pain and 10 represents maximum pain.

- Modified-modified Schober's test for lumbar ROM

The lumbar range of motion like flexion and extension were measured using standard technique of modified-modified schobers test. Markings were done by using a paper tape in which the first mark was at the spine in the line to the two PSIS and the second mark was 15 cm above from the first mark. By using a measuring tape the differences in range of motion are noted. Lateral flexion was measured by using a measuring tape from the tip of the finger to the floor.

- Oswestry low back pain disability questionnaire

This test is considered as the gold standard of low back functional outcome tools. It contains 10 items. For each session the maximum possible score is 5. The score is interpreted by 0%-20%: minimal disability, 21%-40%: moderate disability, 41%-60%: severe disability, 61%-80%: crippled, 81%-100%: bedridden patients.

Data collection

Proper history was taken from the subject who complaint of low back pain. All the necessary investigations including radiology were checked to confirm lumbar spondylosis.

Pre-treatment and Post-treatment measures for pain on VAS, functional disability using Oswestry low back pain disability questionnaire and lumbar range of motion using Modified-modified Schober's test and by using measuring tape were recorded before and after the study.

Pain was measured using the visual analogue scale (VAS). Each subject was asked to mark a point in the 10 cm vertical line on the VAS to indicate the intensity of pain experienced by the subject. Score 0 indicate that there is no pain at the moment and score 10 indicate that there is extreme pain present. The VAS is measured as the distance from 0 cm to the point marked by the subject.

Lumbar range of motion was measured by using modified-modified Schober's test and lateral flexion was measured by using measuring tape.

Quality of life was measured by using Oswestry low back pain disability questionnaire.

Procedure

Both the groups received hot moist pack for a duration of 15 minutes at the low back region and TENS with a frequency of 100-150 Hz, intensity is 12-30 milliampere and pulse width of 100-500 microsecond. Along with this conventional group received static back exercises and interventional group received activity specific spinal stabilization exercises.

Interventional group received activity specific spinal stabilization exercises

It was a three stage exercise program starting with static exercise followed by dynamics and ending up in activities which is used to cause pain.

Table no. 1: Activity Specific Spinal Stabilization Exercises [4-6]

Level	Exercises		Repetitions
Level 1: To reduce pain	Supine 1. Chin tucks 2. Chin tucks+deep breathing+b/l shoulder flexion to 90^0 3. Chin tucks+deep breathing+b/l shoulder abduction to 90^0 4. Chin tucks+deep breathing+shoulder flexion to 180^0 5. Chin tucks+deep breathing+shoulder abduction to 180^0 6. Chin tucks+deep breathing+diagonal patterns of upper limb 7. Abdominal draw in 8. Kegels exercise 9. Thomas stretch 10. Bent leg fall out 11. Abdominal draw in with unilateral heel slide 12. Abdominal draw in with SLR 13. Abdominal draw in with b/l heel slides		30secs hold 10x3 sets
	Prone 14. Chin tucks in prone lying 15. Chin tucks and lifting the forearms and elbows off the floor by squeezing the shoulder blades together		
	Sitting 16. Abdominal draw in and knee lifts to 90^0 17. Isometrics to neck flexors 18. Isometrics to neck extensors 19. Isometrics to neck lateral flexors		30secs hold,10x3 sets
	When the patient is able to perform exercises without pain then progress to level II		
Level II: To improve spinal mobility	Quadripod 20. Shells stretch 21. Cat stretches 22. camel stretches 23. Lifting one arm 24. Lifting one leg 25. Cervical curl ups 26. Abdominal curl ups – hand horizontal across chest behind the head		30 seconds hold 3sets
	Progress to level III		
Level III: To improve functional activities	Activities affected	Exercises	Repetitions
	Picking up objects	31) Wall squats 32) wall squats+abdominal draw in 33)Mini squats 34)mini squats+abdominal draw in 35) Repeated picking up object from the floor by activating segmental muscles.	10 reps
	Reaching forward	36)Forward lunges 37)Backward lunges 38)Sideway lunges 39)Repeated reaching out for objects in forwards	
	Pushing object	40)walking against resistance 41)pushing a weighted object	
	Transferring object	42) core stability exercises	
	Turning Driving Cutting Catching Throwing	43) activation of the segmental muscles and taking steps rather than twisting 44)stretching+core stability exercises 45) core stability exercises in sitting 46) cervical+abdominal curl up	10 reps 30secs hold, 3 sets

The statistical analysis was done using paired‘t’ test and unpaired‘t’ test.

Paired‘t’ test was used for statistical analysis of pre and post intervention within group.

Unpaired‘t’ test was used for between group statistical analysis of Group A and Group B.

RESULT

Table no. 2 Post VAS score between the groups

	VAS(Post)	
	Group A	Group B
Mean±SD	1.906±1.027	2.781±1.008
P value	0.001	
T value	3.440	
Dof	62^0	
Inference	Very significant	

In the present study pre interventional mean ± SD of VAS score was 7.65±0.700 in Group A and 7.68±0.692 in Group B whereas post-interventionally VAS score was 1.906±1.027 in Group A and 2.781±1.008 in Group B respectively. Inter group analysis of VAS score was done by unpaired t- test.

Pre interventional analysis showed no significant difference between group A and group B (p=0.858). Post intervention analysis showed very significant difference between Group A and Group B (p=0.001).

Table no.3 Post flexion score between the groups

	Flexion (Post)	
	Group A	Group B
Mean ± SD	4.5±0.762	3.900±0.856
P value	0.004	
T value	2.931	
Dof	62^0	
Inference	Very significant	

In the present study pre interventional mean ± SD of flexion score was 2.906±0.777 in Group A and 2.969±0.932 in Group B whereas post-interventionally flexion score was 4.5±0.762 in Group A and 3.900±0.856 in Group B respectively. Inter group analysis of VAS score was done by unpaired t- test.

Pre interventional analysis showed no significant difference between group A and group B (p=0.771). Post intervention analysis showed very significant difference between Group A and Group B (p=0.004).

Table no. 4 Post extension score between the groups

	Extension (Post)	
	Group A	Group B
Mean ± SD	3.344 ± 0.483	2.969 ± 0.782
P value	0.024	
T value	2.308	
Dof	62^0	
Inference	Significant	

In the present study pre interventional mean ± SD of extension score was 2.469 ± 0.841 in Group A and 2.406 ± 0.798 in Group B whereas post-interventionally extension score was 3.344 ± 0.483 in Group A and 2.969 ± 0.782 in Group B respectively. Inter group analysis of VAS score was done by unpaired t- test.

Pre interventional analysis showed no significant difference between group A and group B (p=0.761). Post intervention analysis showed significant difference between Group A and Group B (p=0.024).

Table no. 5 Post right lateral flexion score between the groups

	Right lateral flexion (Post)	
	Group A	Group B
Mean ± SD	5.531 ± 1.077	4.937 ± 1.076
P value	0.031	
T value	2.206	
Dof	62^0	
Inference	Significant	

In the present study pre interventional mean ± SD of right lateral flexion score was 4.812 ± 1.306 in Group A and 4.406 ± 1.266 in Group B whereas post-interventionally lateral flexion score was 5.531 ± 1.077 in Group A and 4.937 ± 1.076 in Group B respectively. Inter group analysis of lateral flexion score was done by unpaired t- test.

Pre interventional analysis showed no significant difference between group A and group B (p=0.211). Post intervention analysis showed significant difference between Group A and Group B (p=0.031).

Table no. 6 Post left lateral flexion score between the groups

	Left lateral flexion (Post)	
	Group A	Group B
Mean ± SD	5.5 ± 1.047	4.844 ± 1.081
P value	0.016	
T value	2.467	
Dof	62^0	
Inference	Significant	

In the present study pre interventional mean ± SD of left lateral flexion score was 4.625 ± 1.129 in Group A and 4.406 ± 1.188 in Group B whereas post-interventionally lateral flexion score was 5.5 ± 1.047 in Group A and 4.844 ± 1.081 in Group B respectively.

Inter group analysis of lateral flexion score was done by unpaired t- test. Pre interventional analysis showed no significant difference between group A and group B (p=0.453). Post intervention analysis showed significant difference between Group A and Group B (p=2.467).

Table no. 7 Post Oswestry low back pain disability index score between the groups

	ODI (Post)	
	Group A	Group B
Mean ± SD	0.308 ± 0.073	0.3525 ± 0.081
P value	0.026	
T value	2.278	
Dof	62^0	
Inference	Significant	

In the present study pre interventional mean ± SD of ODI score was 0.444 ± 0.078 in Group A and 0.455 ± 0.081 in Group B whereas post-interventionally ODI score was 0.308 ± 0.073 in Group A and 0.3525 ± 0.081 in Group B respectively. Inter group analysis of ODI score was done by unpaired t- test.

Pre interventional analysis showed no significant difference between group A and group B (p=0.553). Post intervention analysis showed significant difference between Group A and Group B (p=0.026).

DISCUSSION

The main goal of this study was to find out the effect of activity specific spinal stabilization exercises on pain and spinal mobility variables in acute and sub acute stages of lumbar spondylosis. Spondylosis is associated with pain and disability in the worldwide population.

In the total of 64 subjects, after meeting the inclusion criteria there were 32 individuals in which 20 males and 12 females in Group A and 32 individuals in which 15 males and 17 females in Group B. The mean age of the participants in group A was 48.906±12.837 and group B was 51.062±10.013.These values correlates to the age group in the study of Middleton K and Fish D. which states that lumbar spondylosis is more common above 40 years of age. The farm workers were took in this study because of their work positions. They are undergoing repeated bending, lifting weights, driving, transferring objects and these are impaired due to pain.

After analyzing various studies it was concluded that various exercise protocols were designed for the management of low back pain. But this study was undertaken to find out the effect of activity specific spinal stabilization exercises on pain and spinal mobility in individuals with lumbar spondylosis.

Sawant RS and Shinde SB conducted a study on effect of hydrotherapy based exercises for chronic non specific low back pain and concluded that water based exercises resulted in relief of low back pain in the subjects. [8] In a study conducted by Mohite SA and Shinde SB titled effect of early intervention with spinal isometric exercises in acute lumbar intervertebral disc prolapse ended up with a conclusion that spinal isometric exercises has a significant effect on pain and spinal mobility in acute low back pain. [9] Also Sewani R and Shinde S done a study on the effect of hot moist pack and muscle energy technique in subjects with SI joint dysfunction. This study concluded in such a way that combined treatment of hot moist pack and MET is beneficial in reducing pain and improving lumbar range of motion. [10] Also Ahmed B et al carried out a study on the effects of transcutaneous electrical nerve stimulation on patients with acute low back pain and reached in a conclusion that transcutaneous electrical nerve stimulation is effective in terms of acute low back pain. [11]

In this study, group A participants belonged to the interventional group. They received hot moist pack, TENS and activity specific spinal stabilization exercises. Both the group showed improvement, however

the experimental group showed better improvement in outcome measures. In comparison with the conventional group the better result obtained in the experimental group is due to the activity specific spinal stabilization exercises. Those are a set of core stability exercises based on three stages. The first stage contains static exercises, second stage includes dynamic exercises and third stage consists of activities that provoked pain before. These activate the superficial and deep stabilizers of the spine. These exercises will recruit the muscles of the trunk, upper and lower extremities as well as the abdominals and Paraspinal, gluteus, diaphragm and pelvic floor muscles in various positions. [7,12-14]

According to Akuthota et al core stability exercises are essential in cases of spinal instability. Activity specific spinal stabilization exercises induces pain-spasm-pain model, maintain the normal alignment of spine and avoids excessive load on particular segments leading to reduction in pain

At the same time, adding flexibility exercises starting from the cervical, thoracic and lumbar and including the extremity movements activates the superficial muscles and may improve the mobility. This helps to move the bodily joints in their normal range of motion and avoids over activity of particular muscle groups. That may be one of the reasons for the improvement in spinal mobility. The participant is made an active member throughout the study. Once the spinal mobility is improved, it will give a positive impact on the activities of the subject that was limited before and also due to training the outcomes were improved. These finding also correlates with the findings of the other studies. [4,15,16]

There was a reduction of pain in both the groups which can also be due to hot moist pack and TENS. Hot moist pack has been proven beneficial for pain reduction and relaxation of the tissues in the study by Beyerman K and Foster K. It helps in pain reduction by reducing the muscle spindle sensitivity. [17]

In the present study, the statistical analysis for pain, range of motion and quality of life showed extremely significant difference within the group (p=<0.0001). The statistical analysis for pain, range of motion and quality of life between the group in the pre treatment were considered not significant and after the post treatment statistical analysis between the group A and B showed that pain was considered very significant (p=0.0010), flexion was considered very significant (p=0.0047), extension was considered significant (p=0.0243), right lateral flexion was considered significant(p=0.0311), left lateral flexion was considered significant (p=0.0164) and Oswestry disability index was considered significant (p=0.0262). These results could be possibly due to the advantage of stabilization exercises which adds dynamic stability to static stability of the spinal segments causing decrease in pain and improving the motions. It may be because these muscles provide stability to the spine by supporting the discs and joints and there by helps to prevent injuries and further degenerative changes in the lumbar spine. [18,19]

Therefore, the above results conclude that, there was significant difference in reducing pain, improving range of motion and quality of life in individuals after a three weeks intervention in both the groups but the group which received activity specific spinal stabilization exercises is more effective. The recurrence of low back pain in the experimental group was absent compared to conventional group.

CONCLUSION

Based on statistical analysis, results and interpretation it can be concluded that activity specific spinal stabilization exercises has shown significant improvement in pain and spinal mobility. Thus, this study provided the evidence to support that activity specific spinal stabilization exercises has shown relief in pain and improvement in spinal mobility

and quality of life in individuals with lumbar spondylosis.

ACKNOWLEDGEMENT

The authors would like to express their sincere thanks to the university, participants, hospital, staff and friends who had given their valuable contributions to complete this research.

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How to cite this article: George BA, Shinde SB. Effect of activity specific spinal stabilization exercises on pain and spinal mobility in lumbar spondylosis. Int J Health Sci Res. 2019; 9(7):174-182.

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