



## A STUDY TO COMPARE THE EFFECTIVENESS OF THE PILATES METHOD AND GYROTONIC EXPANSION EXERCISE ON SPINAL STABILITY IN SUBJECTS WITH CHRONIC LOW BACK PAIN

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### ABSTRACT

Non-specific chronic low back pain is termed when the pathoanatomical cause of pain is not determined. Studies have shown core muscle weakness can greatly cause low back pain and there exists a strong positive correlation in effectiveness of Pilates method and gyrotonic exercise on spinal stability in subjects with chronic low back pain. The sample was taken between the age group of 30 – 60 years males after 4 weeks of intervention. As core muscles in response to sensory motor mechanism activated by the mechanoreceptors and strengthening muscles of low back region can impact positively. Outcome tools used were LRT, ODI (Oswestry low back pain disability questionnaire), NPRS Scale for screening the patients. Lumbar rocking test was clinically used for assessing the spinal stability of the patients. 30 samples were taken. Measuring the statistical analysis of Group A(n=15) and Group B(n=15) low back pain was reduced and resulting that Pilates exercise (Group A) showed the mean difference and SD of LRT are 0.60 and 0.3 and 't' value is 2.04136 where gyrotonic exercise (Group B) showed the mean difference and SD of LRT are 0.27 and 0.135 and 't' value is 2.04136. In conclusions, the Pilates exercise (Group A) showed significant effect on improvement in pain reduction and spinal stability giving less results in outcome tool of LRT on subjects with chronic low back pain.

**KEYWORDS :** Spinal stability, Lumbar rocking Test, ODI Score, NPRS Scale, Pilates Exercise, Gyrotonic Exercise.

### INTRODUCTION

Low back pain is the leading cause of the years lived with disability in both developed and developing countries and sixth in term of overall disease burden (disability adjusted life years).<sup>[1]</sup> There are several causes for lower back pain but the most common is non-specific cause is due to epidemiological factors and degenerative changes and it accounts for 85% of all cases. Most of the 80% of the populations will experience an episode of LBP at some time during their lives. It is benign 95% of those afflicted recovering within a few months of onset. Some however will not recover and will develop chronic LBP i.e, pain that lasts for 3 months or longer.<sup>[4]</sup>

Low back pain has also been acknowledgement as a wide spread and significant health and socio-economic problem. The people involved in various occupations are being affected by it. The developing countries are not an exception for LBP as there is still much lack awareness in related to ergonomic issues.<sup>[2]</sup> In prevalence of low back pain, which included 165 studies from 54 countries the mean point prevalence was estimated to be 18.3% and 1 month of prevalence was 30.8%.<sup>[3]</sup> One of the major reasons for low back pain is Core muscle weakness. The core muscles are Rectus abdominus, Obliques muscles, Multifidus, Quadratus lumborum, Transverse abdominus, Erector Spinae, Latissimus dorsi and Psoas major. The deep core muscles are often neglected or importantly trained in athletes. This dysfunction of deep core muscle musculature during repetitive, dynamic activity may lead to improper loading, poor coordination, compensatory movement patterns muscle strain or injury to spinal structures all of which have been associated with increased low back pain.<sup>[5]</sup>

Low Back Pain is the second most common cause of disability in US adults and a common reason for lost work days. A less investigations were contributed in factors of increasing the prevalence in chronic low back pain.<sup>[4]</sup>

Also, in preventive strategies of LBP, the evidences suggested that exercise alone or in combination with education is effective for preventing LBP whereas other interventions including education alone, back belts and shoe insoles do not appear to prevent LBP.<sup>[22]</sup> Specific cause of low back pain is not known but a significant portion of the problem is of

mechanical origin. It is often referred to as clinical spinal instability. Clinical spinal instability is defined as the loss of spine's ability to maintain its pattern of displacement under physiologic loads so there is no initial or additional neurologic deficit, no major deformity and no incapacitating pain.<sup>[7]</sup>

Low back pain is caused by a degenerated or damaged facet joint sacroiliac joint with soft tissue injury on the trunk or by lumbar instability from weak end muscle strength. Lumbar instability restricts muscle strength, endurance, flexibility and active range of motion. In particular, patients with CLBP persisting for more than 6 months restrict trunk movement to minimize pain in the lumbosacral area or leg, which aggravates the level of lumbar muscle weakness in paraspinal muscles and multifidus. These changes increase lumbar instability and raise the recurrence of low back pain.<sup>[6]</sup>

The Pilates method, which focuses on improving body awareness and movements through particular exercises is thought to manage the chronic low back pain by activating the deep spinal and abdominal stabilization.<sup>[8]</sup> Pilates is a system of exercises that improved the function of muscles involved in lumbopelvic stabilisation and it facilitates transversus abdominis, multifidus, diaphragm and pelvic floor muscles. This type of exercise may strengthen deep stabilising muscles that support the lumbar spine in treating CLBP patients.<sup>[9]</sup> The neuromuscular demands of traditional Pilates methods can be quite high and therefore a modification of this method is necessary for application to physiotherapeutic interventions. The technique used in this study was adapted but consistent with traditional Pilates techniques focusing on postural symmetry and controlled movement.<sup>[16]</sup>

Gyrotonic exercise uses three dimensional movements which used not only for strengthen the spine but also develop the spine evenly. The name is derived from the combination of Gyro (a circle) and tonic (to strengthen).<sup>[12]</sup> Gyrotonic exercise is one of the exercise programs for low back pain patients that has recently drawn the attention at Europe and America as an exercise program system focused on the spine and it is derived from exercises in a variety of fields such as yoga, gymnastics and swimming. Gyrotonic exercises helps to improve muscles strength and flexibility along with breathing and collaborative muscle contraction by circular and spiral movements that helps to stretch each of the areas in the body. It focuses on

rotational multidirectional movement designed to mobilize the body's energy system and release areas of restricted flow.<sup>[13]</sup> The common basic movement from the gyrotonic expansion System, Arch and Curl (A&C) in its many dimensions were origin, basic principles, biomechanics, common problems and bodywork.<sup>[14]</sup>

Several studies stated that the Pilates and the Gyrotonic exercise showed beneficial effect on low back pain. This study is to compare the effect of Pilates with Gyrotonic exercises on spinal stability for the subjects with chronic low back pain.

**PROCEDURE**

Comparative study was conducted at Sri Venkateshwara Medical College Hospital & Research Centre for 30 patients of age 30 – 60 years old in male category. The methodology was explained at the subjects and got informed consent form from the subjects. The subjects were asked about recent injuries, training sessions, warm up routine and diet. Then height and BMI of the subjects were calculated and tool for assessing spinal stability was explained to the subjects.

Patient who fulfilled the inclusion criteria were the eligible subjects and were selected in the study after obtaining informed consent form. The total of 30 subjects were divided equally into 2 groups. Group A (n= 15) and Group B (n=15). Group A will receive Pilates based exercise and Group B will receive Gyrotonic based exercise. These exercises were performed by the subjects for 4 weeks after being assessed.

**PILATES BASED EXERCISE (GROUP - A)**



Fig: 1.1 - Leg Lifts

Fig: 1.2 - Single Leg Stretch



Fig: 1.3 - Swan Dive

Fig: 1.4 - Criss Cross



Fig: 1.5 - Toe Taps

Fig: 1.6 - Shoulder Bridge

1. Patient was asked to lie down flat in crook lying and asked to raise one leg with knee flexion in 90 degree and hold it for 5 secs and alternately raise another leg and such 10 repetitions was made in a single session. (Fig:1.1)

2. Position the patient in supine position and asked the patient to grasp the flexed leg and hold it for 5 secs and alternately by grasping the next leg and such 10 repetitions was made in a single session. (Fig:1.2)

3. Patient in prone lying on elbow and asked the patient to extend the neck and chest region and hold it for 5 secs and come again to prone position and such 10 repetitions was made in a single session. (Fig:1.3)

4. Patient was made to lie flat in supine lying asked the patient to put his hands together at the back of head with elbows adducted, lateral flex at right to the left flexed leg and alternate lateral flex at left to the right leg in such 10

repetitions was made in single session. (Fig:1.4)

5. Position the patient in supine position then flex the knee to 90 degree and hold it for 5 secs and place the forefoot down and repeated with alternate leg in such 10 repetition was made in single session. (Fig:1.5)

6. Position the patient in side lying and asked the patient to raise both the legs together and hold it for 5 secs and repeated the same for 10 times in a single session. (Fig:1.6)

**Gyrotonic Expansion System (GROUP - B)**



Fig: 2.1 - Arching of back with extension of leg

Fig: 2.2 - Bending Of Spine

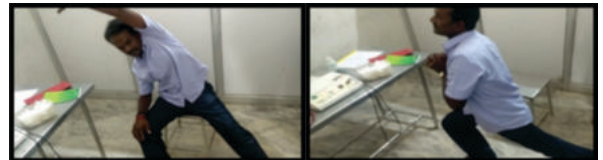


Fig: 2.3 - Lunge position arching on side

Fig: 2.4 - Backward lunges



Fig: 2.5 - Side Bending

Fig: 2.6 - Back alternate leg stretch

1. Patient was to sit on side of the stool and asked the patient that they should bend his body with raised shoulder and extend with extension of one lower limb ipsilaterally and hold it for 5 secs and alternately in such 10 repetitions was made in a single session. (Fig:2.1)

2. Patient in sitting position that patient should grasp the stool and bend the spine and raise it for 10 times in a single session. (Fig:2.2)

3. Patient in lunge position patient has to laterally flex the hip with raising the shoulder and laterally flex at the opposite side for 5 secs and also alternately for 10 times in a single session. (Fig:2.3)

4. Patient in standing asked the patient to clasp their hands together at his chest with one leg in 90-degree knee flexion in which another leg is extended back and made circling with flexing the knee. (Fig: 2.4)

5. Patient in sitting position that patient should join his fingers together on the back of the head and bend on side in right and left and repeat the same for 10 times. (Fig:2.5)

6. Patient in bending position placing the hands on the top of the stool lifting the one leg and stretch for 5 secs and alternately the next leg in such 10 repetitions was made in a single session. (Fig:2.6)

**RESULTS**

**NPRS Scale:**

GROUP A: The mean value and SD of NPRS Scale for pre and post-test are 5.60, 0.40 and 0.4899, 0.4899 and 't' value is 28.08321. The statistical analysis was done with unpaired 't'

test for group A and shows a very statistical significance of ('p' value is 0.001). GROUP B: The mean value and SD of NPRS Scale for pre and post-test are 5.73, 2.29 and 0.44222, 0.79881 and 't' value is 14.03932. The statistical analysis was done with unpaired 't' test for group B and shows statistically significant of (p<0.05).

GROUP A AND GROUP B: The analysis of the sample was done. The mean difference and SD of NPRS Scale are 5.20 and 0.7746 and 't' value is 6.68143. The mean difference and SD of NPRS Scale are 3.47 and 0.63994 and 't' value is 6.68143. The Statistical analysis was done with paired 't' test for the group A and B and shows statistically significant of (p<0.05). It has been found that the pre-test and post-test values of NPRS showed that pain had significant improvement in both group but on comparison it showed higher improvement in group A than group B.

**ODI Score :**

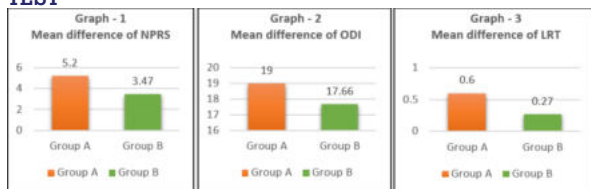
GROUP A: The mean value and SD of ODI Score for pre and post-test are 21.00, 2 and 2.244949 and 't' value is 22.4811. The statistical analysis was done with unpaired 't' test for group A and shows a very statistical significance of ('p' value is 0.001). GROUP B: The mean value and SD of ODI Score for pre and post-test are 21.33, 3.67 and 2.21108, 2.21108 and 't' value is 21.13969. The statistical analysis was done with unpaired 't' test for group B and shows statistically significant of (p<0.05).

GROUP A AND GROUP B: The analysis of the sample was done. The mean difference and SD of ODI Score are 9.00 and 9.5 and 't' value is 2.06599. The mean difference and SD of ODI Score are 17.66 and 8.83 and 't' value is 2.06599. The Statistical analysis was done with paired 't' test for the group A and B and shows statistically significant of (p<0.05). It has been found that the pre-test and post-test values of ODI Score showed that pain had significant improvement in both group but on comparison it showed higher improvement in group A than group B.

**LRT Score:**

GROUP A: The mean value and SD of LRT for pre and post-test are 1.00, 0.40 and 0, 0.4899 and 't' value is 4.58258. The statistical analysis was done with unpaired 't' test for group A and shows very statistical significance of ('p' value is 0.001). GROUP B: The mean value and SD of LRT for pre and post-test are 1.00, 0.73 and 0, 0.44222 and 't' value is 2.2563. The statistical analysis was done with unpaired 't' test for group B and shows statistically significant of (p<0.05). GROUP A AND GROUP B: The analysis of the sample was done. The mean difference and SD of LRT are 0.60 and 0.3 and 't' value is 2.04136. The mean difference and SD of LRT are 0.27 and 0.135 and 't' value is 2.04136. The Statistical analysis was done with paired 't' test for the group A and B and shows statistically significant of (p<0.05). ON ANALYSIS: It has been found that the pre-test and post-test values of LRT showed that pain had significant improvement in both group but on comparison it showed higher improvement in group A than group B.

**GRAPH 1,2,3: THE GROUP ANALYSIS OF BETWEEN THE GROUP A AND GROUP B VALUES FOR NPRS, ODI & LRT TEST**



Graph 1,2,3: Showing the Mean of difference of both values of NPRS, ODI & LRT in Group A and Group B

**DISCUSSION**

This present comparative study has been conducted to find out the effectiveness of Pilates method and Gyrotonic expansion exercises on spinal stability in subjects with CLBP. The CLBP subjects were selected as the study population for better exercise program for spinal stability. The age group were chosen between 30-60 years. While the NPRS and ODI tools were helpful in assessing the outcomes such as Pain and Disability, the Lumbar Rocking Test was helpful in assessing the spinal stability. Out of the 30 samples, none of the participants reported any worsening of symptoms during the treatment sessions.

Core muscle stability deals with local as well as global stabilisation system. Local stability system includes transverse abdominis, internal oblique, multifidus, pelvic floor musculature and diaphragm. These muscles that directly attach to the vertebrae which primarily consist of slow twitch-type 1 fibres. These muscles work to limit excessive compressive, shear and rotational forces between spinal segments. Whereas the muscles of global stabilisation such as quadratus lumborum, Psoas major, external oblique, rectus abdominis, glutes medius and adductor complex has their attachment from pelvis to spine. Thereby, they transfer loads between upper extremity and lower extremity and provide eccentric control of the core strength mainly by inducing them in Pilates training and Gyrotonic training.

Although it has been concluded in few literatures that Pilates training improve the function of stability and we are able to see it among the gyrotonic training and still had an increase in Pilates but very slightly and it comparatively reduced pain and disability as with the as the Group A who performed Pilates training. Certain literatures in our review had stated the effectiveness of core stabilisation and back extensor exercise in improving the spinal stability but subjects were trained by Pilates exercise which are simple and can be done. Gagon et al., concluded that there is no significant difference between Pilates method and other exercises for lumbar stabilisation. However, in the field suggested that Pilates method is more effective than minimal physical exercise intervention in reducing the pain and disability in short term period.<sup>[18]</sup>

Sureenporn Phrompaet et al., (2010) The stability of lumbo-pelvic is also dependent on the central nervous system to determine the requirements of stability by pre-programmed Transverse Abdominus contraction to stabilise the spine prior to the trunk perturbation from the limb movements and external load to the body's parts. By Pilates method, CNS enhances control of spine when the trunk is challenged by the internal and external forces.<sup>[11]</sup> Harrington and Davis et al., Interestingly, there was no participants passing lumbo-pelvic stability test in any of the Pilates and control groups. It shows that asymptomatic individuals present inability of transverse abdominus activation for maintaining lumbo-pelvic stability in normal subjects was also reported so, it is the reason that Pilates is helpful in regaining the stability of the spine.<sup>[11]</sup>

Granata et al., (2005) Stability means the maintenance of a certain state even in the presence of external stimulus. Increased changes in the lumbar stability indicate that the spine can maintain a neutral posture despite stimulation around the lumbar. In this study the result revealed lumbar muscle activity and an increased maintenance time of passive tilt to maintain lumbar stability. This suggests that both gyrotonic and trunk stability exercise are effective in improving lumbar stability.<sup>[12]</sup> Carlton 1987 et al., provides that he educated workers in appropriate lifting. He found that when subjects were watched in laboratory, they complied with instructions and lifted in a correct manner but when they watched at the worksite they lifted in an inappropriate manner. Thus, exercise and education are helpful in workplace interventions to prevent LBP.<sup>[22]</sup>



Thereby, the optimal performance of pain reduction is obtained through Pilates and gyrotonic training and improvement of spinal stability were seen in Pilates training among CLBP subjects and this will be of immense help in people who work in stooped posture and also with people in high precision jobs.

## CONCLUSIONS

This study concluded that the Pilates exercise (Group A) showed significant effect on pain, function and spinal stability than the Gyrotonic exercise (Group B) on subjects with chronic low back pain between the age group of 30 – 60 years males after 4 weeks of intervention.

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