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Comparison of mat and Swiss ball based Pilates exercise in chronic nonspecific low back pain patients

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Abstract

Objective: To compare the effect of mat and Swiss ball based Pilates exercise in chronic nonspecific low back pain patients.

Design: Prospective comparative study

Setting: Department of musculoskeletal department, Pravara Rural Hospital, Loni.

Method: 30 subjects were selected for the study aged between 20-40 years and randomly divided into two equal groups of 15 each. The Group 'A' subjects were asked to perform Pilates exercise on mat and Group 'B' performed similar exercise on Swiss ball. Both the groups were asked to perform 4 types of Pilates exercise for 3 weeks starting with 3 repetitions progressing to 9 repetitions by the end of third week. The core strength was assessed by using ITO test and the pain and disability by using modified Oswestry Pain and Disability Index (MODI).

Result: There was a significant difference seen on comparison between the individual pre-post interventional statistics of both the groups, nevertheless, when comparison was made between the post results of the two interventions, there was no significant difference.

Conclusion: The current study concludes that the mat and Swiss ball based Pilates exercises are equally beneficial in chronic nonspecific low back pain patients.

Keywords: Pilates exercises, low back pain, mat, swiss ball, ITO test, MODI

1. Introduction

The Lumbo-Sacral area of the back is also known as lower back. It is made up by the muscles that are attached and surrounds the spine. The spine is made up of many bones called vertebrae and between each vertebra is a disc. The discs are a combination of a strong fibrous outer layer and a softer, gel-like centre called as nucleus pulposus, is present between the vertebrae. Inter vertebral disc act as shock absorber, allow the spine to be flexible. To give extra support and strength to the spine ligaments are attached to nearby vertebrae^[1].

Pain is defined as an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage^[2]. Low back pain is the second most common cause of disability in adults^[3]. The low back pain can be categorized on the basis of the duration and etiology. On the basis of duration low back pain can be classified as acute, sub-acute and chronic. Acute low back pain is in between 0 and 6 weeks, Sub-acute low back pain is in between 6 and 12 weeks and chronic low back pain is more than 12 weeks^[4]. On the basis of etiology the incidence or progression of low back pain includes the mechanical aspects of the system (i.e., compression, tension, shear, torsion, rate of loading) along with physiological, psychological, socioeconomic, and psychosocial factors^[5]. Non specific low back pain; Non specific low back pain is the most common type of back pain; it can develop for no apparent reason. The severity of the pain can range from mild to severe. Sometimes a pain may develop immediately after you lift something heavy, or after an awkward twisting movement^[6].

Chronic non specific low back pain can be treated by various methods like modalities, William's flexion exercises, McKenzie exercises but it has been shown that Pilates exercise have more beneficial effect on chronic non specific low back pain.

Pilates exercises mainly involve isometric contractions (i.e. contraction without joint movement) of the core muscles, which make up the muscular centre responsible for the stabilization of the body, both while it is moving or at rest.

2. Methodology: The participants were selected as per the inclusion criteria and participants were explained about the intervention. 30 subjects were selected and allocated into 2 groups; 15 for mat and 15 for swissball:

Group A: Pilates exercises given on mat

Group B: Pilates exercises given on swissball

Scales used to assess pain and disability and core strength are

1. Modified Oswestry pain and disability index - The Oswestry Low Back Pain Disability Questionnaire can be used to assess patients with low back pain by determining its impact on the activities of daily living.

2. Ito-test

- For evaluating flexor endurance, subjects were asked to lie in a supine position and to raise the lower extremities with 90° flexion of the hip and knee joints.
- For evaluating extensor endurance, subjects were asked to lie in a prone position while holding the sternum off the floor. A small pillow was placed under the lower abdomen to decrease the lumbar lordosis.

During both procedures, subjects were asked to maintain their maximum flexion of cervical spine, with pelvic stabilization through gluteal muscle contraction.

Subjects were instructed to do warm up exercise for 5 min, like stretching of oblique, rectus abdominis, transverse abdominis. Both groups were asked to perform 4 types of core stability exercises for relieving low back pain for 3 repetitions at 1st week, 6 repetitions at 2nd week and later on 9 repetitions at 3rd week. Pre and post pain can be evaluated by using Modified Oswestry low back pain and disability questionnaire and core strength can be evaluated by Ito-test. Common Pilates based exercises on swiss ball and mat in this study are:

- Bridging
- Curl up
- The hundred prep
- Front plank

Exercise for mat Group

1. Bridging on mat

Starting position: Supine or crook lying, with hands at the side of the body, palm facing downwards.

Procedure: Slowly raise the hips off the grounds so that only forearms and heels are touching the ground.

Instruction: Weight is supported across the shoulder area. Avoid pressing the cervical spine into the floor. Maintain neutral posture in the lumbar and cervical spine throughout

2. Curl-up on mat

Starting position: Supine incline position with arms over the head.

Procedure: Slowly curl your trunk, letting your shoulders and upper back lift off the ground. Return slowly to starting position.

Instruction: Avoid pulling on the head or neck. Return to neutral posture between each repetition.

3. The hundred prep

Starting position: Subject assumes a supine position with elbow under the shoulder and upper arm perpendicular to the ground.

Procedure: Slowly float the head and lift the leg to 90-90, pumping the arm till 5 counts.

Instruction: Inhale to prepare and exhale during float the head and lifting the leg to 90-90. Initiate the movement from the core

4. Front plank on mat

Starting position: Subject assumes a front plank position with elbow under the shoulder and upper arm perpendicular to the ground.

Procedure: Slowly lift the shoulder and pelvis off the ground, supporting points will be on elbow and feet.

Instructions: Balance the forearm under the shoulder and keeping your spine neutral and drawing in your lower stomach.

Exercise for swiss ball group

1. Bridging on Swiss ball

Starting position: Start in supine position with arms out to the side. Place feet on the ball toes pointed forward. Draw abdominal muscles in towards the spine.

Procedure: Contract the abs and gluteus and lift hips off the floor.

Instruction: Avoid rotating toes outwards

2. Curl-up on Swiss ball

Starting position: Start in supine position with lower back supported on the ball. Hands are clasped behind the head. Feet are shoulder width apart. Draw lower abdominal muscles towards the spine.

Procedure: Slowly flex the spine while keeping abdominal muscles draw in. Return to starting position.

Instruction: Keep cervical neutral by keeping the chin tucked.

3. The hundred prep

Starting position: Subject assumes a supine position with elbow under the shoulder and upper arm perpendicular to the ground and leg bent 90-90 on swiss ball.

Procedure: Slowly float the head, pumping the arm till 5 counts.

Instruction: Inhale to prepare and exhale during float the head. Initiate the movement from the core.

4. Front plank on Swiss ball

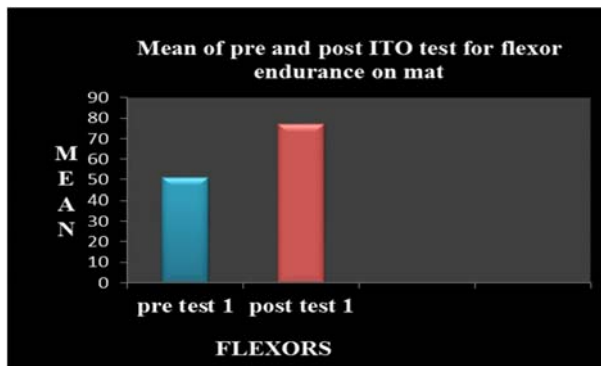
Starting position: Subject assumes a front plank position on the Swiss ball with elbow under the shoulder and upper arm perpendicular to the ground.

Procedure: Slowly lift the shoulder and pelvis off the ground, supporting points will be on elbow and feet.

Instructions: Balance the forearm under the shoulder and keeping your spine neutral and drawing in your Lower stomach the hundred prep.

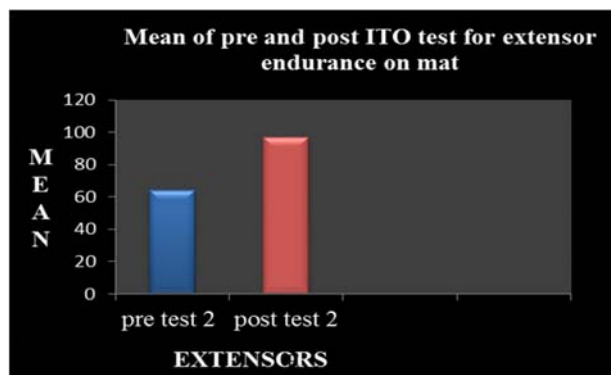
4. Results and Discussion

1. Comparison of pre and post ITO test for flexor endurance on mat



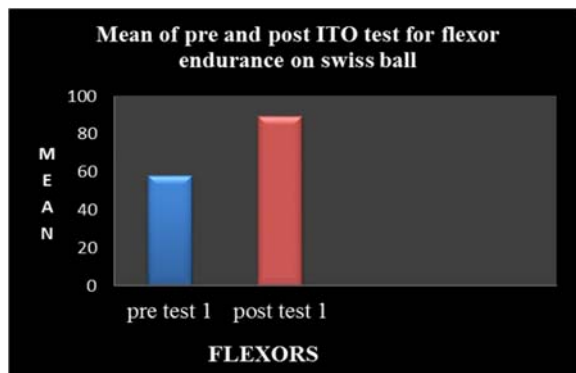
Graph 1: Comparison of pre and post ITO flexor endurance test for mat p value is <0.0001 and t value is 5.832; which is extremely significant.

2. Comparison of pre and post ITO test for Extensor endurance on mat



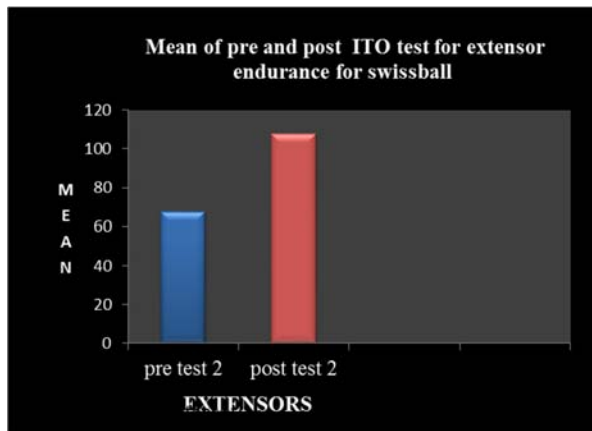
Graph 2: Comparison of pre and post ITO extensor endurance test for mat p value is <0.0001 and t value is 7.197; which is extremely significant.

3. Comparison of pre and post ITO test for flexor endurance on swissball



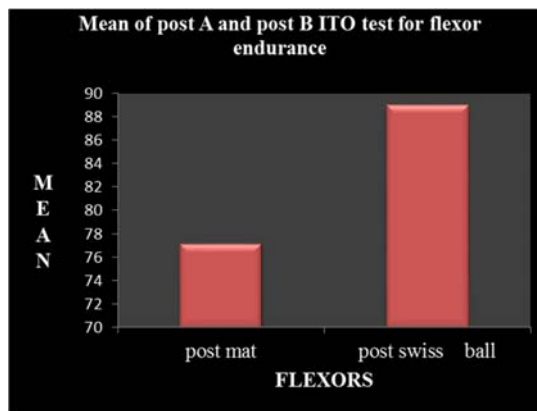
Graph 3: Comparison of pre and post ITO flexor endurance test for swissball, p value is <0.0001 and t value is 8.601; which is extremely significant.

4. Comparison of pre and post ITO test for extensors endurance on swissball



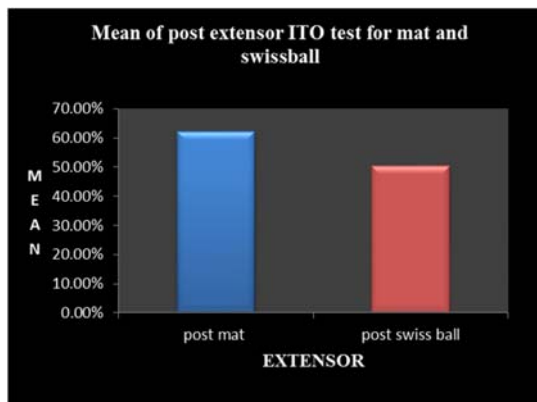
Graph 4: Comparison of pre and post ITO extensor endurance test for swissball using paired t test in which p value is <0.0001 and t value is 10.382; it indicated extremely significant.

5. Comparison of post A and Post B ITO test for flexor endurance on mat and swiss ball



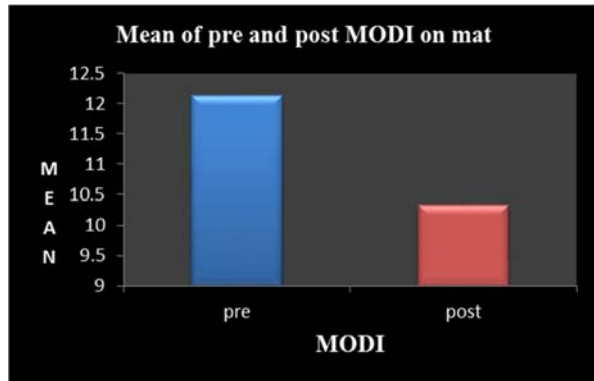
Graph 5: Comparison of Post A and Post B ITO flexor endurance test for swissball and mat using paired t test in which p value is 0.1977 and t value is 1.319; it indicated not significant.

6. Comparison of post A and post B ITO test for extensor endurance on mat and swissball



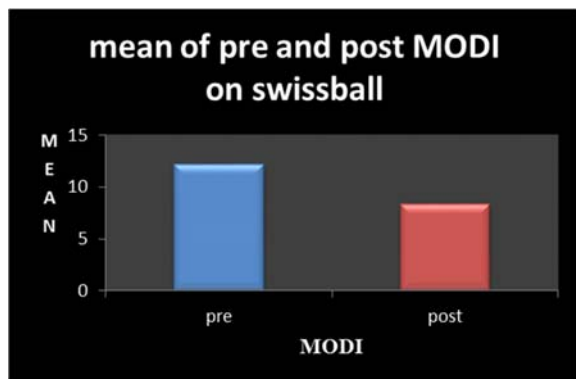
Graph 6: Comparison of Post A and Post B ITO extensor endurance test for swissball and mat using paired t test in which p value is 0.2361 and t value is 1.142; it indicated not significant.

7. Shows comparison of Pre and Post mat pain and disability on MODI



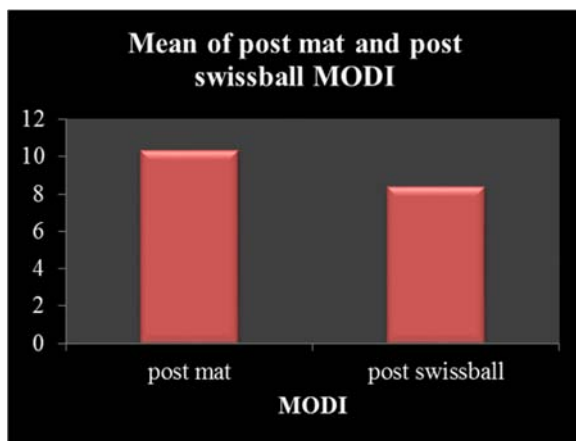
Graph 7: Comparison of Pre and Post MODI on mat using paired t test in which p value is 0.0158 and t value is 2.473; it indicated significant

8. Comparison of Pre and Post swissball pain and disability on MODI



Graph 8: Comparison of Pre and Post MODI on swissball using paired t test in which p value is <0.0001 and t value is 10.333; it indicated extremely significant.

9. Comparison of Post mat and Post swissball pain and disability on MODI



Graph 9: Comparison of Post mat and Post swissball MODI by using paired t test in which p value is 0.0183 and t value is 2.507; it indicated extremely significant.

5. Discussion: Low back pain is a condition which can be treated by wide variety of physiotherapy interventions.

Present study was undertaken to find out effectiveness of mat and swissball based Pilate’s exercise, by using ITO test for core strength and endurance and modified Oswestry pain and disability scale. The intervention included 4 Pilate’s exercises given to all the participants in Group A and Group B on mat and swiss ball respectively for 3 weeks. The four Pilates exercises which are used to relieve low back pain are: bridging, curl up, hundred prep exercises, front plank. Bridging, a body weight strength training exercise, helps muscles in the back and hips (erector spinae, gluteus maximus, hamstring) to work together to coordinate the lifting of the hips and also improves the strength of core muscles. Curl ups are an effective way to strengthen the muscles of your abdomen specifically the rectus abdominis, external and internal oblique. During hundred prep exercise, breathing and percussive pumping of arms not only increases oxygen exchange and blood circulation but also activates pelvic floor muscles and abdominal muscles. During front plank body weight borne on forearm, elbows, and toes strengthens erector spinae, rectus abdominis, transverse abdominis, trapezius, rhomboids, deltoid, pectorals, gluteus maximus, quadriceps, and gastrocnemius. The results of the present study are such that, intervention given on mat and swiss ball showed significant changes in the strength of muscles but when the effects of the intervention on mat and swiss ball were compared no significant changes were seen according to ITO test whereas according to MODI, pain and disability index were reduced more when participants were trained on swiss ball than on mat. As per our knowledge this is the first study which compares the effect of Pilates exercise on mat and swissball in patients with chronic non specific low back pain with 3 weeks of intervention.

Mat: Mat Pilates concentrates mainly on mat based Pilates exercises, is a gentle form of exercise which makes it more suitable for the patients with back pain and those recovering from injury. Pilates can also help to prevent the recurrence of low back pain. Uses of mat based Pilate’s exercises; it eases back pain, Strengthen the core, Increases your flexibility, It makes a great cross training workout, Improves posture, It builds cardiovascular endurance mat has a stable surface which provides sufficient stability to the spine preventing injury that occurs from uneven stress patterns on back and discs. It also improves the mobility of the hip and shoulder joints, balancing the sides of the body, aiding in creating postural symmetry which may trickle into the individual’s daily awareness of how they hold their body during daily activities.

Swiss ball: The Swiss ball is widely used in the recreational training environment to be a training device for core stability exercise. The Swiss ball is a conservative treatment option for back pain sufferers and is designed to help prevent further episodes of low back pain as part of a rehabilitation programme. Uses of Swiss ball based Pilate’s exercises; Improve muscle tone and endurance, Improve posture, Improve balance, Increase flexibility, Experience greater self-confidence and the body responds naturally and automatically to this instability to keep balanced on the exercise ball. Over time, the muscle used to keep in balance on the Swiss ball become stronger. In essence, an individual builds strength in important back muscles and abdominal muscles without

knowing it. Swissball has a dynamic surface in which the level of muscle activity increases and in order to stabilize the spine, muscles co-activation takes place, suggesting a higher demand on the motor control system. More muscle activity is seen when exercises are performed in mid-range [7]. The biggest benefit to training using ball exercises is that they are very effective at targeting core muscles, those muscles that are essential for stability and good posture but are often overlooked when exercising in fixed position [8]. So the study concluded that swissball and mat based pilates exercise are equally effective in treating the chronic non specific low back pain.

Similar studies are done, that also shows that pilates exercise is better than any other group of exercises.

6. Conclusion: The study concluded that On comparison between mat and swissball ITO test there was no significant difference seen whereas, swissball based pilates exercises produces an excellent change in pre and post ITO test for core strength, endurance and modified Oswestry pain and disability scale for relieving chronic nonspecific low back pain when compared between pre and post swissball group after 3 weeks of intervention.

7. Recommendations: Further long term follow-up studies are needed to find the effectiveness of mat and swissball based pilates exercise in chronic nonspecific low back pain with large sample size.

8. Acknowledgement: Indeed I am very glad to present this project as a part of my Internship. I wish to express my sincere gratitude to all those who really helped with it.

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