



A Comparative Study on the Effectiveness of Spine Stabilization Exercises Devoid of Swiss Ball and Dynamic Spine Stabilization Exercises with Swiss Ball in Patient with Low Back Pain (LBP)

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Abstract

Low back pain may be defined as pain perceived as arising from the posterior region of the trunk within an area bounded more or less capital planes tangential to the lateral borders of the erector spine, transverse plane through the lower dorsal spinous process and a transverse plane through the posterior superior iliac spines. Chronic Low Back Pain is when low back pain has been existing for more than three consecutive months' chronic low back pain may start with a history of an injury, spinal ailment or stresses on diverse structures of our body. Low back pain is coined when there is pain, protective spasm and muscular tension, or stiff movement localized to low back, and is well-defined as chronic low back pain when it continues for 12 weeks or longer duration. Low back pain is considered as one of the most frequently mentioned reason for participation restriction secondary to activity limitation under the age group of 45years, and almost roughly 2% of the work force are receiving reimbursement for low back pain annually. A rough estimate of 1.3 billion days a year are lost from work because of Low back pain.

Question and Objective: To put in vogue the role of Swiss ball therapeutic exercises in chronic low back pain individuals.

The purpose of this Study: The need of this study is to validate and compare the effectiveness of back strengthening exercises devoid of Swiss ball use, when compared with exercises on the Swiss ball among low back pain patients.

Design: Pre-test and post-test experimental study design.

Participants: Chronic low back pain patients in the age group between 17-40 years, both males and females were included in the study predominantly White-collar occupation

Intervention: Swiss ball is a ball constructed of elastic soft PVC with a variable diameter ball filled with the air pressure is changed by removing a valve stem and either ceiling with air or by letting the ball appropriately deflate. The human body responds to the dynamic challenge created by the ball to establish spinal stabilization/to arrive at equilibrium engaging sequence of many more muscles. Those muscle becomes strange overtime to keep balance, Swiss ball exercises was developed based on the principal that many back-pain patients have diminished motor control over the force transmitting fascia of the concerned stabilizing musculature.

Outcome Measures: Pain was measured using visual analogue scale and lumbosacral range of motion using the Modified Schober's Test

Results and Conclusion: When comparing the mean value between groups. Group treated with Swiss ball exercises shows more difference than the group treated with the exercises devoid of Swiss ball. Hence it is concluded that Swiss ball exercises is more effective than the back strengthening exercises devoid of Swiss ball (dynamic unstable platform) in reducing pain and Rom among low back pain patients favoring the fact that many back-pain patients have diminished motor control over the force transmitting fascia of the respective stabilizing musculature.

Keywords: Spine Stabilization; Devoid; Swiss Ball; Low Back Pain

Introduction

Pain is coupled between the sensory and emotional magnitudes of the experience and also predict the mutual association in between the severity of tissue injury and pain magnitude. Pain by definition is an unpleasant sensation and emotional disorder related with or without definite tissue damage. Acute pain is associated with tissue damage or threat to such damage and typically resolves once the tissue heals or threat resolves. Acute pain persists more than 3 to 4 months. Chronic pain is defined as pain persists for more than specified length of time such as 3 to 6 months. Chronic pain is long lasting, persistent and of sufficient duration. Chronic pain is the pain that persists past the healing phase following an injury with impairment greater than anticipated or injury and occurs in the absence of observed tissue injury or damage [5].

Low back pain may be defined as pain perceived as arising from the posterior region of the trunk within an area bounded more or less capital planes tangential to the lateral borders of the erector spine, transverse plane through the T12 spinous process and a transverse plane through the posterior superior iliac spines. Low back pain is origin pain above T12 is called as posterior thoracic pain and from pain below S2 in the sacral or coccygeal regions [18].

Low Back Pain falls in the group called chronic low back pain if it has been persistent for more than three months' the cause of chronic low back pain may be secondary to an injury, pathology condition and disease or stresses on various structures in the human body. This type of chronic pain may vary in large and may be perceived as bone pain, neural pain or muscular pain.

The impression of pain may be aches, burning pain, stabbing pain or tingling type of pain, sharp excruciating or dull aches and sometimes well-defined or indefinite [29].

Chronic Low back pain is pain with muscle spasm or considerable stiffness localized below the lumbar margin and above the inferior gluteal folds, with or without radiation, and is defined as chronic back pain when it persists for 3 months or more [22] Lumbar disc hernia occurs in the lower back, most often between the fourth and fifth lumbar spine. Herniated lumbar disc creeps in when the annulus fibrous breaks open or cracks, allowing the nucleus pulposus to outflow. This is called herniated nucleus pulposus or herniated disc [14] It is one of the most common complaints encountered in orthopedic practice. It refers to pain felt in the lumbar and sacral regions and may be associated with pain in the lower limbs. The term sciatica refers to the pain radiating down to the back of the lower limbs for variable distances. Degeneration of the lumbar intervertebral disc is one of the most common causes of low back pain and sciatica.

Statement of Study

To find out the effectiveness of back strengthening exercises devoid of Swiss ball and therapeutic back strengthening exercises on Swiss ball in patients with low back pain.

Need of The Study

The need of this study is to validate and compare the effectiveness of back strengthening exercises devoid of Swiss ball exercises and therapeutic back strengthening exercises on Swiss ball among low back pain patients.

Objectives of Study

- To find out the effectiveness of back strengthening exercises devoid of Swiss ball in the management of lower back pain patients.
- To find out the effectiveness of therapeutic back strengthening exercises on Swiss ball in the management of low back pain patients.
- To compare the effectiveness of back strengthening exercises devoid of Swiss ball and therapeutic back strengthening exercises on Swiss ball in the management of low back pain patients.

Operational Definitions

- **Pain:** Pain is an unpleasant sensation and emotional disturbance associated with or without actual tissue damage (Susan 2014).
- **Disability:** Any restriction in the normal process or lack of capacity that results from an impairment to carry out a motor activity in the manner or within the said range that is well-thought-out to be normal for a human being [5].
- **Low Back Pain:** The world health organization classification of disability recognizes low back pain as abnormality of the structure of the lumbar spine causing disability limiting or preventing the full performance of motion (Paulo 2010).
- **Back Strengthening Exercises:** 1. Bird and dog exercises-bird dog spares the spine of high compressive loads and targets not only the lower back muscles but also works the hip extensors, like the gluteus and the hamstrings. 2. Pelvic bridging Exercises-It is also called pelvic tilt exercises. These exercises targets to work on the tight back muscles and in turn aids flexibility.
- **Swiss Ball Exercises:** Exercise ball also known as Swiss ball is a ball constructed of elastic soft PVC with a diameter of around 65 to 85 CMS ball filled with the air pressure is used for exercises basically an unstable platform which is used to activate the spinal stabilizers.

- **Benefits:** A main benefit of performing exercises with a Swiss ball as supposed to exercising Directly on a hard-flat surface is activating the body response to the instability of the ball to remain balanced engaging many more muscles. Those muscle becomes active and strong overtime to keep balance, Swiss ball exercises was developed based on the principal that many back-pain patients have diminished control over the stabilizing musculature [15].

Methodology

- **Study Setting** The study was carried out at outpatient physiotherapy department of RVS College of physiotherapy, sulur, and Yasodha physiotherapy center Coimbatore.
- **Selection of Subjects** Twenty clinically diagnosed mechanical low back pain subject who fulfil inclusion and exclusion criteria were selected randomly and divided into two groups, Group A (n = 10) Group B (n = 10)
Group A - conventional back strengthening exercises
Group B - Swiss ball exercises

Variables

Dependent Variables

- Low back pain.
- Lumbar Range of motion.

Independent Variables

- Interferential therapy with back strengthening exercises
- Swiss ball exercises

Measurement Tools

Variables	Tools
Low Back Pain	Visual Analogue Scale
Lumbar Rom	Modified Schober’s Test

Table 1

Study Design

- The study design was a pre-test and post-test experimental design.

Inclusion Criteria

- Clinically diagnosed mechanical low back pain patient
- Both sexes are affected.
- Age group between 25-45 years.

- Patient who are willing to participate.
- Patients who can cooperate.

Exclusion Criteria

- Cardiovascular involvement.
- Patient with neurological involvement.
- Spondylolisthesis.
- Recent fracture around the spine.
- Psychosomatic disorder.
- Current pregnant ladies.
- Disc pathologies.
- Spinal surgeries

Orientation to the subjects

Before the collection of data and treatment, the purpose of the study is explained to the subjects and procedure to be applied. The investigator had given a detailed orientation to the various treatment procedures such VAS, modified Schober’s test measure ROM and function with consent and fulfil corporation of each participant was sought after complete explanation. The condition and demonstration of the procedure involved in the study.

Materials Used

- Data collection sheet and evolution chart.
- Treatment coach.
- Pillow.
- Strap/microspore.
- Towel/bed sheet.
- Swiss ball.
- Gel and cotton.
- Interferential therapy equipment.
- Inch tape.

Test administration

Visual analogue scale

Visual analogue scale (VAS) is a 10 cm horizontal scale with two endpoints, one labelled no pain and other as worst pain. Patients were asked to place a mark which corresponds to the level of pain intensity the patient present feels.

Modified Schober's Test

A measure of lumbar spine motion in which parallel horizontal line are drawn 10 cm above hand 5 cm below the lumbosacral junction in the erect subject.

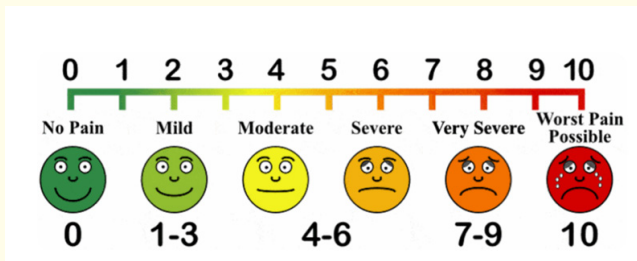


Figure a

Active range of lumbar flexion was measured with the participant standing on the floor. Mark the point 10 cm superior to PSIS and 5 cm inferior to PSIS. Participants then ask to bend forward, distance between superior and inferior points were used to measure the lumbar flexion range.

Active range of lumbar extension was measured with participant standing on the floor. Participant is asked to place both the hands over buttocks hand bend backwards distance between superior and inferior marks were asked to measure lumbar extension range [1].

Group A back strengthening exercises devoid of a Swiss ball

Bird and dog exercises

Bird dog spares the spine of high compressive loads and targets not only the lower back muscles but also works the hip extensors, like the gluteus and the hamstrings.

Patient position: Begin on all fours with hands directly under shoulders and knees directly under hips, placing hand and knee on the floor. Reach right arm forward and left leg back until they are parallel to the floor.

Duration: Four reps with a 10secshold, rest for 30secs. Repeat on opposite side.



Figure 1: Bird and dog exercises.

Pelvic bridging exercises

- It is also called pelvic tilt exercises. It releases the tight back muscles and keep them flexible.

Patient position

Lie back on the floor with knees bent and feet flat, keeping the arms by the sides. Gently arch the lower back and push the stomach out. hold for 5secs, then relax.



Figure 2: Pelvic bridging exercises.

Group B: Swiss ball exercise

Patient position: Sitting on ball.

Procedure

- Sit on ball with hips and knees bent 90°G feet resting on floor.
- Raising one leg while maintaining trunk stability, the patient also mobilizes her neural structures [6] this is an adaptation of the “slump” position [17].



Figure 3: Raising leg exercises.

Patient position: Sitting on ball

Procedure

- Raise arms above head. Feet are firmly on the floor for stabilization.
- Rotate as far as the patient can in one direction, holding for a few seconds at the end of the range.
- Contract the muscles in core while holding. Then slowly rotate back to the neutral position for a second before rotating in the opposite direction.
- Aim for about 10 rotations in both the directions [33].



Figure 4: Spinal rotation exercises.

Patient position: Sitting on ball

- Sit on the exercise ball with feet planted firmly on the floor. Then gently tilt pelvis, pulling the stomach muscles in and moving the hips forwards and upwards.
- Hold for few secs and then return to the starting positions.
- Alternatively, while in the same positions (clockwise) do slow circular rotations in one direction, then switch to opposite direction (counterclockwise).



Figure 5: Pelvic Isolation While Sitting.

Patient position: Lie on stomach over ball

- Walk hands out in front of ball until ball is under legs, reverse to starting position.
- Walk hand out in front of ball is under legs and slowly raise alternating seems overhead.



Figure 6: Lower Back Exercise.

Collection of data

- The selected 20 subject were divided into two groups, group A and group B
- Group A interferential therapy with back strengthening exercises
- Group B Swiss ball exercises
- Both the experimental groups were given the treatment for four weeks before and after completion of four weeks' treatment intervention pain intensity ROM was evaluated by VAS and modified Schober's test and recorded.

Statistical technique

The collection data were analyzed by paired "t" test to find out significant difference between pre-test and post-test value of experimental groups and further unpaired "t" test was applied to find out the difference between the groups.

Data Analysis and Results

This chapter deals with the systemic presentation of the analyzed data followed by the interpretation of the data.

- Paired 't'
- Unpaired 't' test

In group A for pain the calculation paired "t" value is 8.7 and the "t" table value is 3.250 at 0.005 level since the calculated "t" value is more than "t" table value above study shows that there is significant difference in pain following back strengthening exercises in low back pain patients

Measurement	Mean	Mean difference	Standard deviation	Paired "t" value
Pretest	67	37	1.33	8.7
Post test	30			

Table 2: Mean value, mean difference, standard deviation and paired "t" value between pre and post test scores of pain in group A back strengthening exercises devoid of a Swiss ball. *0.005 level of significance.

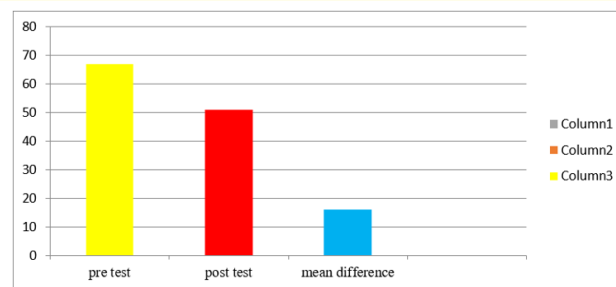


Figure 8: Graphical representation of the pre-test and post-test mean values and mean difference values of pain among group B.

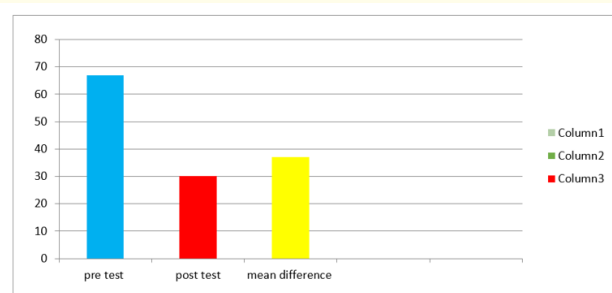


Figure 7: Graphical representation of the pre-test and post-test mean values and mean difference values of pain among group A?

Measurement	Mean value	Mean difference	Standard deviation	Paired 't' value
Pre-test	67	16	0.516	9.79
Post-test	51			

Table 3: Mean value, mean difference, standard deviation and paired "t" value between pre-test and post test scores of pain in group B among Swiss ball exercises. *0.005 level of significance.

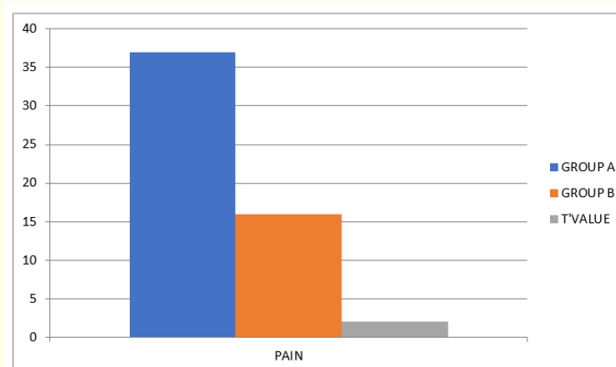


Figure 9: Graphical representation of the pre-test and post-test mean values and mean difference values of pain among group A and group B.

In group B for pain the calculated paired "t" value is 9.79 and the "t" table value is 3.250 at 0.005 level. since the calculated "t" value is more than the "t" table value above study shows that there is significant difference in pain following Swiss ball exercises.

S. No	Variable pain	Mean difference	Standard deviation	Unpaired 't' value
1	Group A	37	1.05	4.46
2	Group B	16		

Table 4: Mean values, mean difference, standard deviation and unpaired 't' value between pre and posttest of pain between Group-A and Group- B. *0.005 level of significance.

Measurement	Mean	Mean Difference	Standard Deviation	Paired 'T' Value
Pretest	16.7	.61.2	1.01	19.14
Post test	77.9			

Table 5: Mean value, mean difference, standard deviation and paired "t" value between pre and post test scores of ROM in group A among conventional physiotherapy (IFT) with back strengthening exercises. *0.005level of significance.

In group A for ROM the calculation paired “t” value is 19.14 and the “t” table value is 3.250 at 0.005 level since the calculated “t” value is more than “t” table value above study shows that there is significant difference in pain following conventional physiotherapy {IFT}with back strengthening exercises among low back pain patients.

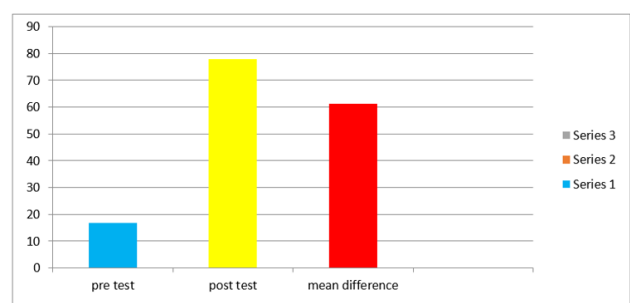


Figure 10: Graphical representation of the pre-test and post-test mean values and mean difference values of ROM among group A.

Measurement	Mean value	Mean difference	Standard deviation	Paired ‘t’ value
Pre-test	18.7	36.6	0.827	14.10
post-test	55.3			

Table 6: Mean value, mean difference, standard deviation and paired “t” value between pre-test and post test scores of ROM in group B among Swiss ball exercises. *0.005 level of significance.

In group B for pain the calculated paired “t” value is 14.10 and the “t” table value is 3.250 at 0.005 level. Since the calculated “t” value is more than the “t” table value above study shows that there is significant difference in ROM following Swiss ball exercises.

S. No	Variable Pain	Mean Difference	Standard Deviation	Unpaired ‘T’ Value
1	Group A	61.2	1.41	3.88
2	Group B	36.6		

Table 7: Mean values, mean difference, standard deviation and unpaired ‘t’ value between pre and posttest of rom between group A and group B. *0.005 level of significance.

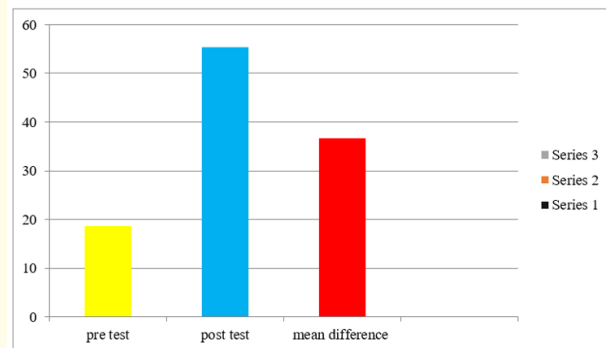


Figure 11: Graphical representation of the pre-test and post-test mean values and mean difference values of ROM among group B.

In Group A and Group B for ROM the calculated unpaired’ value is 3.88 and ‘t’ table value is 2.879 at 0.005 level. Since the calculated ‘t’ value is more than ‘t’ table value, it shows that there is significant difference between conventional physiotherapy and swiss ball exercises to increase ROM in low back pain patients.

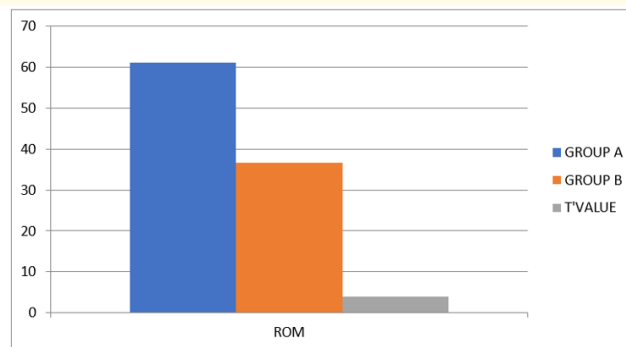


Figure 12: Graphical representation of the pre-test and post-test mean values and mean difference values of ROM among group A and group B

20 Low Back Pain subjects were selected for the study. The subjects were randomly divided into two groups. Group A was treated with back strengthening exercises devoid of Swiss ball exercises. Group B was treated with Swiss ball exercises.

Results

The patient was treated for 6 sessions in two weeks. Before starting the treatment, pain and ROM was graded VAS SCALE and

MODIFIED SCHOBERS TEST. The measurement was repeated at the end of the study duration.

Analysis of Dependent variable pain in Group A: The calculated paired 't' value is 8.7 and 't' table value is 3.250 at 0.005 level of significance. Hence the calculated 't' value is greater than 't' table value, it shows that there is significant difference in pain following conventional physiotherapy with back strengthening exercises among low back pain subjects.

Analysis of Dependent variable pain in Group B: The calculated paired 't' value is 9.79 and 't' table value is 3.250 at 0.005 level of significance. Hence the calculated 't' value is greater than 't' table value, it shows that there is significant difference in pain following Swiss ball exercise among low back pain subjects.

Analysis of independent variable pain among patient between Group A and Group B: The calculated unpaired 't' value is 4.46 and 't' table value is 2.879 at 0.005 level. Since the calculated 't' value is more than 't' table value, it shows that there is significant difference between conventional physiotherapy with strengthening exercises and Swiss ball exercise in reduce pain among low back pain subjects.

Analysis of Dependent variable ROM in Group A: The calculated paired 't' value is 19.14 and 't' table value is 3.250 at 0.005 level of significance. Hence the calculated 't' value is greater than 't' table value, it shows that there is significant difference in ROM following conventional physiotherapy with back strengthening exercises among low back pain subjects.

Analysis of Dependent variable ROM in Group B: The calculated paired 't' value is 14.10 and 't' table value is 3.250 at 0.005 level of significance. Hence the calculated 't' value is greater than 't' table value, it shows that there is significant difference in ROM following Swiss ball exercise among low back pain subjects.

Analysis of independent variable ROM among patient between Group A and Group B: The calculated unpaired 't' value is 3.88 and 't' table value is 2.879 at 0.005 level. Since the calculated 't' value is more than 't' table value, it shows that there is significant difference between conventional physiotherapy with back strengthening exercises and Swiss ball exercise in ROM among low back pain subjects.

When comparing the mean value between groups, group B treated with Swiss ball exercises shows more difference than the group A treated with conventional physiotherapy and low back strengthening exercises. Hence it is concluded that Swiss ball ex-

ercises is more effective than the conventional physiotherapy with back strengthening exercises in reducing pain and Rom among low back pain patients.

Discussion

The study was conducted on 20 subjects. The subjects were divided into two groups, group A and group B.

Group A received conventional physiotherapy with back strengthening exercises.

Group B received Swiss ball exercises.

The aim of the study was to find out the effectiveness of conventional physiotherapy and Swiss ball exercises in management of low back pain. It was Concluded that ergonomics advice on low back ache leads to reduction of intensity of pain and disability [3]. Low backache is a very common problem and has a ubiquitous distribution. Among the galaxy of causative factors, both spinal and extra spinal, the most common cause of low back ache seems to be the lumbar disk disease. Bad posture plays a very significant role in the genesis of this disease. So much is the contribution of bad posture towards this problem that one can categorically conclude that low back ache is all about disk degeneration predisposed by poor posture.

Neuromuscular rehabilitation using a Swiss ball is useful when the response serves a strong protective function. we are aware that patients with lower back pain may not need extra exercise to get better. The idea is to keep being active the spinal stabilizers [29-31] low back pain patients those who keep up with a moderate number of physical activities after injury experience less pain and a greater motor control status than those who are completely avoid activity.

Conclusion

An experimental study was conducted to investigate the effectiveness of conventional physiotherapy with back strengthening exercises and Swiss ball exercises in management of low back pain.

20 patients with low back pain were included in this study and randomly divided into two groups. Group A and B each group consist of 10 subjects. Group A was treated with conventional physiotherapy with back strengthening exercises. Group B was treated with Swiss ball exercises. Pain and ROM were assessed before and after intervention by vas scale and modified Schober's test.

The statistical results show that there is improvement in both the groups. When comparing the mean value of group, A (received conventional physiotherapy with back strengthening exercises)

and B (received Swiss ball exercises). The group treated with Swiss ball exercises shows more difference than the group treated with conventional physiotherapy and back strengthening exercises. Hence it is concluded that Swiss ball exercises is more effective than the conventional physiotherapy with back strengthening exercises in reducing pain and ROM among low back pain patients.

Limitations

- Study sample size was small.
- The study duration was short term.

Suggestions

- Study can be carried out for longer sample size.
- Study can also be carried out different age groups.
- Study can do different variables.
- Number of subjects can be increased.

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