

Analyzing the Functional Efficacy of Foam Roller and Gym Ball on the Thoracic Spine Pain: A Comparative Study.

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Abstract

Background: Excessive thoracic curvature of the spinal column (Hyper kyphosis deformity) is one of the most common postural abnormalities and is one of the most important causes of the upper quarter pathology. Spinal abnormalities in individuals with completed skeletal growth have been reported at an estimated 32% prevalence in adults and a prevalence of 60% in the elderly.

Methods: The Study was a pre-post comparative study. The subjects were allocated to 2 groups through chit methods. The study was conducted at Life Fit Physiotherapy, Shahdara, Delhi. Ethical Clearance was obtained from the institutional ethical committee (IAMR/22/4021) and written informed consent was taken from the subjects before intervention. A total of 35 participants were Screened and 30 patients participated for the study on the basis of Inclusion and Exclusion criteria. And these participants were divided into two groups of 15 participants each. Group-A participants were asked to perform exercises with Foam Roller and Group-B with Gym Ball respectively.

Results: The regression statistics is showing R square value of 0.738119. The pre and post intervention analysis of Foam Roller exercises and Gym Ball exercises group with ANOVA tests shows the F value as 5.63. The test result shows t-value of -0.35541 with a significant p-value of 0.007.

Conclusion: The statistical result shows that there is improvement in both the groups. But when comparing both it's found that Foam roller exercise technique is more effective than gym ball therapy in reducing pain and improving specific function among thoracic spine pain subjects.

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I. Introduction

The goal of physical training is to improve muscle strength, functional mobility, and motor control for better balance, coordination, and endurance. Functional stabilization training begins with identifying range of motion, particularly that of the lumbopelvic region^[1]. The rehabilitative exercises utilizing mid-range oscillatory movements and end-range stretches in prone and sitting rotational movements promote a reduction in pain. Spinal stability is thought to be an important factor in exercise programs for individuals with healthy backs. The effects of physical training on the musculoskeletal system and the ability of the neuromuscular system to adapt to the speed, resistance, and duration of specific types of training have long been known^[1].

As clinical practice is time intensive, clinicians have become sensitive to changes in practice that consume valuable time. These changes have prompted an increase in the research and development of more user-friendly, patient-specific outcome measures. The Patient-Specific Functional Scale (PSFS) is a self-reported, patient-specific measure, designed to assess functional change, primarily in patients presenting with musculoskeletal disorders. The proposed advantages of the PSFS include its wide applicability and ease of use clinically, both desirable attributes in an outcome measure. Currently, the PSFS is used by clinicians, researchers, and healthcare policymakers in their respective settings. It has been proposed that the PSFS be incorporated into the verbal exchange that occurs between therapist and patient, to highlight the functional problems as reported by patients and to document the interaction for clinical interpretation^[2].

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Excessive thoracic curvature of the spinal column (Hyper kyphosis deformity) is one of the most common postural abnormalities and is one of the most important causes of the upper quarter pathology. Spinal abnormalities in individuals with completed skeletal growth have been reported at an estimated 32% prevalence in adults and a prevalence of 60% in the elderly. Furthermore, young adults and teenagers' posture and appearance can be affected by hyper-kyphosis and may consequently affect their health physically and psychologically. The trunk muscles participate in the spine's movement's controls and stability and the deep and central muscles of the body provide spinal stability in dynamic situations and provide stabilization and control of the intervertebral movements^[3].

The WHO also emphasized this in a report called International Classification of Functioning, Disability and Health. Since physical structure, functions, and activities of patients with spine disability are closely related, clinicians should select appropriate therapy strategies to improve patients' physical abilities^[4]. As an exercise method, a foam roller was used to conduct fascia relaxation massage for warming-up, and postural kyphosis was changed into postural lordosis by lateral pull-down exercise using equipment, performed in 5 sets of 15 times at 60% intensity of 1RM, 4 set of 10 crunch exercises using a Togu were done while sitting at the end of a Balance pad, and 4 sets of 15 bridge exercises^[4]. Venous insufficiency is produced by an alteration or abnormality of lower-limb venous system functioning that reduces or hinders blood return. Patients report pain, tiredness, heaviness, heat and swelling, which is generally more intense while standing or in a humid environment^[5].

Delayed-onset muscle soreness is classified as a type I muscle strain, produces tenderness or stiffness to palpation or movement, and predominantly is seen in or amplified by unaccustomed exercise. Sensations associated with DOMS are highly variable and range from slight muscle stiffness that subsides with regular daily activity to severely debilitating pain that restricts any movement. During foam rolling, individuals use their own body mass on a foam roller to exert pressure on the soft tissue. The motions place both direct and sweeping pressure on the soft tissue, stretching it and generating friction between it and the foam roller. Foam rolling can be considered a form of self-induced massage because the pressure that the roller exerts on the muscles resembles the pressure exerted on the muscles through manual manipulation by a massage therapist^[7]. Compression has previously demonstrated recovery capabilities; therefore, the compressive nature of foam rolling has also been researched for its recovery capabilities^[8].

The structure of the thoracic spine but, also, in contractile tissue responsible for facilitating movement, active therapeutic exercise is required. An extension-based trunk exercise is a training protocol that can improve thoracic kyphosis. A thoracic extension exercise is a correctional exercise that improves the thoracic extensor muscle strength and chest muscle stretch to maintain an optimal postural kinetic chain. Thoracic correction exercise also improves kyphosis, pain, and scapular forward distance^[9]. Compared with many other muscles, the erector spinae are rather atypical in that they are primarily postural muscles, responsible for slow and sustained contractions at relatively low force outputs. It is therefore possible that the type II fiber is typically smaller in cross-section than the type I fiber even in the absence of back pain, suggesting that what has previously been considered abnormal for LBP patients, may only be so when compared with other skeletal muscles^[10].

The magnitude of mechanical load on the spine is highly related to back pain, and excessive mechanical load on the lumbar spine can lead to intervertebral disc rupture or vertebral fracture. A strong association has been found between compression and shear force and the prevalence of thoracic pain^[11]. The use of physio balls/Swiss balls in strength and conditioning programs has become ubiquitous. Swiss balls have been incorporated into strength training regimes and touted as a means to more effectively train the musculoskeletal system^[12]. Performing strength exercises on Swiss balls has been advocated on the belief that a labile surface will provide a greater challenge to the trunk musculature, increase the dynamic balance of the user and possibly train users to stabilize their spines to prevent and treat injury^[13]. As stated previously, this study used self-selected pressure and approximately 5 minutes of massage compared with other studies giving at least 10 minutes of massage. The self- selected pressure on the rolling may have varied from subject to subject, unlike the constant pressure given from a masseur^[14]. This supports the argument that Foam Rolling is of clinical relevance for mobility improvement^[15].

Since there is not much evidence available for the use of Foam Roller and Gym Roller in case of Thoracic Spine Pain as per the knowledge of evidences, that helps to objectify in analyzing the effect of Functional Efficacy of Foam Roller and Gym Ball on The Thoracic Spine Pain. In this article, the broader term "physical activity" (defined as "bodily movement produced by the contraction of skeletal muscle that substantially increases energy expenditure") is used interchangeably with "exercise".

Statement Of Question: -Currently, there is no study that shows which out of foam roller and gym ball is most effective tool for treating thoracic back pain.

Need Of Study: -This study will evaluate the most effective tool out of foam roller and gym ball for thoracic back pain and it will help in further future researches and advancements of treatment methods for TSP.

Aim Of the Study: -This study is being carried out to check the effectiveness of foam roller vs Gym ball on thoracic back pain.

Alternate Hypothesis: There is significant relation of Thoracic Spine Pain with mobility exercises using Gym Ball and Foam Roller.

Null Hypothesis: There is no significant relation between the Foam Roller and the Gym Ball in treatment of thoracic back pain.

II. Methods:

Study Design: The Study was a pre-post comparative study. The subjects were allocated to 2 groups through chit methods. The study was conducted Life Fit Physiotherapy, Shahdara, Delhi, India. Ethical Clearance was obtained from the institutional ethical committee (IAMR/22/4021), and written informed consent was taken from the subjects before intervention. A total of 35 participants were Screened and 30 patients participated for the study on the basis of Inclusion and Exclusion criteria. And these participants were divided into two groups of 15 participants each. Group-A participants were asked to perform exercises with Foam Roller and Group-B with Gym Ball respectively.

Inclusion Criteria: Both Male and Female, aged between 30years to 50years, Job workers, Shift timings >8hrs, Working from home from March 2020, Mid Mechanical Back Pain with the history of at least one months.

Exclusion Criteria: Participant should not be of foreign nationality, Pregnant Females, People with TSP due to injury, OA, and PIVD, Participants who are not willing to participate, Age group should not be below 30years and above 50 years.

Procedure: All the subjects gave the consent by filling up consent form. The subjects were informed by the therapist about the whole procedure of the experiment. The subjects underwent pretext using the visual analogue scale and patient specific functional scale before starting the exercises protocol. The subjects were divided into two different groups i.e., Group A-which received the exercises protocol to be done with foam roller and Group B which received the exercises protocol with gym ball for thoracic spine pain. The subjects were asked to perform 4 exercises with foam roller and gym ball respectively. Each exercise was performed 10 times with a hold period 3-4 seconds, and the same protocol was repeated over 12 sessions i.e., 3 times a week. After the 12th session, the participants were again asked to fill the visual analogue scale and patient specific functional scale.

Interventions

Group -A: - Extension using foam roller, Rotation Using Foam Roller, Trapezoid Stretch, Thoracic and Shoulder ROM.

Group -B: - Extension stretches, Flexion Stretch, Thoracic and Shoulder Stretch.

Outcome Measures: Pain Score with Patient's Specific Functional Scale and visual analogue scale.

Statistical Analysis: Data was expressed as Mean \pm SD and P-value generated from paired T-test between the pre and post VAS and PSFS values from both groups (95% confidence interval). In between the groups using mixed model, least square means of two groups and difference between the groups as dependent variable. T-test was done, P-value was calculated (CI 95% confidence interval). Data Analysis was performed with Microsoft Excel and JASP (Jeffrey's Amazing Statistics Program) version 0.16. Descriptive Statistical test and correlation test was done between two Groups of the study i.e., Group A and Group B respectively.

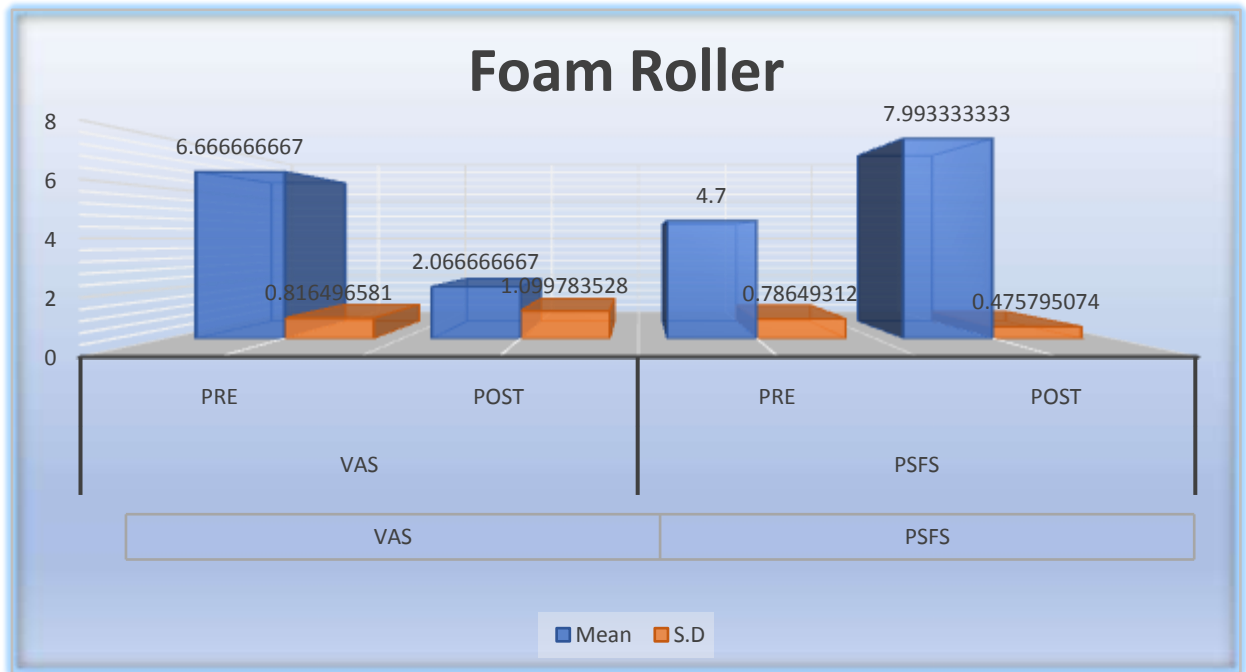
III. Result:

Table No. 8.1: - Descriptive statistics scores of Visual Analog Scale and Patient Specific Functional Scale of Foam Roller in Pre and Post treatment protocols.

| Foam Roller | | | | |
|-------------|--------------|--------------|--------------|--------------|
| | VAS | | PSFS | |
| | Pre | Post | Pre | Post |
| Mean | 6.667 | 2.067 | 4.7 | 7.993 |
| S. D | 0.816 | 1.1 | 0.786 | 0.476 |

According to the Table No. 1: -

- The Mean value and the Standard Deviation values manifested for VAS is as 6.66 ± 0.81 during before the treatment, similarly after the treatment the mean and the standard deviation values are vowing as 2.067 ± 1.1 in the VAS.
- The Mean value and the Standard Deviation values manifested for PSFS is as 4.7 ± 0.786 during before the treatment, similarly after the treatment the mean and the standard deviation values are vowing as 7.993 ± 0.476 in the PSFS.



Graph no. 8.1: - Graphical representation of Visual Analog Scale and Patient Specific Functional Scale of Foam Roller in Pre and Post treatment protocols.

Table No. 8.2: - Descriptive statistical score of the paired sample t-test for pre and post treatment with Foam Roller.

Paired Samples T-Test

| Measure 1 | | Measure 2 | t | df | p |
|-----------|---|-----------|---------|----|--------|
| VAS-Pre | - | PSFS-Pre | 5.527 | 14 | < .001 |
| VAS-Post | - | PSFS-Post | -18.614 | 14 | < .001 |

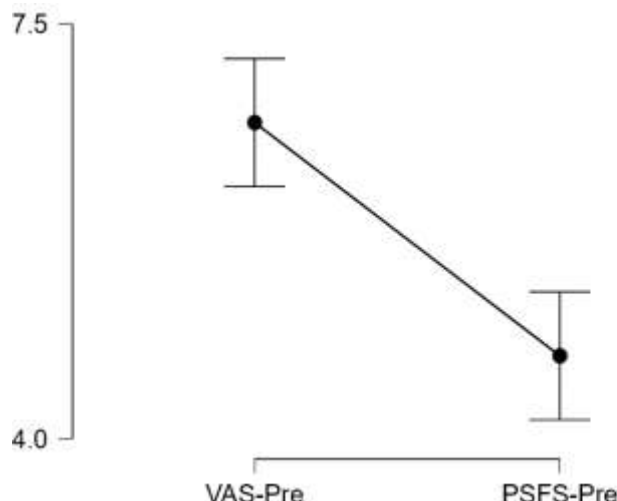
Note. Student's t-test.

According to the table No.2: -

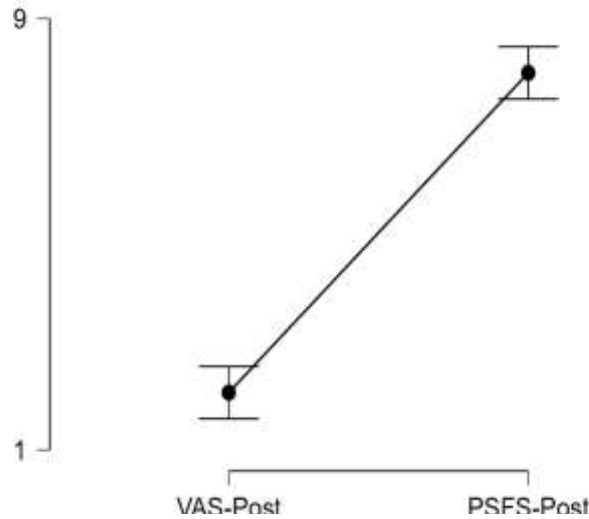
- The t-value for the VAS (Pre) and PSFS (Pre) exhibits as 5.527 with the p-value of 0.001.
- The t-value for the VAS (Post) and PSFS (Post) exhibits as -18.614 with the p-value of 0.001.

Descriptive Plots

VAS-Pre - PSFS-Pre



VAS-Post - PSFS-Post



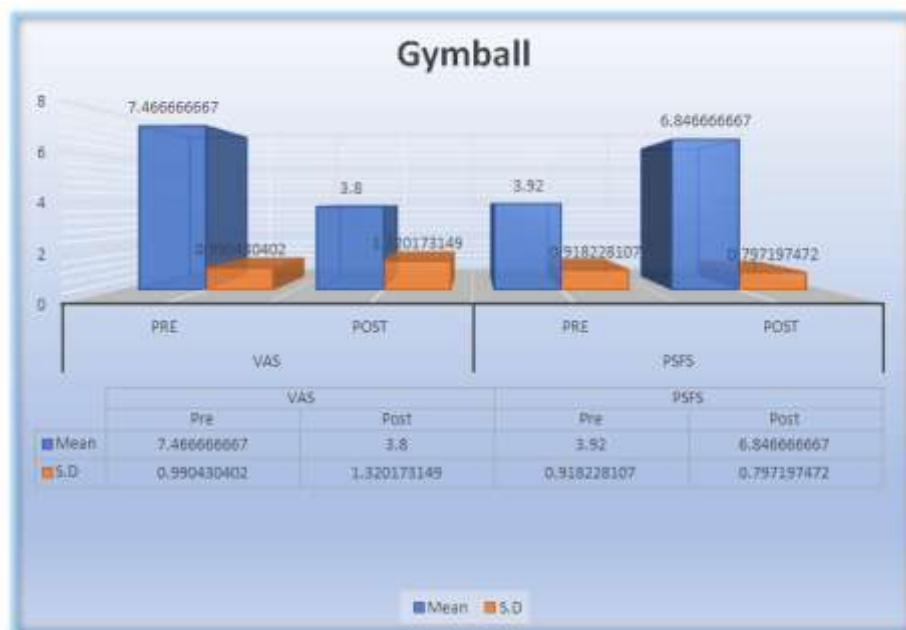
Graph No. 8.2: - Graphical representation of the paired sample t-test for pre and post treatment with Foam Roller.

Table No. 8.3: - Descriptive statistics scores of Visual Analog Scale and Patient Specific Functional Scale of Gym Ball in Pre and Post treatment protocols.

| Gym ball | | | | |
|-------------|--------------|-------------|--------------|--------------|
| | VAS | | PSFS | |
| | Pre | Post | Pre | Post |
| Mean | 7.467 | 3.8 | 3.92 | 6.847 |
| S. D | 0.99 | 1.32 | 0.918 | 0.797 |

According to the Table No. 1: -

- The Mean value and the Standard Deviation values manifested for VAS is as 7.46 ± 0.99 during before the treatment, similarly after the treatment the mean and the standard deviation values are vowing as 3.8 ± 1.32 in the VAS.
- The Mean value and the Standard Deviation values manifested for PSFS is as 3.92 ± 0.918 during before the treatment, similarly after the treatment the mean and the standard deviation values are vowing as 6.847 ± 0.797 in the PSFS.



Graph No. 8.3: - Graphical representation of Visual Analog Scale and Patient Specific Functional Scale of Gym Ball in Pre and Post treatment protocols.

Table No. 8.4: - Descriptive statistical score of the paired sample t-test for pre and post treatment with Gym Ball.

Paired Samples T-Test

| Measure 1 | Measure 2 | t | df | P |
|-----------|-------------|--------|----|--------|
| VAS-Pre | - PSFS-Pre | 7.660 | 14 | < .001 |
| VAS-Post | - PSFS-Post | -5.888 | 14 | < .001 |

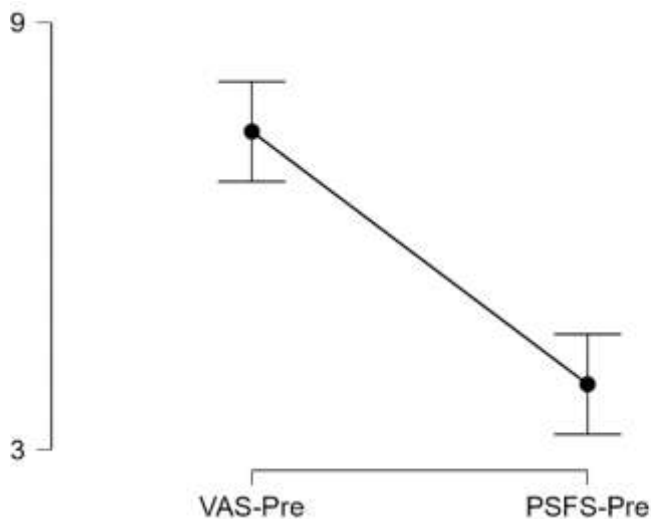
Note. Student's t-test.

According to the table No.2: -

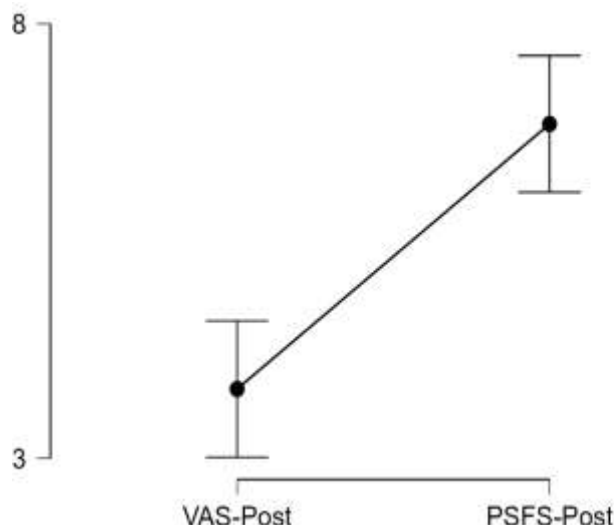
- The t-value for the VAS (Pre) and PSFS (Pre) exhibit as 7.660 with the p-value of 0.001.
- The t-value for the VAS (Post) and PSFS (Post) exhibit as -5.888 with the p-value of 0.001.

Descriptive

Plots VAS-Pre - PSFS-Pre



VAS-Post - PSFS-Post



Graph No. 8.4: - Graphical representation of the paired sample t-test for pre and post treatment with gym ball. The regression statistics is showing R square value of 0.738119. The pre and post intervention analysis of Foam Roller exercises and Gym Ball exercises group with ANOVA tests shows the F value as 5.63. The test result shows t-value of -0.35541 with a significant p-value of 0.007.

IV. Discussion:

The PSFS allows each patient to nominate any activity that he or she may be having difficulty performing due to the patient's health condition. As each activity is self-generated by the patient, the scale is, by definition, patient specific. Because the PSFS takes into account what the patient considers to be the most affected aspects of his or her life at the time of assessment, it can be regarded as a patient-centered measure of outcome. The PSFS has been mapped to the International Classification of Functioning, Disability and Health, a model developed by the World Health Organization that is used globally in physiotherapy practice. The PSFS was designed to detect a change in an individual's perceived functional status for musculoskeletal conditions. The activities nominated invariably differ between individuals, making it difficult to compare the results between patients and to calculate the result of the PSFS. Its use as a baseline measure only (rather than an outcome measure to detect change over time) or to make comparisons between groups cannot be supported, as its validity for these uses has not been established the validity of using the PSFS in many of these designs is questionable. Similarly, although the PSFS has been found to be clinimetrically sound in a number of musculoskeletal conditions, when it is used in populations in which its measurement properties have not yet been established, the results become less meaningful. There does appear to be potential for use of the scale beyond musculoskeletal practice; but the appropriateness of using the PSFS in neurological conditions (along with a number of other musculoskeletal conditions) is yet to be investigated, and in cardiopulmonary conditions only chronic obstructive pulmonary disease has been partially investigated.

Thoracic spine pain is one of the conditions, which can be treated by a wide variety of physiotherapy methods. It is still difficult to formulate all proof guidelines for the management of mid backpain. Various methods of treatment exist with own claims of success without any attempts of comparing the maximal methods. The objective of this study was to find out the effectiveness of foam roller vs gym ball on mid back pain. The study was conducted on 30 subjects. The subjects were divided into two groups i.e., group A and group B.

Group A received exercises protocol using foam roller. Group B received exercises protocol using gym ball. The aim of the study was to find out which protocol works in improving pain and mobility more efficiently in mid back pain subjects. Results of the study shows that there is significant difference in reducing pain and increasing mobility in subjects with Thoracic Spine Pain.

The results were supported by Sullivan KM et al. (2013), who concluded the foam roller is a dense foam cylinder that the individual can roll his body weight over it to improve ROM for a particular body area, as a type of self-massage. It is believed that all through the rolling, direct and sweeping pressure is exerted on the soft tissue causing the fascia to stretch and enhance ROM. Friction is also created during the rolling movement and this friction motives the fascia to increase in temperature and possibly alternate to a more fluid like state. This exchange in state permits for the breaking apart of fibrous adhesions between the different layers of the fascia and retrieves the soft tissue extensibility.

The results were supported by Johannes F et al. (2017) who stated that the usage of foam roll can be a proper and promising tool to prevent and treat the fatigue of neuromuscular tissues.

The results of this study agreed with that of Larry and Celynne et al (2007) who found the stability ball exercises release natural pain inhibitors, leading to decrease pain in some patients. So, prevent and treat back pain by using stability ball exercises. Hence, the experimental and alternate hypothesis are accepted and null hypothesis is rejected.

V. Conclusion:

An experimental study was conducted to investigate the effectiveness of Foam roller exercise therapy and gym ball exercise therapy in the management of thoracic spine pain.

30 subjects with thoracic spine pain were included in this study and randomly divided into two groups A and B each group consist of 15 subjects. Group A was treated with foam roller exercise therapy and Group-B was treated with gym ball exercise therapy.

Pain and specific function were assessed before and after intervention by VAS and PSFS. The statistical result shows that there is improvement in both the groups. But when comparing both it's found that Foam roller exercise technique is more effective than gym ball therapy in reducing pain and improving specific function among thoracic spine pain subjects.

Limitations:

- The study was limited with an age group of 20-50years.
- The study was limited to assess only the pain intensity and Specific function index.
- This study couldn't be generalized to everyone, as the sample size was small.

Ethical Clearance: Institute of Applied Medicine and Research, Amity Institute of Physiotherapy Ethical Clearance was obtained from the institutional ethical committee (IAMR/22/4021) written informed consent taken from the subjects before intervention.

Conflict of Interest: No conflict of interest

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