EFFECTIVENESS OF ABDOMINAL MANOEUVRE WITH QUADRUPED POSITION VERSUS SWISS BALL TRAINING OF TRANSVERSE ABDOMINIS IN PATIENTS WITH CHRONIC LOW BACK PAIN – AN EMG STUDY

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(Registration No-11302629)

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MPT- Orthopaedics II year

LOVELY PROFESSIONAL UNIVERSITY

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PHAGWARA, PUNJAB

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CERTIFICATE

This is to certify that the dissertation work entitled "**EFFECTIVENESS OF ABDOMINAL MANEOUVRE WITH QUADRUPED POSITION VERSUS SWISS BALL TRAINING OF TRANSVERSE ABDOMINIS IN PATIENTS WITH CHRONIC LOW BACK PAIN – AN EMG STUDY**" was carried out by **Mrs. Gajarla Anusha, Register No. 11302629,** Department of Physiotherapy, Lovely Professional University, towards partial fulfilment of the requirements of Master of Physiotherapy (Orthopaedics) degree programme

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The dissertation is fit for the submission and the partial fulfilment of the conditions for the award of **MPT (Orthopaedics).**

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DECLARATION

I hereby declare that the dissertation entitled, "**EFFECTIVENESS OF ABDOMINAL MANEOUVRE WITH QUADRUPED POSITION VERSUS SWISS BALL TRAINING OF TRANSVERSE ABDOMINIS IN PATIENTS WITH CHRONIC LOW BACK PAIN – AN EMG STUDY"** submitted for the MPT degree is entirely my original work and all ideas and references have been duly acknowledged. It does not contain any work for the award of any other degree or diploma.

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DEDICATION

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1. INTRODUCTION

1.1 INTRODUCTION:

Low back pain is a major and most significant cause of disability. Chronic low back pain is commonly defined as pain that persists beyond over the normal tissue healing time (or about three months). People with low back pain is particularly due to the economic development of society and changing of working environments which is an issue of progressive disability seen in patients in their 20s to 40s. [5] It occurs in "indistinguishable proportions in all cultures, as it interferes with an inherent feature of life and work efficiency", and is the most familiar explanation for medical council. Few cases of low back pain are due to specific or non-specific; but most of them are non-specific. [1]

Chronic low back pain is seen in about 85% of the population, with up to 80% of sufferers defining at least one recurrence in lifetime.[2]Chronic low back pain is a "more severe trouble, which oftentimes contribute to great psychological overlay: work discontentment, boredom, and a generous recompense". Low back pain is neither a disease nor a diagnostic entity of any sort. In many instances, however, the cause for low back pain is an ambiguous, but in a minority of cases it does has a direct connection to trace some organic diseases that exist.[1]

The lower back is defined as the lumbosacral area of the back. It is the portion of the back between the bottom of the ribs and the top of the legs. Maximum of the lower back is constituted from muscles that attach to, and surround, the spine. Strong ligaments also attaches to nearby adjacent vertebrae which gives an excessive support like a brace and strength to the spine. The various muscles that are attached to the spine permit to bend forward and backward and move in multifarious ways. [3]

One major risk factor for low back pain is weakness of superficial trunk and abdominal muscles, strengthening of these muscles is frequently companied with revelatory improvement of lower back pain, over and above with decreased functional disability. Another self-reliant risk factor for CLBP is the weakness and absence of motor control of the lumbar multifidus (LM) and transverse abdominis (TrA) muscles which are deep trunk muscles. · Hodges et al. proved, in patients with CLBP has inadequate control and speed of muscle contraction of TrA is delayed. [4]

In particular, the CLBP persisting for more than 6 months restricts and limits the movement of the trunk in order to minimize the pain in leg or lumbosacral area, as it increases the weakness of paraspinal muscles of lower lumbar region and the lumbar multifidus. These changes improve lumbar instability and aggravate the recurrence of low back pain. Therefore, spinal extensors and abdominals are crucial in bettering and improving lumbar stability. Therefore, exercises increase flexibility and muscle strength that are very crucial not only to alleviate low back pain but also for self-care. [5]

LBP is a multifactorial disorder with various available causes and treatment for it varies markedly as it includes medicinal approach, physical modalities, exercise therapy and each of it has its own several interferences. In today's life, multidisciplinary pain programs were seen to successfully treat patients by basing treatment on combination of physical exercise psychological interventions. However, it still remains to be clarified exactly by the features of these programs were liable for patient improvement on despite of their effectiveness. [6]

The TrA muscle fibres run horizontally around the abdomen through the fascia called thoracolumbar fascia of each lumbar vertebrae. The contraction of this muscle results in increase in intra-abdominal pressure and tension of the thoracolumbar fascia. This theory hypothesized that the TrA may augment the stabilization of the spine. It was hypothesized, that the initiation of the limb movement is preceded by the contraction of the TrA muscle. Finally they concluded that the people with LBP would fail to contract TrA before the movement with interrupting the spinal stabilizing mechanism. [7]

A recent focus of CLBP patients, in the physiotherapy management is definite by training the muscles surrounding the region of the lumbar that plays a vital role as a dynamic stabilizer and segmental control of the spine. These are deep abdominal muscles Internal Oblique(IO), transverse abdominis (TA) and the lumbar multifidus (LM).TrA has a primary role in the maintenance of intra-abdominal pressure and compresses abdomen by impairing tension through the thoracolumbar fascia.[8] There has been significant consideration about the role of TrA and LM in case of lumbo-pelvic stability and low back pain. It was been proved that these muscles will contribute more in stability of lumbar spine. It was proved that the ability to contract the multifidus muscle at the L5 level was allied to the ability contract the TrA muscle; i.e. the probability of good contraction of the multifidus were 4.45 times greater for people who have good contraction of TrA than poor muscle ability.[9]

The importance of abdominal muscles for a strong back as it influences assumptions such as [10]

- Few muscles were more important in stabilization of the spine as TrA
- Weak muscles of abdomen preside to low back pain.
- Strengthening of these trunk and abdominal muscles can lower the back pain.
- Injuries can be prevented if have strong CORE.
- It was proved that there is strong relation between the stability and back pain.

Abdominal Drawing Manoeuver (ADIM) is the best procedure to activate isolately on TrA muscle and is the basic exercise program for LBP. This procedure is performed by pulling the lower abdominal towards the spine, while relaxing other superficial muscles to be relaxed such as rectus abdominis and external oblique muscles. This training has shown to improve pain and functional disability in patients with chronic back pain. Once the motor skill of ADIM procedure is taught to the patient, then it is progressed by combining with varied postures of supine and prone. Nevertheless there is oftentimes recurrence of LBP demonstrated in various studies. This recurrence rate may indicate that exercises performing by the patient were not properly activating the respective muscle (TrA) or that a timing dysfunction exists. [11]

The purpose of the ADIM procedure was to voluntary activates the TrA while internal oblique (IO) and external oblique (EO) muscles remain relatively unchanged. These procedures were implemented with low effort and relaxed respiration. Motor control exercises for the deep trunk muscles were introduced for patients with CLBP based on evidence of motor control dysfunction along with delayed activity of TrA and IO and segmental hypertrophy of multifidus muscle. [12]

Classic trunk exercises are performed to activate Para spinal and abdominal muscles as a whole in relation to high contraction level. All muscles of its intervertebral attachments are better proceeded for providing better inter-segmental stability are well characterised within this group of multifidus, TrA, IO, as it is opposed to the longer trunk muscles like Erector spinae, Rectus abdominis which are devoted to generate the movement. No randomized controlled trials have tested the insistence that this stabilization training is preferable in patients with sub-acute and non-specific chronic low back pain by using the outcome measures as pain and disability. [13]

Lumbar segmental stability is maintained by muscle restraints and osseous anatomical ligamentous structures. Logically, the muscles of the local system have its direct attachments to the lumbar vertebrae as it as the greatest capacity to affect the segmental stiffness. In addition to several muscles of the back to active segmental stabilization has been explored in "in vitro" studies. Multifidus muscle results in increase in two-thirds of the stiffness at L4-L5 segment. The stabilization property of multifidus muscle has been recently certified and argued as it has an important role in treatment of low back pain. Another muscle which is a part of local system is transverse abdominis but it has not been extensively studied. The feasible consequences in lumbar stabilization were first demonstrated by Creswell et al. By using fine wire EMG, the muscles of the back and abdominal wall were studied by the researches. They determined that TrA has direct links with the intra-abdominal pressure. The local muscle system has an important role in segmental stability; it appears that both the TrA and multifidus muscles are important components of this system. [14]

Abdominal drawing-in manoeuver(ADIM) and Quadruped exercises are generally targeted in rehabilitation of the TrA muscle; although it is vague, how well the TrA is activated during these processes in low back pain patients, whether this procedure is taught to be performed correctly. It is a basic primary procedure used in core stability exercises; both these procedures are more common prescribed in the biomechanical literature to activate the deep abdominal musculature. [15]

ADIM plays a primary role in strengthening of the deep abdominal muscles such as TrA, IO. With ADIM, abdominal pressure is increased by pulling the abdominal wall inside that TrA and oblique abdominal muscles are contracted, lumbar trunk stability is effectively accomplished by the increased abdominal pressure. The effective approach for the LBP is to reduce the excessive lordosis and tilting of the pelvis. [16]

In both rehabilitation and clinical settings, abdominal exercises performed on a swiss ball have been widely used. The surface of the swiss ball is unstable and it eases the stress on the hip joint and lower back region and also alters proprioceptive demands by that improve motor control for balance and stability of local core muscles. Therefore swiss ball training is very useful for proprioception, balance and for stability but not for increasing the strength of the muscle. Consequently swiss ball exercises are recommended only for low threshold modality in order to improve the posture, balance and joint position. [(17)]

In patient with low back pain, the motor control will be restored by performing ‘‘Abdominal hollowing’’ (AH) exercises by retraining the voluntary activation of TrA by applying low-level tonic contractions. Success in doing these exercises are accustomed by its capability to activate the TrA muscle in superior to the superficial abdominal muscles such as oblique internus (OI) and oblique externus (OE) and/or rectus abdominis. [(18)]

The local muscles of the lumbar–pelvic region were targeted by specific spinal exercises, the local system includes the transverses abdominis and the lumbar multifidus whose attachment is to the lumbar vertebrae and sacrum and they are capable of controlling the lumbar segments. [(19).] In chronic low back pain patients the lumbar extensor muscle weakness will be leading to the weakening of the lumbar flexor muscles, it can be managed by strengthening of the extensor group. Exercises performing on the unstable surface like swiss ball contribute stability to the spine at the beginning of motor control due to the co-activation of global and local muscles. [(22)]

Motor control exercises namely Cat camel, Bridge, Quadruped- bird dog, Side Bridge, Dead bug, Curl-ups, and Hamstring curl have been evaluated before to enhance spine stability in an environment that introduces low loads on spine. Multiple methods of training the abdominal activation strategies, among them hollowing and bracing are the techniques used to improve the lumbar spinal stability. The abdominal hollowing exercises are performed with the significance on the anterior-lateral abdominal muscle activity over the rectus abdominis, whereas the bracing technique helps to co-activation of all the abdominals. [(20)]

The changes in the mean, the amplitudes and duration of TrA in chronic low back pain patients were assessed between the two groups at the baseline and post intervention period were observed. [21]

The purpose of the study was to increase TrA strength and endurance using the ADIM with Quadruped in one group and ADIM with Swiss ball in chronic low back pain patients.

1.2 NEED OF THE STUDY

Low back pain is a leading cause of disability. It occurs in similar proportions in all cultures, interferes with quality of life and work performance and is the common reason of consultants. Various forms of exercises are available to reduce pain in Low back Pain.

Many studies have proven the effect of swiss ball exercise on core strengthening in patients with low back pain. Very few studies are there hardly on both ADIM and Quadruped exercise on isolation of Transverse Abdominis muscle in reduction of pain, disability and increasing flexibility in LBP patients in comparison with EMG study.

No study was there in comparison of ADIM with Quadruped and ADIM with Swiss ball exercises on isolating TrA in patients with chronic low back pain. So the present study intends to find out the effective protocol to improve functional level of the patients with low back pain.

1.3 SIGNIFICANCE OF THE STUDY

The study will provide new insight towards the better interventional protocol for the treatment of chronic low back pain in terms of reducing pain and functional disability.

1.4 AIMS AND OBJECTIVES

- To find out the effect of ADIM with Quadruped position exercises of TrA in relation to pain and functional disability; in patients with chronic low back pain.
- To find out the effect of ADIM with Swiss ball exercises of TrA in relation to pain and functional disability in patients with chronic low back pain.

- To compare the effectiveness of ADIM with Quadruped position exercises and ADIM with Swiss ball exercise of TrA on pain and functional disability in chronic low back pain patients.

1.5 HYPOTHESIS

Alternative hypothesis:

There will be significance difference between effectiveness of the ADIM with Quadruped and ADIM with Swiss ball exercises on transverse Abdominis in reducing pain and functional disability in patients with chronic Low Back Pain.

Null hypothesis:

There will be no significant difference between effectiveness of ADIM with Quadruped and ADIM with Swiss ball exercises on Transverse Abdominis in reducing pain and functional disability in patients with chronic Low Back Pain.

1.6 OPERATIONAL DEFINITIONS

Chronic low back pain: Chronic low back pain is described as the pain that lasting longer than 7 – 12 weeks. Others defines it has, the pain lasting beyond the expected period of healing [23] LBP can also be defined as pain; muscle tension and stiffness localized in the area of back between the bottom of the ribs and the top of the legs. [24]

Abdominal Drawing in Manoeuver (ADIM): ADIM is a best way in activation of isolating an individual TrA muscle and is a best traditional stabilization program for LBP. It is defined as the fundamental exercise by instructing the patient to perform an inward movement of the umbilicus towards the spine. [11]

Quadruped Position: The participants started (resting position) on their hands and knees, with a flat back, while looking straight ahead and to contract the TrA in this position to perform the ADIM. [15]

PAIN: Basic bodily sensation induced by noxious stimulus, received by naked nerve endings, characterised by physical discomfort. Pain is described as unpleasant sensory and emotional experience associated with actual and potential tissue damage. [25]

FUNCTIONAL DISABILITY: Any restriction in range of motion or lack (impairment) of capability to perform an activity in the way or within the range of human-being. [26]

SWISS BALL: The joint position, posture, balance and neural feedback is better improved and well suggested as a low intensity modality. However, swiss ball exercises are considered as a low intensity and strengthening exercises performing on machines are usually performed to induce high level of muscle activation. [17]

EMG: Electromyography is a diagnostic procedure to assess the health of muscles and the nerve cells that control them (motor neurons). Motor neurons transmit electrical signals that cause muscles to contract. An EMG translates these signals in to graphs, sounds or numerical values that a specialist interprets. An EMG uses tiny devices called electrodes to transmit or transmit or detect electrical signals.

2. REVIEW OF LITERATURE:

Hwi-young Cho, Eun-hye Kim, et al.(2014)[(5)] , Effects of the CORE Exercise Program on Pain and Active Range of Motion in Patients with Chronic Low Back Pain; This study aims to measure the outcome on the core exercise regime on pain and active range of motion in the patients with low back pain. Thirty patients were allocated and divided in to two groups: the CORE group (n = 15, received core exercise training) and the control group (n= 15, received no treatment). This study elaborates that the CORE exercise program will be more effective in reducing pain and improving ROM in patients with chronic low back pain.

Chon, Seung- Chul, et al.(2014)[(27)] Co-contraction of Ankle Dorsiflexors and Transverse Abdominis Function in Patients With Low Back Pain; This study stated that the abdominal draw-in manoeuver (ADIM) with co-contraction of ankle dorsiflexors were performed for about 2 weeks duration resulted to be more effective approach in treating TrA than ADIM alone. In this study they computed the thicknesses of the TrA, IO, and EO muscles and the differences in mean and amplitudes, onset time, and latency were compared between the groups. This study concluded that co-contraction of ankle dorsiflexors results in decreasing pain and thickness change of TrA.

M Rajesh[1], A Vishwanth Reddy[2] (2014) [(28)] Effectiveness of Floor Exercises Versus Swiss Ball Exercises on Core Stability in Subjects with Mechanical Low Back Pain. This study has compared the effect of swiss ball exercises and floor exercises on outcome measures as pain and flexibility of lumbar spine with 30patients divided in to group I and group II with mechanical low back pain. This study concluded that there occurred significant difference between both of the floor exercises and swiss ball exercises.

SinHo Chungn juSang Lee et al.(2013)[(22)] They compared the effects of lumbar stabilization exercise using balls to the effect of general lumbar stabilization with respect to changes in the cross section of the Multifidus (MF) in twelve patients participated in either a 8 week (3 days per week) stabilization exercise program using balls and control Group. The computerised tomography (CT) were used to analyse cross-sectional area of MF muscle and they concluded that increase in the CSA of the MF muscle, pain relief, improvement in weight bearing were greater in the experimental group that performed exercises using balls.

Arti Kaushik*, Saurabh Sharma(2013) [29] Their study states about Correlation between latency period of Transverse Abdominis and Dynamic balance and said that TrA is the muscle contracted before the initiation of lower extremity movement illustrating that it is the primary muscle linked to core stability. They finally concluded that latencies between TrA muscle and direct specific muscle of star excursion balance test (SEBT) is highly correlated with one other, So it can be used as an objective assessment tool of core stability along with the modified score analysis.

Dheeraj Lamba, Suneeti Kanddpal et al (2013)[30] in their study, they determined the effect of Core stability exercise on swiss ball in patients with chronic low back pain. 30 patients were participated in the study in to swiss ball group and conventional treatment group with 15 each. The present study concludes that there is significant long term improvement with the exercises done on the swiss ball in chronic low back pain.

Seong- Doo Park, Seong- Hun Yu, et al.(2013)[16] The study purpose is to find out the effect of Abdominal draw- in manoeuver and core exercise in 20subjects with low back pain by using the musculoskeletal ultrasonography on muscle thickness. They were divided in to abdominal drawing manoeuver group: n= 10 and core exercise group: n= 10 for about 3 times a week for 4weeks and made a conclusion that the thickness of TrA, External Oblique may be an effective method by using abdominal drawing manoeuver and Internal Oblique (IO) using Core exercises.

Emil Sundstrup, MSc$_1$ Markus et al(2012)[17] has studied to compare the core muscles and thigh muscles while doing abdominal crunches on a Swiss ball for muscle recruitment by means of electromyography (EMG) , with elastic resistance or on an isotonic training machine when normalized for training intensity. Accordingly balance, stability and proprioception were improved best by using swiss ball training but it doesn’t increases the strength of the muscle. They concluded that high rectus abdominis activity accompanied by low hip flexor activity will be helpful for patients with low back pain when doing crunches added elastic resistance on a swiss ball.

Julie Hides [a,b], Warren Stanton [a], et al.(2011)[9] has studied to examine the relationships between clinical muscle testing and other measures taken in the course of a clinical assessment at a back clinic. The current study concluded that the capability in contraction of the multifidus muscle was in relation with the TrA muscle. The probability of good contraction of the multifidus were 4.45 times greater for people who have good contraction of TrA than poor muscle ability.

N. Pulkovski. A. F. Mannion et al.(2011)[18] The aim of the present study was to calculate the TrA thickness during the performance of Abdominal Hollowing(AH) exercises vary between the low back pain patients and healthy individuals. 100 patients (50 patients with cLBP and 50 healthy controls) were participated in this case–control study. They taught the patients AH in hook-lying position checking the thickness by using M-mode ultrasound. In this research study they suggested that the voluntarily activation of TrA is weakened in cLBP with a very lesser ability to contribute.

Su-Jung Kim, Oh-Yun Kwon, et al.(2011)[31] To compare the effect of single-legged hold exercise performing in the hook-lying position on the floor and on the round foam roll. 19 healthy(11 men and 8 women) individuals were included in the study and were instructed to perform this exercise on the stable surface(on floor) and on the unstable surface(foam roll), this was visualised by EMG and activity of muscle is recorded. They concluded that single-legged hold exercise in hook-lying on an unstable surface has shown the greater EMG amplitude than on the stable surface.

Nathaniel Gorbet, Noelle M. Selkow (2010)[15] The aim of the present study was to determine TrA activation with real-time ultrasound imaging(RUSI) among the ADIM and Quadruped procedures between the groups of healthy and asymptomatic low back pain patients. They concluded that, in rehabilitation or preventive program in LBP patients both the procedures will be appropriate in targeting the TrA muscle, but they noticed that TrA is not as involved as in ADIM than in quadruped exercise, so smaller activation was noticed in the quadruped exercise.

Susan A. Saliba, et al. (2010)[11] The purpose of the study was to examine whether the patients performing bridging exercises on unstable and stable surfaces has greater TrA activation among them. Fifty one adults were randomly assigned in to two groups (sling bridge device or a traditional bridging exercise regime). Both the exercise programs results in activating the TrA muscle but there was a significant gain in bridging exercise performed with sling-based exercise group while abducting hip in comparison with traditional bridge exercise group while abducting the hip in the TrA activation ratio.

Francesca Cecchi, Raffaello Molino-Lova, et al (2009)[32] The present study compared the effect of spinal manipulation(given according to Manual Medicine, scheduled 4 to 6 20' sessions once-a-week), back school(group exercise, ergonomics) and individual physiotherapy(passive mobilization and soft-tissue treatment) in the treatment of chronic low back pain for a three weeks duration in 205 patients(140/210 women). They finally concluded that spinal manipulation provides better short term and long-term results in pain relief than other approaches.

Massiiti, susan(2006)[33] He studied How to Prevent Low Back Pain –Understand it and Prevent; Movements are the best natures remedy for the treatment of low back pain. Moving without pain or as much as u can or take a help to be able to move, every time is much essential in improving the pain and disability. He said that there will be some benefits offered from desired treatment techniques like acupuncture, intramuscular stimulation technique and acupuncture needling will be helpful in treatment of back pain. He concluded that retraining of core muscles especially TrA and lumbar multifidus results in decreasing low back pain.

Critchley Duncan(2002)[34] This study was done to investigate the effect of pelvic floor(PF) contraction during the abdominal hollowing in four-point kneeling, to check the thickness of the TrA muscle by using ultrasound imaging. He did this study on twelve females and eight men with no history of back pain and pelvic floor dysfunction and they were instructed to perform the low abdominal hollowing in four-point kneeling with and without performing PF contraction. He made a conclusion, the healthy individuals performing PF contraction during the abdominal hollowing shows a greater increase in TrA thickness.

Carolyn A. Richardson, Chris J. Snijders, et al.(2002)[10], This study done to demonstrate the effect of two abdominal muscle patterns was contraction of the transverse abdominis alone, the other was a bracing action that used to all the lateral abdominal muscles.

Thirteen healthy individuals who can perform the activity were considered and included in the study. Finally they concluded that the sacroiliac joint laxity is decreased to a greater extent by contracting TrA independently, this decrease in laxity is greater than the bracing exercise.

.**L A Danneels, G G Vanderstraeten, et al.(200**1)**[35]** Their aim is To determine the effect of the cross sectional area (CSA) of the lumbar multifidus muscle in patients with chronic low back pain by different training methods. Out of 59 patients, the group A (n=19) given stabilisation training, the group B (n=20) given stabilisation training combined with dynamic resistance training and group C (n=20) were given stabilisation training combined with dynamic-static resistance training for 10 weeks intervention protocol. They concluded that the size of the multifidus muscle is restored by giving the treatment with the most appropriate method, stabilisation training combined with dynamic-static resistance training.

Julie A. Hides, Gwendolen A. Jull, et al.(2001)[36] The purpose of the study was to report the long-term effect of recurrence rate of low back pain in specific exercise group. 39 patients were participated who has acute first episode of low back pain were medically managed and allocated randomly in to specific exercise group and control group. Telephone Questionnaire reveals that people in specific exercise group experiences lesser recurrence rate from the control group, after an year , specific exercise group recurrence was 30%, and control group recurrence was 84% , later on two- three years after specific exercise group recurrence was 35%, and control group recurrence was 75%.

O'Sullivan, Peter B,et al.(1997)[8] the purpose of the study was to determine the efficacy of specific exercise intervention, forty-four patients were assigned in to two groups who were suffering with chronic low back pain patients. The first group underwent for specific training of the deep abdominal muscles, with co-activation of the lumbar multifidus and the control group underwent for treatment directed by their respected practitioner for a period of 10weeks duration. They concluded that specific exercise group is more effective than any other conservative approaches with the patients of chronically symptomatic spondylolysis or spondylolisthesis.

3. METHODS AND MATERIALS

3.1 STUDY DESIGN

Experimental study design, comparative in nature.

3.2 STUDY SETTING

Study had been conducted from Out Patient Department of Physiotherapy; Sri Baldev Raj Mittal Hospital, Lovely Professional University, Punjab.

3.3 POPULATION AND SAMPLING

Patients with Chronic Low Back Pain for at least 3months of duration were included in the study. Patients were selected conveniently and divided in to Group A and Group B of 30 in each group.

3.4 SELECTION CRITERIA

3.4.1 Inclusion Criteria

- Patients with chronic low back pain of about 3 or more than three months
- Low Back Pain with or without radiating pain
- Age group of 20 - 40 years
- Patients with moderate disability in MODI (Modified Oswestry Disability Index) score
- Pain localised between the T12 Vertebral level and the gluteal fold.
- Long term pain in Prolapsed Intervertebral Disc (PIVD) cases
- Inactive or Sedentary Lifestyle

3.4.2 Exclusion Criteria

- Any previous surgery in the back and abdominal region
- Patients with neurological deficit
- Spondylolisthesis, Spinal fracture, Spinal tumour, Spinal Stenosis
- Vascular diseases
- Scoliosis , T.B Spine

- Very obese patients
- Periarthitis of shoulder

3.5 PARAMETERS

- Pain: The level of pain was assessed by using Numeric Pain rating Scale and each patient was asked to mark the level of pain on NPRS.
- Functional disability in chronic low back pain: Functional disability was assessed by using the Modified Oswestry low back pain questionnaire. Patients were asked to answer in the index according to their disability and the points were given.

3.6 INSTRUMENTS AND TOOLS

- Pain measurement by Numeric Pain Rating Scale: Used for measuring the severity of pain, instruct the patient to choose a number from 0-10 that best describe their current pain. "0" means 'no pain' and "10" would mean 'worst possible pain'. Pain scales were based on self-report, observational and physiological data. (37) Reliability (0.74; 95% CI: 0.55, 0.89) and (0.51; 95% CI: 0.39, 0.61) NPRS.(38)
- Functional Disability by Modified Oswestry Disability Index: It covers 10 domains; they are pain intensity, personal care, lifting, walking, sitting, standing, sleeping, travelling, social life and employment or homemaking. The chosen scored as follows, A=0, B=1, C=2, D=3, E=4, F=5.). Reliability coefficient of r=.89 for a same-day test-retest.(39)

  0- 4: No disability

  5-14: Mild disability

  15-24: Moderate disability

  25-34: Severe disability

  >35: Complete disability (40)

- Motor Unit Actional Potential (MUAP) by EMG activity

3.7 PROCEDURE

68 patients were assessed with chronic low back pain, but among them 2patients (1 patient was having Frozen shoulder and 1 patients was very obese) fell in in the exclusion criteria and were excluded, 3 patients were denied to participate in the study.63 patients (32 in Group A and 31 in Group B) were taken by the convenient sampling. Patients were screened for inclusion and exclusion criteria were participated in the study after giving the consent. Group A received Abdominal Drawing In Manoeuver (ADIM) along with Quadruped position exercise and Group B received ADIM along with Swiss ball exercises. 3 patients were excluded because they were discontinued the treatment (2 from Group A and 1 from Group B). So finally 30 patients were participated in Group A and 30 participated in Group B. Pre-test readings of pain, functional Disability and EMG activity of TrA recorded before giving intervention. Then the intervention was given for 3weeks; 5days in a week. After the intervention, post-test readings of pain, functional disability and EMG activity of TrA and compare.

In Group A, Abdominal Drawing in Manoeuvre and Quadruped exercises had been given for about 3weeks, 5 times a week; each session will last for 30minutes. They were instructed not to participate in other physical program during the intervention. In the Group A, the ADIM and Quadruped position exercise focused on the activation of the TrA thickening, while the internal and external abdominal oblique muscles remained relatively unchanged.

In Group B, ADIM and SWISS ball training were given. Interventions conducted for about 3weeks, 5 times a week; each session will last for 30minutes. They were instructed not to participate in any of other treatment. Focus was on TrA with swiss ball training and to improve the activity of TrA, as this is one of the muscles which will undergo for motor control dysfunction including delayed onset of activity in chronic low back pain patients.

GROUPS	Exercises	Repetitions	Hold Time	Works on	Sets
GROUP A	QUADRUPED Exercise	10	5 sec	TrA	3sets a day
GROUP B	SWISS BALL Training	10	5 sec	TrA	3sets a day
GROUP A+B	ADIM Exercise	10	10 sec	TrA	3sets a day

ADIM: Abdominal Drawing-In manoeuvre, starting position is the patients were instructed to knees bent to 90 degrees in supine lying. To perform the contraction, the patient were instructed to breath in and then after you exhale, pull your abdomen towards the spine[15] and were performed 10 pain free contractions per 2-3 times per day, holding each contraction for 10sec's.The exercises were executed with low effort and with relaxed respiration.[33]

Quadruped Exercise [15]: Participants started with four-kneeling position on their hands and knees, back flat, while looking straight a ahead. To engage TrA in this position they were asked to perform actively by pulling your abdomen and then by raising simultaneously the right arm and left leg until the extremities and trunk are at same level, hold for about five seconds and returns to the starting position. During the hold for five second, the patient was instructed not to rotate the trunk or sag. Rest for 30 seconds, and then the patient performs again.

SWISS Ball Exercise [41]:

Step1: Sit on a swiss exercise ball then walk your legs out, positioning your shoulders blades directly on top of the ball. Lift your pelvis up so it is in line with your body and hold it in this position

Step 2: Suck your navel toward your spine to engage your transverse abdominis. Straighten your arms out to either side.

Step3: Slowly lean toward the left until your left shoulder blade is off of the ball, contracting your abdominals tightly to maintain balance. Hold this position for five seconds then return to the centre position.

Step4: Slowly lean toward the right until your right shoulder blade is off of the ball, contracting your abdominals tightly to maintain your balance. Hold this position for five seconds then return to the centre position.

Step5: Continue to alternate sides, completing 10 total repetitions. Perform three sets.

3.8 Statistical Tool

Statistics were performed using SPSS software. A student's t-test will be used to analyse the difference of reduction in Pain, strength and endurance and functional disability between both the groups; i.e.; group1 and group2. Intra-group analysis between pre intervention scores was also done for both the groups. A significant level of $P<0.05$ was fixed.

Paired t-test: A paired t-test measures whether means from a within subjects test group vary over 2 test conditions. The paired t-test is commonly used to compare a sample group's score before and after an intervention.

Unpaired t-test: An unpaired t-test is using to compare two populations means.

Mean: Using statistical formula for the mean, for a given number of subjects, mean of different age groups and parameters were calculated by:

$\bar{X} = \sum X / n$

Where, n= number of subjects

X= each subjects value

Standard deviation (σ)

$s = \sqrt{\sum x^2} / N$

x= deviation of score from mean

N= number of subjects

Paired t-test: For within group comparison

4. DATA ANALYSIS AND RESULTS

Table 4.1: Mean and SD of age of the subjects for the group A and group B

Age	Mean ± SD	t-value	Level of Significance
Group A	26.40±4.78	0.150	0.88 NS
Group B	26.60±5.74		

Comparison of mean and standard deviation of subject's age (20-40years) between group A (Abdominal drawing in manoeuvre and Quadruped position exercises) & group B (Abdominal drawing in manoeuvre and Swiss ball training).The mean age of group A was 26.40±4.78 and that of group B was 26.60±5.74 respectively. The unpaired t test value was 0.150 ($p>0.05$). There was no significant difference in the age group.

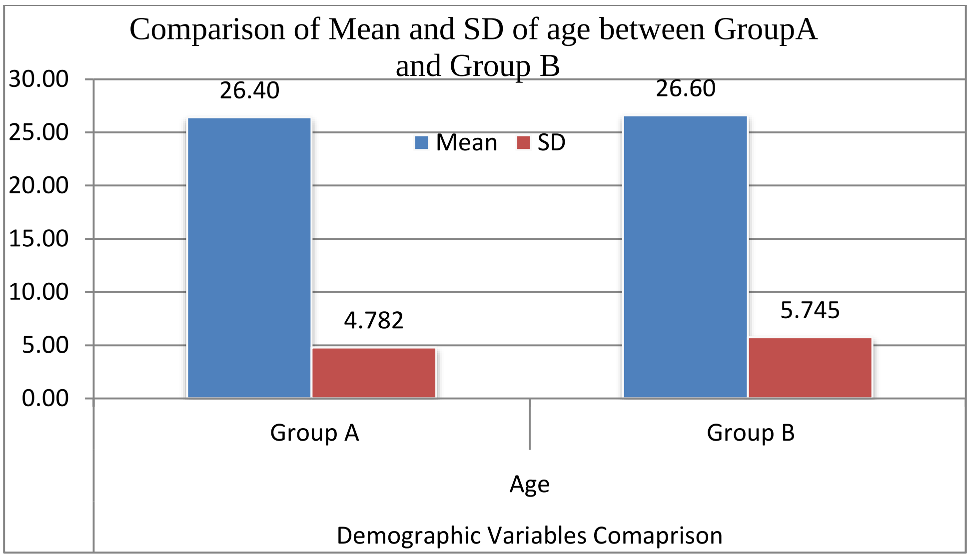

Figure 4.1: Comparison of Mean and SD of age between Group A and Group B

Table 4.2: Paired T-Test for the variable NPRS within group A

NPRS		Mean ± SD	t-value	Level of Significance
Group A	Pre Value	6.70 ± 1.208	17.020	0.0000 S
	Post Value	2.53 ± 0.819		

The mean and standard deviation of the variable NPRS within the group A was 6.70 ± 1.208 and 2.53 ± 0.819 respectively. Paired t-test was done within the group A for the variable NPRS to check the changes within the group. The t-value for NPRS was 17.020 ($p<0.05$). The result for the variable was significant which showed that there were significant changes within the group.

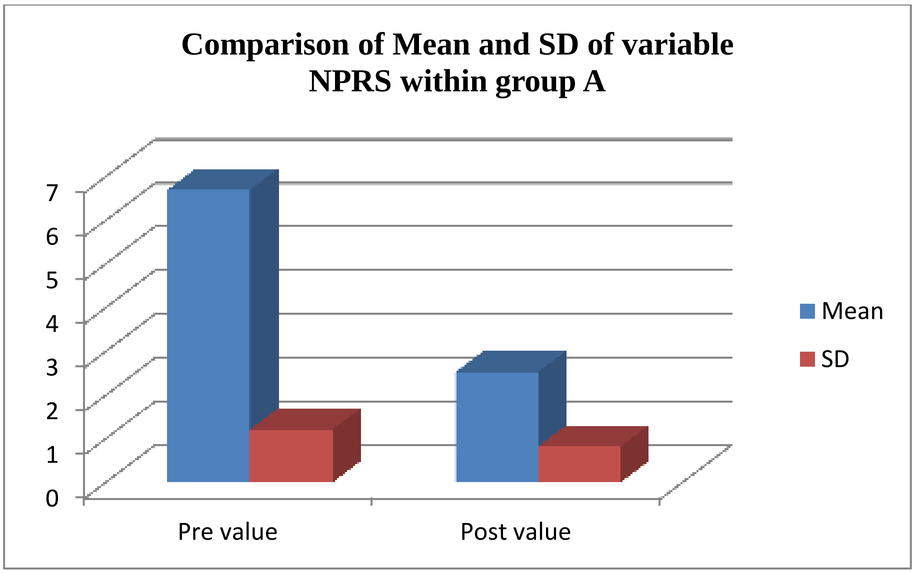

Figure 4.2: Comparison of Mean and SD of variable NPRS within group A

Table 4.3: Paired T-Test for the variable MODI within group A

MODI		Mean ± SD	t-value	Level of Significance
Group A	Pre Value	19.57 ± 3.002	22.190	0.0000 S
	Post Value	10.07 ± 2.753		

The mean and standard deviation of the variable MODI within the group A was 19.57 ± 3.002and 10.07 ± 2.753 respectively. Paired t-test was done within the group A for the variable MODI to check the changes within the group. The t-value for MODI was 22.190 ($p<0.05$). The result for the variable was significant which showed that there were significant changes within the group.

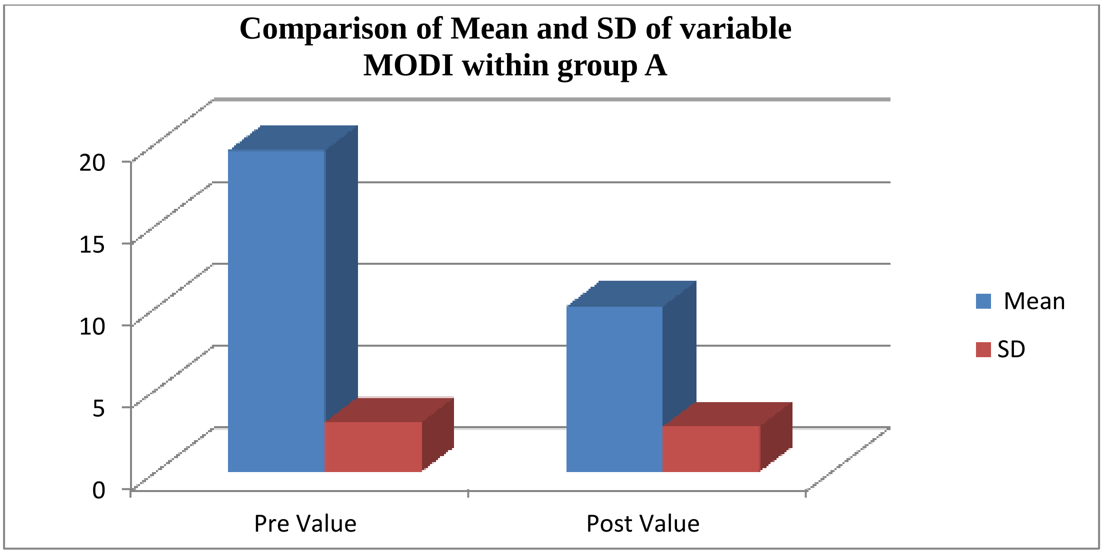

Figure 4.3: Comparison of Mean and SD of variable MODI within group A

Table 4.4: Paired T-Test for the variable EMG Amplitude of Transverse abdominis muscle within group A

Amplitude		Mean ± SD	t-value	Level of Significance
Group A	Pre Value	129.60± 37.496	11.810	0.0000 S
	Post Value	258.13± 69.561		

The mean and standard deviation of the variable EMG Amplitude of Transverse abdominis muscle within the group A was129.60± 37.496 and 258.13± 69.561respectively. Paired t-test was done within the group A for the variable EMG Amplitude of Transverse abdominis muscle to check the changes within the group. The t-value for variable EMG Amplitude of Transverse abdominis muscle was 11.810 ($p<0.05$). The result for the variable was significant which showed that there were significant changes within the group.

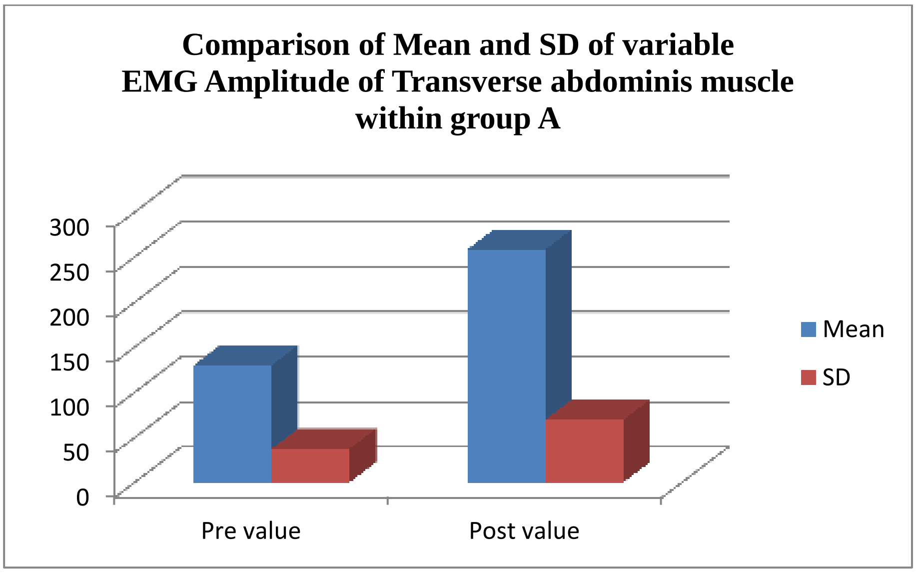

Figure 4.4: Comparison of Mean and SD of variable EMG Amplitude of Transverse abdominis muscle within group A

Table 4.5: Paired T-Test for the variable EMG Duration of Transverse abdominis muscle within group A

Duration		Mean ± SD	t-value	Level of Significance
Group A	Pre Value	2.93± 1.50	11.190	0.0000 S
	Post Value	5.48± 1.46		

The mean and standard deviation of the variable Duration of Transverse abdominis muscle within the group A was2.93± 1.50 and 5.48± 1.46 respectively. Paired t-test was done within the group A for the variable EMG Duration of Transverse abdominis muscle to check the changes within the group. The t-value for variable EMG Duration of Transverse abdominis muscle was 11.190 ($p<0.05$). The result for the variable was significant which showed that there were significant changes within the group.

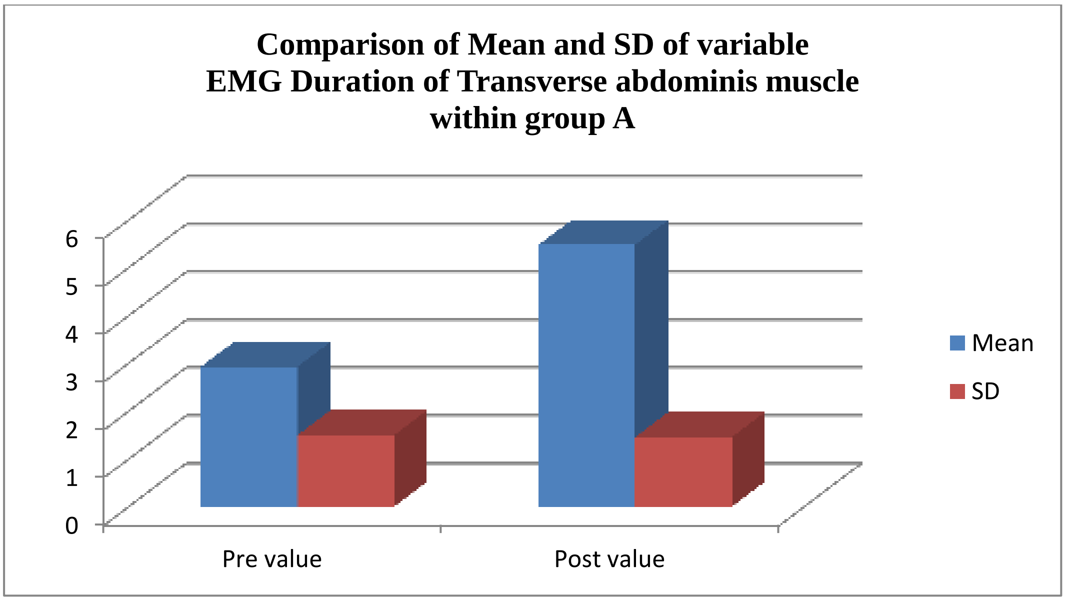

Figure 4.5: Comparison of Mean and SD of variable EMG Duration of Transverse abdominis muscle within group A

Table: 4.6: Paired T-Test for the variable NPRS within group B

NPRS		Mean ± SD	t-value	Level of Significance
Group B	Pre Value	6.77 ± 1.251	15.840	0.0000 S
	Post Value	2.60 ± 0.855		

The mean and standard deviation of the variable NPRS within the group B was 6.77 ± 1.251and 2.60 ± 0.855 respectively. Paired t-test was done within the group B for the variable NPRS to check the changes within the group. The t-value for NPRS was 15.840 ($p<0.05$). The result for the variable was significant which showed that there were significant changes within the group.

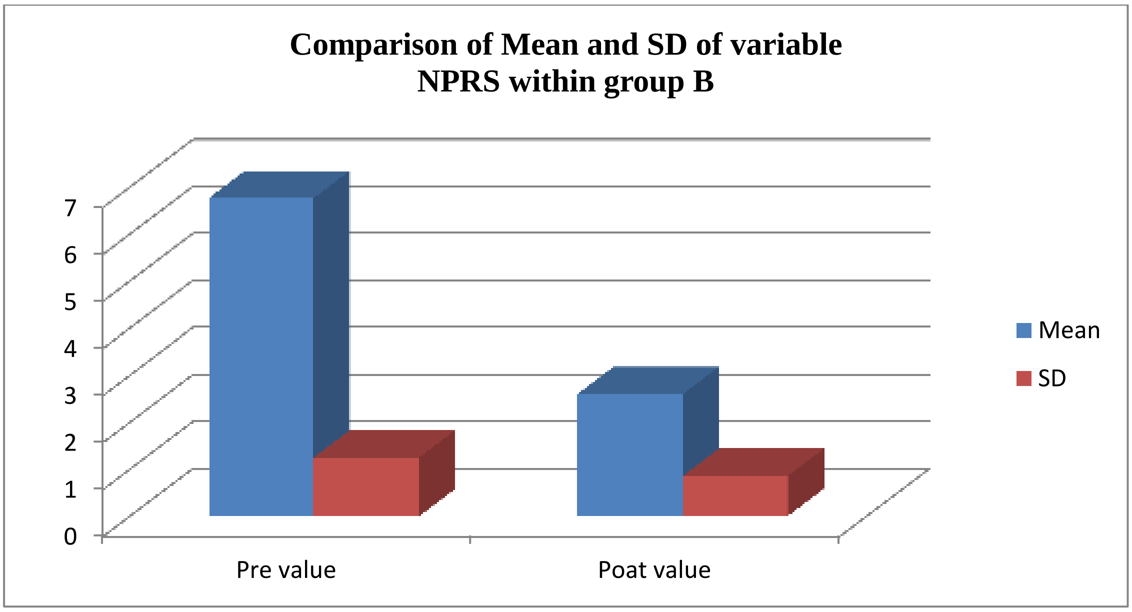

Figure 4.6: Comparison of Mean and SD of variable NPRS within group B

Table 4.7: Paired T-Test for the variable MODI within group B

MODI		Mean ± SD	t-value	Level of Significance
Group B	Pre Value	19.87 ± 2.862	27.120	0.0000 S
	Post Value	7.50 ± 1.889		

The mean and standard deviation of the variable MODI within the group B was 19.87 ± 2.862and 7.50 ± 1.889respectively. Paired t-test was done within the group B for the variable MODI to check the changes within the group. The t-value for MODI was 27.120 ($p<0.05$). The result for the variable was significant which showed that there were significant changes within the group.

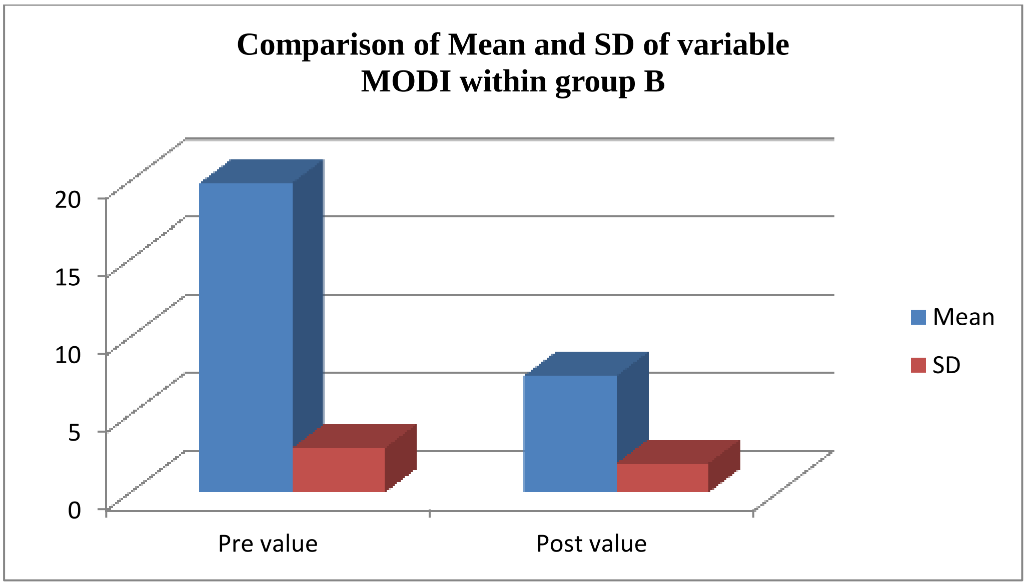

Figure 4.7: Comparison of Mean and SD of variable MODI within group B

Table 4.8: Paired T-Test for the variable EMG Amplitude of Transverse abdominis muscle within group B

Amplitude		Mean ± SD	t-value	Level of Significance
Group A	Pre Value	139.37± 37.166	16.430	0.0000 S
	Post Value	338.67± 68.994		

The mean and standard deviation of the variable EMG Amplitude of Transverse abdominis muscle within the group B was139.37± 37.166 and 338.67± 68.994 respectively. Paired t-test was done within the group B for the variable EMG Amplitude of Transverse abdominis muscle to check the changes within the group. The t-value for variable EMG Amplitude of Transverse abdominis muscle was 16.430 ($p<0.05$). The result for the variable was significant which showed that there were significant changes within the group.

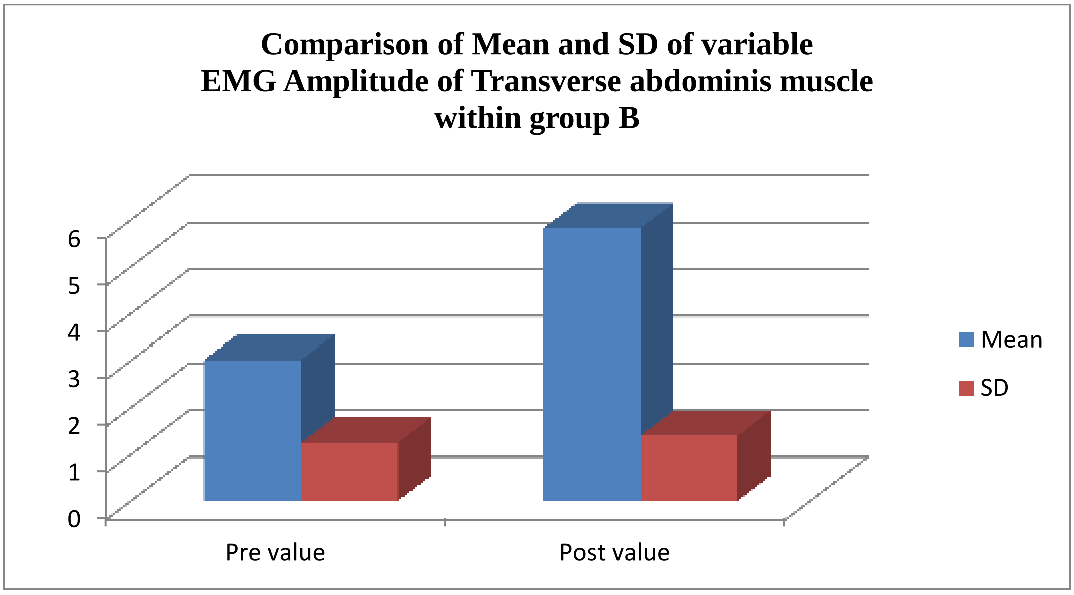

Figure 4.8: Comparison of Mean and SD of variable EMG Amplitude of Transverse abdominis muscle within group B

Table 4.9: Paired T-Test for the variable EMG Duration of Transverse abdominis muscle within group B

Duration		Mean ± SD	t-value	Level of Significance
Group A	Pre Value	3.01± 1.25	14.620	0.0000 S
	Post Value	5.82± 1.40		

The mean and standard deviation of the variable Duration of Transverse abdominis muscle within the group B was 3.01± 1.25 and 5.82± 1.40respectively. Paired t-test was done within the group B for the variable variable EMG Duration of Transverse abdominis muscle to check the changes within the group. The t-value for variable EMG Duration of Transverse abdominis muscle was 14.620 (p<0.05). The result for the variable was significant which showed that there were significant changes within the group.

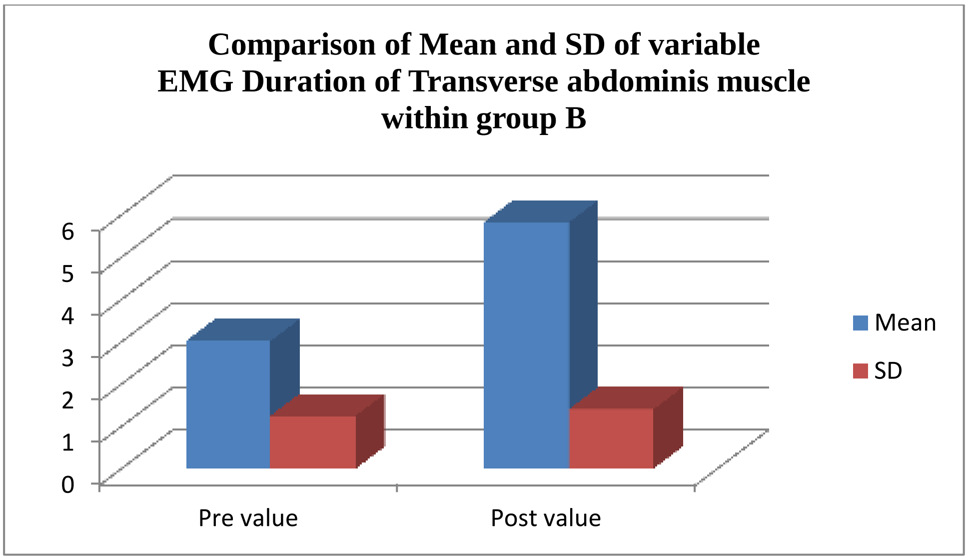

Figure 4.9: Comparison of Mean and SD of variable EMG Duration of Transverse abdominis muscle within group B

Table 4.10: Unpaired T-Test for the variable pre values of NPRS between group A and Group B

NPRS		Mean ± SD	t-value	Level of Significance
Pre Value	Group A	6.70 ± 1.208	0.210	0.8344 NS
	Group B	6.77 ± 1.251		

Unpaired t-test was done between pre values of Group A and Group B to check the changes between the groups. The mean and standard deviation of the variable NPRS of Group A was 6.70 ± 1.208 and Group B 6.77 ± 1.251 respectively. The t-value for pre values of variable NPRS was 0.210 ($p>0.05$). The results for the variable NPRS were not significant which showed that there were no significant changes between the groups.

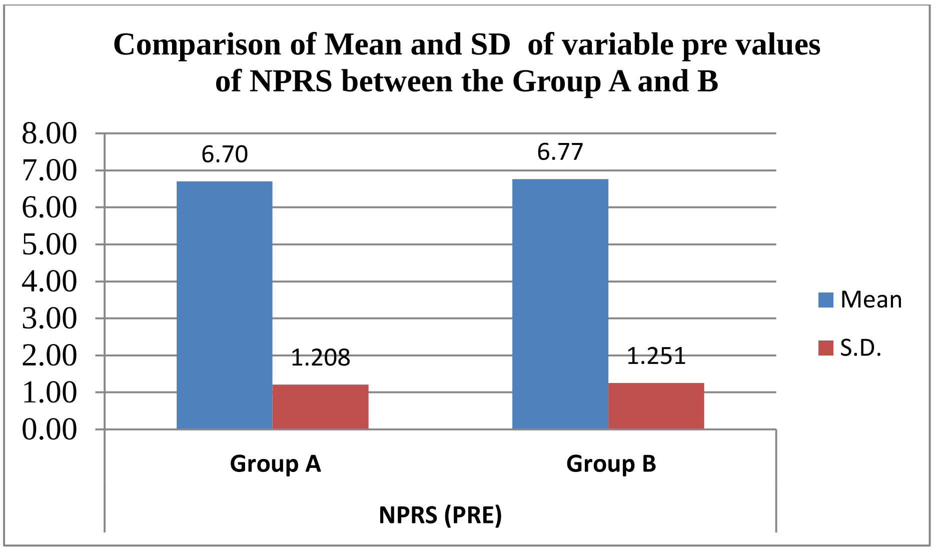

Figure 4.10: Comparison of Mean and SD of variable pre values NPRS between group A and B

Table 4.11: Unpaired T-Test for the variable pre values of MODI between group A and Group B

MODI		Mean ± SD	t-value	Level of Significance
Pre Value	Group A	19.57± 3.002	0.400	0.6934 NS
	Group B	19.87 ± 2.862		

Unpaired t-test was done between the pre values of Group A and Group B to check the changes between the groups. The mean and standard deviation of the variable MODI of Group A was 19.57± 3.002 and Group B 19.87 ± 2.862 respectively. The t-value for pre values of variable MODI was 0.400 ($p>0.05$). The results for the variable MODI were not significant which showed that there were no significant changes between the groups.

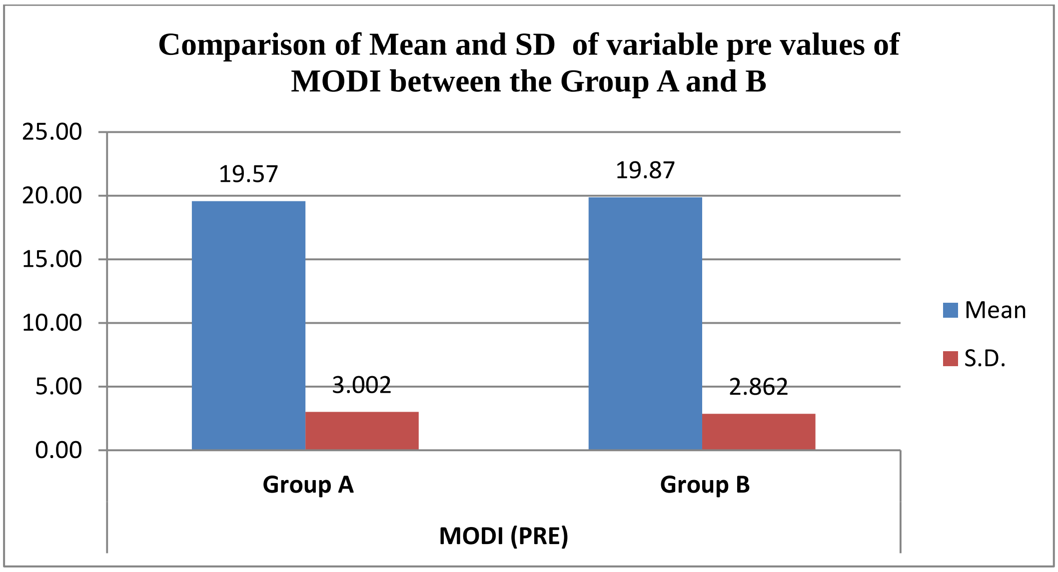

Figure 4.11: Comparison of Mean and SD of variable pre values MODI between group A and B

Table 4.12: Unpaired T-Test for the variable pre values of EMG Amplitude of Transverse Abdominis muscle between group A and Group B

Amplitude		Mean ± SD	t-value	Level of Significance
Pre Value	Group A	129.60± 37.496	1.010	0.3152 NS
	Group B	139.37 ± 37.166		

Unpaired t-test was done between the pre values of Group A and Group B to check the changes between the groups. The mean and standard deviation of the variable EMG Amplitude of Transverse Abdominis muscle of Group A was 129.60± 37.496 and Group B 139.37 ± 37.166 respectively. The t-value for pre values of variable EMG Amplitude of Transverse Abdominis muscle was 1.010 (p>0.05). The results for the variable EMG Amplitude of Transverse Abdominis muscle were not significant which showed that there were no significant changes between the groups.

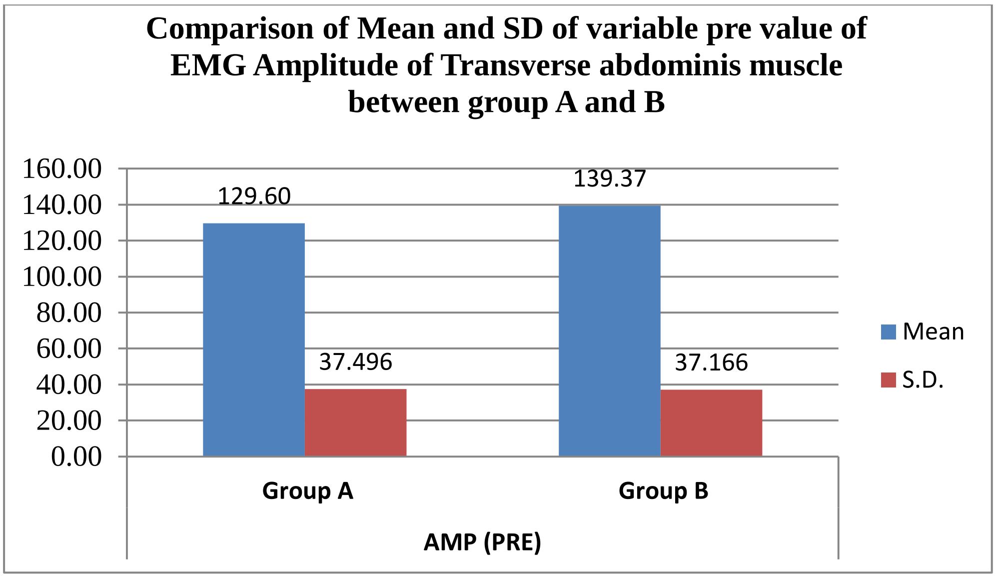

Figure 4.12: Comparison of Mean and SD of variable pre value of EMG Amplitude of Transverse abdominis muscle between group A and B

Table 4.13: Unpaired T-Test for the variable pre values of EMG Duration of Transverse Abdominis muscle between group A and Group B

Duration		Mean ± SD	t-value	Level of Significance
Pre Value	Group A	2.93 ± 1.502	0.210	0.8349 NS
	Group B	3.01 ± 1.249		

Unpaired t-test was done between the pre values of Group A and Group B to check the changes between the groups. The mean and standard deviation of the variable EMG Duration of Transverse Abdominis muscle of Group A was 2.93 ± 1.502 and Group B 3.01 ± 1.249 respectively. The t-value for pre values of variable EMG Duration of Transverse Abdominis muscle was 0.210 ($p>0.05$). The results for the variable EMG Duration of Transverse Abdominis muscle were not significant which showed that there were no significant changes between the groups.

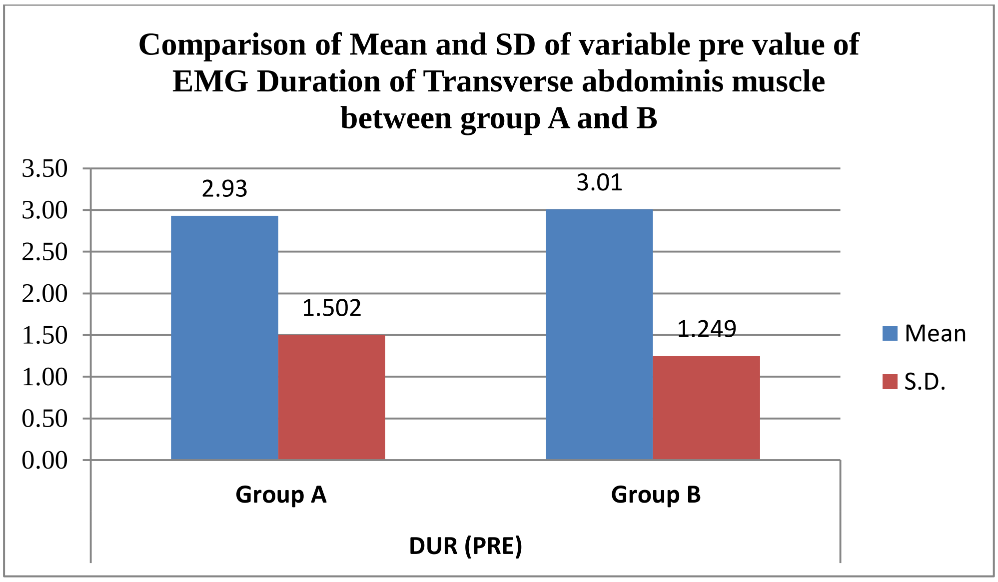

Figure 4.13: Comparison of Mean and SD of variable pre value of EMG Duration of Transverse abdominis muscle between group A and B

Table 4.14: Unpaired T-Test for the variable post values of NPRS between group A and Group B

NPRS		Mean ± SD	t-value	Level of Significance
Post Value	Group A	2.53 ± 0.819	0.310	0.7589 NS
	Group B	2.60 ± 0.855		

Unpaired t-test was done between the post values of Group A and Group B to check the changes between the groups. The mean and standard deviation of the variable NPRS of Group A was 2.53 ± 0.819 and Group B 2.60 ± 0.855 respectively. The t-value for post values of variable NPRS was 0.310 (p>0.05). The results for the variable NPRS were not significant which showed that there were no significant changes between the groups.

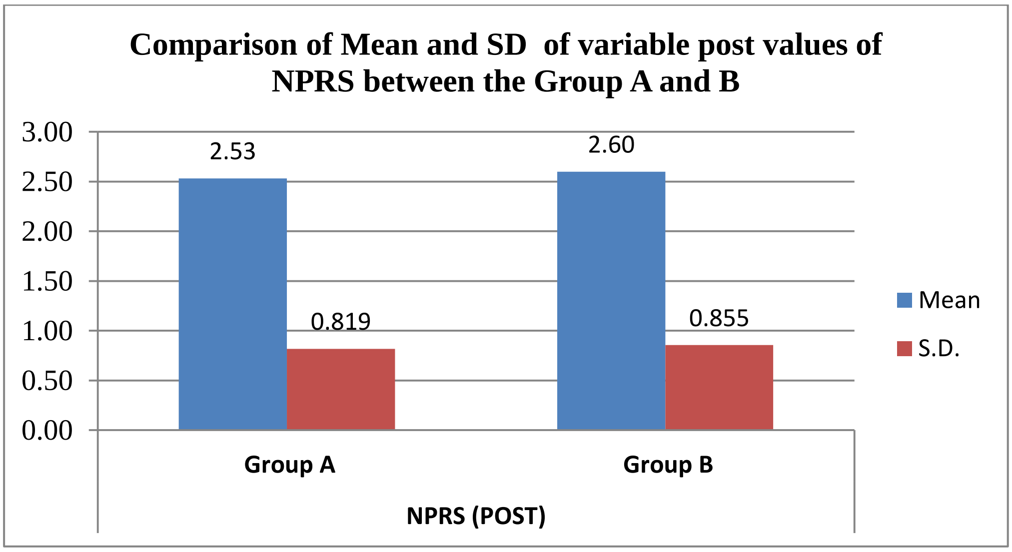

Figure 4.14: Comparison of Mean and SD of variable post values of NPRS between the Group A and B

Table 4.15: Unpaired T-Test for the variable post values of MODI between group A and Group B

MODI		Mean ± SD	t-value	Level of Significance
Post Value	Group A	10.07 ± 2.753	4.210	0.0001 S
	Group B	7.50 ± 1.889		

Unpaired t-test was done between the post values of Group A and Group B to check the changes between the groups. The mean and standard deviation of the variable MODI of Group A was 10.07 ± 2.753 and Group B 7.50 ± 1.889 respectively. The t-value for post values of variable MODI was 4.210 ($p<0.05$). The results for the variable MODI were significant which showed that there were significant changes between the groups.

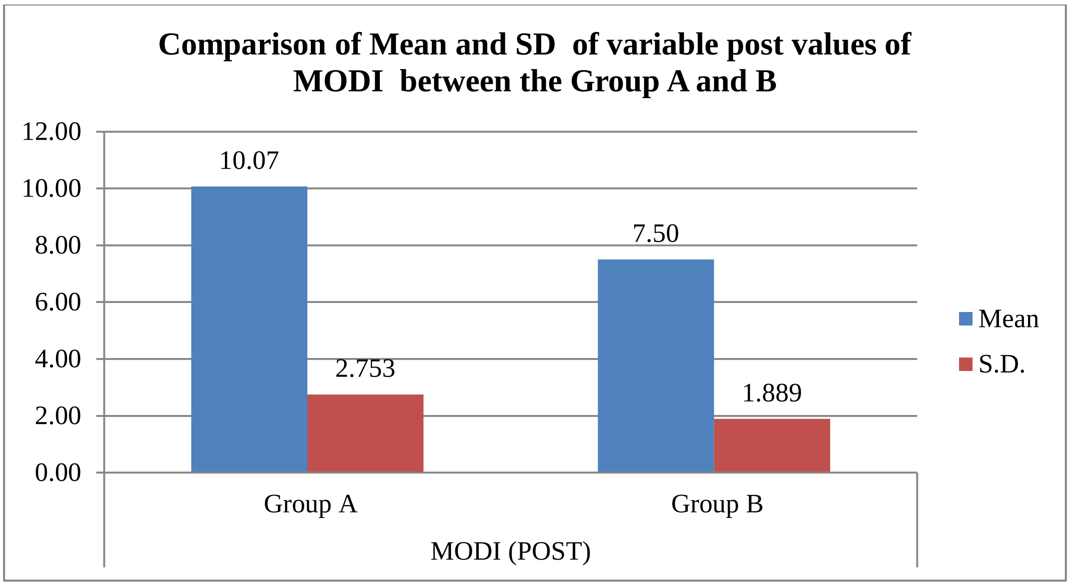

Figure 4.15: Comparison of Mean and SD of variable post values of MODI between the Group A and B

Table 4.16: Unpaired T-Test for the variable post values of EMG Amplitude of Transverse Abdominis muscle between group A and Group B

Amplitude		Mean ± SD	t-value	Level of Significance
Post Value	Group A	258.13 ± 69.561	4.500	0.0000 S
	Group B	338.67 ± 68.994		

Unpaired t-test was done between the post values of Group A and Group B to check the changes between the groups. The mean and standard deviation of the variable EMG Amplitude of Transverse Abdominis muscle of Group A was 258.13 ± 69.561 and Group B 338.67 ± 68.994 respectively. The t-value for post values of variable EMG Amplitude of Transverse Abdominis muscle was 4.500 ($p<0.05$). The results for the variable EMG Amplitude of Transverse Abdominis muscle were significant which showed that there were Significant changes between the groups.

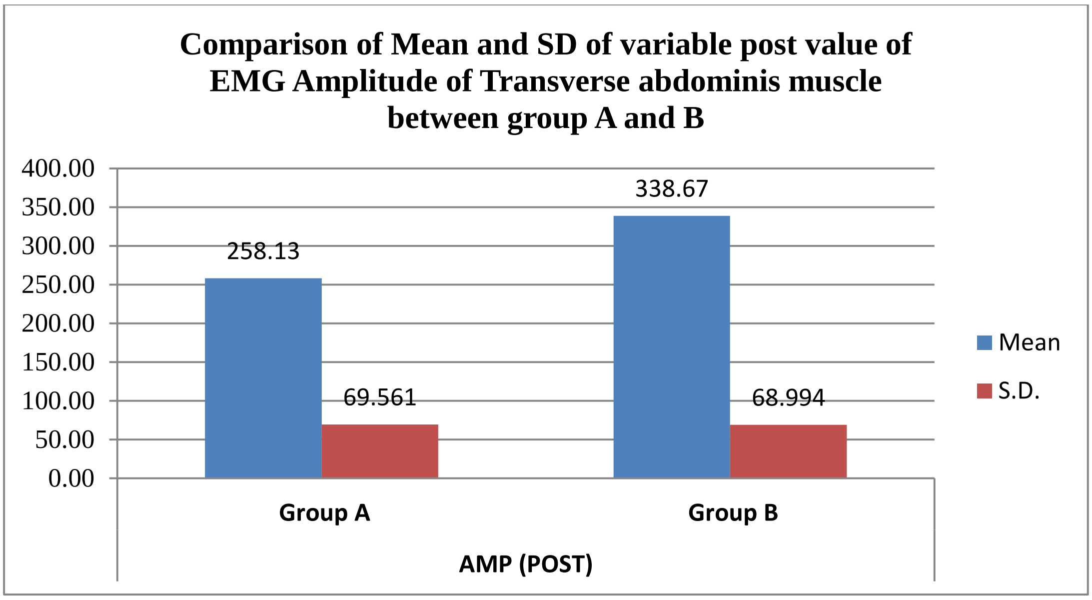

Figure 4.16: Comparison of Mean and SD of variable post value of EMG Amplitude of Transverse abdominis muscle between group A and B

Table 4.17: Unpaired T-Test for the variable post values of EMG Duration of Transverse Abdominis muscle between group A and Group B

Duration		Mean ± SD	t-value	Level of Significance
Post Value	Group A	5.48 ± 1.455	0.920	0.3596 NS
	Group B	5.82 ± 1.402		

Unpaired t-test was done between the post values of Group A and Group B to check the changes between the groups. The mean and standard deviation of the variable EMG Duration of Transverse Abdominis muscle of Group A was 5.48 ± 1.455 and Group B 5.82 ± 1.402 respectively. The t-value for post values of variable EMG Duration of Transverse Abdominis muscle was 0.920 (p>0.05). The results for the variable EMG Duration of Transverse Abdominis muscle were not significant which showed that there were no significant changes between the groups.

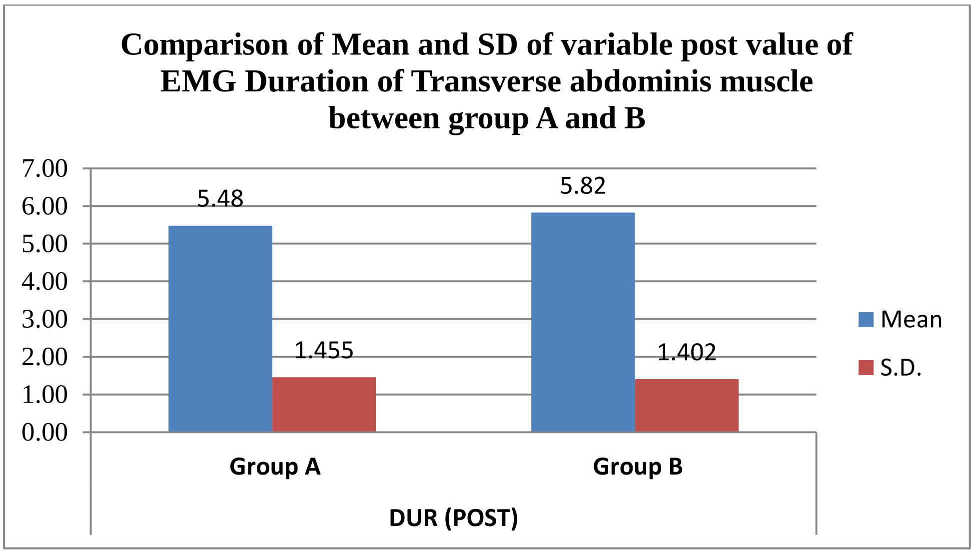

Figure 4.17: Comparison of Mean and SD of variable post value of EMG Duration of Transverse abdominis muscle between group A and B

RESULTS

Comparison of mean and standard deviation of subjects age (20-40years) between group A (Abdominal drawing in manoeuvre and Quadruped position exercises) & group B(Abdominal drawing in manoeuvre and Swiss ball training).The mean age of group A was 26.40±4.78 and that of group B was 26.60±5.74 respectively. The unpaired t test value was 0.150 ($p>0.05$). There was no significant difference in the age group.

The mean and standard deviation of the variable NPRS within the group A was 6.70 ± 1.208 and 2.53 ± 0.819 respectively. Paired t-test was done within the group A for the variable NPRS to check the changes within the group. The t-value for NPRS was 17.020 ($p<0.05$). The result for the variable was significant which showed that there were significant changes within the group

The mean and standard deviation of the variable MODI within the group A was 19.57 ± 3.002and 10.07 ± 2.753 respectively. Paired t-test was done within the group A for the variable MODI to check the changes within the group. The t-value for MODI was 22.190 ($p<0.05$). The result for the variable was significant which showed that there were significant changes within the group.

The mean and standard deviation of the variable EMG Amplitude of Transverse abdominis muscle within the group A was129.60± 37.496 and 258.13± 69.561respectively. Paired t-test was done within the group A for the variable EMG Amplitude of Transverse abdominis muscle to check the changes within the group. The t-value for variable EMG Amplitude of Transverse abdominis muscle was 11.810 ($p<0.05$). The result for the variable was significant which showed that there were significant changes within the group.

The mean and standard deviation of the variable Duration of Transverse abdominis muscle within the group A was2.93± 1.50 and 5.48± 1.46 respectively. Paired t-test was done within the group A for the variable EMG Duration of Transverse abdominis muscle to check the changes within the group. The t-value for variable EMG Duration of Transverse abdominis muscle was 11.190 ($p<0.05$). The result for the variable was significant which showed that there were significant changes within the group.

The mean and standard deviation of the variable NPRS within the group B was 6.77 ± 1.251and 2.60 ± 0.855 respectively. Paired t-test was done within the group B for the variable NPRS to check the changes within the group. The t-value for NPRS was 15.840

($p<0.05$). The result for the variable was significant which showed that there were significant changes within the group.

The mean and standard deviation of the variable MODI within the group B was 19.87 ± 2.862and 7.50 ± 1.889respectively. Paired t-test was done within the group B for the variable MODI to check the changes within the group. The t-value for MODI was 27.120 ($p<0.05$). The result for the variable was significant which showed that there were significant changes within the group.

The mean and standard deviation of the variable EMG Amplitude of Transverse abdominis muscle within the group B was139.37± 37.166 and 338.67± 68.994 respectively. Paired t-test was done within the group B for the variable EMG Amplitude of Transverse abdominis muscle to check the changes within the group. The t-value for variable EMG Amplitude of Transverse abdominis muscle was 16.430 ($p<0.05$). The result for the variable was significant which showed that there were significant changes within the group.

The mean and standard deviation of the variable Duration of Transverse abdominis muscle within the group B was 3.01± 1.25 and 5.82± 1.40respectively. Paired t-test was done within the group B for the variable variable EMG Duration of Transverse abdominis muscle to check the changes within the group. The t-value for variable EMG Duration of Transverse abdominis muscle was 14.620 ($p<0.05$). The result for the variable was significant which showed that there were significant changes within the group.

Unpaired t-test was done between pre values of Group A and Group B to check the changes between the groups. The mean and standard deviation of the variable NPRS of Group A was 6.70 ± 1.208 and Group B 6.77 ± 1.251 respectively. The t-value for pre values of variable NPRS was 0.210 ($p>0.05$). The results for the variable NPRS were not significant which showed that there were no significant changes between the groups.

Unpaired t-test was done between the pre values of Group A and Group B to check the changes between the groups. The mean and standard deviation of the variable MODI of Group A was 19.57± 3.002 and Group B 19.87 ± 2.862 respectively. The t-value for pre values of variable MODI was 0.400 ($p>0.05$). The results for the variable MODI were not significant which showed that there were no significant changes between the groups.

Unpaired t-test was done between the pre values of Group A and Group B to check the changes between the groups. The mean and standard deviation of the variable EMG Amplitude of Transverse Abdominis muscle of Group A was 129.60± 37.496 and Group B 139.37 ± 37.166 respectively. The t-value for pre values of variable EMG Amplitude of Transverse Abdominis muscle was 1.010 ($p>0.05$). The results for the variable EMG

Amplitude of Transverse Abdominis muscle were not significant which showed that there were no significant changes between the groups.

Unpaired t-test was done between the pre values of Group A and Group B to check the changes between the groups. The mean and standard deviation of the variable EMG Duration of Transverse Abdominis muscle of Group A was 2.93 ± 1.502 and Group B 3.01 ± 1.249 respectively. The t-value for pre values of variable EMG Duration of Transverse Abdominis muscle was 0.210 ($p>0.05$). The results for the variable EMG Duration of Transverse Abdominis muscle were not significant which showed that there were no significant changes between the groups.

Unpaired t-test was done between the post values of Group A and Group B to check the changes between the groups. The mean and standard deviation of the variable NPRS of Group A was 2.53 ± 0.819 and Group B 2.60 ± 0.855 respectively. The t-value for post values of variable NPRS was 0.310 ($p>0.05$). The results for the variable NPRS were not significant which showed that there were no significant changes between the groups.

Unpaired t-test was done between the post values of Group A and Group B to check the changes between the groups. The mean and standard deviation of the variable MODI of Group A was 10.07 ± 2.753 and Group B 7.50 ± 1.889 respectively. The t-value for post values of variable MODI was 4.210 ($p<0.05$). The results for the variable MODI were significant which showed that there were significant changes between the groups.

Unpaired t-test was done between the post values of Group A and Group B to check the changes between the groups. The mean and standard deviation of the variable EMG Amplitude of Transverse Abdominis muscle of Group A was 258.13 ± 69.561 and Group B 338.67 ± 68.994 respectively. The t-value for post values of variable EMG Amplitude of Transverse Abdominis muscle was 4.500 ($p<0.05$). The results for the variable EMG Amplitude of Transverse Abdominis muscle were significant which showed that there were Significant changes between the groups

Unpaired t-test was done between the post values of Group A and Group B to check the changes between the groups. The mean and standard deviation of the variable EMG Duration of Transverse Abdominis muscle of Group A was 5.48 ± 1.455 and Group B 5.82 ± 1.402 respectively. The t-value for post values of variable EMG Duration of Transverse Abdominis muscle was 0.920 ($p>0.05$). The results for the variable EMG Duration of Transverse Abdominis muscle were not significant which showed that there were no significant changes between the group.

5. DISCUSSION

The study was designed to evaluate the efficacy of Abdominal drawing in manoeuvre and Quadruped position exercises with Abdominal drawing in manoeuvre and Swiss ball training of Transverse Abdominis in individuals with chronic low back pain- an EMG study. 68 patients of chronic low back pain were taken and excluded 8 patients (2 are excluded as 1 patient was having Frozen shoulder and 1 patients was very obese, 3 refused to participate and 3 discontinued in the middle of the treatment), finally 60 patients of chronic low back pain (cLBP) had been divided in to 2 groups, 30 patients in each group. Group A received Abdominal drawing in manoeuvre and Quadruped position exercises (5times per week) and group B received Abdominal drawing in manoeuvre and Swiss ball training (5times per week). Both groups were given back care education after their specific treatment.

The included parameters were NPRS for pain, Modified Oswestry Disability Index for disability and EMG amplitude and duration for Transverse abdominis muscle in patients with chronic low back pain. Data were collected at the baseline (at day 0) and after 3 weeks to evaluate the changes in outcome measures.

The findings of the present study are that group A (Abdominal drawing in manoeuvre and Quadruped position exercises) and group B (Abdominal drawing in manoeuvre and Swiss ball training) significantly decreased in pain on NPRS scale in patients with chronic low back pain. However on comparing between the groups there is significant difference in disability by Modified Oswestry Disability Index and EMG finding of amplitude but no significant difference in reducing pain and duration of EMG finding between groups. To our knowledge this is the first study to compare Abdominal drawing in manoeuvre (ADIM) and Quadruped position exercises with Abdominal drawing in manoeuvre (ADIM) and Swiss ball training of Transverse Abdominis for the management of chronic low back pain.

Both the treatments techniques were effective in reducing pain after the 3weeks of treatment protocol. There was significant difference in pain outcome measure within the group of group A (ADIM and Quadruped position exercises) and group B (ADIM and Swiss ball training). However on comparing between the groups (group A and group B) there was no significant difference in reducing pain.

The Abdominal drawing in manoeuvre (ADIM) [15] were performed with engaging the Transverse abdominis (TrA) by pulling the lower abdomen towards the spine, Quadruped position exercises [15] involve the TrA by engaging it by raising opposite hand and leg and Swiss ball training [41] has also the same principle of ADIM but here the patients lies on the swiss ball until the shoulder blade is on the ball and pelvis should be in the line with your body.

Kim, 2008 in the recent studies found that the main cause of low back pain symptom is the decrease of muscle mass, hence there is involvement of stability of muscles around the spine and the body trunk. Muscle imbalance induces the overload to the spine while there is involvement of movement of waist as the muscles around the spine helpful in the stabilization of spine and helps in reducing load occurring to spine by Grabiner et al., 1992. Thereby the pain occurs by damaging musculoskeletal system. The weakness of deep abdominal muscles such as TrA which has a role in the stabilising of spine by surrounding it which is the main cause of instability rather than direct injury to the spine leads to the low back pain (Hodges, 2003). Hodge et al. (2003) the thickness of IO and TrA has increased while decreasing the thickness of EO in healthy subjects in patients performing abdominal drawing-in manoeuver. The thickness of IO and TrA muscle thickness has been increased less among the patients who have LBP as they compared the ratio between the healthy individual and low back pain patients in the study done by Beazell et al. (2006). [16]

The study done over youth soccer player's on muscle strength, flexibility, balance and pain who have chronic low back pain by Cho (2010) while performing core exercise and closed kinetic chain exercise. Core training were more effective between groups, apart there showed significant difference in each of the treatment regimen. The results concluded that thickness of TrA/EO and ODI were showed more significant in treatment of abdominal drawing-in manoeuver protocol. [16]

The findings of O'Sullivan et al are in consistent with us has proved that VAS scores of patients were reduced from 6 to 2 with spondylolysis or Spondylolisthesis who performed ADIM exercise for 15minutes a day for about 10days. The implementation of ADIM in combination with various exercise related to core training for about 5 weeks in patients with chronic low back pain were reported by Kumar et al. and the VAS scores were reduced from 7 to 1. Hides et al reported about the evidence of clinical management as they said that the protection and support to the spine is helpful in lumbosacroiliac joint stiffness during performing the selective core stabilization training of TrA muscle, as minimising the reports of lumbar spinal instability and LBP. (21)

O' Sullivan et al founded that there is significant improvement in reducing pain and functional disability by training lumbar multifidus co contractions along with deep abdominal muscles. Increased balance and stability by performing on physio ball which also improves proprioception as the reason behind significant improvement is that this study have included only young chronic LBP patients. G.D Maitland and Richerdson et al found that to increase in intra-abdominal pressure is by co-contraction of deep core muscles i.e., transverse abdominis and multifidus as which tenses the thoracolumbar facia. Hence improves low back pain by reducing the stress on the back and by providing segmental stability to the spine. (30)

Four pint kneeling is suggested to be a posture in which it is relatively easily to perform an isolated contraction of Transverse abdominis (TrA) (Richardson and Jull, 1995). Many subjects still contract more superficial muscles as well as TrA when performing low abdominal hollowing in four-point kneeling (Critchley et al., 1999a, Beith et al., 2001). (34)

The results of Modified Oswestry Disability Index (MODI) were significant in the group which has received Abdominal drawing in manoeuver with Swiss ball training of 3 weeks duration with 3 sets a day for 5 times a week. The MODI score was reduced in both the group A and group B but on comparing both the groups, the results were significant in the group B.

In both rehabilitation and clinical settings, abdominal exercises performed on a swiss ball have been widely used. The surface of the swiss ball is unstable and it eases the stress on the hip joint and lower back region and also alters proprioceptive demands by that improve motor control for balance and stability of local core muscles. Further the comfort is provided by cushioning of the ball that the compliance of exercise makes it very simple and affordable alternative to the machines that are present as alternative for training in the gym. Therefore swiss ball training is very useful for proprioception, balance and for stability but not for increasing the strength of the muscle. Consequently swiss ball exercises are recommended only for low threshold modality in order to improve the posture, balance and joint position. (17)

Physiology behind the Swiss ball training is to concentrate and shift the weight to maintain stability on the ball, normally will not come into play in traditional weight training exercises. The study concluded that postural control during balancing on an unstable surface consists of adapting the motor program to maintain stability, while the overall postural strategy is maintained. Swiss ball training improves nervous system function that results in functional strength gains. (24)

The result shows that EMG Amplitude and Duration of muscles (Transverse abdominis) were significant within the group. However, between groups there was significant difference in EMG Amplitude of transverse abdominis but no significant difference found in EMG Duration. The results were in support with the findings stated by Gloria M., leorgem L and Freddie H., in their study they found that EMG activity was recording during abdominal strengthening exercises. Johannsen et al., in a study, he found that the treatment of for patients with chronic low back pain was not the best method by giving the back extension training alone. (43)

In the present study, Modified Oswestry Disability Index and electromyography study of transverse abdominis also gives significant improvement in group B as compared to group A. This could be because of supportive studies that transverse abdominis is important in enhancing spinal stabilization. The attachment of transverse abdomen and internal oblique in to thoracolumbar fascia may enhance spinal and pelvic stabilization, because these muscles contract they tense the thoracolumbar fascia. (44)

Cresswell, Oddsson and Thorstensson (1994) found the transverse abdominis was always the first muscle in the torso to be active in both unexpected and self-loaded conditions. Cresswell et al. found the transverse abdominis was activated prior to the erector spinae when the torso was loaded ventrally. This seemed paradoxical at first since from a biomechanical view, the erector spinae would be thought to activate immediately to re-establish equilibrium. (45)

5.1 LIMITATIONS

- Small sample size
- Convenient sampling was used in the study.
- There was no assessor blinding in the study.
- There was no follow up for the patients to check retention effect of the treatment.

5.3 FUTURE SCOPE OF THE STUDY

- Future study need to be done on large sample size.

- Follow-up of the patients can be done to evaluate intervention retention in a form of future study.
- Effect of these interventions can be evaluated in terms of gender specificity.
- Random Sampling can be used in future studies.

6. CONCLUSION

Abdominal drawing in manoeuvre with Quadruped position exercises and Swiss ball training were effective in reducing pain and disability in patients with chronic low back pain. On comparing both of these exercise regimens however, there was no significant difference seen in relation to pain but there were significant changes found in relation to disability. On comparing between groups, there was significant difference in EMG amplitudes but there was no significant difference in EMG Duration during the activity of Transverse abdominis.

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8. APPENDICES

8.1 APPENDIX

INFORMED CONSENT

I, ______________________________________ (name of the patient) willingly and voluntarily agree to participate in the research study under the directions of the Gajarla Anusha. I understand that the purpose of the study is to see the "**EFFECTIVENESS OF ABDOMINAL MANEOUVRE WITH QUADRUPED POSITION VERSUS SWISS BALL TRAINING OF TRANSVERSE ABDOMINIS IN PATIENTS WITH CHRONIC LOW BACK PAIN – AN EMG STUDY**". I understand there is no risk involvement to my health and if any, it is being explained to me. I understand that I have the right to seek information regarding the study and can contact Gajarla Anusha. I understand that my confidentiality and anonymity is protected and further I have the right to terminate my participation at any time. I have read and received a copy of this consent.

Signature of the subject

Name:

Address:

Date:

I have explained the procedure with details to which the subject has consented to participate.

Signature of the researcher

Name: **Gajarla Anusha** **Residence Address:**

MPT Orthopaedic

2nd year

8.2 APPENDIX

Assessment Form

Date of assessment:

Patient code:

Name: -

Age:-

Gender:-

Occupation:-

Address:-

Chief Complaints:

Pain Evaluation:

- Site: Localized to low back……../ General………./ other……..
- Side: Right….. / left…..
- Duration of pain history: 3 months……../………..
- Did Pain radiating to the legs: Present……./ Absent…….

  If present: Unilateral……/ Bilateral…….

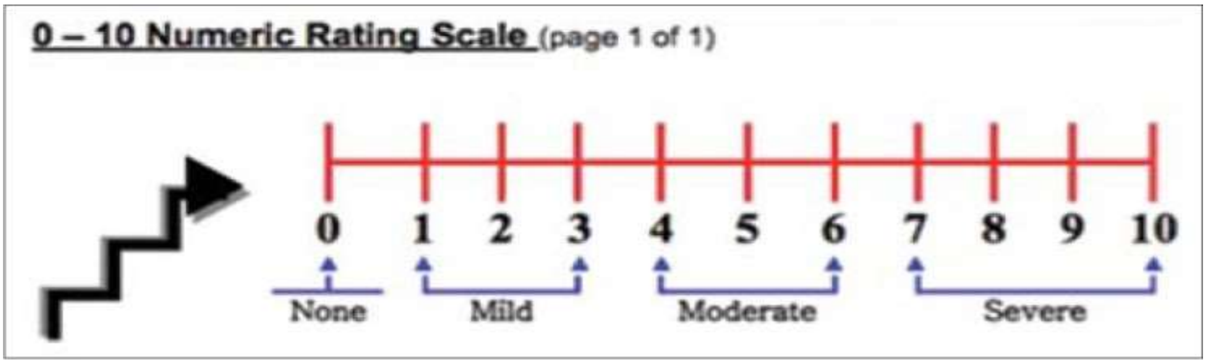
  Right leg: Buttocks……/ Thigh……/ Lower leg……/ Foot…….

  Left leg: Buttocks……/ Thigh……/ Lower leg……/ Foot…….
- Whether patient has any previous history of surgery in the back and abdominal region? Yes……./ No……
- Whether Pain localised between the T12 Vertebral level and the gluteal fold? Yes……./ No……
- Whether patient has any Spinal fracture? Yes……./ No……

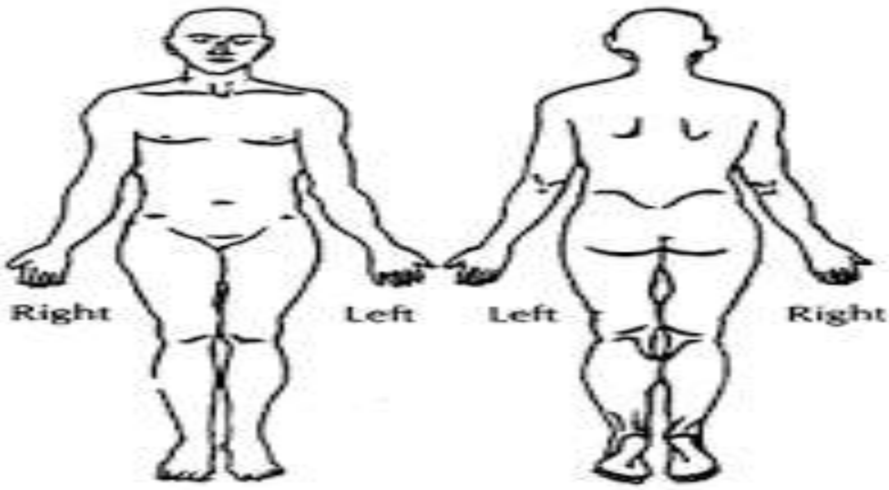
- Patient has any Spondylolisthesis history? Yes……./ No……
- Patient has any T.B Spine? Yes……./ No……
- Patient has any Spinal tumour? Yes……./ No……
- Patient has any history of Spinal Stenosis? Yes……./ No……
- Patient has any history of vascular diseases? Yes……./ No……
- Patient has Scoliosis? Yes……./ No……
- Is Patient is Very obese? Yes……./ No……
- Patient has Periarthitis of shoulder in the present or past? Yes……./ No……
- Whether taken any physiotherapy treatment before? YES……./NO…….

  If yes type of intervention received?............................

- **Pain Intensity on NPRS:- …………….**



- **Body Chart:**



DATA COLLECTION FORM

NAME: CODE:

AGE:

GENDER:

S.NO	PARAMETERS		GROUP-1		GROUP-2	
			PRE TEST	POST TEST	PRE TEST	POST TEST
1	NPRS					
2	MODIFIED OSWESTRY DISABILITY QUESTIONNAIRE					
3	EMG ACTIVITY	AMPLITUDE				
		DURATION				

8.3 APPENDIX

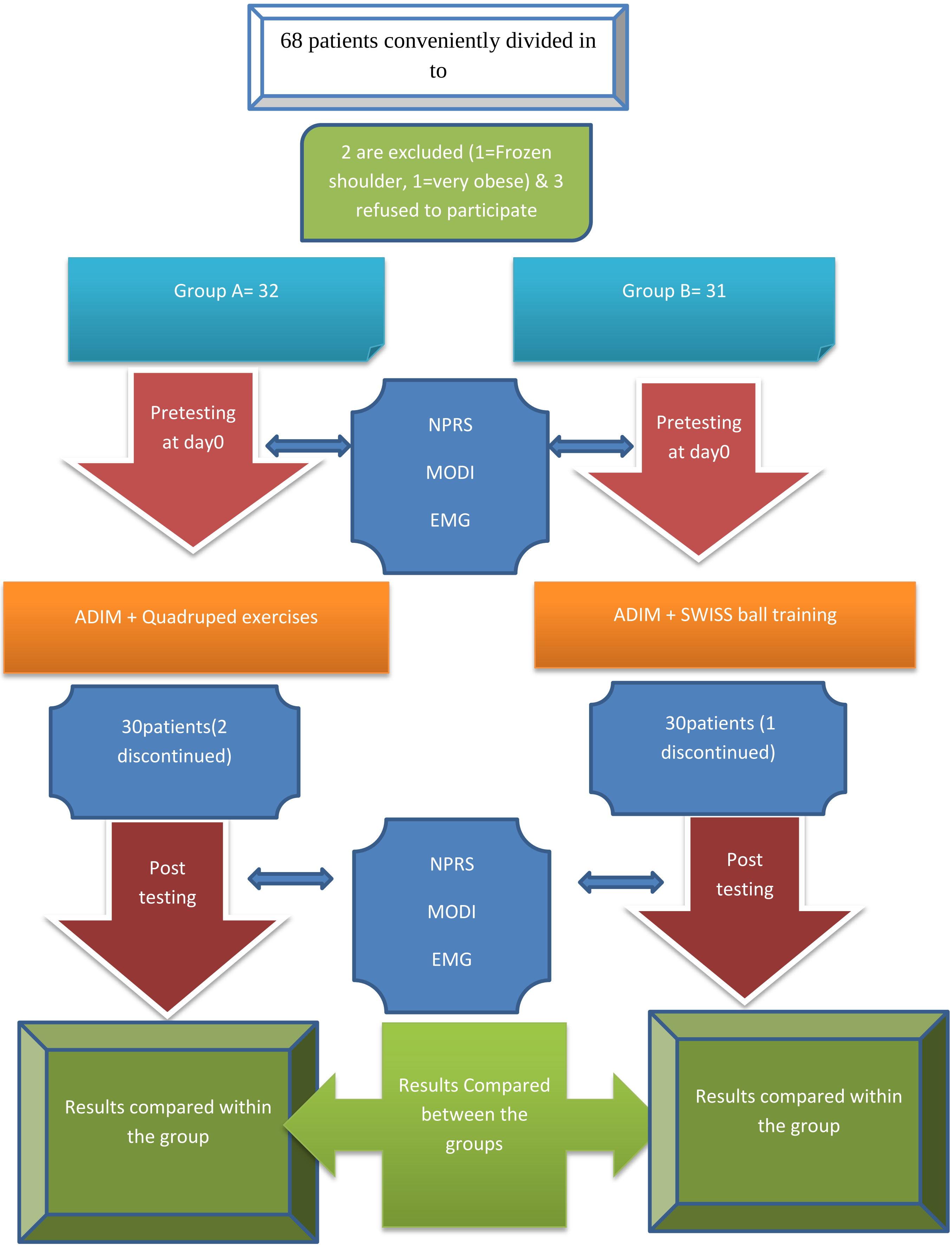
MASTER CHART

Group A									
		NPRS		MODI		AMP(mv)		DUR(ms)	
Group	Age(20-40years)	Pre	Post	Pre	Post	Pre	Post	Pre	Post
A1	25	7	3	24	10	123	200	2.40	3.50
A2	27	5	2	18	8	110	235	5.00	7.20
A3	33	7	3	20	11	116	275	3.20	4.67
A4	21	6	3	21	10	112	184	1.26	3.50
A5	33	8	4	24	12	120	155	1.27	3.50
A6	23	7	2	21	11	215	475	2.20	5.87
A7	29	8	2	23	15	185	365	4.24	6.12
A8	29	8	3	24	11	110	345	5.20	8.87
A9	24	9	3	24	15	100	265	2.00	5.00
A10	31	6	2	17	9	175	250	3.25	6.67
A11	37	5	1	15	7	130	175	1.50	3.50
A12	21	5	4	15	8	120	275	2.40	7.24
A13	22	6	3	18	7	185	260	6.50	6.50
A14	27	7	4	19	8	160	265	3.24	6.63
A15	27	8	3	19	9	115	280	4.00	6.12
A16	38	7	1	18	8	65	130	3.50	4.36
A17	22	8	2	20	8	105	255	2.30	6.63
A18	29	8	2	20	7	120	275	3.00	6.75
A19	21	4	1	15	6	215	290	6.13	7.10
A20	24	6	3	16	6	115	255	3.00	6.38
A21	33	6	3	17	10	100	240	0.75	4.50
A22	25	6	3	17	9	125	290	3.25	5.00
A23	25	7	3	17	8	115	200	1.50	3.74
A24	23	8	2	22	15	190	265	3.80	5.62
A25	26	6	3	20	11	127	320	4.20	7.00
A26	28	5	2	17	11	120	245	1.67	4.00
A27	21	6	3	17	14	125	165	2.00	4.13
A28	22	7	2	22	10	70	195	3.25	3.74
A29	22	7	2	23	15	120	275	1.27	6.10
A30	24	8	2	24	13	100	340	0.70	4.50

Group B									
		NPRS		MODI		AMP(mv)		DUR(ms)	
pt.	Age(20-40years)	Pre	Post	Pre	Post	Pre	Post	Pre	Post
B1	40	7	4	23	11	180	275	2.00	4.60
B2	23	6	3	22	9	135	475	2.70	6.87
B3	25	5	3	22	9	126	350	3.00	5.60
B4	27	6	4	16	5	175	355	2.67	6.00
B5	33	6	3	24	8	155	375	1.25	6.20
B6	22	8	2	24	5	135	370	4.67	8.24
B7	22	8	3	24	6	170	275	3.86	7.74
B8	27	7	2	20	7	140	335	2.74	5.00
B9	28	8	2	19	8	115	290	2.80	6.62
B10	28	8	3	19	7	105	415	0.87	4.50
B11	30	6	3	18	6	170	385	2.60	4.12
B12	31	7	4	16	5	125	370	3.40	7.88
B13	40	9	2	24	10	70	275	3.25	5.40
B14	25	8	1	24	10	95	290	2.62	6.50
B15	27	4	1	16	7	125	275	2.00	3.50
B16	31	5	2	17	6	100	265	4.88	7.24
B17	22	9	3	23	8	105	455	3.13	6.74
B18	21	6	3	18	7	110	255	3.20	6.63
B19	35	6	2	17	6	80	260	1.24	3.63
B20	32	5	1	16	8	115	390	1.70	5.00
B21	33	7	2	19	6	140	290	6.13	7.00
B22	21	8	3	22	8	185	460	2.30	3.50
B23	23	8	3	23	12	160	230	2.13	5.62
B24	20	7	4	20	11	160	325	4.26	6.25
B25	22	6	3	18	7	210	355	4.30	5.50
B26	27	6	3	18	8	140	290	3.20	6.00
B27	22	8	2	20	5	185	360	4.30	6.87
B28	21	6	3	16	6	215	470	5.13	7.67
B29	20	7	2	19	7	160	355	2.13	5.12
B30	20	6	2	19	7	95	290	1.76	3.12

8.4 APPENDIX

TREATMENT PROTOCOL



Assessment tools

EMG Machine

EMG Reading of Transverse Abdominis on patients

Starting Position of ADIM

Abdominal Drawing in Manoeuver

Quadruped Position Exercise

Swiss Ball Training

8.5 APPENDIX

ASSESSMENT TOOLS:

Name________________________________ Date________________

<u>Modified Oswestry Low Back Pain Questionnaire</u>

This questionnaire is designed to enable us to understand how much you low back pain has affected your ability to manage your everyday activities. Please answer each section by marking in each section **one circle** that most applies to you. We realize that you may feel that more than one statement may relate to you, but please **just mark the circle that most closely describes your problem.**

Section 1 - Pain Intensity

O The pain comes and goes and is very mild.

O The pain is mild and does not vary much.

O The pain comes and goes and is moderate.

O The pain is moderate and does not vary much.

O The pain comes and goes and is severe.

O The pain is severe and does not vary much.

Section 2 - Personal Care

O I do not have to change my way of washing or dressing to avoid pain.

O I do not normally change my way of washing or dressing even though it causes me pain.

O Washing and dressing increase the pain, but I manage not to change my way of doing it.

O Washing and dressing increases the pain and I find it necessary to change my way of doing it.

O Because of the pain I am unable to do some washing and dressing without help.

O Because of the pain I am unable to do any washing and dressing without help.

Section 3 - Lifting (skip if you have not attempted lifting since the onset of your low back pain)

O I can lift heavy weights without extra low back pain.

O I can lift heavy weights but it causes extra pain.

O Pain prevents me lifting heavy weights off the floor.

O Pain prevents me lifting heavy weights off the floor, but I can manage if they are conveniently positioned, e.g. on a table.

O Pain prevents me lifting heavy weights but I can manage light to medium weights if they are conveniently positioned.

O I can only lift light weights at the most.

Section 4 - Walking

O I have no pain walking.

O I have some pain on walking, but I can still walk my required to normal distances.

O Pain prevents me from walking long distances.

O Pain prevents me from walking intermediate distances.

O Pain prevents me from walking even short distances.

O Pain prevents me from walking at all.

Section 5 - Sitting

O Sitting does not cause me any pain.

O I can sit as long as I need provided I have my choice of sitting surfaces.

O Pain prevents me from sitting more than 1 hour.

O Pain prevents me from sitting more than 1/2 hour.

O Pain prevents me from sitting more than 10 minutes.

O Pain prevents me from sitting at all.

Section 6 - Standing

O I can stand as long as I want without pain.

O I have some pain while standing, but it does not increase with time.

O I cannot stand for longer than 1 hour without increasing pain.

O I cannot stand for longer than 1/2 hour without increasing pain.

O I cannot stand for longer than 10 minutes without increasing pain.

O I avoid standing because it increases the pain immediately.

Section 7 - Sleeping

O I have no pain while in bed.

O I have pain in bed, but it does not prevent me from sleeping well.

O Because of pain I sleep only 3/4 of normal time.

O Because of pain I sleep only 1/2 of normal time.

O Because of pain I sleep only 1/4 of normal time.

O Pain prevents me from sleeping at all.

Section 8 - Social Life

O My social life is normal and gives me no pain.

O My social life in normal, but increases the degree of pain.

O Pain prevents me from participating in more energetic activities e.g. sports, dancing.

O Pain prevents me from going out very often.

O Pain has restricted my social life to my home.

O I hardly have any social life because of pain.

Section 9 - Traveling

O I get no pain while traveling.

O I get some pain while traveling, but none of my usual forms of travel make it any worse.

O I get some pain while traveling, but it does not compel me to seek alternative forms of travel.

O I get extra pain while traveling that requires me to seek alternative forms of travel.

O Pain restricts all forms of travel.

O Pain prevents all forms of travel except that done lying down.

Section 10 - Employment/Homemaking

O My normal job/homemaking duties do not cause pain.

O My normal job/homemaking duties cause me extra pain, but I can still perform all that is required of me.

O I can perform most of my job/homemaking duties, but pain prevents me from performing more physically stressful activities e.g. lifting, vacuuming, etc.

O Pain prevents me from doing anything but light duties.

O Pain prevents me from doing even light duties.

O Pain prevents me from performing any job or homemaking chore.

SCORE__________________________

0-4: No disability

5-14: Mild disability

15-24: Moderate disability

25-34: Severe disability

>35: Complete disability

ABSTRACT

EFFECTIVENESS OF ABDOMINAL MANEOUVRE WITH QUADRUPED POSITION versus SWISS BALL TRAINING OF TRANSVERSE ABDOMINIS IN PATIENTS WITH CHRONIC LOW BACK PAIN – AN EMG STUDY

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BACKGROUND AND PURPOSE: Chronic low back pain is defined as pain in the lower back that lasts longer than three months, localised below the coastal margin and above the inferior gluteal folds. Few muscles were more important in stabilization of the spine as Transverse abdominis. Abdominal Drawing Manoeuver is the best procedure to activate isolately on Transverse abdominis muscle and is the basic exercise program for low back pain. Here we are using Abdominal drawing in manoeuvre, Quadruped position and Swiss Ball training while this isolately contracts on Transverse abdominis. The purpose of the study is to find out new insight to the patients of chronic low back pain with the techniques of Abdominal drawing in manoeuvre with Quadruped position and Swiss Ball training.

DESIGN: Experimental study design comparative in nature.

PARTICIPANTS: 60 participants between age group of 20 to 40 years people experiencing chronic low back pain were included in this study.

INTERVENTION: Participants attended three sets for ten repetitions for three week duration. The Group A (n=30) received Abdominal drawing in manoeuvre and Quadruped position exercise, Group B (n=30) received Abdominal drawing in manoeuvre and Swiss ball training programme.

OUTCOME MEASURES: The outcome measures were Numeric pain rating scale, Modified oswestry disability index, and Motor unit action potential (Amplitude and Duration) measured at baseline and at the end of three weeks.

RESULTS: No differences were observed in the outcome measure of Pain in terms of NPRS on the 3rd week by the end of the treatment. For the Group B (Abdominal drawing in manoeuvre and Swiss ball training.) there was significant difference in improvement of disability and showed differences in the mean peak EMG Amplitudes for TrA muscle by placing the electrode at 2cm infero-medial to the ASIS. Post values of t-value for NPRS is 0.310 (0.758), MODI is 4.210 (0.001), EMG Amplitude is 4.500 (0.000) and EMG Duration is 0.920 (0.359).

CONCLUSION: This study concludes that there is significant improvement in reduction of disability and improvement of Amplitudes in terms of MODI and EMG peak Amplitude in the post values of Group B (Abdominal Drawing in Manoeuver and Swiss ball training) and no significant improvement is seen in the reduction of pain and EMG Duration values in comparison of between groups..

KEY WORDS: Chronic low back pain**,** Abdominal Drawing in Manoeuver, Quadruped position and Swiss ball training, EMG peak values.