



## TO STUDY THE EFFECT OF SWISS BALL EXERCISES ON PAIN AND CORE ENDURANCE IN INDIVIDUALS WITH NON-SPECIFIC LOW BACK PAIN – A COMPARATIVE STUDY

### Physiotherapy

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### ABSTRACT

Non-specific low back pain is known specific pathology. Stability of spine involves both active and passive structural stiffness. Exercises on unstable surfaces provide stability to the spine due to the co-activation of global and local muscles. As per inclusion and exclusion criteria patients were included in this study and randomly divided in to Group-A and B. Group-A patients received Traditional exercise and Group-B received Swiss ball exercise for two weeks. Prior to starting & at the end of two weeks of intervention Core endurance was measured using "core stabiliser" and Visual analogue Scale was taken. Within the group analysis Core endurance and Vas shows significant improvement (P-value 0.002). Between the group analysis, VAS (P-value 1.00) and Core Endurance (P-value 0.0072) which indicates. both exercises were equally effective in improving pain and core endurance in subjects with non-specific low back pain.

### KEYWORDS

Swiss ball, Nonspecific low back pain, Core endurance

### INTRODUCTION

Low back pain is an important health problem with significant consequences from a socio-economic point of view and is associated with high costs, work absenteeism and disability.<sup>(1)</sup> which is leading cause of occupational injury and disability. Repetitive or static awkward body postures resulting from excessive bending and twisting will increase spinal stress and disproportionate loading to spinal structures.<sup>(2)</sup> Various studies in India demonstrated prevalence of low back pain which varies from 11.1% to 51%.<sup>(3,4)</sup>

"Diagnostic Triage" of low backache is as follow.<sup>(5)</sup>

- Specific spinal pathology
- Nerve root pain/radicular pain
- Non-specific low back pain

Non-specific low back pain (NSLBP) is defined as low back pain not attributed to recognisable, known specific pathology (e.g. infection, tumour, osteoporosis, ankylosing spondylitis, fracture, inflammatory process, radicular syndrome or cauda equina syndrome).<sup>(6)</sup> For Acute, Subacute and chronic low back pain duration is less than 6 weeks, 6 to 12 weeks and 12 weeks or longer respectively.<sup>(7)</sup>

Chronic nonspecific low back pain results decreased physical performance, exacerbated nociceptive sensations, impaired social functioning, work disability, and depression.<sup>(8)</sup>

Poor spinal and abdominal muscle control are associated with individuals with chronic low back pain (CLBP). Because of delayed timing of onset and loss of continuous muscle contraction during activation of the spinal stabilizing muscles. The inhibitory control causes atrophy of multifidus in LBP-patients. So, strength and endurance of trunk muscles are frequently impaired.<sup>(9)</sup>

A range of therapeutic possibilities are available for patients with chronic low back pain. These treatments include educational programs, cognitive behavioural therapy, medication, electrotherapy and thermotherapy, manual therapy, and exercise.

Core stability (CS) arrived in the latter part of the 1990s.<sup>(10)</sup> It is described as a close box with the abdominals in the front, diaphragm as the roof, pelvic floor and hip girdle musculatures the bottom, and the hip abductors and rotators laterally. A bare spine, without muscle attached, is unable to bear much of compressive load.<sup>(11)</sup> Without the dynamic stabilizing activity, the spine would collapse. Both superficial (global) and deep (core) muscles function to maintain the upright posture.<sup>(12)</sup>

Transversus abdominis (TrA) and Multifidus muscles function as core stabilizers. Deep fibres of the multifidi and TrA are the first muscles to become active when there is postural disturbance. But out of these two muscles only the TrA is active with both isometric trunk flexion and extension, at the same time other abdominal muscles activities are reduced. This is attributed to the stabilization function of the TrA.<sup>(13)</sup> Muscular endurance is the ability of an isolated muscle group to perform repeated contraction over a period of time, with intensity of the activity being moderate.<sup>(14)</sup>

Poor endurance of trunk muscle may induce strain on passive structure of lumbar spine and hence result in low back pain.<sup>(15)</sup> As failure to protect passive structure from excessive loads may result in damage to pain sensitive structure and produce pain.<sup>(16)(17)</sup> Endurance of lumbar stabilizer is most important key for preventing lumbar pain.<sup>(18)(19)</sup> Trunk muscle endurance training has been recommended as means of increasing fatigue threshold and improving performance and reducing disability.<sup>(20)</sup>

Swiss ball has been used in physical therapy for about 40 years. Carriere first became familiar with it during his training with Berta and Karel. In 1983 he became an instructor in functional kinetics in Switzerland. In Physical therapy he began to use it for children to facilitate the movement and then he began to use to treat adult patients with orthopaedics and neurological dysfunctions.<sup>(21)</sup>

Exercises on unstable surfaces provide stability to the spine due to the co-activation of global and local muscles at the beginning of motor control. Instability training using Swiss balls mainly activates local stabilizing muscles, while the use of unstable states without using external resistance increases the integration and recruitment of global and local muscles. The overall effect is an increase in muscle activation and improvement in motor control.<sup>(22)</sup>

A wide variety of treatment protocols for non-specific low back pain are available. However, the most effective management remains an area of debate. Therefore, the study is proposed to compare the effect of Swiss ball exercises on core endurance and pain in individuals with non-specific low back pain.

### METHODOLOGY

#### STUDY DESIGN:

A comparative and randomized controlled trial was conducted.

#### STUDY SETTING:

This study has been conducted in Out Patient physiotherapy Department of Ahmadabad. All patients were referred from Consulting Orthopaedic surgeon to Physiotherapy department.

#### SAMPLE SELECTION:

The sample size consisted of 24 (twenty-four) patients who were diagnosed with non-specific low back pain, as per the inclusion and exclusion criteria.

**SAMPLING DESIGN:** Simple random sampling.

#### STUDY DURATION:

All the subjects were treated for once a day for 6 days per week for 2 weeks.

#### SAMPLE SIZE:

It was calculated using Standard deviation (s.d. = 9.83) and difference of mean (= 30) from pilot study. 6 patients were selected in each group at 90% of power of study. However, following number of patients were selected in to the study.

Group A: 12 patients  
Group B: 12 patients

**SELECTION CRITERIA:**

**INCLUSION:**

- Age: 18-40 years.
- Both males and females.
- Subjects with clinical diagnosis of non-specific low back pain.
- Subjects having low back pain since more than 3 months.
- Subjects willing to participate.

**EXCLUSION:**

Participants with any contraindications to physical exercise, Patients with serious spinal pathologies. (e.g. Fractures, tumours, inflammatory disease, etc), Nerve root compromise, Patients who had undergone previous spinal surgeries, Patients who had structural anomalies, Spinal cord compressions, Severe instabilities, Severe osteoporosis, Patients who were pregnant, Cardio-respiratory illness.

**MATERIALS:**

Consent Form, Assessment Form, VAS scale, Swiss Ball 55cms and 65cms – as per patients' height, Examination Table, Paper, pencil, pen, measure tape, Watch, Mat, Pressure bio feedback (Chattanooga), Height measurement scale, TENS Machine

**OUTCOME MEASURES:**

Visual Analogue Scale, Core Endurance

**PROCEDURE:**

Patients with non-specific low back pain referred to physiotherapy department by consultant orthopaedic surgeon were screened to find their suitability as per the inclusion and exclusion criteria. They were requested to participate in the study. They were briefly stated about the study and intervention and written informed consent was taken from them.

Demographic data and assessment was taken prior to the intervention. Then patients' pain was measured using Visual analogue scale (VAS) and core endurance was measured using Core Stabilizer. After 2 weeks of intervention again Pain and Core Endurance were measured.

**CLINICAL INTERVENTION:**

Study participants were requested to continue normal activities and avoid any other forms of treatment or exercise for the duration of the study. Both groups were given conventional TENS (80-120Hz, pulse duration: 100µs, time=15 minutes)

The subjects were divided in to two groups; Group A (Traditional exercise) and Group B (Swiss ball exercise), 12 patients in each group. All the subjects were randomly selected and assigned into each group. Subjects were asked to perform 10 repetitions of each exercise with 5 seconds hold. As subjects become expert repetitions and hold duration was increased.<sup>(25)</sup>

**CORE ENDURANCE MEASUREMENT**

Before starting with exercises, participant's core endurance was measured by pressure bio-feedback (chattanooga).

- Position: Subjects were positioned prone on a firm mat plinth. Head in mid line it should rest on chin. Both the hands kept at the side.
- Placement: The Pressure biofeedback unit was placed beneath the abdomen just proximal to a line running between the anterior iliac crests and centred relative to the naval.<sup>(26)</sup>
- Procedure: participants was instructed to relax his body and then instructed to drawing the abdomen up-and-in towards the spine.
- Performance index: performance was scored via the pressure level that the patient was able to achieve (i.e. activation score) 10 mmHg pressure and hold for 10-second and rest is allowed for 30 seconds between each successive repetition. A performance index was calculated based on the number of times the patient could hold the pressure level achieved for 10 seconds.<sup>(27)</sup>

$$\text{Performance index} = \frac{\text{Number of repetitions} \times \text{Hold time in seconds}}{\dots}$$

**VISUAL ANALOGUE SCALE (VAS)**

A Visual Analogue Scale (VAS) is a measurement instrument that tries to measure a characteristic or attitude of pain. VAS is usually a horizontal 10 centimetre in length anchored by word descriptors at each end. The patients were asked to mark on the line the point they feel represents the perception of their current state. The VAS Score is determined by measuring in centimetres from the left-hand end of the line to the point that the patient marks.

Group A and Group B were given TENS along with exercise for two weeks.

**Group A (Traditional back exercise)**

1. Abdominal curl up exercise
2. Back extension exercise
3. Pelvic bridge
4. Straight leg raises

**Group B (Swiss ball Exercise)**

Before starting with swiss ball exercises, patient was taught basic training on swiss ball. Like - Sitting on Swiss ball, Alternate leg lift.

1. Abdominal curl up exercise.
2. Back extension exercise
3. Pelvic bridge
4. Straight leg raises

**RESULT**

Data was analysed using statistical software SPSS 20 version and Microsoft Excel 2007. Before applying statistical test, data was screened for normal distribution. All outcome measures were analysed at base line and after 2 weeks of treatment using appropriate statistical test. Level of significance was kept 5%. Change in outcome measure were analysed within group as well as between groups. Normality tests were performed using SPSS 20.0 Version. The data was not normally distributed so within the group and between the group, Wilcoxon signed rank test and Mann-Whitney U Test were used respectively.

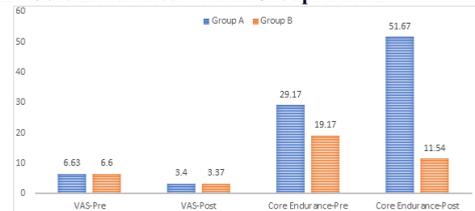
**Table 1: Difference In Pre And Post Treatment Outcome As On Vas And Core Endurance With In Group A And B**

	Pre-treatment		Post treatment		Z value	P value
	Mean	±SD	Mean	±SD		
<b>Group A</b>						
VAS	6.63	0.56	3.40	1.19	-3.06	0.002
Core Endurance	29.17	20.20	51.67	16.96	-3.14	0.002
<b>Group B</b>						
VAS	6.60	0.80	3.37	0.83	-3.06	0.002
Core Endurance	19.17	7.930	46.67	11.54	-3.14	0.002

In Group A P-value found for VAS and core endurance were 0.002 and 0.002 respectively which shows statistical significance.

In Group B P-Value found VAS and Core Endurance were 0.002 which shows statistical significance.

**Graph 1: Difference In Pre And Post Treatment Outcome As On Vas And Core Endurance With In Group A And B**

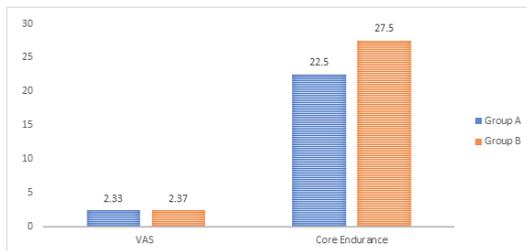


**Table 2: Mean Difference In Vas And Core Endurance Between Group A And Group B**

	VAS		U-VALUE	P-VALUE
	GROUP A	GROUP B		
MEAN	2.33	2.37	69.00	0.85
±SD	1.12	1.20		
<b>CORE ENDURANCE</b>				
MEAN	22.5	27.5	44.00	0.072
±SD	6.21	6.21		

Here, the data was not normally distributed. Hence, Man Whitney U test was used for analysis and p-value was 1.00 between the groups for VAS and for core endurance p-value was 0.072. Here it shows no significant difference.

**Graph 2: Difference In Vas And Core Endurance After The Intervention Between Group A And Group B**



## DISCUSSION

**Comparing both Groups, A and B, there is no significant difference in VAS. (U=69, p=0.85). Both the groups have been given conventional TENS.**

The effect of TENS may have been demonstrated equally among both the groups along with the mechanisms of the respective intervention. The pain gate effect on both A- $\delta$  and C pain fibres in the posterior horn cells are due to stimulation of mechanoreceptors (A- $\beta$  fibres). The effect of TENS is supported by the study done by the literature review by Asami naka et al(2013) which concluded the clinical effectiveness of TENS in reducing the pain.<sup>(28)</sup>

**Comparing both Groups, A and B, there is no significant difference in core endurance statistically. (U=44, p=0.072).**

This finding suggests that both the interventions are similar in improving core endurance. In group A, there were certain exercises which activates the Core musculature. Core muscles were also activated in group B. Hence, similar effects may have been produced in both the groups.

This result is in accordance with the study done by Gasuri Shankar et al (2012), they stated that exercises with Swiss ball and without Swiss ball are equally effective in improving trunk endurance. This is due to traditional and Swiss ball both the exercises activate core muscle as well global muscle.<sup>(29)</sup>

## CONCLUSION

In this study, the experimental hypothesis is rejected while null hypothesis is accepted. The result of the present study shows that the traditional exercise as well as Swiss ball exercises are effective in improving pain and core endurance in persons with non-specific low back pain. However, there was no significant difference found in outcomes while comparing between effects of traditional and Swiss ball exercise. Hence, both exercises are equally effective in treatment of non-specific low back pain.

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