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Effectiveness of Bosu ball exercises on pain and disability in subjects with chronic low-back pain at the end of four weeks

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Abstract

This study will focus on the effectiveness of BOSU ball exercises on non-specific low back pain in young adults who are experiencing pain and disability since 12 weeks or more. In this study an attempt has been made to discuss BOSU ball exercises that are focused on strengthening the core including the deep trunk muscles as well as improving balance.

Bosu ball exercises help in improvement of the strength of core muscles and help in changing the anterior pelvic tilt that causes increased wear and strain on the facet joint which is the common source of pain in the lower back, balancing the centre of gravity posteriorly and prevent extension of the stomach wall which helps in relieving long term pain leading to chronicity.

Methodology: Young adults having chronic non-specific low back pain including male and female were selected. These subjects performed 6 BOSU ball exercises for 4 weeks; 3 sessions per week on alternate days.

The pre-treatment data and post-treatment data were collected and compared to evaluate the significance of the treatment.

Procedure: the effect of BOSU ball exercises to be observed on pain and disability caused by chronic non-specific low back pain at the end of 4 weeks.

Statistical tool: Visual Analogue Scale (VAS) and Oswestry Low Back Disability questionnaire.

Conclusion: This concluded that BOSU ball exercises have been shown to have a significant effect on chronic non-specific low back pain and disability in young adults after 4 weeks of treatment.

Keywords: Parental attitude, participation, sports, girls

Introduction

Chronic Non-specific low back pain as defined by the National institute for health and clinical excellence is tension soreness and/or stiffness in the lower back region for which it is not possible to identify a cause of the pain.

It is mainly pain that does not have a specific pathology (e.g. infection, tumor, osteoporosis, inflammatory disorders, etc).

Chronic low back pain is defined as low back pain lasting for 12 weeks or longer [2].

About the BOSU ball

BOSU stands for 'BOTH Sides Utilized' it is a gym tool used to improve muscle strength and stability. It has a flat surface and a hemisphere which is filled with air [3, 4]. It was invented by David Weck in 1999 with a motive to improve the stability and improve the core muscle activation.

The hemisphere provides instability that prompts the recruitment of the core muscles and the flat surfaces provide stability to perform the exercises with maximum precision. Both the surfaces can be utilized to strengthen the core. Its unstable surface has allowed trainers to use it for a variety of purposes such as for rehabilitation, low impact cardio, balance training and strength training.

When standing on a BOSU ball it causes firing of various muscles to keep the joints in position. It is also helpful in increasing kinaesthetic awareness and proprioception. [4] These exercises mainly concentrate on core strengthening and improving stability.

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Relationship of core with low back pain

If the muscles surrounding our spine are weak, the vertebrae and discs of our spine won't be properly supported.

Weakness of core leads to anterior pelvic tilt, creating imbalance in lumbar disc pressure which causes increased wear and strain on the facet joints that connect the vertebrae. Facet joints are a significant source of low back pain.

Weak abdominals result in an extension of the stomach. This extension contributes to a posture where the centre of gravity is more anterior than usual. This puts added tension in the lower back and tries to maintain balance posteriorly. Therefore poor core endurance is likely associated with non-specific low back pain [5].

Need of Study

Non-specific low back pain has been considered a leading cause for disability with a lifetime prevalence rate of 60-70% and the prevalence of chronic low back pain is 23% with 11-12% of the population being disabled by low back pain [6].

Researches have been conducted to study the effect of BOSU ball exercise on core strengthening, muscle activation and balance control.

But no research study has been done on effectiveness of BOSU ball exercises on pain and disability in chronic non-specific low back.

Thus, this research study concentrates on to study the effectiveness of BOSU ball exercises on pain and disability in chronic non-specific low back at the end of 4 weeks.

AIM

To study the effectiveness of BOSU ball exercises on pain and disability in chronic non-specific low back pain at the end of 4 weeks.

Objective

To study the effect of BOSU ball exercises on pain in chronic non-specific low back at the end of 4 weeks.

To study the effect of BOSU ball exercises on disability in chronic non-specific low back pain at the end of 4 weeks.

Hypothesis

Null Hypothesis: There will be no effect of BOSU ball exercises on pain and disability in chronic non-specific low back pain at the end of 4 weeks.

Alternate hypothesis (H_{1A}): There will be an effect of BOSU ball exercises on pain and disability in chronic non-specific low back pain at the end of 4 weeks.

Alternate hypothesis (H_{1A}): There will be an effect of BOSU ball exercises on pain in chronic non-specific low back pain at the end of 4 weeks.

Alternate hypothesis (H_{1B}): There will be an effect of BOSU ball exercises on disability in chronic non-specific low back pain at the end of 4 weeks.

Methodology

Study type: Experimental study

Study design: Pre-Post experimental study

Sample size: 45

Sample method: Convenient sampling

Study population: Males and Females [18-35 years old] [7].

Study setting: OPD and hospitals in and around Pune

Treatment duration: Minimum 3 times a week for 4 weeks [8].

Study duration: 6 months

Inclusion Criteria

- Age group between 18-35 years [7].
- Both male and female.
- Patients with low back pain lasting for 12 weeks or longer.
- Pain on VAS score between 1 and ≤ 8 .
- Patients with trunk muscle strength are fair and poor [9].
- Patients who are able to maintain standing and Quadruped position on the BOSU ball.

Exclusion Criteria

- Low back pain due to inflammatory disease or degenerative changes of spine.
- Low back pain due to malignancy, trauma, fracture or surgical procedure.
- Patients with balance impairment.

Materials and Tools

Consent form

Pen and paper

Visual Analogue Scale

Oswestry Disability Index

BOSU ball

A Mat

Outcome Measures

Visual analogue scale (VAS)

The pain VAS is a continuous scale consisting of a horizontal or vertical line, usually 10 centimeters in length, anchored by 2 verbal descriptors, one for each symptom extreme. For pain intensity, the scale is most commonly anchored by "no pain" and "severe pain".

Method

The patient is asked to place a line perpendicular to the VAS line at the point. That represents their pain intensity.

Scoring

Using a ruler, the score is determined by measuring the distance on the 10-cm line between the "no pain" anchor and the patient's mark providing a range of scores from 0-10.

Oswestry Low back Disability Questionnaire

The Oswestry Disability Index is an index derived from the oswestry Low Back pain questionnaire used by clinicians and researches to quantify disability for low back pain.

It contains 10 topics and is followed by 6 statements describing different potential scenarios in the patient's life relating to the topic. The patient then checks the statement which most closely resembles their situation.

Each question is scored on a scale of 0-5 with the first statement being 0 and indicating the least amount of disability and the last statement is scored 5 indicating most severe disability.

Procedure

- The study began with the presentation of synopsis to an ethical committee, after the approval from the ethical committee in PES Modern College of Physiotherapy, Shivajinagar Pune -5.
- An informed written consent was taken from the patients who were willing to participate in the study.

- The patients were explained about the procedure and the purpose of the study.
- The subjects were selected for the study according to the inclusion and exclusion criteria.
- Subjects were pre-evaluated and outcome measures were taken
- The treatment procedure starts with 5-10 mins of warm up which includes neck rotations, arm circles, ankle rotations, trunk rotations, trunk bending and extending.
- Total duration of the treatment is 45-50 mins.
- Rest period of 5-10 secs between each set was given or after each exercise, as desired by the patient. After warm up the patient performs BOSU ball exercises. Each exercise given is performed for minimum 6 repetitions in each set. At least 3 sets of each exercise are performed per session.

BOSU ball exercises

BOSU Compressions

The patient is instructed to stand on top of the bubble with feet spaced evenly.

Keeping your torso tight, shift your weight from foot to foot, using arms for balance. Keep shoulders and hips tight.

To make it more difficult, subjects can march on BOSU. (fig.no.1)

Repeat this step for 6-10 times in a set. Perform 2 more sets.



Fig 1: BOSU Leg Abductions

Subject is instructed to stand with his right foot on the top of the bubble letting his left leg hang free. When you feel stable, try to lift the left leg off the BOSU to the side or front, keeping the torso tight and shoulders at level. Repeat for desired reps and then switch sides.



Fig 2: BOSU lateral leg lifts

Instructions are to lie sideways on the ball with hip in the middle and arm on the floor for support. Keep hips stacked, one foot on top of the other.

Construct the abs and lift one leg off the floor. (Fig.No.3)

To make it more difficult, lift one leg or both legs for 6-8 times in a set. (Fig.No.4)



Fig 3: Perform 2 more sets.

Progression



Exercise Description:
BOSU Side Plank

Classification:
BOSU Ball Exercises

Instructions:

1. Lie sideways on the ball, hip in the middle and arm on the floor for support. Keep hips stacked, one foot on top of the other.
2. Contract the abs and lift legs off the floor until body is in a straight line.
3. To make it more difficult, lift lower arm off the ground.
4. Hold for required time.

BOSU bodyweight squat

Fig 4: BOSU bodyweight squat

Stand on the BOSU Balance Trainer with feet slightly forward of center. Bend your knees and squat, as though you are sitting back in a chair.

Keep your back straight and your torso tight.

While coming up extend your arms out to help your balance. Lower as far as comfortable and push back up. Repeat for the required number of repetitions. (Fig.No.5&6)



Fig 5 and 6: Repeat for the required number of repetitions.

BOSU Quadruped Arm/Leg Raise

Patient gets on all fours with knees evenly spaced on top of BOSU and hands on the ground. Straighten one leg until it is parallel to the floor and balance without touching the toe of bent leg to the ground. (Fig.no.7)

Bring that leg down and perform the same with the other leg also.

Now the patient lifts the arms alternatively.

Once the subject starts to feel comfortable this exercise can be progressed to the opposite leg and arm lifted at the same time. (Fig.no.8)

Switch sides and repeat for required repetitions.



Fig 7: Straighten one leg until it is parallel to the floor and balance without touching the toe of bent leg to the ground.

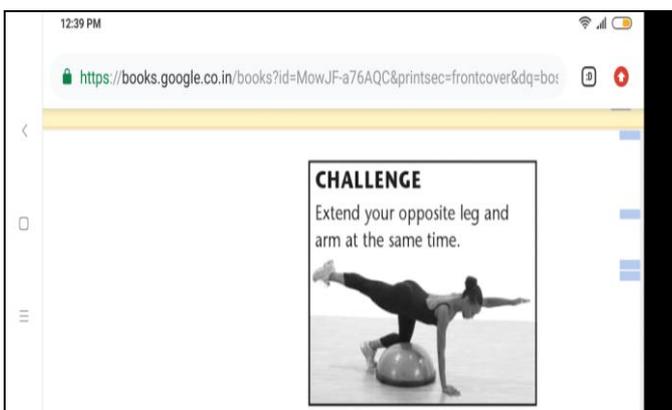


Fig 8: Once the subject starts to feel comfortable this exercise can be progressed to the opposite leg and arm lifted at the same time.

Pushup and Plank on BOSU

Subject starts with a modified position so that the subject can get comfortable and feel stable before progressing.



Fig 9: Holds this position for 30 secs.

The subject holds this position for 30 secs. The subject can progress by increasing the hold time or turning the BOSU ball over and bearing the weight on hands.

To further increase the difficulty, lower into a pushup. (Fig.no.10)

Pushup and Plank on BOSU



Exercise Description:
Pushup and Plank on BOSU

Classification:
BOSU Ball Exercises

Instructions:

1. Turn the BOSU so platform is up and hold on widest portion, chest directly over middle. Either on knees or toes, hold your body in this pushup position with abs in, body in a straight line.
2. Add difficulty by bending elbows and lowering into a pushup.
3. Repeat for the desired time or repetitions if completing pushups.

Fig 10: To further increase the difficulty, lower into a pushup

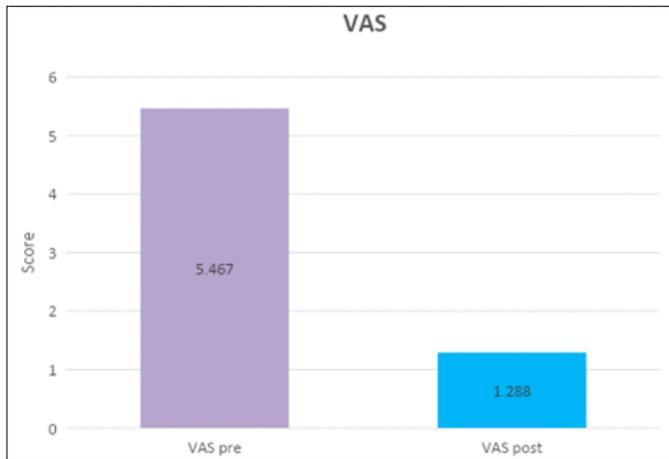
Statistical Analysis

Visual analogue scale was used to assess the pain in subjects Oswestry Disability Index was used to assess the pain and disability.

Table 1: The data passed the normality test.

Scale	Pre- treatment Mean	Post-treatment Mean	t- value	p- value	Significance
VAS	5.467	1.288	16.894	<0.05	Extremely significant

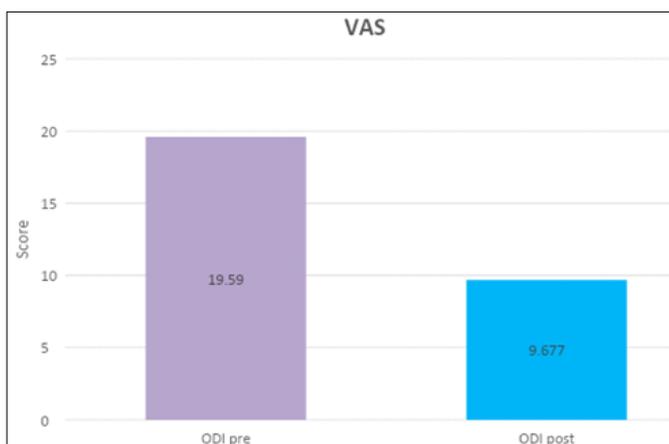
Table 1: Shows the interpretation for Visual analogue scale. Pre-treatment and post-treatment scores analyzed by Paired t test.



Graph 1: Different of VAS per and VAS post

Table 2: Shows the interpretation for disability on Oswestry Disability Index. Pre-treatment and post-treatment scores analyzed by Paired t test.

Scale	Pre-treatment Mean	Post-treatment Mean	t-value	p-value	Significance
Oswestry Disability Scale	19.59	9.677	16.894	<0.05	Extremely significant



Graph 2: Different of ODI pre ODI post

Result

- The difference between PRE and POST were compared and analyzed using paired t-test for the two components.
- Visual Analogue Scale: shows that the p value is less than 0.05 which is extremely significant and hence is effective in reducing back pain in young adults.
- Oswestry Disability index: shows that the p value is less than 0.05 which is extremely significant and hence is effective in reducing low back disability in young adults.

Discussion

The aim of this study was to study the effectiveness of BOSU ball exercises on non-specific low back pain in young adults who are experiencing pain and disability since 12 weeks or more.

For the study 45 subjects were selected having pain in the lower back region and disability due to it for more than 12.

Patients with known pathological cause were excluded which can be systemic conditions, lumbar pathologies, tumors, etc.

The study was conducted in nearby hospitals and OPDs for 4 weeks. The subjects selected had to perform 6 exercises on the BOSU ball for a duration of 4 weeks. Before the treatment assessment and Pre-treatment values were recorded using Visual Analogue scale and Oswestry disability index. At the end of 4 weeks Post treatment readings were calculated using visual analogue scale for pain and Oswestry disability scale for measurement of disability.

Later the data was statistically analysed using Paired t test. The difference between the pre and post values was statistically analysed which showed significance. P value of all the outcome measures was <0.05. The t-value for VAS is 16.894 and t-value for Oswestry Disability index is 7.827.

Non-specific low back pain is pain in the lower region of the back for which a specific reasoning is not possible but is mainly caused due to tension, soreness or stiffness in the structures of lower back. It is believed that there is a relationship between poor core strength and chronic low back pain [11].

According to the paper published by King H yang and Al king in spine 9, the articular facets have been shown to be load bearing and are a common site of low back pain in patients with weak core muscles. Due to the weakness of core he believed that the forces were transferred onto the facets which caused the pain.

The BOSU ball exercises have helped in reducing pain and its effectiveness can be explained by a study done by Wen-Dien Chang on core strength training for low back pain. This study suggested that focusing the training of deep trunk muscles than typical resistance training may help in alleviating low back pain.

BOSU ball exercises focus on strengthening the core including the deep trunk muscles as well as improving balance. These exercises help in building a good core strength which reduces the strain and prevents jolting of the back which is the main reason for chronic low back pain.

The improvement in the strength of core muscles helps in changing the anterior pelvic tilt that causes increased wear and strain on the face joint which is the common source of pain in the lower back. The weak abdominals which result in an extension of the stomach wall which contributes to a posture where the centre of gravity is more anterior than as usual.

This adds tension to the back as it tries to balance the centre of gravity posteriorly. Bosu ball exercises help in balancing the centre of gravity posteriorly and prevent extension of the stomach wall which helps in relieving long term pain leading to chronicity.

Conclusion

The study concluded that BOSU ball exercises have been shown to have a significant effect on chronic non-specific low back pain and disability in young adults after 4 weeks of treatment.

Limitations

- Duration of the treatment can be further extended.
- Larger sample size can be taken.

Future Scope of Study

- The study can be conducted using other age groups.
- A larger sample size can be used for the study.
- Study can be done in different age groups and different types of low back pain.
- This study can be further compared with other intervention and its effectiveness can be known.

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