Efficacy of floor stabilization exercises and Swiss Ball exercises on patients with non-specific low back ache and to assess QOL of patients with low back ache - A comparative study

Authors

Raj Kiran.Tiku¹, Bhumika.Kaul²

¹MPT (Cardio-pulmonary), Asst. Professor, Madhav University, pindwara, Aburoad, Rajasthan.
²MPT (Musculoskeletal),Consultant Physiotherapist, Shyami Muktanand Giri Charitable Hospital, Dehradun, Uttarakhand

Abstract

Study Objective: Comparison between floor stabilization exercises and swiss ball exercises efficacy on patients with non-specific low back ache.

Study Design: Comparative study.

Setting: All subjects were included from various hospitals and orthopaedic clinics at Dehradun.

Method: A total of 30 subjects were recruited for the study on the basis of inclusion and exclusion criteria after signing the informed consent form. The subjects were divided into two groups (I- 15 patients on Swiss ball exercises program & II- 15 patients on Spinal stabilization exercises program).

Outcome measures: Modified Oswestry Low Back Pain Disability Questionnaire (MOLBPDQ), Visual Analog Scale (VAS).

Results: Pain reduction on VAS scale in Group I was statistically significant compared to Group II, the reduction in disability on ODI score in Group I was statistically significant compared to Group II.

Conclusion: The Swiss ball exercises showed statistically significant improvement in reducing back pain and disability when compared to the floor exercises. Thus, performing core stability exercises on a Swiss ball reduces pain and disability significantly compared to floor among mechanical low back ache subjects.

Keywords: Modified Oswestry Low Back Pain Disability Questionnaire (MOLBPDQ), Visual Analog Scale (VAS)

Non-specific low back pain has become a major public health problem worldwide. The lifetime prevalence of low back pain is reported to be as high as 84%, and the prevalence of chronic low back pain is about 23%, with 11–12% of the population being disabled by low back pain. Mechanical factors, such as lifting and carrying, probably do not have a major pathogenic role, but genetic constitution is important. History taking and clinical examination are included in most diagnostic guidelines, but the use of clinical imaging for diagnosis should be restricted. The mechanism of action of many treatments is unclear, and effect sizes of most treatments are low. Both patient preferences and clinical
Evidence should be taken into account for pain management, but generally self-management, with appropriate support, is recommended and surgery and overtreatment should be avoided.\textsuperscript{1} Non-specific low back pain is defined as low back pain not attributable to a recognizable, known specific pathology (e.g., infection, tumour, osteoporosis, fracture, structural deformity, inflammatory disorder, radicular syndrome, or cauda equina syndrome). Low back pain became one of the biggest problems for public health systems in the western world during the second half of the 20th century, and now seems to be extending worldwide\textsuperscript{2,3}. Data from USA shows that the proportion of physician visits attributed to back pain has changed little in the past decade\textsuperscript{5} but the cost has increased substantially\textsuperscript{3}. Nonspecific LBP is usually classified according to the duration as acute (less than 6 weeks), subacute (between 6 weeks and 3 months) or chronic LBP (longer than 3 months)\textsuperscript{4}. In general, prognosis is good and most patients with an episode of nonspecific LBP will recover within a couple of weeks\textsuperscript{6}. Nonspecific low back pain means that your pain is not due to anything specific or that any underlying cause can be found. In some cases the cause may be a sprain (an over-stretch) of a ligament or muscle. These causes of pain are impossible to prove by tests, which make it hard for a doctor to say exactly where the pain is coming from or exactly what is causing the pain. In other cases the cause may be a minor problem with a disc between two vertebrae, or a small facet joint problem between two vertebrae. There may be other minor problems in the structures and tissues of the lower back that result in pain.

Nociceptive factors have a major role in acute pain conditions. Various structures in the spine could constitute the origin of pain in accordance with their innervation, but the clinical interpretation of abnormalities is not possible on the basis of anatomical data alone.\textsuperscript{5} Non-specific low back pain is, by definition, a symptom of unknown cause (i.e., a symptom for which we are currently unable to reliably identify the pathology). However, many factors have been identified as possible causes of the pain or as being able to affect its development and subsequent course. Findings from cross-sectional studies on large population samples have reported a significant association between low back pain and degeneration of the lumbar discs seen with clinical imaging; for example, the odds ratios —OR for disc space narrowing and the presence of low back pain in men is $1 \cdot 9 \ (95\% \ CI \ 1 \cdot 4–2 \cdot 8)$\textsuperscript{6} and OR greater than 2 have been reported for disc degeneration (OR 2 \cdot 18; 1 \cdot 4–3 \cdot 4) and for herniation (OR 2 \cdot 07; 1 \cdot 4–3 \cdot 1).\textsuperscript{7} Nonetheless, a systematic review with meta-analysis concluded that, at the individual level, none of the lesions identified by MRI could be established as the cause of low back pain.

A possible pathophysiological role for tumour necrosis factor α (TNFα) in low back pain was suggested by findings from a prospective case-control study in which, throughout 6 months of observation, the proportion of TNFα positive individuals was consistently and significantly higher in the low back pain group than in the control group.\textsuperscript{8} Other experimental research suggests that nerve growth factor extracted from degenerative nucleus pulposus might have a role in pain transmission, because nerve growth factor promotes axonal growth and induces substance P production.\textsuperscript{9}

It is frequently reported that low back pain symptoms, pathology and radiological findings are poorly correlated. Pain is not attributable to specific pathology (as defined earlier) or neurological encroachment in about 85% of people\textsuperscript{12}. Clinicians should be aware of the incidence and characteristics of specific back pain. About 4% of people seen with low back pain in primary care have compression fractures and about 1% have a neoplasm.\textsuperscript{10} An observational study in more than 7000 women > 65 years reported that 5% developed at least one vertebral fracture in 4 years\textsuperscript{13}.

The spondylarthropathies and spinal deformities commonly involve the whole spine.
Spondylarthropathies have been reported to occur at a rate of 0.8 to 1.9% of the general population\textsuperscript{14}. The prevalence of scoliotic deformities that appear as a rib prominence upon forward bending is reported to be between 1 and 4\%.\textsuperscript{15,16,17} Kyphotic deformities such as Mb. Scheuerman are reported to occur in 1.5 % of the 23 genera population\textsuperscript{18}. Spondylolysis and spondylolisthesis are often classified as non-specific low back pain because a considerable proportion of patients with such anatomic abnormalities are asymptomatic\textsuperscript{19}.

**METHOD**

A total of 30 subjects were taken for the study and assigned to the following groups I&II. These groups consisted of 15 members each fulfilling the inclusion criteria’s age group of subjects between 21-45 years. Patients with minimum to moderate disability (upto 40%) on Modified Oswestry LowBack Pain Disability Questionnaire (MOLBPDAQ).Patients with VAS Grade below 5. Method of sampling was convenient purposive Sampling. Subjects having Spondylolisthesis, Spondylolysis, Ankylosing spondylosis, Osteoarthritis, Cauda Equina syndrome, spinal surgery and trauma were excluded. Material used in this study were Floor Mat, Swiss Ball, Pillow, Pen or Marker, Visual Analogue Scale [VAS], Informed consent form, Modified Oswestry Low Back Pain Disability Questionnaire [MOLBPDAQ] & Clinical Data Sheet (CDS).

**PROCEDURE**

Warm up was suggested to both groups that included spot jogging, free exercises, Diaphragmatic breathing exercises, ROM exercises, Light stretches involving Hamstrings, Hip flexors and extensors and Low Back musculature were performed. Group I consisted of 15 patients of both gender and they were trained with Swiss Ball Strengthening Exercises which consisted:

- Level 1: Beginners including curls up over swiss ball for transverse abdominis and multifidus and bridging over swiss ball for same muscles. Level 2: Intermediate including curl up with rotation over swiss ball for transverse abdominis, multifidus, erector spinae, oblique muscles and single leg raise over swiss ball for above mentioned muscles and gluteals. Level 3: Advanced included plank exercises and spinal extension in quadraped position.

Group II consisted of 15 patients of both gender and they were trained in spinal stabilization exercises which consisted :-Level 1: Beginners including curls up in supine position for transverse abdominis and multifidus, Bridging exercises on floor mat for training Abdominus, Obliques And Multifidus Muscles and Cat stretch-Rocking forward and backward for training Abdominus, Multifidus, Obliques and Gluteal Muscles. Level 2: Intermediate included curls up with rotation Training of Oblique, Abdominus and Multifidus Muscles in supine with knees bent and spine extension in prone for training spinal extensors. Level 3: Advanced included plank exercises in prone for training abdominis, multifidus and gluteals with side planks for training Abdominus, Obliques And Gluteals and Quadruped opposite arm/leg raise.

**Table 1.1-Exercise Plan for both groups**

| STAGE     | NAME                  | STATIC          | DYNAMIC                        |
|-----------|-----------------------|-----------------|--------------------------------|
| Stage 1   | BEGINNE RS            | CORE CONTROL    | curls,up,bridging,            |
|           |                       |                 | Curlsup over swissball, Bridging.|
| Stage 2   | INTERM EDIATE         | CORE STABILIZ ATION | Curls up rotation in supine,spinal extn.|
|           |                       |                 | Curlsup,rotation over swiss ball , Bridging n leg raise over swiss ball.|
| Stage 3   | ADVANCED              | CORE STRENGTHENING | Plank extn                   |
|           |                       |                 | Side plank                    |
|           |                       |                 | Plank with leg on swiss ball, spinal extn                          |

**Table 1.2:- Exercise frequency for both groups**

| STAGE | 1&2 week | 3&4 week | 5&6 week |
|-------|----------|----------|----------|
| Stage 1 | 10-15 rps | 12-15 rps with hold 3-5 sec | 15-20 rps with hold 7-10 sec |
| Stage 2 |           |          |          |
RESULTS
Pain reduction on VAS scale in Group I was statistically significant compared to Group II, the reduction in disability on ODI score in Group I was statistically significant compared to Group II.

Graph 1- showed age distribution

Graph 2-Comparison of pre and post VAS

Graph 3-Comparison of pre and post ODI

DISCUSSION
Comparison of pre and post VAS scores (Figure 19) within two group shows that in both the groups there was significant improvement between pre and post mean scores. In Group I (Swiss ball) when compared for pre and post mean scores there was significant improvement from 3.73±1.06 to 3.2±1.06 with p value< 0.01*.

The comparison of pre and post scores of ODI (Figure 20) within two groups shows in both the groups there was significant improvement between pre and post mean scores. In Group I (Swiss ball) when compared for pre and post mean scores there was significant improvement from 18.8±6.56 to 16.53±4.76 with p<0.01* and in Group II there was significant improvement from 25.87±7.64 to 24.8±7.64 with p<0.01* after 6 weeks of intervention.

Comparison of difference in improvement VAS and ODI (Figure 21) between groups shows that there was significant difference in improvement of VAS and ODI between groups. Group I (Swiss ball) showed better improvement in VAS and ODI compared to Group II with an effect size of 1.47 and 0.99 respectively.

There was a significant improvement in Swiss ball group compared to floor, which may be due to the following reasons- Reduction in contact area, Increase in perturbations, Control of center of gravity with limited base of support.

Gregory J Lehman stated that, performing a bridge on the Swiss ball finds the participants in a more vertical position than floor. Therefore, more muscle activity is required to produce secondary spinal stabilization due to labile surfaces.

LIMITATIONS & FUTURE SCOPE
Sample size was small quantitative measures were not used to compare the effect of individual exercises on isolated muscles to know which exercise gives better effect in reducing pain and disability. No measurements were made to determine the compressive or shear loading on the spine during task. This type of kinematic is optimal when determining the safety and tissue loading properties of various movements. Confounding parameters like agility, speed, balance, motor control can be considered and EMG biofeedback can be used for quantifying muscle activity for future study.
CONCLUSION
The Swiss ball exercises showed statistically significant improvement in reducing back pain and disability when compared to the floor exercises. Thus, performing core stability exercises on a Swiss ball reduces pain and disability significantly compared to floor among mechanical low back ache subjects.

ACKNOWLEDMENT
All our best wishes to those valuable subjects & supporter of this study.

Conflict of interest:
We declare that there were no conflicts of interest in the entire journey of the study.

Ethical clearance: Research Ethics Committee.

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