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Effect of pelvic bridging exercises on stable and unstable surfaces in subjects with low back pain

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Abstract
Background: people those are having sedentary lifestyle and poor posture would land up into weak abdominal muscles which are key spine stabilizers and ultimately it leads to low back pain. Different type of core stability exercises would help in activation of core muscles thus increasing their strength and it also significantly reduces low back pain. Thus current study shows the effect of pelvic bridging exercises on stable surface and unstable surfaces and its effect on strength of transverse abdominis and on low back pain.
Objective: The present study was done to find the effect of pelvic bridging exercises on stable and unstable surface in subjects with low back pain.
Methodology: A sample size of 38 people were calculated. Data were obtained at the beginning and end of the 3-week post-exercise session in both the groups using stable surface for group A and unstable surface for group B.
Results: of the 38 individuals, No significant difference was observed between Group 1 and Group 2 with pretest scores of NPRS (t=-1.0971, p=0.2803) at 5% level of significance. It means that, the mean pretest NPRS scores are similar in Group 1 and Group 2. A significant difference was observed between Group 1 and Group 2 with posttest scores of strength of TrA in mmhg (t=-4.1231, p=0.0002) at 5% level of significance. It means that, the mean post test strength of TrA in mmhg scores is significantly higher in Group 2 as compared to Group 1. Thus bridging exercises on unstable surface found to be effective on increasing strength of TrA significantly.
Conclusion: Based on the analysis of the results obtained, the present study concluded that there no significant difference in NPRS between group A and group B but there is significant difference in strength of transeverse abdominis in group A and group B.

Keywords: Transverse abdominis (TrA), Low back pain, pelvic bridging exercise, intra-abdominal pressure (IAP)

Introduction

Low back pain is one of the most common health problems. It shows that such huge number of people with low back pain creates personal and financial burden globally. It shown to be a major problem throughout the world, with the highest prevalence among female individuals and those aged 40–80 years. According to study, the mean SEM point prevalence was estimated to be 11.9 2.0%, and the 1-month prevalence was estimated to be 23.2 2.9% [1].

Low back pain is an extremely common problem that most people experience at some point in their life. estimates of the 1 year incidence of a first-ever episode of low back pain range between 6.3% and 15.4%, while estimates of the 1 year incidence of any episode of low back pain range between 1.5% and 36%. Low back pain is one of the most common causes of activity limitation and absence from work in most of the places throught the world, and it also causes an enormous economic burden on individuals, families, communities, industry and governments [2].

Bergmark [3] presented a model for the trunk that shows how different muscles contribute to the stability of spine. His model identified muscles as either ‘‘local’’ or ‘‘global,’’ based on its anatomic characteristics. The local muscles are those muscles that cross one or a few segments and that have a limited moment arm to move the joint, but an ideal anatomy to control intervertebral motion. Bergmark included muscles such as the lumbar multifidus in this group; however, other muscles that also satisfy these criteria are transversus abdominis (TrA), intertransversarii and interspinales, posterior fibers of psoas and medial fibers of quadratus lumborum [4]. By contrast, the global muscles cross several joints with attachments to the pelvis and the thorax. These muscles have a larger moment arm (ie, greater torque-generating capacity) and they are suited to the control of orientation and external forces. Examples of the global muscles include: rectus abdominis, obliquus externus and internus abdominis, thoracic portions of the longissimus and iliocostalis, lateral fibers of quadratus lumborum, anterior fibers of psoas, and latissimus dorsi. There is overlap between these systems, and some muscles share features of both, such as the lumbar longissimus and iliocostalis, and the superficial fibers of multifidus having one attachment to the lumbar vertebrae and sharing some features of the local system [5].

Two local or deep intrinsic lumbopelvic muscles have taken special attention in the literature: the TrA and the lumbar multifidus. TrA is a broad sheet-like muscle with extensive attachments to the lumbar vertebrae via the thoracolumbar fascia, and to the pelvis and rib cage. The muscle fibers have a relatively horizontal orientation and, therefore, minimal ability to move the spine, although they may contribute to rotation [6]. Contribution to spinal control is likely to involve modulation of intraabdominal pressure (IAP) and tensioning the thoracolumbar fascia. TrA has been shown to be associated closely with control of IAP [7], and recent data confirm that spinal stiffness is increased by

IAP. [8]Fascial tension may restrict intervertebral motion directly or provide gentle segmental compression via the posterior layer of the thoracolumbar fascia [9]. Recent porcine studies confirm that the combined effect of IAP and fascial tension is required for TrA to increase intervertebral stiffness, and the mechanical effect of its contraction is reduced if the fascial attachments are cut [8].

Many exercise strategies have been made for this purpose of core stability exercise. Strategies that are consistent with this approach include Pilates exercise, dissociation exercises [10], limb movements with a neutral lumbar spine and pelvis, Swiss ball programs [11], McGill's stability exercises, rhythmic stabilization exercises from proprioceptive neuromuscular facilitation [12], balance board and balance shoe training [13], floor exercise programs, and so on. The key features of exercise vary between approaches but include features such as control of the lumbopelvic position (particularly in neutral) during movement of the limbs, and on unstable surfaces, closed chain tasks, and resisted movements [14].

Muscles surrounding the vertebrae are divided into global muscles and local muscles according to their roles. The global muscles are involved in large motions, and the local muscles are responsible for stability in each spinal segment [15]. It has been reported that people with back pain have shortened contraction times and poorer recruitment of the transverse abdominis and multifidus, which are deep local muscles [16]. The functions of these muscles are not automatically restored even after recovery of normal function. Functional damage and weakening of the transverse abdominis and multifidus cause back pain, and the transverse abdominis plays an important role in vertebral stability [17].

Trunk stability exercise is an intervention for vertebral stability, which is performed to protect the vertebrae from repetitive damage, mitigate pain, and reduce degenerative deformation that might have developed in the vertebrae [18]. Special exercises for trunk stability help back pain patients retain normal structure of the lumbar segments, provide stability, reduce pain, and improve function [19].

Bridging exercise, a closed chain weight-bearing exercise, is an exercise which increases muscular strength of the hip extensor and promotes trunk stability. It is often prescribed for patients with back pain [20], and increases the activities of trunk stabilization muscles such as the internal oblique, external oblique, and erector spinae muscles [21].

Among the trunk stabilization exercises, a stabilization exercise under a dynamic condition using a sling is known to have greater effect than a stabilization exercise under a static condition. It improves sense of balance and balance maintenance ability by stimulating proprioceptors[19]. Exercise on an unstable support surface elicits greater muscle activity than exercise on a stable support surface, and improves dynamic balance, promotes vertebral stability, and prevents vertebral injury [22]. It has been reported that stabilization exercise on an unstable support surface increases activity and coordination of the ventral muscles, and that the bridging exercise on an unstable support surface causes alteration of the internal oblique and rectus abdominis muscles.

Materials and method

This study was designed to identify the effectiveness of pelvic bridging exercises on stable and unstable surfaces on low back pain and strength of transverse abdominis in subjects with low back pain. The research ethics committee of Krishna Vishwa Vidyapeeth approved the study.

Both male and female individuals with low back pain in the age group of 40-80 years of age were chosen by random sampling method in this interventional study. Patients were approached on Krishna institute karad, an assessment was done for strength of transverse abdomisis and low back pain and individuals were selected based on inclusion criteria. Individuals were informed about the study procedure and consent was taken before being enrolled in the study. The demographic data of the subjects which includes name, age, and gender were collected and 3 weeks of exercise protocol was implicated on the patients. After 3 weeks patients were again assessed for the back pain and strength of transverse abdomisis.

Inclusion criteria

- Patients with acute low back pain.
- Subjects with weak abdominal muscles.
- Subjects with sedentary lifestyle.
- Subjects with chronic low back pain

Exclusion criteria

- Subjects who had detected with hernia.
- Lumbar spine fracture.
- Malignancy.
- Pregnant women with complications in pregnancy.

Outcome measures

For strength of transverse abdominis: the strength of transverse abdominis was assessed with the help of pressure biofeedback. With the patient prone, the stabilizer is placed horizontally under the abdomen. Inflate the stabilizer to 70mmHg. Have the patient perform a drawing-in maneuver. A decrease of 6-10mmHg during the drawing in maneuver indicates proper activation of the deep abdominal muscles.

For back pain: for the back pain the assessment was based on the NPRS (numerical rating scale). On the first day, the pain was assessed by the NPRS scale. Patients with significant scores on the NPRS scale were included in the study.

Intervention

1. Pelvic bridging exercise on stable surface:

Pelvic bridging on mat	30-sec hold x 3

2. Pelvic bridging exercises on unstable surface

Pelvic bridging exercises on bosu ball	30-sec hold x 3

Statistical method

The data obtained was entered, compared, and analyzed using instat app. The data within a group were analyzed using an independent t-test.

Results

Represented below are the data findings of the individuals with low back pain before and after the 3 weeks of intervention programs

Demographic data

Table 1: The demographic variable of participants

Variables	No. Of individual	Percentage of individuals
1. Age		
40-60 years	14	36.84%
60-80 years	24	63.15%
2. Gender		
Female	22	57.89%
Male	16	42.11%

Table 2: Comparison of Group 1 and Group 2 with pretest and posttest scores of NPRS by independent t test

Times	Groups	Mean	SD	SE	t-value	P-value
Pretest	Group 1	5.44	0.98	0.23	-1.0971	0.2803
	Group 2	5.89	1.41	0.33		
Posttest	Group 1	1.89	1.18	0.28	0.1460	0.8847
	Group 2	1.83	1.10	0.26		
Difference	Group 1	3.56	1.15	0.27	-1.5137	0.1394
	Group 2	4.06	0.80	0.19		

From the results of the above table, it can be seen that,

- No significant difference was observed between Group 1 and Group 2 with pretest scores of NPRS (t=-1.0971, p=0.2803) at 5% level of significance. It means that, the mean pretest NPRS scores are similar in Group 1 and Group 2.
- No significant difference was observed between Group 1 and Group 2 with posttest scores of NPRS (t=0.1460, p=0.8847) at 5% level of significance. It means that, the mean post test NPRS scores are similar in Group 1 and Group 2.
- No significant difference was observed between Group 1 and Group 2 with changes in NPRS scores from pretest to post test (t=-1.5137, p=0.1394) at 5% level of significance. It means that, the changes in NPRS scores from pretest to posttest are similar in Group 1 and Group 2. The mean and SD of pretest and posttest scores are also presented in the following figure.

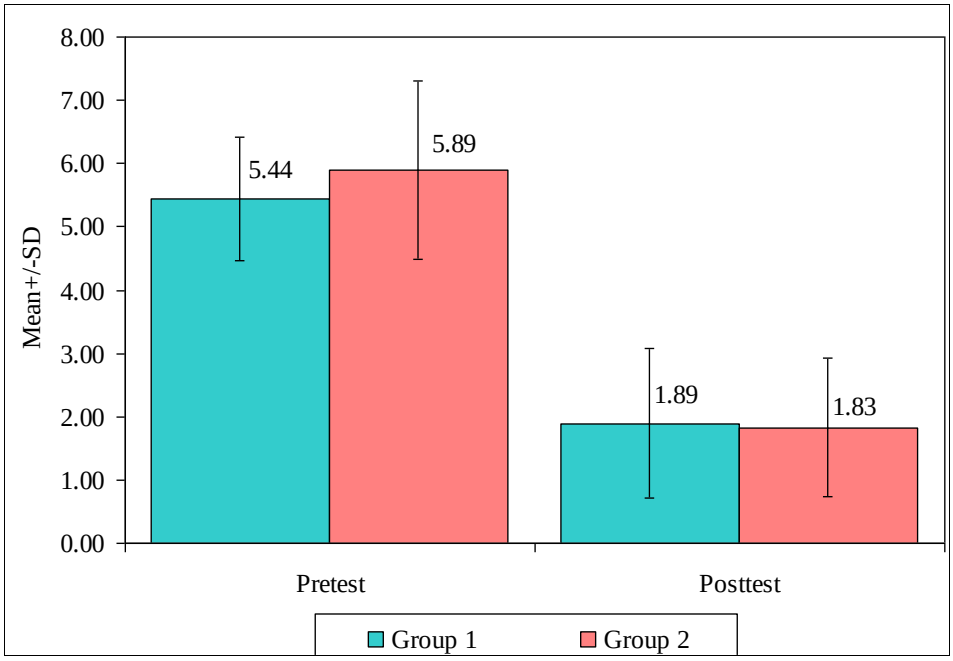

Fig 1: Comparison of Group 1 and Group 2 with pretest and posttest scores of NPRS

Table 3: Comparison of Group 1 and Group 2 with pretest and posttest scores of strength of TrA in mmHg by independent t test

Times	Groups	Mean	SD	SE	t-value	P-value
Pretest	Group 1	4.78	1.00	0.24	0.6764	0.5034
	Group 2	4.50	1.42	0.34		
Posttest	Group 1	6.50	0.86	0.20	-4.1231	0.0002*
	Group 2	8.00	1.28	0.30		
Difference	Group 1	1.72	0.96	0.23	-5.4880	0.0001*
	Group 2	3.50	0.99	0.23		

*p<0.05 indicates significant

From the results of the above table, it can be seen that,

- No significant difference was observed between Group 1 and Group 2 with pretest scores of strength of TrA in mmhg (t=0.6764, p=0.5034) at 5% level of significance. It means that, the mean pretest strength of TrA in mmhg scores is similar in Group 1 and Group 2.
- A significant difference was observed between Group 1 and Group 2 with posttest scores of strength of TrA in mmhg (t=-4.1231, p=0.0002) at 5% level of significance. It means that, the mean post test strength of TrA in mmhg scores is significantly higher in Group 2 as compared to Group 1.
- A significant difference was observed between Group 1 and Group 2 with changes in strength of TrA in mmhg scores from pretest to post test (t=-5.4880, p=0.0001) at 5% level of significance. It means that, the changes in strength of TrA in mmhg scores from pretest to posttest are significantly in Group 2as compared to Group 1. The mean and SD of pretest and posttest scores are also presented in the following figure.

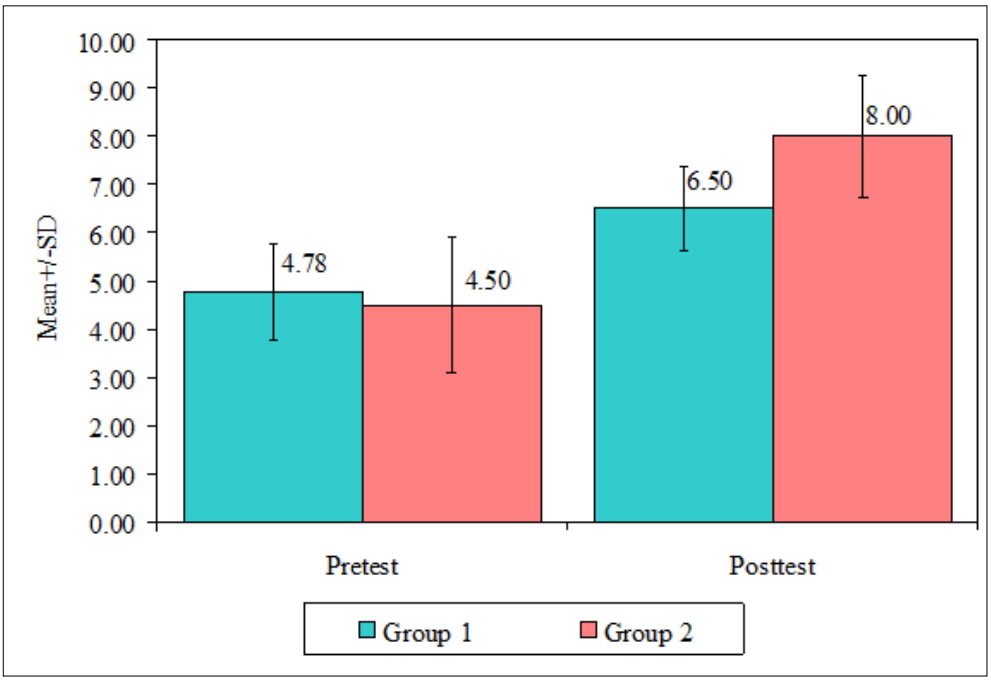

Fig 2: Comparison of Group 1 and Group 2 with pretest and posttest scores of strength of TrA in mmHg

Discussion

Low back pain is an extremely common problem that most people experience at some point in their life. It also causes an enormous economic burden on individuals, families, communities, industry and governments. Bergmark [3] presented a model for the trunk that shows how different muscles contribute to the stability of spine. TrA has been shown to be associated closely with control of IAP [7], and recent data confirm that spinal stiffness is increased by IAP. Many exercise strategies have been made for this purpose of core stability exercise. Special exercises for trunk stability help back pain patients retain normal structure of the lumbar segments, provide stability, reduce pain, and improve function[19]. Pelvic bridging is one of the exercises which focuses on core muscles and helps in stability of spine.

This study aimed to investigate effect of pelvic bridging exercises on stable and unstable surfaces and how it creates an effect in patient with low back pain and also how the strength of transverse abdominis get affects. Pelvic bridging exercises acts on core stabilizers of spine. Studies have shown that to reduce the back pain weak spine stabilizers should get strengthen. To investigate whether performing pelvic bridging exercise on unstable surface makes any significant difference on patients with back pain and on the strength of transverse abdomins this study was conducted in Krishna hospital. Two equal groups were made group A and group B. group A was given pelvic bridging exercises on stable surface and group B was given pelvic bridging exercises on unstable surface. The duration of exercise protocol was 3 weeks. Exercise was performed 3 repetitions with 30 sec hold. While initiating the pelvic bridging subjects rolls pelvis backwards thus stabilizing pelvis and lumbar spine. Hold creats contractions in deep group of abdominal muscles which are key spine stabilizers.

After collecting all the dada statistical analysis was done. Study have shown that there is no significant difference in NRPS range in post test of group A and group B. study have also shown that there is significant difference in strength of transverse abdominis in post test of group A and group B.

Conclusion

From an overall perspective, it is readily apparent that pelvic bridging exercises on stable and unstable surface do not show significant difference in NPRS but it shows signicant difference in strength of transeverse abdominis.

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