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Research Article

Effectiveness of Mulligan's Bent Leg Raise (BLR) and Gate Technique among Patients with Non-Specific Low Back Pain – A Randomised Controlled Trial

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A B S T R A C T

Introduction: Despite a great deal of research, the reasons for low back pain remain unknown, and the results of treatment are not adequate. Therefore, the purpose of this study was to determine whether Mulligan's Bent Leg Raise and Gate approach was beneficial for non-specific low back pain. This study is intriguing in that the technique utilised in previous studies was primarily focused on improving the hamstring flexibility of patients with lower back pain; in contrast, the focus here was on improving the patient's pain and range of motion.

Method: Eighty samples in total were collected and split into two groups: A = 40 and B = 40. For four weeks, Group A received Mulligan's Bent Leg Raise technique, while Group B received the Gate technique with the participants ranging in age from 20 to 59 years. Five days a week for four weeks, the pre- and post-test results for the modified - modified Schober Test and Visual Analogue Scale were recorded.

Results: Following therapy, both variables (pain and ROM) significantly (i.e., $p < 0.05$) improved in both group outcome parameters, according to a group analysis using a paired t test.

Conclusion: Although post-treatment between group studies using an unpaired t test revealed that there was no statistically significant distinction between the groups that were administered the Gate or Bent Leg Raise approach, it concluded that both techniques are equally effective.

Keywords: Bent Leg Raise Technique, Gate Technique, Non-Specific Low Back Pain, Visual Analogue Scale, Modified-Modified Schober Test

Introduction

"Low back pain" is the term used to describe any discomfort felt in the lower back region (where the lordotic curve forms) when it originates in the lumbar spine, spinal cord and nerves, lower back muscles, internal organs of the pelvis and abdomen, or the skin covering the lumbar area.[1]

The five distinct vertebrae that make up the lumbar vertebral column are referred to as the L1, L2, L3, L4, and L5 vertebrae, depending on where they are in the intact column as viewed from above.[2] The sacral region, which is located next to the lumbar region, is made up of five vertebrae that work together to form an inverted triangle. With two zygapophyseal facets that face posteriorly for articulation with the inferior facets of the fifth lumbar vertebrae, the first sacral vertebrae form the basis of the inverted triangle.

The lateral portion of the sacrum, which is created by the consolidation of the ischium, pelvis, and ilium, articulates with the innominate bone, whereas the fifth sacral vertebrae articulate with the coccyx. The sacrum will nutate over the innominate bone when a lower limb is moved. The term "lumbosacral region" refers to the area of the lower back that spans the first lumbar to the first sacral vertebrae of the spine.[3]

The best estimates indicate that the prevalence of chronic low back pain is approximately 23%, with 11–12% of the population having lived with a disability. The lifetime prevalence of low back pain is reported to be as high as 84%.[4]

According to gross sectional statistics, the first signs of low back pain often appear around the age of 30, and their frequency peaks between the ages of 45 and 60.[5]

In India, LBP is reported to have a 23.09% incidence and 60–85% lifetime prevalence. About one-third of the population has persistent low back discomfort.[6]

90% of patients are thought to have non-specific low back pain, which is divided into specific and non-specific categories based on the pathophysiology of low back pain. Chronic non-specific low back pain was present in 62.2% of the participants with chronic low back pain.[7]

Recurrent non-specific low back pain was reported by 29% of the adolescents.[8] Specific LBP is primarily caused by tumours, inflammatory diseases, spondylolisthesis or spinal stenosis, nerve root compression, and vertebral fractures. Since non-specific low back pain cannot be linked to a clearly defined specific pathology, its exact cause is unknown. Based on length, there are three forms of non-specific LBP: acute (less than six weeks), subacute (six weeks to three months), and chronic (more than three months).

The impacts of LBP are evident in an individual's physical, physiological, and social wellness.

Flexion, extension, lateral flexion, and rotation are all possible movements of the lumbar area. Greater flexion occurs at the L5-S1 joint during flexion and extension in the sagittal plane; the upper lumbar region exhibits the greatest degree of freedom in lateral flexion and rotation.

It was discovered that the normative values for Modified-Modified Schober Test flexion and extension were roughly 6.85 cm and 2.42 cm, respectively.[9]

The contralateral zygapophyseal joint compresses and the ipsilateral zygapophyseal joint distracts during rotation. Formal tests have demonstrated that the medial end of the lumbar zygapophyseal joints records the maximum pressure during flexion; this finding may also be related to the ageing changes observed in these joints. Coupled motion often involves axial rotation and lateral flexion in the lumbar area.

Reduced spinal stiffness (stability) will occur from a decrease in the ligamentous pre-stress that the ligamentum flavum typically provides. This decrease in tension may also cause the ligamentum to buckle under movement, impressing the spinal cord. Either repeatedly applying a relatively modest load or applying a suspended load for an extended period of time (prolonged sitting or stooping position) might result in repetitive strain injuries. About 80% of the compressive pressures are borne by the lumbar interbody joint and just 20% by the lumbar zygapophyseal joint. Alter mechanisms can cause this percentage to fluctuate. When walking on level ground, compressive stresses are almost twice as great as the body weight, but lumbosacral loads in an upright standing position are roughly comparable to the body weight.

When compared to men, women suffer more. Oestrogen insufficiency, which is most common between the ages of 45 and 60 years, is a major contributing factor to the aetiology of a number of degenerative musculoskeletal disorders, including osteoarthritis and spondylosis. Collagen wasting is frequently brought on by oestrogen deficiency and is seen in postmenopausal women's skin and bones. When oestrogen levels are lowered, the body responds biologically at the bone level through several molecular mechanisms. This causes severe disc space constriction (more so than in age-matched men compared to women) and lower back pain.[10]

A sedentary lifestyle, intense activity, psychosocial factors, and occupational factors are major risk factors for chronic low back pain. Most people with acute LBP heal rather rapidly, according to reports, and only 10 to 15% go on to experience persistent difficulties.[11]

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Spinal manipulation, acupuncture, massage therapy, exercise therapy, and other therapies (such as IFT, low-level laser therapy, SWD, EMS, TENS, yoga, heat/ cold and traction, and some painkillers) are some of the treatment options available for low back pain. Surgical procedures are advised in certain circumstances where significant diseases such as infections, tumours, and fractures are the cause.[12] However, the results of all of the aforementioned will not be satisfactory for LBP.

Brain Mulligan created the idea of mobilisation through movement and the phenomenon of pain relief. The fact that more than 100 studies have been published in various journals supporting Brain's MWM technique serves as evidence for the Mulligan concept's evidence-based practice. In the realm of manual therapy, the Mulligan principle is one of the most popular ideas. Since the patient can perform the offending action in a functional position free from discomfort, it is frequently the first treatment option recommended by specialists. This makes the outcome extremely satisfying.

Mulligan's manual therapy methods include the Bent Leg Raise (BLR) and the Gate technique. When the aforementioned two techniques are used in the supine position, the intradiscal pressure load is reduced and is more minimal than in other positions, for instance, an individual weighing 100 kg in a supine position experience an intradiscal pressure of approximately 25 kg, which is more minimal than in other positions.

The study's objective is to evaluate the efficacy of the Gate and Mulligan's Bent Leg Raise techniques in treating patients with non-specific low back pain.

Subjects and Method

This experimental study design was carried out at Aarupadai Veedu Medical College & Hospital in Puducherry between January and June of 2023. The study was approved by Aarupadai Veedu Medical College's ethical clearance committee. Participants in the study were those with non-specific low back pain who were sent to the Aarupadai Veedu Medical College and Hospital's physiotherapy outpatient department. There are 80 samples in all. After obtaining the participants' informed consent, the participants were divided into two groups: Group A consisted of 40 participants who received the Bent Leg Raise technique, and Group B consisted of 40 participants who received the Gate technique. This was based on the inclusion of both genders with non-specific low back pain in the age group of 20–59 years, with a duration of more than 6 weeks and less than 3 months, and excluding spinal injury, deformity, arthritis, pregnancy, and malignancy. The Visual Analogue Scale and Modified-Modified Schober Test were used as outcome measures. The data analysis will be conducted using SPSS version 28.

Treatment Procedure

Group A: Bent Leg Raise Technique along with Interferential Therapy[13]

The patient is requested to grip the plinth from the unaffected side and place the hand from the affected side under his head and neck while supine at the edge of the plinth, with his hips and knees at a 90-degree angle and his heel off of it. The therapist should adopt a walking stance and stand lateral to the patient. Place the inner hand's shoulder beneath the popliteal fossa and use both hands to grab the lower part of the thigh, which is quite near the fossa. Along the femur's long axis, longitudinal traction is applied. The therapist flexes the hip towards the shoulder on the same side until the first resistance is experienced. The contract-relax method is used when a patient reports experiencing stretch pains or when the therapist senses resistance from the patient's tense muscles. The patient is asked to gently push the therapist's shoulder and hold it for a few seconds. With no pain, the therapist can now move the patient's hip into deeper flexion. Before adding greater hip flexion, the hip might be moved into abduction or external rotation if the patient complains of pain during this manoeuvre. Hold the final posture for as long as it is pain-free, for around 20 seconds.

For four weeks, repeat the procedure three times per session, five days a week. As a post-treatment assessment, evaluate the changes brought about by this mobilisation once more.

Group B: Gate Technique along with Interferential Therapy[1]

The patient should grab the plinth from the side that is not injured while supine resting at its edge. Put the other hand over the shoulder. The therapist should adopt a walking stance and stand lateral to the patient. The therapist holds the knee joints with both hands. The patient's knees are bent so that their feet are not on the plinth. By grasping both knees from the anterior aspect, the therapist slowly (passively) films the patient's legs to cause rotation of the lumbar spine towards the uncomfortable side. When a patient complains of discomfort, the therapist moves the patient's flexed legs in one of two directions—either flexion or extension—at the hip and lumbar joints to determine a pain-free position. The therapist rotates the legs more in the direction of the afflicted side while sustaining this new range of flexion and extension. The patient's knees are stabilised with the therapist's groin area (abdomen) to provide passive overpressure at the end range. The therapist shifts where his hands are placed, placing one over the chest's lateral wall and the other over the pelvic gluteal region. The flexion or extension position of the hip and knee is maintained when the end range is felt, allowing the therapist to further rotate the patient's lumbar spine.

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The patient's pelvis is pulled with one hand while the other stabilises the thoracic area, and the patient pushes both legs down towards the floor. The therapist loses height in a fairly convenient way to accomplish this. After 20 seconds of maintaining this end range, take a minute to rest. Return to the neutral position after that. In the unusual event that returning hurts as well; try to locate a gate or door (a pain-free position) by increasing or decreasing flexion or extension. Then, de rotates the lumbar spine in the direction of the starting position. For four weeks, repeat the procedure three times per session, five days a week.

Results

Table 1.Quantity and Proportion of Males and Females in Groups A and B

Gender	Group A		Group B	
	Number	Percentage	Number	Percentage
Male	13	32.5	19	47.5
Female	27	67.5	21	52.5
Total	40	100.0	40	100.0

There were 32.5% men and 67.5% women in Group A, and 47.5% men and 52.5% women in Group B (Table 1).

Table 2.Age Distribution in Quantity and Proportion in Groups A and B

Age (years)	Group A		Group B	
	Number	Percentage	Number	Percentage
20–30	6	15.0	7	17.5
31–40	9	22.5	9	22.5
41–50	13	32.5	15	37.5
51–59	12	30.0	9	22.5
Total	40	100.0	40	100.0

The age range of 20 to 30 years consisted of 15% of the population of Group A and 17.5% of Group B; in the age range of 31 to 40, both Groups A and B comprised 22.5%; the age range of 41 to 50 years consisted of 32.5% of the population belonging to Group A and 37.5% to Group B; and the age group of 51 to 59 years included 30% of the population belonging to Group A and 22.5% to Group B (Table 2).

Table 3.Pre- and Post-Test VAS Values in Groups A and B

VAS	Group A			Group B		
	Mean	SD	p Value	Mean	SD	p Value
Pre-test	6.53	1.30	< 0.0001	6.49	1.30	< 0.0001
Post-test	3.35	0.89		3.13	0.80	

VAS - Visual Analogue Scale

Following treatment, pain in Group A was dramatically reduced ($p < 0.0001$), going from a baseline of 6.53 ± 1.3 to 3.35 ± 0.89. Similar to Group A, Group B experienced a significant decrease in pain from 6.49 ± 1.3 at baseline to 3.13 ± 0.8 following treatment ($p < 0.0001$). Following therapy, the VAS score was significantly lower in both groups (Table 3).

Table 4.Pre- and Post-Test ROM Values of Group A and Group B

Test Mean	Group A			Group B		
	Mean	SD	p Value	Mean	SD	p Value
Flexion						
Pre	3.1050	0.8630	< 0.0001	2.0130	0.7390	< 0.0001
Post	6.3950	0.8150		6.2950	0.8010	
Extension						
Pre	2.0125	0.7293	< 0.0001	2.0880	0.7920	< 0.0001
Post	3.2140	0.4738		3.1350	0.4890	

After therapy, the mean MMST score in both groups climbed significantly. Following therapy, Group B showed a greater mean difference in lumbar flexion than Group A. In Group A, the mean MMST score improved significantly from 3.105 ± 0.863 prior to therapy to 6.395 ± 0.815 following treatment ($p < 0.0001$). Similar improvements were seen in Group B, where MMST went from 2.013 ± 0.739 pre-treatment to 6.295 ± 0.801 post-treatment ($p < 0.0001$) (Table 4).

Similarly, after treatment, improvements in both groups in lumbar extension were statistically significant. In Group A, the mean MMST score improved significantly from 2.0125 ± 0.7293 prior to treatment to 3.214 ± 0.4738 following treatment ($p < 0.0001$). Similar improvements were shown in Group B, where MMST increased from 2.088 ± 0.792 pre-treatment to 3.135 ± 0.489 post-treatment ($p < 0.0001$).

Table 5.Mean Difference of Outcomes Before and After the Intervention

Outcome	Mean Difference
Visual Analogue Scale	0.220
Flexion	0.100
Extension	0.079

Between Groups A and B, the post-test mean differences in VAS, MMST flexion, and extension were 0.22, 0.1, and 0.079, respectively (Table 5).

In this study, patients with non-specific low back pain received four weeks of treatment using Mulligan's Bent Leg Raise and Gate approach. The participants' mean age ranged from 20 to 59 years. The study finds that at baseline, there was no discernible difference ($p > 0.05$) between the

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two groups. Following therapy, both variables pain (VAS) and range of motion (MMST) significantly (i.e., $p < 0.05$) improved in both group outcome parameters.

Discussion

Eighty samples, ranging in age from 20 to 59 years, were collected from Aarupadai Veedu Medical College and Hospital for this study. The samples were split into two groups. Using the simple random sample technique, Group A (40) and Group B (40) were created. Mulligan's Bent Leg Raise was administered to Group A along with IFT, and the Gate method was administered to Group B along with IFT. The purpose of this study was to determine whether Mulligan's Bent Leg Raise and Gate technique would be beneficial for patients experiencing non-specific low back pain. Using paired "t" test analysis, the VAS (pain score) and MMST (ROM) as end measures were used to determine the intragroup difference following four weeks of treatment.

Unpaired "t" tests are used for inter-analysis. The study's final result indicates that while the intergroup differences were not statistically significant ($p > 0.05$), the intragroup differences for both groups were statistically significant ($p < 0.05$) The study's conclusion demonstrates that Group A (BLR) and Group B (Gate method) were equally successful in enhancing range of motion and lowering pain following therapy.

Postural abnormalities may be associated with muscles that are tight. Both may have a role in many musculoskeletal disorders. One potential contributing factor to low back problems could be reduced extensibility brought on by increased hamstring stiffness. According to clinical observations, hamstring tightness may be linked to changes in the sagittal spine curvatures during trunk flexion (TF) and alters the lumbar pelvic rhythm.

Given that tight hamstrings may have an indirect role in the aetiology of lower back pain (LBP), the hamstring muscles are of great therapeutic interest in both preventing and treating LBP. It is unclear if hamstring extensibility plays a predictive role in the development of LBP or if it is a result of the body's persistent adaptation to the onset of symptoms, which may be linked to other maladaptive postural techniques.

Mulligan's BLR technique is used to increase the range of the straight leg raise (SLR) in individuals with referred thigh discomfort and/ or lower back pain. It is also used to increase hamstring flexibility in individuals with tight hamstrings. This approach aims to lessen physical disability and lower back pain while restoring normal mobility. It stretches the hamstring, adductor, and rotator musculature of the lower extremities. The sciatic nerve travels via the adductor magnus and gluteus maximus at the hip level, and this technique may relieve the adhesion between them. This is one possible explanation for bent leg raises. Stretching the hamstrings' gluteus maximus and adductor magnus while keeping the knee flexed aids in releasing adhesions between these muscles and the sciatic nerve. As a result, the sciatic nerve will be mobilised with respect to these muscles without experiencing any stretching. Aids in the lumbar spine's facet joints and intervertebral foramen opening as the pelvis tilts posteriorly during the end range. Additionally, this may aid in relaxing and stretching the thoracolumbar fascia.

Malik et al.[9] concluded that the evidence showed a decline in lumbar extension with ageing. Males exhibited greater lumbar flexion than females, but there was no gender difference in lumbar extension.

A study by Hall et al. showed that while there was no immediate improvement in hamstring flexibility after a single application of Mulligan's BLR technique, there was an increase 24 hours later.[14] When comparing the current study's immediate post effects to earlier research assessing the effects on hamstring flexibility following BLR and Traction with Straight Leg Raise (TSLR), the latter showed comparatively less statistical improvement. Following Mulligan's TSLR, Hall et al., second investigation showed an instant improvement in the results of straight leg raises.[15] These findings support the current study's findings that patients with low back pain benefit from Mulligan's technique for developing hamstring flexibility.

The Two Leg Rotation technique's favourable effects on hamstring flexibility in the study may be the result of altered hamstring muscle stretch tolerance and improved hamstring viscoelastic characteristics brought on by the technique's use.[16]

The reduction in Active Knee Extension (AKE) measurement in the study clearly shows that increases in muscle length are measured by "extensibility", which is an improvement based on genuine muscle lengthening (i.e., improved extensibility). The functional issues linked to tight hamstrings have been documented by Hoffman et al. and Addison et al.[17,18] Based on the findings of this study, Mulligan's TLR technique may be useful in improving hamstring flexibility and lowering the likelihood of issues related to tight hamstrings.

Limitations

- The age group is restricted to individuals aged 20–59 years.
- Psychological aspects were not taken into account.
- A smaller sample was collected.
- The strength of the muscles was not measured.

Suggestions

- Future research with a larger population is needed to increase the validity of the findings.
- To evaluate the precise function of muscles, one needs to consider their muscle strength.

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Conclusion

This study revealed that after the therapy, Mulligan's Bent leg raise and Gate approach both worked equally well to reduce pain and enhance range of motion.

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Conflict of Interest: None

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