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COMPARISON OF EFFECTIVENESS OF POSTERIOR SUPERIOR ILLIAC SPINE INOMMINATION CORRECTION WITH THERAPEUTIC EXERCISES IN LOW BACK PAIN

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Abstract

Background: *Low back pain (LBP) is a leading cause of disability and may be associated with sacroiliac joint dysfunction in some patients. Management commonly includes therapeutic exercise, physical modalities, and manual therapy techniques.*

Objective: *To compare the effects of posterior innominate correction and therapeutic exercises on pain and disability in patients with LBP.*

Methods: *A quasi-experimental study was conducted on 50 participants recruited through non-probability purposive sampling from Fatima Memorial Hospital, Lahore, and Specialist Care Hospital, Okara. Participants were allocated into two groups (n=25 each) by lottery method. Both groups received baseline treatment consisting of ultrasound, hot pack application, and gluteal-setting exercises. Group A additionally received pelvic innominate correction, whereas Group B performed therapeutic exercises including hamstring stretching, William's flexion exercises, pelvic rotations, pelvic tilting, and hip abductor isometrics. Outcomes were assessed at baseline and during weeks 1, 2, and 3 using the Numeric Pain Rating Scale (NPRS), Oswestry Disability Index (ODI), and Roland–Morris Disability Questionnaire (RMDQ). Data were analyzed using SPSS version 17, with statistical significance set at $p \leq 0.05$.*

Results: *Both groups demonstrated reductions in pain and disability over the treatment period. No statistically significant between-group differences were observed in NPRS, ODI, or RMDQ scores ($p \geq 0.05$). Mean pain reduction was 1.52 in the innominate correction group and 1.64 in the therapeutic exercise group.*

Conclusion: *Both interventions were associated with improvement in pain and disability; however, no statistically significant difference was found between them.*

Introduction

Low back pain (LBP) is a prevalent musculoskeletal condition that affects people of all ages and may present as either acute or chronic pain. It can substantially affect mobility, work performance, and quality of life. In addition, prolonged or recurrent episodes of LBP may impose a considerable financial burden on patients and healthcare systems(Hartvigsen et al., 2018). Even though LBP has been studied for many years, finding the exact cause is still difficult in many cases because several structures of the lower back and pelvic region can produce similar symptoms. Therefore, a large number of patients are classified as having non-specific low back pain when no definite cause can be identified(Kaneda et al., 2025).

Low back pain (LBP) is a common health problem worldwide and affects a large number of people across different age groups. According to the Global Burden of Disease Study 2021, around 619 million people were living with LBP in 2020, and this number is expected to rise to nearly 843 million by 2050 because of population growth and ageing(Ferreira et al., 2023). In Pakistan, the burden of LBP has also increased over time. Recent estimates based on Global Burden of Disease data reported that the age-standardized prevalence increased from about 6.5% in 1990 to 7.5% in 2021(Tayyab et al., 2025).

The sacroiliac joint (SIJ) is also considered a possible source of pain in some patients with low back pain. It connects the sacrum with the pelvis and helps transfer body weight from the trunk to the lower limbs. Previous studies have reported that the SIJ may contribute to pain in a proportion of patients, particularly those with persistent low back symptoms(Barros, McGrath, & Gelfenbeyn, 2019). The joint is supported by strong ligaments and surrounding muscles and has an irregular articular surface. It also receives sensory nerve supply, which means that irritation of the joint and its surrounding tissues can produce pain in the lower back and pelvic area(Polly Jr, 2026).

Low back pain is also a common reason for seeking medical care and missing work and remains an important cause of disability worldwide (Huang et al., 2026). A large proportion of the population experiences LBP at some point during life(Tesio, 2023). Sacroiliac joint-related pain has also been reported in a proportion of patients presenting with low back pain. Therefore, identifying and treating possible SIJ-related dysfunction may be useful in selected patients(Booth, Morris, & Rheumatology, 2019).

Different physiotherapy approaches are used for the management of mechanical low back pain and SIJ-related problems. These include repeated exercises, joint mobilization and manipulation, bracing, physical modalities, patient education, aerobic conditioning, and therapeutic exercises(Booth et al., 2019). Exercise treatment may include hamstring stretching, strengthening exercises, core stabilization, and exercises for pelvic control(Hayden, Ellis, Ogilvie, Malmivaara, & van Tulder, 2021). Manual techniques such as muscle energy techniques (METs) are also used in clinical practice to manage some pelvic and lumbopelvic dysfunctions (Santos et al., 2022; Yoon, Jung, Cho, & Shin, 2023).

Pelvic asymmetry and altered innominate position have been suggested as possible contributors to disturbed lumbopelvic mechanics. In clinical practice, the position of the posterior superior iliac spine (PSIS) is sometimes used to identify possible anterior or posterior innominate rotation. Manual correction techniques may then be used with the aim of improving pelvic position and muscle balance(Ludwig et al., 2024; Trager et al., 2024). Therapeutic exercises targeting the hip abductors, adductors, gluteal muscles, hamstrings, and pelvic stabilizers may also help improve pelvic control and functional movement(Jangra, Kaur, Malik, Rani, & Therapies, 2025; Santamaría et al., 2023).

Although therapeutic exercises and manual correction techniques are both used for patients with mechanical low back pain and SIJ dysfunction, only limited research has directly compared these two approaches in patients with innominate dysfunction. Most previous studies have focused on exercise therapy, stabilization, muscle imbalance, or manual treatment as separate interventions. Therefore, it is still uncertain whether posterior innominate correction gives better results for pain and disability than a therapeutic exercise program.

Comparing these treatments is important in physiotherapy practice. Therapeutic exercises can be taught to patients and can also be performed at home, whereas innominate correction requires treatment by a physiotherapist. If both approaches produce similar outcomes, exercise-based treatment may provide a practical option for patients. On the other hand, if correction techniques provide greater improvement, they may be useful as part of the treatment program.

Therefore, this study was conducted to compare posterior innominate correction using a muscle energy technique with therapeutic exercises for reducing pain and disability in patients with mechanical low back pain associated with sacroiliac joint dysfunction.

Materials and Methods

Study Design and Setting

A quasi-experimental study was carried out at the outpatient departments of Fatima Memorial Hospital, Shadman, Lahore, and Specialist Care Hospital, Okara, Pakistan. Fifty patients with low back pain were recruited through non-probability purposive sampling. After enrollment, participants were assigned to two groups by lottery method, with 25 patients in each group.

Participants

Patients of either sex who reported low back pain greater than 3 on the Numeric Pain Rating Scale (NPRS) were included in the study. The planned age range was 30 to 65 years. Patients were excluded if their symptoms were associated with serious spinal or systemic conditions such as rheumatoid arthritis, infection, tumor, fracture, osteoporosis, or spinal stenosis. Patients with lumbar nerve root involvement, lumbar muscle tear confirmed by diagnostic imaging, central nervous system disorders, previous lumbar or thoracic spine surgery, significant spinal trauma, red-flag symptoms, or systemic rheumatic disease were also excluded. Those who were unwilling to undergo treatment or had received treatment for back pain from another healthcare practitioner during the previous month were not enrolled.

Interventions

Participants were divided into two treatment groups. Group A received posterior innominate correction using a muscle energy technique, while Group B received a therapeutic exercise program. Both groups received the same baseline treatment consisting of ultrasound therapy at 1 MHz for 3 minutes, hot pack application for 10 minutes, and one set of 10 gluteal setting exercises.

For posterior innominate correction, the patient was positioned in prone lying and the therapist stood on the opposite side of the affected sacroiliac joint. One hand supported the anterior aspect of the patient's knee, while the other monitored movement around the posterior pelvis. The affected leg was slowly extended until the first point of resistance was reached. The patient was then asked to flex the hip gently against the therapist's resistance using approximately 20% of maximal effort for 10 seconds. After relaxation, the therapist gently moved the leg toward the new movement barrier during exhalation. No forceful movement was applied. The technique was repeated when required to reduce restriction and improve pelvic movement(Al Matif et al., 2023).

Participants in the therapeutic exercise group performed hamstring stretching for three repetitions with a 30-second hold, one set of 10 Williams flexion exercises, one set of 10 pelvic rotations, anterior and posterior pelvic tilting in supine lying, and one set of 10 hip abductor isometric contractions with a 3-second hold. Stretching and strengthening exercises are commonly used in the management of chronic non-specific low back pain and may help reduce pain and improve function(Hayden, Van Tulder, & Tomlinson, 2005).

Outcome Measures

Pain and disability were assessed using the Numeric Pain Rating Scale (NPRS), Oswestry Disability Index (ODI), Roland–Morris Disability Questionnaire (RMDQ), and clinical palpation assessment. These measures were used to evaluate changes in pain intensity, functional disability, and clinical findings during the treatment period.

Data Collection Procedure

Written informed consent was obtained from all participants before treatment. Demographic information and relevant medical history were recorded using a pre-designed data collection form. Each participant underwent an initial assessment that included history taking, physical examination, lumbar spine assessment, and baseline recording of NPRS, ODI, RMDQ, and palpation findings.

Treatment was continued for three weeks. Patients were reassessed during the treatment period, including after the 2nd, 4th, and 6th visits. At each follow-up, pain, disability, and clinical findings were recorded using the same assessment tools. The same researcher carried out the interventions and collected outcome data throughout the study.

Statistical Analysis

Data were analyzed using SPSS version 26 for Windows, with statistical significance set at $p \leq 0.05$. Demographic and clinical characteristics were summarized using descriptive statistics. Continuous variables were presented using measures of central tendency and variability, while categorical variables were reported as frequencies and percentages.

Results

A total of 50 participants were included in the study, with 25 participants in the posterior innominate correction group and 25 in the therapeutic exercise group. The demographic and clinical characteristics of both groups are summarized in Table 1.

Table 1. Baseline demographic and clinical characteristics of participants

Characteristics	Posterior Innominate Correction (n=25)	Therapeutic Exercises (n=25)
Age, years, mean ± SD	38.84 ± 11.43	39.84 ± 8.70
Sitting time, hours/day, mean ± SD	6.84 ± 2.87	7.00 ± 3.18
Male, n (%)	8 (32.0)	14 (56.0)
Female, n (%)	17 (68.0)	11 (44.0)
Acute pain, n (%)	8 (32.0)	9 (36.0)
Chronic pain, n (%)	17 (68.0)	16 (64.0)
Sedentary lifestyle, n (%)	7 (28.0)	1 (4.0)
Active lifestyle, n (%)	18 (72.0)	24 (96.0)

The mean age and daily sitting duration were similar in both groups. Chronic pain was more common than acute pain in both treatment groups. Females made up a greater proportion of the posterior innominate correction group, whereas males were slightly more common in the therapeutic exercise group. Most participants in both groups reported an active lifestyle.

Table 2. Between-group comparison of NPRS scores during the treatment period

Assessment	Mean Difference	t	df	p-value
Pretreatment	0.44	1.011	48	0.317
Week 1	0.00	0.000	48	1.000
Week 2	0.24	0.539	43.350*	0.593
Week 3	0.36	1.095	48	0.279

*Welch's result reported because the assumption of equal variances was not satisfied.

There was no statistically significant difference in NPRS scores between the posterior innominate correction and therapeutic exercise groups at baseline or at weeks 1, 2, and 3 (all $p>0.05$). These findings indicate that the reduction in pain followed a broadly similar pattern in both groups during the three-week treatment period.

Table 3. Between-group comparison of disability outcomes (ODI and RMDQ)

Outcome	Assessment	Mean Difference	t	df	Reported p-value
ODI	Pretreatment	1.04	0.690	48	0.493
ODI	Week 1	-0.60	-0.362	48	0.719
ODI	Week 2	0.60	0.480	48	0.633
ODI	Week 3	1.20	1.859	34.300*	0.072
RMDQ	Pretreatment	0.32	0.460	48	0.647
RMDQ	Week 1	0.24	0.240	48	0.811
RMDQ	Week 2	1.32	2.150	48	0.067†
RMDQ	Week 3	0.76	1.633	35.793*	0.111

*Welch's result used where the equal-variance assumption was not satisfied. †The Week-2 RMDQ *t* statistic and reported *p*-value in the source output appear internally inconsistent and should be checked against the original SPSS output before publication.

No statistically significant between-group differences were reported for ODI at baseline or during any of the follow-up assessments. Similarly, the source data reported no significant difference between the groups for RMDQ scores. The Week-3 ODI and RMDQ comparisons also remained non-significant after accounting for unequal variances. Overall, neither intervention demonstrated clear statistical superiority in reducing disability during the three-week treatment period.

Table 4. Within-group changes from baseline during the three-week treatment period

Outcome	Assessment vs. Baseline	Posterior Innominate Correction Mean Change	p-value	Therapeutic Exercises Mean Change	p-value
NPRS	Week 1	2.64	<0.001	3.08	<0.001
NPRS	Week 2	4.68	<0.001	4.88	<0.001
NPRS	Week 3	6.32	<0.001	6.40	<0.001
ODI‡	Week 1	2.64	<0.001	3.08	<0.001

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Outcome	**Assessment vs. Baseline**	**Posterior Innominate Correction Mean Change**	**p-value**	**Therapeutic Exercises Mean Change**	**p-value**
ODI‡	Week 2	4.68	<0.001	4.88	<0.001
ODI‡	Week 3	6.32	<0.001	6.40	<0.001
RMDQ	Week 1	8.96	<0.001	8.88	<0.001
RMDQ	Week 2	10.12	<0.001	11.12	<0.001
RMDQ	Week 3	11.88	<0.001	12.32	<0.001

‡The ODI pairwise-comparison table in the supplied results contains exactly the same mean-change values as the NPRS table. These values should therefore be verified against the original SPSS dataset/output before inclusion in the final manuscript.

Within-group comparisons showed progressive improvement over the three-week treatment period. NPRS scores decreased significantly from baseline at each follow-up assessment in both groups (p<0.001), with baseline-to-week-3 reductions of 6.32 points in the posterior innominate correction group and 6.40 points in the therapeutic exercise group. RMDQ scores also showed significant within-group improvement. The baseline-to-week-3 change was 11.88 points in the posterior innominate correction group and 12.32 points in the therapeutic exercise group, with both comparisons reaching statistical significance (p<0.001).

Taken together, the results show that both treatment groups improved over time in terms of pain and disability. However, the between-group analyses did not demonstrate a statistically significant advantage of posterior innominate correction over therapeutic exercises. Therefore, the findings support the conclusion that both interventions were associated with improvement, but superiority of either intervention was not demonstrated.

Discussion

The present study compared posterior innominate correction using a muscle energy technique with therapeutic exercises in patients with mechanical low back pain associated with sacroiliac joint dysfunction. Both groups showed improvement in pain and disability during the three-week treatment period. However, no statistically significant differences were found between the groups for NPRS, ODI, or RMDQ scores. These findings suggest that both interventions may be useful, but neither treatment showed a clear advantage over the other.

Pelvic asymmetry has traditionally been considered a possible contributor to low back pain. However, its clinical importance remains uncertain. Levangie found no clinically meaningful association between static pelvic asymmetry and low back pain and suggested caution when treatment decisions are based mainly on pelvic landmark asymmetry(Levangie, 1999). More recent evidence also indicates that identification of sacroiliac joint pain should not depend on a single physical finding or the position of the PSIS. A systematic review by Saueressig et al. reported limited diagnostic certainty even when SIJ pain-provocation tests were used in clusters (Saueressig et al., 2021). Therefore, the clinical response to innominate correction should not necessarily be interpreted as proof that a structural pelvic displacement has been permanently corrected.

The findings of the present study are consistent with Nejati et al. who compared exercise therapy, manipulation, and a combination of both in patients with SIJ dysfunction(Nejati, 2019). Exercise and manipulation both improved their pain and impairment, but combining the two therapies did not consistently yield any extra benefits. Similarly, Kamali et al. discovered that there was no discernible difference between manipulation and stabilization exercises in terms of improving pain and impairment(Kamali et al., 2019). These results strongly corroborate the current study's findings, which showed improvement without significant between-group differences from both posterior innominate correction and therapeutic activities.

Additionally, Javadov et al. noted that individuals with SIJ dysfunction benefited from manual therapy and exercise regimens(Javadov, Ketenci, & Aksoy, 2021). More significantly, Trager et al.'s 2024 systematic review and meta-analysis, which included 16 randomized controlled trials, discovered that SIJ manual therapy may lessen disability, however its impact on pain was less clear. The review was unable to establish that one particular manual therapy technique was superior to other approaches (Trager et al., 2024). This supports the present findings and suggests that manual therapy may have a role in treatment but should not be considered superior to active rehabilitation on the basis of current evidence.

The improvement seen in the therapeutic exercise group is also supported by the broader evidence for low back pain management. Hayden et al. (Hayden et al., 2021), in a Cochrane review, found moderate-certainty evidence that exercise improves pain in people with chronic low back pain. Differences between exercise and manual therapy were small. Current clinical practice guidelines also recommend exercise as an important part of treatment for chronic low back pain(George et al., 2021). A systematic review conducted to inform the World Health Organization guideline similarly concluded that structured exercise probably reduces pain and functional limitations in adults with chronic primary low back pain (Verville et al., 2023).

Recent evidence further supports these observations. Jangra et al.'s 2025 systematic review and meta-analysis found that in individuals with SIJ dysfunction, exercise, mobilization, and muscular energy treatments improved pain. Additionally, exercise has been shown to have positive impacts on disability (Jangra et al., 2025). These results imply that both manual and exercise-based therapies may have therapeutic benefit, and that the patient's presentation, functional limitations, and reaction to treatment should be taken into consideration when selecting a course of treatment rather than relying solely on assumed pelvic alignment.

There are certain limitations to the current investigation. Purposive sampling was used to recruit participants, the sample size was tiny, and the follow-up period was only three weeks. It was challenging to pinpoint the precise amount of improvement brought about by the innominate correction or therapeutic exercise program because both groups also got ultrasound, hot packs, and gluteal exercises. In addition, treatment and assessment were performed by the same researcher, which may have introduced measurement bias. Future randomized controlled trials should include larger samples, blinded outcome assessment, standardized diagnostic criteria, and longer follow-up periods.

Conclusion

Both posterior innominate corrections using a muscle energy technique and therapeutic exercises were associated with improvement in pain and disability in patients with mechanical low back pain and sacroiliac joint dysfunction. No statistically significant difference was demonstrated between the two interventions during the three-week treatment period. Therefore, the findings do not establish superiority or statistical equivalence of either treatment. Therapeutic exercise may provide a practical approach because it can be continued independently, while manual correction techniques may be used as an adjunct according to individual clinical findings and treatment response.

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