

Observation on the Therapeutic Effect of Core Stability Training of Lumbar and Back Muscles Combined with Dynamic Joint Mobilization on Patients with Sacroiliac Joint Dysfunction

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Abstract: *Objective:* To explore the clinical efficacy of core stability training of the lumbodorsal muscles combined with dynamic joint mobilization in patients with sacroiliac joint dysfunction. *Methods:* From October 2023 to December 2025, 38 patients with sacroiliac joint dysfunction were randomly divided into a training group ($n = 13$), a treatment group ($n = 12$), and a combined intervention group ($n = 13$). The training group received core stability training of the lumbodorsal muscles, the treatment group received Mulligan's technique, and the combined intervention group first received core stability training of the lumbodorsal muscles followed by Mulligan's technique. Before treatment and after six weeks of treatment, evaluations were conducted using the Numeric Pain Rating Scale (NPRS), the Oswestry Disability Index (ODI score), lumbar range of motion (ROM), and pressure pain threshold (PPT). *Results:* After six weeks of treatment, both the treatment group and the combined intervention group showed a decrease in NPRS scores compared to before intervention ($P < 0.05$). All three groups showed a decrease in ODI scores compared to before intervention ($P < 0.05$), with the combined intervention group having lower NPRS scores than the training group ($P < 0.05$) and lower lumbar extension ROM than the treatment group ($P < 0.05$). *Conclusion:* Core stability training of the lumbodorsal muscles combined with dynamic joint mobilization can effectively alleviate pain and improve dysfunction in patients with sacroiliac joint dysfunction, demonstrating good clinical application value.

Keywords: Sacroiliac joint dysfunction; Core stability training of the lumbodorsal muscles; Dynamic joint mobilization

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1. Introduction

Low back pain is a common musculoskeletal disorder, and sacroiliac joint dysfunction is a common subtype^[1]. Clinical treatments include exercise, manual therapy, medication, and surgery, among which core stability

training is widely used ^[2]. However, the efficacy of a single type of training is limited, and evidence for combined treatments remains insufficient. This study adopts core stability training combined with dynamic joint mobilization to evaluate its clinical efficacy.

2. Subjects and methods

2.1. General information

Thirty-eight patients with sacroiliac joint dysfunction who visited the Rehabilitation Medicine Department of the First Affiliated Hospital of Hainan Medical University in Haikou City from October 2023 to December 2025 were selected as the study subjects, including 8 males (21.1%) and 30 females (78.9%), with an average age of 38.76 ± 10.44 years. The 38 patients were randomly divided into a training group (13 cases), a treatment group (12 cases), and a combined intervention group (13 cases) using a random number table method. This study was approved by the hospital's Medical Ethics Committee (Ethics Approval Number: 2023-KYL-164).

2.2. Inclusion and exclusion criteria

Inclusion criteria: (1) Meeting the relevant diagnostic criteria of the 2021 Chinese Expert Consensus on the Diagnosis and Treatment of Sacroiliac Joint Pain, with diagnosis supported by CT or MRI examination; (2) Presenting with unilateral or bilateral persistent dull pain or needle-like pain; (3) Showing asymmetry in gait, shoulders, or pelvis on physical examination, with significant tenderness within 2 cm of the posterior superior iliac spine; (4) Having at least 3 positive results in sacroiliac joint pain provocation tests; (5) Negative results in the straight leg raise test and neurological examination. Exclusion criteria: (1) Spinal pathologies (e.g., infection, tumor, osteoporosis, fracture, structural deformity, inflammatory disease), radicular pain/radiculopathy (e.g., radicular syndrome or cauda equina syndrome), recent fracture or surgery in the lumbosacral or pelvic region; (2) Fear of manual therapy, etc.

2.3. Treatment methods

All three groups received treatment for 6 weeks, 3 times a week.

2.3.1. Training group

The training group received core stability training of the lumbodorsal muscles, mainly including the following exercises ^[3,4]: (1) Transversus abdominis training: The patient lies supine with hips and knees flexed, adjusts breathing, and actively contracts the abdomen during exhalation to draw the abdominal wall inward toward the spine. (2) Bird-dog exercise: In a quadrupod position, alternately lift the opposite upper and lower limbs while maintaining trunk stability. (3) Side bridge training: Lie on the side, support the body with the elbow and foot, and maintain the trunk in a straight line. (4) Bridge exercise: Lie supine with knees flexed, contract the gluteal and lumbodorsal muscles to elevate the pelvis. Each exercise is performed 10–15 times per set, 3 sets each time. As tolerance increases, a balance pad or Swiss ball can be used to increase training difficulty.

2.3.2. Treatment group

The treatment group received Mulligan's dynamic joint mobilization (Mobilisations With Movements, MWM) ^[5]. The direction of sacroiliac joint dysfunction is determined based on motion palpation: posteromedial MWM is used for anterior iliac dysfunction, and anterolateral MWM is used for posterior iliac dysfunction. Treatment is performed within a pain-free or significantly reduced pain range, with each movement repeated 6–10 times, 3 sets each time, approximately 10 minutes per session.

2.3.3. Combined intervention group

The combined intervention group received dynamic joint mobilization combined with core stability training, with the same treatment content and dosage as the above two groups. The combined treatment aims to first correct abnormal joint position and movement patterns through manual therapy, then consolidate pelvic and lumbar stability through core stability training to reduce recurrence.

2.4. Observation indicators

2.4.1. Pain perception

The degree of pain was assessed using the 0–10 Numeric Pain Rating Scale (NPRS) ^[6], with higher scores indicating more severe pain.

2.4.2. Functional disability

The degree of lumbodorsal-related functional disability was assessed using the Oswestry Disability Index (ODI) ^[7], with higher scores indicating more severe functional disability.

2.4.3. Range of motion

Lumbar flexion and extension range of motion (ROM) ^[8] were measured.

2.4.4. Pressure pain threshold

The pressure pain threshold (PPT) ^[9] was measured using a handheld push-pull dynamometer, recording the pressure value when the patient first felt pain, measured separately on the left and right sides.

2.5. Statistical methods

Statistical analysis was performed using SPSS 20.0 software. Measurement data conforming to a normal distribution were expressed as mean \pm standard deviation (SD). Paired sample t-tests were used for within-group comparisons, one-way analysis of variance was used for between-group comparisons, and the LSD method was used for post-hoc pairwise comparisons. A *P*-value <0.05 was considered statistically significant.

3. Results

3.1. Comparison of general information among the three groups

There were no significant differences in general information such as gender, age, and body mass index among the three groups (*P* > 0.05). See **Table 1**.

Table 1. Comparison of general information among the three groups of subjects (mean \pm SD)

	Training group	Treatment group	Combined intervention group
Number of participants (persons)	13	12	13
Age (years)	38.76 \pm 10.44	40.00 \pm 8.84	38.23 \pm 12.99
Male/Female	3/10	2/10	3/10
Height (cm)	164.31 \pm 6.51	165.17 \pm 8.96	166.77 \pm 8.72
Body weight (kg)	58.02 \pm 6.01	57.17 \pm 7.79	58.81 \pm 7.09
Body mass index (kg/m ²)	21.71 \pm 2.08	20.99 \pm 2.69	21.10 \pm 1.39

3.2. Comparison of NPRS scores among the three groups of patients

In this study, a comparison of the pre-intervention NPRS scores among the three groups of patients revealed no significant differences ($P > 0.05$). After the intervention, both the treatment group and the combined intervention group showed a decrease in NPRS scores compared to their pre-intervention levels ($P < 0.05$), with the combined intervention group having significantly lower NPRS scores than the training group ($P < 0.05$). See **Table 2**.

Table 2. NPRS (points, mean \pm SD) of the three groups before and after intervention

	Training group ($n = 13$)	Treatment group ($n = 12$)	Combined intervention group ($n = 13$)
Before intervention	3.62 \pm 1.33	4.29 \pm 2.07	3.5 \pm 1.29
After intervention	3.15 \pm 0.99 ^a	2.00 \pm 1.54 ^b	1.65 \pm 1.41
<i>P</i> value	0.273	0.005	0.010

Note: ^a indicates that the comparison between the combined intervention group and the training group shows $P < 0.05$; ^b indicates that the comparison between the combined intervention group and the treatment group shows $P < 0.05$.

3.3. Comparison of ODI scores among the three groups of patients

In this study, there was no significant difference in ODI scores among the three groups of patients before intervention ($P > 0.05$). After intervention, the ODI scores of all three groups decreased compared to those before intervention ($P < 0.05$), with no significant difference among the three groups ($P > 0.05$). See **Table 3**.

Table 3. ODI scores (points, mean \pm SD) before and after intervention for three groups of subjects

	Training group ($n = 13$)	Treatment group ($n = 12$)	Combined intervention group ($n = 13$)
Preintervention	36.15 \pm 11.49	36.00 \pm 7.68	36.77 \pm 9.64
Postintervention	30.00 \pm 9.06	28.67 \pm 7.24	27.54 \pm 10.43
<i>P</i> value	<0.001	<0.001	<0.001

3.4. Comparison of forward flexion range of motion (ROM) among the three groups of patients

In this study, there was no significant difference in forward flexion ROM among the three groups of patients before and after intervention ($P > 0.05$). See **Table 4**.

Table 4. Range of motion (ROM) in forward flexion ($^{\circ}$, mean \pm SD) before and after the intervention for three groups of participants

	Training group ($n = 13$)	Treatment group ($n = 12$)	Combined intervention group ($n = 13$)
Pre-intervention	27.64 \pm 5.13	28.33 \pm 4.40	28.61 \pm 5.29
Post-intervention	27.08 \pm 7.96	26.70 \pm 4.46	29.59 \pm 5.98
<i>P</i> value	0.785	0.414	0.590

3.5. Comparison of extension range of motion (ROM) among the three groups of patients

When comparing the extension ROM before and after intervention among the three groups of patients, no significant differences were observed among the groups ($P > 0.05$). After intervention, the extension ROM in the combined intervention group was significantly lower than that in the treatment group ($P < 0.05$). See **Table 5**.

Table 5. Extension ROM ($^{\circ}$, mean \pm SD) before and after intervention among the three groups of subjects

	Training group ($n = 13$)	Treatment group ($n = 12$)	Combined intervention group ($n = 13$)
Pre-intervention	13.72 \pm 2.80	14.86 \pm 3.93	15.56 \pm 4.29
Post-intervention	15.85 \pm 3.41 ^a	17.08 \pm 4.14 ^b	14.23 \pm 4.24
<i>P</i> value	0.073	0.188	0.260

Note: ^a indicates a significant difference ($P < 0.05$) between the combined intervention group and the training group; ^b indicates a significant difference ($P < 0.05$) between the combined intervention group and the treatment group.

3.6. Comparison of left PPT among the three groups

When comparing the left PPT of the three groups before and after intervention, there were no significant differences among the three groups ($P > 0.05$). See **Table 6**.

Table 6. Left PPT of subjects in the three groups before and after intervention (mean \pm SD)

	Training group ($n = 13$)	Treatment group ($n = 12$)	Combined intervention group ($n = 13$)
Pre-intervention	2.10 \pm 1.04	2.13 \pm 0.88	1.95 \pm 0.48
Post-intervention	2.29 \pm 1.09	2.10 \pm 0.51	2.20 \pm 0.44
<i>P</i> value	0.334	0.898	0.198

3.7. Comparison of right PPT among the three groups

When comparing the right PPT of the three groups before and after the intervention, there were no significant differences observed among the three groups ($P > 0.05$). See **Table 7**.

Table 7. Right PPT of subjects in the three groups before and after intervention (mean \pm SD)

	Training group ($n = 13$)	Treatment group ($n = 12$)	Combined intervention group ($n = 13$)
Pre-intervention	2.27 \pm 1.15	2.11 \pm 0.62	2.06 \pm 0.45
Post-intervention	2.11 \pm 1.01	2.19 \pm 0.49	2.20 \pm 0.42
<i>P</i> value	0.445	0.707	0.366

4. Discussion

The stability of the sacroiliac joint relies on the combined action of joint structure, ligament system, muscular system, and neural control system. When ligaments are lax, pelvic alignment is abnormal, or local stabilizing muscles are insufficiently controlled, the sacroiliac joint may experience minor dislocation and abnormal stress distribution, thereby inducing lumbosacral pain, functional limitations, and abnormal movement patterns^[10,11].

Mulligan's mobilization with movement emphasizes the application of appropriate assisted gliding during the patient's active movement to correct abnormal joint positions or movement trajectories^[12,13]. This method can restore local mechanical balance with minimal pain induction, reduce mechanical stimulation of the joint capsule, ligaments, and surrounding soft tissues, thereby alleviating pain. In addition to mechanical effects, manual therapy may also produce analgesic effects through neurophysiological mechanisms such as modulating central and peripheral pain transmission and activating descending inhibitory systems^[14-17]. Core stability training primarily targets deep stabilizing muscles such as the transverse abdominis, multifidus, pelvic floor muscles, and diaphragm. By enhancing the activation capacity and synergistic contraction level of these muscle groups, it can strengthen the dynamic stability of the lumbar-pelvic complex, improve posture control and load transfer efficiency, and reduce compensatory pain caused by insufficient stability^[13,18]. For patients with sacroiliac joint dysfunction, relying solely on passive treatment may be difficult to maintain long-term efficacy, while core stability training can provide continuous support at the functional level^[19].

The results of this study show that both the treatment group and the combined intervention group outperformed the training group in terms of pain improvement, and the NPRS score of the combined intervention group was lower than that of the training group after treatment, indicating that mobilization with movement has a more direct effect on pain relief, while combined treatment can further enhance efficacy. The ODI results showed that all three groups improved functional impairment, suggesting that both exercise therapy and manual therapy contribute to enhancing patients' daily activity capabilities. The combined group showed a numerically greater improvement in ODI, indicating that the treatment approach of "manual correction combined with active stabilization" has certain advantages.

However, this study revealed that after intervention, the extension range of motion (ROM) in the combined intervention group was significantly lower than that in the treatment group, possibly related to the increased lumbar stability resulting from core stability training of the lumbar and back muscles. Future research needs to further explore the impact of core stability training on lumbar stability. Although there was an upward trend in PPT, it did not reach statistical significance, possibly due to factors such as a small sample size, short treatment duration, and significant individual differences in pain sensitivity. The pressure pain threshold is greatly influenced by local tissue status, psychological factors, and the degree of central sensitization, and short-term intervention may not fully reflect its changes^[20,21]. Future research could appropriately expand the sample size, increase follow-up observations, and incorporate objective indicators such as surface electromyography, ultrasound, or motor control assessment to more comprehensively elucidate the mechanism of combined treatment.

5. Conclusion

In summary, core stability training of the lumbar and back muscles combined with mobilization with

movement can reduce pain and improve functional impairment in patients with sacroiliac joint dysfunction. However, due to the small sample size in this study, future research could expand the sample size and increase follow-up duration to further track the efficacy of core stability training of the lumbar and back muscles combined with mobilization with movement in treating sacroiliac joint dysfunction.

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Disclosure statement

The authors declare no conflict of interest.

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