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ORIGINAL ARTICLE

The Correlation between Sacroiliac Joint Dysfunction and Hip Adductor Tightness

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ABSTRACT

Background. Low back pain is one of the ten most common causes of disability, and sacroiliac joint dysfunction is one of the most common causes of it. **Objectives.** This study aimed to find if there is any association between hip adductor tightness with sacroiliac joint dysfunction. **Methods.** Sixty people who had attended our Sports Medicine Clinic took part in this study (30 in each group). The case group contains patients who had sacroiliac joint dysfunction based on physical examination, and the control group was patients with similar characteristics who attended for reasons other than spinal or lower limb problems. A fixed sports medicine specialist assessed both groups' tenderness and tightness of adductor muscles. **Results.** The level of tenderness (Kendall Tau correlation coefficient equal to 0.440 and P<0.001) and tightness (Kendall Tow correlation coefficient equal to 0.479 and P <0.001) of the hip adductor muscles in the case group were significantly higher. More people in the case group reported hip adductor muscle pain than the control group (P <0.001). **Conclusion.** This study showed more hip adductor muscle involvement in people suffering from sacroiliac joint dysfunction.

KEYWORDS: ***Sacroiliac Joint Dysfunction, Hip Adductors, Low Back Pain, Muscle, Tightness.***

INTRODUCTION

Low back pain is one of the most common causes of disability and imposes a high annual cost on the healthcare system (1, 2). It is more common in high-income countries (3), and its prevalence is estimated at 3-20%. It is more common in middle age and people over 50 (4), and about 70-80% of people develop low back pain during their lifetime (5, 6). One of the most common causes of low back pain is sacroiliac joint dysfunction (7, 8), accounting for 15-25% of the causes of back pain (9).

The sacroiliac joint (SIJ) is the largest joint in the body, which is a unique synovial joint with limited movements, including nutation (forward rotation) and counter-nutation (backward rotation). This joint is surrounded by numerous muscles and ligaments that, in addition to providing stability, connect this joint to different parts of the spine, pelvis, and groin (9, 10). SIJ connects the axial skeleton to the lower limb and is responsible for transmitting force to the lower limb (5). The pelvic joints are connected in a closed kinetic chain, and the ligaments make a stronger connection between the spine, pelvis, and groin, according to which the SIJ and the symphysis pubis can interact (11).

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Diagnosis of pain and SIJ dysfunction is completed using invasive and non-invasive methods (12). Invasive methods include the injection of local anesthetic into the SIJ capsule (12, 13). Non-invasive methods include touching and provocative tests of the location of SIJ (14-16). A single test is usually insufficient to diagnose SIJ pain and dysfunction (5). It is recommended to perform 6 tests simultaneously, and the criterion for detecting the positive of 3 tests is recommended (17, 18).

Hip adductors include adductor longus, adductor magnus, and adductor brevis. Adductor longus is derived from the inferior ramus of the pubis, adductor brevis is derived from the upper pubis ramus, and adductor magnus is derived from the upper pubis ramus and ischial tuberosity (19).

In addition to hip adduction, these muscles help stabilize the hip and lower limbs during the standing phase of the gait. One of the most common symptoms of hip adductor muscle disorder is groin and inner thigh pain, which worsens with walking and running (11).

Diagnosis of pain and stiffness of hip adductors is by clinical examination. Clinical examinations included (20):

1) Proximal touch of the adductor muscles to check for tenderness
2) Touch the adductor muscles to check muscle stiffness
3) Adduction of the lower limb against resistance
4) Stretching of hip adductors

The sacroiliac joint plays an important role in the transmission of forces, and any disturbance in this joint can upset the balance of these forces.

Previous studies have shown that in low-back pain, the biomechanics of standing and walking undergo changes, the most important of which are changes in rotation and reduced abduction of the hip and lower limbs (21).

In our clinical experience, we noticed a possible coexistence of hip adductor muscle stiffness and pain in patients with SIJ pain and dysfunction. Since there was insufficient evidence to support this finding, this study aimed to investigate the correlation between hip adductor stiffness and SIJ dysfunction and report the results for the first time.

MATERIALS AND METHODS

Study Design. Participants were selected from patients who attended the Sports Medicine Clinic of Taleghani Hospital during 2019-2020 for low back pain and were diagnosed with SIJ dysfunction. The control group was selected from those who attended the clinic with a complaint other than spinal or lower extremity problems during the same period.

The pain and stiffness of hip adductor muscles were evaluated and measured by a fixed sports medicine specialist in both case and control groups by performing a series of clinical examinations.

This study was performed in the sports medicine department of Taleghani Hospital in Tehran under the Medical School of the Shahid Beheshti University of Tehran (IRCT registration ID: IR.SBMU.RETECH.REC.1399.756.).

Participants. The sample size was 60 people, including 30 in the case group and 30 in the control group.

Inclusion criteria included: age 18-60 years, low back pain episode of fewer than 3 months, presence of SIJ dysfunction (3 or more positive test of SIJ tests), equality of true and apparent length of lower limb (apparent length: distance between the navel and below the medial ankle, true length: distance between anterior superior iliac spine and lower of the medial ankle), no history of severe trauma to the spine, pelvis, lower limbs, abdomen, and chest during the last 12 months, no history of spinal, pelvic, lower limb, abdominal and chest surgery for the past 12 months, absence of localized spinal cord injury including tumor, infection and fracture, absence of known congenital disorders of the pelvis and spine that limit movement or obstruction of examination, absence of known systemic arthropathy, absence of neuropathy, absence of metabolic disorders, absence of no signs or evidence of radiculopathy, no pregnancy, no first six months after delivery, no menopausal women.

Exclusion criteria included: any musculoskeletal disorders of the lower extremities that interfere with movement or examinations and unwillingness to cooperate during the study.

After selecting the samples, all stages of the study were explained to them and written consent was obtained from them to carry out the project. Patient information was kept confidential.

Study Protocol. Individuals underwent clinical examinations by a fixed sports medicine specialist. These examinations included:

1) Touching SIJ to check for tenderness.

Information regarding SIJ tenderness was recorded as follows: 1- No pain 2- Mild tenderness (causing pain with deep touch) 3- Moderate tenderness (causing pain with superficial touch) 4- Severe tenderness (severe reaction of the patient with superficial touch).

2)Performing six diagnostic tests for SIJ dysfunction (Figure 1):

a) Gaenslen test
b) Distraction test
c) Compression test
d) Sacral thrust test
e) Thigh thrust or femoral shear test
f) FABER test

The result was recorded by the same person as; Positive: causing pain similar to patient pain and Negative: painless.

If three or more of the six tests listed above were positive, the person was diagnosed with SIJ dysfunction and was placed in the case group.

The control group consisted of people without lumbar and lower extremity involvement who had no evidence of SIJ dysfunction on examination and were similar in age, sex, BMI, and level of physical activity.

People's height was measured in standard conditions using a meter attached to the wall without shoes. Weight was measured using a scale in which validity had been checked and with a minimum of usual clothing (shirts and light pants for men and coats and lightweight pants for women). BMI was calculated as weight in kilograms divided by height squared in meters.

The level of physical activity according to the ACSM guideline (at least 3 days a week for 30 minutes during the last 3 months of regular and targeted physical activity with moderate intensity) was divided into two groups: sedentary and active.

In the next stage, people in both groups underwent clinical examination to evaluate hip adductors, including:

I- Touching the origin of the adductor longus muscle to check the tenderness: tenderness was recorded as 1- painless 2- mild tenderness (causing pain with deep touch) 3- moderate tenderness (causing pain with superficial touch) 4- severe tenderness (severe patient reaction with superficial touch)

II-Touching the length of the adductor longus muscle to check muscle stiffness: stiffness was recorded as 1- Normal consistency 2- Touch of stiffness 3- Clear bulge

III-Lower limb adduction against resistance (Figure 2A): results were recorded positively (causing pain) and negatively (without pain)

IV- Stretching of hip adductors (Figure 2B): results were recorded positively (causing pain) and negatively (without pain).

A fixed sports medicine specialist performed all examinations.

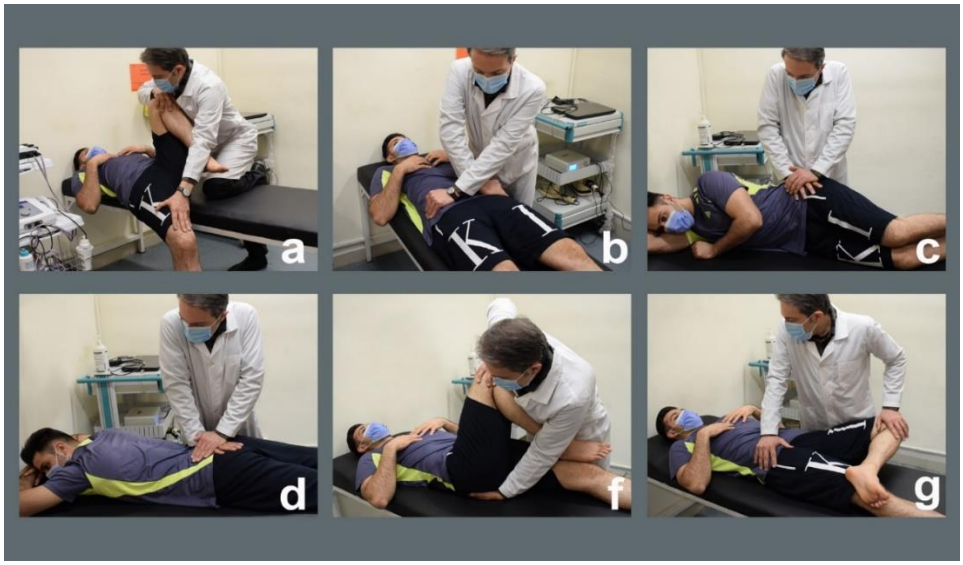

Figure 1. SIJ provocative physical examination maneuvers.

a: The Gaenslen maneuver, **b:** The distraction test, **c:** The compression test, **d:** The sacral thrust test, **f:** The thigh thrust or femoral shear test, **g:** The FABER (flexion, abduction, and external rotation) test.

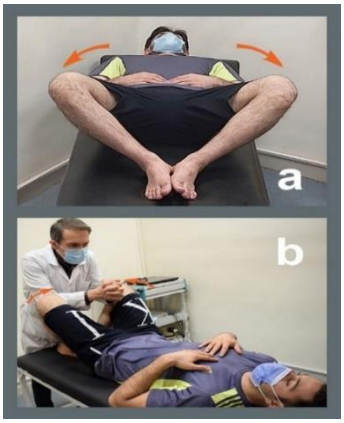

Figure 2. Hip adductors tests.
a: Stretching of the adductor muscles, **b:** Adduction against resistance.

Statistical Analysis. Analysis of data was blinded. Quantitative data was displayed using mean or standard, or median deviation and mid-quarter range, and qualitative data were displayed using frequency and percentage. Regarding variables such as stiffness and tenderness of the adductor, the maximum intensity for each person was compared between the two groups.

To compare the indices between the two study groups, chi-square tests (Fisher's exact P-Value was calculated if necessary), Kendall Tau B, independent t-test, and Mann-Whitney correlation coefficient were used. The significance level of statistical tests was considered 0.05, and analyzes were performed in SPSS software version 25.

RESULTS

A total of 60 subjects were examined, 30 in the case group (age:40.73 ± 8.88 years old) and 30 in the control group (age:40.73± 9.03 years old).

There were no statistically significant differences in mean age (P = 0.999), patient sex ratio (P = 0.999), delivery history (P = 0.999), body mass index status (P = 0.896) and activity level (P = 0.999) in the two study groups. Details are shown in Table 1.

The results of six tests for SIJ dysfunction are shown in Table 2.

-Sacroiliac joint tenderness:

In the case group, two people (6.7%) had mild tenderness, 20 people (66.7%) had moderate tenderness, 8 people (26.7%) had severe tenderness, and none of the subjects were without tenderness. Twenty-eight people (93.3%) of the control group did not have sacroiliac joint tenderness, and only two (6.7%) had mild tenderness. In the case group, the intensity of SIJ tenderness was significantly higher than in the control group (Kendall Tau correlation coefficient was 0.874 and P <0.001).

-Hip adductors tenderness:

In the examination of hip adductors tenderness, 4 people(13.3%) were without tenderness in the case group. In the control group, 14 people(46.7%) were without tenderness, 6 people(20%) in the case group and 10 people(33.3%) in the control group had mild tenderness, 15 people (50%) in the case group and 5 people (16.7%) in the control group had moderate tolerance, and 5 people (16.7%) in the case group and 1 people (3.3%) in the control group had severe tenderness. In the case group, the intensity of hip adductors tenderness was significantly higher than in the control group. (Kendall Tau correlation coefficient was 0.440 and P <0.001). The results are shown in Table 3.

-Hip adductors stiffness:

In the examination of hip adductor stiffness of people in the case group, 8 people (26.7%) had normal consistency, 17 people (56.7%) of patients had stiffness, and 5 people (16.7%) had clear bulging, and in the control group 23 people (76.7%) had normal consistency, 6 people (20%) had stiffness, 1 people (3.3%) had obvious bulging. The severity of hip adductor stiffness in the case group was significantly higher than in the control group (Kendall Tau correlation coefficient equal to 0.479 and P <0.001). The results are shown in Table 3.

-Hip adductors pain:

Twenty-four people (80%) in the case group and 9 (30%) in the control group suffered from hip adductor pain. The proportion of people

suffering from hip adductor pain in the case group was statistically significantly higher than in the control group (P <0.001). The results are shown in Table 3.

Hip adductor pain was assessed by two tests, including lower limb adduction against resistance and passive stretching of the adductors; the results are shown in Table 4.

Table 1. Base Line Characteristics

Variable		Groups		P-Value
		Case (n=30)	Control (n=30)	
Age	Average (standard deviation)	40.73 ± 8.88	40.73 ± 9.03	0.999
Sex				0.999
Male	Number(percent)	15 (50)	15 (50)	
Female	Number(percent)	15 (50)	15 (50)	
BMI				0.896
Normal	Number(percent)	14 (46.7)	15 (50)	
Overweight	Number(percent)	13 (43.3)	12 (40)	
Obese	Number(percent)	3 (10)	3 (10)	
Delivery history				0.999
Yes	Number(percent)	2 (13.3)	2 (13.3)	
No	Number(percent)	13 (86.7)	13 (86.7)	
Physical activity				0.999
Sedentary	Number(percent)	21 (70)	21 (70)	
Active	Number(percent)	9 (30)	9 (30)	

Table 2. Comparison of Sacroiliac Joint Pain and Dysfunction in Case and Control patient

Sacroiliac Dysfunction Test. Test Result	Groups		P-Value
	Case	Control	
	Number (Percent)	Number (Percent)	
Gaenslen test			< 0.001
Positive	29 (96.7)	1 (3.3)	
Negative	1 (3.3)	29 (96.7)	
Distraction test			< 0.001
Positive	16 (53.3)	0 (0)	
Negative	14 (46.7)	30 (100)	
Compression test			< 0.001
Positive	22 (73.3)	1 (3.3)	
Negative	8 (26.7)	29 (96.7)	
Sacral thrust test			< 0.001
Positive	15 (50)	1 (3.3)	
Negative	15 (50)	29 (96.7)	
Thigh thrust or femoral shear test			< 0.001
Positive	22 (73.3)	1 (3.3)	
Negative	8 (26.7)	29 (96.7)	
FABER test			< 0.001
Positive	26 (86.7)	3 (10)	
Negative	4 (13.3)	27 (90)	
Total result			< 0.001
Positive	30 (100)	0 (0)	
Negative	0 (0)	30 (100)	

Table 3. Determining and Comparing the Frequency of Tenderness, Stiffness and Pain of Hip Adductors in Case and Control Groups

Variable. Level of Variable Intensity	Groups		P-Value
	Case	Control	
	Number(Percent)	Number(Percent)	
Hip adductors tenderness			**< 0.001**
No pain	4 (13.3)	14 (46.7)	
Mild tenderness	6 (20)	10 (33.3)	
Moderate tenderness	15 (50)	5 (16.7)	

Severe tenderness	5 (16.7)	1 (3.3)	
Hip adductors tightness			**< 0.001**
Normal consistency	8 (26.7)	23 (76.7)	
Tight in touch	17 (56.7)	6 (20)	
Obvious bulging	5 (16.7)	1 (3.3)	
Hip adductors pain			**< 0.001**
Positive	24 (80)	9 (30)	
Negative	21 (70)	6 (20)	

Table 4. Determining and Comparing the Frequency of Hip Adductor Pain in Terms of Clinical Tests in Case and Control Groups

Test. Result	Groups		P-value
	Case	Control	
	Number(percent)	Number(percent)	
Lower limb adduction against resistance			0.001
Painless	15 (50)	27 (90)	
Painful	15 (50)	3 (10)	
Stretching of hip adductors			0.004
Painless	10 (33.3)	21 (70)	
Painful	20 (66.7)	9 (30)	

DISCUSSION

This study examines the correlation between pain and dysfunction of SIJ with pain and stiffness of hip adductors for the first time. The hypothesis was that hip adductors' pain and stiffness are associated with SIJ's pain and dysfunction. It was confirmed by the results of our study and showed that hip adductors are tender and stiffer in patients with SIJ pain and dysfunction. Besides, hip adductor pain was reported more commonly in these people. However, the results cannot determine the cause-and-effect relationship, meaning that SIJ dysfunction causes pain and stiffness of the hip adductors or vice versa, or there is a two-way relationship between them.

According to a study conducted by Kurosawa et al., the prevalence of groin pain in patients with SIJ dysfunction was significantly higher than in patients with sacroiliac spinal cord stenosis and lumbar disc herniation (22). Although they had not evaluated the cause of groin pain, now, concerning the results of this study, it can be postulated that adductor tightness is responsible for it.

SIJ pain is frequently seen in cross-country skiers and rowers (23). Also, athletes involved in unilateral loadings, such as kicking and throwing, are at increased risk (24). On the other hand, adductor injuries and groin pain are more common in sports involving kicking (25, 26).

The axial force of the body's weight enters the acetabulum and femoral head through the SIJ and tends to deflect the head of the femur. The adductor and abductor muscles try to stabilize the femoral position at the coronal level by applying reciprocal forces. The imbalance between these forces causes gait disturbance (10, 27). SIJ and symphysis pubis are linked in a closed kinetic chain and can interact (28). As the hip adductor muscles are connected to the pubis' upper and lower ramus, these muscles' forces are transmitted to the pelvis and eventually to the SIJ. As a result, SIJ disorders and hip adductors can interact also.

According to the results of this study, it is recommended that patients with SIJ pain and dysfunction be examined for hip adductors. It is recommended that future studies be performed to investigate the cause-and-effect relationship between the two disorders and the effect of hip adductor stiffness therapy on pain and SIJ dysfunction.

CONCLUSION

This study has revealed a correlation between sacroiliac joint dysfunction and the involvement of hip adductor muscles for the first time. It has been shown that these muscles were tenderer and tighter in people who were suffering from sacroiliac joint pain or dysfunction.

In this study, hip adductors were examined in general, and each was not examined separately.

This study was performed with the control group. A fixed sports medicine specialist examined all patients. Therefore, the tests (how to do the test and the power of touch) were the same for everyone. The case and control group members were selected from the same community to reduce bias.

APPLICABLE REMARKS

- This study has revealed a correlation between sacroiliac joint dysfunction and the involvement of hip adductor muscles for the first time.
- According to the results of this study, it is recommended that patients with SIJ pain and dysfunction be examined for hip adductors.

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AUTHORS' CONTRIBUTION

Study conceptualization and design: Mohammad Hassabi, Seyedeh Sara Shams. Data collection: Mohammad Hassabi, Seyedeh Sara Shams, Amir hosein Abedi Yekta, Shahin Salehi, Mehrshad Poursaeid Esfahani. Data analysis and interpretation: Mohammad Hassabi, Seyedeh Sara Shams, Mohammad-reza Sohrabi. Writing manuscript: Mohammad Hassabi, Seyedeh Sara Shams. All authors read and approved the final version of the manuscript.

SUPPORTED

Medical School of Shahid Beheshti University of Tehran (IRCT registration ID: IR.SBMU.RETECH.REC.1399.756.).

CONFLICT OF INTEREST

The authors mention that there is no "Conflict of Interest" in this study.

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