

# Investigating the Etiology and Diagnosis of Sacroiliac Joint Pain

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Received: 18 February 2021; Revised: 27 April 2021; Accepted: 10 June 2021

## Abstract

The sacroiliac (SI) joint is often characterized as a large, auricular-shaped, and diarthrodial synovial joint. The SI ligamentous structure is more extensive in the dorsal part due to the absence of the posterior capsule, which functions as a connecting band between the sacrum and ilium. In addition, a network of muscles supports the SI joint that helps deliver regional muscular forces to the pelvic bones. The third and fourth decades of life promote senescent changes manifested by surface irregularities, crevice formation, fibrillation, and clumping of chondrocytes.

**Keywords:** Sacroiliac Joint; Joint Capsule; Ankylosis

**Citation:** Abotalebi MH, Shafiei SH. Investigating the Etiology and Diagnosis of Sacroiliac Joint Pain. *J Orthop Spine Trauma* 2021; 7(3): 99-101.

## Background

The largest axial joint in the body is the sacroiliac (SI) joint, with a medium surface area of 17.5 cm<sup>2</sup> (1). The size, shape, and surface contour of the SI joint varies notably among adults and even within the same individual (2).

The SI joint is often characterized as a large, auricular-shaped, and diarthrodial synovial joint (3). The true synovial joint is defined as the anterior third of the interface between the sacrum and ilium; an intricate set of ligamentous connections comprises the rest of the junction (4). The SI ligamentous structure is more extensive in the dorsal part due to the absence of the posterior capsule, which functions as a connecting band between the sacrum and ilium (5).

The main goal of this ligamentous structure is to reduce motion in all planes of movement. Moreover, a network of muscles supports the SI joint that helps deliver regional muscular forces to the pelvic bones. The actions of some of these muscles affect joint mobility by functionally connecting to the SI joint ligaments. These muscles include the gluteus maximus, piriformis, and biceps femoris (6).

Vertical shearing potentially occurs in approximately 30% of the SI joints, owing to the more acute angulation of the short, horizontal articular component (7). During puberty, age-related changes occur in the SI joint and continue throughout life. The iliac surface becomes rougher, duller, and coated in some areas with fibrous plaques during adolescence. The third and fourth decades of life promote senescent changes manifested by surface irregularities, crevice formation, fibrillation, and clumping of chondrocytes. The capsule becomes collagenous and fibrous ankylosis occurs during the sixth decade of life, and the joint motion becomes markedly restricted. The erosions and plaque formation are ubiquitous in the eighth decade of life (8).

## Etiology

A combination of axial loading and rotation describes the mechanism of injury to the SI joint (9). Some

nociceptors present throughout the SI joint capsule, ligaments, and subchondral bone. Therefore, the pain might originate from any of the surroundings (10). The most common cause among the intra-articular (IA) etiologies are arthritis and spondyloarthropathies (11). The most frequent sources among the extra-articular (EA) etiologies are ligamentous and muscular injuries and enthesopathy (12).

## Predisposing Factors to SI Joint Pain

### Biomechanical Abnormalities:

Biomechanical abnormalities include leg length discrepancies, transitional anatomy, gait and persistent strain/low-grade trauma, scoliosis, pregnancy, and spine surgery (3). The SI joint pain in pregnancy is due to weight gain, exaggerated lordotic posture, third-trimester hormone-induced ligamentous relaxation, and the pelvic trauma associated with parturition (13).

Increased stress and abnormal force vectors on the ipsilateral lower extremity due to true and functional leg length discrepancies can cause SI joint pain (14).

**Surgery:** A common SI joint pain source is spine surgery, especially operations involving fusion to the sacrum. Increased SI joint stress occurs after surgery, which was least following L4-5 fusion and greatest after L4-S1 fusion. The most frequent causes for SI joint pain are motor vehicle collisions, falls, repetitive stress, and pregnancy, in descending order (15).

## Pain Pattern and Physical Examination

Another challenging step towards diagnosis is physical examination. An asymmetry, protrusion, or erythema are rarely shown in an inspection. Provocative maneuvers mainly guide physicians towards a diagnosis. The most common maneuver is Patrick's test, which shows SI joint pain during flexion, abduction, and external rotation. In addition, Gaenslen's test aggravates the SI joint pain during hip extension (16). During the Gaenslen's test, the examiner pushes downward/applies dorsal pressure toward the anterior aspects of both knees to facilitate the rotation motion (17).

The iliac gapping test and iliac compression test are



less frequent exams, which involve applying anterior pressure to the anterior superior iliac spine and lateral pressure to the uppermost iliac crest, respectively. During the thigh thrust test (femoral shear test), the examiner should apply a graded force through the femur's long axis, leading to the anterior-to-posterior shear to the SI joint on the same side (18).

Reliable results cannot be achieved throughout history nor physical examination solely (19). The above-mentioned common provocative maneuvers can identify 20% of asymptomatic patients (20).

#### Diagnostic Criteria

Diagnosis of the SI joint pain is particularly a challenge due to the probability of arising pain from different sources, including the piriformis region, the dorsolumbar fascia and musculature, lumbar discs, and lumbar facets. The diagnosis of the SI joint pain mainly relies on the patient's background, patient's ambulation, sitting, transitioning to standing, and performing several provocative physical evaluations that stress the SI joint (21).

The most common physical tests for the SI joint examination include joint distraction, compression, Gaenslen maneuver, flexion-abduction external rotation (FABER), also known as Patrick test, thigh thrust, and iliac gapping test (21).

While there is no definite "gold standard" for the SI joint pain, the performance of image-guided intra-articular blockade with local anesthetic has been confirmed as a target-specific method by many clinicians to assess clinically suspected SI joint symptomatology (22). Injections might be performed using fluoroscopy, computed tomography (CT) scan, and even magnetic resonance imaging (MRI) or ultrasound. Blind injections without image guidance are not recommended as previous studies showed that only 22% of these patients underwent intra-articular injection of the joint, with epidural or dorsal sacral foraminal flow demonstrating 24 and 44% of the time, respectively (23).

#### Conclusion

SI joint is a complex joint that is a common source of pain in the lower back region. The presentation is often nonspecific, and physical diagnostic tests have low diagnostic value and reliability. The performance of a diagnostic block is the current gold standard for diagnosis. Because of the complex biomechanics and anatomy of the joint, diagnosis and treatment will likely continue to be a challenge for physicians.

#### Conflict of Interest

The authors declare no conflict of interest in this study.

#### Acknowledgements

None.

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