The Sacroiliac Joint As a Factor in Low Back Pain: A Review

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Objectives: To review the normal anatomy and biomechanics of the sacroiliac joint (SIJ) and the pathological changes that occur to them and to determine whether SIJ dysfunction is a factor in idiopathic low back pain.

Data Sources: Articles containing information on the anatomy, biomechanics, and dysfunction of the SIJ. The databases searched were MEDLINE, the Cumulative Index to Nursing and Allied Health Literature, and SPORTDiscus.

Studies Used: Those found using the search terms sacroiliac joint and injury and sacroiliac joint and athletes. Additional sources were gathered from the reference lists of these initial sources.

Data Extraction: Data found pertinent to understanding the anatomy, biomechanics, and pathophysiology of the SIJ region were used, as well as data on the existence and prevalence of SIJ dysfunction and its relation to low back pain.

Conclusions: The literature provides strong evidence that SIJ dysfunction should be considered a major factor in the etiology of idiopathic low back pain.

Key Words: sacrum, athlete, dysfunction


Low back pain (LBP) has been estimated to occur, on at least 1 occasion, in approximately 80% of the population. Numerous conditions have been identified as causes of LBP. These include, but are not limited to, muscular strains, ligamentous sprains, fractures, vertebral disk disruption, and degenerative joint disease. Signs and symptoms are generally identified as pain, tenderness, and muscle spasm in the area of the lumbar spine; decreased trunk range of motion and function; and radiating pain, numbness, and/or tingling in the buttock, thigh, calf, and foot. Mechanism of injury is often sudden, specific, and associated with forward bending, twisting, lifting, pushing, or pulling motion. In many cases, however, no unusual circumstance can be identified with the onset of pain. Because of the variability of injury mechanisms, signs and symptoms, and possible causes of LBP, it has often been difficult to identify a verifiable diagnosis for idiopathic LBP.

The frequency of the inability to identify a cause of LBP has been estimated to be quite high. Dillane and coworkers found that the specific cause
was unknown in 79% to 89% of patients experiencing an initial bout of LBP. Leavitt and coworkers found that 84% of compensable cases of disabling LBP were without a definite diagnosis, and Nachemson indicates that in only approximately 15% of chronic LBP cases is a proven pathoanatomic explanation detected. The cause of idiopathic LBP is often ascribed to diskogenic causes or degenerative disk disease. Schultz states, however, that this assertion has never been proven and that disks very often degenerate without symptoms of LBP. In addition, almost every pathological change and lumbosacral irregularity attributed to LBP has been shown in the symptom-free population. Several authors have suggested that the sacroiliac joint is a major and often overlooked factor in the development and cause of idiopathic LBP. This point remains somewhat controversial and continues to be viewed with some skepticism. The purpose of this article, therefore, is to review the normal anatomy and biomechanics of the sacroiliac joint (SIJ), review known pathological changes shown to occur in the anatomy and mechanics/function of the SIJ, and attempt to determine whether the SIJ can be a major source of LBP. We will explore possible etiology of LBP relative to the SIJ aside from known causes of LBP (ie, vertebral ligament sprains, muscular strains, fractures, and disk disruptions). Evaluation and treatment of SIJ dysfunction has been described in detail elsewhere and is not addressed in this article.

Etiology and Prevalence of Idiopathic Low Back Pain

Because of the weight-transfer function of the SIJ and the pelvis in general, tremendous amounts of force and stress must be absorbed and dissipated by this region. Intuitively, cartilaginous breakdown or degeneration would be expected. A significant breakdown of the articular cartilage could then lead to pain production at the joint. Degenerative changes of the SIJ surfaces have been observed and appear to be associated with increasing age. These changes were present, however, in younger subjects and were thought to be significant to the production of low back pain (LBP). The tendency for fibrocartilage to degenerate and produce signs of osteoarthritis has been observed on the ilial surfaces by age 30 in men and 40–50 years of age in women. Other changes include joint surface fibrillation and erosion and cartilage splitting; however, these changes are thought to be consistent with stress and strain to the joint and not necessarily pathological or contributory to LBP. Severe changes to the joint surface, such as bony ankylosis, are thought to be somewhat rare but para-articular synotosis has been reported as a common finding in both sexes after the age of 50 years. Other changes seen in the SIJ consist of surface topography adaptations. Increasing age has been linked to surfaces becoming more irregular and prominent, and these changes in surface elevation are also thought to be normal responses to joint stress and to increase joint stability at the ex-
pense of joint mobility. These normal topography changes, however, are often mistaken for osteophytes and misinterpreted as causative of LBP.

The presence of an accessory sacroiliac joint (ASIJ) has been attributed as a possible source of LBP. Because of its development as a possible response to repetitive stress, pain might develop as a result of cartilaginous breakdown or injury or joint capsule injury. This in turn might contribute to, or be responsible for, SIJ dysfunction. At this time, however, no reports exist as to innervation of the joint or pain patterns, so the ASIJ as a factor in LBP is purely speculative.

Numerous authors have indicated that SIJ dysfunction is a major cause of LBP but little research has been done on the quantitative scope of SIJ dysfunction in the general population, as well as the athletic or physically active population. A recent study attempted to estimate the prevalence of SIJ pain in a population of patients with LBP that had defied diagnosis. Diagnostic intra-articular injection blocks of the SIJ were performed on 43 patients with LBP of an average duration of 14 months. Thirteen patients (30%) in the sample attained relief from symptoms with the SIJ blocks. No significant clinical sign or symptom besides groin pain was found to be associated with positive responses to the injections. These results led the investigators to conclude that the SIJ is a significant source of LBP.

Gemmell and Jacobson found the incidence of SIJ dysfunction in physically fit college students to be 19.3% and the incidence of LBP to be 26.5%. They concluded that there was no significant relationship between SIJ dysfunction and LBP.

One recent study attempted to contrast the incidence of SIJ dysfunction in elite cross-country skiers to that in a normal control group. A group of 18 elite cross-country skiers and 15 pain-free controls were assessed for SIJ symmetry, SIJ function, and lumbosacral (LS) function. Thirty-nine percent of the skiers presented with abnormal SIJ function, compared with none of the controls. No differences were found between the groups in SIJ symmetry or LS function. This difference was attributed to the unique hip and LS movements used in cross-country-skiing technique.

These results provide some quantitative data on the prevalence of SIJ dysfunction or pain in normal and active populations. Additional epidemiologic research is needed in this area, especially in occupational and athletic populations in which LBP is a frequent source of injury or disability.

**Anatomy of the Sacroiliac Joint**

**Bony and Cartilaginous Anatomy**

The sacroiliac joint (SIJ) consists of the articulation between the sacrum and the bilateral ilium portions of the os coxa. The sacrum is a double-wedge-shaped fusion of 5 sacral vertebrae, which tapers from anterior to posterior and from cephalad to caudal. The SIJ is classified as a plane,
synovial joint in which matching bumps and depressions roughen the articular surface, which increases friction and limits movement. Some authors believe that only the anterior third of the articulation is a true synovial joint, with the balance consisting of ligamentous connection. These joint surfaces are described as asymmetrical in size, shape, and direction, and this variability contributes to joint stability. SIJ surface irregularities are described as always reciprocal (ie, rise on sacrum fits into a depression on the ilia), and these ridges and depressions vary from 2 to 11 mm in height or depth.

The general shape of the joint-surface topography at birth until puberty is flat. After puberty, the contour changes to a crescent-shaped ridge that develops along the entire length of the ilial surfaces, with a corresponding depression on the sacral side. This topography tends to be more variable and developed in men. The SIJ articulation helps to form the posterior arch of the pelvis, which includes the upper 3 sacral vertebrae and portions of the paired ilia spreading from the SIJ to the acetabulum. The superincumbent weight of the trunk and upper extremities is transmitted through this arch. The anterior arch consists of the superior pubic rami and pubic symphysis. The 2 arches as 1 form an osteoarticular ring system. Gender differences are present in the shape of this pelvic ring. Women tend to have a shorter, broader pelvis with ilia oriented in a more laterally oblique direction. Men's pelves tend to be less flared, with the ilia more vertical and a narrower sacral base. These differences are related to the ability to bear and deliver children.

The articular surfaces of the ilium and sacrum have been described as L-shaped; the shorter, cranial segment is more vertical, and the caudal segment is longer and horizontally aligned. This appears to facilitate vertical load bearing. Gender differences exist in the articular surfaces, as well. The sacral articular surface in women is shorter and generally extends along the lateral surfaces of the S1 to S3 vertebrae. At birth, there is a dense hyaline articular cartilage surface on the sacral side, which is characteristic of other synovial joints. The iliac side has poorly developed cartilage and consists of a thin layer of stacked chondrocytes. During the first 3 years of life the ilial side slowly matures into a thin layer of fibrocartilage, and by skeletal maturity, the sacral side is approximately 1.5 times thicker than the iliac side.

Another structure has been identified relative to the articulation of the sacrum and ilium: It is called the accessory sacroiliac joint (ASIJ). This articulation is described as being located at the level of the sacral crest, at the first and second posterior foramina and on the ilium at the medial surface of the PSIS and the tuberosity. Two forms of the ASIJ have been identified: the axial joint, considered to be a syndesmosis (ie, bony ilium fits into a sacral concavity and is supported by connective tissue), and the accessory that is enclosed by a joint capsule and is thought to be a true synovial joint. The ASIJ might be present at birth and has been observed in 8% to 92% of cadaver and in vitro samples. The higher frequency of the
ASIJ in adults with increasing age might be indicative of the concept that increased weight-bearing stress can cause their development.16

Muscular and Ligamentous Anatomy and Function

The contours of the SIJ, as mentioned, provide significant stability to the joint. The joint has little direct muscular support, but several large ligaments surround and support the area and provide stability to the SIJ. These include the following:

- The interosseous SI ligament is an extensive ligament that supports the irregular spaces posterior and superior to the joint space. It consists of a deep portion and a superficial portion. The superficial portion might blend with the dorsal SI ligament.33 This is considered the largest syndesmosis in the body and the strongest support in this region. This ligament resists vertical separation and anteroposterior translation and provides overall joint stability.15,16,31

- The anterior SI ligament is actually an inferior and anterior thickening of the joint capsule. It is most developed near the posterior superior iliac spine and the arcuate line. This ligament counters inferior superior translation, separation of the joint surfaces,15,31 and anterior movement of the sacral promontory.10

- The dorsal SI ligament covers the interosseous ligament, and these 2 structures provide the posterior two thirds of the joint connections. The long portion of this ligament connects the sacrum to the posterior superior iliac spine, is directly caudal to the PSIS, and is covered by the fascia of the gluteus maximus.31,34 This portion of the ligament assists in controlling counternutation of the sacrum.34 This can blend with the sacrotuberous ligament15,16,31 and thoracolumbar fascia.33

- The sacrotuberous ligament is partly blended with the dorsal ligaments and connects the lower sacrum, upper coccyx, and posterior superior iliac spine to the ischial tuberosity.34 The course of the ligament is oblique and twisted, and it blends with inferior fibers of the gluteus maximus and the tendinous portion of the long head of the biceps femoris.33 It opposes sacral rotation or nutation during flexion.15,16,34

- The sacrospinous ligament is a thin, triangular-shaped ligament that lies anterior to the sacrotuberous ligament and courses from the ischial spine to the coccyx and sacrum.33 It functions to resist rotation about the frontal and transverse planes15,16 or flexion of the sacral promontory.33

- The iliolumbar ligaments course from the transverse processes of L4 and L5 to the iliac crests and blend with the interosseous ligament. The function of this ligament is to limit motion between the distal lumbar spine and the sacrum and to prevent separation of the sacrum from the ilia.15,31
The pubic symphysis is possessed of 3 ligaments: the superior pubic, the arcuate pubic, and the interpubic. This structure opposes shear stresses, vertical rotation of the sacrum, and SIJ separations.\textsuperscript{15,31}

This extensive system of support provided by the ligaments must be able to resist every possible movement of the joint and resist or temper large amounts of force for prolonged periods of time. The actual contribution of the ligaments to SIJ stability found by some researchers is substantial. Simonian and coworkers\textsuperscript{35} progressively loaded cadaver pelvic rings and systematically cut various ligaments. An increase in SIJ joint movement occurred only after the anterior SI ligament and the interosseous ligament were cut, and the motion that occurred was small. This is in agreement with the results of Vrahas and coworkers,\textsuperscript{36} who found that the SI joints were stable as long as the pubic symphysis and anterior or posterior SI ligaments were intact.

Despite the fact that there is no single muscle that acts as an agonist or prime mover of the SIJ, there are numerous muscles and fascia that act indirectly on the joint in stabilizing roles. The ligaments of the SIJ and lumbar spine mesh with the thoracolumbar fascia.\textsuperscript{15} These ligaments and fascia are then in the position to act as primary attachment sites for the main muscle groups that provide movement and stability to the spine and lower extremities.\textsuperscript{15} This provides a complex and 3-dimensional bracing mechanism that provides stability as it also transfers and absorbs body-weight forces.\textsuperscript{15,33} The following muscles and fascia could directly or indirectly affect pelvic and thus SIJ function:

- The abdominal muscles, erector spinae, and quadratus lumbarum provide stability to the pelvic girdle. The deep erector spinae and multifidi might have slips to the posterior SI and iliolumbar ligaments.\textsuperscript{15,16,21,33}

- The tensor fascia latae and gluteus medius and minimus provide for pelvic stability in the frontal plane and can affect iliac motion directly.\textsuperscript{15,16,21,33}

- The hip extensors provide for sagittal-plane stability and can affect sacral movement because of their attachments to the sacrotuberous ligament.\textsuperscript{21,33,34}

- The rectus femoris and sartorius can generate direct iliosacral movement, in addition to affecting movement at the knee and hip.\textsuperscript{21,33}

- The hip adductors influence motion of the pelvis in general but can cause movement at the symphysis pubis when acting unilaterally.\textsuperscript{33}

- The iliopsoas, because of its attachments on the ilium, sacrum, lower lumbar segments, and the anterior SI ligament, can directly affect lumbopelvic function.\textsuperscript{21,33}

- The femoral external rotators, the piriformis especially, are considered direct influences on sacral and pelvic mechanics.\textsuperscript{21,33}
The thoracolumbar fascia is identified as an important element in the transfer and dissipation of forces from the upper trunk to the lumbopelvic region and to the lower extremities through the SIJ.\textsuperscript{15,16} The lumbar posterior layer (lumbodorsal fascia [LDF]) of the thoracolumbar fascia attaches to the lumbar spinous processes, the interspinous ligaments, and the median sacral crest. The middle layer of the LDF is affixed to the tips of the lumbar transverse processes and the intertransverse ligaments from the iliac crest to the 12th rib. The anterior layer of the LDF covers the anterior aspect of the quadratus lumborum muscle, connects to the anterior surfaces of the lumbar transverse processes, and connects to the ilium and the iliolumbar ligament. The deep layer of the LDF attaches to the fascia of the erector spinae, internal oblique, serratus posterior inferior, sacrotuberous ligament, dorsal SI ligament, posterior iliac spine, and the sacral crest.\textsuperscript{15,31} These anatomical traits point to the role of the LDF as a major stabilizer of the lumbar spine and SIJ.\textsuperscript{15}

This area is also richly innervated, and mechanoreceptors similar to Golgi tendon organs have been identified throughout the SI ligamentous system.\textsuperscript{33} The fibrous capsules of the joints are also provided with a nociceptive receptor system. This system is present throughout the entire thickness of each joint capsule, as well as the SI ligament.\textsuperscript{37}

The presence of proprioceptors has also been shown in the lumbar regions of rabbits and humans. Yamashita and coworkers\textsuperscript{38} studied the lumbar facet joints of 30 adult white rabbits. They identified groups III and IV proprioceptive afferent units in the facet joints and concluded that these receptors responded to movement of the joint and had both low and high thresholds for movement. Yamashita and coworkers\textsuperscript{39} again studied the prevalence of proprioceptive units in rabbits but used lumbar intervertebral disks and the psoas muscle. Ten adult white rabbits were used, and group III, or slow-adapting, receptors were found in the intervertebral disk area. Slow- (groups III and IV) and fast- (group II) adapting fibers were found in the adjacent psoas muscle. The authors concluded that these fibers are evidence that these areas could be sources of LBP.

Evidence of proprioceptors in the lumbar joints also exists for humans. McLain and Pickdo\textsuperscript{40} studied 23 human lumbar facet capsules. They found groups I, II, and III endings in the lumbar facet joint capsules. These proprioceptors were identified as providing movement-related and movement-protective information to the central nervous system regarding joint position and function. The limited number observed compared with the cervical spine, however, indicates that lumbar spine proprioception might be less refined.

Evidence of mechanoreceptors in the intervertebral disks of humans is also available. Roberts and coworkers\textsuperscript{41} studied the intervertebral disks of 67 humans and found structures resembling Pacinian corpuscles, Ruffini
endings, and Golgi tendon organs. These structures were found in the outer 2–3 lamellae of the disk and the anterior longitudinal ligament. These receptors were thought to provide sensation of posture and movement, as well as nociception. The function of this complex system of muscle, ligament, and fascia appears, therefore, to not be motion generation at the SIJ but a stabilizing and bracing effect for efficient transfer of force.\textsuperscript{15,16,42}

**Biomechanics of the SI Joint**

### SIJ Movement

The concept that the SIJ is a center of LBP is contingent on the fact that the SI joint has available movement. The SIJ is a typical synovial joint in its anterior half, so the idea that movement can occur there is a sound one. Numerous studies have been conducted in vivo and in vitro using a variety of methods.\textsuperscript{15,16,29,30,33,43–48} One factor that most sources agree on is the concept that there is no simple, single axis for SI joint motion,\textsuperscript{16,44,45,48} and the joint possesses 6 degrees of freedom.\textsuperscript{16,44} The axes that have been identified appear difficult to orient to the conventional cardinal planes of movement and also appear to change with variations in femoral position.\textsuperscript{45} For example, Reynolds\textsuperscript{45} identified sacral rotation as occurring in the sagittal plane during hip flexion, on a longitudinal axis during hip abduction, and in a frontal axis during a combination of hip abduction and flexion. Bourdillon\textsuperscript{17} states that movement occurs in an oblique axis through the SIJ during oblique trunk flexion. Some authors\textsuperscript{33} identify translation and rotation of the sacrum in the sagittal plane as the predominant movements. Others\textsuperscript{48} believe that it is a simultaneous combination of translation and median plane movement (flexion/extension, upward/downward movement, and rotation). Three separate axes of rotation through the pubic symphysis have been demonstrated with 1 hip placed in flexion and the other in extension.\textsuperscript{44}

Brunner and coworkers\textsuperscript{43} identified gender differences in SIJ movement. Using 7 cadaver specimens, they described male specimen motions as more likely to be translational and female motions more likely to be rotational. They attributed this difference to joint surface topography. The consensus of the type of movement that occurs at the SIJ appears to be that rotational and translatory movement occur, but these motions cannot be classified as movements in the traditional cardinal planes.

The amount of movement that can occur in the SIJ has also been studied extensively with a variety of methods in vivo and in vitro.\textsuperscript{16,30,33,43,47,49} Studies conducted in the last 10 years on rotary motion have found ranges of 1–3° of movement.\textsuperscript{16} Studies measuring translational movement in the last 10 years have found the range to be less than 3 mm.\textsuperscript{16} Vleeming and coworkers\textsuperscript{47} found that in 83% of their subjects, the total range of motion never exceeded 2°, with one subject having 2.7° of movement. In support of these
findings, they measured maximum motion in male subjects to be 1.2° and 2.8° in women. During flexion of the sacrum, the ilia displaced toward one another a maximum of 1–1.5 mm. Changes in motion of the SIJ also appear to occur with increased age. A decrease in movement is generally found to occur. The evidence appears to be strong that movement occurs in the SIJ, but the small amounts appear to add implausibility to the concept that hypermobility can be a cause of SI pain. It has been observed, however, that people with severe joint pathology or traumatic instability, multiparous women, or people with muscular atrophy from prolonged bed rest or lower motor neuron injuries can have significant hypermobility, thus making it a possible cause of SIJ pain.

SIJ Function

It is well accepted that the SIJ’s major role is transmitting and absorbing energy during weight bearing. These forces include the superincumbent weight of the body, as well as gravitational forces. The most common functional movements identified as occurring at the sacrum include nutation and counternutation. Nutation is defined as an anterior-inferior movement of the sacral promontory, in which the paired ilia approximate and the ischial tuberosities separate. During counternutation, the converse occurs. An example of this relationship can be found in the concept of lumbopelvic rhythm. After the first 60° of trunk flexion, the pelvis rotates anteriorly around the acetabulum, and the sacrum follows the lumbar spine into flexion or nutation. During the return to standing upright or trunk extension, the opposite motions occur (counternutation of the sacrum). Sacral movements during trunk side-bending appear to be to the same side as side-bending occurs, but the opposite side that trunk rotation occurs. In normal standing posture, the line of gravity falls posterior to the center of the acetabula, and most of the weight of the trunk is transmitted through the posterior pelvis. This produces a posterior rotation force, and the pelvis rotates posteriorly and downward around the acetabula, creating an automatic pelvic tilt.

During the swing phase of gait, the ilium evidently rotates posteriorly, then converts to an anterior rotation after the loading response and achieves the maximum position at terminal stance. The sacrum appears to rotate forward about a diagonal axis during the loading response, reaching its maximum position at mid stance, and then begins to reverse itself during terminal stance. The thorax rotates 180° out of phase relative to the pelvis during the swing phase while the lumbar spine tends to rotate with it. Intrapelvic motion might also occur to help attenuate the axial, torsional, and shear stresses. During gait there is an inertial moment of the upper trunk, and the deceleration moment on the innominates is a shearing force that the SIJ absorbs. The counterrotation of the upper trunk serves to rotate the sacrum posteriorly, which then serves to lessen the deceleration moment on the SIJ.
Pathology of SIJ Dysfunction Relative to Idiopathic Low Back Pain

Pathomechanics of the SIJ

The current literature concerning SIJ dysfunction identifies 2 basic types: anterior and posterior. Regardless of the type of dysfunction, several common mechanisms or chains of events have been identified as causative of SIJ dysfunction. Anterior dysfunction has been identified as having 2 likely mechanisms. The first is during forward trunk flexion in which the innominates rotate anteriorly and downward and fix on the sacrum. If little support is available from the abdominal muscles during the return to an upright position, the additional weight causes the sacrum to settle vertically downward and lock the SIJ. The anterior movement of the innominates would slacken the posterior SI ligaments, thus stressing the thinner anterior ligament.

A second mechanism is a misstep down that is hard and sudden or a fall on a buttock. This sudden deceleration, combined with an inertial moment on the sacrum, forces the sacrum vertically downward. Other authors feel that a posterior dysfunction or a posterior locking of the innominates on the sacrum is more common. DonTigny questions this possibility by the nature of the thicker, stronger posterior SI ligaments, as well as the normal locking mechanism that occurs with posterior innominate rotation. Possible mechanisms during gait have also been described. DonTigny states that if the SIJ is fixed or hypomobile as a result of injury or dysfunction, the shear between the inertial moment of the trunk and the deceleration of the pelvis is not absorbed but transferred to surrounding tissue, including the L5–S1 disk. The SIJ can also be strained in chronic kyphotic postures, unsupported sitting, posterior translation of the thorax, extension of the thorax, and asymmetrical loading of the lower extremities. Prolonged sitting has also been described as a stressor to the SIJ. If wedging at the SIJ spreads the innominate bones, this stress can stretch the anterior capsule and the nerve roots.

DonTigny has postulated that SIJ dysfunction can mimic and might even hasten lumbar disk pain. He argues that the SIJs provide limited accessory motion to decrease torsional stress on the lumbar disks. The normally functioning SIJ allows a small increase in trunk rotation, and impairment to SIJ function would increase the torsional stress on the disk. The sacrum glides caudally and ventrally during ambulation, and if a dysfunction is present increased vibration occurs at the superior aspect of the sacrum, increasing shear force at the lumbosacral disks. Increased intra-abdominal pressure might spread the innominate bones on the sacrum, stretching inflamed tissues and mimicking disk pain. Therefore, DonTigny argues that idiopathic back pain can be biomechanical and precipitated by SIJ dysfunction. Stretching of nerve roots and increased shear forces on the disks can lead to degen-
eration and eventual herniation of the disk. In other words, LBP from SIJ dysfunction might precede disk herniation as a causative factor, rather than disk herniation causing LBP.

The events of pregnancy offer further evidence that SIJ dysfunction can be a significant cause of LBP. Because of the release of relaxin during pregnancy, it is well accepted that the SIJ is more mobile, and gait dysfunction, pain, and tenderness at the SIJ have been reported. As weight on the anterior pelvis increases and pelvic muscular support weakens, an anterior rotation strain occurs. The presence of relaxin also softens the ligaments, making them more prone to injury. These types of forces are similar to those seen in common SIJ injury mechanisms.

Pathology of SIJ Soft Tissue

Because of the tremendous forces that the SIJ must transmit and the complex system of support surrounding it, it would be logical to expect possible injury or disruption of the system to cause dysfunction and injury. Increased stress or strain to the area, such as prolonged postural loading, can produce creep deformation in the SIJ ligaments, leading to changes in SI function. Therefore, isolated or multiple injuries to the SIJ ligaments will have implications for producing LBP signs and symptoms because of changes in SIJ stability and joint motion. This type of change has been implicated in the etiology of LBP. This same line of inference can be taken concerning changes and/or injuries to muscular/fascial tissues. Support for this is found in the observation that patients with chronic LBP present with degenerative changes in the thoracolumbar fascia. Spasm in the lower back or pelvic muscles can lead to changes or increased stress on the innervated tissues of the SIJ, thus leading to joint dysfunction and increased tissue inflammation and pain. The richly innervated soft tissue complex of the SIJ region would then be vulnerable to injury or disruption and able to produce pain sensations. This is in contrast to the nucleus pulposus and annulus fibrosis of the vertebral disks, which contain limited receptor nerve endings and are often implicated as causes of LBP. Therefore, there appears to be strong evidence implicating injury to the soft tissues of the SIJ as a cause of LBP.

Summary

The shape of the sacrum, the symmetrical ridges and depressions of the SI joint, and the strong and complex complement of ligaments make the SIJ a joint of high stability and limited mobility. The extensive muscular and fascial support system furnishes the pelvis with a strong bracing system that enables it to absorb and transfer large forces during static and dynamic activities. Although SI joint motion cannot be classified as moving in the traditional cardinal planes of movement, it appears that a combination of rotation
and translation occurs. This movement is small, however, and generally does not exceed 2–3°, or 1–3 mm. The SIJ role as a force conductor and dissipater in various functional activities including standing, walking, sitting, and trunk movements appears to make it especially vulnerable to injury and dysfunction. Common mechanisms include abnormal or prolonged sitting and standing postures, asymmetrical loading during lifting or weight bearing, and blunt trauma associated with falls. The stresses absorbed by the SI joint appear to be consistent with producing dysfunction that can produce significant LBP. Whether lumbar joint or disk degeneration and dysfunction are causative of SIJ dysfunction or vice versa is an unproven concept at this point. It does appear, however, that the SIJ can be considered a major factor in the production of idiopathic LBP and should be regarded as a component of LBP etiology in a wide range of populations. Additional epidemiological research is needed, however, to further clarify the prevalence and scope of SIJ dysfunction.

References

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