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A Critical Review of the Sacroiliac Joint

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A CRITICAL REVIEW OF THE SACROILIAC JOINT

by

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This Independent Study, submitted by Lori Hefta in partial fulfillment of the requirements for the Degree of Master of Physical Therapy from the University of North Dakota, has been read by the Chairperson of Physical Therapy under whom the work has been done and is hereby approved.

(Chairperson, Physical Therapy)

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ABSTRACT

The purpose of this independent study is to provide information regarding the anatomy, function, and evaluation of the sacroiliac joint. Primary emphasis was given to the relevance of anatomy and function of this complex and unique joint. Arthrokinematics of the joint were discussed relevant to functional movements. Evaluation of the sacroiliac joint continues to be questioned regarding reliability of clinical models, and future research in this area is encouraged.

CHAPTER I

INTRODUCTION AND METHODOLOGY

Low back pain is one of the most frequent diagnoses referred for physical therapy. It is also one of the most frustrating areas to evaluate and treat. There are many potential causes of low back pain. These include mechanical derangement of the intervertebral joints, intervertebral discs problems, ligament sprains, muscular strains, and other pathologic conditions. A frequently suspected area of injury which results in low back pain is involvement of the sacroiliac joint.[1,2]

The sacroiliac joint (SIJ) remains the most controversial area in the low back.[3] The SIJ is a curious and unique joint which is definitely involved in the production of pain referred to the low back. Because of its location and orientation, the SIJ is a difficult joint to visualize and evaluate with radiographic procedures. This increases the difficulty in accurately diagnosing SIJ involvement.

A considerable amount of literature exists on this topic. Literature mainly focuses on joint structure, and deals with the question of whether movement occurs at this joint. Because of the intricate configuration of the SIJ, a few clinician-investigators report very limited movement.[4] Clinicians are now in agreement that there is a small amplitude of movement around this multiaxial joint.[1-11]

In the clinical setting, SIJ evaluation ranges from commonly diagnosed to totally ignored. Weis-Mantel stated:[3(p5)] "Some therapists find only 5% involvement while others find over 50%; I estimate that 25-30% of my cases involve the sacroiliac, sometimes along but most frequently in combination with lumbar spine lesions."

In review of patient x-rays, arthritic changes can be observed to occur around the SIJ, indicating movement which resulted in breakdown of joint surfaces. Interest in the SIJ dates back to the time of Hippocrates, who observed that a woman's pelvis separated in first labor and remained so thereafter.[4] Early studies focused on the potential for motion at this joint. In 1989, a study was published which involved roentgen stereophotogrammetric analysis of the joint. In that study, Sturesson et al[5] confirmed that movement does occur, although very small at .8 degrees to 3.9 degrees.

The purpose of this independent study was to review the published literature on the sacroiliac joint; compiling the results to support clinicians' theories on evaluation and treatment of the joint. The study also included a review of anatomy, function, evaluation, and treatment procedures for the SIJ.

The methodology employed a review of existing literature, beginning with a Med-line computer search. Of the articles introduced by the Med-line, extensive bibliographies were associated with each article. Other sources for review include textbook materials.

CHAPTER II

ANATOMY

The bony pelvis forms the base of the spine, supporting the body structures and linking the vertebral column to the lower extremities.[6] The pelvis is made up of three bones, the paired ilia and intervening sacrum. Three joints also are associated with the pelvis, the two sacroiliac joints and the symphysis pubis.[6]

The size, shape, and function of the pelvis varies with gender and age. Gender differences become evident by 12 to 14 years of age as the male sacroiliac ligaments begin to increase in strength while the female joints become more mobile.[12] In the adult female, the sacrum is shorter and wider with a ventral concavity that is deeper. Also, the pelvic surface of the female sacrum faces more downward, resting in a slightly greater lumbosacral angle.[13] The sacral articular surface is shorter in females, although for both males and females, it usually extends along the sides of S_1 to S_3.[13] Women tend to have a shorter, broader pelvis with more laterally oblique ilia, resulting in a more valgus angulation of the lower limbs.[6] The shape and mobility of the female pelvis facilitates the birthing process and subjects women to greater torsional and shear stresses during and immediately following pregnancy.[1] In men, the pelvis tends to be less flared, with the ilia more vertical and a more narrow sacral base.[6]

Osteology

The sacrum is large, triangular, and formed by the fusion of the five sacral vertebra.[13] The sacrum is situated at the upper and posterior portion of the pelvic cavity, inserted like a wedge between the two innominate bones. Its narrow, blunted apex is at the inferior end of the bone and articulates with the coccyx.[13] The base of the sacrum lies superiorly and articulates with the fifth lumbar vertebra with which it forms the lumbosacral angle.[13] The base contains features of a typical vertebra with slight modifications; it has a body, superior articular surfaces to articulate with L_5, a sacral canal, and spinous processes which are represented by spinous tubercles.[13] In the upright posture, the sacrum is very oblique and is also curved longitudinally with its dorsal surface convex and pelvic surface concave. This allows for increased internal capacity of the pelvis. In addition to the base and apex, the sacrum contains dorsal, pelvic, and lateral surfaces as well as encloses the sacral canal.[13]

The dorsal surface is convex backwards and upwards. The important aspects of the dorsal surface are the spinous tubercles (4, sometimes 3) which are rudiments of the sacral spinous processes; the dorsal sacral foramina which allows transmission of the dorsal ramus of the sacral spinal nerve, and a rough irregular surface for attachment of muscles and ligaments.[13]

The pelvic surface faces downwards and forwards. It is concave from superior to inferior as well as side to side. It also contains foramina which transmit the ventral rami of the sacral spinal nerves. The ventral surface allows for the attachment of the piriformis muscle.[13]

The lateral surface is formed by the fusion of the transverse processes and costal elements of the sacral vertebra.[13] (Figure 1) It is wide above and diminishes in width at the lower portion. The broad upper portion bears an ear-shaped appearance and is termed the auricular surface; it allows for the articulation with the ilium. The area posterior to the auricular surface is rough and deeply pitted allowing for attachment of ligaments. The auricular surface is shaped like the letter L. The long arm of the L would be laying horizontally, the short arm extends from the first sacral vertebra and the long arm extends down to the second and middle of the third sacral vertebra. At this point, the ilia articulate with S_1, S_2, and part of S_3, creating the sacroiliac joint. The auricular surface is covered with hyaline cartilage and demonstrates elevations and depressions to its joint surface with the ilium.[13]

The paired ilia, which are the two other bones that make up the pelvis, are actually part of the innominate bone.[13] The innominate bone consists of three parts, the ilium, ischium, and pubis. These portions fuse to create the innominate. The ilium is the upper portion, which contains the upper portion of the acetabulum and expanded flat bone above. The ischium contains the lower portion of the acetabulum and the bone below and behind. The pubis forms the anterior portion of the acetabulum and meets with the pubis on the opposite side in the median plane creating the symphysis pubis.[13]

The paired ilia are the bones that join with the sacrum to form the sacroiliac joint. The iliac crest is the upper border of the ilium. The crest has anterior and posterior projections which are termed anterior and posterior iliac spine.[13] They allow for attachment of muscles and ligaments.

The sacropelvic surface is the posterior and lower part of the medial aspect of the ilium.[13] It is divided into three areas: the iliac tuberosity, the auricular surface, and the pelvic surface. The iliac tuberosity is an extensive roughened area lying immediately below the dorsal portion of the iliac crests. It bears depressions and is attached to the sacrum by the sacroiliac ligament.[13]

The auricular surface is situated immediately in front of and below the iliac tuberosity; it articulates with the lateral surface of the sacrum.[13] Similar to the lateral surface of the sacrum, it is shaped like an ear. Its edges are smooth and defined but the surface is roughened and irregular.[2] The pelvic surface lies below and in front of the auricular surface and helps to form the wall of the lesser pelvis.

The posterior inferior iliac spine gives rise to the sacrotuberous ligament as well as the piriformis.[13] Along the posterior border of the ilium, in front of the PSIS, the greater sciatic notch is situated. This notch is the opening for the sciatic nerve and superior gluteal vessels as they emerge from the pelvis.[13]

The innominate bone allows for bony attachment of muscles and ligaments. Later in the text, discussion of muscles and ligaments will occur and review of bony landmarks in relation to attachments will be provided.

Arthrology

In an article published by Alderink[1], reference was made to Lynch, Albinus, and Hunter (1700s). They were the first to demonstrate that the sacroiliac joint articulations were true joints possessing synovial membranes.[1] Van Luschka[1] described the SIJ as true diarthrodial joints; still others reported the SIJ as amphiarthrodial. Differences in classification stems from the type of cartilage found on the articular surface.[1]

Gray[13] states that the articulation is synovial between the auricular surfaces of the sacrum and ilium. In the infant, the surfaces are nearly flat. In the adult, the surfaces become irregular with elevations and depressions. These irregular surfaces, which are more pronounced in males, give rise to the strength and stability of the joint. The intricate articulation between the two surfaces restricts movement, which contributes to the strength of the joint which transmits weight from the vertebral column to the lower extremity.[13]

Adhesion formation and loss of sacroiliac joint synovial cavity has been reported in both genders.[1] Osteophyte formation and degenerative changes have been noted in several studies. Sashim,[1] in a 1930 publication, noted 85 percent of males and 50 percent of females aged 40 to 49 years had osteophyte formation in the SIJ. Cohen,[1] in a 1967 publication, noted 6 percent involvement of the SIJ in those under 50; 24 percent in those over 50.

The amount of elevation and depression in the articular surface of the SIJ has been thoroughly studied and found to vary from author to author. All authors tend to agree that the joint surfaces were flat until puberty, and in adulthood elevations and depressions develop. The elevations and depressions are very irregular and individualistic.

As with all joints, the sacroiliac joint is supported by ligaments. The ligaments of the joint are termed the ventral (Figure 2), interosseous (Figure 3), and dorsal (Figure 4) sacroiliac.[13] The ventrosacroiliac ligament is located on the anterior surface of the joint and is a thickening of the fibrous capsule.[13] The purpose of this ligament is to resist anterior movement of the sacral promontory.[1] The interosseous ligament is massive and forms the primary bond between the sacrum and ilium.[13] It is the primary constraint to excess sacroiliac movement.[1] It fills the irregular space above and behind the joint. It lies under the dorsal sacroiliac ligament; the two are separated by the dorsal rami of the sacral spinal nerves and blood vessels.[1]

The dorsal sacroiliac ligament consists of several weak fasciculi which arise from the lateral crest of the sacrum to the posterior superior iliac spine and inner lip of the dorsal part of the iliac crest.[13] The inferior fibers of this ligament are continuous laterally with the sacrotuberous ligament and medially with the posterior layer of the thoracolumbar fascia.[1] The dorsal sacral ligament may resist downslipping of the sacrum.[6]

There are several other ligaments that are situated away from the joint that become involved when the sacroiliac joint moves; these are secondary to the origins and insertions of the major ligaments and are termed the vertebropelvic ligaments. The first of these is the iliolumbar ligament (Figures 2 and 4) which is attached from the transverse process of the fifth lumbar vertebra to the ilium.[13] The iliolumbar ligament is not directly involved in stabilization of the sacroiliac joint; it does play a major role in iliolumbar and lumbosacral mechanics.[1] The ligament is well developed and primarily prevents anterior shearing of the fifth lumbar vertebra.[1] Because of its attachment to the ilium, when it becomes taut, the ilium can rotate anteriorly causing insult to the SIJ.

The sacrotuberous ligament (Figure 4) is attached by a broad base to the posterior superior iliac spine, lower sacrum, and upper portion of the coccyx.[13] Its fibers run obliquely downward and laterally forming a narrow band that attach to the ischial tuberosity.[13] At its point of insertion, the sacrotuberous ligament blends with fibers of the gluteus maximus and the long head of the biceps femoris.[1]

The sacrospinous ligament (Figure 4) is thin and triangular; it attaches to the spine of the ischium and inserts medially into the lateral margins of the sacrum and coccyx.[13] The sacrospinous and sacrotuberous ligaments resist the tendency for the sacrum to flex forward when placed under stress by an external force.[1] The ligaments also form a border that converts the greater and lesser sciatic notches into foramina.[13]

Myology

There are several muscles of the trunk and lower extremity that can directly or indirectly influence the mechanics of the pelvis. The abdominal muscles, erector spinae, and quadratus lumborum provide three-dimensional gravitational and body weight forces.[7] The deep erector spinae and multifidi may have expansions to the posterior sacroiliac and iliolumbar ligaments.[1] The erector spinae and quadratus lumborum attach firmly to the sacrum and iliac crest respectively; the abdominal muscles arise from the pubic symphysis.[13]

The tensor fascia latae and other hip abductors provide for pelvic stability in the frontal plane but can also affect innominate motion directly via their attachment to the ilium.[7] The hip extensors provide for sagittal plane pelvic stability and may indirectly influence sacral motion by their attachment to the sacrotuberous ligament.[7]

The rectus femoris and sartorius can directly influence iliosacral movements in addition to their actions at the hip and knee.[7] These muscles originate from the anterior superior and inferior iliac spine and attach distally, thus innominate movement is possible if muscle imbalance occurs.[13]

The hip adductors influence pelvic motion in general; however, acting unilaterally, they may affect motion at the pubic symphysis.[7] The iliopsoas, with its attachments on the ilium, sacrum, lower lumbar segments, and anterior sacroiliac ligament, is often involved in lumbopelvic dysfunction.[1,7]

The femoral external rotators, particularly the piriformis due to direct sacral attachment, must be considered relevant to sacroiliac function and dysfunction.[1,7] Although there is only one muscle with direct attachment to the sacrum, the piriformis, it is evident that many trunk and lower extremity muscles may exert a profound influence on sacral mechanics via non-contractile links.[1,7]

Muscle imbalance may contribute a significant relationship to sacroiliac function and dysfunction. This is pointed out in a case report by Cibulka[2] in 1992. In this report, limited hip mobility was found to be the major factor in diagnosing and treatment of sacroiliac joint pain.[2] The patient in the study was found to have asymmetrical hip mobility; passive internal rotation on the right was 25° and on the left 50° with external rotation on the right of 65° and on the left of 45°. The patient complained of right buttock pain and was observed to prefer sitting with the right lower extremity crossed over the left in extreme external rotation.[2]

With treatment, Cibulka[2] gave the patient stretching exercises to improve right hip internal rotation (stretching right lower extremity external rotators, particularly the piriformis) as well as preventive positioning and postures of the lower extremity. The patient responded well and when seen on a three-month follow-up was completely pain free.[2]

It is important to understand the influence muscle balance and imbalance can create on the sacroiliac joint function and dysfunction. A muscle imbalance occurs when two related muscle groups are significantly different in their length and strength.[8] This can occur between an agonist and antagonist; i.e., the left quadriceps and the left hamstrings, or between a muscle and its counterpart on the opposite extremity; i.e., left and right medial rotators. A weak or long muscle will allow a tilt of the innominate bone in the opposite direction of the muscle; and conversely, a strong or short muscle will cause a tilt of the innominate in the direction of the shorter or stronger muscles.[8] Examples of this include: 1) a person with bilateral short hip flexors will develop an anterior tilt of the pelvis; 2) a person who has a short left hamstring in comparison to the right hamstring will develop a unilateral posterior tilt of the innominate on the left; and 3) a person who has a weak quadriceps femoris on the right will develop a unilateral posterior tilt of the innominate on that side.[8]

The knowledge of muscles, their attachments, and their relationship to movement of the sacroiliac joint can become very useful in the treatment of SIJ dysfunction. Aside from strengthening and stretching imbalances, the muscles can be utilized in mobilization treatments by way of muscle-energy techniques.

Grieve[9] defines muscle energy as active participation by the patient, by muscular contraction, and/or inspiration or expiration during manual treatment techniques. It rests on the prime importance of the soft tissues, particularly the muscles as opposed to the skeletal elements of the joint structures.[9]

In the sacroiliac joint, successful treatment utilizing muscle energy techniques relies on the clinician's knowledge of muscle origin, insertion, and action on the joint. Muscle energy is based on the inhibition and facilitation of the appropriate muscles to achieve the desired response. Muscle energy is performed by inhibition of the shortened, strong muscle and facilitation of the weak, long muscle.

It is clear that the clinician must understand the anatomy of the bony structures, ligaments, and particularly the muscles. This is important in comprehending the kinematics, evaluation, and treatment of the sacroiliac joint.

CHAPTER III

KINEMATICS

It is extremely difficult to study sacroiliac joint movement. Direct palpation of the joint is impossible. Studies have been performed to assess movement of this joint. These studies include empirical and analytic methods to study motion in both living subjects and cadavers.[1]

The hypothesis that sacroiliac joint involvement is a source of low back pain is based on the assumption that the SIJ is capable of movement. The SIJ is synovial with all properties of a true joint. While there are critics who continue to deny that movement occurs, it has been well studied with published articles that there is movement, although minimal, in the joint.

Investigators of SIJ mobility generally have focused on two main questions: what is the extent of movement? and what is (are) the axis(es) of motion?[4] Available studies have strongly supported movement but little agreement in the literature exists on a single model of SIJ motion. As described in the last chapter, the structure of the joint is widely variable; so also is the axis of motion.

Sacroiliac joint movement may be described as the movement of the ilium on the sacrum (iliosacral) or the movement of the sacrum on the ilium (sacroiliac).[8] According to Cibulka,[8] the most commonly seen is the iliosacral movement. In reviewing the literature, very few authors differentiate between the two terms. Examples of terms utilized include nutation and counternutation which describe flexion or extension of the sacral base.[1]

Alderink,[1] in 1991, published a review article that explored in detail the literature on the osteokinematics of the joints. This article is an excellent source for the history of the research literature involved in defining the axis of motion.

There are typically five areas of movement around the sacroiliac joint.[3] Although specific location may vary as individual structure varies, these axes are as follows:[3]

1. Transverse axis: The axis runs transversely through the symphysis pubis about which the pubes rotate allowing movement of the ilia in walking.
2. Superior transverse axis: This axis is found at the second sacral segment. This is the respiratory axis, about which the movements of flexion and extension occur.
3. Middle transverse axis: This axis is found at the level of the second sacral body. It is the principal axis of normal *sacroiliac* flexion and extension.
4. Inferior transverse axis: This axis runs transversely through the inferior pole of the sacral articulation and extends laterally through the ilia near the posterior inferior spines. It is regarded as the

principal axis of normal *iliosacral* movements in locomotion. (The first and fourth axes move and "rotate" together--a fact important in treatment.)

5. Oblique axes: This axis runs obliquely through the sacrum extending from the superior end of the articular surface on one side (the base) to the inferior end of the articular surface on the other side (the apex). Each axis is named for its site of origin at the base; thus, the right oblique axis (ROA) and the left oblique axis (LOA). It is important to note that the movement of the sacrum about the oblique axis results in the sacral base on the side opposite to the origin of the oblique axis moving anteriorly and inferiorly while the apex of the sacrum on the same side as the origin moves posteriorly and inferiorly.

The extent of movement within the sacroiliac joint has been reported to vary. The published literature[1-11] reviewed is in agreement that movement does occur.

Cyriax[10] reports that sacroiliac movement occurs at the extreme of trunk flexion and extension; with rotation occurring between the sacrum and ilium. This movement is limited to .25 mm.[10]

Sturesson et al[5] performed a stereoradiographic study in 1989 on live subjects in physiologic positions as well as extremes of physiologic positions. Five positions were studied: 1) supine, 2) prone with hyperextension of the lower extremity (imitating the posterior leg when taking a big step), 3) same as number 2 with the right lower extremity, 4) standing, and 5) sitting with straight knees (imitating forward flexion). Positions 2, 3, and 5 are considered extremes of motion. The axis of rotation for this study was the transverse axis through S_2 and oblique axis.[5] Rotation occurred around the transverse axis and translation around the oblique axes.[5]

Results of Sturesson's study[5] showed movements to be very small as follows:

1. Changing from supine to standing or sitting--1°-2°
2. Changing from standing to hyperextension of the leg--2°-3°
3. The translation was also small with a mean of .5 mm and never exceeding 1.6 mm.

A number of other investigators performed studies to quantify sacroiliac motion. Pithin and Pheasant, as reviewed by Alderink,[1] used both x-rays and inclinometer studies to show flexion/extension movement around a transverse axis at S_2 to be 4° and with a transverse axis at the pubic symphysis to be 11°. Weisl[3] recorded a mobility of 6°. Cholachis[3] recorded a translation of 5 mm.

Sturesson's[5] study was performed on symptomatic and asymptomatic joints. The conclusion to utilizing stereoradiographic analysis reported the following: analysis of the mobility under physiologic load cannot identify a sacroiliac dysfunction in patients with sacroiliac joint syndrome.[5]

Recent studies[1-11] have demonstrated motion occurring at the sacroiliac joint; however, the data reports this movement to be small. Movement of this amplitude is very difficult to be assessed by clinical evaluation techniques. In the following chapter, review of evaluation techniques will be provided, although emphasis in evaluation is on reproduction of pain and positions which decrease and abolish pain.

Movement of the sacroiliac joint during functional activities is important to understand. This will assist in evaluation and treatment of the joint. During forward trunk bending, there is a relationship between the lumbar spine and pelvis; this is described as lumbopelvic rhythm. During the initial phases of trunk flexion, the pelvis is locked by the hip extensors and the lumbar lordosis flattens. After 60° of flexion, the pelvis rotates anteriorly around the hip joint.[1] During lumbar rotation, the sacrum rotates to the same side and sidebends to the opposite.[1] If sidebending was performed in the trunk, rotation occurred to either side.[1]

During the gait cycle, the ilium has been shown to rotate posteriorly during the swing phase and converts to an anterior rotation soon after the loading response, achieving a maximum position at terminal stance.[1] The sacrum tends to rotate forward about a diagonal axis during the loading response, reaching its maximum position at mid-stance.[1] It then begins to reverse itself during terminal stance.[1] Iliac and sacral motions may be influenced by lower extremity muscles, Alderink believes sacral movement occurs primarily in response to the load imposed by body weight and ground reaction forces. Alderink[1] also reports intuition would suggest that intrapelvic motion during ambulation is necessary to help dampen the axial, torsional, and sheer stresses, but more studies are needed to verify these hypotheses.

Movement of the sacroiliac joint in labor and delivery have been widely reported.[1,6] It is well-known that the SIJs become more mobile during the gestational period secondary to hormonal changes.[1,6]

DonTigney[11] reported in his study that postmortem specimens at various stages of pregnancy showed that an increase in range of movement is easily recognizable by the fourth month and that at full term the range increased two and one-half times. In one subject, the anterior margins of the joint could be separated by almost 2 cm.[11]

During labor, the hips are generally placed in extension, placing a traction force on the hip flexor muscles.[1] This results in an anterior pelvic tilt and simultaneously counternutates (extends) the sacrum, allowing for a wider pelvic brim for the descent of the fetus.[1] The hips are then placed in flexion, abduction, and external rotation during delivery. This places tension in the hamstring muscles, which posteriorly rotates the pelvis relative to the sacrum (sacral nutation or flexion).[1] This allows for an increased pelvic outlet for delivery of the baby.[1]

As the expectant mother pushes, internal pressure increases allowing for increased expansion. If the hamstring muscle and associated ligaments are tight, this restriction will further increase rotation at the SIJ possibly resulting in ligament strain and/or SIJ dysfunction.

The sacroiliac joint may function in an open kinematic chain and also in a closed kinematic chain.[1] It may respond differently in each of the circumstances. Current models of movement are reasonable, but more research should continue to test and verify sacroiliac function.

CHAPTER IV

EVALUATION

Clinical assessment of sacroiliac joint dysfunction is difficult. The sacroiliac joint should not be examined until the lumbar spine, hip, and lower limb examinations have been completed. This self discipline is necessary because of our commonly encountered tendency to jump to conclusions about supposed sacroiliac joint conditions as the cause of low back pain and/or sciatica.[9] A good rule of thumb might be: *Deformity or asymmetry does not always mean pathology.*[9]

The minimal range of motion present in the population casts doubt on whether therapists can detect one to three degrees or one to three millimeters of motion occurring specifically at the SIJ.[4] Perhaps the term "play" should be utilized when referring to the SIJ, as motion connotes the idea of a quantity of motion.[4]

Intertester reliability has been challenged. A study examining the intertester reliability of 13 specialized test for sacroiliac joint dysfunction was published in 1989.[14] Eight therapists with advanced education in musculoskeletal evaluation and manual therapy examined 17 patients with lumbosacral pain and unilateral lower extremity symptoms.[14] Reliability was poor; 11 of the 13 tests resulted in less than 70% agreement.[14] Two tests that relied solely on subjective patient response and imparted no information on SIJ position or mobility were within a range of 70-90% agreement.[14]

Clinical evaluation should begin with the appropriate intake of the patient's history and symptoms.[15] SIJ pain tends to be unilateral and referred to the posterior thigh, iliac fossa, and buttock on the affected side.[15] Pain is usually felt when turning in bed, getting up from sitting, or stepping up with the affected leg.[15] Falls, twists, or strains increase the likelihood of SIJ involvement.[15] These are but a few of the most common subjective comments.

Objective evaluation of the SIJ involves specialized testing. Cyriax[10] describes eight evaluation tools:

1. Anterior SIJ ligaments: The patient is supine and the examiner presses downward and laterally on the anterior superior spine of each ilium. Gapping of anterior joint occurs. The response to stretch is only positive if it evokes unilateral gluteal or posterior crural pain.
2. Posterior SIJ ligament: The patient is sidelying; the examiner applies force through the ilium downward. Gapping of posterior joint occurs. Again, positive response is provocation of pain.
3. Anterior ligament: Performed with the patient prone and force applied forward on sacrum. Gapping of anterior joint occurs.

4-8. Passive mobility of the hip.

   a. hip flexion

b. lateral rotation

c. medial rotation

d. extension

e. straight leg raise

-- Positive result again is unilateral provocation of patient's pain.

Magee,[15] Orthopedic Physical Assessment, is an excellent source for indepth description of specialized testing of the SIJ. The amount of information on the specialized procedures is vast and will not be discussed here. The author encourages the reader to review the text material.

DonTigney[11,16,17] and Cibulka[2,8,18,19] have performed extensive evaluation and treatment of the SIJ with literature published on the topic. Cibulka[2] points out that a clinician should not base the assessment of a patient on one clinical finding. The use of a combination of tests and findings of four positive tests suggests the presence of sacroiliac joint dysfunction.[2]

Cibulka's[2] evaluation of the SIJ consists of gross assessment of ROM (trunk and lower extremity), palpation of bony landmarks (ASIS, PSIS, and iliac crests), and strength testing. Specialized SIJ procedures include palpation of PSIS movement while the patient forward bends in standing and sitting to assess symmetrical or asymmetrical movement.[2] Palpation for provocation of pain, Fabere testing, straight leg raising, and examination of leg lengths are also included.[2]

Leg length testing is a commonly utilized evaluation tool but has been reported to be unreliable.[2,11,14] Leg length testing to determine SIJ involvement is performed with the patient supine. Comparison of the level of the inferior aspect of the medial malleoli in supine and long sit is performed.[2] For example, if the apparently shorter right leg appeared to lengthen, the test would indicate that the right innominate is posteriorly rotated, or conversely that the left innominate is anteriorly rotated on the sacrum.[2] This test has been demonstrated to be unreliable and can be influenced by muscle guarding/spasm, patient positioning, or therapist technique.[14]

Cibulka[2] also performs the Cyriax[10] evaluation techniques for pain provocation. Of the testing procedures performed, Potter and Rothstein[14] found the highest reliability with Cyriax special tests #1 and #2 described previously.

Wilson,[20] in an article published in 1989, describes one test that would provide immediate confirmation of SIJ dysfunction. As a physical therapist working in an Army School and associated with football injuries, he found a high incidence of SIJ involvement in athletes who complained of low back pain.[20] The one screening test he performs for the SIJ is prone bilateral hip internal rotation, knees bent to 90°, with over-pressure applied.[20] He indicated that the SIJ was implicated if there was a discrepancy in the amount of movement from one femur to the next, with a marked reduction in the springy end feel of the affected side.[20]

Specialized testing of the SIJ has been demonstrated to be unreliable and depends on therapist palpation skills.[14] Walker,[4] in a review article cited recent studies demonstrating high errors in palpation of bony landmarks.

A study performed by Jano and Simmonds, as reviewed by Walker,[4] studied four bony points for intrarater and interrater reliability. Intrarater error was 7 to 14 mm and interrater error was 12 to 24.5 mm.[4] A specific example was palpation of the PSIS, with an intrarater mean of 8 mm and an interrater mean of 20.4 mm.[4]

Such landmark identification is the foundation of a majority of special tests to determine SIJ dysfunction.[4] With such significant difference in interrater and intrarater testing, it is easily demonstrated that SIJ testing is unreliable. There appears to be little support for highly specific tests and procedures for the SIJ.[4] Provocation tests and a treatment approach that emphasizes patient involvement is supported.[4]

CHAPTER V

CONCLUSION

The sacroiliac joint is complex. The anatomy of the pelvic area has been demonstrated to be variable with age and gender, as well as with women during pregnancy and among individuals in general. This review article emphasized the anatomy and function of the SIJ as it is imperative for clinicians to gain knowledge of the vast differences for effective evaluation and treatment.

Evaluation of the SIJ continues to be complicated with numerous testing procedures involved. Reliability studies have not supported specialized testing of the SIJ. At the present time, SIJ involvement is determined primarily on pain provocation and response to treatment.

Investigation needs to continue for a unifying model of sacroiliac function during movement. Clinical measurement tools and evaluation techniques need to be researched more thoroughly with emphasis on reliability of the techniques.

A universal model for evaluation of the SIJ is necessary with language that is easily understood. Objectives need to be set for more insight in the diagnosis and treatment of sacroiliac dysfunction.

APPENDIX A

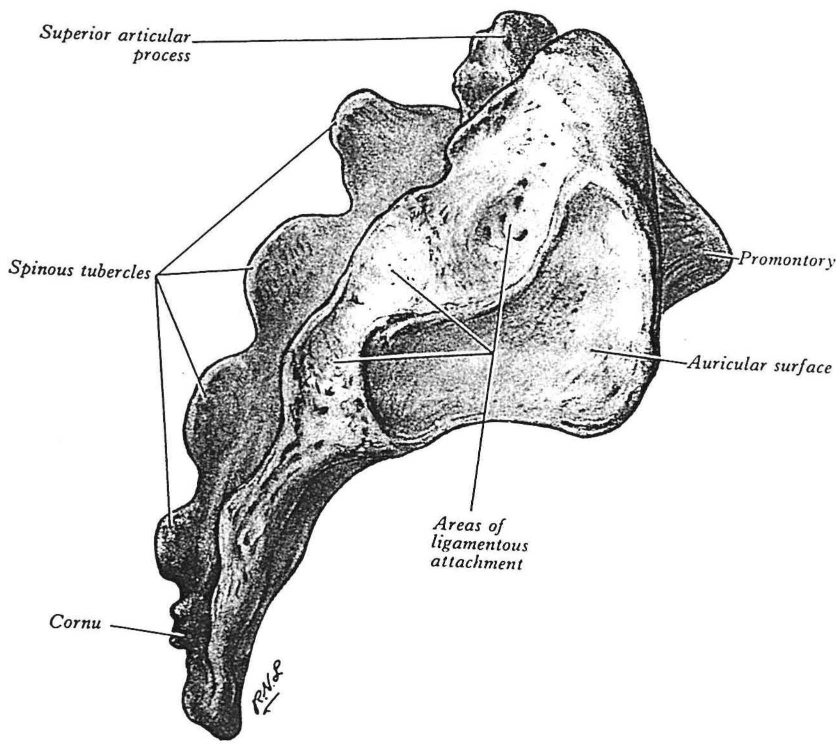

Figure 1. Lateral view of sacrum.[13]

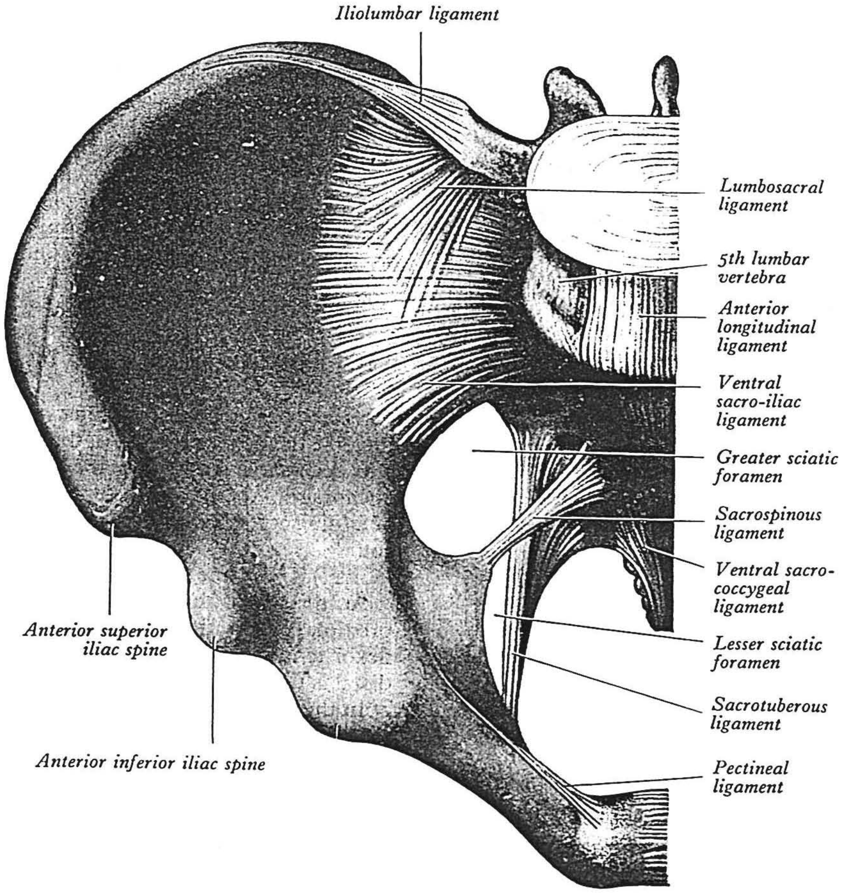

Figure 2. Ventral aspect of pelvis.[13]

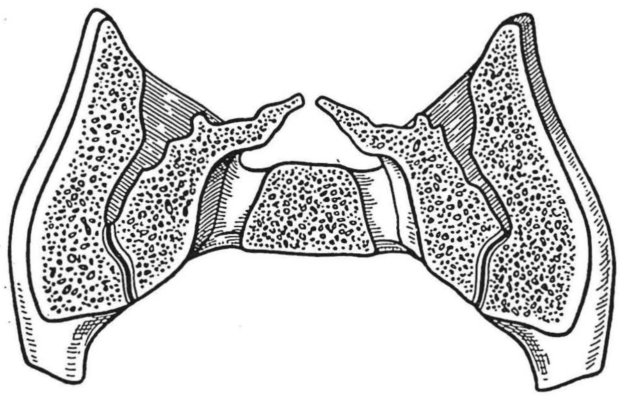

Figure 3. Coronal section of pelvis (interosseous ligament).[13]

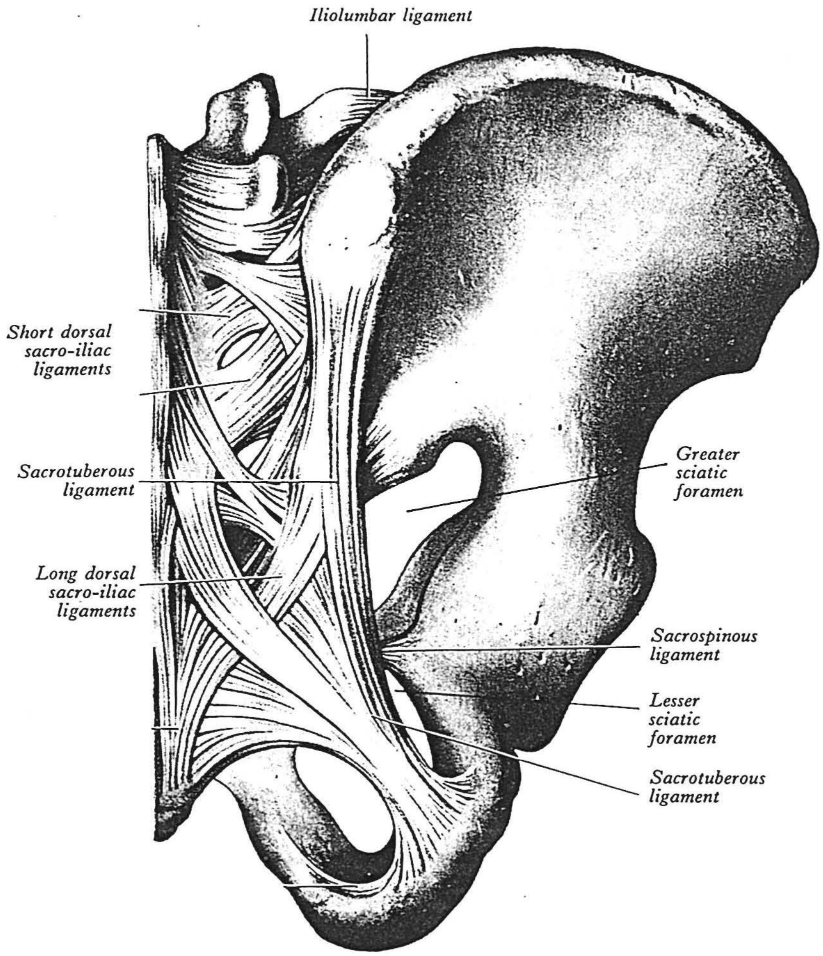

Figure 4. Dorsal aspect of pelvis.[13]

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