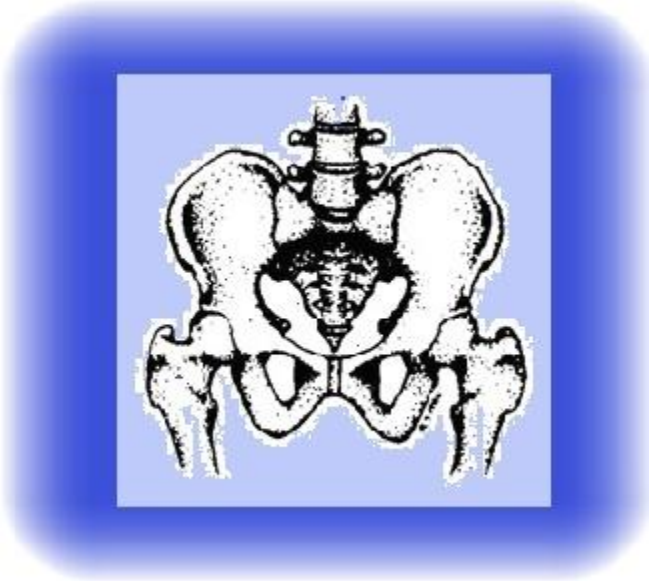
THE HESCH METHOD OF TREATING SACROILIAC JOINT DYSFUNCTION: INTEGRATING THE SI, SYMPHYSIS PUBIS, PELVIS, HIP AND LUMBAR SPINE

BASIC AND INTERMEDIATE WORKBOOK



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By jh 2011

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Jerry Hesch, MHS, PT, Hesch Seminars and PT, LLC, March 2009

QUOTATIONS

This evaluation and treatment approach may have more to do with the integration of the hip, pelvis (as a single structure), and lumbar spine than the SI joint itself, and I take great comfort in gradually de-emphasizing the latter. The biomechanics of the pelvis (as a single structure) are very relevant. The pelvis can move on both femoral heads, yet move asymmetrically. The posterior soft tissues of the back and pelvis will distort asymmetrically and give the appearance of "SIJ mechanical dysfunction". Much of what we call SIJD is actually a deformation of posterior soft tissues with a fairly predictable pain pattern that requires direct treatment as opposed to various lumbar spine paradigms. The pelvis being connected to the lumbar spine and trunk, distorts them as well. I hope that in time clinicians will include thorough testing of the pelvic (as single structure) biomechanics, as this large structure has a relevant influence on proximal soft tissues, distal structures due to the righting reflex, and again, influences the hips, the lumbar spine, etc.

The paradigm of "SIJ Dysfunction" remains controversial, depending on what literature you read. Research has recently shown that manipulation does not alter the position of sacroiliac joint[1], and that a common traditional movement test does not actually induce motion in the SIJ[2]. Quite some time ago, prior to the above research, many of the traditional tests were brought into question[3]. Some manual therapists continue to teach those tests, while others are abandoning the paradigm of SIJ dysfunction altogether. Altered pelvic landmarks, which are rendered symmetrical with intervention; do not validate that the SI joint was successfully treated. Many times it means that the pelvis itself has improved posture, not a bad thing to achieve! This approach is a relevant paradigm for both "true SIJ dysfunction" and altered pelvic mechanics.
Jerry Hesch, MHS, PT

The importance of the normal structural function of the pelvis can be expressed very sufficiently by saying that the pelvic girdle is the cross-roads of the body, its architectural center, the meeting place of the locomotive apparatus, the resting place of the torso, the temple of the reproductive organs, the framework within which new life develops, the place of the two main functions of elimination and last but not least a place on which to sit down.
Fred L. Mitchell, D.O.

Little wonder that the ancient phallic worshipers named the base of the spine the sacred bone. It is the seat of the transverse center of gravity, the keystone of the pelvis, the foundation of the spine. It is closely associated with our greatest abilities and disabilities, with our greatest romances and tragedies, our greatest pleasures and pains.
H.H. Fryette D.O.

Fortunately, biomechanical research into the pelvic girdle is increasing and, as new knowledge is acquired, the theoretical construct provided here may well need modification.
Philip E. Greenman D.O.

Unfortunately, cadaver dissections and static biomechanical analysis cannot replicate living anatomy nor duplicate habitual movement of the lower extremity either in weight-bearing or non-weight-bearing. In light of current scientific data, the presence or absence of sacroiliac joint mobility and its significance to the patient's presenting complaints are best judged by accurate, objective, clinical evaluation. In the absence of bony intra-articular ankylosis, the clinical impression is that age does not preclude motion— the individual's ontogeny may just be slightly behind his time.
Diane Lee, P.T.

The differential diagnosis between sacroiliac dysfunction and low back pain is difficult.
Alvin Stoddard, D.O.

Dogma dulls the wits! Sometimes arbitrary and perhaps impatient attempts to impose order, reason, and logic from without, on the irrational behavior of signs and symptoms in common joint problems, may be misguided and counterproductive. The body cannot read books and know what is confidently expected of them by the theorist, logician, and biomechanist. In our enthusiasm for this or that therapeutic revelation we sometimes overlook the infinite range of biological plasticity of response, and the individual uniqueness of response, which makes fools of all of us at one time or another. Perhaps it is wiser to let joints speak for themselves, especially in the matter of palpatory findings, and to assess and treat joint problems on the basis of acceptance of what is there to be observed, while views about its genesis must often remain unproven.

In our condition of limited, albeit increasing certainty, careful and clinically responsible empiricism, and moderation in the use of vigor during treatment seem to be prudent things. Humanly, we seek a guru, with the short and certain answer to our difficulty of swimming in a sea of relativity, and of making up our own mind on the evidence before us. It is as unrealistic to hold that most sacroiliac area pain arises from the joint itself as it is to solve difficult problems by asserting that it all comes from the lumbar spine. In assessing the clinical status of this mysterious joint we need all the discernment we can muster.
Gregory P. Grieve. *Common Vertebral Joint Problems.* Churchill Livingstone, NY, 1983.

INTRODUCTION

My first introduction to the pelvic joints was rather inelegant and occurred in 1974. I was riding a motorcycle on some bumpy terrain and accelerating at 45 miles per hour. It was great fun, but I started to lose control and applied the brakes, which locked. I encountered the gas tank with my left pubic bone/ischium. I limped home sans motorcycle and humbly informed my brother that his motorcycle was near the railroad tracks. I moved rather slowly and utilized a kidney belt for several weeks. I sought medical care and was assured that time would take its course. If memory serves me, I managed fairly well for quite some time. I sought some care through manipulation and Rolfing. I was interested in both approaches, but also sensed that there were additional methods available for integration. Upon completing my last clinical affiliation as part of my physical therapy training, it was suggested that I take a job with Richard DonTigny, as he was known for his work on the sacroiliac joint. I claim full responsibility for my internal response of *Sacroiliac? What is that joint like?* I had little memory of that joint and felt quite inadequate in my understanding of that region of the body. I accepted the job and was very fortunate to have him as a mentor. I read and reread his work several times, and it took quite some time before I felt that I had an elementary grasp of the concept of sacroiliac joint dysfunction. When he treated my sacroiliac, I felt an incredible sense of relief, which lasted for quite some time.

I started to read everything I could get my hands on, and started to question some of the things I was reading. A lot of what I read seemed to oversimplify a complex problem. As an example, the most common pattern of lumbopelvic movement dysfunction has up to 8 components which occur sequentially though they are traditionally presented as disjointed random events. Other times the literature seemed to over complicate a simple problem, such as describing triplane sacral mechanics as though they were the norm, when sacral motion dysfunction is typically uniplanar or biplanar and rarely triplanar.

I was very surprised that passive accessory motion tests were given minimal if any application to the pelvic joints, and yet were part of a standard orthopedic physical therapy evaluation of every other joint in the body. I started to apply the few accessory motion tests that I encountered in the literature and developed several more and refer to them as Spring Tests. I felt very strongly that if the literature indicated that the structure moved a certain way we should be able to validate the motion or lack thereof with the Spring Tests. Initially these were utilized in pure planes and in pure directions. Over time I became convinced that the biomechanics of the SI, symphysis pubis, and pelvic structure was quite different than what was being propounded, yet undeniably there was a lot of good in the traditional model also. The current model which the profession has adopted was developed in the late 1950's and is presented within different treatment paradigms such as manual therapy, muscle energy, strain/counterstrain, etc. There have been some minor changes, but I would refer the reader to Mitchell's landmark article (1958). I am grateful for his contribution and hope that I have honored his work (and that of his contemporaries) by making it more accessible, more understandable, adding Spring Tests, and developing it further. One cannot take away but rather can only add to a work of significance.

Initially I was very focused on the concept that motion occurs in the SI joint and treatment should restore normal functional mobility and stability within the joint. I am now much more broad minded and view motion as something that must occur *through* the SI joint. Initially I thought the Spring Tests measured motion *occurring in* the joint, and now believe they may assess motion occurring *through* the joint; and I feel strongly that this is an important distinction. For example, several muscle groups are essentially inaccessible to direct assessment or are only partially accessible, especially with respect to palpation, such as the iliacus, psoas, quadratus lumborum, and pelvic floor. These muscles can have a significant influence on pelvic posture and mobility as measured by "Joint Spring Tests". Fortunately, in spite of this lack of clarity (pure joint restriction versus muscular restriction), treatment is usually fairly straightforward, and usually very effective in restoring mobility/integrity as measured by the Spring Tests. The Spring Tests measure a very important and inextricable functional property of joints; which is joint play. The growth in our understanding of the role of joint receptors with respect to overall function of the neuromusculoskeletal system and their relation to pain syndromes mandates their inclusion in treatment paradigms. Increase or decrease in joint mobility is usually treatable and has much to do with respect to overall rehabilitation goals. I much prefer to view the lumbopelvic-hip complex as part of the integrated neuromuscular-multi-joint system that is not fully understood at this point in time. Within this paradigm is a respect of the functional interdependence of the "whole body." From this perspective one should never treat the lumbopelvic-hip complex in isolation.

My contributions to the evaluation and rehabilitation of the lumbopelvic complex are:
A uniquely thorough palpatory assessment, integrating multiple landmarks and systematic, three dimensional techniques for identifying landmarks.

Multiple articular accessory motion tests (Spring Tests). The Hesch Method is much more Spring Test driven than any other of which I am aware, which contributes to a clearer understanding of the client's dysfunction.

Refinement of several traditional patterns of dysfunction by expanding on their description; such as describing Anterior Ilium Dysfunction as a triplanar pattern, not a uniplanar or biplanar phenomenon.

Identification of and treatment techniques for several new patterns of pelvic joint dysfunction.

The most common patterns of dysfunction are in the basic workbook; the advanced material includes less common, but no less significant patterns. In fact, the advanced work can be the "missing ingredient" for treatment of complex or chronic dysfunction, such as was the cased with my own injury. Developing a logical sequence in which some of the common dysfunctions are encountered in the clinic, thus making evaluation and treatment logical and sequential for the first and second most common patterns of lumbopelvic dysfunction.

Treatment featuring short levers, with low-load and long duration stretches/mobilizations. This approach is gentle on the clinician yet empowering to the client. Treatment hold times are longer than the traditional approach, with the belief that creep (deformation over time) is the key to quickly resolve biomechanical dysfunction. Most treatments can be performed by the client

easily, and patient education is considered to be an important aspect of care.

A technique that purports to evaluate the transfer of energy thru the pelvis, instead of relying on pain-provocation or postural compensations.

A method capable of identifying symmetric dysfunction of the pelvis, in addition to the more traditional asymmetrical patterns.

I think that a deeper understanding of this problem has come from a continual state of questioning and receptivity, allowing the joint to `speak for itself.' I am less concerned about *how* one treats the joint than I am about the importance of a thorough evaluation and re-evaluation to assure that treatment goals are realized, as the joint undergoes several permutations throughout the course of treatment. I am convinced that there are many adequate approaches to treatment and offer what usually works readily in my hands.

I think I have imaged almost every conceivable way the joint/structure can move. I have been blessed with a healthy dose of empiricism and have been frustrated with traditional approaches to the lumbopelvic region. Integrating the lumbar spine with the pelvis, and vice-versa is an on-going lesson for me. The lumbopelvic-hip complex is inter-connected, inextricably linked, as it is also with the rest of the neuromusculoskeletal system.

Philosophically, the problem needs a whole body approach. This cannot be expressed within this workbook and within the constraints of a 2 or 3-day workshop. I consider exercise, patient education, and self-treatment to be critical components of successful rehabilitation. These concepts are not fully expressed in the workbook or workshop due to space and time constraints.

This workbook is not designed to stand alone, but rather is designed to accompany a hands-on workshop. Several original and key concepts have been purposely omitted from the workbook to protect my ownership. I am convinced that this hands-on approach cannot be learned by reading about it, and post seminar surveys have reinforced this belief. Several key concepts are unique and at odds with traditional theory. These were realized by allowing the joint to `speak for itself' and seem to be learned optimally via an empirical approach.

The integration of this approach with the rest of your clinical skills is a challenge that will develop into the art of your own unique expression. I am honored to be a part of that. This workbook has undergone many laborious revisions over the past years and I hope that I have succeeded in making it serve as a useful tool in your clinical armamentarium. This work has evolved only because others have coaxed me along the way and because they have shared their resources of time and talent. The evolution needs to continue and I invite your participation.

Jerry Hesch, Hesch Seminars and PT, LLC September 6, 2010

DEFINITION OF SACROILIAC JOINT DYSFUNCTION

SIJ dysfunction is defined as altered mobility of the SIJ/pelvic structure per passive accessory motion tests, also named Springing with Awareness, which is a specific manner of performing Spring Tests. The tests are performed with the client's body in stable positions, which are correctable with intervention. The pelvis may or may not be symmetrical. In other words, a symmetrical pelvis can present with hypomobility or hypermobility that is treatable. SIJ dysfunction may also have altered proximal soft tissues, especially if asymmetry is present. The literature describes a fairly unique pain pattern with SIJD, however this model is a biomechanical model, and many more clients have treatable pelvic asymmetry that is relevant to the concept of prevention and optimizing biomechanical function. Pain does not have to be present in order to have SIJ dysfunction.

Chapter 1 - ANATOMY

ARTICULAR REVIEW

(for your reference, please see Figures at the end of this chapter)

The pelvis is comprised of the ilia, ischia, pubes, and sacrum.

The sacroiliac joint (SIJ) is best described as a synovial joint, as it has five of six synovial characteristics. It has a joint cavity with synovial fluid, a capsule with an outer fibrous layer and inner synovial membrane, cartilage covering the joint surfaces, and ligamentous connections, and it has definite motion. The main non-synovial characteristic is that only one joint surface is hyaline (the sacrum), while the ilium is covered with fibrocartilage (Bowen and Cassidy 1981).

The SIJ is a true joint and does not necessarily fuse. A recent review of one hundred CT scans revealed the average age for grade zero joint narrowing to be sixty six, and grades one (slight narrowing) and two (moderate) to be sixty-seven (Yagan 1987).

The SIJ has up to three planes which are angulated to each other. It is impossible to visualize the entire joint surface on radiographs.

The sacrum is shown in the dorsal, ventral, transverse and sagittal views.

The joint has many furrows and interdigitations and may vary from individual to individual and side to side in the same person. The iliac surface is not an exact mirror image of the sacral articular surface.

The angle of the joint orientation as well as that of the lumbosacral facets may vary from side to side. Several types have been identified.

Solonen (1957) studied sacral articular orientation in the frontal and transverse planes. In the frontal plane 90% of specimens narrowed inferiorly at S1, 85% narrowed inferiorly at S2, and 80% then widened inferiorly at S3. In the transverse plane, S1 and S2 narrow posteriorly and S3 widens posteriorly.

Fryette (1954) described six types of sacra. Type A narrows in the frontal plane inferiorly at S1 and S2. It widens inferiorly at S3, and the superior facet orientation (lumbosacral) is in the frontal plane. The dorsal surface (transverse width) is slightly wider at S1, more so at S2, and narrower at S3.

In the frontal plane type B widens inferiorly at S1, its transverse width is much less ventrally at S1, and the superior articular facets are oriented sagittally (lumbar type).

Type C is a combination of type A on one side and type B on the other with regard to both sacral articular and lumbosacral facet orientation.

Fryette also described a type D with smooth convex surface on the anterior to posterior sacral articular surface. This type corresponds with the "rare" (my own quotations) Inflare or Outflare.

Type E is the average type described elsewhere (central depression, elevation at each end).

Type F is extremely irregular and concave with significant stability.

The great variety of anatomical possibilities requires an individual approach to every presentation. Based on the variety of sacral types described above, one realizes that the only clinical tool we have available to make conclusions about movement dysfunction is to gather information using multiple articular Spring Tests. The range of possibilities of joint orientation requires individual approaches to treatment. If one realizes that the joint can move in three planes and may have up to six degrees of freedom in dysfunctional joints, evaluation and treatment can have a logical approach, with a limited number of permutations. The joint Spring Tests and descriptions of the most common types of dysfunction are presented elsewhere.

Most sacra narrow inferiorly in the frontal plane. Some widen inferiorly, and others are a combination.

In the transverse plane most sacra have a narrower dorsal surface. If one could make a single plane of the articular surface, it could be described as "parasagittal" with approximately a 30-45 degree angle away from the sagittal plane. This is visualized clinically by connecting the anterior superior iliac spines (ASIS's) with the posterior superior iliac spines (PSIS's).

In the sagittal plane the sacral articular shape is described as "C" shaped, or as an inverted "L" or auricular (ear) shaped. The convex part is anterior. The short arm is narrower and is superior; the longer, wider arm is inferior.

The angle of the two arms varies from an acute angle in a dynamic type spine (curves are accentuated, and it has more mobility), to a static type spine (reduced curves, less mobile) to an almost purely vertical articular surface as noted by Kapandji.

The upper arm is usually formed at the first sacral segment. The lower arm is usually formed at S2 and S3. The PSIS's are usually at the level of S2, where the apex of the arms is located. A medial view of the sacrum and ilium shows the articular surfaces.

Occasionally accessory articulations are present; usually these are posterior to the first or second sacral segments. They are much more common in adult specimens and may develop in response to the stress of weight-bearing (Ehara et al. 1988).

The SI joint may occasionally span as far down as the fourth sacral segment. The sacrum has a central depression with elevations at each end. The ilium is similarly shaped, though not a mirror image, with a central elevation known as Bonnare's tubercle. The joint is beautifully designed to tolerate stresses in all directions.

Clinically, a generalization that describes the joint as being parasagittally oriented (in the transverse plane) has been found to be helpful.

The sacral promontory usually lies at 30 degrees to the horizontal. If the angle is 55 degrees or greater, there is a 92% probability of back pain with pregnancy (Farbot 1952).

The line of gravity usually is anterior to the sacrum and posterior to the hip joint.

In "normal" posture the ASIS's and symphysis pubis lie in the frontal plane, and the ASIS's are only slightly lower than the PSIS's.

The joint is very stable due to its articular shape and ligamentous support, with little direct muscular support. The role of muscle is not fully understood though many large muscles cross the pelvis and serve to couple motion between the spine, pelvis, and lower extremity.

The actual joint is at least 2 cm anterior to the PSIS, if not more.

LIGAMENTS

The sacroiliac ligaments are described as capsular and accessory. The capsular ligaments are the ventral and dorsal SI ligaments, the lumbosacral, and the interosseous. The accessory ligaments are the iliolumbar, the sacrotuberous and the sacrospinous.

The anterior SI capsule and ligaments are quite weak. The anterior ligament is often described as a thickening of the capsule. The posterior SI ligaments are at various angles, with up to three layers. The sacrospinous ligament connects the sacrum to the ischial spine and may have slips to the coccyx. Tension in the sacrospinous ligament can pull on the coccyx. The sacrotuberous is a powerful ligament that connects sacrum to ischial tuberosity and has slips to the coccyx. This and the sacrospinous connection may explain the occasional relief of coccygeal pain after ilium mobilization. The sacrotuberous ligament is pierced by the S2 and S3 sensory nerves which supply the medial and inferior buttock. Tension in this ligament may cause a sensory nerve impingement.

The sacrospinous and sacrotuberous ligaments are very important stabilizers. If the ligaments were severed, the pelvic joint dysfunction would be much greater in the lower sacroiliac, and perhaps more so in the symphysis pubis, since these ligaments (especially the sacrospinous) are essentially in the same transverse plane as the symphysis pubis. It is not uncommon to find a tender and taut sacrospinous ligament with anterior/posterior malposition of the same sided pubic bone. If these ligaments are hyper/hypotonic the pain pattern and mechanical dysfunction may be more proximal (region of the sciatic notch), and may enhance piriformis spasm with resultant compromise of the sciatic nerve and sciatic notch contents.

In some dissections it is apparent that the left and right posterior ligaments meld with one another. This may partly explain the perception of bilateral dysfunction being the norm. For example a right-sided movement dysfunction often accompanies the opposite type of dysfunction

on the contralateral side, although often one of the movement dysfunctions is of a greater magnitude. There are at least two other anatomical explanations for my perception of dysfunction always being bilateral. There is only one joint in front, the symphysis pubis, which transmits forces from one hemipelvis to the other. The sacrum and lumbar segments (L4-L5) bridge one hemipelvis to the other and if asymmetrical sacral motion fixation is present it will invariably produce opposite effects on each side. Another consideration is the postural response of the body in attempting to conserve energy and minimize the excursion of the center of mass.

The interosseous ligament is the largest connection, is very strong, and is retroarticular.

The iliolumbar ligament is an important, albeit indirect, supporter of the SIJ. If cut during bone grafting, it can render the SIJ unstable (MacNab 1981).

THE SYMPHYSIS PUBIS

The symphysis pubis is another very important stabilizer of the SIJ, and if cut or unstable, renders the SIJ unstable (MacNab 1981). It is a fibrocartilaginous joint. The joint surface is an elongated oval covered with cartilage and having small ridges and depressions which may give resistance to shear. The hyaline cartilage of each pubic bone is connected by a thick fibrocartilage disc. It is supported by a superior pubic ligament, inferior arcuate ligament, posterior pubic ligament, and an anterior pubic ligament (Kapandji 1974).

INNERVATION AND MECHANORECEPTORS

The posterior ligaments of the SI and skin of the medial buttock are derived from the posterior primary rami of L5, S1, and S2 (Grieve 1976). The anterior ligaments and capsule are derived from L3 through S2. Therefore, a variety of proximal and referred pain patterns are possible.

The lumbosacral trunk lies directly over the anterior lower third of the joint.

The SI joint contains some of the strongest and the largest quantity of ligaments in the body. While the primary function of ligaments is to act as primary stabilizers, there is an important secondary role which is subserved by the rich plexus of articular receptors (see Table 1). These provide important proprioceptive functions. The SI joint may be similar to the knee. If there is ligament damage or the knee capsule is distended secondary to swelling, there is a significant inhibition of quadriceps function. The SI ligaments and capsule may act similarly. When there is an SI ligament strain or capsular distension there may be a reflex inhibition of proximal musculature.

Proximal musculature may have a significant role as a secondary stabilizer of the SI. If this is true, then the actual motion available in a dysfunctional joint may be greater than the norm when muscle function is inhibited. If the amount of actual movement dysfunction is nominal, the influence on muscular imbalance via articular mechanoreceptors may be the most significant component of the dysfunction. In other words, the ongoing debate of the actual motion available

and the importance of movement dysfunction, and the ability to detect it clinically, may be futile and counterproductive. Rather, the implications of dysfunction with altered ability to dissipate shock and the significance of mechanoreceptor dysfunction should be our primary focus. No doubt lumbopelvic muscle imbalance can be a significant contributor to low back pain. The musculature may actually be a primary stabilizer, such as during pregnancy when the ligaments and capsule are weakened.

Type	Axon Classification	Receptor Morphology	Location in Joint	Location in Body	Threshold	Adapt-ability	Function
I	II	Ruffini-like	fibrous capsule and ligaments	proximal joints	Low	slow	active at rest during movement
II	II	Paciniform	synovial junction of capsule, fat pads	distal joints	Low	rapid	active at beginning and end of movement
III	I	GTO-like	ligaments	all joints (except) cervical	Low	slow	active at the extremes of end range
IV	III-IV	Free nerve endings	Ligaments, capsule, fat pads		High	slow	active to extreme mechanical irritation and deformation

TABLE 1. CLASSIFICATION OF ARTICULAR RECEPTORS
Source: Crutchfield C., Barnes M: The Neurophisiological Basis of Patient Treatment. Atlanta, Stokesville Publ. Co., 1984, p. 302.

MUSCULAR INFLUENCE

Muscular influences on the SI are poorly understood. Vleeming and colleagues (1989) addressed the connections of the piriformis, gluteus maximus and biceps femoris with the sacrotuberous ligament. Tension on this ligament via the biceps femoris was shown to reduce SI motion. In six of twelve specimens there was a partial connection of the biceps femoris with the sacrotuberous. In two specimens the biceps tendon completely bypassed the ischial tuberosity and attached directly and completely on the sacrotuberous ligament. The role of muscle will be addressed in more detail later in the text.

There are no muscles that cross the joint, yet many powerful muscles exist in close proximity and no doubt have a significant influence in coupling motion in the lumbopelvic-hip joint complex. Several large muscles have fibrous expansions that blend into the anterior and posterior ligaments and add strength to the ligaments and capsule (Walker 1992). These include

the hamstrings, as mentioned above, the quadratus lumborum, gluteus maximus, gluteus medius, piriformis, erector spinae, iliacus, and the latissimus dorsi. The latissimus dorsi is a fascinating muscle, especially from a functional perspective. It has a cervical innervation and has a strong influence on the posture of the pelvis. It can integrate motion between the upper extremities and pelvis and can stabilize either the pelvis during tasks that involve the upper extremity, or the upper extremities while allowing movement of the pelvis.

The pelvic floor is an important group of muscles that should not be ignored. Pelvic floor strengthening has been very effective in the management of pelvic joint hypermobility. There are other important issues to consider: Does the pelvic floor add to the stability of the pelvic joints, and should pelvic floor strengthening be included in the rehabilitation of pelvic joint dysfunction? Does the pelvic floor, which has several layers of strong fascia, have receptors for the hormone relaxin? Can sacroiliac joint dysfunction create weakness of the pelvic floor via malposition, reflex inhibition via articular mechanoreceptors, or via pudendal nerve compression or tension?

ANATOMY FIGURES

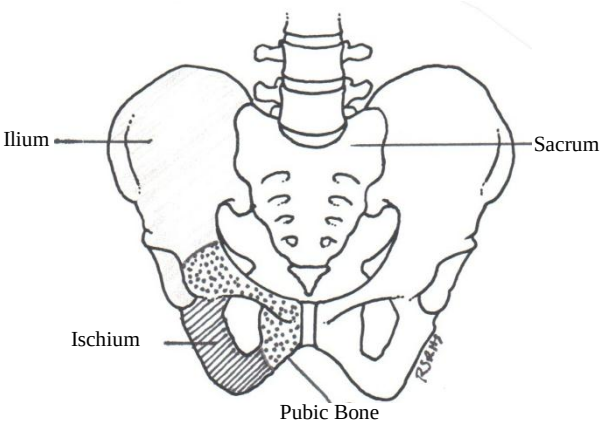


FIGURE 1. The bony pelvis is comprised of the ilia, ischia, pubic bones and sacrum.

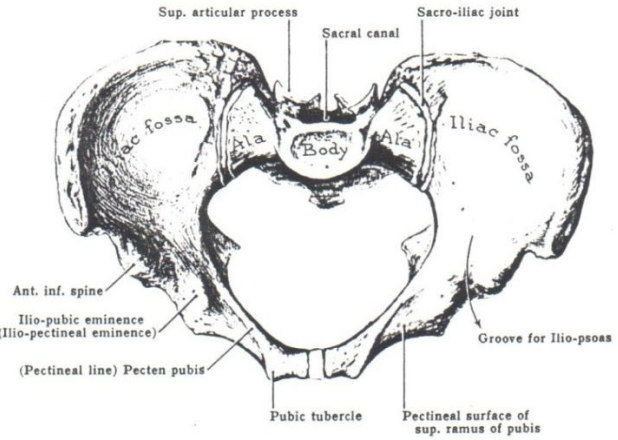
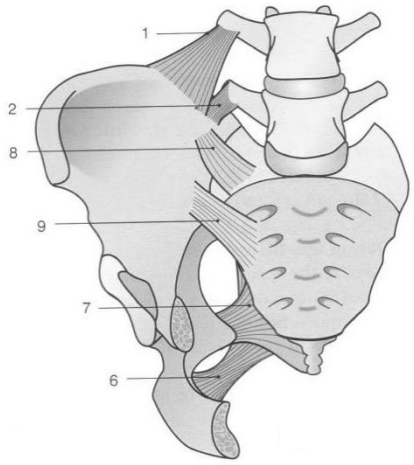


FIGURE 2. Transverse view of the pelvis.



Following are labels for **FIGURES 3, 4a & 4b**:

1. Iliolumbar Ligament Superior Bundle.
2. Iliolumbar Ligament Inferior Bundle
3. Superior Sacroiliac Ligament
4. Posterior Sacroiliac Ligaments Note variation in attachments.
5. Anterior (deeper) Portion of the Dorsal SIJ Ligaments. Note the insertion onto the sacral tubercles.
6. Sacrospinous Ligament.
7. Sacrotuberous Ligament.
8. Anterior Sacroiliac Ligament (superior portion).
9. Anterior Sacroiliac Ligament (inferior portion).
10. Axial Portion of Interosseous Ligament (also named Illi's ligament).

FIGURE 3. Anterior view of the pelvis with ligaments. (Kapandji 2008 p59)

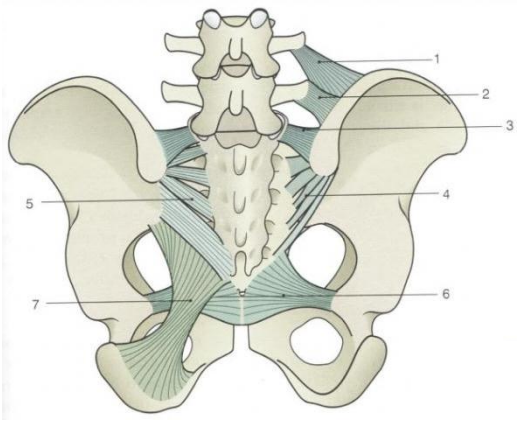


FIGURE 4a. Posterior views of the pelvis with ligaments . (Kapandji 2008 p59)

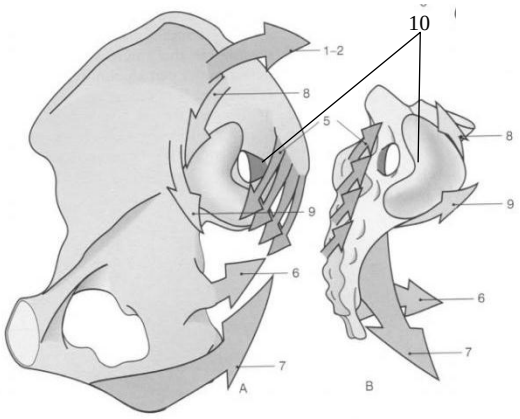


FIGURE 4b. Medial views of the pelvis with ligaments. (Kapandji 2008 p59)

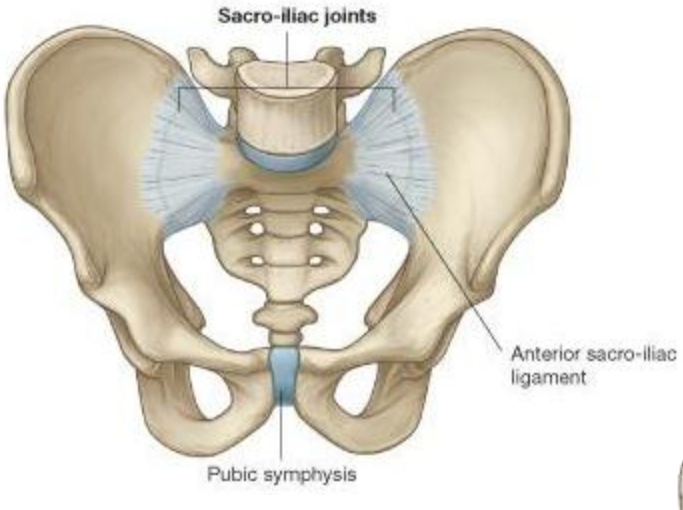
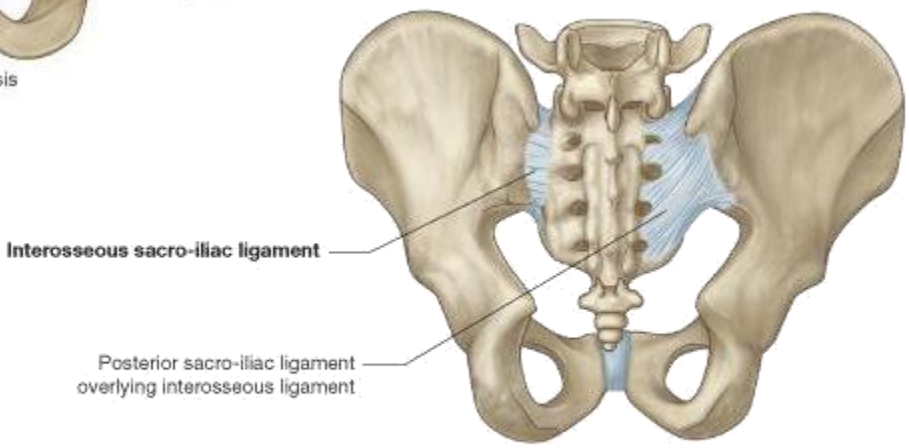


FIGURE 5a. Note the broad fan-like expansion from the sacrum to ilium in the anterior sacroiliac ligament.

FIGURE 5b. Note the expanded interosseous sacroiliac ligament



Sacro-iliac joints and associated ligaments.

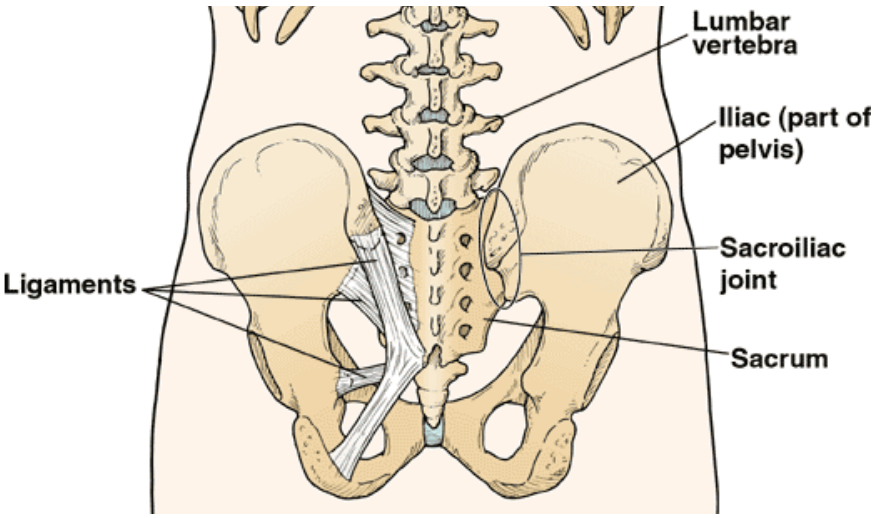


FIGURE 6. Posterior view of the pelvis showing superficial ligaments

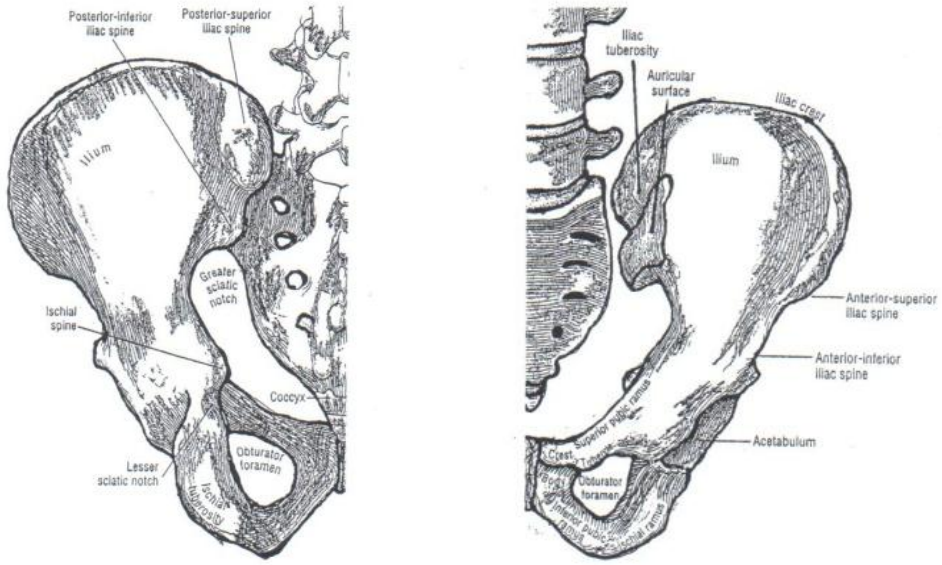


FIGURE 7. Bony landmarks (redrawn from Neumann).

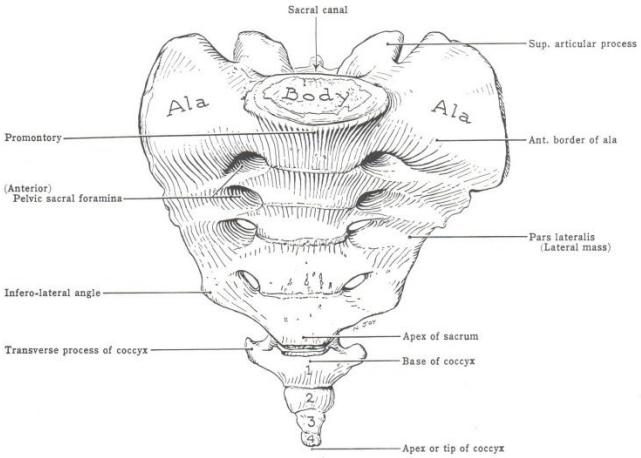


FIGURE 8. Anterior view of sacrum. (Anderson)

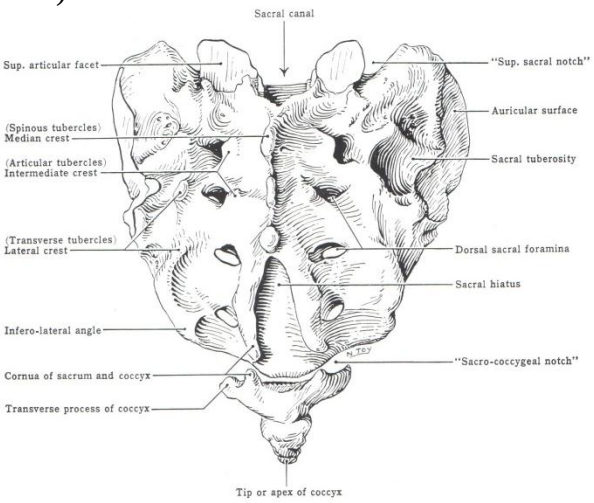


FIGURE 9. Posterior view of sacrum.

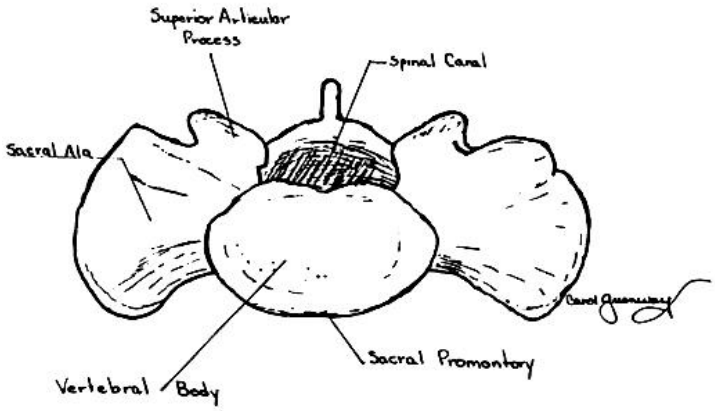


FIGURE 10. Transverse lateral view of the first sacral segment (redrawn from Lee).

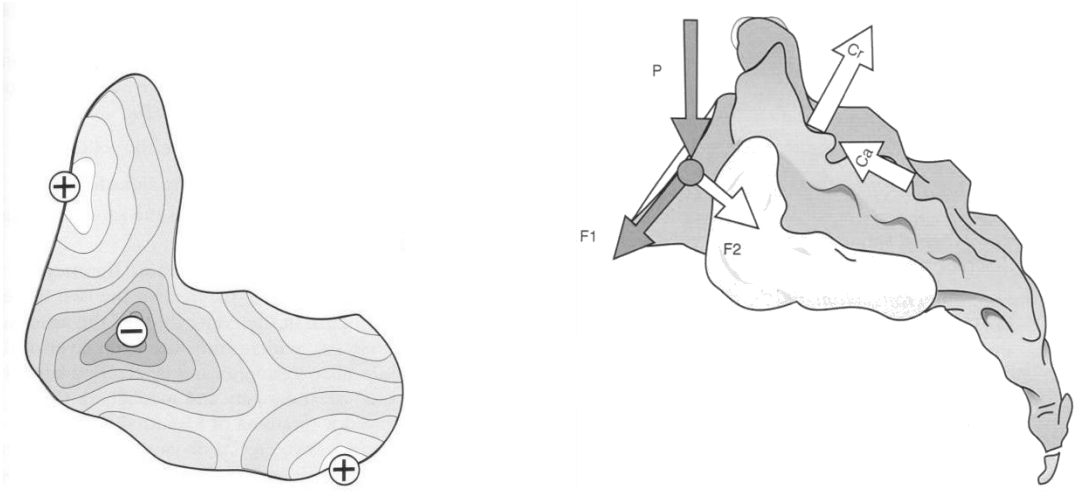


FIGURE 11. Lateral view of sacral articular surface. Note depressions (-) and elevations (+). Also note that the articular surface only occupies the upper 2/3 of the sacrum. (Kapandji 2008 p57)

P = Body Weight

F1 = Anterior-inferior component of body weight.

F2 = Force of body weight (posterior-inferior component) which is perpendicular to the L5-S1 vertebral body and disc.

Cr = Cranial Group SI Ligaments.

Ca = Caudal Group SI Ligaments. These ligaments oppose the F2 force.

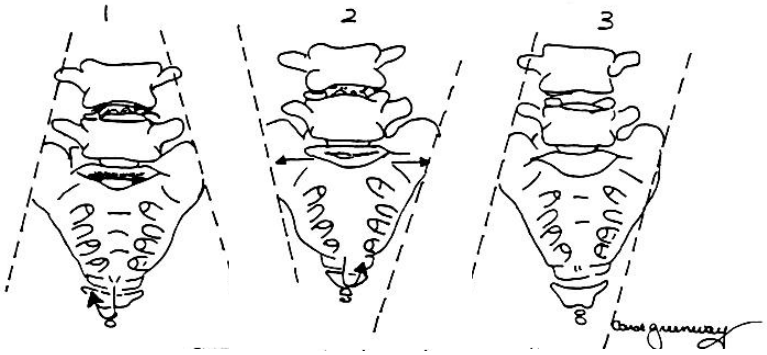


FIGURE 12. Frontal orientation of the sacrum. 1) Sacrum widens inferiorly. This is rare. 2) Sacrum narrows inferiorly. This is very common. 3) Sacrum has a combination of 1 & 2. This is rare. (redrawn from Mitchell).

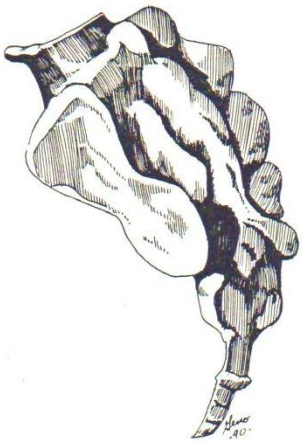


FIGURE 13. Lateral view of sacrum. (drawn by Geno 1990)

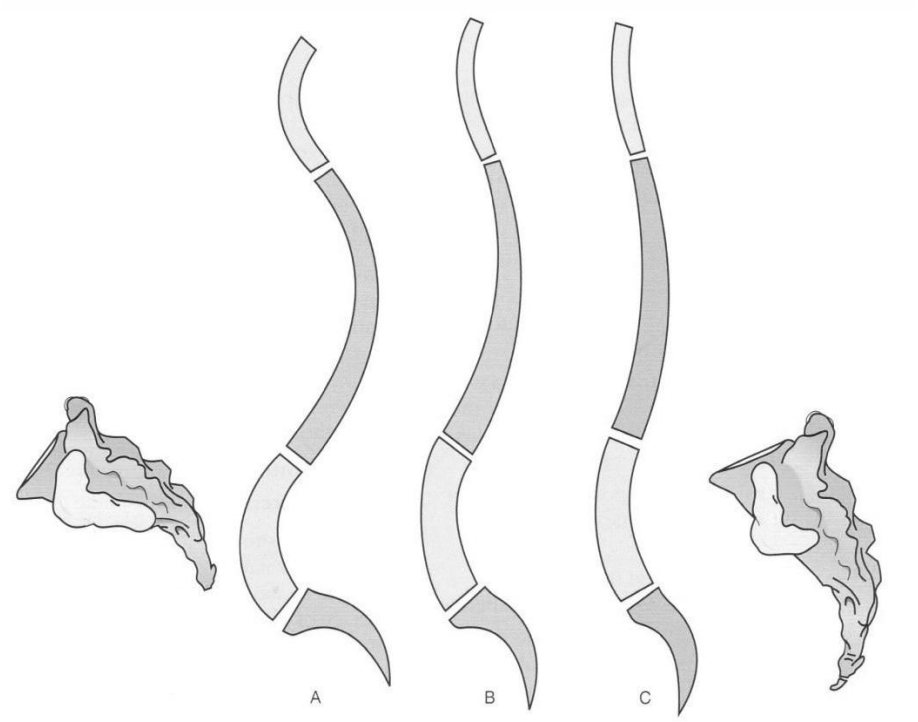


FIGURE 14. Dynamic and static spines. Left image of sacrum and spine (A) represent a more dynamic spine. Middle spine image B a more "normal/ideal" spine, and spine image C and sacrum on the right, a more static spine. (Kapandji 2008 p57)

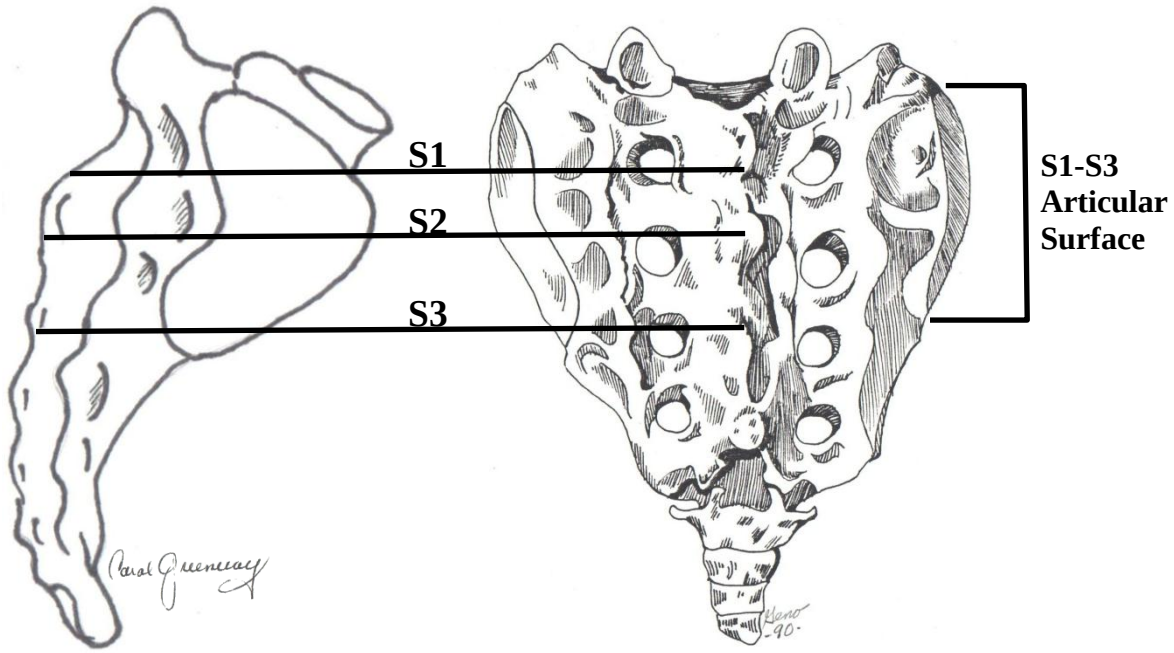


FIGURE 15. Medial and posterior views of sacrum. Note that the joint is formed by S1, S2, and part of S3 (redrawn from Kapandji and Lee).

Figure 16a

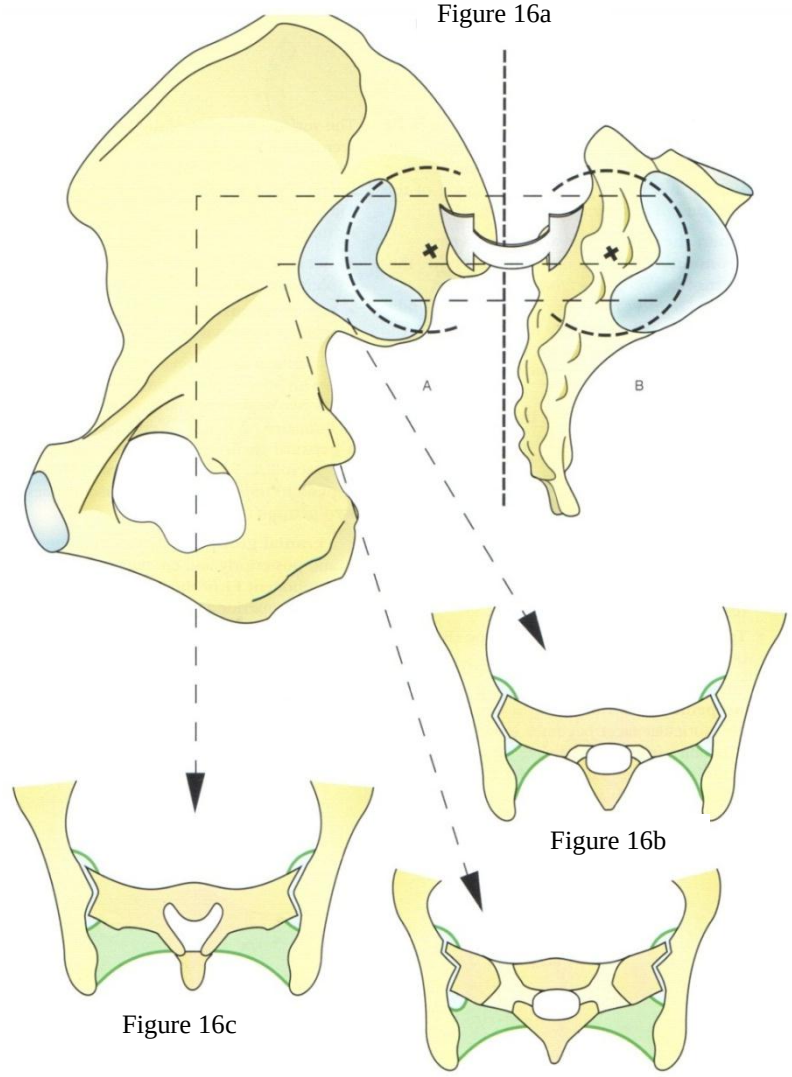


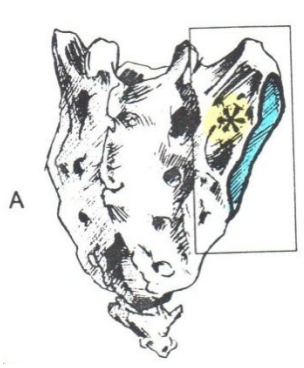
Figure 16b

Figure 16c

Figure 16d

FIGURE 16a. Medial view of ilium and sacrum. (Kapandji 2008 p55)

FIGURE 16b, c, d. Transverse slices show varying angulations that add stability at upper middle and lower thirds. (Kapandji 2008 p55)



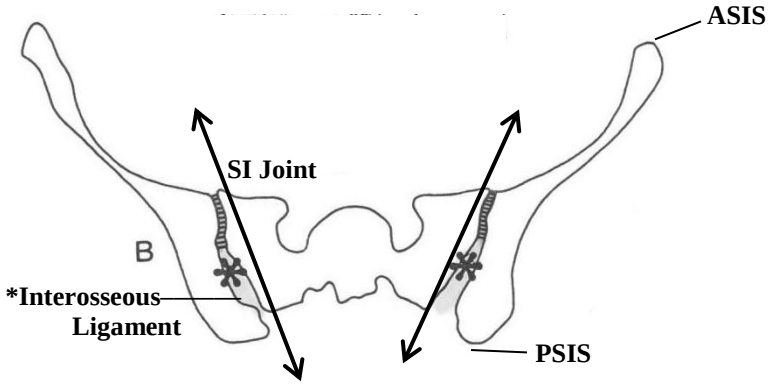


FIGURE 17a. Transverse view of sacroiliac showing parasagittal orientation of joint. The * indicates the insertion of the vast interosseous ligament onto the sacral tuberosity.

FIGURE 17b. Transverse view shows the interosseous ligament behind the artucular portion of the SIJ. (drawings unknown)

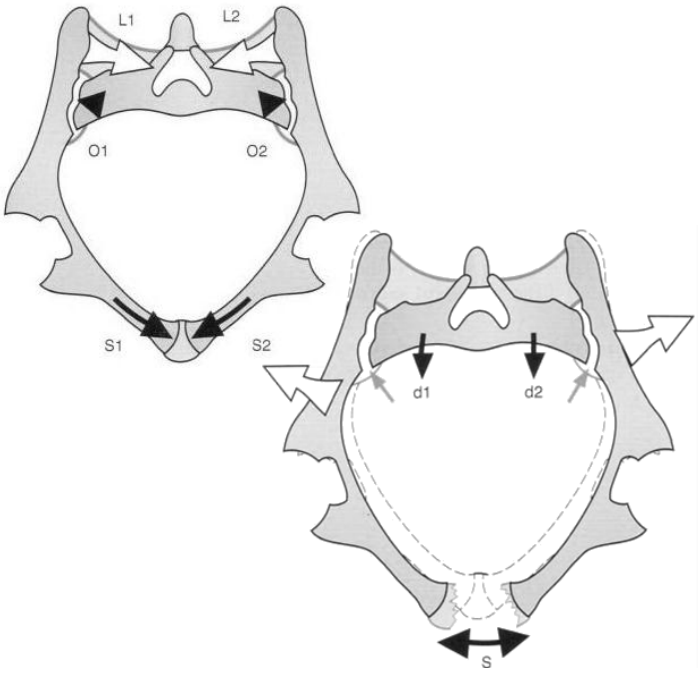


FIGURE 18. Transverse view of pelvis. In a normal pelvis the sacrum rotates anteriorly in upright posture. This causes tension in the dorsal ligaments which then compresses the SI joint and symphysis pubis, thus enhancing stability. When the symphysis pubis is compromised, the SI is rendered unstable with anterior glide of the sacrum d1 and d2, widening of the SIJ's. The symphysis ruptures and separates laterally (diastasis). (Kapandji 2008 p53)

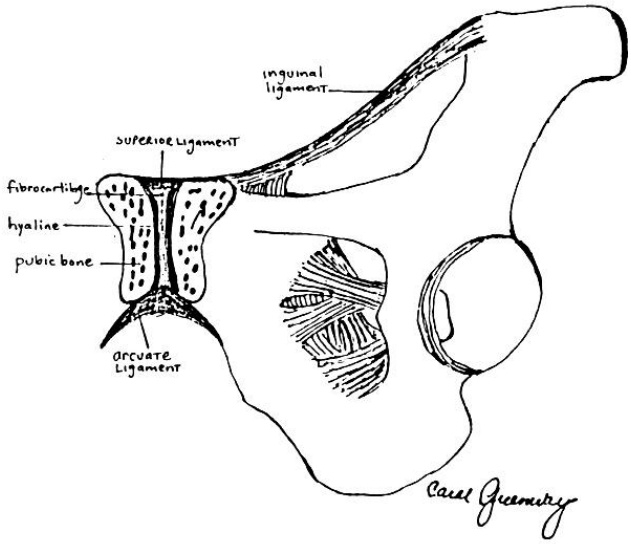


FIGURE 19. Symphysis Pubis. (redrawn from Gamble)

Chapter 2 - MOTION IN THE PELVIC JOINTS

SACROILIAC JOINT MOTION

In the past, motion of the SIJ was controversial. This was probably due to studies on older specimens and inappropriate interpretation of radiographs, which have been proven to be unreliable in interpreting joint degenerative change and ankylosis (Vleeming et al. 1990, Yagan 1987). Numerous studies have confirmed motion of at least 2 mm to be the norm. Motion is variable from person to person due to genetics, hormonal influence, disease, trauma, posture, occupation, habit, surgical history, childbearing influence, and body type. While true ankylosis does occur on occasion, it appears to be much less common than previously believed. Radiographs often give a false impression of bony ankylosis.

Motion within the SIJ and symphysis pubis is small, though there are exceptions. That movement occurs in the joint is an indication of its function, though isolating this motion is not necessarily easy. A much more important concept than the fact *motion must occur in the joint* is the concept that *motion must occur through the joint.* This has important clinical ramifications.

Rule of physiological motion: When the pelvis gets stuck in a direction of functional or physiological motion, it will always be able to move further into the direction of dysfunction but cannot move out of the dysfunction until treated by a passive external force. Thus, it is predictably hypermobile in the direction of dysfunction and hypomobile in the direction out of dysfunction.

Rule of non-physiological motion: When the pelvis gets stuck in a direction that is not functional or is an unphysiological motion, it will either be able to move further into the direction of dysfunction (hypermobile) or it will be hypomobile in the direction of dysfunction. The response is unpredictable. Normal movement can be restored by a passive external force.

Bowen and Cassidy (1981) were able to elicit gliding motions in all directions in first decade specimens, and sagittal rotation thereafter which was reduced by degenerative changes in older specimens. Parasagittal rotation has been mentioned by others, as has rotation with translation, anterior and posterior translation, and cranial/caudal translation. Elaborate descriptions of movement dysfunctions are listed elsewhere.

Motion has been quantified as:

- A couple of degrees SI motion and up to 0.4 cm difference between PSIS's (Egund et al. 1978).
- Four degrees (Nachemson et al. 1979, Vleeming et al 1990).
- 2.7 mm average up to 12 degrees (Frigerio et al 1974).
- 5 mm between PSIS's (Colachis et al 1963).
- 5.5 mm ventral shift of the sacral promontory (Weisl 1955).
- At most a few degrees and rotation of a few degrees at most (Scholten et al. 1988).
- 0.76 to 2.74 mm anteriorly and 1.4 to 6.21 degrees axial rotation of the sacrum on a fixed ilium (Miller et al. 1987).

- 6 mm translation and 10-12 degrees of rotation (Lavignolle et al. 1983).

It is important to realize that motion can occur in all three planes, and can occur in all three joints that comprise the pelvic ring. Independent or coupled movement can occur with one or both ilia, the sacrum, and the pubic bones. So the actual motion may be much greater than that perceived in a single plane.

Vleeming et al. (1991) did a study on four specimens between 65 and 82 years of age. They concluded, as did Miller et al. (1987) that ankylosis in the elderly is not the norm, but that mobile joints are the norm, albeit less mobile than in younger individuals. Sturesson et al. (1989) found no decrease in mobility in a group of patients up to age 45. Vleeming et al (1991) found motion to be the greatest on the side in which a total hip replacement was present.

Creep is an important concept when evaluating SI joint mobility. Deformation over time, especially with increasing load, may create greater motion than an abrupt force of short duration. Recovery will therefore be time-dependent and may require an external force.

Some investigators and clinicians seem to confuse joint widening with joint motion (Walker 1986). Functionally, the joint does *not* have to widen or separate in order to move through a norm of 2 mm. Lack of evidence for joint widening does not imply a non-moveable "joint". As an example one could wet two surfaces of glass, and they could move without any separation.

The ilium may move on the sacrum which usually couples with lumbar rotation, perhaps due to the iliolumbar ligament and muscular connections. This motion probably occurs during heel strike or any other type of lower extremity loading. According to Weisl (1954) and clinical observation, motion of one ilium results in paired antagonistic motion of the contralateral ilium. The ilia may move together on a fixed sacrum, or the sacrum and ilia may move together as a fixed unit. The sacrum may move independently within the ilia, through a small range. This is probably more common in sitting or when bent over in standing, and strong leg muscle contraction prevents movement of the ilium or ilia. This seems especially common in clients who sustain SI injuries when bent over in standing. It usually involves twisting of the trunk and pelvis on fixed lower extremities, particularly with weighted upper extremities.

Clinical assessment of motion is based on pre- and post-treatment changes in bony landmarks such as the sacroiliac sulcus depth, changes in accessory motion tests, and changes in ligamentous stress tests. These ligamentous stress tests and accessory motion tests are not much different from accepted tests for stressing the collateral and cruciate ligaments in the knee. Motion can be graded, based on joint Spring Tests, on a six-point scale (modified from Paris 1991):

Mobility Scale

0=no motion
1=extremely hypomobile
2=slightly hypomobile
3=normal
4=slightly hypermobile
5=extremely hypermobile,
6=unstable.

Increased tone in the sacrotuberous and sacrospinous ligaments is palpable and may indicate motion dysfunction or change in muscular tension which can reduce joint motion (Vleeming 1992). Changes in articular motion may be more readily apparent to a skilled clinician, while subtle changes in position are perhaps less apparent. This is no different from any other joint in the body. For example, ligament stress tests applied to the knee tell us more about change in mobility/stability than about actual position of one bone relative to another.

When motion is evaluated via joint Spring Tests, several factors may come into play, which cause the perceived motion to be greater than the actual motion. Cartilage deformation may occur according to Walker (1986) and Vleeming et al. (1990). Spring Tests from the anterior pelvis apply a significant mechanical leverage to the joint as they act at a distance, and motion information obtained may appear greater than the actual motion available. In spite of our best efforts to stabilize one part of the pelvis, a Spring Test might initially test motion of the pelvis as a whole moving on the spine. It is worthwhile to practice Spring Tests on patients with fused SI joints (advanced ankylosing spondylitis) and to practice on fused spines.

Articular Spring Tests are difficult to quantify, and the need for quantification has led to the development of several knee laxity testing devices. Unfortunately, attempts at generating interest in developing a similar device with application to the pelvis have been unsuccessful. It seems that perhaps the purest Spring Test for the pelvis is an anterior to posterior force applied to one pubic bone while palpating the opposite side. All other tests act at a distance and may utilize long levers, therefore giving the impression that motion is much greater than perceived. Spring Tests have often been utilized to determine if the sacroiliac joints are a source of pain. I note that Spring Tests seldom reproduce pain but often give useful information about the joint's ability to dissipate shock and indirectly give information about muscle function. Rather than using a pain model, I use a biomechanical model with the goal of optimizing lumbar, pelvic and hip posture, mobility and stability.

Bony deformation has recently been addressed experimentally for the first time by Vleeming et al. (1990), who reported 0.5-1 cm of sacral deformation with manual pressure of 15 kg. The sacroiliac joint motion was slight and did not account for the degree of deformation.

SYMPHYSIS PUBIS MOTION

It is much easier to study motion of the symphysis pubis than to study sacroiliac motion as it can be done with an anterior-posterior view of the pelvis. It is important to remember that only vertical differences and symphyseal widening are demonstrated with this technique. Rotary changes cannot accurately be determined. Rotary changes may be more common, and therefore we are only measuring perhaps a small amount of the actual dysfunction, if any of it, when using A-P films. This can be readily demonstrated by using the thumbs to represent the pubic bones. Align the thumbs with the fat pads opposing. Rotate one thumb 30 to 45 degrees about a transverse axis and ask several people to estimate the amount of rotation, or take a picture of it. It is very difficult to accurately perceive the actual motion with a frontal plane view. Normal symphyseal width is 4 mm. Most patients with hypermobility have a 2-5 mm increased width but a few have greater than 10 mm increased width (Haagen 1974). The majority have less than 5 mm vertical shift. Coventry and Tapper (1972) mentioned that motion should not be greater than 2 mm, and cited clinical and radiographic tests. They implicated removal of the sacroiliac ligament and iliac bone for lumbar fusion as a cause of instability. Four of six patients were asymptomatic after symphysis pubis and sacroiliac fusion.

Death et al (1982) quote Vix and Ryu (1977) who reviewed 400 intravenous pyelograms and found the upper margins of the symphysis pubis to be horizontal in 97% of men and 84% of women. I interpret this to mean that symmetry is the norm, with women having a lower percentage of symmetrical pubes. Young (1940) noted widening of 4 to 9 mm during pregnancy. Laban (1975), using Chamberlin's technique of radiography, found up to 5 mm increased width in symptomatic patients.

Walheim (1979) used pins on the pubic bones and with an x-y recorder measured up to .0-0.5 mm motion; however, in those with suspected instability he found 1.5-10 mm. In a later study (1984) using volunteers and cadavers, values for translation were 2 mm or less, rotation less than 1.5 mm, and vertical mobility usually less than 2 mm. Vertical mobility in two cases was 3 mm. He agreed that mobility was greater in the multiparous population. During gait and unilateral stance vertical translation of one pubic bone on the other averaged 0.5-1.9 mm in males, 0.8-2.6 mm in nulliparous, and 1.6-3.1 mm in multiparous females. Motion in the X axis did not exceed 2.0 mm. The purpose of the study was to establish normative data. None of the subjects suffered from any apparent pelvic joint dysfunction.

In order for unilateral motion to occur in the symphysis pubis, motion must also occur in the sacroiliac. However, there are several articles in the sports medicine literature addressing adductor strains or osteitis pubis that mention and demonstrate radiographic evidence for symphysis motion with no mention whatsoever of the necessary concurrent motion in the SIJ (Hanson et al. 1978; Rold 1986). The functional relationship of the symphysis pubis and sacroiliac should not be denied.

MOTION OF THE PELVIC STRUCTURE

The pelvis can move in a variety of directions without motion having to occur in the SIJ. It appears that many clinicians including physical therapists learn about pelvic motions first in kinesiology classes and then unlearn this, replacing it with the paradigm than any asymmetry of pelvic posture and any asymmetry of active motion of the pelvis represents "the ilium moving on the sacrum" or the "sacrum moving on the ilium." ***Most of the time so-called SIJD is actually asymmetry of the pelvis moving on and with the trunk and hip joints.*** Therefore treatment is reasonable to enhance posture, restore normative movement, maximize efficiency and reduce pain, etc. Unfortunately, linguistic obfuscation pervades the profession and probably always will. The reader is encouraged to review basic kinesiology on the hip and pelvis, such as Newman 2002, and Levangie and Norkin 2005.

Chapter 3 - RADIOLOGY

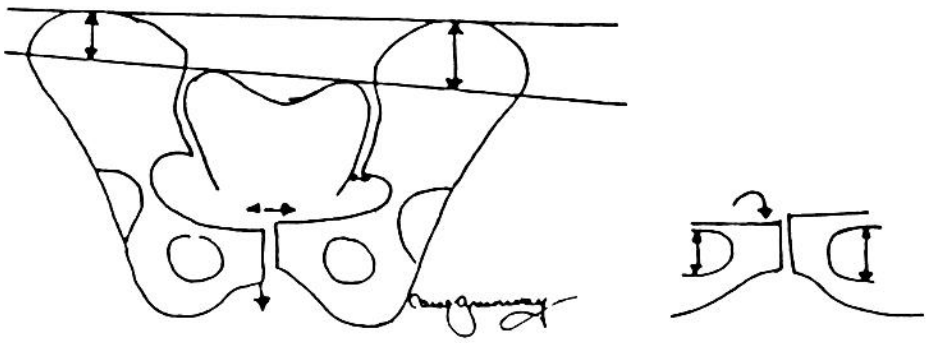
There are several methods of radiographic analysis, each having certain advantages and limitations. CT scans give the most information regarding degenerative changes. In one study (Lawson, 1982), CT scans were superior to conventional radiographs. CT scans are seldom used, if ever, to demonstrate mechanical dysfunction. There is no radiographic technique available for visualizing all planes of the joint at the same time. Yagan et al. (1987) did a retrospective study of the SI using abdominal CT scans to look at degenerative changes in the SI joint (n equals 100, or 200 joints). SI joint narrowing did not occur until age 67. Bony sclerosis along the joints, as seen on plain films was sometimes caused by nonmerging spurs, at times it is erroneously interpreted as true ankylosis.

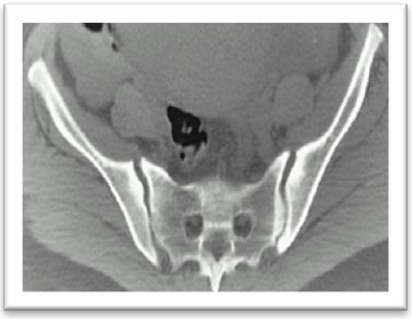
Another method uses a 10-20 degree angle with an A-P radiograph which includes the entire sacrum and the ASIS's. A vertical line is drawn through mid-sacrum and a horizontal line is drawn across the ASIS's. It is readily apparent whether or not they define symmetry. Other landmarks may also be analyzed.

Dihlman's book, *Diagnostic Radiology of the Sacroiliac Joints* (1979) is very insightful. He uses a simple method of radiograph analysis on pelvic films (Figure 20). He draws a line across the top of both sacral ala and a line across the top of the iliac crests. The greatest vertical distance is compared. A difference of 2 mm or more is considered significant for pelvic loosening. He also measures symphysis width, vertical difference of pubes, and width of the SIJ. Other methods are also presented.

One study exists that supports the concept of pelvic loosening in response to inflammation. Davis and Lentle (1978) studied 50 females with backache and 66 asymptomatic females. Bone scans were positive in 2 of 66 asymptomatic for sacroiliitis, and in 22 of 50 symptomatic for unilateral or bilateral sacroiliitis. Radiographs were negative in 20 of 22 symptomatic females with positive scans, but radiographs may be of limited value in detecting low grade inflammatory processes. In this study HLA-B27 antigen was absent. It was concluded that SI disease is a common cause of low back pain in women and can be assessed with bone scans when radiographs are negative. The problem is probably much more common than is generally suspected.

Farbrot (1952) studied 311 joints and classified them according to the amount of sclerosis noted on radiographs. He classified them as having clean joints with no evidence of sclerosis, subsclerotic with a narrow area of sclerosis adjacent to the joint cartilage, or sclerotic with a marked joint density. Ninety percent of the males and nulliparous females had clean joints, while 93% of the parous females had sclerosis or subsclerosis. This gives credence to the belief that increased motion in the joint makes for increased wear and tear.

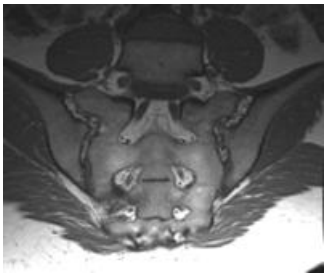




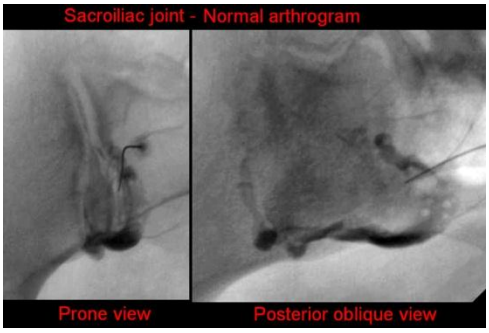
CT scan showing increased anterior SIJ width. From Kowalk 2008.

X-ray demonstrating symphyseal diastasis. From Kowalk 2008.

CT with 3D reconstruction. From http://www.ceessentials.net/article47.html



MRI coronal image. From http://www.ajronline.org/content/187/6/1420/F7.expansion.html



Fluroscopy image of injection into SIJ with dye. From http://emedicine.medscape.com/article/103399-overview#a15.

FIGURE 20. FILMS OF THE PELVIS FOR PELVIS

A-P film of the pelvis can provide useful information regarding the possibility of SIJ dysfunction. If the width of the SI exceeds 2-3mm or the width of the symphysis has increased (may require comparative film), or is greater than the norm of 2-4mm nulliparous, 2-6mm parous, symphyseal and therefore SIJ hypermobility is suspected. The height of the obturator foramina and pubic crests is also informative, except for the fact that the person can be standing or lying asymmetrically. A horizontal line can be drawn across the top of the sacrum and another line is drawn across the top of the ilia. The vertical distance is compared on each side. If the difference is greater than 2mm, SIJ hypermobility is suspected, but most likely is over-interpreted. Repeat testing in stork position and discerning change is probably much more reliable.

Chapter 4 - FUNCTION OF THE SI JOINT

This joint is one of the strongest in the body and relies on its articular shape and ligaments for its primary support. While muscles no doubt influence the joint, there is a paucity of hard data on the precise role of muscle influence. There are more than 29 pairs of muscles that connect the pelvis to the spine and lower extremity. The pelvis functions to communicate or couple motion from the lower extremity into the spine and from the spine into the lower extremity.

Altering the position of the head alters the posture of the pelvis. This is referred to as the occulo-pelvic reflex. The reverse is also true. The pelvis also acts as a stable base for lower extremity motion to occur, (Imagine the pelvic stability required when kicking a soccer ball). It also acts as a stable base for trunk motion.

In standing, the weight of the body tends to displace the sacral promontory forward and downward into the pelvis (Figure 21), while the apex of the sacrum moves posterior and superior (Grieve 1976). This motion is then resisted by the powerful posterior ligaments, which draw the ilia together and compress the joint. Body weight is transferred through the SI to the pelvis and femurs; in sitting it is transferred to the ischial tuberosities (Figures 18, 21, 22). In gait the joint appears to help absorb the shock of heel strike. The joint appears well designed to tolerate stresses in all three planes and to reduce stresses at the lumbar spine. No doubt the joint reduces the shock of landing on our ischial tuberosities every time we sit down!

The joint allows parturition by spreading in response to the hormone relaxin and perhaps responding by creep due to increasing weight during pregnancy (Figure 21).

The abundance of pelvic ligaments and therefore abundance of mechanoreceptors probably plays an important role in posture and balance of the entire body, especially since the pelvis is the hub of the body.

The SIJ has a small normal range of movement and little or no active movement potential according to Smith (as quoted by Chaitow 1991). Movement therefore acts in response to external forces, not intrinsic forces. Thus, if there is an imbalance in the movement of the SIJ, the body is obliged to compensate for the problem. The compensation can occur elsewhere in the body, these compensations sometimes being "locked into the body" and requiring treatment to the primary source (the SIJ). Due to the fact that the SIJ has little or no active movement potential, dysfunction of the joint requires a *passive* force to correct, and does not respond to active forces such as active exercise regimes. While active exercise such as AROM and strengthening are very useful in treating low back pain, their appropriate role in the treatment of SIJ dysfunction comes *after* resolving the movement dysfunction (often referred to by this author as a strain pattern).

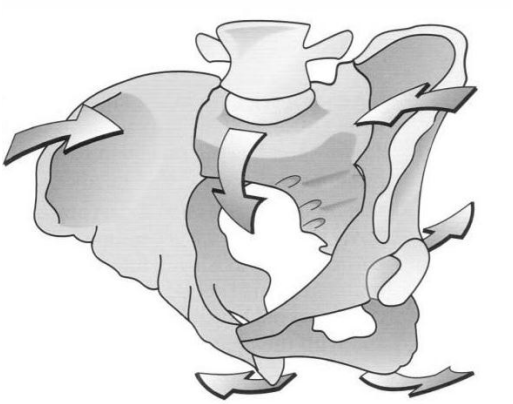


FIGURE 21a.

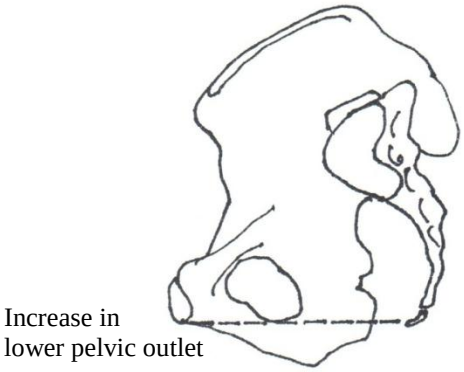


FIGURE 21b.

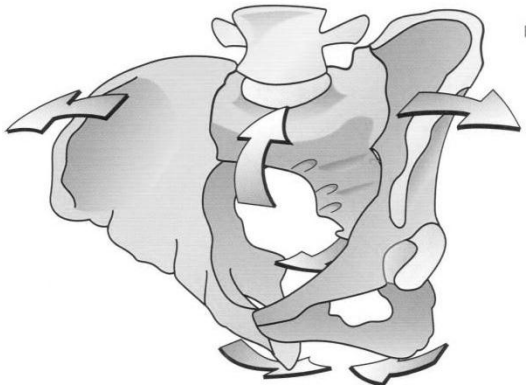


FIGURE 21c.

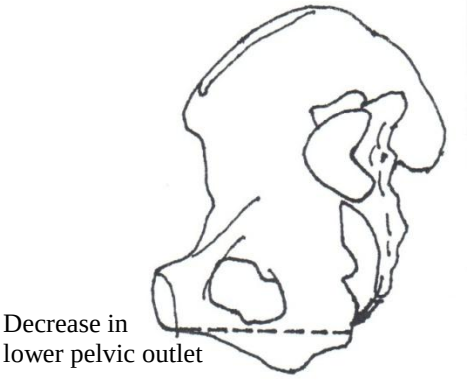


FIGURE 21d.

FIGURES 21a, b, c, & b. The influence of upright posture on the pelvis. This also describes the pelvic movement during the final stages of partuition. (Kapandji 2008 p61)

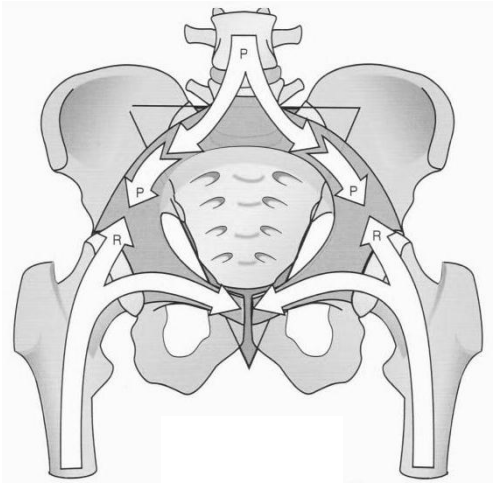


FIGURE 22. Weight of the upper body and ground reaction forces acting on the SI joint and sympysis pubis (Kapandji 2008 p53)

Chapter 5 - SI JOINT DYSFUNCTION

DEFINITION

According to Hesch SIJ dysfunction is defined as altered mobility of the SIJ/pelvic structure per passive accessory motion tests (Spring Tests), as tested in stable positions, which are correctable with intervention. The pelvis may or may not be symmetrical. In other words, a symmetrical pelvis can present with hypomobility or hypermobility that is treatable. SIJ dysfunction may also have altered proximal soft tissues, especially if asymmetry is present. The literature describes a fairly unique pain pattern with SIJD, however this model is a biomechanical model, and many more clients have treatable pelvic asymmetry that is relevant to the concept of prevention and reducing stress along the kinetic (and reflexogenic) chain. Probably more often than not, the term SIJD could appropriately be replaced with a more general term such as "faulty posture and motion coupling of the lumbopelvic and hip complex.

THEORY

Sacroiliac dysfunction is a movement dysfunction involving the sacrum and ilium or both ilia. It may be a hypomobility in which one of the bones has moved near to, or at, the end of its physiological range of motion and has become stuck or unable to return to its normal functional position. It may also be a hypermobility or instability. It may cause pain that is local and/or referred. It may also cause spasm and biomechanical dysfunction of the SI, spine and lower extremities due to their functional interdependence. Dysfunction may cause a reflex inhibition of muscle function due to the powerful influence of articular mechanoreceptors, which are in abundance in the many pelvic ligaments. Motion dysfunction of the symphysis pubis and lumbosacral region nearly always accompany sacroiliac joint dysfunction.

Motion dysfunction, specifically fixation which results in hypomobility, can occur anywhere along the available range. It may occur at the beginning of range, along mid-range, or at end range. This concept is very poorly understood, the usual belief being that the joint is always stuck at end range. The Spring Tests (discussed in detail later) are very useful in determining the status. Example: Left rotation of the sacrum rarely occurs at end range as Spring Tests done to induce further left rotation are usually capable of increasing it. Spring Tests applied to induce right rotation usually fail to do so.

Sacroiliac joint dysfunction is a misnomer which has pervaded our profession for too long. On the basis of a few gross motion tests, a few positional tests (both with low inter and intra-rater reliability) we have concluded that the "joint" was in dysfunction. We need to make the distinction between faulty motion coupling of the pelvis as a unit, and actual joint mobility dysfunction.

In order to have a true joint dysfunction the articular Spring Tests must reveal a hypomobility or hypermobility. Traditionally only a few Spring Tests have been used and they often lacked precision. The Spring Tests also have relied on a pain response rather than grading of motion response, such as hypomobile, normal or hypermobile.

It seems wrong to interpret joint Spring Tests of the pelvis on the basis of pain alone. Adequate work on the amount of type IV pain receptors in the pelvic joints has not been done. Clinical experience causes me to suspect that there is a paucity of pain receptors in the pelvic joints or that they fire only at the very extremes of deformation. The pelvis is a tri-planar shock absorber, and the relationship of structure and function would not predict an abundance of low threshold pain receptors. Pelvic joint dysfunction is very common based on positional and especially on articular Spring Tests. The biomechanical model alludes to the importance of structural pelvic function with *any* biomechanical dysfunction *anywhere* along the kinetic chain. In fact, it is not uncommon to see strain patterns at distal sites which act in concert with the lumbopelvic strain pattern. In my clinical practice I often improve pelvic joint mechanics whose dysfunction is presumed to be of old. The pelvis has an uncanny ability to respond to minimal and simple corrective forces. The purpose of treatment is to decrease adaptive or compensatory stress at the site of recent trauma or pain. In addition to traditional movement and Spring Tests, new ones have been developed to assess the SIJ and symphysis pubis. They are interpreted primarily on the basis of motion response and less so on the basis of pain response.

For our purposes dysfunctions will be named on the basis of position of the anterior landmark. The loss of mobility will be in the opposite direction. For example, when the sacrum rotates to the left (about a vertical axis) the anterior surface faces left and it lacks rotational mobility to the right. Posterior palpation reveals prominence on the entire left side of the sacrum. A Spring Test will reveal less mobility on the left and more on the right posterior surface of the sacrum (client is prone).

If the symphysis pubis is dysfunctional the adductor muscles will have abnormal length/tension curves. Several articles on adductor strains and pubis stress symphysisitis demonstrate symphysis pubis asymmetry (Rold 1986; Gamble 1986).

Hamstring strains are common with rotation fixation of the ilium and respond much better if treatment to the hamstrings is coupled with ilium mobilization (Cibulka et al. 1986).

Sacral hypomobility may overload the lumbar disc and facet joints. Sacral rotation with fixation may have deleterious effects on the lumbosacral neuroforamen. Sacral rotation and ilium rotation both have an influence on all proximal musculature, especially the piriformis. Sciatic notch contents may be altered with an increase in tension and compression.

Alteration of lumbar, pelvic and hip posture and movement requires alteration in posture and motion elsewhere in the body. A very common compensation for an Anterior Ilium is an upper cervical rotation to the opposite side. Altered patellofemoral tracking has been noted and successfully corrected with treatment for Inflare of the ilium. One must always be mindful of proximal and distal adaptive and compensatory strain patterns that are associated with lumbopelvic dysfunction.

Hypomobility of the ilium may dictate that shock attenuation occur at the hip joints and lumbar spine.

Dihlman (1979) mentions several predisposing factors of pelvic loosening, one being a transitional lumbosacral vertebra which lifts part of the weak anterior capsule and ligaments. I note a clinical correlation between transitional vertebrae, pars defects, and SIJ dysfunction.

Chronic irritation such as extrinsic trauma, habit, or occupation, and intrinsic microtrauma such as hypermobility may contribute to chronic low grade inflammation. Dihlman also mentions inflammatory processes as attacking fibrous parts of the articular tissue and leading to pelvic loosening.

SIGNS AND SYMPTOMS OF DYSFUNCTION

Antalgia is not uncommon.

Pain with sitting is a common complaint with an inability to sit "squarely" on both buttocks.

Pain upon turning in bed is a frequent complaint.

Pain is common at one or both PSIS's, or medial to it/them, sometimes radiating to the trochanter, sometimes to the inguinal region or the anterolateral thigh, and rarely to the anteromedial thigh.

Patients may speak of hip pain but point to the PSIS, and may describe it as "I got a hitch in my get-along!"

Clients may have proximal or distal pain syndromes as the only manifestation of SIJ dysfunction. This appears to be on a mechanical basis. If distal mechanical dysfunction is present, the secondary compensations and adaptive changes may never resolve till the primary SI joint dysfunction is corrected. For example, upper cervical rotation is often in the opposite direction of lumbopelvic rotation. The cervical rotation is much easier to treat, (when it exists as a compensatory pattern), if the lumbopelvic rotation is treated first.

Weight-bearing is sometimes uneven when measured with each foot on a separate scale.

Clumsiness, especially of the lower extremity on the side of dysfunction, is fairly common.

Clients often complain of the lower extremity "giving out from under them," yet have normal quadriceps strength.

They may have a positive bone scan with negative test for HLA-B27 antigen.

SI dysfunction does not cause severe lancinating sciatica such as that which is common with acute disc prolapse with nerve root compromise. SI dysfunction rarely refers pain below the knee, and if it does it is an ache.

Patients often have a normal medical workup and are neurologically intact, with all medical tests being essentially normal. They may have a history of multiple medical and non-medical consultations without results.

SI dysfunction is common with torsional injuries, a fall on the buttocks, a step off a curb, or a twist involving a fixed foot, and is often associated with lifting injuries or an MVA.

It occurs during pregnancy, or after delivery, and of increasing degree with multiple deliveries. It is also associated with a certain phase of the monthly cycle.

It can be aggravated by intercourse.

It is not uncommon after gynecological surgery. Perhaps it occurs while the protective muscle and proprioceptive responses are not present in the anesthetized patient and the legs are being removed from stirrups. Additionally, the pressure on the sacrum during these procedures is unphysiological and preexisting (SI) conditions may be worsened. The drugs used to facilitate pelvic floor relaxation reduce the stabilizing influence on the pelvic joints.

Altered pelvic posture and altered pelvic joint mobility based on articular Spring Tests are consistent findings in suspected SI joint dysfunction.

SI dysfunction does not always exist alone. More often than not it accompanies any one of the many causes of low back pain. Treatment is often more effective and more lasting if all components are addressed.

HYPOMOBILITY

One of the main functions of the SIJ appears to be that of a shock absorber (DonTigny 1990). Therefore, any hypomobility would impede shock attenuation. Malposition often is a cause of apparent hypomobility, which resolves readily with mobilizing procedures. This is referred to as Apparent Hypomobility. (Please review the definitions of Apparent and True Hypomobility as these are key concepts in this approach.) It is critical that one do a thorough reevaluation after treatment appears completed. When proper shock attenuation is restored, other joints along the kinetic chain may be spared tissue breakdown.

The SI joint is one of the most remarkable joints in the body, especially with regard to its ability to alter mobility with simple procedures. There are many causes for hypomobility, most causes being treatable. Hypotenuse of the pelvic girdle muscles including the pelvic floor may cause hypomobility. When a hypomobile joint responds readily to simple mobilization procedures with minimal expenditure of time, it is referred to as an "apparent hypomobility." This is useful in distinguishing it from a hypomobility which requires much more effort or is an unchangeable state such as that which is due to ankylosing spondylitis. This is called True Hypomobility (please see definition). Fortunately, most clients present with Apparent Hypomobility.

Hypomobile and hypermobile states of the joint often work together. For example, an Anterior Ilium is usually hypermobile in an anterior, medial and inferior direction (the anterior portion of the ilium), but is hypomobile in a posterior, superior and lateral direction. The pelvis usually becomes stuck in a pattern which it can readily move into, but is unable to move out of. This is a critical concept and must be understood to practice this approach. The pelvis is seldom stuck at end range. Rather than assume that mobility is or is not present, we are obligated to test for it. This is performed with joint Spring Tests, which guides us to treat what we find, letting the joint "speak for itself," rather than treat on the basis of outmoded and incorrect theories of dysfunction.

When hypomobility is a general status and does not respond to gentle stretching and mobilizing procedures, then it is accepted, and biomechanical function is optimized by restoring normal strength and mobility throughout the rest of the kinetic chain.

HYPERMOBILITY AND USE OF SACROILIAC SUPPORTS

It is not uncommon to encounter what appears to be a hypermobility initially, but upon establishing the appropriate triplanar position of the joint, to see findings resolve. This is referred to as an "apparent hypermobility". As an example, a Posterior Ilium will appear to be hypermobile in a posterior, superior and lateral direction (when tested at the Anterior Ilium in supine). The ilium will be hypomobile in an anterior, inferior and medial direction. When treating all three components the apparent hypermobility usually resolves readily.

Sacroiliac supports are rarely indicated if a thorough triplanar approach is utilized. Furthermore, the role of muscle, especially the pelvic floor in multiparous females, is often ignored. Significant stability can be achieved in a few weeks with a triplanar approach to treatment coupled with Kegel's exercises and pelvic girdle isometrics.

On rare occasions support is necessary for a uniplanar, biplanar or global hypermobility. One client was very hypermobile but established stability in four weeks with the use of a trochanter belt. The belt is worn just above the trochanters and works much like the posterior ligaments in drawing the ilia together.

Hypermobile joints may eventually show signs of wear and tear by forming osteophytes, and the SIJ is no exception. How ironic it is that the argument against motion in the joint (degenerative changes) is the very argument that supports motion and stresses, perhaps excessive, existing in the joint at some time in the past. It is these excessive mechanical stresses that create degenerative changes.

Use of a pelvic support with 50 newton force applied reduced rotation of the sacrum (forward and backward bending) in eight of twelve subjects by an average of 29% (Vleeming et al. 1991). Increasing the force to 100 N was inconsequential. Interestingly, one joint had an increase in displacement with application of the support.

Supports are sometimes useful in limiting end-range excursion in a normal joint that gets over-stressed in activities such as martial arts, and golf, etc.

Many supports are available on the market. Supports should be a minimum of 3" wide, as narrower supports (named trochanter belts) may be uncomfortable. The material should breathe and the support should be tapered in order to fit comfortably. Clients should be shown where to apply the support before purchasing, as it is not uncommon for clients to return with supports that do not fit because they were applied to the lumbosacral region! I usually suggest that the supports should be worn under clothing but outside the underwear. The belt may need adjusting during the day and clients are advised against sensory nerve compression/irritation. Some use is better than no use, and I am therefore liberal with regard to use of the support. It may be useful to become familiar with what is available locally.

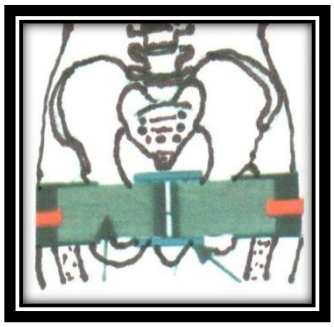
Response to use a sacroiliac support is individual and sometimes unpredictable. They are worthy of trial in clients with persistent pain, even if they appear to have "stable joints".

TRANSVERSE AND VERTICAL SACROILIAC SUPPORTS

Traditional placement below the waist.

Second image from OTPT.com.

Optimal placement at the level of the trochanters.



Second image redrawn from Bottlang 2002.

TRANSVERSE SACROILIAC SUPPORTS. Typic ally these are worn just below the belt line/waist. However, recent resarch has determined that 40% greater compression at the pelvic joints occurs when placed over the trochanters. For symphysis pubis dysfunction and diastasis, the placement at the trochanter level seems optimal as the compression occurs directly in the plane of the pubic joints, not above, as it does with the traditional placement. (see Pel, Pennig, Bottlang and Krieg 2002, and Bottlang and Simpson 2002)

Right vertical SI support. On the left image the force is primarily vertical. The image on the right shows an oblique and vertical compression. Note that the lower part remains under the right ischial tuberosity. A large portion of the SIJ ligaments have a vertical vector, therefore a vertical SIJ support is worthy of consideration.

Left vertical SI support. On the left image the force is primarily vertical. The image on the right shows an oblique and vertical compression. Note that the lower part remains under the left ischial tuberosity. A large portion of the SIJ ligaments have a vertical vector, therefore a vertical SIJ support is worthy of consideration.

These supports are worn intermittently for hypermobility/instability of the symphysis pubis and/or sacroiliac joint. Typically the transverse support can be worn under clothing. The vertical support is more conspicuous and it is worn in standing where it tends to support the medial ischium. In sitting it can be moved laterally to support the lateral ischium. I have found the vertical support to be of significant benefit even if used for short periods of time such as 5 minutes. It is first worn vertically under the ischium and ipsilateral shoulder. It is then crossed to the other shoulder as shown above.

INSTABILITY

Surgical instability can occur as a result of taking the iliolumbar ligament or a portion of the posterior sacroiliac ligaments during removal of bone for fusion (Macnab 1981). Fusion often leads to adaptive hypermobility in the joints above and below the fusion, and the sacroiliac joint is certainly not an exception. The symphysis pubis is also an important stabilizer of the SI. Any disruption of the symphysis pubis will render the SI hypermobile or unstable (Macnab 1981).

Occasionally patients may need a sacroiliac joint fusion, though this is often missed. One patient had a "successful" repeat fusion for a spondylolisthesis. In spite of a solid fusion, she continued to refuse to bear weight on her right leg. She used crutches and appeared to depend on her iliopsoas as a secondary "stabilizer." Her low back, SI and buttock were extremely hypersensitive. She went on to have a bilateral sacroiliac joint fusion. In less than one year post-fusion she reported that she was doing markedly better and was off the crutches. She is now participating in race walks for charity. Although she was childless, physicians often responded to her X-rays by asking "How many children have you had?" This was due to increased symphyseal width which implied a potential for hypermobility of the symphysis pubis and the sacroiliac.

Fusion at both the sacroiliac joints and symphysis pubis may be necessary in some cases. A plate with screws to approximate the symphysis pubis is being utilized in Europe (Vleeming 1991). When symphysis fusion is mandated, this approach seems reasonable, as it compresses the symphysis and therefore increases tension in the posterior ligaments, which is essentially the same mechanism that occurs in upright posture. A questionable approach spreads the symphysis by inserting a bony block. This stretches the anterior SI ligaments and capsule and renders the posterior ligaments slack. This procedure would most likely fail over time, if not immediately.

Supports are seldom tolerated by clients who have global instability. The pressure of the support increases pain in soft tissue that is already hypersensitive due to the degree of facilitation in the nociceptors. External supports seem unable to provide adequate stabilization in globally unstable joints.

HORMONAL LAXITY

Hormonal laxity is well-documented. The same laxity that occurs with pregnancy also occurs to a lesser degree during the menstrual cycle (Colachis 1963). The major hormone responsible for the laxity is relaxin. Due to increased ligamentous laxity during pregnancy, along with the increased weight, increased lordosis and anterior shift of line of gravity, the SIJ is susceptible to strain and dysfunction. It is not uncommon to hear women report a totally negative history of back troubles until their first pregnancy. Unfortunately, malposition and hypermobility acquired during this time do not necessarily self-resolve after delivery, and ligamentous integrity does not always return. While pelvic joint integrity will certainly improve shortly after delivery, it does not appear to return to normal, and this seems to be a factor in susceptibility to back pain. Pelvic joint Spring Tests are useful in determining mobility. Gross movement tests are popular in evaluating SIJ motion, but are of limited value in evaluating actual hypermobility.

Relaxin not only increases ligamentous laxity, it also softens cartilage and causes proliferation of synovium (Bookhout and Boissonnault 1988). The main purpose is to increase pelvic inlet and outlet dimension to allow passage of the fetus. Relaxin is a peptide hormone that is produced by the corpus luteum (Weiss 1976). Relaxin was detected within 14-21 days after conception in 12 of 13 patients by Quagliarello (1979). He felt that it was reliable enough to be used as a pregnancy test. The serum levels were seen to rise during pregnancy, peak at about the 36th week, and then drop (Thorn 1977; Quagliarello 1979). This is not in agreement with Weiss (1984), who noted the highest levels of relaxin to be in the first trimester. He and others (O'Byrne et al. 1978) did not note any prelabor elevation of relaxin, and noted a return to prepregnancy levels within three days of delivery, regardless of lactational status. Others believe that breast feeding encourages continued secretion of relaxin.

Eichner (1956) has shown that estrogenic priming is essential for relaxin to be effective. Maclennan (1983) also noted the relationship between relaxin and estrogen, and also mentioned that the estrogen/progesterone ratio may mediate the effects of relaxin. He stressed the fact that relaxin is specific to tissues that have receptors for it such as the pelvic joints, cervix, myometrium, decidua and breast connective tissue. One wonders if the pelvic floor might also have receptors for relaxin.

In postpartum studies, Epstein (1959) noted increased width between the pubes varying from 1 to 12 mm, with an average of 5 mm. This has been observed by several other authors, with one patient presenting with an increase of 6 cm after delivery of her fifth child (Hagen 1974). Vertical shift has also been noted (Hagen 1974; Farbot 1952). In a study of 286 cases a 1-7 mm increase, with an average of 2.5 mm was noted by Farbot in 97% of parous females. This seems to worsen with the number of pregnancies. It is possible that these measurements were incomplete, since anterior to posterior radiographs do not measure rotation of the symphysis pubis.

Lynch (1920) has noted that widening of the sacrosciatic space was a frequent radiographic finding in pregnant women.

MUSCULAR IMBALANCE

The potential for muscle dysfunction associated with lumbopelvic joint dysfunction has been alluded to in earlier sections. While the role of muscle is not completely understood, several authors implicate weak abdominals, piriformis spasm, etc., in the etiology of sacroiliac dysfunction. It is reasonable that soft tissue stretching and muscle strengthening, endurance, balance and proprioceptive activities should be addressed in treatment.

Muscle imbalance is common with pelvic joint dysfunction, perhaps mediated by the powerful and abundant mechanoreceptors. This method initially addresses the faulty articular mobility in order to minimize reflex inhibitory influences on muscle function. Muscle function can be addressed simultaneously, or within a few visits, after the articular function is much improved. Clinical experience has shown that muscle function is often significantly improved when

inhibitory influences are reduced with articular mobilization in cases of hypomobility. This effect has been noted by others (Crutchfield and Barnes 1984).

Twenty nine pairs of muscles originate or insert on the pelvis. Alteration in the length and tension of any of these muscles can have profound and far reaching effects on the biomechanics of the lumbopelvic-hip complex. Some of the muscles and muscle groups are listed below.

Abdominals
Adductors
Quadratus Lumborum
Iliopsoas
Erector Spinae
Tensor Fascia Lata
Gluteals
Hamstrings
Sartorius and Rectus Femoris
Obturator Externus

External Rotators of the Hip: Piriformis, Gemelli, Obturator Internus, and Quadratus Femoris, Transverse Fibers of Adductor Magnus

LEG LENGTH INEQUALITY

Leg length inequality (LLI) may create uneven stresses at the SIJ and lead to dysfunction. SIJ dysfunction may create functional LLI, and the response of the body seems to be the same as that to real LLI. Leg length inequality can create compensatory scoliosis.

The significance of LLI was demonstrated in a population of fifty patients with LLI of 9 mm or more, and fifty controls with 3 mm or less (Giles and Taylor 1981). Those with an LLI of 9 mm or more had concavities in the end plates of the vertebral bodies, wedging of the L5 vertebral body, lateral traction spurs, and osteophytes to a much greater degree than the controls. There is a strong association between LLI and idiopathic osteoarthritis of the hip (Gofton 1971).

Another X-ray study used 798 patients with chronic back pain, sciatica, and/or hip pain that was resistant to therapy (Frieberg 1983). Controls were 359 asymptomatic subjects. Greater than 79% demonstrated chronic or recurrent sciatica or hip symptoms on the long side (5-25 mm). In the majority, response to heel lifts was dramatic.

Maex (1967) studied the entire spine in 200 patients with cervical dysfunction. Ninety five percent had a functional scoliosis with a pelvic tilt. If a cervicothoracic scoliosis was secondary to a LLI, a heel lift was utilized. Heel lift therapy was found to decrease postural headaches and migraine, and it decreased spasm of the retinal and vertebral arteries. No doubt real or functional LLI associated with SIJ dysfunction may contribute to similar problems.

Leg length must be evaluated with clients who present with SIJ dysfunction. A true LLI may perpetuate SIJ dysfunction and might even be the primary cause. Triplanar balance of lumbopelvic landmarks and balanced muscle function should be achieved before assuming that a true LLI exists.

Chapter 6 - PRINCIPLES OF MANUAL THERAPY

MANUAL THERAPY

The primary sources for this section are Greenman 1989; Lee 1989; Mitchell, Moran, and Pruzzo 1974; Cyriax 1982; Maitland 1986; Paris 1991)

The terminology used by different authors in describing joint dysfunction can be confusing. Caution is advised when reading works by different authors. It is important to know when they are describing *positional* dysfunction and when they are describing *movement* dysfunction. Movement Dysfunction and Positional Dysfunction are opposite terms. If a segment cannot flex, it is called a Flexion Movement Dysfunction. It is however, positionally extended, and if we were to describe it by the position only, and not by the movement dysfunction, it would be referred to as an Extension Dysfunction. Some authors describe the dysfunction in terms of its position, others in terms of the loss of movement. One needs to be able to recognize the intent of the author when reading this and other works. I have purposely inserted the word Movement Dysfunction to indicate description based on the lack of movement and inserted Positional Dysfunction to indicate the position of the segment.

Spinal curves are named for their convexity. Spinal motion is named for the top segment moving on the inferior segment. This can be somewhat confusing when treating the sacrum first, as this rule is broken when describing the lowest segment (the sacrum). This approach usually balances the pelvis first and then ascends up the spine, segment by segment. Motion and position are named for the front of the body part in normal anatomical position. In right spinal rotation the front of the vertebral body faces right, whereas the spinous process moves left. In describing the landmarks on a client's body during palpation, reference is made to the client's right/left side, not the clinician's hands. Standard anatomical terms are very helpful, such as anterior/posterior, superior/inferior, and medial/lateral. For example, regardless of the patients' physical orientation in space (prone, supine, side lying or upright), anterior means in the direction of the abdomen, posterior means in the direction of the spine, superior means in the direction of the head, inferior means in the direction of the feet, left means the patient's left side, and right means the patient's right side. Terms that are less clear or are seldom used in the literature are generally discouraged and include the following: rostral or cephalic/caudal, forward/backward, prominent, deeper, and depressed.

1. Distraction/Compression
2. Anterior/Posterior Translation
3. Right/Left Lateral Translation
4. Right/Left Rotation
5. Right/Left Side Bending
6. Flexion/Extension

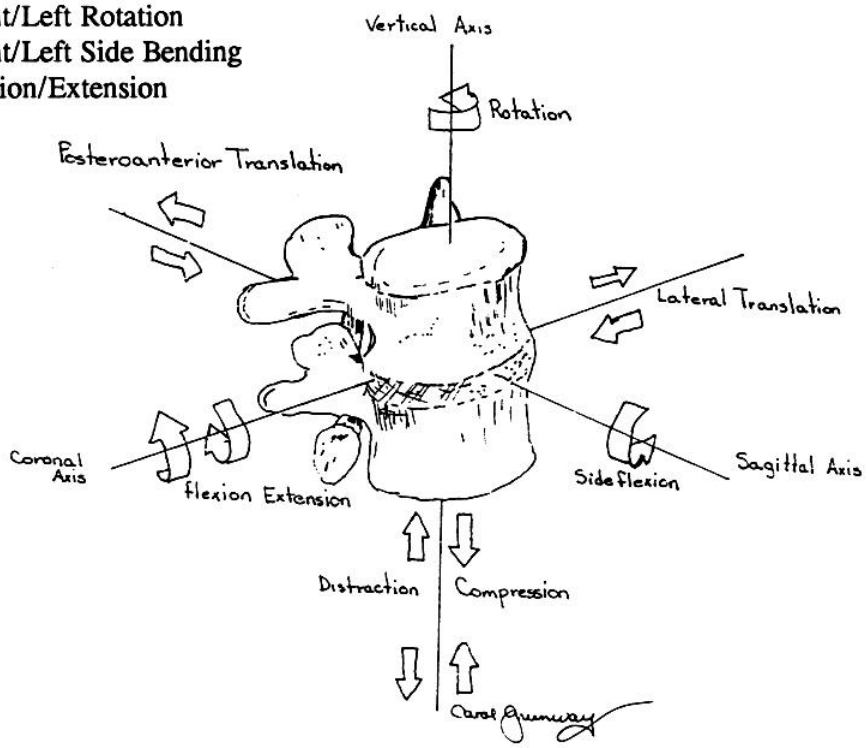


FIGURE 23. Six degrees of freedom of a lumbar segment

End Feel of Joints:

Bone-to-Bone Abrupt Halt: Such as elbow extension.
Spasm: Firm resistance, sudden.
Capsular: Rubbery, normal end feel of shoulder rotation.
Spring Block: Intra-articular displacement, such as a torn meniscus.
Tissue Approximation: Such as elbow flexion.
Empty Feel: Lacks resistance, has pain before end of motion due to metastasis, hysteria, anxiety, etc. This sometimes occurs with acute bursitis.

The spine has six degrees of freedom. Of these motions, the patient can only actively utilize three in a spinal motion segment: flexion/extension, rotation, and side bending. The accessory motions of which the person has no active control at a specific segment are left and right side-glide, vertical and inferior glide, anterior and posterior glide.

Passive Joint Mobility Grading

Hypomobile	0 — ankylosed, do not treat joint
	1 — considerable limit
	2 — slight limit
Normal	3 — normal
Hypermobile	4 — slight increase
	5 — considerable increase
	6 — pathologically unstable, surgical candidate?

Hypermobile segments are often compensatory for hypomobile segments, and the opposite is certainly true also. Oftentimes the hypermobility resolves when the primary hypomobility is resolved. Goals of treatment are relief of pain, and restoration of normal joint mobility, and stability. Always consider treating regional dysfunctions, which may be primary or secondary.

Grades of Mobilization Treatment

Grade 1 A small-amplitude motion near the starting position.

Grade 2 A large-amplitude motion that moves toward or beyond mid-range. It does not move into stiffness or spasm.

Grade 3 Also of large amplitude, but does move into stiffness or spasm.

Grade 4 A small amplitude movement which stretches into spasm or stiffness.

Grade 5 Seldom used, it is a low amplitude, high velocity manipulation performed at end range.

Grade 6 This author added #6 (1985) in which the slack is taken out of the joint and that force remains constant and is maintained for 2 minutes, sometimes longer in order to produce creep; first elastic, then plastic deformation. My goal is to make lasting change.

The Rules of Physiological and Non-physiological Movement Dysfunction

Rule of physiological movement dysfunction: When a structure moves in a physiological direction and becomes stuck, it does not become stuck at end-range. Spring Tests will therefore be negative, that is, there will be motion perceived, perhaps hypermobility. The structure can always move further in the direction of dysfunction. This can seem counterintuitive can be a difficult concept to embrace initially, but with experience, it will become clear.

Rule of non-physiological movement dysfunction: When a structure moves in a non-physiological direction and becomes dysfunctional (stuck), it will usually become stuck at end-range, rendering a positive (hypomobile) Spring Test. On occasion it will not be stuck at end range and will thus move in the direction of dysfunction, though this is fortunately rare.

TYPE	LOCATION	FIRED BY
Type I Postural	Capsule	Graded or Progressive Oscillation
Type II Dynamic	Capsule	Graded or Progressive Oscillation
Type III Inhibitive	Capsule and Ligaments	Stretching, Sustained Pressure or Manipulative Thrust

TABLE 2. THE INFLUENCE OF TREATMENT ON MECHANORECEPTORS (Paris 1991)

Direct and Indirect Treatment Technique

There are two methods of treating movement dysfunction. The first is known as direct technique. Direct technique uses active or passive positioning of a body part against a motion barrier. It works against and through the barrier. Muscle energy and joint mobilization are direct techniques.

The second technique is called indirect technique, also referred to as lesion exaggeration. With indirect technique the body part is positioned or moved in the free direction away from the restriction (barrier). This is done actively or passively. It is often utilized if direct techniques fail. It can also be very successful as a primary technique. Sometimes it is followed by a direct technique.

This workbook presents direct treatment methods. It is nonetheless very important to be aware of alternate treatment methods, especially when pain response contraindicates a direct method.

MUSCLE ENERGY

Definition: Muscle Energy is the utilization of force from specific isolated muscles to alter or change the position of a skeletal component.

Benefits of Muscle Energy

- It is safe, as the patient controls the motion when positioning the part. The patient can stop the procedure at any time.
- The patient can usually learn to self-treat.
- It is gentle and does not over-stress soft tissues and joints.
- It treats in a pain-relieving direction.
- Muscle tone and resting length are more balanced.
- It increases ROM, decreases pain and spasm, and improves circulation.
- It is easy to learn.
- It teaches patients normal movement patterns.

General Principles of Muscle Energy

Muscle energy uses the principle of post-isometric relaxation. Muscle energy is a direct technique; it positions the body part against the movement barrier and attempts to move the part through the barrier. The movement limitation (barrier) is often maintained by muscle spasm. Therefore, by relaxing the muscle spasm the body part can be moved past the restriction. For example, if supination is limited, it can be treated with positioning the forearm in maximal supination, against the barrier. Isometric pronation is resisted gently for 3-10 seconds. The patient then relaxes, and the part is moved through the barrier into the new available range. Supination is increased and the facilitated or shortened pronators achieve a more normal length and resting tone. The inhibited supinator also gains more normal resting length and tone.

Treat the most painful area first.

Sometimes a short course of modalities is useful.

Treat only in pain-relieving directions.

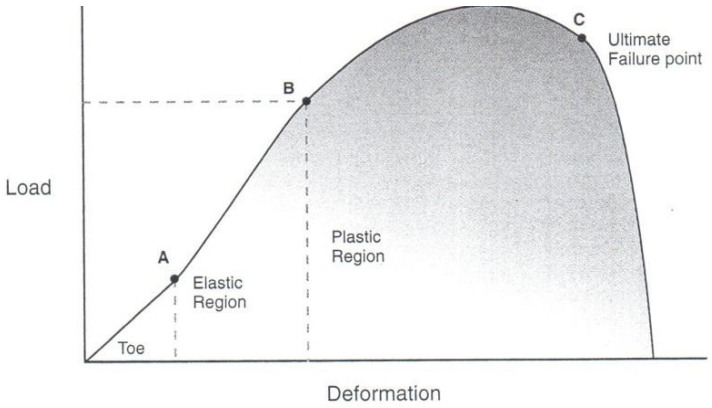
Whenever possible, distract the joint before mobilizing it.

The commencement of isometric contractions and their release must be done very gently.

The Viscoelastic/Creep Model of Treatment

This is the model of choice and should replace the Muscle Model when treating chronic conditions or wanting to effect plastic versus elastic deformation.

This will be addresses in the seminar in greater detail. This concept is deeply steeped in the Hesch Method.



Load-deformation curve for a connective tissue tested in tension. Initially, the crimp straightens with little force (toe region). Then, collagen fibers are stretched as the elastic region begins at A. After the elastic region ends (B), further force application causes a residual change in tissue structure (plastic region). Continuation of load may cause the tissue to rupture at its ultimate failure point (C). (From Butler DL, Grood ES, Noyes FR, et al.: Biomechanics of ligaments and tendons. Exerc Sport Sci Rev 6:144, 1978, with permission from Lippincott William and Wilkins.)

Chapter 7 - SACROILIAC EVALUATION

COMPREHENSIVE SACROILIAC EVALUATION

The focus on the pelvis and sacroiliac joint is done only after a thorough history is taken, and a lumbar screen has been completed.

STANDING

Realize that many findings encountered in standing are compensatory. I place more validity in prone and supine findings and reevaluates in standing *after* treatment. Postural and gross movement patterns are most apparent in standing. Joint function evaluation based on joint Spring Tests requires prone and supine positioning. The root cause of compensatory postural patterns is most often best appreciated in prone and supine. The strain pattern is often very different in standing and sitting when compared to prone and supine. Palpation of bony landmarks in standing is usually more difficult, and interexaminer reliability is much better in prone and supine (Ellis, Moore, Jackson 1990).

POSTURE, MUSCLE TONE

GAIT, INCLUDING MECHANICS OF ENTIRE LOWER EXTREMITY

WEIGHT-BEARING ON TWO SCALES

ILIAC SHELVES ANTERIORLY

ASIS's: SUPERIOR/INFERIOR

ASIS's: MEDIAL/LATERAL

ASIS's: ANTERIOR/POSTERIOR

GROSS SPINAL ROM

POSTERIOR ILIAC SHELVES

SPINAL POSTURE: GROSS AND SEGMENTAL

SACRUM: PALPATE BILATERALLY ALONG ENTIRE LENGTH

SITTING

Again, sitting evaluation may encounter compensatory patterns that do not exist in prone and supine. These sitting patterns will often change or will resolve when the primary problem is resolved. I use sitting primarily for evaluating lumbar segmental position and active spinal motion in a flexed position.

SLUMP SIT SLR: Add dorsiflexion, cervical flexion.

POSTURE: GROSS AND SEGMENTAL, MUSCLE TONE

SEGMENTAL POSITION AND ACTIVE MOTION: Test in neutral sitting, hyperflexion, extension, side bending, and rotation.

ANTERIOR ILIAC SHELVES

ASIS's: ANTERIOR/POSTERIOR

ASIS's: MEDIAL/LATERAL

ASIS's: SUPERIOR/INFERIOR

PSIS's: ANTERIOR/POSTERIOR

SACRUM: Palpate THE entire length.

POSTERIOR ILIAC SHELVES

QUICK SCREEN OF ENTIRE TRUNK

SUPINE

STRENGTH/SENSATION

APPARENT LEG LENGTH: At inferior shelves of medial malleoli

APPARENT LEG LENGTH: At inferior shelves of lateral malleoli

APPARENT LEG LENGTH: At calcaneus with feet in symmetrical dorsiflexion

SLR: If painful, where?

HIP ROM: Rotation, flexion, Thomas test, Patrick-Faber, and modified test for TFL

ANTERIOR ILIAC SHELVES

ASIS's: ANTERIOR/POSTERIOR

ASIS's: MEDIAL/LATERAL

ASIS's: SUPERIOR/INFERIOR

INGUINAL LIGAMENTS: Evaluate tone

PUBIC TUBERCLES: ANTERIOR/POSTERIOR

PUBIC CRESTS: SUPERIOR/INFERIOR

INFERIOR PUBIC BONES

SPRING TESTS (see separate section)

SOFT TISSUE OF ABDOMEN AND LOWER EXTREMITY

SIDE LYING

SEGMENTAL FLEXION, EXTENSION AND POSTERIOR GLIDE L4, L5

PRONE

LUMBAR GROSS AND SEGMENTAL POSTURE AND MOVEMENT RESPONSE FROM NEUTRAL PRONE TO HYPEREXTENSION

LUMBAR SPRING TESTS: Posterior/Anterior at midline and at each transverse process

POSTERIOR ILIAC SHELVES: Place extended digits at iliac shelves that are midway between midline of the spine and the most lateral soft tissue of the trunk. First press anteriorly into soft tissue below the lowest rib and bring your extended digits inferiorly onto the pelvic shelves.

PSIS's: ANTERIOR/POSTERIOR

SACROILIAC SULCUS (optional)

SACRUM: Palpate entire length 1 cm away from midline, then 2-3 cm from midline. Press firmly to palpate through soft tissues.

INFERIOR LATERAL ANGLES: SUPERIOR/INFERIOR

SACROSPINOUS LIGAMENT TONE

COCCYX: Position and mobility (POSTERIOR/ANTERIOR, side bending)

ISCHIAL TUBEROSITIES: SUPERIOR/INFERIOR

ISCHIAL TUBEROSITIES: ANTERIOR/POSTERIOR

ISCHIAL TUBEROSITIES: MEDIAL/LATERAL

SACROTUBEROUS LIGAMENTS: EVALUATE TONE

SOFT TISSUE ASSESSMENT OF SPINE, PELVIS, AND LOWER EXTREMITY

PASSIVE HIP ROM

POSTERIOR TROCHANTER P-A

SPRING TESTS (See separate section.)

Chapter 8 - SPECIFIC PELVIC JOINT SPRING TESTS

SPRING TESTS

The SIJ does not exist in isolation. The argument about whether or not motion exists within the SIJ needs to be laid to rest. Perhaps more important than the fact that motion occurs within the SIJ, is the concept that motion occurs *through* the SIJ. While observing a video of Spring Tests and functional movements applied during a fluoroscopy study of the SIJ (Bernard, 1992), it is very apparent that motion occurs within the joint, but even more fascinating is the observation that forces and motion were communicated *through* the SIJ.

Walker (1992) asks a relevant question with regards to SIJ motion testing: "Is the motion present adequate in total range to be detected by observation and manual palpation, as extensively described by several clinicians?" She goes on to provide a very insightful comment: "The minimal range of motion present in probably most of the population casts doubt on whether therapists can detect 1 to 3 degrees or 1 to 3 mm of motion occurring specifically at the SIJ. Perhaps the term *play* (joint play) should be used when referring to the SIJ, as *motion* implies quantity of motion similar to other synovial joints, which does not appear to be the case."

This seems to have significant functional ramifications and fits well with Walker's comments regarding joint play. Proper function of the pelvic articulations requires the ability to translate forces through these articulations and to dissipate forces via elastic properties. This method of Spring Testing (developed by Jerry Hesch, MHS, PT) allows the clinician to perceive the elastic response of the joints individually, and the pelvic structure as a whole. Spring Tests are useful in evaluating these important properties of pelvic joint function. Spring Testing, as defined within the Hesch Method model, identifies motion within the joints of the pelvis motion thru the pelvis

Tests other than Spring Tests exist in the literature and common practice. Although they supposedly evaluate the sacroiliac, they transmit force through the hip joint and/or lumbar spine and therefore can make interpretation obscure. Some other tests utilize long levers. These types of tests are not used to identify SIJ dysfunction in the Hesch Method.

Spring Tests are performed in single planes along specific axis. While motion in the joints of the pelvis is triplanar, and rarely occurs in single planes or along pure axes, this method of testing allows precision, and is comprehensive as all potential planes and axes are tested. Please note that these tests are named for the direction of force imparted on the client's landmark(s) underneath the tester's hand(s). They are not necessarily named for the specific movement that occurs in the joint. This is done to minimize confusion, and to make the Spring Tests easier to learn. The SI joint is a triplanar joint and force applied at one landmark may cause motion in the opposite direction at the joint. For example, posteriorly directed force in the sagittal plane on the ASIS causes a posterior force in the sacroiliac joint. A laterally directed force at the ASIS causes the PSIS and iliac joint surface to move medially and slightly posteriorly. This is simply due to the shape of this unique triplanar structure.

PURPOSE/GRADING

The Spring Test should primarily test actual mobility in the joint, and to a lesser extent a response in the surrounding soft tissue, which includes the elastic nature of the structures, and their ability to transmit force thru those structures.

When performing Spring Testing, the quality of the motion perceived is rated as:
normal,
hypomobile, or
hypermobile.

Identifying the Spring Tests as above are all that is necessary to utilize the Hesch Method approach.

Mobility Grading Scale

0= No movement, joint is ankylosed
1= Extremely hypomobile
2= Slightly hypomobile
3= Normal
4= Slightly hypermobile
5= Extremely hypermobile
6= Unstable

There is a degree of subjectivity in rating the motion. Skill in motion testing comes with practice and training. Spring Tests are not used to determine if pain is present; they are an evaluation of the biomechanical function of the pelvic girdle. However, if pain is encountered, it is acknowledged and the test is modified or deferred, in order to minimize pain provocation.

TECHNIQUE

Because treatment logically follows the information gathered from the Spring Tests, it is of paramount importance that the Spring Tests be learned properly.

All tests are done on one side of the patient, and then the other unless specified otherwise. The clinician should stay on the same side of the plinth regardless of which side of the patient is being tested. Spring Tests are always used even if the pelvic landmarks are symmetrical. Firm pressure is applied to the part being tested, taking up soft tissue and joint slack, before imparting a "spring." The Spring Test therefore should primarily test actual mobility in the joint, and to a lesser extent a response in the surrounding soft tissue. Make note of the end feel of the Spring Test as well as the subjective response. Retest up to three times if unsure.

To perform a Spring Test, the clinician applies firm pressure to the soft tissue and joint to take up the slack, after taking up the slack in the joint, the clinician can then measure how much force is required before motion thru the joint is perceived. The pelvis is tested bilaterally, and can be

measured both pre and post treatment. The appropriate amount of force necessary to perform a Spring Test is the least amount that yields useful information, without increasing pain.

The actual amount of force used in Spring Tests can be measured with force transducers such as the MICROFET* muscle testing device. The MICROFET is one of several force transducers available. (MICROFET is distributed by EMPI Inc. 1275 Grey Fox Road, St Paul, Minnesota 55112)

It is a hand held instrument that measures the amount of force the clinician applies. In order to determine how much force is actually used in Spring Tests, the Microfet was used by a clinician with over ten years of Spring Testing experience, on a small sample of subjects. The following amounts of force where then determined:

Pubic Bones: 0 lbs.-5 lbs.-10 lbs.-5 lbs.-0 lbs.

Sacrum: 0 lbs.-10 lbs.-20 lbs.-10 lbs.-0 lbs., up to 0 lbs.-15 lbs.-30 lbs.-15 lbs.-0 lbs.

Ischium: 0 lbs.-15 lbs.-30 lbs.-15 lbs.-0 lbs., up to 0 lbs.-20 lbs.-40 lbs.-20 lbs.-0 lbs.

Ilium: 0 lbs.-15 lbs.-30 lbs.-15 lbs.-0 lbs., up to 0 lbs.-20 lbs.-40 lbs.-20 lbs.-0 lbs.

To perform a Spring Test on an ilium:

- Take up the slack approximately 20 lb. (The proper amount of force is the least amount of force you need to take up the motion that is readily available.) Hold for 1-2 seconds
- Test the ilium by imparting an additional force (the "Spring") up to 40 lb. maximum. (The correct amount of force is the least amount that gives useful information and does not produce discomfort.) Hold 1-2 seconds.
- Release the Spring Test to the loaded position of 20 lb. in order to evaluate the quality of return. Hold 1-2 seconds. This cannot be over-emphasized, and is particularly informative in cases of hypermobility or instability.
- Release from the loaded position of 20 lbs. back to zero lbs., or "unload."

The force needed varies from person to person. In general, female patients are tested with less force than males. The above averages serve as a guideline with which to develop the skill of applying the Spring Tests.

In a Normal Grade Spring Test, you will be able to take up the slack (0-20 lbs.), then "Spring" (20-40 lbs.) When releasing from the "Spring" position to the "Loaded" position (40-20 lbs.), an elastic recoil, typical of ligament testing will be appreciated. It can be described as firm and fairly abrupt.

In a Hypermobile Spring Test, you will be readily able to take up the slack (0-20 lbs.) and Spring (20-40lbs.). The recoil from 40-20 lbs. will lack the elastic quality of the normal joint, and will recoil more slowly, with a "boggy" feel.

In a Hypomobile Spring Test, you may be unable to even "take up the slack (0-20 lbs.)" Often, the hypomobile movement dysfunction has already "taken out" the slack, so that the Spring Test is truly so hypomobile that the slack cannot be taken up at all, or to such a limited amount that it is readily apparent. If you cannot perform the Spring Test, you will, of course, not be able to feel recoil. If the joint is not stuck but is just hypomobile, taking up the slack typically requires more force than usual; and the recoil is both very firm, and very abrupt. It is possible that a hypomobile dysfunction would allow the tester to "take up the slack (0-20 lbs.)," but then not allow the Spring portion of the test (20-30 lbs.) to occur. So, a test is also considered "hypomobile" if you can take out the slack, but cannot spring the joint.

PRACTICE

Although Spring Testing should always be undertaken with the preconception that the clinician should use the least amount of force necessary to test the particular patient, it is imperative to learn specific forces to assure competence.

A study was performed to determine whether therapists could learn to accurately produce specific forces to the lumbar spine (Keating, Matyas, and Bach 1993). Subjects in the experimental group (n=6) were students in a postgraduate manipulative physical therapy course. They practiced applying 1, 5, 10, 15, 20, and 25 kilograms on a bathroom scale. They practiced for 10 minutes a day for 30 days. Their ability to produce these forces on command was determined by standing on a force platform and applying forces on the lumbar spine of normal subjects (positioned in prone). The reduction in body weight as measured by the force platform equaled the force applied to the lumbar spine. The control group (n=6) had no training with the scales, but were also students in the postgraduate manipulative physical therapy course. In comparison with the control group, the experimental group showed reduced error in force production both immediately after training and 1 month later. Diaries indicated that low errors were achieved for all subjects in the experimental group within 3-5 days of training and was maintained throughout the training. The authors concluded that therapists can learn to quantify applied forces, with significant implications for communication and evaluation of joint behavior. This work seems very encouraging to this approach which teaches the application of quantified forces to the pelvis during evaluation.

Before attempting Spring Testing on patients, one should then train their ability to accurately produce specific forces thru the following exercises.

USE OF A SCALE TO LEARN APPROPRIATE FORCE FOR SPRING TESTS

The average force for taking up the slack in the pelvis is 20 lb. and the average force to apply the Spring Test is 40 lb. A bathroom is a useful tool to learn to apply the appropriate amount of force. The recoil is an important phenomenon to perceive and when "letting go" of the Spring Test you actually return to the loaded position of 20 lbs. The Spring Test is thus accurately denoted as: 0 lbs.-20 lbs.-40 lbs.-20 lbs.-0 lbs.

It is suggested that Spring Tests are practiced with thumb at lighter force (0-5-10-5-0 lbs.) and the heavier forces be practiced with the open palm (thenar and hypothenar contact) and with the ulnar border of the dominant hand, or both if ambidextrous. The following forces are suggested:

Pubic Bones: 0 lbs.-5 lbs.-10 lbs.-5 lbs.-0 lbs.

Sacrum: 0 lbs.-10 lbs.-20 lbs.-10 lbs.-0 lbs., up to 0 lbs.-15 lbs.-30 lbs.-15 lbs.-0 lbs.

Ischium: 0 lbs.-15 lbs.-30 lbs.-15 lbs.-0 lbs., up to 0 lbs.-20 lbs.-40 lbs.-20 lbs.-0 lbs.

Ilium: 0 lbs.-15 lbs.-30 lbs.-15 lbs.-0 lbs., up to 0 lbs.-20 lbs.-40 lbs.-20 lbs.-0 lbs.

The empirical sense of 5- 10 lbs., 15-30 lbs. and 20-40 lb. can be developed by practicing with a non-digital bathroom scale or Microfet or similar device, on a normal population. It is also suggested that therapists practice intermediate forces, the range being:

0 lbs.-5 lbs.-10 lbs.-5 lbs.-0 lbs.
0 lbs.-10 lbs.-20 lbs.-10 lbs.-0 lbs.
0 lbs.-15 lbs.-30 lbs.-15 lbs.-0 lbs., and
0 lbs.-20 lbs.-40 lbs.-20 lbs.-0 lbs..

Practice using the following forces:
0 lbs. - 15lbs. - 30 lbs. - 15 lbs. - 0 lbs. Hold at each force (15 lbs., 30 lbs., 15 lbs.) 2 seconds each. In other words: 15 lbs. hold 2 seconds, 30 lbs. hold 2 seconds and partially let go until 15 lbs. and hold 2 seconds. Then completely let go for a return to 0 lbs. Repeat the entire test 3 times. The force applied in moving from 0 lbs. to 15lbs.takes up the slack, Applying force from 15 - 30 lbs. is the Spring Test, and 30 lbs. to 15 lbs. is the recoil. This Spring Test describes the approximate amount of force used to evaluate the SIJ on a female client.

0 lbs. - 20 lbs. - 40 lbs. - 20 lbs. - 0 lbs. Hold at each force (20 lbs., 40 lbs., 20 lbs.) for 2 seconds each. In other words: 20 lbs. hold 2 seconds, 40 lbs. hold 2 seconds and partially let go until 20lbs, let go for return to 0 lbs. Repeat the entire test 3times. The force applied in moving from 0 lbs. to 20 lbs. takes up the slack, Applying force from 20-40 lbs. is the Spring Test, and 40 lbs. to 20 lbs. is the recoil. This Spring Test describes the approximate amount of force used to evaluate the SIJ on a male client.

With practice the tests can be performed in a very short period of time.

PRACTICING SPRING TESTS ON EACH SIDE OF THE TREATMENT TABLE TO DEVELOP SYMMETRY OF APPLIED FORCE

A bathroom scale on the treatment table mimics the clinical situation where the therapist often stands on one side of the table and applies the Spring Test to each side of the client's pelvis.

USE OF A FORCE TRANSDUCER TO MEASURE THE AMOUNT OF FORCE APPLIED TO THE PELVIS

USE OF A SPRING TEST DEVICE TO LEARN THE FEEL OF SPRING TESTS

The hypomobile spring requires greater than 50 lbs. to completely load. The hypermobile spring has a very soft end-feel at 20 lbs. of force, and it feels like it could keep going without reaching the true end of its range. The spring labeled "female load" stops moving at approximately 18 lbs. and the "female spring" stops at approximately 36 lbs. The "male load" spring stops moving at approximately 22 lbs. and the "male spring" stops moving at approximately 42 lbs. The average force to load and spring a male or female pelvis is 20-40 lbs. This spring device is very useful for learning what normal values are for taking up the slack and for performing the Spring Tests and for learning what a hypermobile and hypomobile pelvis feels like. These forces are appropriate for the ilium and ischium, less force is required at the sacrum and must less should one test the symphysis pubis.

DISCUSSION/RELEVANCE

The rules of physiological and non-physiological movement dysfunction were presented in an earlier section but are very appropriately reiterated here as they are very important concepts.

Rule of physiological movement dysfunction: When a structure moves in a physiological direction and becomes stuck, it does not become stuck at end-range. Spring Tests will therefore be negative, that is, there will be motion perceived, perhaps hypermobility. The structure can always move further in the direction of dysfunction.

Rule of non-physiological movement dysfunction: When a structure moves in a non-physiological direction and becomes dysfunctional (stuck), it will usually become stuck at end-range, rendering a positive (hypomobile) Spring Test. On occasion it will not be stuck at end range and will thus move in the direction of dysfunction, though this is fortunately rare.

Chapter 9 - THE BASIC SACROILIAC JOINT SPRING TESTS

The Spring Tests are performed on both sides of the body. The pictures shown the tests being performed on one side of the body, and to show the test being performed on both sides seems unnecessary. Within this text, reference may be made to the Spring Test being performed on the same side as shown and at times on the opposite side.

1. PELVIC SIDE GLIDE

If blocked, pelvis is side-glided toward the clinician and cannot side glide away.

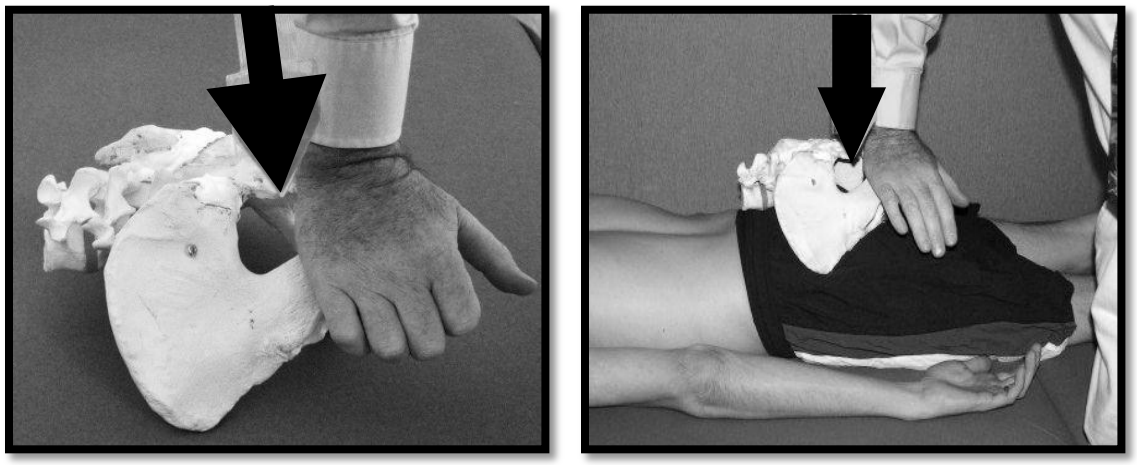
Patient Position: Supine.

Therapist Contact: Sitting or standing on left side of treatment table. Wrists extended with open palms contacting the lateral pelvis above the trochanter.

Force and Direction of Force: Take up the slack by pushing the pelvis from left to right, and then apply spring. Left to right glide occurs about a transverse axis.

Other: This pattern is at times subtle when using visual cues, and thus can be missed if one does not do the Spring Test. This is a distinctly different pattern than the Lateral Shift described by Robin McKenzie. Pelvic Side Glide does not appear to involve the intervertebral disc, but rather is a muscular/postural pattern. It is much more commonly restricted going from left to right, perhaps due to the manner in which we typically get in and out of the driver's seat of a car, in which pelvis and les and pelvis and trunk may become disassociated.

2. ANTERIOR SPRING OF THE ISCHIUM



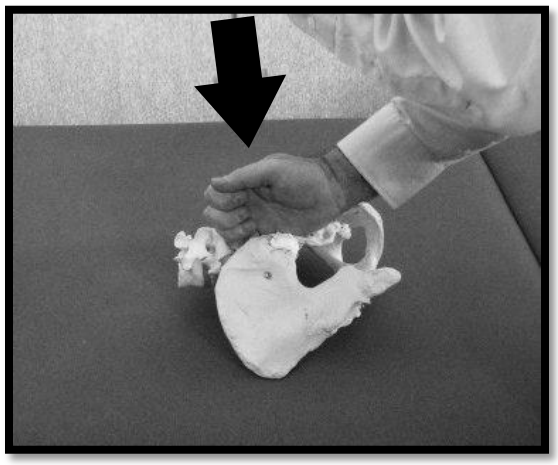
If blocked it is positive for posterior pubic bone, or left transverse plane rotation of lower pelvis.

Patient Position: Prone.

Therapist Contact: the flat portion of the ischium which is at the 2-3" portion of the lower buttock above the gluteal crease.

Force and Direction of Force: Approximately 15# of force to take up the slack and an additional 15# (30# total) to spring in a pure P-A direction. Anterior glide occurs in the sagittal plane along an A-P axis.

3. PRONE SACRAL ROTATION



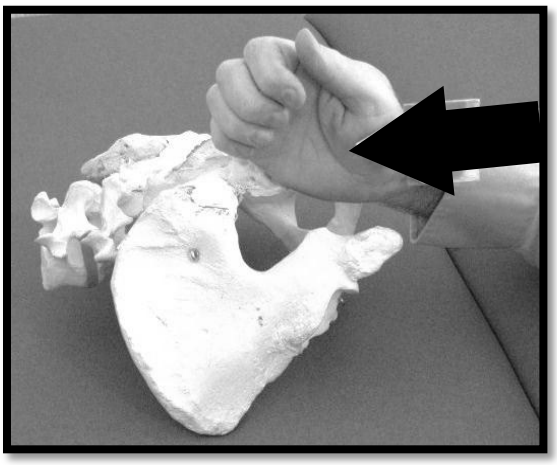
If blocked, suspect rotation of sacrum in the direction of your hand, or muscle guarding or transverse plane rotation of the pelvis

Patient Position: Prone.

Therapist Contact: Lateral border of 5th metacarpal or open palm encompassing S1-S3 medial to the PSIS.

Force and Direction of Force: Approximately 15# to take up the slack and an additional 15# (total of 30#) to perform Spring Test in a pure P-A direction. Rotation occurs in the transverse plane about a vertical axis.

4. PRONE SACRAL SIDE BENDING SPRING TEST



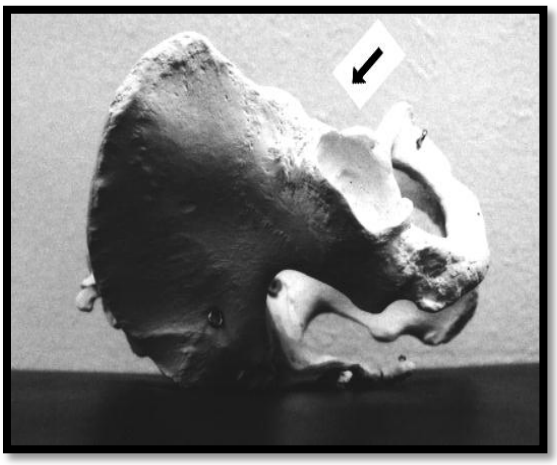
If mobility is blocked (usually on left) suspect left sacral side bend fixation which lacks right side bending mobility. Alternately, it may be an increase in soft tissue tone and extrinsic restriction of mobility.

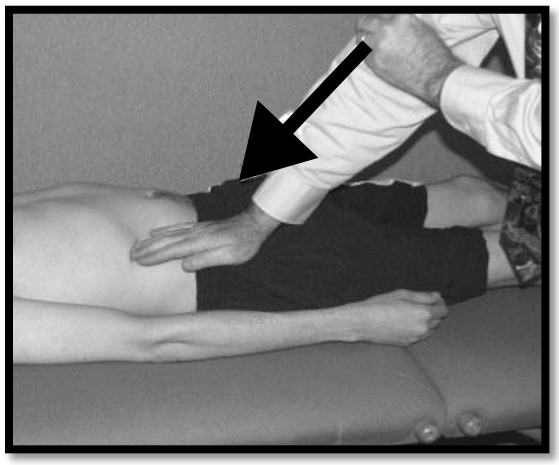
Patient Position: Prone.

Therapist Contact: Fifth metacarpal under the inferior lateral angle of the sacrum 1 cm lateral to the coccyx.

Force and Direction of Force: Five to 10# to take up the slack an additional 5-10# (total of 10-20#) to spring in a superior direction. Side bending occurs in the frontal plane about an A-P axis.

5. SUPINE POSTERIOR ROTATION OF THE ILIUM





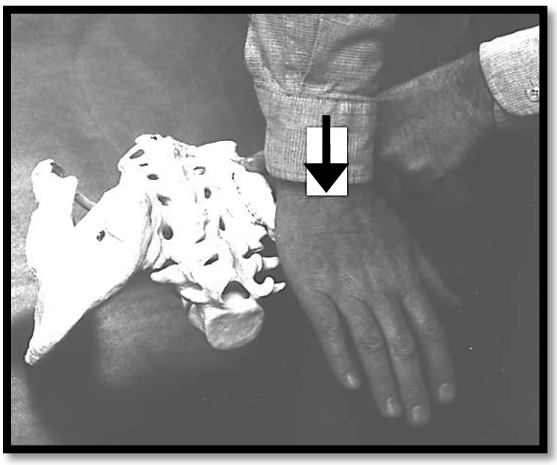
When blocked, suspect Anterior Ilium.

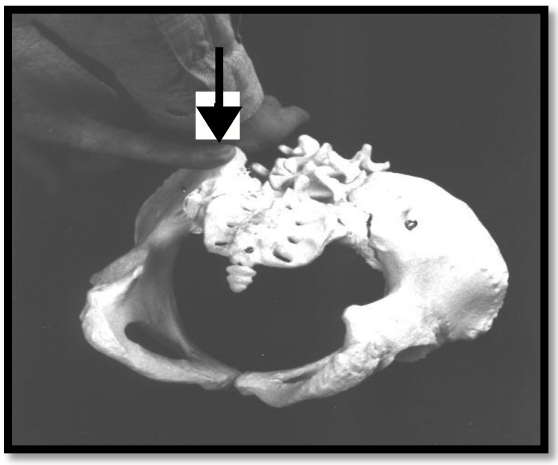
Patient Position: Supine.

Therapist Contact: Open palms on anterior pelvis with maximum contact for comfort.

Force and Direction of Force: Take up the slack with approximately 20# and apply Spring Test up to approximately 40#. Test is performed at a 45 degree angle following the angle of the anterior shelf. It would be wrong to spring in a pure A-P direction which would just compress the joint. Spring is done on one side at a time, though both receive information. Posterior rotation occurs in the sagittal plane about a medial/lateral axis.

6. PRONE ANTERIOR ROTATION OF THE ILIUM





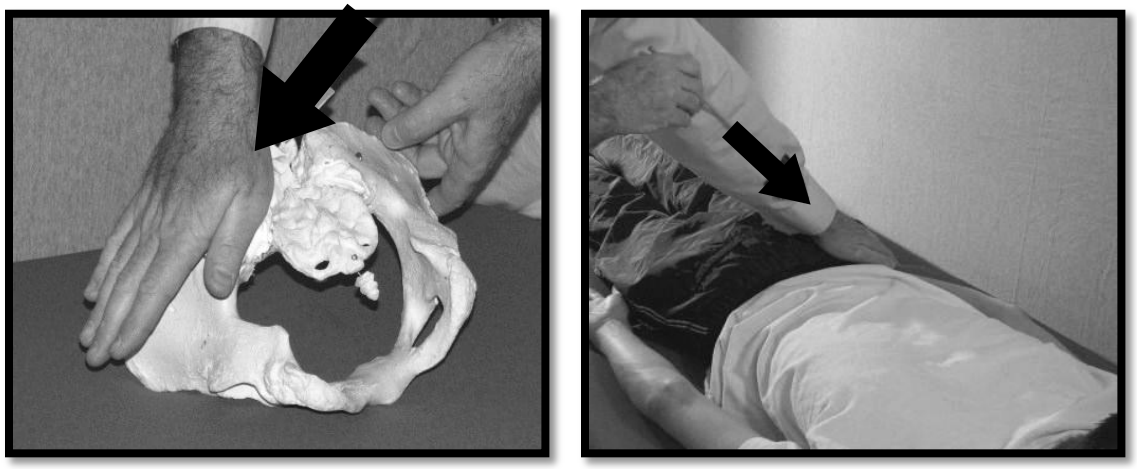
When blocked, suspect Posterior Ilium

Patient Position: Prone.

Therapist Contact: Open palm on the ilium just below the posterior shelf, well above and lateral to the PSIS.

Force and Direction of Force: Approximately 20# of force to take up the slack and an additional 20# (40# total) to spring in a pure P-A direction. Anterior rotation occurs in the sagittal plane about a medial/lateral axis.

7. PRONE LATERAL ILIUM SPRING TEST



Blocked mobility on the left is positive for a Left Outflare.

Patient Position: Prone.

Therapist Contact: The depression between the thenar and hypothenar eminences contacts the PSIS and the rest of the palm contacts the rest of the ilium with hand facing laterally at a 45 degree angle, pointing toward the baseboard molding where the floor and wall meet.

Force and Direction of Force: Up to 20# to take up the slack and an additional 20# (40#) total to spring at a 45 degree angle (inferolateral, see photo above). Hypomobility is much more readily apparent with this Spring Test than hypermobility.

8. P-A GLIDE TO EACH SACRAL QUADRANT IN YOGA CHILD POSE POSITION

Tests for Sacral Torsions about an oblique axis.

Patient Position: Yoga Child Pose Position, or near end range of trunk and hip flexion.

Therapist Contact: Appropriate quadrant of the sacrum.

Force and Direction of Force: Posterior to anterior, keeping in mind that this would be perpendicular to the plane of the sacrum

Other: Traditional naming is confusing. We believe that clearer language names the quadrant that is posterior and has blocked motion. Contrast the following new naming schema with the traditional.

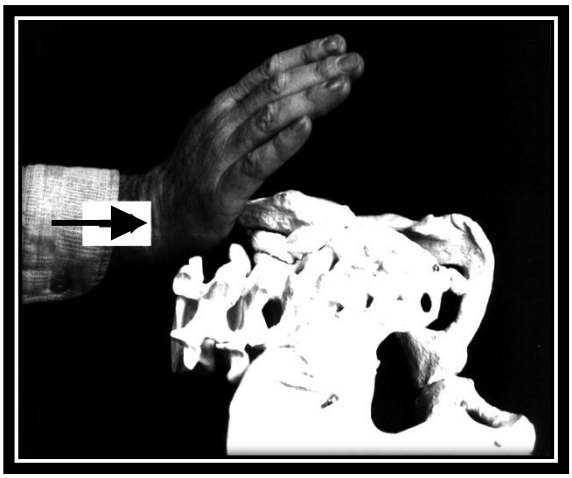
Posterior Left Lower Sacral Quadrant With Blocked P-A Spring.
Versus: Left on Left Sacral Torsion.

Posterior Left Upper Sacral Quadrant With Blocked P-A Spring.
Versus: Left on Right Sacral Torsion.

Posterior Right Upper Sacral Quadrant With Blocked P-A Spring.
Versus: Right on Left Sacral Torsion.

Posterior Right Lower Sacral Quadrant With Blocked P-A Spring.
Versus: Right on Right Sacral Torsion.

9. PRONE INFERIOR SPRING TEST TO THE ILIUM



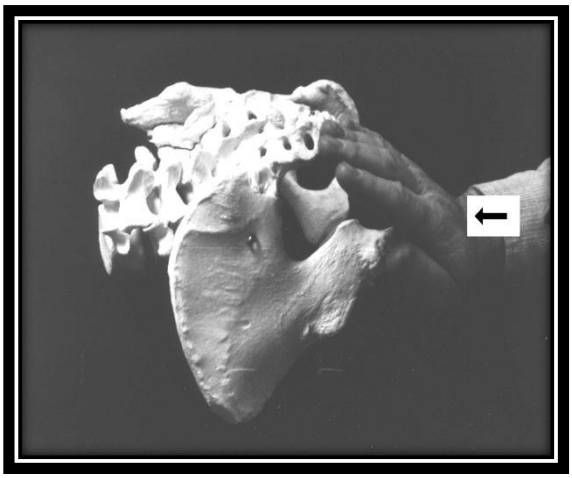
Test used for several patterns, see text.

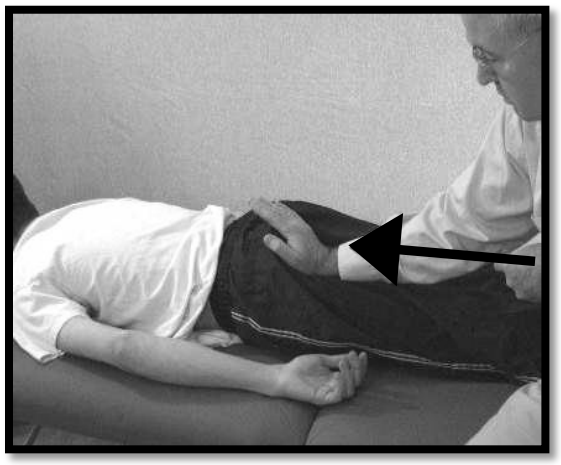
Patient Position: Prone.

Therapist Contact: Open palm contacts the posterior iliac shelf pointing inferiorly.

Force and Direction of Force: Use approximately 20# to take up the slack and an additional 20# (40# total) to spring in an inferior and medial direction (30-45 degrees) towards the opposite knee. Inferior and medial glide occurs in the frontal plane about a vertical axis that orients laterally, along the plane of the joint.

10. PRONE SUPERIOR SPRING TEST TO ISCHIAL TUBEROSITIES





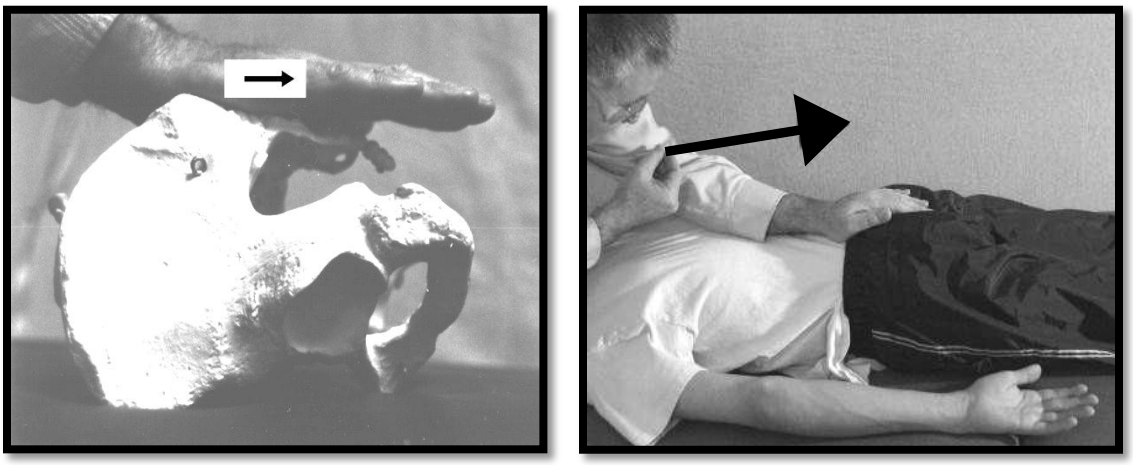
Test used for several patterns, see text.

Patient Position: Prone.

Therapist Contact: Open palm directly under the ischial tuberosity.

Force and Direction of Force: Use approximately 20# to take up the slack and an additional 20# (40# total) to spring in a superior and lateral direction towards the shoulder. Superior glide occurs in the frontal plane along a vertical axis that orients laterally along the plane of the joint.

11. PRONE INFERIOR GLIDE SPRING TEST TO THE SACRUM



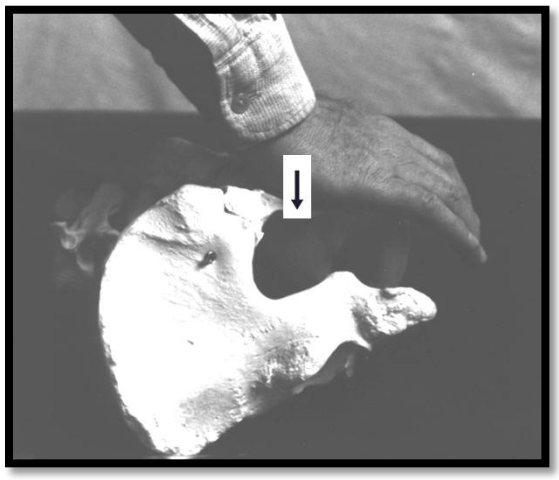
Tests for superior glide fixation of sacrum/lumbosacral compression.

Patient Position: Prone.

Therapist Contact: With the open hand pointing inferiorly, place the tip of the middle finger on the tip of the coccyx and let the hand fall onto the sacrum.

Force and Direction of Force: Apply approximately 10-15lbs. to take up the slack and an additional 10-15lbs. (20-30lbs. total) to spring. Inferior glide occurs in the frontal plane along a vertical axis. If mobility is normal, the heels can be observed to move inferiorly up to 3/8".

12. PRONE BACKWARD BENDING SACRAL SPRING TEST



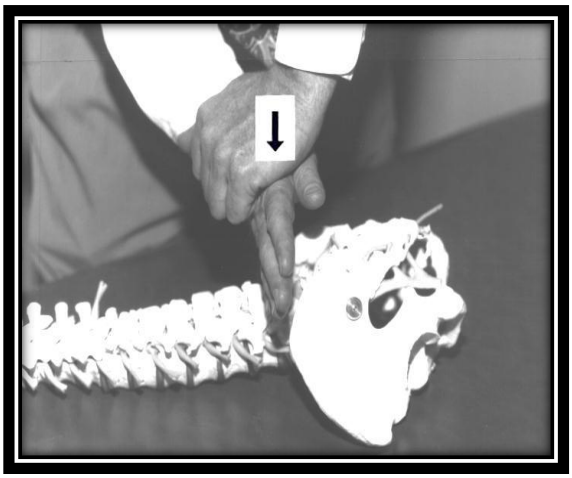
Tests for Forward Bent Sacral Fixation.

Patient Position: Prone.

Therapist Contact: Place the heel of the hand on the apex of the sacrum at S4-5.

Force and Direction of Force: Apply approximately 10-15lbs. to take up the slack and an additional 10-15lbs. (20-30lbs. total) to spring. Backward bending occurs in the sagittal plane about a transverse axis. The apex (S4-5) moves anterior, the base (S1-2) moves posterior.

13. ANTERIOR GLIDE OF L5



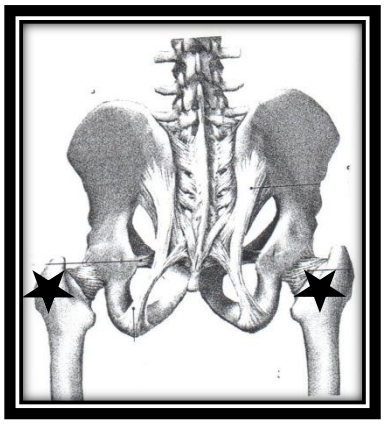
Blocked mobility indicates that L5 is stuck at end range extension and anterior glide. This is consistent with the rest of the pattern which essentially sets the stage for this restriction. In other words, the sacrum is forward bent and L5 follows. In contrast, a flexed L5 segment would not be consistent with the rest of the pattern. Furthermore, a flexed L5 segment would gain mobility with P-A springing, whereas an extended L5 would not, and the latter most like would be painful.

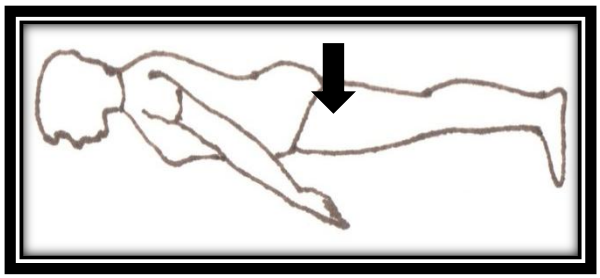
Patient Position: Prone.

Therapist Contact: The open palm contacts L5.

Force and Direction of Force: Apply approximately 10# to take up the slack and an additional 10# (20# total) to spring. Anterior glide occurs in the sagittal plane along an A-P axis.

14. P-A TO THE TROCHANTERS





Tests for Posterior Glide Trochanter Fixation.

Patient Position: Prone.

Therapist Contact: Place the heel of the hand on the flat portion of posterior trochanter.

Force and Direction of Force: Apply approximately 10-15lbs. to take up the slack and an additional 10-15lbs. (20-30lbs. total) to spring.

15. P-A TO SACRUM

Patient Position: Prone.

Therapist Contact: Place the heel of the hand on the sacrum at midline between the PSIS'.

Force and Direction of Force: Apply approximately 10-15lbs. to take up the slack and an additional 10-15lbs. (20-30lbs. total) to spring.

QUICK SCREEN OF THE PELVIS: PALPATION AND BASIC PELVIC SPRING TEST GRADING FORM

It is suggested that you copy this form and use it for one side of the body only, performing Spring Tests on one side and then using another form for the other side. Indicate on the form which side you are testing. You may also decide to only mark the hypomobilities initially and tally them up for one side of the body at a time. As you become more proficient this form will no longer be necessary.

REFERENCE BODY SIDE ☐ LEFT ☐ RIGHT

SUPINE PALPATION

Leg Length:	☐ LONG	☐ SHORT
Anterior Iliac Shelves:	☐ SUPERIOR	☐ INFERIOR
ASIS's:	☐ ANTERIOR	☐POSTERIOR
ASIS's:	☐ SUPERIOR	☐ INFERIOR
ASIS's:	☐ MEDIAL	☐ LATERAL
Pubic Crests:	☐ SUPERIOR	☐ INFERIOR
Pubic Tubercles:	☐ ANTERIOR	☐POSTERIOR
Inferior Pubic Bones:	☐ ANTERIOR	☐ POSTERIOR

SUPINE SPRING TESTS

1. Supine Pelvic Side Glide: HYPOMOBILE	☐ LEFT	☐ RIGHT
5. Supine Posterior Rotation of the Anterior Ilium: HYPOMOBILE	☐ LEFT	☐ RIGHT

PRONE PALPATION

Posterior Iliac Shelf:	☐ SUPERIOR	☐ INFERIOR
PSIS's:	☐ ANTERIOR	☐ POSTERIOR
Sacral Sulci	☐ ANTERIOR	☐ POSTERIOR

Sacral ILA's:	☐ SUPERIOR	☐ INFERIOR
Sacrotuberous Ligament:	☐ HYPERTONIC	☐ HYPOTONIC
Ischial Tuberosity:	☐ SUPERIOR	☐ INFERIOR
Ischial Tuberosity:	☐ ANTERIOR	☐ POSTERIOR
Ischial Tuberosity:	☐ MEDIAL	☐ LATERAL
L5 Vertebrae Position:	☐ ANTERIOR	☐ POSTERIOR
P-A Trochanters Position:	☐ ANTERIOR	☐ POSTERIOR

PRONE SPRING TESTS

2. Anterior Spring to Ischium: HYPOMOBILE ☐ Left ☐ Right

3. Sacral Rotation: HYPOMOBILE ☐ Left ☐ Right

4. Sacral Side Bending: HYPOMOBILE ☐Left ☐ Right

6. Anterior Rotation of the Ilium: HYPOMOBILE ☐ Left ☐ Right

7. Lateral Ilium Spring Test: HYPOMOBILE ☐ Left ☐ Right

8. Yoga Child Pose Position: POSTERIOR/HYPOMOBILE
☐ Left Upper ☐ Right Upper ☐ Left Lower ☐ Right Lower

9. Inferior Spring to the Posterior Iliac Shelf/Ilium: HYPOMOBILE
☐ Left ☐ Right

10. Superior Spring to the Ischial Tuberosity: HYPOMOBILE
☐ Left ☐ Right

11. Inferior Sacral Glide Test: ☐ HYPOMOBILE

12. Sacral Backward Bending: ☐ HYPOMOBILE

13. Anterior Glide L5: ☐ HYPOMOBILE

14. P-A Trochanters: HYPOMOBILE ☐ Left ☐ Right

Chapter 10 – TREATMENT

INDICATIONS AND CONTRAINDICATIONS

A thorough evaluation of the hip joints, lower extremities, and spine should be performed to rule out other conditions. Medical problems from pelvic viscera, especially the colon, bladder, and reproductive organs can refer pain to the back and sacroiliac region.

Lumbar screen must include neural tension tests, strength, sensation, reflexes, and of course, one must take a thorough history. If neural tension tests enhance leg pain (below the knee) or there is distal sensory loss or motor weakness or significant difference in reflexes, client most likely does not have mechanical back pain and absolute caution is warranted.

Poor response to mechanical therapy hints strongly at a non-mechanical problem. When a client does not make the expected response to treatment after three visits, other causes should be given consideration. Good communication with the referring physician is mandatory when response to treatment is limited.

When taking a history, one should inquire about previous illnesses, inquire about night pain, and ask about positions of comfort and discomfort. Pain that changes with position is usually mechanical (musculoskeletal). According to Grieve (1976), there are other conditions that require consideration: sacroiliitis, ileitis, ankylosing spondylitis, gout, rheumatoid arthritis, ulcerative colitis, Reiter's disease, tuberculosis, bone disease, and metastasis.

From Grieve's article (1976): "Manipulation without indication is a speculation". Contraindications are usually relative to the unique presentation of the patient and level of skill of the therapist as well as the technique utilized. In other words they require caution, but are not absolute contraindications. They are: 1) tuberculosis, 2) recent violent trauma, 3) painful hip joint, 4) osteoporosis, 5) men over fifty (consider prostatitis), 6) women over sixty, 7) inflammatory arthritis, 8) Paget's disease unless radiographically excluded from the SIJ, 9) primary neoplasms elsewhere, 10) hypermobility, 11) undiagnosed pain, 12) intractable night pain.

I add poor patient rapport as a contraindication. If the client is unable to relax, joint mobilization may be unsuccessful and is better saved for another day. Severe protective spasm warrants caution. Increased pain with joint Spring Tests, with no direction that eases pain, contraindicates treatment with joint mobilization. Oftentimes the acute severe pain will abate within a few visits with medication, rest and pain-relieving modalities and will then allow joint mobilization.

A common phrase in manipulative circles is "When in doubt, don't." Recent HNP with nerve root compromise or spinal cord compression are absolute contraindications. A thorough evaluation to include strength and sensation testing is always performed before considering treatment for pelvic joint dysfunction. A positive straight leg raise below 45 degrees (leg symptoms) encourages caution, especially if there is a positive crossed leg raise (opposite leg). Sitting straight leg raise should also be tested. Clients with paraesthesia below the knee are

rarely helped with procedures directed to the pelvic joints. This point must be clearly communicated to clients who have a referral with a diagnosis of "pelvic joint dysfunction" who present with lower leg symptoms. Advanced diabetes, generalized laxity, vascular abnormalities, use of anticoagulants, and any status that would affect tissue viability should be a contraindication or encourage caution. With regard to spinal mobilization, a person at risk is a female with generalized laxity who is a smoker and takes birth control pills. This scenario is associated with vertebral artery compromise with cervical manipulation, and requires caution and gentleness of approach with regard to the pelvis.

Stoddard's Warning Signs (Stoddard 1980)

1. A patient who presents with a backache, having a history of malignancy during the previous two years; must be assumed to have secondary malignant deposits in the spine until this is proved otherwise, even though the onset is mild and the x-rays are negative. Usually such patients have a raised erythrocyte sedimentation rate.

2. When the onset of back pain is late in life, without any previous history of back symptoms, the patient is more likely to have osteoporosis or secondary deposits than some simple mechanical fault.

3. When there is serious loss of spinal function, or shock, or vomiting after trivial spinal injury or strain, the patient is likely to have a pathological fracture of the spine.

4. Intense pain which requires morphine for more than forty-eight hours may indicate serious disease.

5. Severe pain, deformity, and muscle spasm in areas of the spine other than the lower cervical and lower lumbar should arouse suspicion of disease.

6. Constitutional signs which accompany back pain like pyrexia, loss of weight, malaise, and excessive weakness suggest disease.

7. Loss of power which is too widespread to be accountable by a single nerve-root lesion suggests neurological disease.

8. Loss of sphincter control is never due to simple mechanical causes.

9. Continuous pain unrelated to posture is unlikely to be mechanical in origin.

10. A normal erythrocyte sedimentation rate does not exclude disease entirely.

A thorough evaluation indicates when treatment is appropriate. The treatment is a logical extension of the evaluation, and both are performed gently, based on the biomechanical model. Treatment is done only in pain-relieving directions, and often with the patient participating actively. Treatment is never performed if pain or unpleasant symptoms increase. My literature

search did not reveal any adverse response to manipulation of the ilium, and there was only one adverse response to forceful sacral manipulation. Forceful techniques are not part of this treatment philosophy. Since nerves do not traverse the pelvic joints, pelvic manipulation is safer than spinal manipulation. The treatment techniques taught keep the spine close to neutral position and the use of long levers is avoided.

Fortunately, this approach is a very gentle one with most of the techniques being controlled by the patient. Patients are clearly advised not to enhance pain with self-treatment. When passive treatments are performed, they are advised to communicate any increase in discomfort so that the treatment may be stopped or adjusted accordingly.

TREATMENT GOALS

Basic goals of treatment are to restore normal joint function and relieve pain. If hypomobile, then restore mobility. If hypermobile, restore stability. The Spring Tests are useful in monitoring treatment effects. Address muscle length, strength, resting tone and endurance. All trunk and lower extremity muscles must be considered as having a potential effect on the SIJ. Balance and proprioception should also be addressed. External support is helpful sometimes by compressing the joint, other times by enhancing proprioceptive cues. Patient education and decreasing pain and inflammation are very important aspects of care. Proximal and distal compensatory patterns and causative factors must be addressed. This list is not exhaustive. A few methods will be mentioned but many more are available. The end result is certainly primary; different techniques work in different hands.

TREATMENT METHODS

For joint treatment, one could use joint mobilization, AROM, AAROM, and PROM, and teach self-treatment. For hypomobility, a prolonged stretch for two minutes or more, without causing discomfort, is desirable, due to the viscoelastic properties of connective tissue. This is a very important consideration in cases that are difficult to treat, and that recur readily. Oftentimes an acute strain is superimposed on a chronic hypomobility.

HINTS FOR SUCCESSFUL EVALUATION AND TREATMENT

Use your dominant eye.

Name the findings on only one side of the *patient's* body regarding position of bony landmarks and Spring Tests. Never name them relative to *your* right or left side.

Stay on one side of the client.

Ignore subtle findings (at least initially).

When in doubt, hang out. Maintain contact with the landmark for up to two minutes, to allow some tactile accommodation and enhanced proprioceptive interpretation.

If you are having a hard time, be kind to yourself and move on to something else. You can come back to it next time.

Treat the hypomobility first as this may reflexively improve (reduce) the hypermobility.

Always remember that the presence of lumbopelvic asymmetry and asymmetrical mobility is *not* necessarily the *only* cause of pain, but nonetheless may be worthy of treatment.

Be aware that there is an advanced workbook and video that contains patterns of dysfunction not mentioned in this workbook and course, so that if you encounter findings that do not make sense there is a resource available.

This workbook presents some common patterns and presents them on the side of the body in which they occur most frequently. For example Anterior Ilium is much more common on the right. It certainly does occur on rare occasions on the left side, though there is no mention of it and no treatment photo. So if you encounter it on the side opposite of what is presented in this workbook, trust your findings and treat accordingly! You can hand out the self-treatment from the workbook with the image on the paper flipped on the other side and by holding it up to the light you will see it "on the correct side."

SEQUENCE OF EVALUATION AND TREATMENT

Unlike other approaches, the Hesch Method recognizes that patients present with pelvic dysfunctions comprised of multiple components. One must treat the most apparent or most significant component first, then reevaluate and treat whatever remains or whatever new permutation should manifest. It is not uncommon for up to eight components to appear in a single pattern, such as the Most Common Pattern. However, there are dysfunctions that occur singularly, and cannot be grouped within a common pattern. Never the less, these singular dysfunctions must also be considered and addressed. A sequence of evaluation and treatment is needed for a complete evaluation and treatment session. The following list provides the clinician with a structure to address the patient with multiple components, after a complete initial evaluation is completed. Dysfunctions not found in the basic workbook are mentioned for thoroughness, and can be found in the advanced work

The treatment of each component via the list below has been very successful in resolving dysfunction within a few visits, and seems to be a "manipulation of articular neurology" and balancing of forces, and muscle length and strength, as much as it is anything else (i.e. moving one bone in relationship to another). *The list below is meant to be a general guideline, not a rigid format*. The best approach is a moment to moment adaptation based on patient's response, therapist skill and intuition. *The treatment sequence listed below is in the order of importance for resolving most cases of dysfunction. Please do not confuse this listing with a list of frequency of occurrence of various types of dysfunction in the population.*

1. Screen hip for restricted hip extension. Restore hip extension to equal that of normal side. If restriction is bilateral and is not a fixed deformity, treat both sides

2. Treat Pelvic Side Glide Dysfunction. These occur in 10-20% of the persons with pelvic asymmetry and can create a lot of confusion if missed visually. Unlike the McKenzie approach, the Hesch paradigm allows for a postural/muscular pattern that is mild, moderate or severe (as opposed to implicating the disc) and is evaluated in supine (as opposed to standing) and evaluated via Spring Tests (as opposed to via observation.)

3. Treat any vertical symphysis pubis dysfunction (inferior or superior pube) and any vertical ilium dysfunction, such as Upslip or Downslip.

4. Treat the Most Common Pattern (all eight components if present.)

5. Treat any oblique axis sacral dysfunction such as left on right (left rotation of sacrum about right oblique axis), L on L, etc. Based on this method of evaluation, these are not very common, though the literature and workshops would no doubt disagree.

6. Treat the 2nd Most Common Pattern,

7. Treat any advanced patterns (Hesch Advanced Video)

8. Treat biomechanical dysfunction that exists anywhere else in the spine or extremities.

Chapter 11 - SINGULAR PATTERNS OF DYSFUNCTION OF THE PELVIS, SIJ, AND SYMPHYSIS PUBIS

The Hesch Method describes a few group patterns of pelvic movement dysfunction. Examples are the First Most Common Pattern and the Second Most Common Pattern. The First is very common and it consists of up to 9 different components that are treated sequentially. The term "up to 9" is relevant as this pattern does at times contain more than 1 and fewer than 9 of these patterns. However, there are other patterns that are single dysfunctions, or stated differently; stand- alone dysfunctions. When these are encountered, they are the singular most over-arching dysfunction that must be treated, while essentially ignoring other possible patterns. Why? Because the singular pattern is at that moment in time, the only true restriction in which motion is completely blocked; therefore treating it takes the highest priority, in spite of appearances that there may be other patterns, based on palpatory findings alone. After treating the singular pattern, reevaluation typically reveals complete correction, without any other patterns being present. There are exceptions, but these are not predictable. I refer to these single dysfunctions as "Core" because they drive the system of asymmetry of position, and upon resolving them; there typically is a lack of a secondary permutation/movement dysfunction.

Single Patterns which may at times act alone, in which resolving them, resolves any other pattern noted initially. Other times, they may be part of a group pattern. The sequence in which this workbook is laid out is ideal for treating in order of frequency of occurrence in the clinic. For now this page may be held in abeyance, as its meaning may elucidate with experience and time.

Pelvic Side Glide

Any of the 4 possible Sacral Torsions about an Oblique Axis

Upslip of the Ilium and Downslip of the Ilium

Upslip of the Pubic Bone and Downslip of the Pubic Bone

Oblique Downslip of the Ilium and Oblique Upslip of the Ilium (Advanced material)

Posterior Glide Fixation of the Sacrum (every Spring Test will be blocked until this "core" restriction is resolved)

Inferior Glide Fixation of the Symphysis Pubis Fibrocartilage (Advanced material)

Posterior glide Fixation of the Symphysis Pubis Fibrocartilage (Advanced material)

Posterior Glide Fixation of the Ilium (Advanced material)

HIP FLEXION AND FEMORAL POSTERIOR GLIDE FIXATION WITH LIMITED EXTENSION

A lack of passive hip extension can indicate that the femoral head is "stuck" in a posterior glide and flexed position. It is a somewhat common dysfunction (at least one in 20 SIJD clients) It is much more common unilaterally. With this dysfunction in weight bearing, the pelvis becomes quite asymmetrical, and this can lead to false positives concerning SIJD when traditional screening tests are utilized. In standing the pelvis is visibly asymmetrical in response to the hip restriction. In contrast to prone and supine, in which the pelvis is relatively symmetrical. In rare cases, this dysfunction can also occur bilaterally.

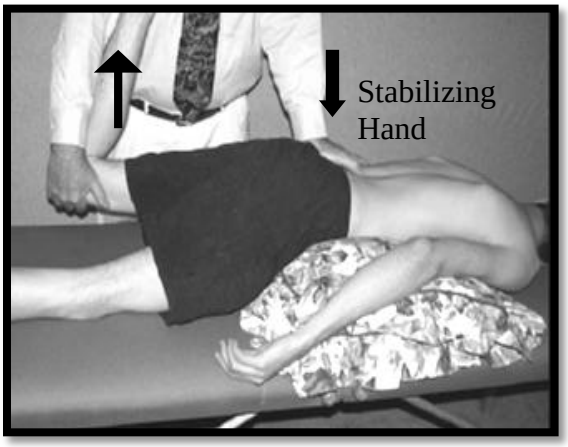
This dysfunction is not to be confused with joint contracture, dysplasia due to arthritis, or a developmental etiology. This dysfunction is a soft tissue phenomenon that responds easily and dramatically to gentle treatment within two minutes. Treatments effects can be dramatic and lasting. Some clients describe feeling much lighter during gait after hip extension is restored. Some note less patellofemoral pain, especially during tasks such as stair climbing and squatting.

In supine, the length of the femur will be more anterior/prominent on the side of dysfunction. The exception is palpation at the neck and head of the femur, which will be more posterior. It is not necessary to perform an A-P spring along the femur, but if you were to do so; mobility would be hypomobile (specifically, it will be blocked at end range.) Additionally, while it makes theoretical sense, a prone P-A to the proximal femur is challenging and unnecessary, therefore discouraged. Because the hip joint is in slight flexion, the knee joint will also be in slight flexion. In supine, you will find greater space below the knee, affirming flexion positioning. Grasping the patella on the medial and lateral slide and lifting it anteriorly, will reveal significantly .restricted mobility on the side of dysfunction, but relatively free mobility on the contralateral side. This is not subtle.

In prone, the dysfunctional side presents with minimal passive hip extension, from 0 to 5 degrees. In contrast, the uninvolved side will measure 15-20 degrees, which is typical in a normative population. Remember to manually stabilize the pelvis while isolating passive hip extension. The findings in supine and prone reasonably translate to phenomena in standing and in gait. During stance and gait, compensations are common. This is due to the fact that 15-20 degrees of hip extension is normative from mid stance to toe off. This pattern also prevents complete knee extension and certainly, the normal movements of the pelvis during gait are altered. Various compensations occur. Hip hiking is one, lower extremity circumduction is another.

In the period from 2005 to February of 2009 there have been at least three hip motion research articles in *PTJ* and *JOSPT* that did not specifically address hip extension. This is noteworthy as the present trend is to encourage clinical practice to be research-based, and thus it is possible that there is an indirect (even if unintentional) tendency to discourage measurement of hip extension. The authors of this workbook encourage conversation on the topic as it is more complex than can be reasonably addressed in the context of this workshop. As prevention is an important paradigm, it is plausible that restoring normal hip extension would, reduce pathological forces.

TESTING PASSIVE HIP EXTENSION

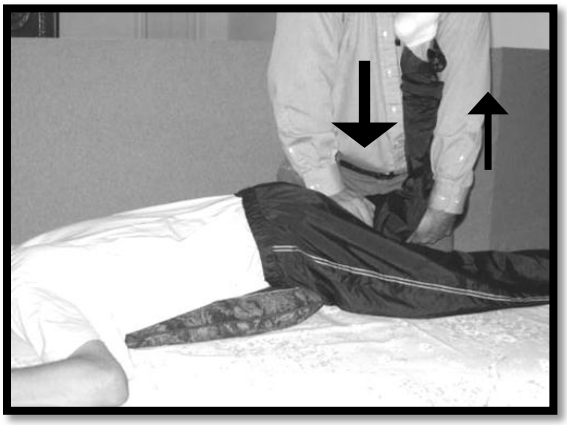


Therapist Position: First on right side to test right hip, then on left side to test left hip.

Positional Dysfunction: In supine, nearly the entire length of the femur will be anterior, while the proximal head and neck will be posterior.

Movement Dysfunction: In prone, lack of passive hip extension. In supine, patella lacks anterior lift.

HIP FLEXION DYSFUNCTION TREATMENT



Patient Position: Prone, knee flexed 90 degrees. A pillow can be placed under the stomach to place lumbar spine in safe neutral, and prevent hyperextension.

Therapist Position: Contact on the underside of the distal femur, immediately above the patella. The client's tibia can rest against the therapist's chest to maintain the patient's knee in 90 degrees of flexion. The therapist's other hand is placed flat on the proximal thigh just below the gluteal crease.

Treatment: Anterior pressure is applied to the proximal thigh while very gently stretching the distal thigh into progressive hip extension; applied for 2 minutes.

Retest: Retest passive hip extension. You may also test anterior patellar lift, and free space underneath both knees.

Home Program: Teach gentle hip extension stretch and rectus femoris stretch. Suggest 2 minutes daily.

SIDE GLIDE FIXATION OF THE PELVIS

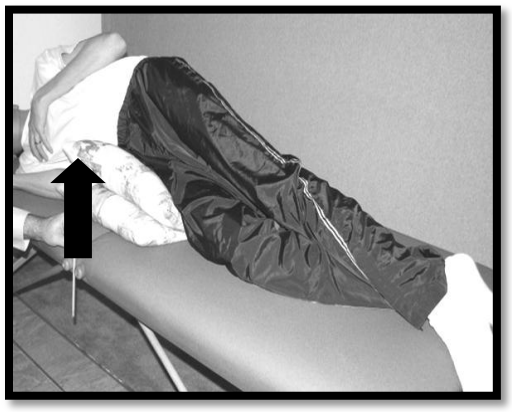
A loss of active or passive side glide to the lumbopelvic region can be detrimental to realizing the full rehabilitation potential. It is a direction of movement that is often ignored. This pattern should be tested whenever other patterns are resolved, whether they are individual or group dysfunctions. I would never consider any strain pattern resolved without testing for this pattern as it can perpetuate recurrence.

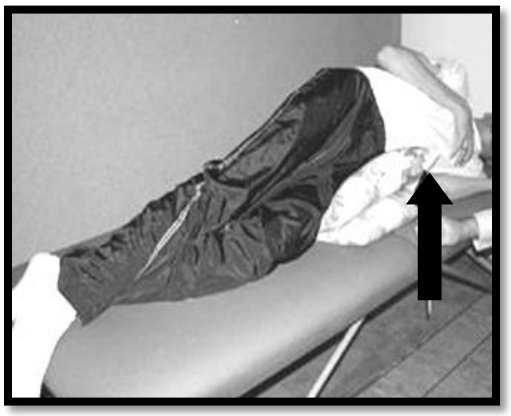
1. TESTING PASSIVE SIDE GLIDE OF THE PELVIS

If blocked, pelvis is side-glided toward the clinician and cannot side glide away

Patient Position: Client is supine. Push the lateral pelvis to the opposite side till the slack is taken out and push with an additional moderate force to assess mobility.

SELF-TREATMENT FOR LUMBOPELVIC SIDE GLIDE DYSFUNCTION





Patient Position: Side lying with pillows under the pelvis. The hips and knees may be flexed to enhance comfort.

Treatment: A gentle, prolonged, passive stretch is performed for up to 5 minutes.

Retest: Retest with Spring Test in supine.

Home Program: 1x day x1 week, 1x week thereafter. Teach ITB, TFL stretching if tight.

Other: I prefer the passive stretch in contrast with the standing side glide stretch, because in standing some of the antigravity muscles are active and thus may not effectively stretch.

Alternate Active Approach: Test and Treatment: Test left to right pelvic side glide by having the client perform active pelvic side glide in standing, performing 10 reps going left to right followed with 10 reps going right to left. If there is a subjective difference, have client actively perform side glide in the direction of the restriction 30 reps daily for a week and test weekly.

Chapter 12 - THE MOST COMMON PATTERN OF LUMBOPELVIC DYSFUNCTION

This is the pattern of faulty lumbopelvic motion coupling which is most common. In an outpatient physical therapy clinic this pattern is encountered on a daily basis. Sometimes this pattern appears to be the root cause of the lumbopelvic pain syndrome, other times it is a contributing factor. The most common pattern of dysfunction includes the following:

These two patterns may precede the most common pattern, see previous section for detailed description.

A. Hip Flexion and Femoral Posterior Glide Fixation With Limited Extension
B. Side Glide Fixation Of The Pelvis

1) Left Posterior Pubic Bone.

2) Left Sacral Rotation.

3) Left Sacral Side Bending.

4) Right Anterior Ilium.

5) Left Posterior Ilium.

6) Right Type I Inflare.

7) Left Type I Outflare.

8) Left Type II L5-S1 Flexion Movement Dysfunction.

9) Posterior Glide Fixation of the Trochanters.

All of the components of the most common pattern are considered to be physiological patterns. Therefore the rule of physiological movement dysfunction applies and is reiterated.
Rule of physiological movement dysfunction: When a structure moves in a physiological direction and becomes stuck, it does not become stuck at end-range. Spring Tests will therefore be negative, that is, there will be motion perceived, perhaps hypermobility. The structure can always move further in the direction of dysfunction.

In the following section an * indicates the most important Spring Test. All others are optional, and become more important if the pattern is not readily resolving (1-3 visits). Sometimes the other Spring Tests will indicate a more complex pattern. I hope it is useful when I provide hints under the section titled "other." I sometimes refer to the advanced workbook and trust that in time this may be useful to you and make for efficient care in the long run, even if temporarily it seems out of place. Clinical reality requires this. I have chosen not to include the pattern titled

pelvic side-glide dysfunction in this section. I am presenting it by itself with the caveat that it is a very important and must be considered after resolving any individual dysfunction or pattern of dysfunctions, whether a basic or advanced pattern. See separate section when appropriate. Home programs are not always necessary, quite often the pattern resolves readily. See the home program section below each treatment section.

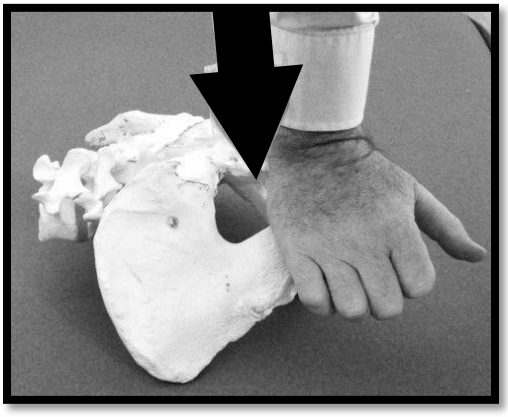
LEFT POSTERIOR PUBIC BONE

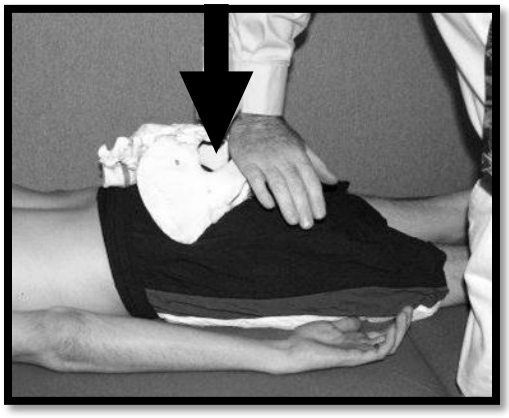
Positional Dysfunction: The left pubic bone is posterior along its entire length, in relation to the contralateral pubic bone.

Movement Dysfunction: Spring Tests are seldom necessary, because the palpatory findings correlate very well with findings from Spring Tests, and clients are usually very tender. Treatment is therefore based on palpatory findings. If Spring Tests were performed they would reveal increased posterior mobility on the left pubic bone, and decreased posterior mobility on the right. One could also spring the ischium anteriorly in which case the left would be hypomobile, the right would be mobile.

Other: This should resolve within 1-2 treatments when the rest of the most common pattern (especially sacral rotation) is addressed. If it does not, suspect a Type II Inflare/Outflare which is covered in the advanced workbook.

SPRING TEST	Hypomobile	Hypermobile
2. Prone Anterior Spring to Left Ischium	☒	





If blocked it is positive for posterior pubic bone or left transverse plane rotation of lower pelvis.

Patient Position: Prone.
Therapist Contact: the flat portion of the ischium which is at the 2-3" portion of the lower buttock above the gluteal crease.
Force and Direction of Force: Approximately 15# of force to take up the slack and an additional 15# (30# total) to spring in a pure P-A direction. Anterior glide occurs in the sagittal plane along an A-P axis.

METHOD 1. SELF TREATMENT FOR LEFT POSTERIOR PUBIC BONE

Patient Position: Supine with hips and knees in neutral position.

Self-Treatment: Place the towel roll horizontally under the left ischium just above the gluteal crease and maintain for 2-5 minutes.

Retest: Retest mobility with appropriate Spring Test.

Home Program: Rarely indicated, only if pattern is recurrent.

LEFT SACRAL ROTATION ABOUT A VERTICAL AXIS

Positional Dysfunction: With patient prone, the entire left side of sacrum is prominent as the sacrum assumed to be is rotated about a vertical axis or mobility is limited by muscular control.

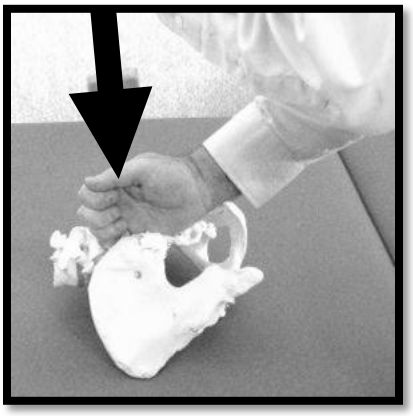
Movement Dysfunction: The prominent left side will have decreased anterior mobility; the deep right side will have increased anterior mobility (tested in prone).

Other: This is a fairly common pattern and may accompany a right anterior and/or left Posterior Ilium, Right Inflare and Left Outflare. It is possible that the Spring Tests measure the influence of muscular guarding on articular mobility. In some cases the direct treatment is not tolerated due to pain, and alternately you may try treating the ilium on the same side for a relative Outflare. This may "carry" the sacrum into correction.

If a posterior pubic bone on the left side was not initially encountered, it is important to retest for it after resolving the sacral rotation. Quite often it is not present initially but due to the functional interdependence of the sacrum and symphysis pubis, it often manifests after resolving the sacral component.

SPRING TESTS	Hypomobile	Hypermobile
*3. Prone Sacral Rotation		
on Left Side	☒	
on Right Side (optional)		☒

3. PRONE SACRAL ROTATION SPRING TEST



If blocked, suspect rotation of sacrum in the direction of your hand, or muscle guarding or transverse plane rotation of the pelvis.

Patient Position: Prone.

Therapist Contact: Lateral border of 5th metacarpal or open palm encompassing S1-S3 medial to the PSIS.

Force and Direction of Force: Approximately 15# to take up the slack and an additional 15# (total of 30#) to perform Spring Test in a pure P-A direction. Rotation occurs in the transverse plane about a vertical axis.

METHOD 1. LEFT SACRAL ROTATION TREATMENT

Patient Position: Supine with hips and knees flexed. Padded dowel placed vertically on the left side of the sacrum to encompass S1-S3. A magic marker with rolled up washcloth works well, but tape the cap, or use a dried up marker.

Treatment: Prolonged stretch for 2 minutes. If direct pressure of the dowel is painful, you may treat via Inflare/Outflare exercises 1-4.

Retest: Retest sacral mobility with appropriate Spring Test. Then retest symphysis pubis for left posterior pubic bone.

Home Program: Rarely indicated, only if pattern is recurrent.

LEFT SACRAL SIDE BENDING

Sacral side bending can perpetuate faulty lumbosacral motion coupling, pain and spasm. Left Sacral Side Bending is much more common than right. It is a fairly common pattern and is very easy to treat.

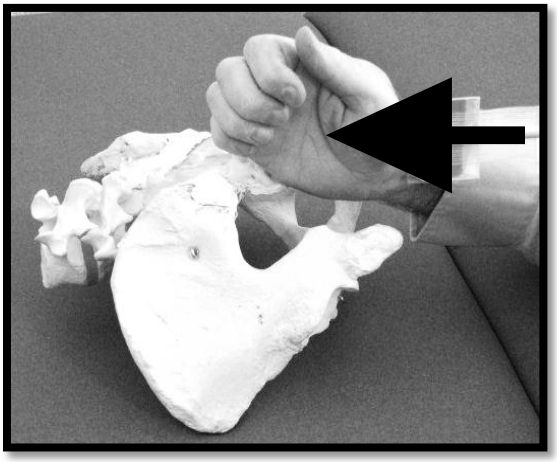
Positional Dysfunction: The left inferior lateral angle will be lower.

Movement Dysfunction: Lack of superior glide when tested at the left inferior lateral angle.

Other: This pattern should not require repeat treatment. If it does more than once refer to superior/inferior pubic bone in this workbook and treat the symphysis pubis if this dysfunction is present.

SPRING TESTS	Hypomobile	Hypermobile
*4. Sacral Side Bending		
Left (superior spring to left ILA)	☒	
Right (superior spring to right ILA) (optional)		☒

PRONE SACRAL SIDE BENDING SPRING TEST



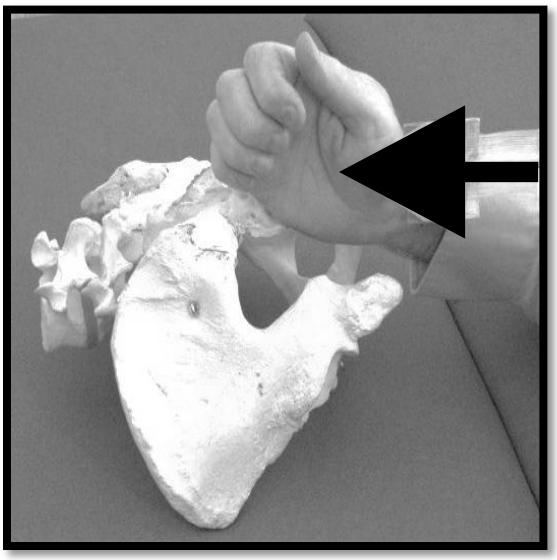
If mobility is blocked (usually on left) suspect left sacral side bend fixation which lacks right side bending mobility. Alternately, it may be an increase in soft tissue tone and extrinsic restriction of mobility.

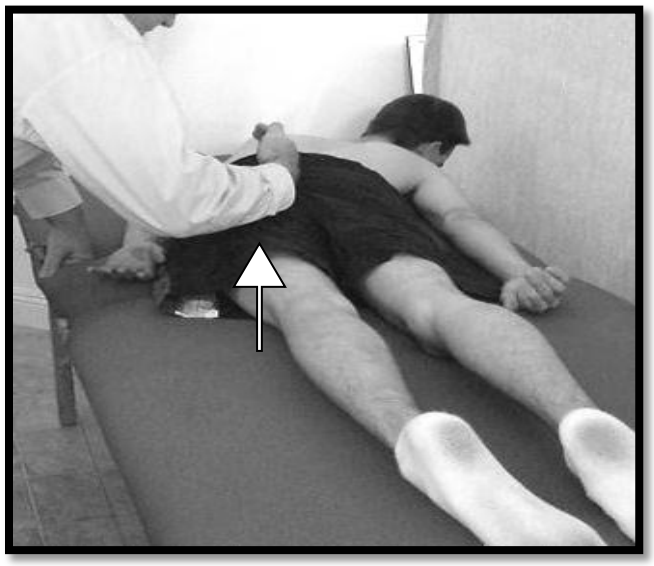
Patient Position: Prone.

Therapist Contact: Fifth metacarpal under the inferior lateral angle of the sacrum 1 cm lateral to the coccyx. Test left side, then right.

Force and Direction of Force: Five to 10# to take up the slack, and additional 5-10# (total of 10-20#) to spring in a superior direction. Side bending occurs in the frontal plane about an A-P axis.

METHOD 1. LEFT SACRAL SIDE BENDING TREATMENT





Patient Position: Prone. The spine is side bent to the right. This is done to minimize lumbosacral facet compression during mobilization, and to pull the sacrum into right side bending.

Therapist Position: With the ulnar border of the hand on the left inferior border of the inferior lateral angle.

Treatment: Very gentle superior pressure on the left ILA applied for 1-2 minutes, or gentle oscillations performed at end range (0#-10#-20#), usually 5 reps are adequate.

Retest: Retest mobility with appropriate Spring Test.

Home Program: Rarely indicated, only if pattern is recurrent.

ANTERIOR RIGHT ILIUM

Positional Dysfunction:

ASIS — anterior, medial, inferior
Anterior Iliac Shelf — inferior
PSIS — Anterior (although lateral and superior also, these can be quite subtle and therefore are not usually assessed). The superior/inferior position of the ilium is much more readily perceived at the posterior iliac shelf and the ischial tuberosity.
Posterior Iliac Shelf — superior
Ischial Tuberosity — superior

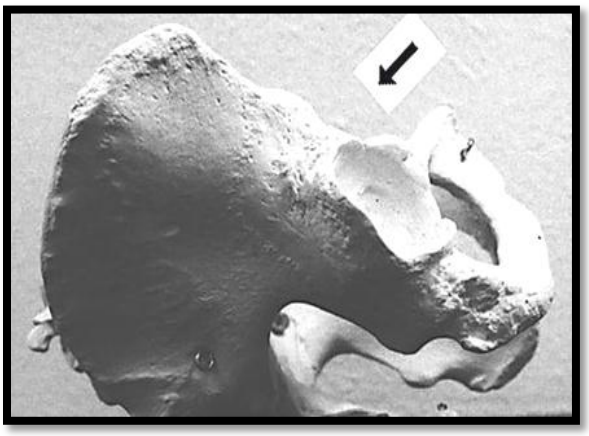
Movement Dysfunction: Reduced posterior rotation and increased anterior rotation.

Other: Anterior Ilium is very common and occurs on the right side, very rarely occurring on the left. It is a common postural adaptation due to asymmetrical sitting posture, getting in and out of the car in a hurried fashion, holding babies supported on one side of the pelvis, etc. It is present to some degree in most of the adult population and oftentimes is asymptomatic. In acute injuries, the client may have had an Anterior Ilium for quite some time, and then overloaded the soft tissues, enhancing a pattern which heretofore was quiescent. Anterior Ilium is a contributor to faulty biomechanics and therefore is often addressed in clients who do not appear to have sacroiliac joint pain. Anterior Ilium should resolve readily, especially with home program. If it does not and the entire sequence of the most common pattern has been addressed 2-3x (left Posterior Ilium, Inflare/Outflare, type II L5-S1 pattern) suspect a more complex pattern such as Anterior Ilium with Upslip (see separate section) or an advanced pattern (see advanced workbook.) The tri-plane description appears to be unique to this approach.

SPRING TESTS	Hypomobile	Hypermobile
Supine		
5. Right Posterior Rotation of the Anterior Ilium	☒	
Prone (optional)		
6. Right Anterior Rotation of the Posterior Ilium		☒
9. Prone Right Inferior Spring to the Posterior Ilium	☒	
10. Right Superior Spring to Ischial Tuberosity		☒

**Hand placement is critical, you must be just below the Posterior iliac crest, and well above and lateral to the PSIS. Force direction is pure P-A.*

1. SUPINE POSTERIOR ROTATION OF THE ILIUM SPRING TEST

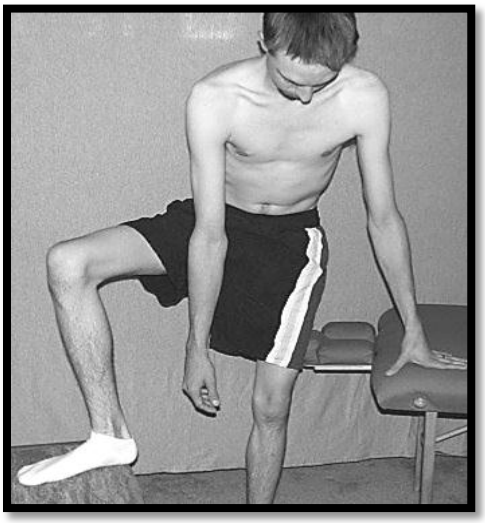


Patient Position: Supine.

Therapist Contact: Open palms on anterior pelvis with maximum contact for comfort.

Force and Direction of Force: Take up the slack with approximately 20# and apply Spring Test up to approximately 40#. Test is performed at a 45 degree angle following the angle of the anterior shelf. It would be wrong to spring in a pure A-P direction which would just compress the joint. Spring is done on one side at a time, though both receive information. Posterior rotation occurs in the sagittal plane about a medial/lateral axis.

METHOD 1. SELF-TREATMENT FOR RIGHT ANTERIOR ILIUM



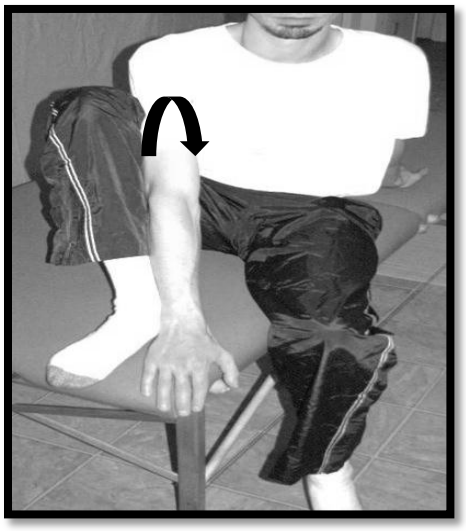
Patient position: The right foot on a stool with the hip flexed and abducted 45 degrees. The client then reaches towards the floor with the right hand inside of the right thigh. It is important to have the client reach only to the point where a comfortable stretch is perceived, it should not be forceful. The left hand holds onto a table or wall for balance.

Treatment: The stretch is performed gently for 2 minutes.

Retest: mobility with appropriate Spring Test.

Home Program: 2x/ day x 1 week, 2x week thereafter.

METHOD 2. SELF-TREATMENT FOR ANTERIOR ILIUM



Patient Position: In sitting, supine or side lying, bring the knee on the right side towards the right axilla and stretch gently for 2 minutes. Muscle energy technique: The client clasps the right thigh and isometrically attempts to move it into extension and adduction against an unyielding force. The contraction is maintained for 3-10 seconds and then it is relaxed and the thigh then moves passively into the new barrier. This is repeated 3-10 times.

Retest: Retest mobility with appropriate Spring Test.

Home Program: 2x /day x 1 week, 2x week thereafter.

METHOD 3. SUPINE TECHNIQUE FOR RIGHT ANTERIOR ILIUM

Patient Position: Supine with hip on side of dysfunction in abduction, flexion, external rotation towards end range. An alternate position would be side lying.

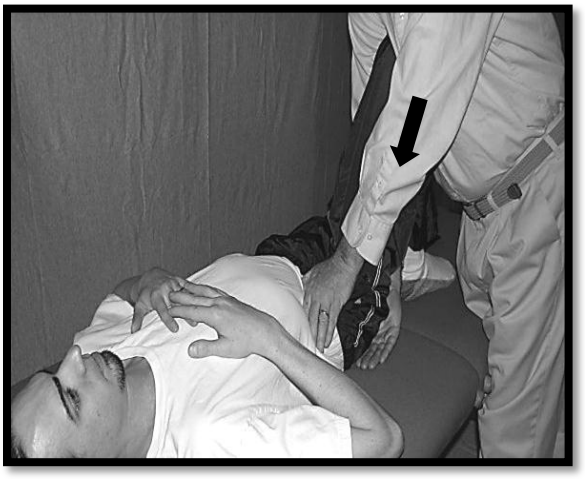
Therapist Position: On side of dysfunction.

Treatment: Passively increase hip flexion, abduction and external rotation to end range 3 times. Muscle energy method: At end range the therapist resists isometric hip extension, adduction, internal rotation gently for 3-10 seconds; patient relaxes and therapist assists leg into new barrier of further flexion, external rotation, and abduction. Repeat 3 times.

Retest: mobility with appropriate Spring Test.

Home Program: 2x day x 1 week, 2x week thereafter.

METHOD 4. SUPINE MANUAL TECHNIQUE FOR RIGHT ANTERIOR ILIUM



Patient Position: Supine with the right hip flexed, foot flat, hip in slight external rotation and slight abduction. An alternate position would involve placing the left thigh off the table in extension and slight abduction.

Therapist Position: On the right side with one hand on the ischial tuberosity, the left hand on the Anterior Ilium with as much contact as possible in order to maximize comfort.

Treatment: Gently mobilize with posterior rotary force maintaining pressure at end range for 2 minutes or 10-30 oscillations at end range (0#-15#-30#, up to 0#-20#-40#). Muscle energy technique: Resist hip extension 3-10 seconds, have patient relax and rotate ilium further into barrier. Repeat 3 times.

Retest: Retest mobility with appropriate Spring Test.

Home Program: 2x day x 1 week, 2x week thereafter.

POSTERIOR LEFT ILIUM

Posterior Ilium does not always follow Anterior Ilium, in fact, treating the anterior dysfunction first will often restore normal movement on both sides. When it does not, the movement on the side of anterior dysfunction is often restored but re-evaluation will reveal the presence of a Posterior Ilium on the contralateral side.

Positional Dysfunction:

ASIS — superior, lateral, posterior.
Anterior Iliac Shelf — superior.
Posterior Iliac Shelf — inferior.
Ischial Tuberosity — inferior.
PSIS — posterior.

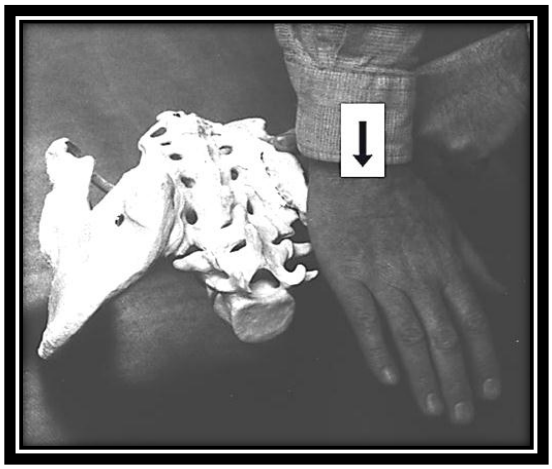
Although the PSIS is medial and inferior, these two positions are extremely subtle. The inferior relationship is best assessed via the iliac shelf and ischial tuberosity.

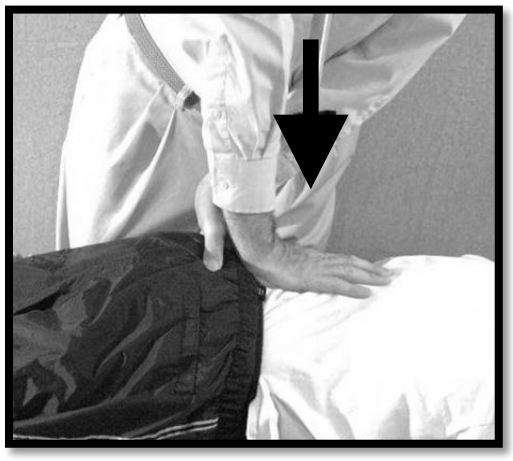
Movement Dysfunction: Increased posterior rotation and decreased anterior rotation. Increased lateral mobility in supine.

Other: Posterior Ilium often converts to an Outflare with a Type II or Type IIB L5 motion dysfunction, which needs to be addressed consecutively. Symptoms from a Posterior Ilium are usually much more severe than symptoms from an Anterior Ilium. Posterior Ilium can be subtle and may be present when treatment for a contralateral Anterior Ilium is not successful. Thus you can have an anterior and Posterior Ilium occurring together, on opposite sides. Both dysfunctions must be addressed. Home program is taught if the pattern repeats on any subsequent visit, but not taught on day 1. If appropriate for home program 1x day for week 1 and 3x week thereafter is adequate.

SPRING TESTS	Hypomobile	Hypermobile
Prone		
*6. Left Prone Anterior Rotation of the Ilium	☒	
Supine (optional)		
5. Left Posterior Rotation of the Anterior Ilium		☒
Prone (optional)		
9. Prone Left Inferior Spring to the Ilium		☒
10. Left Superior Spring to Ischial Tuberosity	☒	

PRONE ANTERIOR ROTATION OF THE ILIUM SPRING TEST





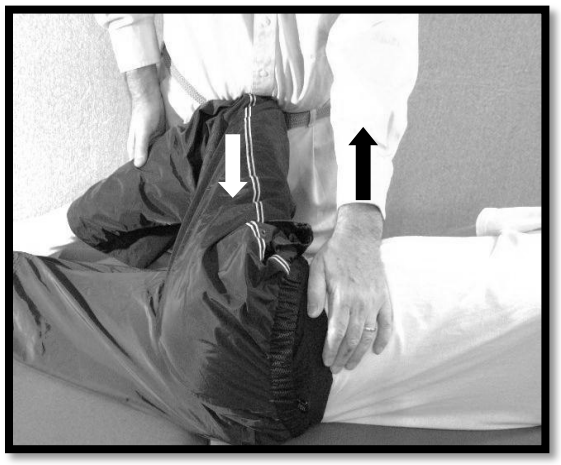
If motion is blocked, suspect Posterior Ilium, be it the SIJ or the entire pelvis torsioned with unilateral hypertonicity.

Patient Position: Prone.

Therapist Contact: Open palm on the ilium just below the posterior shelf, well above and lateral to the PSIS. Hand placement is critical; you must be just below the posterior iliac crest and well above and lateral to the PSIS.

Force and Direction of Force: Approximately 20# of force to take up the slack and an additional 20# (40# total) to spring in a pure P-A direction. Anterior rotation occurs in the sagittal plane about a medial/lateral axis.

METHOD 1. SIDE LYING TREATMENT FOR POSTERIOR ILIUM



Patient Position: Side lying with the hip on top flexed to 60-90 degrees. Typically males require less hip flexion to avoid enhancing posterior rotation of the ilium. This can be monitored by palpating medial to the PSIS while flexing the hip. A pillow is placed between the knees for comfort.

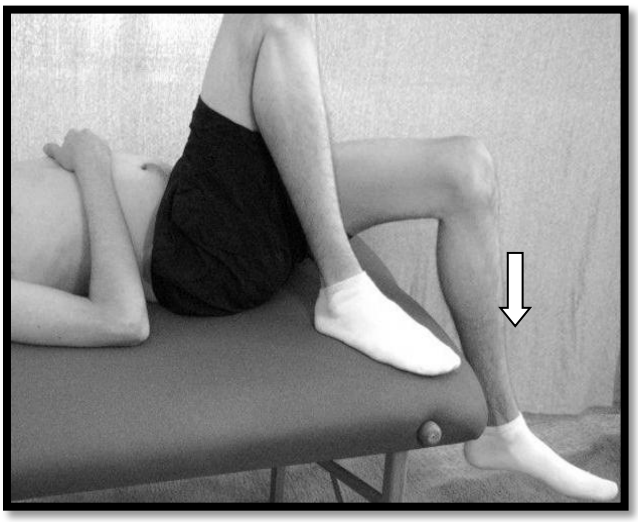
Therapist Position: Palmar contact is made on the Posterior Ilium; it must be above the PSIS/rotatory axis. The other hand can be stacked or you may choose to monitor movement palpating just medial to the PSIS. The patient's uppermost knee can rest against the therapist's abdomen or pelvis/ilium.

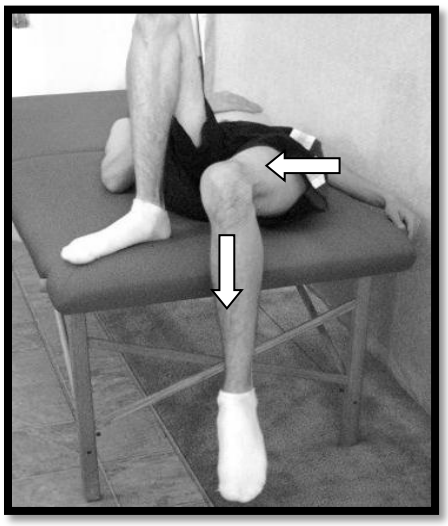
Treatment: The therapist gently rotates the ilium anteriorly and provides a prolonged stretch or gentle oscillations at end range (0#-15#-30#). Muscle energy: The knee is resting against the therapist and the therapist pushes into the femur along its long axis to take up the slack. The patient pushes the knee into the therapist's body, which is unyielding. Upon relaxing, the femur moves posteriorly, effecting an anterior rotation of the ilium.

Retest: Retest mobility with appropriate Spring Test.

Home Program: Taught only if pattern recurs. 1x day x 3 days.

METHOD 2. SELF-TREATMENT FOR POSTERIOR ILIUM





This requires a high level of skill and is not appropriate for all patients.

Patient Position: Supine with the left leg partially off the table. The left hip is adducted and extended, the knee is flexed. The right hip and knee are flexed and can be brought to the chest or right axilla to enhance comfort.

Treatment: Passively, gently extend and adduct the left femur to end range and let it stretch gently for 2 minutes.

Retest: Retest mobility with appropriate Spring Test.

Home Program: Taught only if pattern recurs. 1x day x 3 days.

OUTFLARE LEFT TYPE I

Positional Dysfunction:
ASIS — lateral and deep (posterior)
PSIS — posterior and medial

Movement Dysfunction: There will be decreased anterolateral mobility as tested in prone at the Posterior Ilium (thenar contact just lateral to the PSIS). Usually there will be increased posterolateral mobility of the anterior pelvis as tested in supine, though this Spring Test is not utilized much, due to inconsistency.

Treatment: See exercise sequence for reducing Inflare/Outflare on the following page.

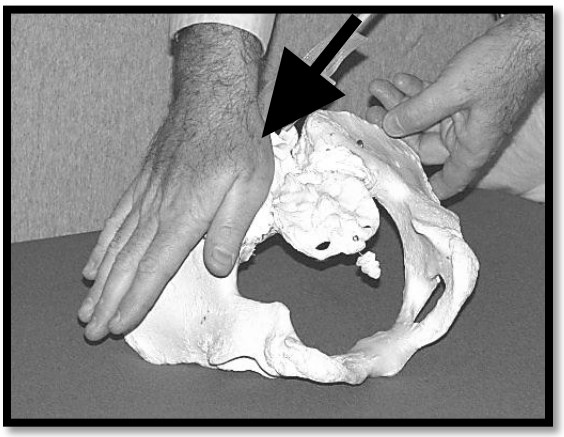
Other: Home program is appropriate 1x day for 1 week, 3x week thereafter.
Treatment is more successful if the opposite side is treated for relative Inflare. See exercise sequence for reducing flaring. The lumbar spine will almost always rotate with L5 in the same direction as the relative Outflare. If the lumbar rotation does not resolve with treatment for flaring it must be treated separately. Now perform the side lying tests for Type II Outflare.

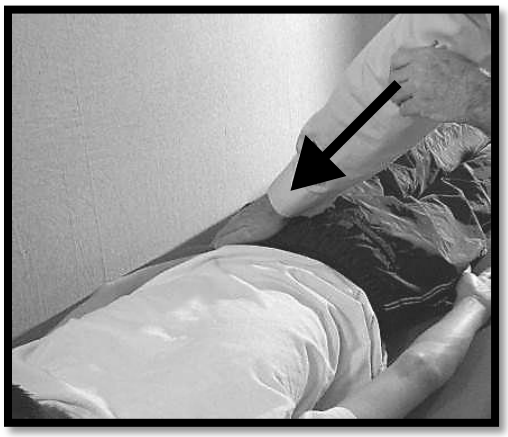
Retest: Retest mobility with appropriate Spring Test.

Home Program: 2x day x 1 week, 2x week thereafter.

SPRING TEST	Hypomobile	Hypermobile
Prone		
7. Left Lateral Ilium Spring Test. Blocked mobility on the left is positive for a Left Outflare.	☒	

7. PRONE LATERAL ILIUM SPRING TEST





Blocked mobility on the left is positive for a Left Outflare.

Patient Position: Prone.

Therapist Contact: The depression between the thenar and hypothenar eminences contacts the PSIS and the rest of the palm contacts the rest of the ilium with hand facing laterally.

Force and Direction of Force: Up to 20# to take up the slack and an additional 20# (40#) total to spring at a 45 degree angle laterally towards the trochanter. Hypomobility is much more readily apparent with this Spring Test than hypermobility.

INFLARE RIGHT TYPE 1

Inflare is a very common strain pattern both as a single entity and as a residual pattern remaining after Anterior Ilium. It is almost always on the right side. Inflare is commonly followed by a Type II or Type IIB lumbosacral motion dysfunction. Cases of Inflare that do not respond to the flare exercises are usually a muscular response to a Type II or Type IIB lumbosacral motion dysfunction. Inflare is always accompanied by an opposite-sided relative Outflare.

Treating both sides of the pelvis seems most effective. Treat the other side for relative Outflare. See exercise sequence for reducing flaring which is very effective. If the Inflare is resistant to treatment treat L5-S1 first, as well as soft tissue. After resolving the Inflare pattern, recheck for a Type II or Type IIB lumbosacral pattern. If present address it. Now do the side lying Spring Tests to evaluate for Type II Inflare. This description of Inflare is not the same as the traditional (osteopathic) description which is described in the advanced workbook. This pattern occurs much more frequently. I thought it was unique to this approach; in fact it is one of the first "new" patterns I encountered though I later encountered the positional description in Diane Lee's first book which is referenced and is on my suggested reading list.

Position Dysfunction:

ASIS — medial and anterior
PSIS — lateral and deep (anterior)

Movement Dysfunction: Although it is inconsistent, decreased posterolateral mobility as tested at the Anterior Ilium in supine is sometimes encountered. Because of inconsistency, this Spring Test is not utilized much. Increased anterolateral mobility will be noted when tested at the Posterior Ilium in prone (thenar contact just lateral to the PSIS).

Treatment: See exercise sequence for reducing Inflare/Outflare on following page.

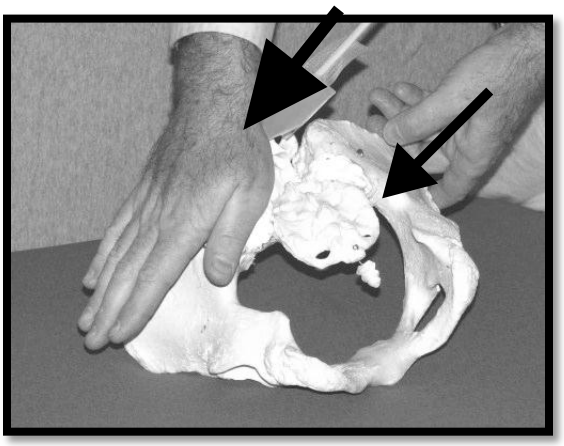
Retest: Retest mobility with appropriate Spring Test.

Home Program: See Flare exercises. 2x day x 1 week, 2x week thereafter.

SPRING TEST	Hypomobile	Hypermobile
Prone		
7. Left Lateral Ilium Spring Test*	☒	

Blocked mobility on the left is positive for a Left Outflare.

7. PRONE LATERAL ILIUM SPRING TEST



Blocked mobility on the left is positive for a Left Outflare.

Patient Position: Prone.

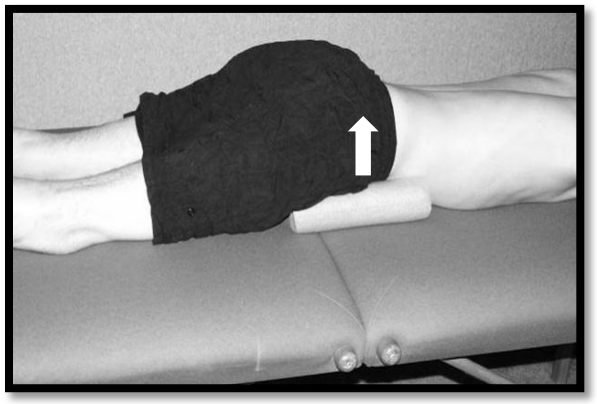
Therapist Contact: The depression between the thenar and hypothenar eminences contacts the PSIS and the rest of the palm contacts the rest of the ilium with hand facing laterally.

Force and Direction of Force: Up to 20# to take up the slack and an additional 20# (40#) total to spring at a 45 degree angle laterally towards the trochanter. Hypomobility is much more readily apparent with this Spring Test than hypermobility.

FLARE EXERCISES

Do these daily for one week and one time per week thereafter.

FLARE EXERCISE 1.



1. Lie prone over a foam roll placed vertically beneath the right ilium, stay x 2 minutes.

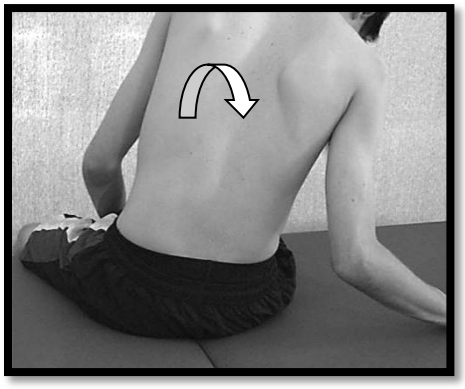
FLARE EXERCISE 2.

2. Lie supine with foam roll beneath the left ilium and ischium placed at a 30 degree angle. Allow passive stretch (creep) for 2 minutes while also stretching the hip into adduction.

FLARE EXERCISE 3.

3. Place right lower leg on a folded pillow and allow the right hip to passively stretch laterally at a 90 degree angle for 2 minutes.

FLARE EXERCISE 4.

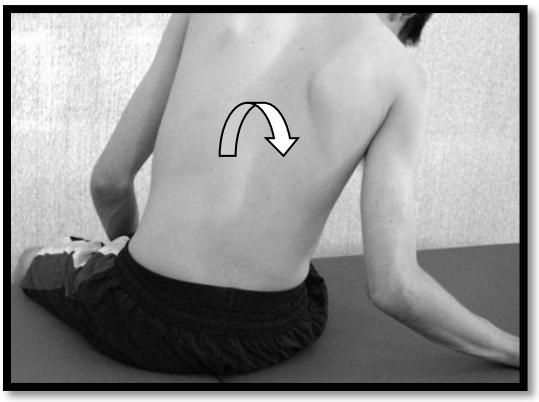


4. Have client sit and flex spine comfortably. Add right side bending and right rotation by placing weight on the right hand which is behind the right hip, laterally. Client gently stretches into right lumbar side bending 30 reps.

TYPE II LEFT LUMBAR FLEXION MOVEMENT DYSFUNCTION

If a vertebra is *positionally* extended, the *movement* dysfunction will be restricted flexion. When the spine has restricted flexion on one side, rotation will be induced when flexion is attempted. If a vertebra cannot flex on the left, it will remain in extension on the left when the rest of the spine flexes. This creates a pathological axis, and the vertebra will extend, side bend, and rotate to the left. The left facet moves inferiorly into extension and the right facet moves superiorly into flexion. With flexion *movement* dysfunction there may be a slight asymmetry in neutral. With active extension there is no asymmetry. With flexion there is increasing asymmetry. Palpation of the transverse process or facets will demonstrate increased prominence with flexion. In other words, the side with flexion dysfunction becomes prominent with flexion.

SELF-TREATMENT FOR TYPE II LEFT LUMBAR FLEXION MOTION DYSFUNCTION



Self-Treatment: Sitting with the lumbar spine in flexion, right side bending, and right rotation. Gentle right rotation is repeated 30 times at end range.

Retest: Retest mobility with appropriate mobility test. Test for side-glide dysfunction.

Home Program: 2x day x 1 week, 2x week thereafter

MUSCLE ENERGY TREATMENT FOR TYPE II LEFT LUMBAR FLEXION MOTION DYSFUNCTION

Patient Position: Sitting with the lumbar spine in flexion.

Therapist Position: Sitting behind the patient. The left thumb palpates the left lumbosacral junction. The right hand is placed in front of the right shoulder.

Treatment: The motion barrier is engaged with flexion from above downward until the lumbosacral segment attempts to flex. Then side bending to the right and rotation to the right are added. Do not position the spine such that motion occurs below the dysfunctional segment. Do not allow the segmental muscles below the dysfunctional part to contract. Do not allow the left ischium to lift up from the sitting surface. Resist the client as he attempts to rotate left for 10 seconds isometrically. As client relaxes he will move into the barrier. Repeat 3 times. Rotation can be deferred if uncomfortable.

Retest: Retest mobility with appropriate mobility test. Test for side-glide dysfunction.

Home Program: 2x day x 1 week, 2x week thereafter. See Flare exercise #6.

POSTERIOR GLIDE FIXATION OF THE TROCHANTER SELF TREATMENT

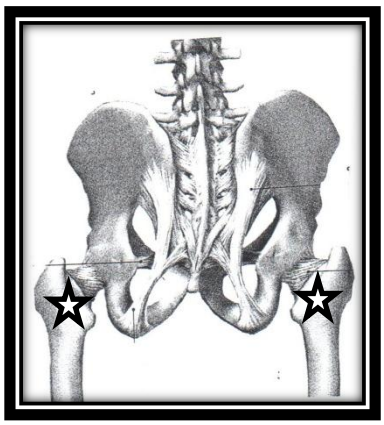
Position Dysfunction: Trochanter is posterior in relation to the opposite side. Paradoxically, hip rotation, especially internal rotation tested passively may be full.

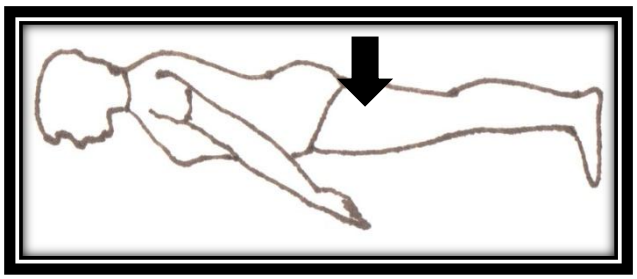
Movement Dysfunction: Blocked P-A spring to posterior trochanter, client is prone. This may involve tightness in the hip rotators that have a different angulation from the piriformis et al; specifically, the posterior horizontal portion of the adductor magnus and the quadratus femoris.

Treatment: In supine, a 3" foam roll or tightly rolled hand towel placed vertically under the trochanter. 2-5 minutes passive stretch.

Retest: Retest mobility with P-A Spring Test, with client prone.

Home Program: 2x a day x 1 week, 2x a week thereafter.





SPRING TEST	Hypomobile	Hypermobile
Prone		
14. P-A spring at the posterior trochanter.	☒	

POSTERIOR GLIDE FIXATION OF THE TROCHANTER SELF TREATMENT

Place foam roll under the: □ Right hip □ Left hip

Treatment: In supine, a 3" foam roll or tightly rolled hand towel placed vertically under the trochanter. A 2-5 minutes passive stretch is performed with leg in neutral, client supine.

Home Program: 2x a day x 1 week, 2x a week thereafter.

Chapter 13 - SACRAL TORSION ABOUT AN OBLIQUE AXIS

Sacral Torsion about an Oblique Axis (often referred to simply as "torsion") is a rather complex phenomenon of the sacrum. Fortunately it is much less common than the sacral patterns mentioned earlier, though I know many would disagree with this statement. I have defended this elsewhere (Hesch 1992). Sacral Torsion is a tri-planar behavior of the sacrum about an oblique axis. There are 2 oblique axes. The right oblique axis originates on the superior and anterior portion of the right SI joint and terminates on the inferior and posterior portion of the left SI joint. The left oblique axis is the opposite. See illustrations below.

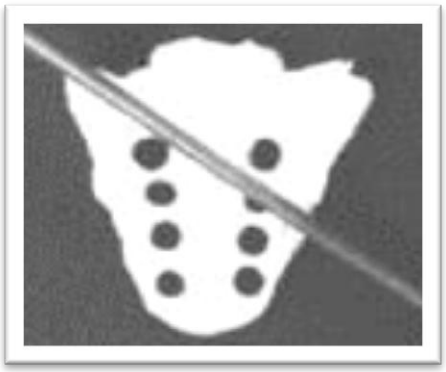


FIG. 23. LEFT SACRAL OBLIQUE AXIS
Note that top of axis is on the left.

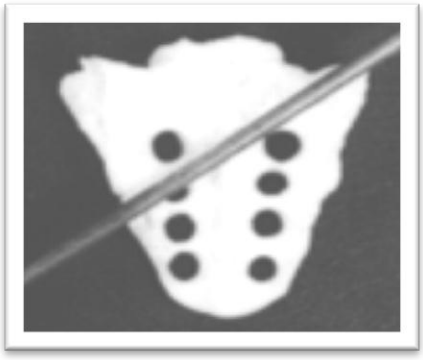


FIG. 24. RIGHT SACRAL OBLIQUE AXIS
Note that top of axis is on the right.

The osteopathic and chiropractic and more recently the physical therapy literature refer to an oblique sacral axis extending from the anterior part of the upper sacral articular surface down to the contralateral inferior and posterior joint surface (S1-S3). The axes are named right oblique axis (begins on the right upper joint) and left oblique axis (begins on left upper joint). Dysfunctions are named for the direction of rotation on the axis, such as Right on Right, meaning right rotation of the sacrum on the right oblique axis. Other dysfunctions are Left on Left, Left on Right, and Right on Left.

Some of the literature regarding sacral motion is confusing. One Osteopathic list of terminology on the internet lists no less than 13 different names for Sacral Torsion about an Oblique Axis! It sometimes seems to ascribe rotation about a vertical axis, yet refers to it as rotation about an oblique axis. Details are inadequate. Rotation about an oblique axis is referred to as Sacral Torsion. I believe that clarity can be established by utilizing more landmarks for palpation, and adding passive Spring Tests. Sacral rotation about a vertical axis and side bending about an anterior-posterior axis are frequently observed when utilizing this evaluation schema. Pure forward and backward bending dysfunctions about a transverse axis are observed, though less frequently. Additionally the Spring Tests can be performed in neutral, though more importantly must be performed in full extension and full flexion. When the oblique axis dysfunctions are present they can be significant (with respect to degree of symptoms) and I can personally vouch for that. When I have a left on right torsion that occurs in flexion I am profoundly symptomatic. I am grateful to the osteopathic profession for helping my understanding of this pattern. My purpose is not to discount the significance of Torsions, but rather to put them in perspective and

hopefully make the concept less obscure. Many clinicians are confused by these concepts and I hope to make them more readily understood, and therefore utilized in the clinic.

Another dysfunction is named unilateral sacral flexion or unilateral extension. Semantically this is problematic. Semantically it is hard to see how a sacrum can flex/extend on only one side. Rotation or torsion might be a better term. As I understand it, they are describing the oblique axis once again, but side-bending couples differently. With a Torsion the rotation occurs to the same side as the side bending, whereas with unilateral flexion/extension, they are coupled in opposite directions, if in fact I understand it correctly. Fortunately, such a pattern would be encountered by the same evaluation utilized for the other Sacral Torsions; it would appear to be a typical Sacral Torsion except that the side-bending component would be opposite the rotation. I have never encountered one of these, those I have diligently looked for it, for several decades. The limited use of bony landmarks, limited use of accessory motion tests, adds confusion to this pattern and has also been addressed elsewhere (Hesch 1990, 1992, 1997), though I will elaborate a little. Because I have not encountered this pattern I will not present a treatment section, though if it did occur it would be encountered with the evaluation and treatment should be logical (treat the rotation and side-bending dysfunctions separately).

The traditional approach utilizes only a few tests, which include palpation of only 8 sacral landmarks: the sacral base, the sacral sulci, and the inferolateral angles (anterior-posterior and superior-inferior relations). Palpation of the sacral sulci can be problematic, as a change in the sacral sulci does not necessarily describe a positional change of the sacrum. It only gives information about the *relationship* of the PSIS and the sacrum. One could have an altered ilium, a normal sacrum, with an altered sulcus. One could also encounter an altered position of both ilia and the sacrum. It seems that sacral or ilium dysfunction rarely occurs in isolation. Usually both the ilium/ilia and sacrum, and oftentimes the symphysis pubis, all show varying degrees of dysfunction, clouding the test of sacral sulci depth.

The inferolateral angle of the sacrum is often palpated to determine anterior/posterior and superior/inferior position of the sacrum. The inferolateral angle may be altered due to developmental asymmetry, and additional sacral landmarks need to be taken. Also soft tissue tone of the sacrotuberous ligament and gluteus maximus can mimic a positional dysfunction in the presence of normal or near normal mobility per Spring Tests. If sacral side bending does indeed exist, a joint movement test (Spring Test) used in addition to the positional test, would validate the problem. Up to 14 landmarks on the sacrum are utilized with this evaluation method, and they can be repeated in neutral, though are more importantly performed in flexion and extension. This includes posterior-anterior relationship along the length of the sacrum (S1-S5) underneath the ILA's and the sulci. Palpation whether revealing symmetry or asymmetry always leads to Spring Testing.

Left and right rotation about a vertical axis seems much more prevalent based on experience with these additional positional tests and with consideration of the orientation of the plane of the sacroiliac articular surface. Miller and colleagues (1987) support the idea that rotation about a vertical axis is more probable, and occurs to a greater degree than other motions. The limitations of other tests used to discern Sacral Torsions via the traditional evaluation will not be elaborated on here (see Hesch 1992).

I felt it important to include the Sacral Torsions in the basic workbook because there seems to be a lot of confusion that limits the clinical application. It is my hope that I can make the concepts, evaluation, and treatment more accessible to clinicians and place them in their rightful context; which is that these oblique axis dysfunctions are fairly encountered on a fairly regular basis. If not symptomatic at the time, in time the client may become symptomatic at the next mobile segment above; most likely L4-5, as L5 would be stuck also. Otherwise a distal compensation due to the righting reflex may become symptomatic in time. When torsional patterns are present they can be very symptomatic and after clearing the basic patterns I always screen for torsions.

TESTING OBLIQUE SACRAL POSITION AND MOBILITY

Palpate the length of the sacrum bilaterally at S1, S2, S3, S4, S5 at least 1 cm lateral to midline. In the presence of a Sacral Torsion the sacrum will be most asymmetrical at the sacral base and at the apex (Figure 25). In the presence of a Sacral Torsion the sacrum will be most symmetrical at the mid-point where the axes cross at S2 (Figure 26).

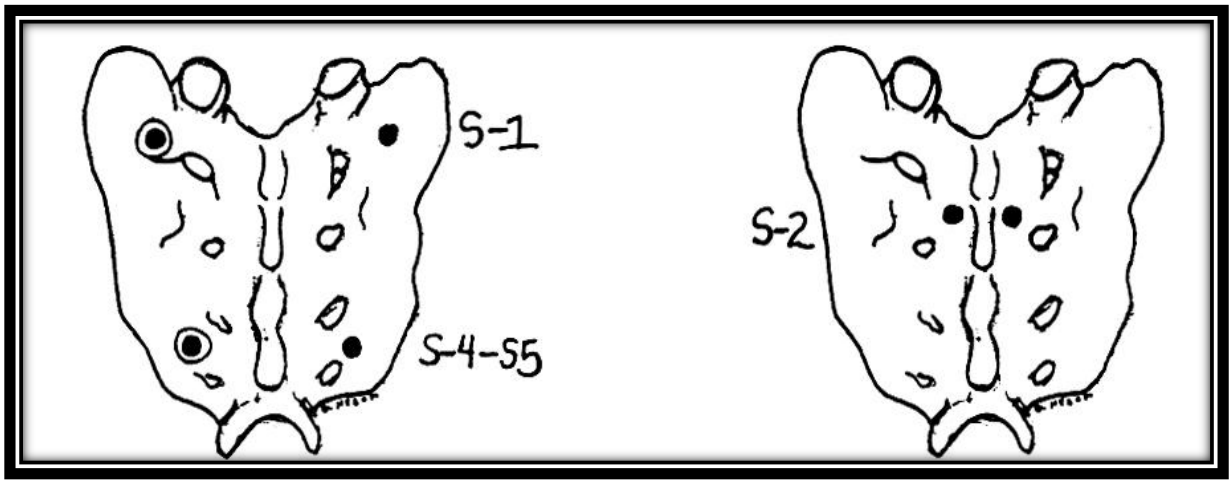


FIG. 25. POINTS OF GREATEST ASYMETRY

FIG. 26. POINTS OF GREATEST SYMMETRY

Draw an oblique line or place a pen across the sacrum with the right side approximately 1 cm above the right PSIS and the left side approximately 1 cm below the left PSIS. This represents the right oblique axis. With the heel of your hand at least 1.5 cm above and parallel to the axis take up the slack and perform the Spring Test in flexion (Yoga Child Pose Position/fold-up. Then repeat the Spring Test with contact at least 1.5 cm below and parallel to the axis. Then perform the sacral side-bending Spring Test by springing superiorly under each inferior lateral angle.

Then create the left oblique axis by drawing a diagonal line or placing a pen across the sacrum with the left side approximately 1 cm above the left PSIS and the right side approximately 1 cm below the right PSIS. With the heel of your hand at least 1.5 cm above and parallel to the axis take up the slack and perform the Spring Test in flexion (Yoga Child Pose Position/fold-up). Then repeat the Spring Test with contact at least 1.5 cm below and parallel to the axis. Then perform

the sacral side-bending Spring Test by springing superiorly under each inferior lateral angle.

Each time you perform a P-A spring above and below the left and right oblique axis you are actually doing the spring on one of the sacral quadrants. See diagram below.

NEW, SIMPLER, AND LUCID NOMENCLATURE

Compare and contrast the new Hesch Method nomenclature below (bolded) with the traditional nomenclature (italicized). Is the new nomenclature easier to visualize? Are evaluative findings of palpation and Spring Tests easier to communicate from one therapist to another? We submit that the answer is yes.

Posterior Left Lower Sacral Quadrant with Blocked P-A Spring. Versus: Left on Left Sacral Torsion.

Posterior Left Upper Sacral Quadrant with Blocked P-A Spring. Versus: Left on Right Sacral Torsion.

Posterior Right Upper Sacral Quadrant with Blocked P-A Spring. Versus: Right on Left Sacral Torsion.

Posterior Right Lower Sacral Quadrant with Blocked P-A Spring. Versus: Right on Right Sacral Torsion.

	POSITION			MOBILITY		
NEW Nomenclature (TRADITIONAL Nomenclature)	Upper Sacral Quadrant	Lower Sacral Quadrant	*Sacral Inferior Lateral Angle (ILA)	Sacral P-A Spring Above Oblique Axis	Sacral P-A Spring Below Oblique Axis	*Superior Spring To Sacral ILA
Posterior Left Lower Sacral Quadrant With Blocked P-A Spring AKA Left On Left (Left Rotation on Left Oblique Axis)	subtle, n/a	posterior left	inferior right	mobile right upper quadrant	restricted left lower quadrant	restricted right
Posterior Right Lower Sacral Quadrant With Blocked P-A Spring AKA Right On Right (Right Rotation on Right Oblique Axis)	subtle, n/a	posterior right	inferior left	mobile left upper quadrant	restricted right lower quadrant	restricted left
Posterior Left Upper Sacral Quadrant With Blocked P-A Spring AKA Left on Right (Left Rotation on Right Oblique Axis)	posterior left	subtle, n/a	inferior right	restricted left upper quadrant	mobile right lower quadrant	restricted right
Posterior Right Upper Sacral Quadrant With Blocked P-A Spring AKA Right on Left (Right Rotation on Left Oblique Axis)	posterior right	subtle, n/a	inferior left	restricted right upper quadrant	mobile left lower quadrant	restricted left

TABLE 3. NOVEL AND TRADITIONAL SACRAL TORSION NOMENCLATURE: PALPATION AND SPRING TEST FINDINGS

*These are only included for the sake of completeness. As stated in the text, it is not necessary to screen the superior/inferior position and mobility of the Inferior Lateral Angles (ILA) as these components resolve when the primary rotation is corrected.

PALPATION AND SPRING TEST CHECKLIST FOR SACRAL TORSION ABOUT OBLIQUE AXIS

Explanation: The horizontal and vertical lines separate the sacrum into quadrants only. In this example they *do not* represent axes. Please note that this drawing is not to scale. In an actual client, the horizontal line is at S2, which is at the upper part of the sacrum at *2/5*.

Test Position: Yoga Child Pose
Mark the most posterior and hypomobile Quadrant. They will one and the same

Palpation: Only one quadrant will be prominent.

LEFT UPPER QUADRANT OF SACRUM:	☐ PROMINENT/POSTERIOR
LEFT LOWER QUADRANT OF SACRUM:	☐ PROMINENT/POSTERIOR
RIGHT UPPER QUADRANT OF SACRUM:	☐ PROMINENT/POSTERIOR
RIGHT UPPER QUADRANT OF SACRUM:	☐ PROMINENT/POSTERIOR

Spring Test: 8. P-A glide to each sacral quadrant in Yoga Child Pose position

SPRING TEST FOR OBLIQUE AXIS SACRAL TORSION

The Spring Test is the same as the treatment except that contact is prolonged for 2 minutes.

Mandatory Test Position: Yoga Child Pose which is end-range flexion (fold-up position which is on all 4's sitting on heels with spine, hips, pelvis and knees in full flexion)

Optional Test positions: Prone neutral, these torsions enhance in full flexion. I have never encountered an Oblique Axis Torsion in extension. Please note that while altered muscle tone could give the impression that Torsions exists in extension, the definitive diagnosis is based on passive motion testing (Spring Tests).

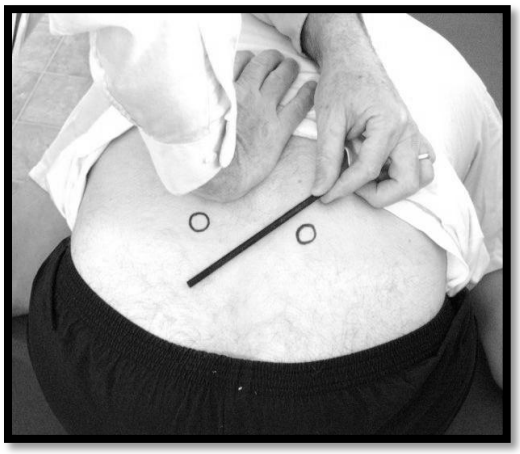
Positional Dysfunction: The left or right side will be more prominent at the sacral base (S1) and at the apex (S4-S5) whereas it will be nearly symmetrical close to midline of S3.

Movement Dysfunction: Rotation about an oblique axis.

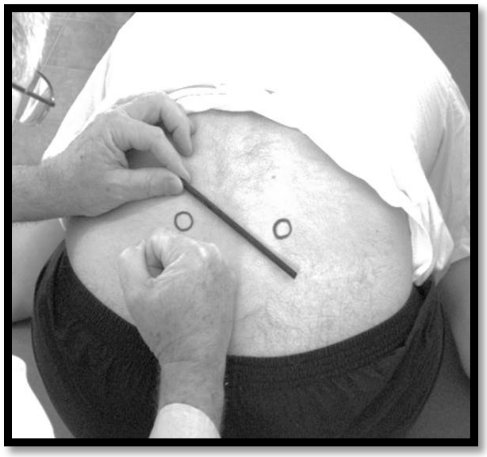
Spring Test:

8. P-A glide to each sacral quadrant in Yoga Child Pose position

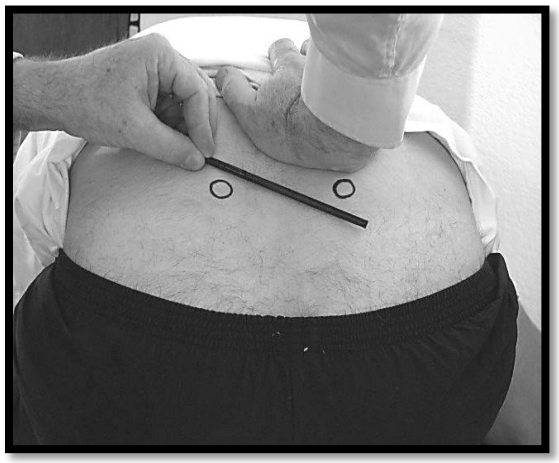
With the heel of the hand, or closed fist, or stacked hands, Spring Testing is performed at each quadrant with a P-A force. Take up the slack and apply gentle, mild to moderate posterior to anterior force for 2 minutes (0#-10#-20#, up to 0#-15#-30#). Be sure to orient the direction of force to the anatomical plane which is altered by the patient's position, so that the direction of force is indeed pure posterior to anterior. Hypomobility will be encountered when there is a movement dysfunction.



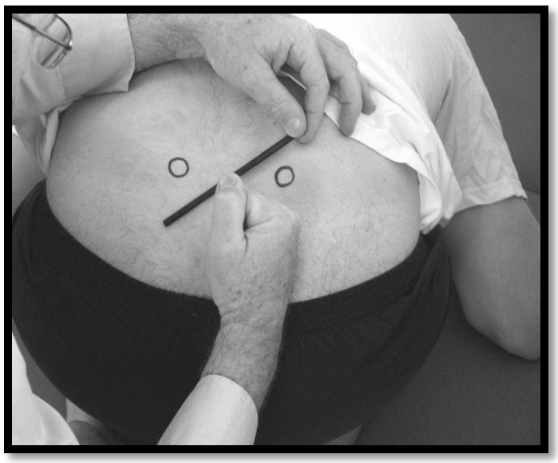
1. Spring to left upper sacral quadrant, above right oblique axis.



2. Spring to left lower sacral quadrant , below left oblique axis.



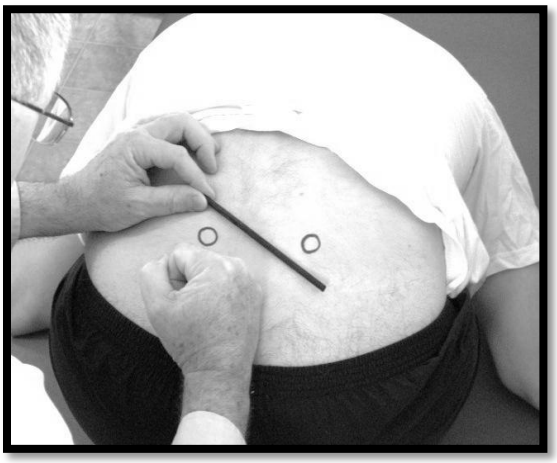
3. Spring to right upper sacral quadrant, above left oblique axis.

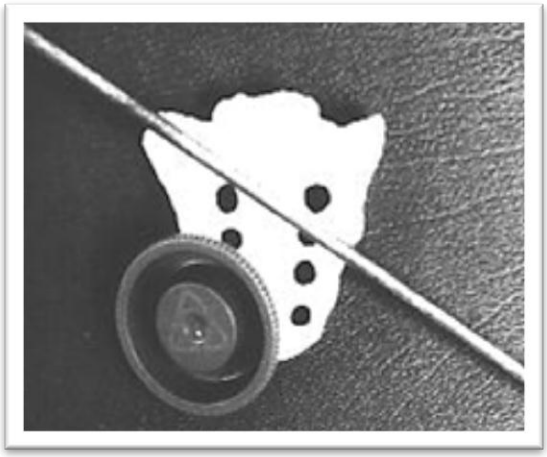


4. Spring to right lower sacral quadrant, below right oblique axis.

TREATMENT FOR SACRAL TORSIONS

Treatment: P-A Glide To Left Lower Sacral Quadrant In Yoga Child Pose Position





Left Rotation on Left Oblique Axis Sacral Torsion

Patient Position: Yoga Child Pose which is end-range flexion (fold-up position which is on all 4's sitting on heels with spine, hips, pelvis and knees in full flexion)

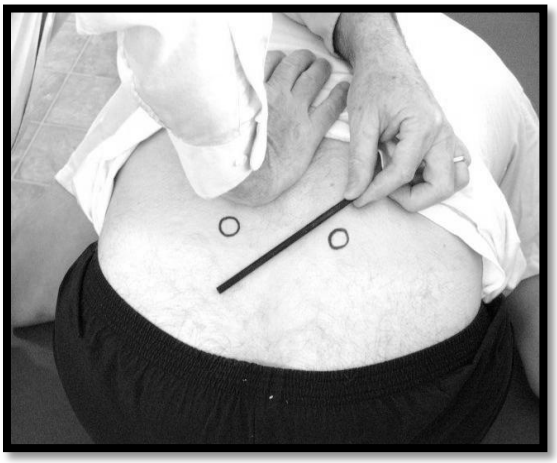
Therapist Contact: Heel of hand on left lower sacral quadrant

Force and Direction of Force: Pure anterior glide using firm pressure of approximately 20#, maintaining for 2 minutes.

Home Program: 30 reps pelvic tilts with sacrum against wall, or repeat trunk flexion with sacrum against a wall.

Other: Traditional naming is confusing. We believe that clearer language names the quadrant that is posterior and has blocked motion.

TREATMENT: P-A GLIDE TO LEFT UPPER SACRAL QUADRANT IN YOGA CHILD POSE POSITION



Left Rotation on Right Oblique Axis Sacral Torsion

Patient Position: Yoga Child Pose which is end-range flexion (fold-up position which is on all 4's sitting on heels with spine, hips, pelvis and knees in full flexion)

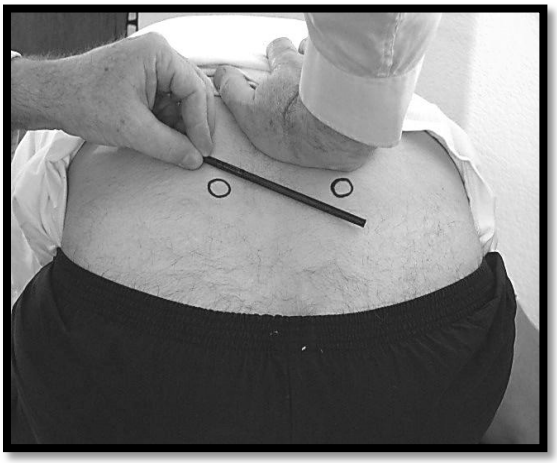
Therapist Contact: Heel of hand on left upper sacral quadrant

Force and Direction of Force: Pure anterior glide using firm pressure of approximately 20#, maintaining for 2 minutes.

Home Program: Home Program: 30 reps pelvic tilts with sacrum against wall, or repeat trunk flexion with sacrum against a wall.

Other: Traditional naming is confusing. We believe that clearer language names the quadrant that is posterior and has blocked motion.

TREATMENT: P-A GLIDE TO RIGHT UPPER SACRAL QUADRANT IN YOGA CHILD POSE POSITION



Right Rotation on Left Oblique Axis Sacral Torsion

Patient Position: Yoga Child Pose which is end-range flexion (fold-up position which is on all 4's sitting on heels with spine, hips, pelvis and knees in full flexion)

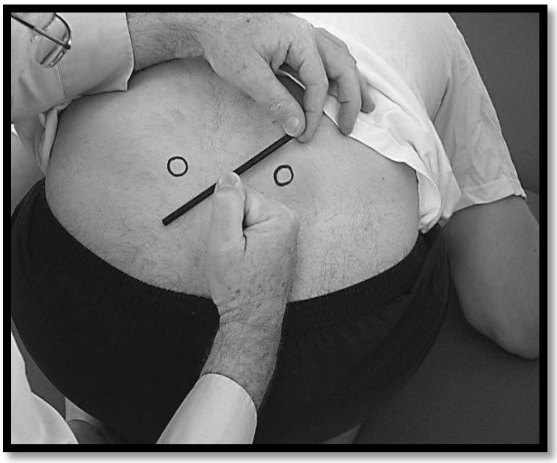
Therapist Contact: Heel of hand on right upper sacral quadrant

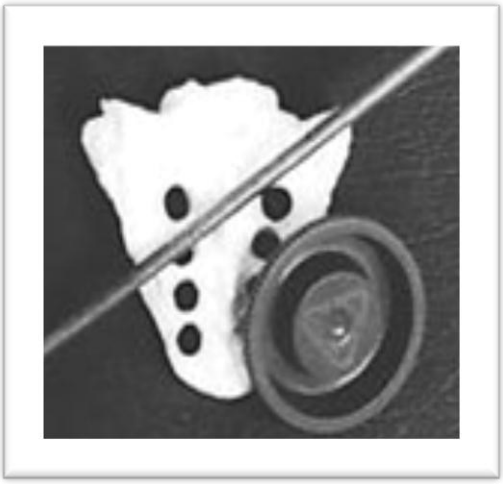
Force and Direction of Force: Pure anterior glide using firm pressure of approximately 20#, maintaining for 2 minutes.

Home Program: Home Program: 30 reps pelvic tilts with sacrum against wall, or repeat trunk flexion with sacrum against a wall.

Other: Traditional naming is confusing. We believe that clearer language names the quadrant that is posterior and has blocked motion.

TREATMENT: P-A GLIDE TO RIGHT LOWER SACRAL QUADRANT IN YOGA CHILD POSE POSITION





Right Rotation on Right Oblique Axis Sacral Torsion

Patient Position: Yoga Child Pose which is end-range flexion (fold-up position which is on all 4's sitting on heels with spine, hips, pelvis and knees in full flexion)

Therapist Contact: Heel of hand on right lower sacral quadrant

Force and Direction of Force: Pure anterior glide using firm pressure of approximately 20#, maintaining for 2 minutes.

Home Program: Home Program: 30 reps pelvic tilts with sacrum against wall, or repeat trunk flexion with sacrum against a wall.

Other: Traditional naming is confusing. We believe that clearer language names the quadrant that is posterior and has blocked motion.

SELF TREATMENT FOR ALL TYPES OF SACRAL TORSION

METHOD 1

With feet 18" in front of the wall, sacrum against wall, client performs 30 pelvic tilts. Alternately they can also do 30 reps of trunk flexion. Initially the lower sacrum is against the wall; with a posterior pelvic tilt the upper sacrum contacts the wall. Repeat daily. This is a very effective self-treatment.

METHOD 2

Some individuals have a difficult time isolating a pelvic tilt. This is an optional self-treatment method. With feet 18" in front of the wall, sacrum against wall, client performs 30 reps of trunk flexion, not to exceed 30 degrees of flexion. Repeat daily. This is a very effective self-treatment.

Chapter 14 - SYMPHYSIS PUBIS DYSFUNCTION

Symphysis pubis dysfunction can occur as a superior or inferior glide fixation, an anterior or posterior glide dysfunction, or a rotary dysfunction. With symphysis pubis movement dysfunction the client is nearly always tender on one side of the symphysis pubis. Oftentimes they are not aware of the degree of tenderness until it is palpated. Spring Testing is seldom necessary at the symphysis pubis as the asymmetry has been noted to correlate very well with the Spring Tests and clients are often anxious about pressure applied to this region. Traditional approaches utilize palpation of the crests and tubercles of the pubic bones. This approach also utilizes palpation of the entire anterior portion of the pubic bones.

SUPERIOR PUBIC BONE

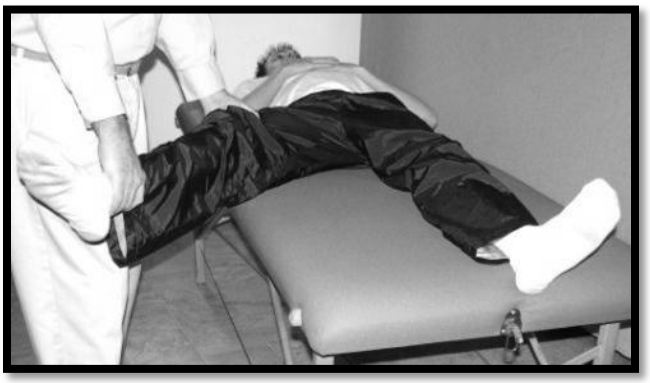
Positional Dysfunction: Pubic crest is superior. Oftentimes this is just a difference in tone of the tendons of the rectus abdominal muscles. This pattern is probably significantly over diagnosed. *A true vertical shift of a pubic bone would require a definite step-off when palpating across the pubic bones.* If step off is absent but there is a difference in soft tissue tone on one side, Treatment is still relevant for balancing soft tissue tone.

Movement Dysfunction: Spring Tests are not performed as they are difficult and uncomfortable.

Other: Pain localized at the symphysis which is reproduced with palpation. When this pattern readily recurs, treat the opposite side for an inferior pubic bone. Also evaluate the sacrum for a side-bent fixation. Superior Pubic Bone is not necessarily more common on any one side. Treatment pictures arbitrarily address one side.

Spring Test: Spring Tests are not performed as they are difficult and uncomfortable.

METHOD1. RIGHT SUPERIOR PUBIC BONE TREATMENT



Patient Position: Supine with hip abducted.

Therapist Position: Supporting the limb above and below the knee.

Treatment: Muscle energy: Isometric adduction is resisted for ten seconds. Upon relaxing, the leg is taken further into abduction; gentle traction through the leg can be added. Repeat 3 times.

Retest: Retest symphysis pubis position, check for sacral side-bending fixation.

Home Program: 1-2x day x 1 week, 2x week x 4 weeks (see Method 3).

METHOD 2. LEFT SUPERIOR PUBIC BONE TREATMENT

Patient Position: Supine with hip on involved side extended and abducted off the side of table.

Therapist Position: On same side with hand on inferior thigh and opposite Anterior Ilium.

Treatment: Passive prolonged stretch by therapist or passively by patient.

Muscle Energy: Resist isometric flexion and adduction 3-10 seconds. Patient relaxes and leg is moved further into extension and abduction into the new barrier. Long axis traction can also be added to the leg. Repeat 3 times.

Retest: Retest symphysis pubis position, also check for sacral side-bending fixation.

Home Program: 1-2x day x 1 week, 2x week x 4 weeks (see Method 3).

METHOD 3. SELF TREATMENT FOR RIGHT, LEFT SUPERIOR PUBIC BONE

Patient Position: Standing with hip on the side of Superior Pubic Bone in abduction, with foot on a chair or table at an appropriate height.

Treatment: Passive prolonged stretch for two minutes.

Retest: Retest symphysis pubis position, and test for sacral side-bending fixation.

Home Program: 1-2x a day x 1 week, 2x week, x 4 weeks.

INFERIOR PUBIC BONE

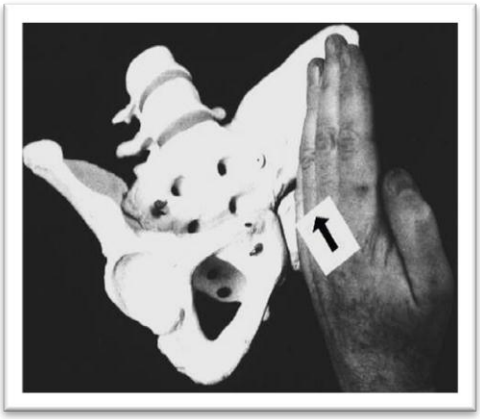
Positional Dysfunction: Pubic crest is inferior.

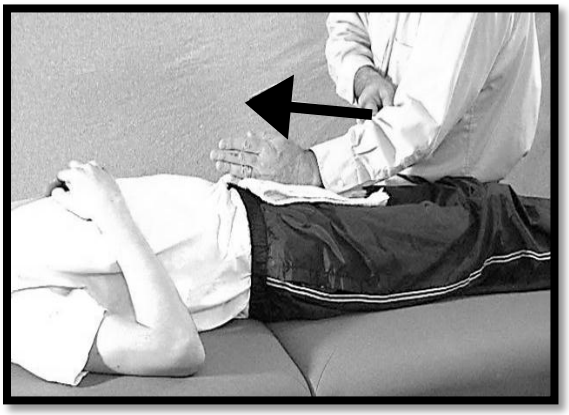
Movement Dysfunction: Spring Tests are not necessary, but if performed would reveal increased inferior mobility, decreased superior mobility.

Other: The symphysis will be painful and pain will increase with inferior spring (though Spring Testing is discouraged). When this pattern is difficult to resolve or readily recurs, treat the opposite side for a Superior Pubic Bone. Also evaluate the sacrum for a side-bent fixation. Inferior pubic bone is not necessarily more common on one side. Treatment pictures arbitrarily address one side.

SPRING TEST: Spring Tests are not performed as they are difficult and uncomfortable, except in cases of suspected instability, and are taught as part of the advanced material.

METHOD 1. INFERIOR PUBIC BONE TREATMENT





Patient Position: Supine with hips slightly abducted.

Therapist Position: With ulnar border of the hand on the pubic bone.

Treatment: Gently take up the joint slack by pushing the inferior pube vertically and maintain a passive stretch with no more than 5-10# for 2 minutes. Another method is to mobilize the pube bone superiorly for ten to thirty reps. Minimal force in the pain free range is utilized.

Retest: Retest symphysis pubis position and test for sacral side-bending fixation.

Home Program: Seldom necessary. If needed use assistance for Method 1, 2 or self-treatment for Downslip with the sheet or SI support applied medially to encompass the ischium and pubic bone.

Again, a true inferior pubic bone will present with a true step-off palpating across the top of the pubic bones. Oftentimes a difference in tone of the rectus abdominal muscle and tendon will give a false positive. Nonetheless, treatment usually restores normal tone.

METHOD 2. TREATMENT OF INFERIOR LEFT PUBIC BONE

This is an alternate method that is less specific and somewhat uncomfortable for the therapist. It has the advantage of being more impersonal for the client.

Patient Position: Supine with hip flexed maximally.

Therapist Position: Hand on ischial tuberosity and anterior pelvis.

Treatment: Isometric hip extension 3-10 seconds, relax, therapist moves pelvis superiorly (0-15#-30#, up to 0#-20#-40#). Repeat 3 times. Note that the direction of force is superior and lateral.

Retest: Retest symphysis pubis position and test for sacral side-bending fixation.

Home Program: Seldom necessary. If needed use assistance for Method 1, 2 or self-treatment for Downslip with the sheet or SI support applied medially to encompass the ischium and pubic bone.

SYMPHYSIS PUBIS SHOTGUN TREATMENT METHOD

This technique can be used for any type of symphysis pubis dysfunction. Sometimes it is ineffective, other times it is very effective, and is thus worthy of consideration, when other methods fail. It has *never* been my first choice. This is a popular method which is highly over-rated. It does not address the plastic component. A pop is often heard and makes some believe that "something therapeutic happened". You must retest, which I cannot over stress. Many times the pop is just a negative pressure gas release in the adductor tendon sheath.

Patient Position: Supine, hips and knees flexed.

Therapist Position: Standing at side with hands on lateral inferior thighs.

Treatment: Patient maximally abducts against Therapist's unyielding resistance for 10 seconds, relaxes and therapist places hands on medial thighs. Adduction is maximally performed against unyielding resistance for 10 seconds. Repeat 3 times.

Retest: Retest symphysis pubis position and test for sacral side-bending fixation.

Chapter 15 - UPSLIP (VERTICAL ILIUM)

Upslip is a non-physiological movement dysfunction (see rule below). When Upslip is present along with any another type of ilium dysfunction, the Upslip component takes priority. The Upslip must be resolved first. After resolving the vertical component the anterior/posterior and medial/lateral relationships are evaluated. Quadratus lumborum and external oblique spasm or guarding often accompanies or causes an Upslip. An Upslip is a very stable (very stuck) pattern as ground reaction forces during stance and gait reinforce it. Upslip is not necessarily more common on one side. Treatment pictures arbitrarily address the one side. In reference to Upslip, some of the literature mentions a Superior Pubic Bone in addition to the above landmark changes. If there is a Superior Pubic Bone dysfunction present, it is a separate entity and requires a separate procedure. Of course many times Upslip is a pure muscular phenomenon, in which the pelvis and lower lumbar spine is essentially side-bent. Treatment is effective for these presentations also.

Rule of non-physiological movement dysfunction: When a structure moves in a non-physiological direction and becomes dysfunctional (stuck), it will usually become stuck at end-range, rendering a positive (hypomobile) Spring Test. On occasion it will not be stuck at end range and will thus move in the direction of dysfunction, though this is fortunately rare.

Positional Dysfunction:

ASIS — superior
PSIS — superior
Anterior Iliac Shelf — superior
Posterior Iliac Shelf — superior
Ischial Tuberosity — superior

Sacrotuberous Ligament: slack in comparison with the contralateral

Movement Dysfunction: Increased superior mobility (unless it is at end range), definite decreased inferior mobility when tested at both the anterior and posterior shelves.

CAUTIONARY NOTE: Never treat on the basis of landmark position only. Always perform Spring Tests and monitor pain response. Sometimes a Downslip (see next section) can masquerade as an Upslip due to muscle guarding, and treatment would be very painful and inappropriate. See Cautionary Note under Downslip section.

SPRING TESTS	Hypomobile	Hypermobile
Prone		
9. Prone Inferior Spring to Posterior Ilium	☒	
10. Superior Spring to Ischial Tuberosity	☒*	

*On rare occasions you might actually find some vertical mobility, I believe that inter-individual differences in joint morphology make this possible. The sacrotuberous ligament will always be slack in cases of true Upslip.

9. PRONE INFERIOR SPRING TEST TO THE ILIUM

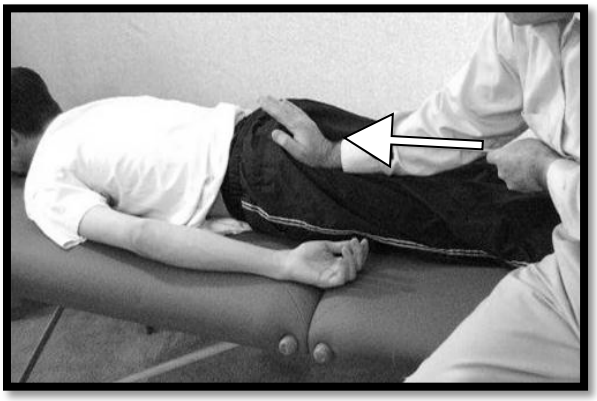
Test used for several patterns, see text.

Patient Position: Prone.

Therapist Contact: Open palm contacts the posterior iliac shelf pointing inferiorly.

Force and Direction of Force: Use approximately 20# to take up the slack and an additional 20# (40# total) to spring in an inferior and medial direction (30-45 degrees) towards the opposite knee. Inferior and medial glide occurs in the frontal plane about a vertical axis that orients laterally, along the plane of the joint.

10. PRONE SUPERIOR SPRING TEST TO ISCHIAL TUBEROSITIES



Test used for several patterns, see text.

Patient Position: Prone.

Therapist Contact: Open palm directly under the ischial tuberosity.

Force and Direction of Force: Use approximately 20# to take up the slack and an additional 20# (40# total) to spring in a superior and lateral direction towards the shoulder. Superior glide occurs in the frontal plane along a vertical axis that orients laterally along the plane of the joint.

METHOD 1. UPSLIP SELF-TREATMENT

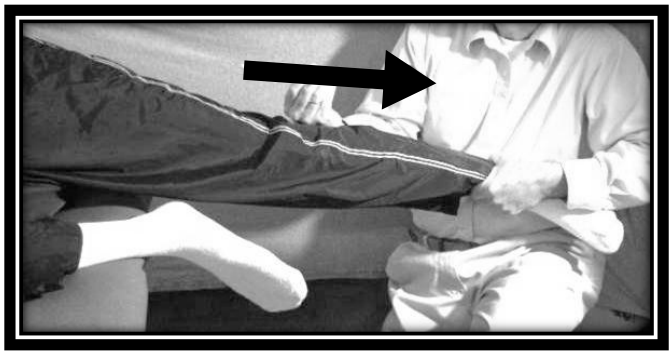
Patient Position: Side lying with side of dysfunction superior and same-sided leg hanging off table in neutral adduction.

Treatment: Passive stretch as tolerated up to 3 minutes.

Retest: Retest mobility with appropriate Spring Test.

Home Program: 1-2x day x 1 week, PRN thereafter.

METHOD 2. SIDE LYING LEG TUG TREATMENT FOR UPSLIP



Patient Position: Side lying with side of dysfunction on top, hip adducted.

Therapist Position: At foot of table clasping patient's ankle.

Treatment: Gentle inferior traction using quick tugs or prolonged stretch. Muscle energy may also be used by resisting isometric hip hiking; patient relaxes, therapist gently pulls leg inferiorly into new barrier and repeats 3 times.

Retest: Retest mobility with appropriate Spring Test.

Home Program: 1-2x day x 1 week, PRN thereafter (see Method 1).

METHOD 3. SUPINE LEG TUG TREATMENT FOR UPSLIP

Patient Position: Supine with hip in adduction or neutral, as dictated by pain. Adduction captures the plane of the SI joint.

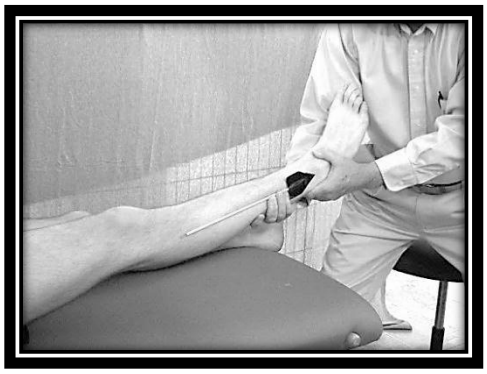
Therapist Position: At foot of treatment table.

Treatment: Gently tug leg inferiorly 3 times. Muscle energy: Patient hikes hip 3-10 seconds isometrically against therapist's resistance. Patient relaxes and therapist stretches inferiorly. Repeat 3 times. A prolonged passive gentle stretch (2 minutes or longer) is also very effective.

Retest: Retest mobility with appropriate Spring Test.

Home Program: 1-2x day x 1 week, PRN thereafter (see Method 1).

METHOD 4. UPSLIP TREATMENT FOR RESISTANT CASES



Patient Position: Supine with hip and knee flexed 90 degrees.

Therapist Position: At foot of table clasping patient's ankle.

Treatment: Assist patient going from hip flexion into hip extension and adduction with knee extension, 3 times. Advise patient to forcefully kick the leg into extension on the third time; add passive moderate force toward the end of the kick.

Retest: Retest mobility with appropriate Spring Test.

Home Program: 1-2x day x 1 week, PRN thereafter (see Method 1).

Chapter 16 - DOWNSLIP

Downslip is a non-physiological movement dysfunction. See rule below. When a Downslip is combined with other dysfunctions, the inferior component (Downslip) must be treated first. Downslip is a rare finding and often accompanies ligamentous insufficiency. However, the sacrotuberous ligament will be palpably taut in contrast with the contralateral. This is due to the ischial tuberosity where ligament inserts being more inferior. Clients who have a Downslip pattern often complain of lower extremity paraesthesia, which often resolves when the Downslip resolves. It seems plausible that tension and compression of the sciatic nerve and the blood supply may occur within the sciatic notch. Downslip is perhaps the most symptomatic type of pelvic joint dysfunction. Unfortunately, it is also perhaps the most subtle type.

Downslip can accompany inhibition of the quadratus lumborum and facilitation of the hamstring muscles. Constant drag on the last rib (from quadratus lumborum tension, being pulled from below) can reduce normal superior glide of the last rib. Superior glide mobilization of the last rib can decrease pain and decrease inhibition of quadratus function when combined with mobilization for Downslip. Muscular re-education logically follows.

If treatment for Downslip is unsatisfactory evaluate for possible sacral side bending and oblique axis dysfunction of the ilium/hemipelvis (see separate section).

Why is there no described pattern of Anterior or Posterior Ilium with Downslip? The answer is that when there is a Downslip present it takes on a much more important role in the sequence of treatment. The Downslip must be treated before any apparent anterior or Posterior Ilium is treated. Additionally, the apparent Anterior or Posterior Ilium may spontaneously resolve when the Downslip is resolved.

Rule of non-physiological movement dysfunction: When a structure moves in a non-physiological direction and becomes dysfunctional (stuck), it will usually become stuck at end-range, rendering a positive (hypomobile) Spring Test. On occasion it will not be stuck at end range and will thus move in the direction of dysfunction, though this is fortunately rare.

Downslip is not necessarily more common on one side. Treatment pictures arbitrarily address one side.

Positional Dysfunction:

ASIS— inferior
Anterior Iliac Shelf— inferior
Posterior Iliac Shelf— inferior
PSIS— inferior
Ischial Tuberosity— inferior

Palpation of Sacrotuberous Ligament: Taut in contrast with the contralateral.

Movement Dysfunction: Increased inferior mobility at the anterior and posterior shelves (unless

stuck at end range), decreased superior mobility at the ischial tuberosity.

CAUTIONARY NOTE: While landmarks with Downslip are typically inferior, there are times when muscle guarding of the external obliques, quadratus lumborum and extensors cause the landmarks to appear superior because sacrum and ilium are elevated, when in fact the structure (at the articulation) consists of the ilium being stuck inferior in relation to the sacrum. I hope this is not confusing, trust the Spring Tests. Thus it may appear to be an Upslip and treatment for an apparent Upslip would be very painful if the true pattern was a Downslip. Fortunately this can be avoided by treating on the basis of mobility (per Spring Tests) not on the basis of landmarks.

SPRING TESTS Prone		Hypomobile	Hypermobile
9.	Inferior Spring to Posterior Ilium	☒*	☒*
10.	Superior Spring to Ischial Tuberosity	☒	

***** This is a variable finding based on joint type. Those who for example have a wasp-shape joint may tend to have motion blocked in both directions. Therefore, it is most important to check ligament tone in which the sacrotuberous would be hypotonic.

9. PRONE INFERIOR SPRING TEST TO THE ILIUM

Test used for several patterns, see text.

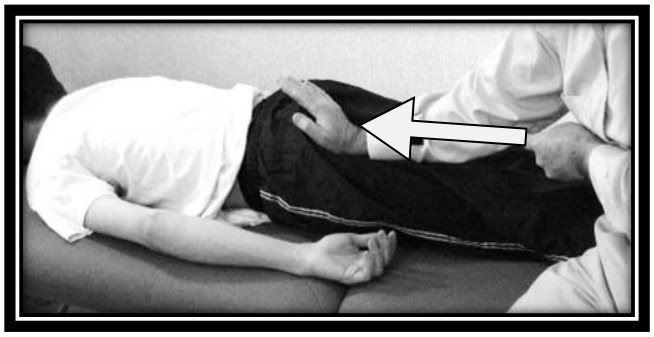
Patient Position: Prone.

Therapist Contact: Open palm contacts the posterior iliac shelf pointing inferiorly.

Force and Direction of Force: Use approximately 20# to take up the slack and an additional 20# (40# total) to spring in an inferior and medial direction (30-45 degrees) towards the opposite knee. Inferior and medial glide occurs in the frontal plane about a vertical axis that orients laterally, along the plane of the joint.

10 PRONE SUPERIOR SPRING TEST TO ISCHIAL TUBEROSITIES

Test used for several patterns, see text.

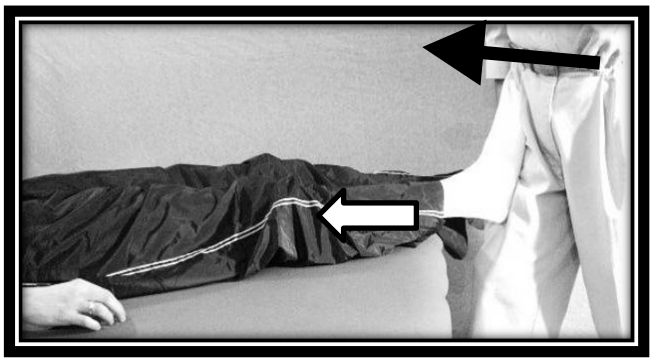


Patient Position: Prone

Therapist Contact: Open palm directly under the ischial tuberosity.

Force and Direction of Force: Use approximately 20# to take up the slack and an additional 20# (40# total) to spring in a superior and lateral direction towards the shoulder. Superior glide occurs in the frontal plane along a vertical axis that orients laterally along the plane of the joint.

METHOD 1. DOWNSLIP SUPINE TREATMENT



Patient Position: Supine hip in neutral, slight adduction, or slight abduction depending on which position isolates the joint. To test for isolation of forces during treatment, you can palpate the SI ligaments just medial to the PSIS while you passively move the hip into adduction and abduction. You will perceive movement and increase in ligamentous tension when forces are applied appropriately.

Therapist Position: At foot of table clasping patient's ankle.

Treatment: Take up the slack and apply a very gentle superior force repeated with gentle oscillations 10 times, performed very gently in a pain-free range.

Retest: Retest mobility with appropriate Spring Test.

Home Program: 1-2x day x 1 week, PRN thereafter (Method 3 or 4).

METHOD 2. DOWNSLIP SIDE LYING TREATMENT IN NEUTRAL OR ADDUCTION

Patient Position: Side lying with side of dysfunction superior. The hip on top is in neutral, with the knee extended, or in adduction, as dictated by comfort and ability to isolate the SIJ (direction of ease).

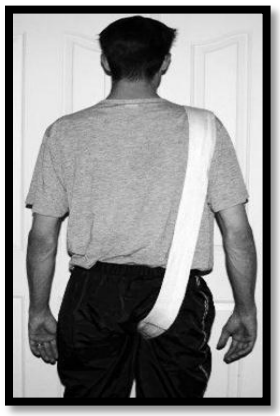
Therapist Position: The patient's foot is against the therapist's hands or lateral pelvis.

Treatment: Therapist applies a passive, very gentle force vertically through the lower extremity and takes up the slack. A prolonged passive stretch may be performed, or up to 10 oscillations.

Retest: Retest mobility with appropriate Spring Test.

Home Program: 1-2x day x 1 week, PRN thereafter (Method 3 or 4).

METHOD 3. SELF TREATMENT FOR DOWNSLIP VERTICAL SI SUPPORT




Right Downslip Vertical Support. The left image shows typical placement, the right image replicates not only the vertical ligaments but also the oblique ones.


Left Downslip Vertical Support. The left image shows typical placement, the right image replicates not only the vertical ligaments but also the oblique ones.

While it may appear odd one does not have to wear a vertical support in public. It is relatively inexpensive, and is worn briefly a few times a day. It can yield very positive results, even if worn intermittently.

Patient Position: Sitting. In the absence of a vertical support a sheet can be used..The support is tied (or adjusted) while the client forward bends, so that when they sit upright it will have a vertical pull. After treating for five minutes or more, the support is crossed over to the other side of the neck to affect an oblique compressive force. Again, the support is tied (or adjusted) while the client forward bends, so that when they sit upright it will have a vertical pull. The second position is done in sitting only, for an additional 5 minutes or more.

Treatment: Passive vertical stretch five minutes or greater.
Retest: Retest mobility with appropriate Spring Test.
Home Program: 1-2x days x 1 week, PRN thereafter (Method 3 or 4).

METHOD 4. SELF TREATMENT FOR DOWNSLIP

Patient Position: Supine with the side of dysfunction closest to an outside corner of a wall. Bend the hip in flexion and place the foot on the wall with hip in abduction. The same-sided buttock must be close to the wall. The opposite leg can be straight or bent for comfort.

Treatment: Passive stretch occurs via the position; the femur tends to pull the hemipelvis superiorly and laterally. Maintain for 2-5 minutes.

Retest: Retest mobility with appropriate Spring Test.

Home Program: 1-2x day x 1 week, PRN thereafter (Method 3 or 4).

Chapter 17 - THE SECOND MOST COMMON PATTERN

The second most common pattern of lumbopelvic movement dysfunction is similar to the most common pattern in that it involves Anterior Ilium except that the pattern is bilateral. The second most common pattern of dysfunction includes the following:

1. Posterior Glide Sacral Fixation (not always present, but if it is; it takes precedence).
2. Bilateral Anterior Ilium.
3. Bilateral Inflare.
4. Superior Glide Fixation of the Sacrum.
5. Forward Bent Sacrum.
6. Bilateral L5-S1 Flexion Dysfunction.

Posterior Glide Sacral Fixation

I learned of this pattern from a European Osteopathy book (Richard) and from Fred Mitchell Sr, DO's landmark 1958 paper. Mitchell's son wrote the first text on Muscle Energy Technique. I believe that it is not taught in the majority of MET and manual therapy classes. I discovered the non-physiological Bilateral Inflare pattern that accompanies it and doing so was instrumental to developing an effective treatment. Typically the client is thin, athletic, and very flexible such that encountering the significant SIJ and pelvic restrictions is very surprising, especially as hip flexion (SLR) oftentimes exceeds 90 degrees, and overall flexibility is apparent. Sometimes they have general hypermobility, and other times have mixed hyper and normal mobility throughout the major axial and extremity joints. They admit early evening fatigue, both physically and mentally, urinary frequency. They might not have any particular pain other than low back pain as there is excessive stress placed on the L4-5 motion segment as the L5-S1 joint is stuck in an un-physiological anterior "tilt" or at least the force that limit motion appear to be so, induced by the posterior migration of the sacrum. Most clients do not have a recall of any precipitating event. I suspect that an unremembered trauma as causative in some, such as a fall on both buttocks in which the SIJ opens bilaterally, momentarily and the weight of the upper body forces sacrum posterior and ilia anterior and medial. This could happen in childhood when the body is supple and there is no memory of a "painful" event. A large baby may also be implicated for some. A recent client had significant cervicogenic headache and a posterior glide sacral fixation. She did have a significant trauma, and restoring the sacral mobility significantly reduced neck pain and headache.

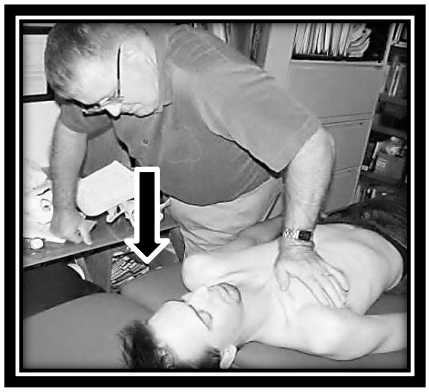
Positional and Movement Dysfunction
The sacrum is prominent, stuck in posterior glide, with a shallow sacral sulcus. Sometimes you actually climb up onto the sacrum going from PSIS to sacrum as S-2. Both ilia are stuck at end-range Inflare. The sacrotuberous and sacrospinous ligaments will be remarkable hypertonic, in fact; feel like bone. In response to the pelvis, the T3-4, 3rd ribs bilaterally and the upper body of the sternum just below the manubrium will be hyperextended and stuck. This can reduce deep inspiration. Occipito-atlantal joint is stuck in hyperextension, and there is no A-P or superior spring at the mastoids, no lateral/medial glide to tubercles of atlas, no occipito-atlantal traction

(force must be applied anterior to the ear on temple), suboccipital muscles are very tight. Because the sacrum is shifted posteriorly unphysiologically, they flex at the hips and L4-L5 junction, both of which makes them weight bear on the feet anteriorly. They do have some greater susceptibility to plantar fasciitis, or so it seems. They counteract the forced flexion by hyperextending at T3-4 and occipito-atlantal junction. This is reflexively-driven; they cannot oppose it consciously, certainly not for long. This may partially explain the fatigue they experience as they are inefficiently fighting gravity all day long. In order to get a sense of what they experience, stand and shift your pelvis posteriorly and maintain for a minute while you walk around. It is remarkably unpleasant, at least for me.

Spring tests for motion restrictions and ligament tone.

1. Mandatory spring test: P-A spring of sacrum.
2. No spring motion throughout the pelvis and sacrum, however hips are typically very flexible. No pelvic side-glide, no P-A spring of sacrum, no anterior or posterior ilium rotation, no P-A ischial spring, no symphyseal spring, no L5-S1 anterior P-A, etc., etc.
3. No A-P sternal spring upper 1/3 of sternum just below manubrium, T3 stuck in hyperextension.
4. No lift when isolated at the O-A joint.
5. No lateral to medial motion at C1 transverse tubercle.
6. No AP or side-bending mobility at mastoid.
7. Bilateral hypertonic sacrotuberous and sacrospinous ligaments. They feel like bone, not like a firm rubber-like, slightly deformable ligament.

1. #15 Mandatory P-A Spring to Mid Sacrum

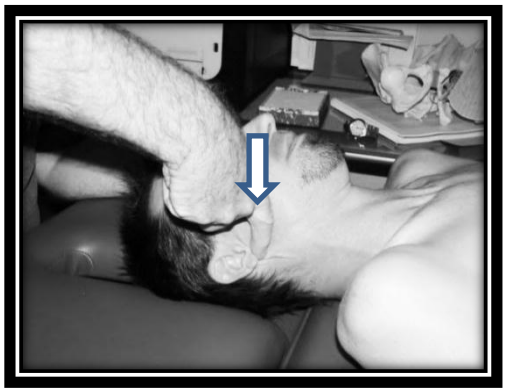


2. A-P to Sternum Below Manubrium

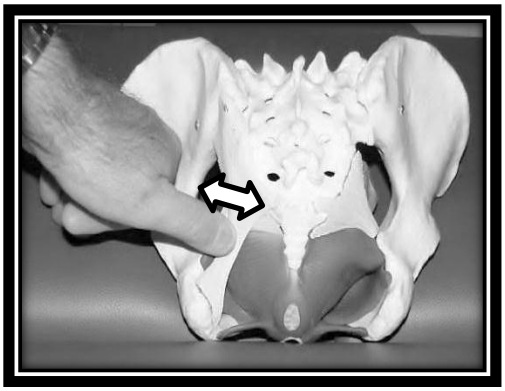
3. P-A Spring at T3-4

4. Occiput Lift at O1-C1 Joint

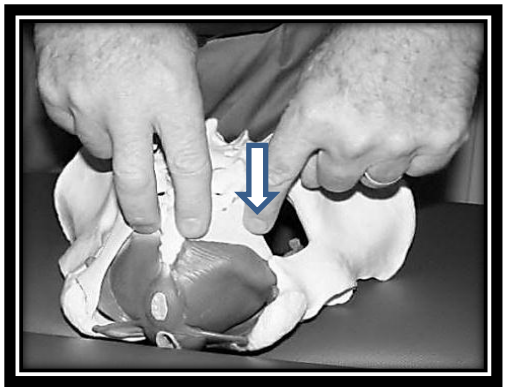
5. Left and Right Glide Tubercle Atlas Mastoids



6. Left and Right A-P Spring



7. Sacrotuberous Ligament Tone Evaluation



8. Sacrospinous Ligament Tone Evaluation

Treatment

Treatment is surprisingly simple and straight forward, logical and very well tolerated. It is easy on the therapist also. Patients respond in a typically dramatic manner to 10 minutes of treatment and all of the above restrictions are freed up. They oftentimes report improved bladder control, less frequency, greater energy especially at the end of the day and greater mental clarity. I note improved balance and stability to pre and post-test with unexpected push at the sternum with client standing. Treatment utilizes viscoelastic creep, and the mechanoreceptors facilitate articular-muscular reflexes, reducing hypertonus, while enhancing normative movement.

Treatment sequence: Place the ulnar border of your forearm on the mid sacrum, or your stacked hands onto the mid sacrum.

1. The client lies prone on 3" x 8" foam rolls placed vertically under each ilium for 5 minutes. No shortcuts, the time is critical.
2. The therapist can stack their hands on the sacrum, or apply the ulnar border of the forearm at the midline of S-2. The therapist imparts a pure P-A glide using firm pressure of approximately 10-15#, maintaining it for 5 minutes. No shortcuts, the time is critical.

Retest: After treatment retest pelvic and SIJ mobility with P-A to sacrum and also do a few other random SIJ spring tests. Check tone of the sacrospinous and sacrotuberous ligaments. Do a P-A at L5-S1, check O1-C1 motions, A-P to upper 1/3 of sternum just below manubrium.
Home Program: Lie prone on foam rolls for 5 minutes with a comfortable force from an ankle weight on the sacrum (no contact on ilium) for 5 minutes 3 days in a row, and then once every 2 weeks. Note that there is essentially no weight on the sacrum when prone, and as the creep proceeds over 5 minutes, a very small weight can be quite effective. Much less weight than the initial therapist-induced glide is very reasonable. Correction is very long lasting.


1. Foam Rolls Under Anterior Pelvis


2. P-A Spring to Mid Sacrum (keep rolls)

BILATERAL ANTERIOR ILIUM

Bilateral Anterior Ilium is common with an anterior pelvic tilt and increased lordosis. Realize that anterior pelvic tilt is only a positional description, whereas bilateral Anterior Ilium is not so much a positional description as a bilateral mobility dysfunction. Bilateral Anterior Ilium may become apparent after correcting a unilateral dysfunction (one or several components of the most common pattern). After correcting a unilateral dysfunction, such as what appears to be a unilateral Anterior Ilium the pelvis will appear symmetrical. Upon performing the Spring Tests to reevaluate mobility, one may realize that there is a bilateral mobility dysfunction which might not have been readily apparent earlier. This is a common phenomenon; the pelvis tends to undergo serial permutations until the dysfunction(s) is/are ultimately resolved. Flexion exercises are very appropriate with this population. This includes stretching the spinal extensors, Psoas, iliacus, rectus femoris, ITB, TFL, hamstrings and gastroc-soleus muscle groups. Strengthening the spinal flexors and hip extensors is very appropriate.

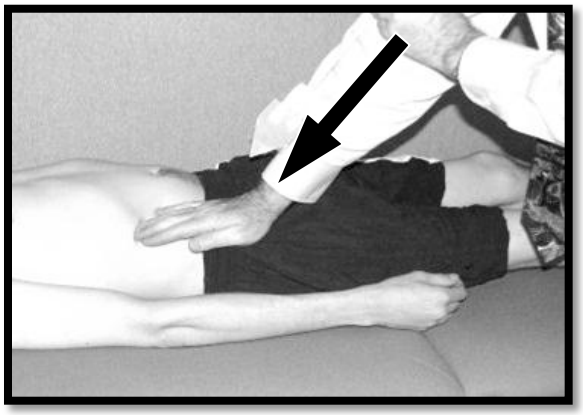
Positional Dysfunction: Anterior tilted pelvis. The ASIS's are lower that the PSIS's and they are anterior to the pubic tubercles as tested in supine.

Movement Dysfunction: Reduced posterior rotational mobility of the ilia as tested in supine. Increased anterior rotational mobility of the ilia as tested in prone.

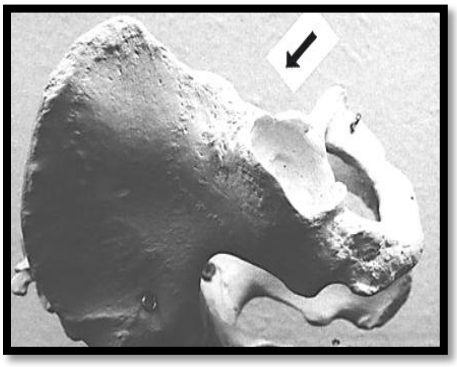
Treatment: The same as for unilateral Anterior Ilium, except that it is performed bilaterally.

Retest: Retest mobility with appropriate Spring Test. After pattern is resolved test for pelvic side-glide dysfunction.
Home Program: 1-2x day x 1 week, 2x week thereafter.

SPRING TESTS	Hypomobile	Hypermobile
Supine (mandatory)		
*5. Bilateral Posterior Rotation of the Anterior Ilium.	☒	
Prone (optional)		
9. Bilateral Inferior Spring to the Posterior Ilium.	☒	
10. Bilateral Superior Spring to Ischial Tuberosity.		☒



5. SUPINE POSTERIOR ROTATION OF THE ILIUM



When blocked suspect Anterior Ilium

Patient Position: Supine.

Therapist Contact: Open palms on anterior pelvis with maximum contact for comfort.

Force and Direction of Force: Take up the slack with approximately 20# and apply Spring Test up to approximately 40#. Test is performed at a 45 degree angle following the angle of the anterior shelf. It would be wrong to spring in a pure A-P direction which would just compress the joint. Spring is done on one side at a time, though both receive information. Posterior rotation occurs in the sagittal plane about a medial/lateral axis.

SELF TREATMENT FOR BILATERAL ANTERIOR ILIUM

Patient: Use self-treatment for Anterior Ilium on each side for two minutes, switch sides and repeat once.

Alternate treatment method: Use any of the treatment approaches described earlier for right Anterior Ilium in the most common pattern treat the left side also.

Retest: Mobility with appropriate Spring Test. Home Program: 1-2x day x 1 week, 2x week thereafter.

BILATERAL INFLARE

Note: This is redundant and unnecessary if the client presented with a posterior glide sacral fixation, in which case; it has already been addressed. So do not retreat! If they did not have the previous pattern; proceed.

Bilateral Inflare is a non-physiological movement dysfunction. See rule below. This pattern is the same a unilateral Inflare, except that it is a bilateral pattern and it seems that the ilia have migrated to end range, thus the Spring Tests will reveal hypomobility, not hypermobility as noted with unilateral Inflare. The client may present with a shallow sulcus bilaterally. The anterolateral Spring Test (Spring Test #6, performed in prone lying) will be restricted bilaterally. Treatment is done on both sides. The first flare exercise is with a towel under each anterior pelvis in prone lying.

Rule of non-physiological movement dysfunction: When a structure moves in a non-physiological direction and becomes dysfunctional (stuck), it will usually become stuck at end-range, rendering a positive (hypomobile) Spring Test. On occasion it will not be stuck at end range and will thus move in the direction of dysfunction, though this is fortunately rare.

SPRING TEST	Hypomobile	Hypermobile
Prone - Performed on Both Sides		
7. Bilateral Lateral Ilium Spring Test.	☒	

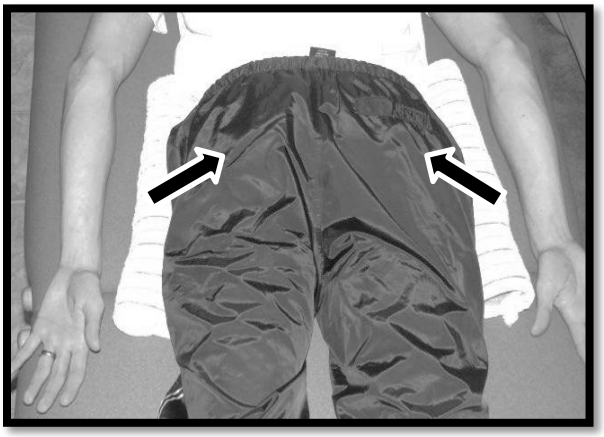
7. PRONE LATERAL ILIUM SPRING TEST

Blocked mobility on the left is positive for a Left Outflare.

Patient Position: Prone.
Therapist Contact: The depression between the thenar and hypothenar eminences contacts the PSIS and the rest of the palm contacts the rest of the ilium with hand facing laterally at a 45 degree angle, pointing toward the baseboard molding where the floor and wall meet.

Force and Direction of Force: Up to 20# to take up the slack and an additional 20# (40#) total to spring at a 45 degree angle (inferolateral, see photo above). Hypomobility is much more readily apparent with this Spring Test than hypermobility.

METHOD 1. BILATERAL INFLARE SELF TREATMENT



Patient Position: Prone lying with towel roll placed vertically under each Anterior Ilium. A pillow under the abdomen may be necessary if prone lying is uncomfortable and does not reduce the effectiveness.

Treatment: Passive stretch for 2 minutes.

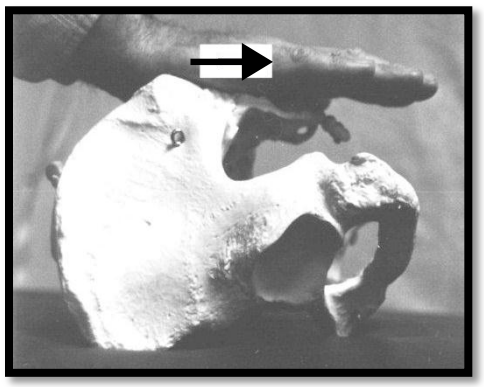
Retest: Retest mobility with appropriate Spring Test.
Home Program: 1-2x day x 1 week, 2x week thereafter.

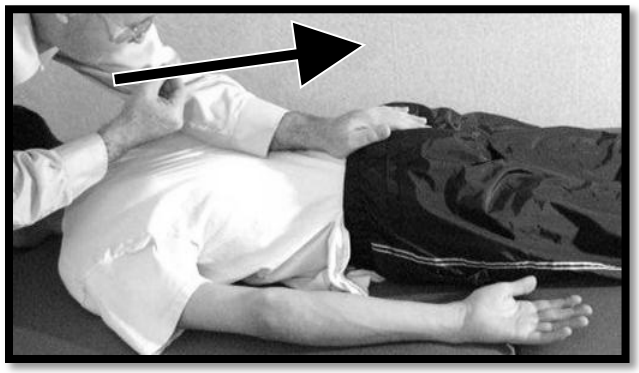
SACRUM WITH SUPERIOR GLIDE FIXATION

Sacral inferior glide dysfunction (superior glide fixation) exists when there is very limited inferior glide with adequate or increased superior glide. This implies lumbosacral compression, especially of the facet joints. A lack of inferior glide often accompanies limited sacral backward bending. Restoring sacral inferior glide will often restore or enhance sacral backward bending. This pattern often accompanies limited segmental flexion at the lumbosacral junction.

SPRING TEST	Hypomobile	Hypermobile
11. Inferior Sacral Glide Test.	☒	

11. PRONE INFERIOR GLIDE SPRING TEST TO THE SACRUM





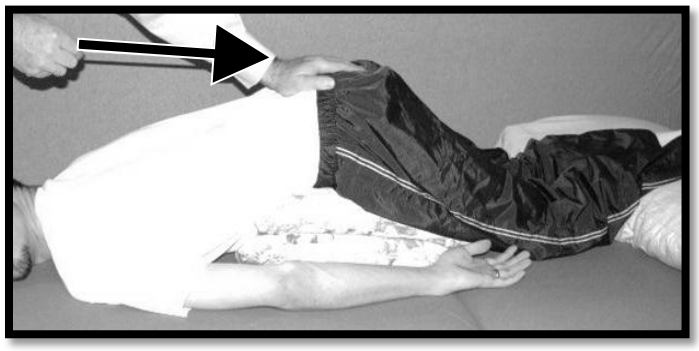
Tests for superior glide fixation of sacrum/lumbosacral compression

Patient Position: Prone.

Therapist Contact: With the open hand pointing inferiorly, place the tip of the middle finger on the tip of the coccyx and let the hand fall onto the sacrum.

Force and Direction of Force: Apply approximately 10-15# to take up the slack and an additional 10-15# (20-30# total) to spring. Inferior glide occurs in the frontal plane along a vertical axis. If mobility is normal, the heels can be observed to move inferiorly up to 3/8".

METHOD 1. SUPERIOR GLIDE SACRAL FIXATION TREATMENT



Patient Position: Prone; pillow under stomach might be more comfortable.

Therapist Position: At head of table with firm contact with open palm on sacrum. A small amount of anterior pressure is needed to obtain adequate friction.

Treatment: Prolonged inferior glide stretch for up to 5 minutes, performed gently (0#-10#-20#).

Retest: Retest mobility with appropriate Spring Test.

Home Program: You may teach a family member to treat QW x 2 minutes or PRN.

FORWARD BENT SACRUM (BASE ANTERIOR, APEX POSTERIOR)

Sacral forward bending often accompanies limited sacral inferior glide. Treatment is often most effective when inferior glide is restored before addressing a forward bending fixation of the sacrum. See Sacral Inferior Glide on one of the following pages.

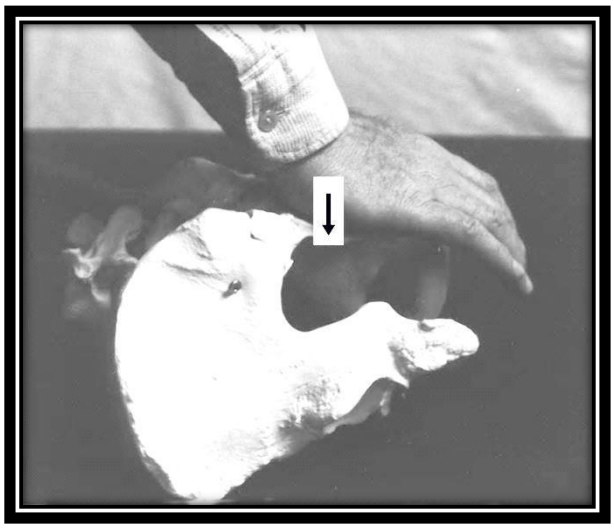
Positional Dysfunction: Sacrum may or may not appear to be excessively forward bent. Patient usually has anterior tilt of pelvis with increased lordosis. Sacrum is otherwise symmetrical.

Movement Dysfunction: Increased sacral forward bending with decreased backward bending.

Home Program: QOD x 2 weeks, PRN thereafter. Pattern should resolve readily.

SPRING TEST	Hypomobile	Hypermobile
12. Sacral Backward Bending.	☒	

PRONE BACKWARD BENDING SACRAL SPRING TEST



When blocked, indicates sacrum is stuck in forward bending, lacks backward bending

Patient Position: Prone.

Therapist Contact: Place the heel of the hand on the apex of the sacrum at S4-5.

Force and Direction of Force: Apply approximately 10-15# to take up the slack with an additional 10-15# (20-30# total) to spring. Backward bending occurs in the sagittal plane about a transverse axis. The apex (S4-5) moves anterior, the base (S1-2) moves posterior.

METHOD 1. FORWARD BENT SACRUM SELF-TREATMENT

Patient Position: Supine with hips and knees flexed, with racquet, tennis, or rubber ball on inferior sacrum, below PSIS's, above apex.

Treatment: Passive stretch without discomfort up to 5 minutes.

Retest: Retest mobility with appropriate Spring Test.

Home Program: QOD x 2 weeks, PRN thereafter. Pattern should resolve readily.

METHOD 2. FORWARD BENT SACRUM TREATMENT

Patient Position: Prone, may use pillow under stomach.

Therapist Position: With heel of hand just above sacral apex.

Treatment: Gentle anterior and inferior oscillation is performed 10 times, or prolonged stretch for up to 2 minutes, in pain-free range (0#-10#-20#).

Retest: Retest mobility with appropriate Spring Test.

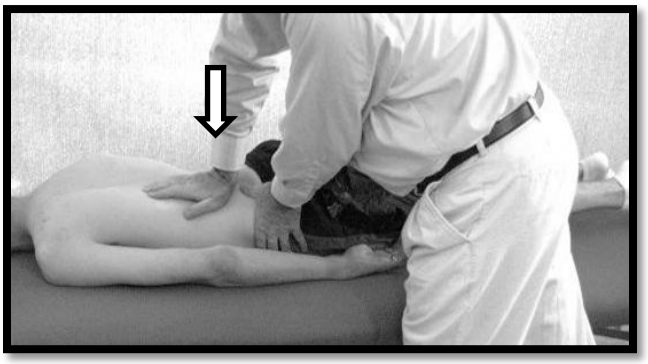
Home Program: QOD x 2 weeks, PRN thereafter. Pattern should resolve readily.

BILATERAL L5-S1 EXTENSION/ANTERIOR GLIDE FIXATION

If the single motion segment dysfunction is bilateral, there will be a visible and palpable stutter at that segment with flexion. In bilateral flexion *movement* dysfunction both facets will fail to glide forward and upward when the other segments go from extension into flexion. This segment remains *positionally* extended and is deeper than the segments above and below. The facets do not open. The treatments for this pattern (described on the next page) would be augmented with flexion exercises.

SPRING TEST	Hypomobile	Hypermobile
13. Anterior Glide of L5.	☒ (stuck at end-range)	

ANTERIOR GLIDE OF L5 SPRING TEST



Blocked mobility indicates that L5 is stuck at end range extension and anterior glide. This is consistent with the rest of the pattern which essentially sets the stage for this restriction. In other words, the sacrum is forward bent and L5 follow into extension and anterior glides.

Patient Position: Prone.

Therapist Contact: The open palm contacts L5.

Force and Direction of Force: Very gently apply approximately 10# to take up the slack and an additional 10# (20# total) to spring. Anterior glide occurs in the sagittal plane along an A-P axis.

SELF-TREATMENT FOR BILATERAL L5-S1 EXTENSION/ANTERIOR GLIDE FIXATION

Patient Position: Supine with hips flexed to 90 degrees. Feet are resting on folded pillow or bolster.

Treatment: A 2 1/2 inch thick book with a towel on top (for padding) is placed under the pelvis at the level of the PSIS' to allow posterior glide and flexion stretch to the lumbar spine. A posterior pelvic tilt will further enhance the position. Passive stretch for up to 5 minutes has been found to be very helpful. Ten to 30 reps of posterior pelvic tilt is then added.

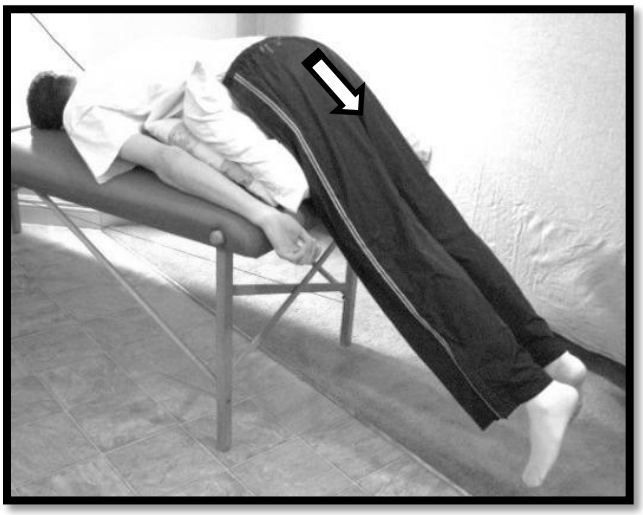
Retest: Retest mobility with appropriate Spring Test.

Home Program: QOD x 2 weeks, PRN thereafter. Pattern should resolve readily.

TRACTION FOR BILATERAL L5-S1 EXTENSION/ANTERIOR GLIDE FIXATION

Prone flexed traction can be performed at home with the client flexed over a pillow at the edge of a bed. The surface of the bed can be effectively "raised" by placing several pillows on top of each other, along the length of the bed (not shown). The first position can be evaluated for 2-5 minutes and progression can be made to the other positions.

BEGINNING POSITION



The lower portions of the lower legs are off of the surface of the treatment table/bed. Traction is performed for 2-5 minutes and can be increased in duration if tolerated well.

Home Program: 1-2x day x 1 week, 2x week thereafter.

MID POSITION

The legs are in contact with the table/bed at mid-thigh. Traction is performed for 2-5 minutes and can be increased in duration if tolerated well.

Home Program: 1-2x day x 1 week, 2x week thereafter.

FINAL POSITION FOR SELF-TRACTION

The legs are completely off the table/bed. They may dangle, although I have found it to be more comfortable if there is at least forefoot contact with the floor. Traction is performed for 2-5 minutes and can be increased in duration if tolerated well. You may also have the client extend the knees and stretch the heel cord. I often perceive the stretch extend into the hamstrings as well.

Home Program: 1-2x day x 1 week, 2x week thereafter.

SITTING LUMBAR TRACTION/DECOMPRESSION

Place a 3" towel roll under each femur, just in front of the ischial tuberosities. The clients sits for five minutes or greater. It is remarkable to note how comfortable this is. When I sit for up to 2 hours I do this for approximately 5 minutes and it makes a significant difference in sitting comfort.

Home Program: 1-2x day x 1 week, 2x week thereafter.

Chapter 18 - EVALUATING AND TREATING FAULTY LUMBAR MOTION COUPLING

CATEGORIES OF SPINAL MOVEMENT DYSFUNCTION

Type I Spinal Movement Dysfunction: This occurs in neutral spine position, such as normal standing or neutral sitting. The spine is neither flexed nor extended. Side bending and rotation occur in opposite directions. This is a multisegmental dysfunction, and is usually compensatory. Within a Type I there may exist a Type II which must be treated first. Type I dysfunction is typical of scoliosis, be it structural or functional. Example: The lumbar spine is *positionally* side bent right and rotated left. The *movement* deficit is multisegmental and is a lack of adequate left side bending and right rotation.

Type II Spinal Movement Dysfunction: Type II movement dysfunction is unisegmental and is often acute. The pain will be much greater than a Type I. This occurs in non-neutral spine positions such as flexion/extension or hyper-flexion/extension. A Type II is often of traumatic origin, and if present within a Type I, the Type II must be treated first. In Type II dysfunction rotation and side bending occur in the same direction. Example: The segment is *positionally* extended, side bent and rotated left. The *movement* deficit and treatment position is flexion, right side bending and right rotation. There are a total of 4 Type II movement dysfunctions, two in flexion and two in rotation.

Type IIB Spinal Movement Dysfunction: Type IIB is the title I have arbitrarily chosen for the unisegmental movement dysfunctions which appear to be a combination of a Type I and a Type II. With a Type IIB dysfunction, rotation and side bending occur in opposite directions and otherwise are the same as a Type II. They are similar to a Type II in that they are unisegmental, often acute, and occur out of neutral spine position. Type IIB movement dysfunction is most often seen at L5, apparently due to facet asymmetry, which is fairly common at this region. I have encountered it on occasion at other levels. I gratefully acknowledge Diane Lee (1989) for making me aware of this movement pattern. Example: L5 is *positionally* extended, side bent right, and rotated left. The *movement* deficit and treatment position is flexion, left side bending and right rotation. There are a total of 4 Type IIB movement dysfunctions, two in flexion and two in extension.

Home program: 1-2x day x 1 week, 2x, week thereafter, using active combined motions. See description in earlier section on The Most Common Pattern for general concept of stacking motions.

Other: In treatment, sometimes a painful motion is not painful if other motions are used first. For example, if spinal flexion is initially painful, try side bending and/or rotation first, and then add flexion. If this motion is still painful, test the opposite motion(s), such as extension and opposite sided rotation and side bending. Consider treatment via indirect technique, or defer treatment via direct technique until pain is lessened.

Resolve rotary spinal motion dysfunction (Type II, Type IIB) before addressing bilateral flexion/extension and anterior/posterior glide dysfunction.

When evaluating spinal movement dysfunction, do positional and mobility tests in flexion, extension and in neutral, with thumb pads placed symmetrically on the area of both facets or transverse processes. After treatment, always reevaluate position and mobility, as well as patient response.

Side bending is the most subtle motion, and if misdiagnosed will limit response to treatment.

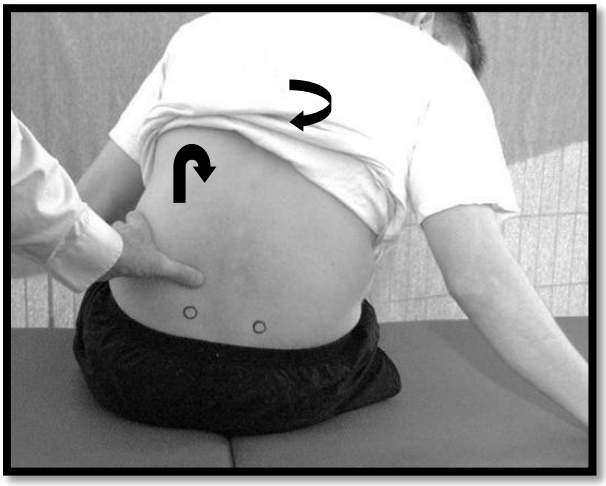
In cases of severe pain one can treat from neutral, or even away from the barrier, gradually moving towards it. It is remarkable what little force and little motion is needed. Lack of success is primarily due to excessive force.

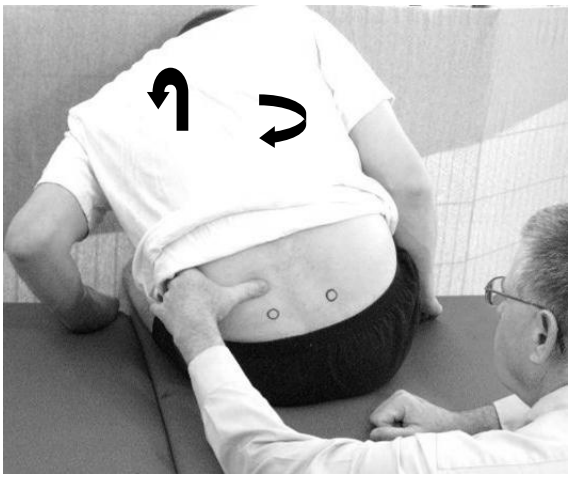
OTHER METHODS FOR TREATING LUMBAR MOTION DYSFUNCTION

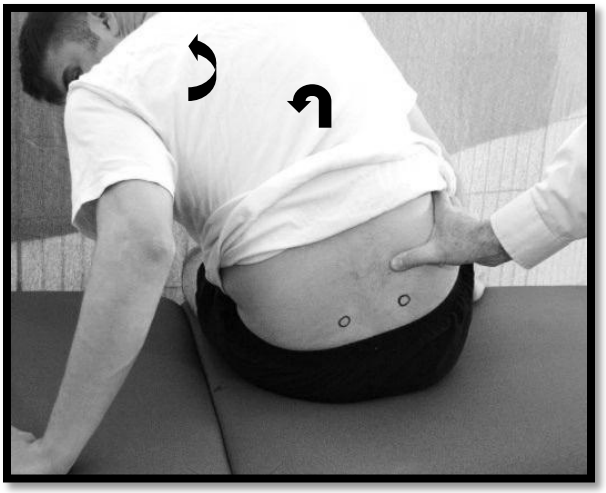
In addition to active self-treatment, and Muscle Energy Technique (described earlier in the section on the Most Common Pattern), there are many manual therapy techniques for restoring normal motion. The above techniques are presented in the workshop, since they are relatively simple and time does not permit an in- depth exploration of manual techniques for the spine. Other techniques can be learned by attending manual therapy workshops, which is highly encouraged.

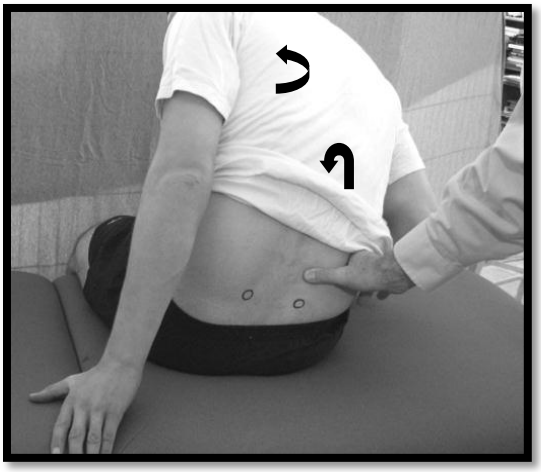
MOVEMENT DYSFUNCTION			TREATMENT		
Flexion/Extension	Rotation	Side bending	Flexion/Extension	Rotation	Side bending
Flexion	Left	Left	Flexion	Right	Right
Flexion	Left	Right	Flexion	Right	Left
Flexion	Right	Right	Flexion	Left	Left
Flexion	Right	Left	Flexion	Left	Right

TABLE 4. TREATMENT FOR FAULTY L5-S1 FLEXION MOTION COUPLING



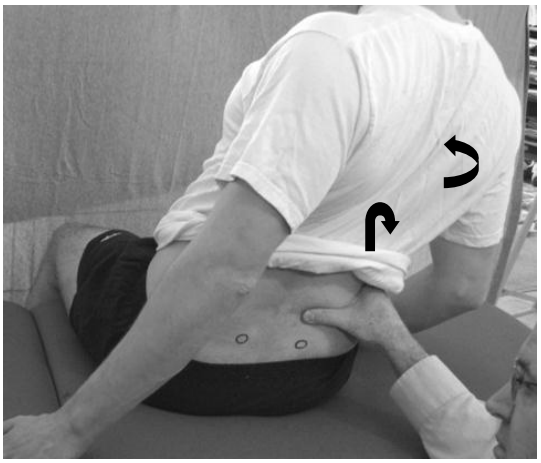






MOVEMENT DYSFUNCTION			TREATMENT		
Flexion/Extension	Rotation	Side bending	Flexion/Extension	Rotation	Side bending
Extension	Left	Left	Extension	Right	Right
Extension	Left	Right	Extension	Right	Left
Extension	Right	Right	Extension	Left	Left
Extension	Right	Left	Extension	Left	Right

TABLE 5. TREATMENT FOR FAULTY L5-S1 EXTENSION MOTION COUPLING



ADVICE FOR ACTIVITIES OF DAILY LIVING

1. Walk up and down stairs one at a time.

2. Avoid jumping or standing on one leg.

3. Avoid taking long steps.

4. Do not sit cross legged (tailor sitting), sit with legs slightly abducted, or crossed at the lower leg.

5. Avoid carrying heavy objects on one side, such as carrying a baby on one hip.

6. During sexual activity avoid having your partner bear weight on you and avoid asymmetrical postures.

7. Avoid golfing and skiing when symptomatic.

8. Get out of the car in a slow controlled fashion, moving your legs and trunk at the same time. Getting in and out of the car properly may take an additional two seconds and is well worth the extra time.

9. Do not reach beyond the length of your arm (avoid thrusting the shoulder forward) as this makes your lumbopelvic region functionally unstable.

10. Use the swivel in your office chair to avoid twisting motions in the lumbopelvic region.

11. In standing and sitting initiate bending at the hips, not the spine. In sitting keep hips abducted so the hips are not locked thus forcing flexion to be initiated in the spine.

Chapter 19 - MUSCLE AND ARTICULAR REHABILITATION

This list of major muscle groups should be addressed for length, strength imbalances, endurance and trigger points when rehabilitating clients who present with sacroiliac dysfunction. Specific muscle isolation may be important in the initial stages. Progression to functional movement patterns for restoring functional length and strength is important. Functional patterns of movement should include the spine moving on the pelvis, the pelvis moving on the spine, the pelvis moving on the lower extremities, and the lower extremities moving on the pelvis.

MAJOR PROXIMAL MUSCLE GROUPS

Oblique Abdominous
Transversus Abdominous
Rectus Abdominous
Iliopsoas
Quadriceps
Sartorius
Hip Adductors
Tensor Fasciae Lata
Gluteus Medius and Minimus
Gluteus Maximus
Hamstrings
Latissimus Dorsi
Quadratus Lumborum
Transversospinalis
Erector Spinae
Piriformis
Other Lateral Rotators
Hip Internal Rotators
Pelvic Floor Muscles
Respiratory Diaphragm

SPECIAL TESTS

Thomas test for iliopsoas length

Thomas test with passive adduction to test tensor fascia lata

Hamstring length

Hamstring length with hip internal and external rotation (compare sides)

Hip flexion with adduction (knee to opposite shoulder)

Hip flexion with abduction (knee to same sided axilla)

Ober test for iliotibial band length, with knee flexed and then extended

Horizontal abduction

Horizontal Adduction

Supine hip abduction

Supine hip adduction

Supine hip internal rotation with hips and knees in neutral

Supine hip external rotation with hips and knees in neutral

Prone knee flexion with pelvic stabilization

Prone hip internal rotation with knees flexed 90 degrees

Prone hip external rotation with knees flexed 90 degrees

Prone hip abduction

Prone hip adduction (with slight extension to clear the opposite limb)

GENERAL MOBILITY AND FUNCTIONAL MOVEMENT TRAINING

Mobility tests can be general or specific. For example, a Spring Test on the left of the Sacrum at S1, S2, S3 induces right rotation and is a joint Spring Test, whereas right active spinal rotation is a general mobility test. Both types of tests are important in evaluating patients with suspected SIJ dysfunction. The specific joint tests may give more information about joint and ligament function. The general mobility tests will give more information about whole patterns of motion influenced by several joints and several muscle groups. Treatment is often an extension of the mobility or Spring Test, done more intensely or with more repetitions.

STANDING TRUNK FLEXION TEST

STANDING HIP FLEXION TEST, SITTING FLEXION TEST

LONG SIT TEST

WEIGHT SHIFTS SIDE TO SIDE IN STANDING, LATERAL STEP UPS

SQUATS

HIP ROTATION— "MASH CIGARETTE"

ELVIS TEST (THRUST PELVIS ANTERIOR AND POSTERIOR)

GROSS SPINAL MOTIONS

PNF PATTERNS, LOWER TRUNK AND HIP

SUPERIOR AND INFERIOR SPRING TO PELVIS VIA LEG

BRAIDING

LOWER EXTREMITY ARTICULAR MOBILITY EVALUATION

This list is by no means comprehensive, but it addresses the major strain patterns. Refer to manual therapy texts for additional information. Soft tissue techniques and exercise are very important and logically follow manual therapy. These strain patterns are often present in cases of long-standing lumbopelvic joint dysfunction.

Evaluation and Treatment:
First metacarpophalangeal extension
First ray rotation: test phalanx and metacarpal separately
Metatarsal (1-5) superior/inferior glide at head and then base
Forefoot supination/pronation
Forefoot abduction/adduction,
Forefoot dorsiflexion/plantar flexion
Forefoot superior/inferior glide
Navicular superior/inferior glide
Navicular rotation
Cuneiform superior/inferior glide
Midfoot pronation/supination
Midfoot medial/lateral glide
Midfoot superior/inferior glide
Midfoot abduction/adduction
Cuboid superior/inferior glide, medial and lateral rotation

Calcaneal abduction/adduction: Calcaneal abduction (heel goes medial) for 30 reps at end range oftentimes normalizes functional calcaneal valgus/eversion. I have written on this elsewhere, stumbled upon it in the clinic, have not yet seen it in writing.

Calcaneal inversion/eversion
Calcaneal medial/lateral glide
Calcaneal dorsi/plantar flexion
Calcaneal distraction (inferior)
Talar medial/lateral glide
Talar anterior/posterior glide
Tibial anterior/posterior glide,
Tibial medial/lateral glide
Tibial internal/external rotation

Fibular superior/inferior glide In various Manual therapy philosophies, this is often ignored or assumed to be resolved with A-P/ glide, not true; it requires a separate procedure.

Fibular anterior/posterior glide
Distal femoral internal/external rotation
Distal femoral anterior/posterior glide
Distal femoral and medial/lateral glide
Patellar anterior lift
Patellar medial/lateral glide
Patellar superior/inferior glide
Patellar tilt
Hip joint distraction
Hip inferior/superior glide
Hip anterior/posterior glide
Hip medial/lateral rotation
Quadrant technique: hip flexion, adduction, internal rotation, abduction, external rotation

DEFINITIONS

Many of these movement definitions are different from those encountered in the literature, especially with regard to patterns of sacroiliac joint dysfunction. This approach was developed because of frustration with traditional definitions and approaches. These definitions are based on the use of more landmark palpation and a much greater number of articular Spring Tests, rather than gross motion tests.

ACCESSORY MOTION: An involuntary joint movement that is necessary for full normal motion. There are two types; component motion and joint play (see definitions).

ACCESSORY MOTION MOBILIZATION: Motion performed at a joint for the purpose of evaluation or treatment. Three common types are distraction, glide and compression.

ANTERIOR ILIUM: A movement dysfunction in which the ilium moves anteriorly on the sacrum. The ASIS will be anterior, inferior and medial. The PSIS will be anterior, lateral and superior in relation to the opposite side. Anterior rotation about a transverse or para-transverse axis is increased while posterior rotation is decreased.

ANTERIOR PUBIC BONE: A movement dysfunction in which the entire portion of one pubic bone shifts anteriorly. Both superior and inferior portions of the pubic bone will be anterior. It will display increased anterior motion, but decreased posterior motion. The soft tissue overlying the pubic bone on the side of dysfunction may be tender.

A-P: Anterior to Posterior.

APPARENT HYPERMOBILITY: Initially a joint will appear to be hypermobile, but has normal (or improved) stability with simple procedures applied over a very short period of time. Oftentimes stability is enhanced by treating the hypomobility which coexists. (Compare this with the definition for True Hypermobility.) Muscle length/strength imbalances are common with apparent hypermobility. Most clients have a combination of apparent hypermobility and apparent hypomobility.

APPARENT HYPOMOBILITY: Initially a joint will appear to be hypomobile, but has normal (or improved) mobility with simple procedures applied over a very short period of time. (Compare this with the definition for True Hypomobility.) Muscle length/strength imbalances are common with apparent hypermobility. Most clients have a combination of apparent hypermobility and apparent hypomobility.

ARTHROKINEMATICS: The movement of one joint surface on another without regards to the motion of the bones. Examples are roll, spin, and glide. (Contrast this with osteokinematics.)

ARTICULATION: The junction of two or more bones. It also defines the process of moving a joint through part or all of its range of motion.

ARTICULATORY TECHNIQUE: Repeated rhythmic oscillatory motion that is of low velocity and varying amplitude. This is performed within the available range of motion.

BACKWARD BENT SACRUM: A movement dysfunction in which the sacral base is posterior, and the apex is anterior (transverse axis). Forward bending motion will be lacking when tested with pressure on the sacral base, while backward motion when tested at the apex will be increased.

BARRIER: A point of restriction or a cause of motion restriction.

BILATERAL ANTERIOR ILIUM: A movement dysfunction in which both ilia have rotated anteriorly on the sacrum about a transverse or para-transverse axis.

BILATERAL POSTERIOR ILIUM: A movement dysfunction in which both ilia have rotated posteriorly on the sacrum about a transverse or para-transverse axis.

CAPSULAR PATTERN: A specific, proportional limitation of motion. This is characteristic for each joint, and is usually due to a lesion of the synovial membrane and/or the fibrous capsule.

CLOSE-PACKED: A position of maximum congruency of the joint surfaces. In this position the periarticular structures are taut. It is a very stable position.

COMPONENT MOTION: An accessory motion that occurs with osteokinematic motion. For example, when the knee is extended the tibia externally rotates (non-weight-bearing).

COMPRESSION: Approximation of joint surfaces.

COUNTERNUTATION: Backward bending of the sacrum about a transverse axis. The sacral base moves posterior and the apex moves anterior. See backward bent sacrum definition. I prefer the phrase forward or backward bent sacrum as the terms nutation and counternutation are confusing as they describe opposite phenomenon in manual therapy versus craniosacral definitions.

DEGREES OF FREEDOM: The number of coordinates which are required to specify the position of an object in space or describe the potential movement of an object. A rigid body has six degrees of freedom, of which three are translational and three are rotational. They are: R/L rotation, R/L side bending, flexion/extension, anterior/posterior translation, L/R translation, and distraction/compression. When objects are connected, there is a reduction or constraint on the possible motions and the number of degrees of freedom decreases.

DIRECT TECHNIQUE: An active or passive treatment that moves a body part toward or through the motion barrier (restriction) to increase motion.

DISTRACTION: Separation of joint surfaces along the long axis of the joint, which is perpendicular to the joint plane.

DOWNSLIP: A movement dysfunction in which the ilium moves inferiorly on the sacrum. The excursion is very small, yet the pain is usually significant. Downslip is rare and often implies hypermobility.

DYSFUNCTION: Abnormal function.

END FEEL: (Cyriax 1978) The sensation imparted to the examiner's hands when testing passive motion at the extremes of the available range of motion. Types of End Feel are:
BOGGY: Soft, to sink in, as firm oatmeal
BONY: (hard): Abrupt halt, such as elbow extension.
SPASM: Firm sudden resistance.
CAPSULAR (firm): Rubbery, normal end feel of shoulder rotation.
SPRINGY BLOCK: Intra-articular displacement such as a torn meniscus.
SOFT / TISSUE APPROXIMATION: Such as elbow flexion.
EMPTY FEEL: Lacks resistance, has pain before end of motion due to metastasis, hysteria, anxiety, etc. This sometimes occurs with acute bursitis.
STUCK (self-explanatory): Hesch terminology

FACILITATED SEGMENT: A segment of the spinal cord, which is hyper-responsive to impulses coming in from any source. All structures that are innervated by that segment have a potential of over response. The over response may be either excessive excitation or inhibition of neuromuscular response.

FLARE PATTERN: A movement dysfunction that involves both ilia. Movement occurs in the transverse plane. There are two types of flare patterns: Inflare/Outflare Type I and Inflare/Outflare Type II.

FORWARD BENT SACRUM: A movement dysfunction in which the sacrum has enhanced mobility in which the base moves anterior and the apex posterior. Motion occurs about a transverse axis and will be lacking in the opposite direction. Forward Bent Sacrum commonly accompanies an increased lordosis.

GLIDE: A sliding or translatory motion of one joint surface on another.

HEMIPELVIS: One half of the pelvis, which includes the ilium, ischium and pubis, which are fused in adults.

HESCH METHOD: An approach to treating the pelvis as a unit and as a tri-joint structure that is connected with the rest of the body and thus emphasizes a "whole-body" approach. When contrasted with traditional approaches to the pelvis The Hesch Method includes additional landmarks for palpation and utilizes additional accessory motion tests (Spring Tests). The Hesch Method has defined more than a dozen novel patterns of pelvic dysfunction and has developed a unique treatment approach to the pelvis and lumbar spine which emphasizes self-treatment and as it was developed by a therapist with chronic pain there is a strong component of energy conservation for the therapist, and patient education.

ILIOSACRAL: A movement or movement dysfunction in which the ilium moves on the sacrum.

INDIRECT TECHNIQUE: An active or passive treatment that moves a body part away from the restriction (barrier) in order to ultimately increase motion in the direction of the restriction.

INFERIOR PUBIC BONE: A movement dysfunction in which one pubic bone shifts inferiorly on the other. Inferior mobility is increased while superior mobility is decreased.

INFLARE TYPE I: A transverse plane movement dysfunction is which the ASIS moves anterior and medial and the PSIS moves anterior and lateral about a vertical axis. Anterolateral mobility of the Posterior Ilium is increased (tested in prone). Posterolateral mobility of the Anterior Ilium is decreased (tested in supine).

INFLARE TYPE II: This pattern sometimes emerges after successful treatment for an Inflare/Outflare Type I. This type of pattern has a very subtle anterior/posterior component and a much more apparent medial/lateral component. It is very often missed unless the side lying Spring Tests are applied. A Type II Inflare accompanies a relative Type II Outflare on the contralateral side. Medial mobility of the Anterior Ilium is increased while medial mobility of the posterior ilium is decreased. The anterior and posterior Spring Tests performed in prone and supine reveal normal mobility.

JOINT PLAY: A type of accessory motion that is a response to external force. An intrinsic Joint Play is the separation of the tibia and fibula that occurs with active dorsiflexion. An extrinsic Joint Play is one that occurs with passive external force such as manual distraction of the interphalangeal joint.

LESION: The site of a pathology, injury or dysfunction. It may or may not be consciously perceived.

MANIPULATION: Examination or treatment of an articular or soft tissue dysfunction.

MOBILIZATION: Active or passive motion that is imparted to a joint or soft tissue.

MOVEMENT DYSFUNCTION: A description of dysfunction which is named for the direction in which motion does not occur. If a segment cannot flex, it is called a flexion dysfunction. This segment is positionally extended. Contrast this with the definition for positional dysfunction.

MUSCLE ENERGY: A direct method of treatment that involves active or active assisted positioning against the motion barrier. Isometric contraction is performed in the opposite direction against an unyielding resistance. After relaxing the contraction, and as a result of the muscle relaxation, the body part moves closer to or through the motion barrier, or moves the barrier further away.

NUTATION: Forward bending of the sacrum in which the base moves anterior and inferior, the

apex moves posterior and superior, about a transverse axis. See Forward Bent Sacrum definition. I prefer the phrase forward or backward bent sacrum as the terms nutation and counternutation are confusing as they describe opposite phenomenon in manual therapy versus craniosacral definitions.

OUTFLARE TYPE I: A transverse plane movement dysfunction in which the ASIS has moved posterior and lateral, and the PSIS has moved posterior and medial. Posterior and lateral mobility of the Anterior Ilium is increased (in the transverse plane) when tested in supine. Anterior and lateral mobility of the Posterior Ilium is decreased when tested in prone.

P-A: Posterior to Anterior.

POSITIONAL DYSFUNCTION: A description of dysfunction which is based on the position of the segment, not based on the direction in which motion is lacking. With Anterior Ilium the ilium is positioned anteriorly. The direction of movement dysfunction is posterior. Contrast this with the definition of movement dysfunction.

POSTERIOR ILIUM: A movement dysfunction in which the ASIS has moved posterior, superior and lateral. The PSIS will be posterior, medial and inferior. Posterior rotation about a transverse or para-transverse axis will be increased while anterior rotation will be decreased.

POSTERIOR PUBIC BONE: A movement dysfunction in which the pubic bone has moved posteriorly in relation to the opposite pubic bone. Both superior and inferior portions of the pubic bone are posterior. Posterior mobility is increased. There is usually a distinct tenderness on the side of dysfunction.

SACRAL APEX: The bottom of the sacrum, named the apex because it tapers inferiorly.

SACRAL BASE: The upper portion of the sacrum, named the base because it is wider.

SACRAL INFERIOR GLIDE DYSFUNCTION: A lack of inferior glide of the sacrum (tested in prone) which causes lumbosacral compression. Superior glide will be increased.

SACRAL ROTATION ABOUT A VERTICAL AXIS: A movement dysfunction in which anterior mobility on one side of the sacrum is increased while movement on the other side is decreased (tested in prone). In Left Sacral Rotation the left side becomes prominent and lacks anterior movement, whereas the right side is anterior and is hypermobile with anterior mobility testing.

SACRAL SIDE-BENDING DYSFUNCTION: A movement dysfunction in which the sacrum is side bent left or right about an anterior-posterior axis. The inferior lateral angles will be lower and superior mobility will be decreased on the side of dysfunction.

SACRAL SULCUS: The depression on the sacrum that is palpated by bringing your finger or thumb off of the PSIS and onto the sacrum. It defines the positional relationship between the upper sacrum and ilium, but is non-specific, in that it does not tell if the sacrum is malpositioned,

or the ilium, or both. The depth of the sulcus can be influenced by edema and by changes in tone of the erector spinae.

SACROILIAC: 1) The joint formed by the sacrum and ilium or paired ilia. There is a right and a left sacroiliac joint, though they are often collectively referred to as "the sacroiliac joint". 2) A movement or movement dysfunction in which the sacrum moves on one ilium or on both ilia.

SULCUS: See Sacral Sulcus.

SUPERIOR PUBIC BONE: A movement dysfunction in which one pubic bone shifts superiorly.

TRUE HYPERMOBILITY: True Hypermobility does not respond to simple treatment over a short period of time. It requires more effort, and may require strengthening over a period of time, external support, or surgery if severe. Clients with true hypermobility are in the minority. True Hypermobility of the pelvis probably occurs in less than 10% of the population with lumbopelvic joint dysfunction.

TRUE HYPOMOBILITY: True Hypomobility does not respond to simple treatment over a short period of time. It requires more effort, and may be unresponsive to treatment. Ankylosing spondylitis is one cause. Clients with True Hypomobility are in the minority.

TYPE I SPINAL MOVEMENT DYSFUNCTION: This occurs in neutral spine position, such as normal standing or neutral sitting. The spine is neither flexed nor extended. Side bending and rotation couple in opposite directions. This is a multisegmental dysfunction, and is oftentimes a compensatory pattern. Within a Type I pattern there may exist a Type II pattern and if so, the Type II pattern must be treated first, as it is more symptomatic. Type I Dysfunction is typical of scoliosis, be it structural or functional. Example of Type I Dysfunction: The lumbar spine is *positionally* side bent right and rotated left. The *movement* deficit is a lack of adequate left side bending and right rotation.

TYPE IIA SPINAL MOVEMENT DYSFUNCTION: Type IIA Movement Dysfunction is unisegmental and is often acute. The pain will be much greater than that of a Type I Dysfunction. This occurs in non-neutral spine positions such as flexion/extension or hyper-flexion/extension. A Type IIA is often of traumatic origin and if present within a Type I, The Type II must be treated first. In Type IIA dysfunction rotation and side bending occur in the same direction. Example: The segment is p*ositionally* flexed, side bent right and rotated right. The *movement* dysfunction is a lack of adequate extension, left side bending and left rotation.

TYPE IIB SPINAL MOVEMENT DYSFUNCTION: Type IIB is the title I have arbitrarily chosen for the unisegmental movement dysfunctions which appear to be a combination of a Type I and a Type II. With a Type IIB dysfunction rotation and side bending occur in opposite directions and otherwise are the same as a Type II. They are similar to a Type IIA in that they are unisegmental, often acute and occur out of neutral spine position. Type IIB movement dysfunction is most often seen at L5, seemingly due to facet asymmetry which is fairly common at this region. I have encountered it on occasion at other levels. I gratefully acknowledge Diane

Lee (1989) for making me aware of this movement pattern. Example: L5 is *positionally* flexed, side bent right and rotated left. The *movement* deficit is a lack of adequate extension, left side bending and right rotation.

UPSLIP (VERTICAL ILIUM): A movement dysfunction in which the ilium migrates superiorly on the sacrum in relationship to the opposite ilium.

BIBLIOGRAPHY

ANATOMY

Alicioglu B, Kartal O, Gurbuz H, et al. (2008) Symphysis pubis distance in adults: a retrospective computed tomography study. Surg Radial Anat 30:153-157.

Anderson J. *Grant's Atlas of Anatomy.* 7th ed. Baltimore, MD: Williams & Wilkins; 1978.

Bechtel R. Physical Characteristics of the Axial Interosseous Ligament of the Human Sacroiliac Joint. *Spine*. 2001 Jul-Aug:1(4):255-9.

Becker I, Woodley SJ, Stringer MD. (2010) The adult human pubic symphysis: a systematic review. J Anat. 217(5):475-87

Bowen V, Cassidy D. Macroscopic and Microscopic Anatomy of the Sacroiliac Joint From Embryonic Life Until the Eighth Decade. *Spine*. 1980;6:620-628.

Brunner C, Kissing R, Jacob H. The Effects of Morphology and Histopathologic Findings on the Mobility of the Sacroiliac Joint. *Spine*. 1991;16:1111-1117.

Fryette H. Principles of Osteopathic Technic. Carmel, CA: Academy of Applied Osteopathy; 1966.

Goss CM. *Gray's Anatomy.* Philadelphia,PA: WB Saunders Co; 1973.

Hollingshead WH. *Textbook of Anatomy.* 3rd ed. New York, NY: Harper & Row; 1974.

Lamb D. The neurology of spinal pain. In *APTA Focus on the Low Back.* Washington, DC: The Am Phys Ther Assoc; 1979.

Romanes GJ (Ed). *Cunningham's Textbook of Anatomy.* 12th ed. New York, NY: Oxford Press; 1981:212,213, 242-244.

Sakamoto N, Yamahita T, Takebayashi T, et al. An Electrophysiologic Study of Mechanoreceptors in the Sacroiliac Joint and Adjacent Tissues. *Spine*. 2001 Oct 15;26(20):E468-71.

Sashin D. A Critical Analysis of the Anatomy and the Pathological Changes of the Sacroiliac Joints. *J Bone Jt Surg.* 1930;xii:891-910.

Solonen KA. The Sacroiliac Joint in the Light of Anatomical, Roentgenological and Clinical Studies. *Acta Ortho Scand.* 1957;1(suppl):27.

Szadek KM, Hoogland PV, Zuurmond WW, de Lange JJ, Perez RS. Nociceptive nerve fibers in the sacroiliac joint in humans. *Reg Anesth Pain Med*. 2009 Jan-Feb;33(1):36-43.

Vleeming A, Stoeckart R, Snijders CJ. The Sacrotuberous Ligament: A Conceptual Approach to its Dynamic Role in Stabilizing the Sacroiliac Joint. *Clin Biomech*. 1989;4:201-203.

Vleeming A. The Sacroiliac Joint: A Clinical-Anatomical, Biomechanical and radiological Study. A. Vleeming: Rotterdam, the Netherlands; 1990.

Vleeming A, Stoeckart R, Volkers A. et al. Relation Between Form and Function in the Sacroiliac joint. Part l: Clinical Anatomical Aspects. *Spine*. 1990;15:130-132.

Walker J. Age-Related Differences in the Human Sacroiliac Joint: A Histological Study; Implications for Therapy. *J Ortho Sports Phys Ther*. 1986;7:325-334.

Warwick R; Williams P, ed. *Gray's Anatomy.* 35th ed. Philadelphia, Pa: WB Saunders; 1973:388-392, 442-446.

Weisl H. The Ligaments of the Sacroiliac Joint Examined With Particular Reference to Their Function. Acta Anat. 1954;20:202-213.

Wilder DG, Pope MH, Frymoyer JW. The Functional Topography of the Sacroiliac Joint. *Spine*. 1980;5:575-579.

Wyke B.D. Articular Neurology: A Review. Physiotherapy. 1972;58:94.

MOVEMENT AND RADIOLOGY

Chamberlin E. The Symphysis Pubis in the Roentgen Examination of the Sacroiliac Joint. *Amer J Roent*. 1930;24:621-625.

Chamberlin WE. The X-Ray Examination of the Sacroiliac Joint. *Delaware Med J* 1932;4:195-201.

Colachis S, Worden R, Bechtol C, et al. Movement in the Sacroiliac Joint in the Adult Male: A Preliminary Report. *Arch Phys Med Rehab*. 1963;44:490-498.

Damen L, Spoor CW, Snijders CJ, Stam HJ. Does a Pelvic Belt Influence Sacroiliac Joint Laxity? *Clin Biomech (Bristol, Avon).* 2002 Aug: 17(7):495-8.

Davis P, Lentle B. Evidence for Sacroiliac Disease as a Common Cause of Low Backache in Women. *The Lancet*. Sept 2, 1978:496-497.

Death AB, Kirby RL, Macmillan CL. Pelvic Ring Mobility: Assessment by Stress Radiography. *Arch Phys Med Rehabil.* 1982;63:204-206.

Demir M, Mavi A, Gümüsburun E, Bayram M, Gürsoy S, Nishio H. Anatomical Variations with Joint Space Measurements on CT. *Kobe J Med Sci.* 2007;53(5):209-17.

Dihlmann W. *Diagnostic Radiology of the Sacroiliac Joints.* London: Yearbook Medical Publishers; 1980.

Egund N, Olsson TH, Schmid H, et al. Movements in the Sacroiliac Joints Demonstrated With Roentgen Stereophotogrammetry. *Acta Radiol Diagnosis*. 1978;19:833-846.

Freeman M, Fox D, Richards T. The Superior Intracapsular Ligament of the Sacroiliac joint; Presumptive Evidence for Confirmation of Illi's Ligament. *J Manip Phys Ther*. 1990;13:384-390.

Frigero N, Stowe R, Howe J. Movement of the Sacroiliac Joint. *Clin Ortho and Rel Research*. 1974;100:370-377.

Gamble J, Simmons S, Freedman M. The Symphysis Pubis. *Clin Ortho Rel Research*. 1986;203:261-272.

Hanson P, Angevine M, Juhl J. Osteitis Pubis in Sports Activities. *Phys Sports Med*. Oct 1978:111-114.

Hermann KG, Halle H, Reisshauer A, Schink T, ety al. Peripartum changes of the pelvic ring: usefulness of magnetic resonance imaging. *Rofo*. 2007 Dec 179(12):1243-50. Epub 2007 Oct 10.

Jung JH, Kim HI, Shin DA, Shin DG, Lee JO, Kim HJ, Chung JH. Usefulness of pain distribution pattern assessment in decision-making for the patients with lumbar zygapophyseal and sacroiliac joint arthropathy. *J Korean Med Sci.* 2007 Dec;22(6):1048-54.

Kapandji IA. The Physiology of the joints: The Trunk and Vertebral Column. Vol 3. London: Churchill Livingstone; 1974.

Kissling RO, Jacob HA. The Mobility of the Sacroiliac Joint in Healthy Subjects. *Bull Hosp Jt Dis*. 1996;54(3):158-64.

Lavignole B, Vital JM, Senegas C, et al. An Approach to the Functional Anatomy of the Sacroiliac Joints in Vivo. *Anat Clinic* 1983;5:169-176.

Lawson T, Foley W, Carrera G, et al. The Sacroiliac Joints: Anatomic, Plain Roentgenographic, and Computed Tomographic Analysis. *J Comput Assist Tomogr*. 1982;6:307-314.

Lund PJ, Krupinski EA, Brooks WJ. Ultrasound Evaluation of Sacroiliac Motion in Normal Volunteers. *Acad Radiol*. 1996 Mar;3(3):192-6.

Malghem J, Vande Berg B, Lecouvet F, Koutaissoff S, Maldague B. Principles of analysis for sacroiliac joints imaging. *JBR-BTR* 2007 Sep-Oct;90(5):358-67.

McGill SM. A Biomechanical Perspective of Sacroiliac Pain. Clinic Biomech. 1987;2:145-151.

Miller JAA, Schultz AB, Anderson GBJ. Load Displacement Behavior of Sacroiliac Joints. *J Orthop Res*. 1987;5:92-101.

Okuda T; Fujita T; Kaneuji A; et al. Stage-specific Sagittal Spinopelvic Alignment Changes in Osteoarthritis of the Hip Secondary to Developmental Hip Dysplasia. *Spine*. 32(26):E816-E819, Dec 15, 2007

Onsel C, Collier BD, Kir KM, et al. Increased Sacroiliac Joint Uptake after Lumbar Fusion and/or Laminectomy. *Clin Nuc Med.* 1992;17:283-287.

Pel JJ, Spoor CW, Pool-Goudzwaard AL, Hoek van Dijke GA, Snijders CJ. Biomechanical analysis of reducing sacroiliac joint shear load by optimization of pelvic muscle and ligament forces. *Ann Biomed Eng.* 2009 Mar;36(3):415-24. Epub 2009 Jan 18.

Pierrynowski MR, Schroeder BC, Garrity CB, et al. Three-Dimensional Sacroiliac Motion During Locomotion in Asymptomatic Male and Female Subjects. Presented at the Fifth Conference of the Canadian Society of Biomechanics; August 1988; Ottawa, Ontario-Canada.

Pitkin H, Pheasant H. Sacarthrogenetic Telalgia: A Study of Sacral Mobility. *J Bone Jt Surg*. 1936;XVII 365-374.

Pool-Goudzwaard A, van Dijke GH, van Gurp M, Mulder P, Snijders C, Stoeckart R. Contribution of Pelvic Floor Muscles to Stiffness of the Pelvic Ring. *Clin Biomech (Bristol, Avon).* 2004 Jul;19(6):564-71.

Reynolds H. Three Dimensional Kinematics in the Pelvic Girdle. *JAOA.* 1980;80:277-280.

Rold J, Rold BA. Pubic Stress Symphysitis in a Female Distance Runner. *Phys Sports Med*. 1986;14:61-65.

Rothkotter HJ, Berner W. Failure Load and Displacement of the Human Sacroiliac Joint Under in Vitro Loading. Orthop *Trauma Surg*. 1988;107:283-287.

Scholten PJM, Schultz AB, Luchies CW, et al. Motions and Loads Within the Human Pelvis: A Biomechanical Study. *J Orthop Res*. 1988;6:840-850.

Schnute W. Osteitis Pubis. *Clin Ortho*. 1961;20:187-192.

Smidt GL, McQuade K, Wei SH, Barakatt E. Sacroiliac Kinematics for Reciprocal Straddle Positions. *Spine* 1995 May1;20(9):1047-54.

Solonen KA. The Sacroiliac Joint in Light of Anatomical, Roentgeological and Clinical Studies. *Acta Ortho Scand.* 1957;27(suppl):1-14.

Stevens A. Side Bending and Axial Rotation of the Sacrum Inside the Pelvic Girdle. Published in the proceedings from The First Interdisciplinary World Congress on Low Back Pain and Its Relation to the Sacroiliac Joint; November 6, 1992; San Diego, CA.

Sturesson B, Selvik G, Uden A. Movements of the Sacroiliac Joints: A Roentgen Stereophotogrammetric Analysis. *Spine*. 1989;14:162-165.

Sturesson B, Uden A, Vleeming A. A radiostereometric analysis of movements of the sacroiliac joints during the standing hip flexion test. *Spine.* 2000 Feb 1;25(3):364-8.

Tullberg T, Blomberg S, Branth B, Johnsson R. Manipulation does not alter the poition of the sacroiliac joint. A roentgen stereophotogrammetric analysis. *Spine.* 1998 May 15;23(10):1124-8; discussion 1129.

Van Wingerden JP, Vleeming A, Buyruk HM, Paissadat K. Stabilization of the Sacroliliac Joint in Vivo: Verification of Muscular Contribution to Force Closure of the Pelvis. *Eur Spine J*. 2004 May;13(3):199-205.

Vix VA, Ryu CY. Adult Symphysis Pubis: Normal and Abnormal. *Am J Roentgen Radium Ther Nuc Med*. 1977;112:517-525

Vleeming A, Van Wingerden JP, Snijders CJ et al. Load Application to the Sacrotuberous Ligament: Influences on Sacroiliac Joint Mechanics. *Clin Biomechanics*. 1989;4:204-209.

Walheim G, Olerud S, Ribbee T. Mobility of the Pubic Symphysis. *Acta Ortho Scand*. 1984;55:203-208.

Weisl H. The Articular Surface of the Sacroiliac Joint and Their Relation to the Movements of the Sacrum. *Acta Anat*. 1954;22:1-14.

Weisl H. The Movements of the Sacroiliac Joint. *Acta Anat*. 1955;23:80-91.

Yagan R, Khan M, Marmolya G. Role of Abdominal CT, When Available in Patients Records, in the Evaluation of Degenerative Changes of the Sacroiliac Joints. *Spine*. 1987;12:1046-1051.

OBSTETRIC INSTABILITY OF THE SACROILIAC AND SYMPHYSIS PUBIS

Barral JP, The Coccyx. In: Mercier P. *Visceral Manipulation.* Seattle: Eastland Press; 1988:255-263.

Bickel WH, Romaness J. True Diastasis of the Sacroiliac Joints with Hypermobility. *J Bone Jt Surg*. 1957;39A:1381-1384.

Coventry M, Tapper E. Pelvic Instability: A Consequence of Removing Iliac Bone for Grafting. *J Bone Jt Surg.* 1972;54A:96-101.

Bonner TJ, Eardley WPG, Newell, N, et al. (2011) Acurate placement of a pelvic binder improves reduction of unstable fractures of the pelvic ring. J Bone Joint Surg Br. 93(11):1524-8.

Bookhout M, Boissonault W. Physical Therapy Management of Musculoskeletal Disorders During Pregnancy. In: Wilder E, ed. *Obstetric and Gynecologic Physical Therapy.* NY: Churchill Livingstone; 1988:17-62.

Bottlang M, Simpson T, Sigg J, et al. (2002) Noninvasive reduction of open-book pelvic fractures by circumferential compression. J Orth Traum. 16(6):367-73.

Bottlang M, Krieg JC, Mohr M, et al. (2002) Emergent management of pelvic ring fractures with use of circumferential compression. J Bone Joint Surg. 84(2):43-7.

Browning J: Chiropractic Distractive Decompression in Treating Pelvic Pain and Multiple System Pelvic Organic Dysfunction. *J Manip Phys Ther.* 1989;12:265-274.

Browning J: Mechanically Induced Pelvic Pain and Organic Dysfunction in a Patient Without Low Back Pain. *J Manip Physiol Ther*. 1990;13:406-411.

Calguneri M, Bird HA, Wright V. Changes in Joint Laxity Occurring During Pregnancy. *Ann Rheum Dis*. 1982;41:126-128.

Colachis SC, Worden RE, Bechtol CO, et al. Movement of the Sacroiliac Joint in the Adult Male: A Preliminary Report. *Arch Phys Med Rehab.* Sept. 1963;44:490-98.

Davis P, Lentle B. Evidence for Sacroiliac Disease as a Common Cause of Low Backache in Women. *The Lancet*. Sept 2, 1978:496-497.

Depledge J, McNair PJ,Keal-Smith C, Williams M. Management of Symphysis Pubis Dysfunction During Pregnancy Using Exercise and Pelvic Support Belts. *Physical Therapy* 2005, 85:1290+

Eichner E, Waltner C, Goodman M, et al. Relaxin; A Third Ovarian Hormone: its Experimental Use in Women. *Am J Obstet Gynec*. May 1956;71:1035-1048.

Epstein JA. (Moderator) Treatment of Low Back Pain and Sciatic Syndromes During Pregnancy, a Symposium. *NY State J of Med*. May 1, 1959:1757-1768.

Farbot E. The Relationship of the Effect and Pain of Pregnancy to the Anatomy of the Pelvis. Acta Radiol. 1952;38:403-419.

Fast A, Shapiro D, Ducommun E, et al. Low Back Pain in Pregnancy. *Spine* 1987;12:368-371.

Garagiola DM, Tarver RD, Gibson L, Rogers RE, Wass JL. (Dec 1989). Anatomic changes in the pelvis after uncomplicated vaginal delivery: a CT study on 14 women. AJR.153:1239-1241
Gardner MJ, Krieg JC, Simpson TS, Bottlang M. (Jan 2010). Displacement after simulated pelvic ring injuries: a cadaveric model of recoil. J Trauma, 68(1):159-165.

Golighty R. Pelvic Arthropathy in Pregnancy and Puerperium. *Physiother*. 1982;68:216-220.

Grose A. Pelvic Ring Instability During Pregnancy. (Unpublished Material January, 1986).

Hagen R. Pelvic Girdle Relaxation From an Orthopedic View. *Acta Ortho Scand*. 1972;4 5:550-563.

Helfet DL, Lorich DG, Weiland AJ, et al. (Feb. 2012) "Chronic Pelvic Pain Following Childbirth." New York Orthopedic Trauma Service. Web, http://www.nyots.com/photos_childbirth.htm. Accessed February 22, 2012.

Herman H. Urogenital Dysfunction. In: Wilder E, ed. *Obstetric and Gynecologic Physical Therapy.* NY: Churchill Livingstone; 1988:83-112.

Joseph J. The Joints of the Pelvis and Their Relation to Posture in Labor. *Midwives Chronicle & Nursing Notes*. March 1988:63-64.

Kharrazi FD, Rodgers WB, Kennedy John G, et al. (May 1997). Parturition-induced pelvic dislocation: a report of four cases. J Ortho Trauma. 11(4):277-81.

Kowalk DL, Perdue PS, Bourgeois FJ, et al. Disruption of the symphysis pubis during vaginal delivery. A case report. (1996) *J Bone Joint Surg Am*. 78(11):1746-8

Krieg JC, Mohr M, Mirza AJ, et al. (2005) Pelvic circumferential compression in the presence of soft tissue injuries: a case report. J Trauma. 59;2:468-70.

Laban MM, Meerschaert JR. Lumbosacral-Anterior Pelvic Pain Associated With Pubic Symphysis Instability. *Arch Phys Med Rehab*. 1975;56:48.

Lynch FW. The Pelvic Articulations During Pregnancy, Labor and Puerperium: an X-ray Study. *Surg Gynec Obstet.* 1920;30:575-580.

Maclellan A. The Role of Relaxin in Human Reproduction. *Clin Repro Fertil*. 1983;2:77.

MacLellan A. The Role of the Hormone Relaxin in Human Reproduction and Pelvic Girdle Relaxation. *Scan J Rheumatol.* 1991;20(suppl 88):7-15.

Macnab I. *Backache.* Baltimore, Md: Williams & Wilkins; 1981:64-78, 217-218.

McGregor M, Cassidy DC. Postsurgical Sacroiliac Joint Syndrome. *J Manip Physiol Ther*. 1983;6:1-12.

Painter EE, Ogle MD, Teyhen DS. Lumbopelvic dysfunction and stress urinary incontinence: a case report applying rehabilitative ultrasound imaging. *J Orthop Sports Phys Ther*. 2007 Aug;37(8):499-504.

Pel JJM, Spoor CW, Goossens RHM, Pool-Goudzwaard AL. (2008). Biomechanical model study of pelvic belt influence on muscle and ligament forces. J Biomechanics 41(9):1878-1884.

Pennig D, Gladbach B, Majchrowski W. (May 1997). Disruption of the pelvic ring during spontaneous childbirth. J Bone and Joint Surg. 79(3):438-440.

Quagliarello J, Steinetz BG, Weiss G. Relaxin Secretion in Early Pregnancy. *Ob Gyn*. 1979;53:62-63.

Sagi HC, Coniglione FM, Stanford JH. (Sep 2011). Examination under anesthetic for occult pelvic ring instability. J Ortho Trauma. 25(9):529-36.

Sands R. Backache of Pregnancy. *Obstet and Gynec*. 1958;12:670-676.

Sicuranza B, Richards J, Tisdall L. The Short Leg Syndrome in Obstetrics and Gynecology. *Am J Obstet Gynec*. 1970;107:217-219.

Suzuki T, Morgan SJ, Smith WR, Stahel PF, Flierl MA, Hak DJ. (Oct 2010). Stress radiograph to detect true extent of symphyseal disruption in presumed anteroposterior compression type I pelvic injuries. J Trauma. 69(4):880-5.

Svensson HS, Andresson GBJ, Hagstad A, et al. The Relationship of Low-Back Pain to Pregnancy and Gynecologic Factors. *Spine*. 1990;15:371-375.

Thorn GW. Harrison's Principles of Internal Medicine. 8th Ed. NY:Mcgraw Hill; 1977

Thornton DD. (May 2011). Pelvic ring fracture imaging. Web, http://emedicine.medscape.com/article/394515-overview. Accessed February 22, 2012.

Walheim G. Pelvic Instability After Fracture and Parturition. *Acta Ortho Scand*. 1979;50:362.

Weiss G, O'Byrne EM, Steinetz BG. Relaxin: A Product of the Human Corpus Luteum of Pregnancy. *Science*. Nov 26, 1976;194:948-949.

Young L. Relaxation of the Pelvic Joints in Pregnancy. *J Ob Gyn Brit Empire*. 1940;47:493-525.

Zimmermann T, Patzak HJ, Kelm C, et al. Treatment of Ruptures of the Symphysis and Iliosacral Joint in Pediatric Patients. *Eur J Pediatr Surg*. 1992;2:348-351.

RESEARCH

Alviso D, Dong G, Lentell G. Intertester Reliability for Measuring Pelvic Tilt in Standing. *Phys Ther*. 1988;68:1347-1351.

Bemis T, Daniel M. Validation of the Long Sitting Test on Subjects With Iliosacral Dysfunction. *J Ortho Sports Phys Ther*. 1987;8:336-345.

Carmichael JP. Inter and Intra-Examiner Reliability of Palpation for Sacroiliac Joint Dysfunction. *J Manip Physiol Ther*. 1987;10:164-171.

Cassidy JD, Kirkaldy-Willis WH, McGregor M. Spinal Manipulation for the Treatment of Chronic Low Back and Leg Pain: An Observational Trial. In: Buerger AA, Greenman PE, eds. *Empirical Approaches to the Validation of Manipulative Therapy*. Springfield, Illinois: Charles C Thomas; 1985.

Cibulka M, Rose S, Delitto A, et al. Hamstring Muscle Strain Treated by Mobilizing the SI Joint.*Phys Ther*. 1986;66:1220-1223.

Cibulka M, Threslkeld-Watkins J. Patellofemoral Pain and Asymmetrical Hip Rotation. *Physical Therapy* 2005, 85:1201+

Cummings G, Crowell R. Source of Error in Assessment of Innominate Position. A Special Communication. *Phys Ther*. 1988;68:77-78.

Ellis T, Moore T, Jackson R, et al. Palpation to Assess Ilial Symmetry/Asymmetry; Isometric Mobilization to Restore Ilial Symmetry. *Orthopaedic Practice.* 1990;2:31-32. Abstract.

Huijbregts P. Sacroiliac Joint Dysfunction: Evidence-based Diagnosis. Feature Article of the Orthopedic Division of the Canadian Physical Therapy Association. May/June 2004.

Keating J, Matyas TA, Bach TM. The Effect on training on Physical Therapist's Ability to Apply Specific Forces of Palpation. *Phys Ther.* 1993;73:38-46.

Levangie P, Bates A, Drips A, et al. Three tests of Sacroiliac Joint Dysfunction in Subjects With and Without Low-Back Pain. Paper presented at the National Conference APTA, Anaheim, California. June 1990.

Lipetz N, White S. Determination of Confidence Intervals for Detecting Rotational Asymmetry of the Pelvis. Unpublished study, 1990.

Mann M, Glasheen-Wray M, Nyberg R. Therapist Agreement for Palpation and Observation of Iliac Crest Heights. *Phys Ther*. 1984;64:334-338.

Marshall P, Murphy B. The Efeect of Sacroiliac Joint Manipulation on Feed-forward Activation Times of the Deep Abdominal Musculature. *J Manipulative Physiol Ther*. 2006 Mar-Apr; 29(3):196-202.

Olson L. Effects from the Hesch Method Pelvic Mobilization on Lumbar flexion, Straight Leg Raise Performance, and Standing Pelvic Inclination Angles in Patients With Low Back Pain. Chicago, Il: Finch University of Health Sciences/The Chicago Medical School; 1998, Thesis.

O'Sullivan PB, Beales DJ, Beetham JA, Cripps J, Graf F, Lin IB, Tucker B, Avery A. Altered Motor Control Strategies in Subjects with Sacroiliac Jopint Pain During Active Straight-leg-raise Test. *Spine* 2002 Jan 1;27(1):E1-8

Potter N, Rothstein J. Intertester Reliability for Selected Tests of the Sacroiliac Joint. *Phys Ther*. 1985;65:1671-1677.

Smith R, Sebastian B, Gajdosik R. Effect of Sacroiliac Mobilization on the Standing Position of the Pelvis in Healthy Men. *J Orto Sports Phys Ther*. 1988;10:77-84.

Stuber KJ. Specificity, sensitivity, and predictive values of clinical tests of the sacroiliac joint: a systematic review of the literature. *JCCA J Can Chiropr Assoc.* 2007 Mar; 51(1):30-41.

*The following Kraemer projects utilized the Hesch method of Evaluation and Treatment, even those in which "Hesch Method" is not specifically named in the title.

*Kraemer TJ. Hamstring Length, Lumbar Spinal Range of Motion, Pelvic Tilt, Pelvic Mobility, & Low Back Pain Among Racially Diverse Employees. World Confederation of Physical Therapy: Vancouver, BC. June 5, 2007.

*Olsen L, Kraemer TJ. Establishing the reliability of the Hesch Method™ spring and positional tests in patients with low back pain. World Confederation of Physical Therapy: Barcelona, Spain; June 8, 2003.

*Kraemer TJ. Sacroiliac Joint Dysfunction in Acute Low Back Pain Patients. American Pain Society; November 11, 1995.

*Kraemer TJ. Radiological Assessment of the SI Joint in Low Back Pain Patients. American Pain Society; November 11, 1995.

*Kraemer TJ. Use of McConnell Taping for SI Joint Dysfunction. American Pain Society; November 11, 1995.

*Kraemer, T & Heather Gamble. Hamstring length, lumbar spinal range, pelvic mobility, & low back pain in male power lifters: A pilot study. ATSU. 2007

*Establishing the reliability of the Hesch Method™ spring and positional tests in patients with low back pain. USF Grant. Funded. $2,500. Principal Investigator. 2003-2004

*Lumbopelvic Mobility & Back Pain among Certified Nursing Assistants. Sunshine ERC. USF Grant. Funded. $14,964. Principal Investigator. 2002-2003

*Factors associated with Low Back Pain among Racially Diverse University Employees. Institute of Black Life. USF Grant. Funded. $4,000. Principal Investigator. 2002-2003

*Work Related Factors and Back Pain in Certified Nursing Assistants. Sunshine ERC. USF Grant. Funded. $15,724. Principal Investigator. 2001-2002

*Effect Of Exercise On Lumbopelvic Motion. Touro University Nevada. 2008-2009

*Lumbopelvic Mobility as an Indicator of Low Back Pain and Hamstring Injuries in Collegiate Runners. National Athletic Trainers™ Association. Principal Investigator. 2007

*Hamstring length, lumbar spinal range, pelvic mobility, & low back pain in male power lifters: A pilot study. National Strength & Conditioning Association. Funding Initially Approved. Co-Investigator. 2006-2007

*Lumbopelvic Mobility as an Indicator of Low Back Pain and Hamstring Injuries in Collegiate Runners. National Athletic Trainers™ Association. Not Funded - Invitation for Complete Proposal by March 2007. Principal Investigator. 2006-2007

GENERAL SACROILIAC AND MANUAL THERAPY REFERENCES

Alderink G. The Sacroiliac Joint: Review of Anatomy, Mechanics and Function. *JOSPT*. 1991;13:71-84.

Beal MC. The Sacroiliac Problem: Review of Anatomy, Mechanics and Diagnosis. *JAOA*. 1982;81:73-85.

Bellamy N, Park W, Rooney PJ. What Do We Know About the Sacroiliac Joint? *Seminars in Arthritis Rheum*. 1983;12:282-313.

Bernard T. Sacroiliac Joint Injection. Presented at the First Interdisciplinary World Congress on Low Back Pain and Its Relation to the Sacroiliac Joint. November 5, 1992; San Diego, CA.

Breig A. Adverse Mechanical Tension in The Central Nervous System. Stockholm,Sweden: Almquist and Wiskell; 1972.

Buijs E, Visser L, Groen G. Sciatica and the sacroiliac joint: a forgotten concept. *Br J Anaesth*. 2007 Nov;99(5):713-6. Epub 2007 Sep 14**.**

Chaitow L. *Palpatory Literacy.* London: Thorsons; 1991;116, 123.

Cibulka M, Koldehoff R. Evaluation of Chronic Sacroiliac Dysfunction. *Clinical Mgmt in Phys Ther*. 1986;6:12-15.

Cibulka M, Rose S, Delitto A, et al. Hamstring Muscle Strain Treated by Mobilizing the Sacroiliac Joint. *Phys Ther*. 1986;66:1220-1223.

Cyriax J. Textbook of Orthopedic Medicine: Diagnosis of Soft Tissue Lesions. 7th. London:Bailliere Tindall; 1978:575-577.

Dreyfuss P, Dreyer SJ, Cole A, Mayo K. Sacroiliac Joint Pain. *J Am Acad Orthop Surg*. 2004 Jul-Aug;12(4):255-65.

DonTigny R. Anterior Dysfunction of the Sacroiliac Joint as a Major Factor in the Etiology of Idiopathic Low Back Pain Syndrome. *Phys Ther*. 1990;70:250-262.

DonTigny R. Dysfunction of the Sacroiliac Joint and its Treatment. *JOSPT*. 1979;1:23-35.

DonTigny R. Function and Pathomechanics of the Sacroiliac Joint. *Phys Ther*. 1985;65:35-44.

Erhard R, Bowling R. The Recognition and Management of the Pelvic Components of Low Back and Sciatica Pain. *Bull Ortho Section APTA*. 1978;2:4-14.

Foley BS, Buschbacher RM.Sacroiliac joint pain: anatomy, biomechanics, diagnosis, and treatment. *Am J Phys Med Rehabil.* 2006 Dec;5(12):997-1006.

Fryer G. Muscle Energy concepts - A need for change. *J Osteop Med*. 200;3(2):54-9.

Fryer G. (2011) Muscle energy technique: an evidence-informed approach. Int J Osteopathic Med, 14:3-9.

Letter to editor and reply, *Am J Phys Med Rehabil*. 2007 Dec;86(12):1032-3; author reply 1033

Goldwait JE. *Essentials of Body Mechanics.* London: Lippincott; 1952.

Greenman PE. *Principles of Manual Medicine.* Baltimore, MD: Williams & Wilkins; 1989:225-270.

Grieve G. The Sacroiliac Joint. *Physiotherapy.* 1976;62:384-400.

Grieve G. Modern Manual Therapy of the Vertebral Column. NY: Churchill Livingstone; 1986.

Hesch J. Manual Therapy for the Sternum. *Phys Ther Today*. 1989 Fall Issue 56-58.

Hesch J, Aisenbrey J, Guarino J. The Pitfalls Associated With Traditional Evaluation of Sacroiliac Dysfunction and Their Proposed Solution. Presented at Annual Conference of the American Physical Therapy Association, Anaheim, Ca June 25, 1990.

Hesch J. Manual Therapy Evaluation of the Pelvic Joints using Palpatory and Articular Spring Tests. Presented at the First Interdisciplinary World Congress on Low Back Pain and Its Relation to the Sacroiliac Joint; November 6, 1992; San Diego, CA.

Hesch J. The Hesch Method of Treating Sacroiliac Joint Dysfunction: An Integrated approach Advanced Workbook. Albuquerque: 1996

Hesch J. Evaluating Sacroiliac Joint Play with Spring Tests. J ObGyn PT. 1996;20:3 4-7.

Hesch J. Evaluation and Treatment of the Most Common Pattern of Sacroiliac Joint Dysfunction. In: *Movement, Stability & Low Back Pain: The Essential Role of the Pelvis.* Vleeming A, Mooney V, Dorman T, Snijders C, Stoeckart R, eds. London:Churchill Livingstone 1997: chap. 42.

Hesch J. Sacral Torsions About An Oblique Axis: A New Approach To An Old Problem. Book Chapter in review. June 2011.

Hoyt H, Bard D, Shaffer F. Experience With an Antigravity Leverage Device for Chronic Low Back Pain: A Clinical Study. *JAOA.* March 1981.

Kirkaldy-Willis WH. A More Precise Diagnosis for Low Back Pain. *Spine*. 1979;4:102-109.

Laslett M, Young SB, Aprill CN, McDonald B. Diagnosing Painful Sacroiliac Joints: A Validity Study of a McKenzie Evaluation and Sacroliliac Provocation Tests. *Aust J Physiother*. 2003;49(2):89-97.

Lee D. *The Pelvic Girdle.* NY: Churchill Livingstone; 1989.

Lee D, Walsh M. A Workbook of Manual Therapy for the Vertebral Column and Pelvic Girdle. British Colombia: Nacent Publishing; 1985.

Mitchell F, Moran P, Pruzzo N. An Evaluation and Treatment Manual of Osteopathic Muscle Energy Procedures. Valley Park, MO: ICEOP; 1979.

Mitchell F. Structural Pelvic Function. *Academy Applied Osteopathy,* 1958:72-90.

Nyberg R. Pelvic Girdle. In: Payton O, ed. *Manual of Physical Therapy.* New York: Churchill Livingstone; 1989:363-382.

Ongley M, Klein R, Dorman T, et al. A New Approach to the Treatment of Chronic Low Back Pain. *The Lancet.* July 18, 1987:143-146.

Paris S. *Introduction to Evaluation and Manipulation of the Spine*. St. Augustine: Institute of Graduate Physical Therapy; 1991:43, 51.

Porterfield J. The Sacroiliac Joint. In: Davis G, Gould J, eds. *Orthopedics and Sports Physical Therapy*. St Louis: CV Mosby; 1985:550-579.

Porterfield JA, DeRosa C. The Sacroiliac Joint. In: Davis G, Gould J, eds. *Orthopedic and Sports Physical Therapy*. 2nd ed. St Louis: Mosby-Yearbook; 1990:553-574.
Porterfield J, DeRosa C. Mechanical Low Back Pain: Perspectives in Functional Anatomy. Philadelphia: W.B. Saunders; 1991.

Richard R. *Osteopathic Lesions of the Sacrum.* NY: Thorsons Publ Co; 1986

Stoddard A. Manual of Osteopathic Technique. London: Hutchison Publ;1980.

Travell J, Simons D. *Myofascial Pain and Dysfunction: The Trigger Point Manual.* Baltimore, MD: Williams & Wilkins; 1983.

Vleeming A, Snijders CJ, Stoeckart R. Progress in Vertebral Column Research, First International Symposium on The Sacroiliac Joint: Its Role in Posture and Locomotion; April 27, 1991; Maastricht, The Netherlands.

Walker ML, Rothstein JM, Finucane SD, et al. Relationships Between Lumbar Lordosis, Pelvic Tilt, and Abdominal Muscle Performance. *Phys Ther*. 1987;67:512-516.

Walker JM: The Sacroiliac Joint. A Critical Review. *Phys Ther*. 1992;72:903-916.

Weksler N, Velan GJ, Semionov M, Gurevitch B, Klein M, Rozentsveig V, Rudich T. The role of sacroiliac joint dysfunction in the genesis of low back pain: the obvious is not always right. *Arch Orthop Trauma Surg.* 2007 Dec;127(10):885-8. Epub 2007 Sep 8.

Woerman A. Evaluation and Treatment of Dysfunction in the Lumbar-Pelvic-Hip Complex. In: Donatelli R, Wooden M, ed. *Orthopaedic Physical Therapy.* New York: Churchill Livingstone; 1989:403-484.

LEG LENGTH INEQUALITY

Beattie P, Isaacson K, Riddle D, et al. Validity of Derived Measurements of Leg-Length Differences Obtained by use of a Tape measure. *Phys Ther*. 1990;70:150-157.

Butler J. Short Leg Backache. *The J Lancet*. 1946;10-11.

Cibulka M, Koldehoff R. Leg Length Disparity and its Effects on Sacroiliac Joint Dysfunction. *Clin Mgmt in Phys Ther*. 1986;6:10-11.

Clarke GR. Unequal Leg Length: An Accurate Method of Detection and Some Clinical Results. *Rheum Phys Med J*. 1972;2:385-390.

Fisk JW, Baigent ML. Clinical and Radiological Assessment of Leg Length. *New Zealand Med J*. 1975;81:477-480.

Friberg O. Clinical Symptoms and Biomechanics of the Lumbar Spine and Hip Joint in Leg Length Inequality. *The Military Hospital 3*. Kouvola, Finland; 1983:643-651.

Friberg O. Clinical Symptoms and Biomechanics of Lumbar Spine and Hip Joint in Leg Length Inequality. *Spine*. 1983;8:643-650.

Giles LGF, Taylor JR. Low Back Pain Associated With Leg Length Inequality. *Spine*. 1981;6:510-521.

Giles LGF, Taylor J. Lumbar Spine Structural Changes Associated With Leg Length Inequality. *Spine*. 1982;7:159-162.

Gofton J, Trueman G. Studies in Osteoarthritis of the Hip: Part 2, Osteoarthritis of the Hip and Leg Length Disparity. *Can Med Assoc*. 1971;104:791.

Maex L. Postural Headache and Migraine. *Headache*. Jan 1967:204-207.

Rush W, Steiner H. A Study of Lower Extremity Length Inequality. *Am J Roentgen.* 1946;56:616-623.

Subotnick S. Limb Length Discrepancies of the Lower Extremity. *JOSPT*. 1981;3:11-16.

OTHER

Sacroiliac joint fusion case study: http://www.spineuniverse.com/professional/case-studies/sembrano/low-back-pain-due-sacroiliac-joint (cut and paste in browser). April 28, 2011.

Goode A, Hegedus EJ, Sizer P, et al. Three Dimensional Movements of the Sacroiliac Joints: A Systematic Review of the Literature and Assessment of Clinical Utility. *J Man Manip Ther*. 2008;16(1):25-38.

Huijbregts P. Sacroiliac joint dysfunction: evidence-based diagnosis. Feature Article of the Orthopedic Division of the Canadian Physical Therapy Association. May/June 2004.

Huijbregts P. Evidence-based diagnosis and treatment of the painful sacroiliac joint. *J Man Manip Ther*. 2008;16(3): 153–154.

Haussler KK, McGilvary KC, Aytuk UM, et al. Deformation of the equine pelvis in response to in vitro 3D sacroiliac joint loading. *Equine Vet J.* 2009;41(3):207-12.

Gregersen G, Lucas D. An in vivo study of the axial rotation of the human thoracolumbar spine. *J. Bone and Joint Surg.* 1967;49A2:247-262.

Ivanov AA., Kiapour A., Ebraheim NA., Goel V. Lumbar fusion leads to increases in angular motion and stress across sacroiliac joint: a finite element study. *Spine* . 2009;34(5):162-9.

Prather H, Hunt D. Sacroiliac joint problems. In: Guanche CA, ed. *Hip and Pelvis Injuries in Sports Medicine.* Philadelphia, PA: Lippincott Williams & Wilkins; 2010:200-206.

Clem A, DeStephano L, Devine W, et al. Glossary of Osteopathic Terminology Usage Guide. http://ww.AACOM.org ; 2006: accessed September 23, 2010.

Dar G., Khamis S., Peleg S., Masharawi Y., Steinberg N., Peled N., Latimer B., Hershkovitz I. Sacroiliac joint fusion and the implications for manual therapy diagnosis and treatment. *Man Ther*. 2008;13(2):155-8.

Flynn TW, Cleland JA., Whitman JM. Users Guide to Musculoskeletal Examination: Fundamentals for the Evidence-Based Clinician. Evidence in Motion; Buckner, NY: 2008:196-217.

Szadek KM, Hoogland PV, Zuurmond WW, de Lange JJ, Perez RS. Nociceptive nerve fibers in the sacroiliac joint in humans. *Reg Anesth Pain Med.* 2009;33(1):36-43.

MurakamiE, Tanaka Y, Aizwa T, et al. Effect of periarticular and intraarticular lidocaine injections for sacroiliac joint pain: prospective comparative study. *J Ortoped Science.* 2007;12:274-280.

Alicioglu B., Kartal O., Gurbuz H., Sut N. Symphysis pubis distance in adults: a retrospective computed tomography study. *Surg Radial Anat* 2008;30:153-157.

Okuda T; Fujita T; Kaneuji A; et al. Stage-specific sagittal spinopelvic alignment changes in osteoarthritis of the hip secondary to developmental hip dysplasia. *Spine*. 2007;32(26):816-819.

Cusi M. Paradigm for assessment and treatment of SIJ mechanical dysfunction. *Journal of Bodywork & Movement Therapies*. 2010:1-10.

Ivanov AA., Kiapour A., Ebraheim NA., Goel V. Lumbar fusion leads to increases in angular motion and stress across sacroiliac joint: a finite element study. *Spine* . 2009;1;34(5):162-9

Malghem J, Vande Berg B, Lecouvet F, Koutaissoff S, Maldague B. Principles of analysis for sacroiliac joints imaging. *JBR-BTR* 2007;90(5):358-67.

Indahl A, Kaigle A, Reikeras O, et al. sacroiliac joint involvement in activation of the porcine

spinal and gluteal musculature. *J Spin Disorders*. 1999;12(4):325-330.

Articles of value are being published all the time. Therefore, it is always wise to do a current literature search.

APPENDIX 1 – HOME EXERCISE PROGRAM

