The Pitfalls Associated with Traditional Evaluation of Sacroiliac Dysfunction and their Proposed Solutions

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INTRODUCTION

The purpose of this paper is to review traditional evaluation methods for sacroiliac (SI) joint dysfunction, point out potential problems with their use, and propose new methods of evaluation.

The SI joint seems to suffer more than any other part of the body, from inadequate definition when describing dysfunction. Too often SI dysfunction is named on the basis of gross motion tests which use multiple joints and large muscle groups. When evaluating the SI the distinction needs to be made between muscle problems, ligamentous sprains, hypo and hypermobilities, and boney malpositions. With regards to the SI there appears to be an adequate amount of gross motion and muscle tests, but an inadequate amount of ligamentous and accessory motion tests.

DYSFUNCTION

Sacroiliac joint dysfunction will be defined as a movement dysfunction of one pelvic bone in relation to another. It may singularly involve the sacrum or the ilium, or it may involve both ilia. Dysfunction may also be a combination of the sacrum with the ilium or the ilia. It is not uncommon for the symphysis pubis and lumbar spine to also be involved. Due to the functional interdependance of the sacrum and ilia, we believe it to be a rare event when only one pelvic bone is involved without causing dysfunction of the others. If the dysfunction is a hypomobility then there may be a general decrease, or loss of mobility in one or several directions, or it may be a loss in all directions. In this example one or several of the pelvic bones may have moved near to or at the end of the physiological range of motion and became stuck. Hypermobility may be an increase in mobility in one or several directions, or it may be an increase in all directions. Pain from the movement dysfunction may be secondary to muscle spasm and ligamentous tension. Referred pain can vary due to capsular and ligamentous innervation spanning from the second lumbar to the second sacral segments.[1,2] Due to the functional interdependance of the musculoskeletal system, and the fact that the pelvis is the hub of the body, and the large number of muscles that originate on the pelvis, SI dysfunction may contribute to proximal or distal biomechanical dysfunction.[3,4]

FUNCTION

The main function of the joint is to transfer body weight[5] and function as a tri-planar shock absorber.[6,7] Therefore the hypomobile joint will not dissipate shock and other structures will be stressed.[7] The hypermobile joint may create excessive ligamentous stress. The joint is a weightbearing structure that

accepts ground reaction forces in gait and upperbody weight in stance and sitting.[8,9] It is essentially a synovial joint having five of six synovial characteristics[10]: 1) It has a joint cavity with synovial fluid. 2) A capsule with an outer fibrous and inner synovial membrane. 3) Cartilage covering the joint surfaces. 4) Ligamentous connections. 5) Definite motion. Movement in the joint is no longer questionable.[10-29] In a single plane up to 2mm is normal, however, motion is tri-planar and the patient population may posess a much greater amount of mobility.

POSITIONAL TESTS

Physical Therapists and other health care practitioners use several tests to determine if ilium movement dysfunction is present. The current standard is to describe movement of boney landmarks in one,[30] or two,[31] or three planes.[32] We will use the example named Anterior Ilium Dysfunction in which the ilium moves on the sacrum and becomes stuck. When Anterior Ilium Dysfunction is present, the anterior superior iliac spine (ASIS) is described by some as moving inferiorly in a single plane,[30] by others as moving anteriorly and inferiorly in two planes,[7] and by others as being anterior, inferior and medial in three planes.[32] The posterior superior iliac spine (PSIS) will be superior, anterior, and lateral.[32] We believe that the tri-planar description is most appropriate. To ignore one plane in evaluation and treatment might perpetuate dysfunction.

Another positional test performed with the client standing is iliac crest height. Two authors are in general agreement on all landmark findings with Anterior Ilium Dysfunction except for Iliac crest height. One author palpates the iliac crest being positioned in front of the client, the other palpates from behind.[8,33] Could it be that one or both authors are missing the true crest?

Several studies have shown a low interrater reliability with iliac crest palpation in standing.[34,35] Instead of palpating the iliac crests in standing we suggest palpating the anterior and posterior shelves in prone and supine. The anterior iliac shelf is defined as the two inch portion of the ilium immediately above the ASIS. The anterior shelves are palpated in supine with digits in full extension. The posterior shelf is the portion of the ilium that is midway between midline of the spine and the most lateral part of the ilium. The posterior shelves are palpated in prone with extended digits first pressing into soft tissue and then inferiorly onto the ilia.

We believe that when biomechanical problems exist above and below the pelvis, the standing positional tests may render false information. Examples are: true[36] or functional leg length inequality, unilateral pronation[37] or supination, habit, posture, spasm[38] or muscle imbalance. We therefore try to minimize the

influence of the trunk and lower extremities by doing our positional tests in prone and supine. There is a high inter and intrarater agreement with positional tests in prone and supine.[39]

Some authors palpate the posterior superior iliac spines (PSIS's) to determine vertical relationships. The PSIS's are much closer than the ASIS's are to the true joint. Therefore, changes in PSIS position are more subtle than changes in the ASIS. We have found vertical and horizontal changes in the PSIS's to be quite subtle, while anterior and posterior changes are readily apparent in prone. Instead of using a single landmark to determine vertical changes, we utilize both the posterior iliac shelves and ischial tuberosities.

The sacrum is also palpated for position. Typically the sacral sulcus, single palpation of the sacral base, and the sacral inferior lateral angles are the only sacral landmarks palpated.[30,31] We define the sulcus as the depression that is measured digitally between the PSIS and the sacrum. We believe that a shallower or deeper sulcus is not diagnostic of sacral malposition. The change in the sulcus depth may reflect a change in sacral position, or of ilium position,[30] or a combination of sacrum with ilium or ilia. The inferior lateral angles are landmarks that might sometimes be uneven on a developmental basis. The use of only the sacral sulci, sacral base, and lateral angles may increase the margin of error. In order to reduce the margin of error, we palpate the sulci, inferior lateral angles, and repeatedly palpate the sacrum bilaterally at one and three centimeters from midline for a total of sixteen landmarks. We believe that this minimizes error and increases accuracy. If only a few of these landmarks are asymmetrical, the possibility of developmental asymmetry is given consideration. If many of the landmarks are asymmetrical, we have a greater confidence in implicating a positional asymmetry, and proceed to perform a spring test to assess joint mobility.

A split traction table that opens in the middle can be used to minimize positional artifact in changing clients from prone to supine. The client's anterior landmarks are palpated in supine and the therapist then lies on the shelf below to palpate the posterior landmarks, without changing the position of the client.

LUMBAR MOBILITY TESTS

Some clinicians observe the lumbar curve in neutral, flexion and hyperextension.[30,31] During these movements the motion response of the sacrum is noted by palpating the sacral inferior lateral angles. The lumbar spine is also evaluated via anteriorly directed spring tests.[30,31] All of these tests are used to correlate with a specific type of sacral dysfunction. We question the ability of these tests to interpret sacral dysfunction. Lumbar motion may give the impression of faulty sacral motion for the following reasons: 1) Lumbosacral facet asymmetry, which is very common,[40]

may change the motion of the sacrum. 2) A torsion of the ilium could change lumbar and sacral mechanics due to the ligamentous and muscular attachments. 3) Unilateral spasm may be enhanced with active lumbar motion. From a functional perspective these lumbar tests do seem useful however, in interpreting how the lumbar spine and sacrum work together.

RADIOGRAPHS

While radiographs appear to be objective, they are unable to visualize all three planes of the joint simultaneously. They do not correlate well with dissection, nor with CAT scans.[28,41] They often give the appearance of boney spurs or ankylosis which may not actually be present.[28,42] The normal intraarticular boney ridges and depressions may be misinterpreted as osteophytes (42). Radiographs seem to have a limited ability to demonstrate mechanical dysfunction. A view that includes the pubes may only show increased joint width and vertical changes, without accurately demonstrating rotary dysfunction.

GENERAL PELVIC MOBILITY TESTS

While all of the positional tests give information regarding positional asymmetry, they say nothing about movement dysfunction. The literature search revealed varied use of joint spring tests, with general mobility tests being more commonly used. The standing flexion test, a general mobility test is performed by palpating the shelves beneath the PSIS's while the client flexes his trunk. If one PSIS rises more than the other PSIS, the same sided ilium or lower extremity is theoretically limiting the mobility of the SI. The sitting flexion test is very similar except that trunk flexion is performed in sitting. In seated flexion if one PSIS rises more than the other than the sacrum or spine is theoretically limiting mobility at the ipsilateral SI joint. While these tests are correlated with other tests before implicating the SI joint as being dysfunctional, we cannot help but question the validity of these procedures. To our knowledge no research has proven that these tests actually measure SI joint motion. These tests use large muscle groups that span multiple joints. While there is poor to fair inter and intrarater reliability with these tests, the validity has yet to be established.[34,43]

Another general mobility test is the long sitting test. The leg lengths are assessed in supine, and as the client comes up to long sitting a change in leg length is noted.[44] One study shows a fairly good correlation of this test with palpation of PSIS's height in standing and with a positive standing flexion test, however, the validity of all of these test procedures is in question. Furthermore, another study shows low intertester reliability.[34]

JOINT SPRING TESTS

If one of the main functions of the SI is to absorb shock,[6,7] then an important test would be one that measures the ability of the joint to absorb shock. We believe that specific joint spring tests may be effective in measuring this. We utilize twenty different joint spring tests to measure multidirectional mobility and stability in the SI joint and symphysis pubis.[32] The quality of movement is noted and is rated as hypomobile, normal or hypermobile. The movement may be further clarified by describing it as mildly, moderately, or significantly hyper or hypomobile. Pain response is also noted with spring testing.

The spring tests are performed on one side and then the other unless specified otherwise. Spring tests are always utilized, even in the presense of a symmetrical pelvis. Firm pressure is applied to the part being tested with as much contact as possible. The slack is taken out of the joint before applying the spring test. The spring test should therefore test actual joint mobility, not surrounding soft tissue extensibility. The spring tests are as follows:

SUPINE

1) **POSTERIOR ROTATION OF THE ILIUM.** Stabilize both anterior ilia with open hands in the region of the ASIS's and above. Induce a posterior rotary force on one side and then the other.
2) **COMPRESSION TEST.** Compress both ilia medially with hands on the lateral border of the pelvis just above the ASIS's.
3) **DISTRACTION TEST.** Apply posterolateral force on both anterior ilia with heels of hands just medial to the ASIS's.
4) **INFERIOR STRESS TEST.** Push inferiorly on each iliac crest.
5) **POSTERIOR SPRING TEST TO PUBIC BONES.*** With thumb pads on the pubic tuburcles apply a posterior force, one side at a time.
6) **INFERIOR SPRING TEST TO PUBES.*** With thumb pads on pubic crests apply an inferiorly directed force to each pubic bone.
7) **SUPERIOR SPRING TEST TO PUBES.*** With heel of hand on pube bone apply superior force. An alternate technique is to apply a postero-superior force at a fourty five degree angle and to "subtract" the posterior component which was tested earlier (see #5).
8) **SYMPHYSIS DISTRACTION TEST.*** With heels of hands on most lateral portion of pubes and inferior ilia, apply a lateral force on both sides at the same time.

PRONE

9) **SUPERIOR STRESS TEST TO ILIUM.** Apply superior force at ischial tuberosity.
10) **ANTERIOR ROTATION OF ILIUM.** With heels of hands at superior ilia above the PSIS's, apply an anterior rotary force.

11) **SACRAL ROTATION.** With heel of hand at first, second and third sacral segments on the right apply a left rotary force by pressing anteriorly. Then test right rotation by pressing anteriorly on the left side at the first three sacral segments.
12) **SACRAL FORWARD BENDING.** With heel of hand above the second sacral segments (on sacrum above the level of the PSIS's) apply an anterior rotary force.
13) **SACRAL BACKWARD BENDING.** With heel of hand at lower sacrum (S3 or below) apply an anterior rotaty force.
14) **SACRAL DEPRESSION.** With heel of hand apply an anterior force at the second sacral segment (level of PSIS's). This evaluates gross laxity if the sacrum should appear to "sink into the pelvis".
15) **SUPERIOR MOBILITY OF THE SACRUM.** With palmar contact on the sacrum apply a superiorly directed force.
16) **INFERIOR MOBILITY OF THE SACRUM.** With palmar contact on the sacrum, apply an inferior force.
17) **SACRAL SIDEBENDING.** With ulnar border of the hand on the right sacral inferior lateral angle apply a superiorly directed force. Repeat on the other side.
18) **LATERAL MOBILITY OF THE ILIA.** With flat hand stabilizing sacrum with anterior pressure, apply a lateral and slightly anterior force on the ilium just lateral to the PSIS. Repeat on the other side.
19) **PUBIC DISTRACTION.*** Apply a lateral force simultaneously at both medial inferior ischia.
20) **PUBIC COMPRESSION.*** With heels of hands on lateral inferior ischia, apply a medial force bilaterally.

* Due to potential modesty it is suggested that patients be fully informed of the nature and purpose of the tests, be fully clothed, perhaps even with a towel draped over the region to further "impersonalize" the test. Use of a skeletal model is suggested as well as the presense of an assistant of same sex as client. The explanation of the functional interdependance between the symphysis pubis, sacroiliac and lumbosacral region is suggested.

CONCLUSION

We believe that confidence and accuracy can be enhanced by using the proposed methods of evaluation. There is a significant need for research on traditional evaluation methods and on the methods we propose. While research is in progress, we must be aware of both what is known and what is not known regarding the sacroiliac joint. In spite of a limited amount of research we must not ignore the joint, we must instead strive for better methods of evaluation and treatment and contribute to the body of research.

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