VALIDITY AND RELIABILITY OF CLINICAL TESTS FOR THE SACROILIAC JOINT

A Review of the Literature

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Abstract:
Background: The sacroiliac joint (SIJ) can be a source of low back pain. The complexity of the system involving the SIJ and the varied SIJ pain referral pattern makes it difficult to clinically assess SIJ dysfunction. Despite the emergence of detail of the SIJ complex, the basis of the clinical tests has not been thoroughly investigated.
Objective: To review the literature from the last decade dealing with the validity and reliability of clinical tests for SIJ dysfunction in order to determine which tests are reliable and valid.
Discussion: For clinical tests with multiple studies, there was agreement on reliability for Gaenslens, Thigh Thrust test, Finger Point test and SIJ Pain Mapping and agreement on validity for Thigh Thrust test. However, Gillets Test, Patrick's FABER and Sacral Thrust/Compression were considered invalid and unreliable, although these results may have been influenced by methodological shortcomings. Examination of the entire SIJ complex may mean that a series of tests are required.

Key Words: Sacroiliac joint, reliability, validity, clinical tests.

INTRODUCTION

There is little doubt that the sacroiliac joint (SIJ) can be a source of low back pain. Fortin et al[1] injected contrast medium into the SIJ's of asymptomatic volunteers. This resulted in the development of pain around the SIJ with a varied referral into the buttock and thigh. Vleeming et al.[2] suggested that pain in the area of the SIJ may be related to a failure in the system controlling the transfer of load through the SIJ as opposed to the pain being due to a local problem in the joint itself. The complexity of the system involving the SIJ and the varied SIJ pain referral pattern makes it difficult to clinically assess SIJ dysfunction.

There are two types of clinical tests used by practitioners in the assessment of SIJ dysfunction - : motion palpation which assesses the movement of the SIJ or position of relevant landmarks; and the pain provocation which stresses the SIJ with the aim of reproducing the patient's symptoms[3]. However, both motion palpation[4] and pain provocation[5] tests appear questionable with respect to their validity and reliability. Motion palpation tests rely on the detection of SIJ movement which is difficult as movement is limited to around 2.5 degrees[6]. In addition, the application of these tests requires palpation of relevant landmarks which vary in anatomy. These landmarks must be palpated through soft tissue and are influenced by soft tissue tension which may lead to palpatory illusion[7]. Furthermore, asymmetrical SIJ motion may actually be a normal finding due to anatomical variations of the right and left SIJs[4]. Pain provocation tests not only stress the SIJ but also stress the lumbar spine, hips and soft tissues over the SIJ. Vleeming et al.[8] suggests that pain in the region of the long dorsal sacroiliac ligament (LDSL) could indicate a spinal condition with sustained counter-nutation of the sacrum. However, pain not exclusively along the LDSL but with associated buttock pain could result directly from the SIJ.

Oldreive's[9] review on tests for the SIJ revealed that validity and reliability of many individual SIJ tests was poor with varying accounts of signs, symptoms and definitions of positive results used. The author concluded that greater precision and standardisation of definitions for positive results would be required. An earlier review by Walker[4] suggested that tests which are used to determine SIJ motion are questionable and that some support exists for the use of pain provocation tests. These results pose a challenge to the continued use of these tests by clinicians and in tertiary education programs[3]. However, clinicians endeavour to continue to identify a dysfunctional SIJ in order to apply appropriate treatment.

This review will examine the literature on clinical tests for the SIJ over the last decade in an attempt to understand which tests have reliability and validity.

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ANATOMICAL CONSIDERATIONS OF THE SIJ COMPLEX

The SIJ complex, which includes joints and soft tissues, functions to transmit forces from the spine to the lower extremities and vice versa. The biomechanics of the SIJ are controlled by the size and structure of the articular surfaces, several large ligaments and numerous surrounding muscles. Importantly, the function of these soft tissue and bony structures act to increase stability of the pelvic ring and minimise SIJ movement[3].

The latissimus dorsi, posterior layer of the thoraco-lumbar fascia and contralateral gluteus maximus act to stabilise the SIJ. The erector spinae may also have a role by creating increased tension in the deep lamina of the posterior layer of the thoraco-lumbar fascia.[2]

Both the biceps femoris and gluteus maximus muscles attach to the sacrotuberous ligament which functionally bridges the SIJ. The fascia of the gluteus maximus is also connected to the LDSL which in turn is connected to the deep lamina of the posterior layer of the thoraco-lumbar fascia and the aponeurosis of the erector spinae muscle including the multifidus. The LDSL is tensed when the sacrum is counternutated aiding in control and slackened when nutated. During nutation both erector spinae muscles and sacrotuberous ligament can counterbalance the slackening of the LDSL.[8]

Barker & Briggs[10] reported that the posterior layer of the thoraco-lumbar fascia extended as superiorly as the rhomboids and splenius muscles. These authors also suggested that the role of the posterior layer may include stabilisation of the back across multiple segments between SIJ to the skull. They suggest that tension in the fascia may be controlled specifically at each segment by muscle activity, for instance, the deep abdominal muscles and multifidus. Therefore, the posterior layer of the thoraco-lumbar fascia may be tensioned in tests involving movement of the spine, head and limbs. Additionally, the extensive distribution of the posterior layer may play a proprioceptive role in preventing injury as it is ideally positioned to receive feedback from many structures and may regulate ligamentous tension via its extensive muscular attachments[10].

DISCUSSION

Twenty-eight clinical tests were identified. Considering the large number of tests, there are very few studies examining their validity and reliability. Indeed, eighteen of the twenty-eight tests are considered in only one study. A description of each clinical test as described in the studies is presented in Appendix 1.

In general, there is a paucity of research on the validity and reliability of clinical tests for the SIJ, with many tests being examined by only one study and considered unreliable and invalid. For clinical tests with multiple studies, there was agreement on reliability for Gaenslens[11,12], Thigh Thrust test[11,12], Finger Point test[11,13] and SIJ Pain Mapping[1,11] and agreement on validity for Thigh Thrust test[14,15]. However, Gillets Test[11,16,17], Patrick's FABER[11,18-21] and Sacral Thrust/ Compression[11,12,18-20] were considered invalid and unreliable.

The results provide little support for many tests. However, a number of factors which may have influenced these results have been suggested by the researchers. These include methodological quality, technique application, use of 'gold standards' and VAS pain parameters. Van der Wurff et al.[22,23] conducted a methodological review including many of these studies. With regard to validity, they stated "the overall negative conclusion of this review can be attributed to the inappropriate design of the studies included"[22]. In contrast, their conclusion on the methodological quality of the reliability studies was sufficient to confirm the negative conclusion of the authors[23].

Nevertheless, there are concerns that tests may not have been executed in a standardised and experienced manner. Clear examples of the lack of standardisation of tests are evidenced by the varying descriptions of the Patrick's FABER test, Gillet's test, Finger Point test, SI Pain Mapping and Standing Forward Flexion test used in these studies (see Appendix 1.). In addition, Strender et al.[20] examined the interexaminer reliability between physicians and physiotherapists and concluded that testing procedures between the professions were variable. Laslett & Williams[12] minimised differences in examination technique by providing several training sessions. In contrast, Dreyfuss et al.[11] had an expert panel select the tests for study and it was not described how the examiners were trained in these tests. Lewit & Rosina[24] highlighted a number of areas where the execution of tests may be made more reliable through improved palpation, springing, and simplification of testing procedures. The use of multiple tests in succession may influence the results of subsequent tests. For instance, Dreyfuss et al.[11] had each patient examined independently and sequentially by a physician and a chiropractor using 12 tests. Meijne et al.[17] suggested that possible errors encountered whilst executing Gillets test may be due to subjects not raising their legs equally on both sides.

The acceptance of anaesthetic block as a 'gold standard' is considered questionable by van der Wurff et al.[22], Dreyfuss et al.[25], Maigne et al.[18] and Broadhurst & Bond[14]. Their concern is that the technique only investigates intra-articular sources of pain and not that of the whole SIJ and that there is no certainty that the block affects all parts of

the joint capsule. In addition, the needle may pass through extra articular structures which may be a source of pain and may actually increase the level of pain[1]. Associated with the 'gold standard' is the use of various cut-off points for determining whether the block is successful. The VAS cut off points varied from 70%[14] through to 90%[11]. A cut-off as close as possible to 100% should be used[22].

It appears that a lack of knowledge about the anatomy, function and pathophysiologic mechanisms of the SIJ may have contributed to the development of numerous clinical tests. However, despite the emergence of detail of the SIJ complex where the SIJ is considered stable, and significant control is supplied by the ligaments and muscles surrounding it, the basis of these tests has not been examined.

It is generally accepted that SIJ movement is minimal. However, motion tests demonstrate larger movements which probably results from palpatory illusion created by soft tissue tension. It may be appropriate to abandon the concept of motion palpation tests for the SIJ and describe them as tests of dynamic control of the SIJ complex. As many soft tissues are involved in the control of the SIJ complex, existing tests may engage so many of these tissues that it is difficult to identify the dysfunctional ones. For instance, an explanation for the poor reliability of the Gillet's test may be that it tests most elements of the SIJ complex as it engages the SIJs bilaterally[26]. To simplify the test, Lewit & Rosina[24] suggest that rather than lifting the knee towards the chest, keep the foot on the ground and let the hip drop. They believe the same mechanics occur, however the subject tends to be more stable and contraction of surrounding tissues is reduced.

In support of the role of the soft tissues, it appears that adjustment of the SIJ creates a change in soft tissues rather than creating a change in the SIJ position. Tullberg et al.[27] applied manipulation to the SIJ and demonstrated no change in sacrum/ilium alignment. However, prior positive clinical test results became negative suggesting the changes occur in the soft tissue and postural neuromuscular reflex patterns. In addition, SIJ manipulation results in an immediate reflex increase in EMG activity in the gluteals, erector spinae, latissimus dorsi, trapezius, deltoid and splenius muscles which may inhibit hypertonic muscles and increase functional ability[28]. This suggests that the outcome of SIJ adjustment may be considered to be due to the effects of a 'neurological shotgun blast' rather than a specific change in the biomechanics of the SIJ. The soft tissues are also implicated in asymptomatic subjects who demonstrate positive clinical tests. It has been suggested that these test results may be due to soft tissue and neuromuscular functional adaptations[29] or changes in the lumbar-hip-pelvis complex[25].

Importantly, a greater understanding of the clinical tests is required taking into consideration the entire SIJ complex and not just the SIJ. This may mean that a series of tests are required:

- to rule out articular dysfunction in joints surrounding the SIJ.
- to identify the source of pain.
- to examine the dynamic components of the SIJ complex.

An example of a test series is:

- Finger Point Test to identify pain arising from or related to the SIJ.
- Straight leg raise to examine biceps femoris tension which may influence sacrotuberous ligament tension.
- Palpation of long dorsal sacroiliac ligament which may be inflamed with sustained sacral counternutation.
- Hip internal rotation asymmetry may indicate piriformis hypertonicity which results in sustained force closure of the SIJ.
- Iliac crest tension test may indicate increased thoracolumbar fascia tension again resulting in greater force closure or dysfunctional force closure.
- Gaenslens to stress the anterior SIJ ligaments and capsule.
- Thigh thrust test to stress posterior SIJ ligaments and capsule.

CONCLUSION

There was agreement on reliability for Gaenslens, Thigh Thrust test, Finger Point test and SIJ Pain Mapping and agreement on validity for Thigh Thrust test. Gillets Test, Patrick's FABER and Sacral Thrust/Compression were considered invalid and unreliable.

Generally, there is little support for many tests. However, the study results may have been influenced by low methodological quality, execution of tests in a non standard and inexperienced manner and results compared against a questionable 'gold standard' of intra-articular SIJ injection. Clearly, future research in this area must address these issues.

Despite the emergence of literature detailing the SIJ complex, where the SIJ is considered stable and significant control is supplied by the ligaments and muscles surrounding it, the basis of the clinical tests has not been examined. Consideration of the entire SIJ complex may mean that a series of tests are required, some to rule out articular dysfunction in joints surrounding the SIJ, some to examine the dynamic components of the SIJ complex and others to identify the source of pain. In addition, it may be appropriate to abandon the concept of motion palpation tests for the SIJ and describe them as tests of dynamic control of the SIJ complex.

SUMMARY OF IMPORTANT POINTS

- Numerous clinical tests have been developed but the bases of these tests have not been examined despite the emergence of literature detailing the SIJ complex where the SIJ is considered stable and significant control is supplied by the surrounding ligaments and muscles.
- For clinical tests with multiple studies, there was agreement on reliability for Gaenslens, Thigh Thrust test, Finger Point test and SIJ Pain Mapping and agreement on validity for Thigh Thrust test. Gillets Test, Patrick's FABER and Sacral Thrust/Compression were considered invalid and unreliable.
- The test results appear to have been influenced by varied methodological quality, technique application, use of 'gold standards' and VAS pain parameters ie. tests may not have been executed in a standardised and experienced manner.
- In consideration of the entire SIJ complex, a series of tests may be required:
  - to rule out articular dysfunction in joints surrounding the SIJ
  - to identify the source of pain
  - to examine the dynamic components of the SIJ complex.

APPENDIX 1. TEST DESCRIPTIONS
Pain Provocation Tests

Cranial Shear	Subject is supine and a pressure is applied to the coccygeal end of the sacrum, directed cranially. The ilium is held immobile through the hip joint as the examiner holds the leg firmly with a counter pressure in the form of a traction force directed caudad.
Gaenslen's Test	Subject is supine with one hip and knee flexed and the other hip extended. Then overpressure is applied. There was no description as to whether the overpressure was applied to both limbs or only to the flexed limb and Slipman et al.[19] provided no description of the test.
Gapping or Distraction Test	Subject is supine and pressure is applied to the anterior superior iliac spine directed posteriorly and laterally.
Iliac Compression	Subject is side-lying facing away from the examiner and downward pressure is applied to the upper most iliac crest.
Patrick's FABER	This test has a varied description. Broadhurst & Bond[14] and Dreyfuss et al.[11] describe the test simply as flexion, abduction and external rotation of the hip. Maigne et al.[18] describes the test as the subject is supine, one leg flexed so the heel is on opposite knee, movement is passively reinforced by the examiner pressing on the flexed knee. Strender et al.[20] describes the test as subject is supine, foot on opposite knee and lowered to the table, the hand of examiner placed on opposite iliac spine to hold it in position, at the end point of the range of motion the hip is slightly extended. Van Deursen et al.[21] describes the test as the subject is supine, one leg flexed so that ipsilateral heel is next to the opposite knee, the subject is asked to press the flexed knee outwards and the movement is passively enforced by the examiner.
Pubic Symphysis Springing	Pressure applied directly on the pubic symphysis.

Resisted Hip Abduction	Subject is supine with the leg fully extended and abducted to 30 degrees. The examiner contacts the ankle and pushes medially as the subject pushes laterally.
Resisted Hip External Rotation	Subject is prone and resistance to external rotation of the hip is applied.
Sacral Sulcus Tenderness	Tenderness on palpation is present immediately medial to the posterior superior iliac spine.
Sacral Thrust/Compression	Subject is prone and a thrust is applied to the sacrum in an anterior direction. However, the point of contact on the sacrum varied amongst the authors and there was no description as to whether a single thrust or multiple thrusts (springing) were applied.
Standing Extension	Not described.
Thigh Thrust	Subject is supine, the hip is flexed to 90 degrees and the knee flexed and a posterior shearing stress is applied along the line of the femur. Examiner position is variously described as ipsilateral and contralateral to the side tested. Broadhurst & Bond [14] use hip adduction to the midline where Laslett & Williams[12] notes that excessive adduction is to be avoided due to discomfort.
Yeoman's Test	Not described.

Mobility Tests

Flexion-adduction Hip	Described as testing for restriction in hip flexion and adduction due to the supposed reflex shortening of the gluteus maximus and piriformis muscles in response to SIJ restriction.
Gillet Test	Meijne et al.[17] provided a detailed description. The subject stands on a footplate with the examiner seated behind, the first set of thumb contacts is applied, the subject slowly raises the contralateral leg with knee flexed, then raises the homolateral leg with the knee flexed. This process is repeated using the other seven thumb contacts. The thumb contacts are L5 spinous process and PSIS, S1 spinous process and PSIS, S3 spinous process and PSIS and hiatus sacralis and caudolateral to hiatus sacralis beneath the ischial spine. All contacts are duplicated on the left and right sides. SIJ restriction exists if: the lateral thumb moves in conjunction with the other thumb, and does not move downward in relation to the other thumb; or if the lateral thumb moves upward relative to the other thumb. Dreyfuss et al.[11] used an abbreviated technique. The subject stands with feet 12 inches apart, the examiner sits behind and palpates S2 spinous process with one thumb and PSIS with other, the subject flexes the hip and knee on test side, as if taking large marching step. A positive result is determined if the thumb on the PSIS fails to move posterior-inferior with respect to the thumb on S2.

Hip Internal Rotation	Subject is supine with the hip and knee in 90 degrees flexion and the hip is internally rotated. Decreased range and/or asymmetry is considered a positive result.
Iliac Crest Tissue Tension Test	The practitioner stands behind the subject with both hands anchored on the posterior iliac crests. The subject turns their head as far possible to one side, then to the other. When maximum rotation to one side is reached, the hand on that side rises thereby creating a 'pelvic distortion'. This change in hand position is not present when the SIJ is hypomobile.
Lateroflexion Test	The subject is standing with the examiner seated behind with both thumbs on the subject's two Posterior Superior Iliac Spines. The subject bends to one side and the examiner determines whether the PSIS on the convex side lowers and whether it is lower at the end of the movement which is considered normal.
Patrick's FABER	See the descriptions under Pain Provocation Tests.
Sitting Forward Flexion	Not described.
Spine Test	The subject is standing with the examiner seated behind with one thumb on the PSIS and the other on the crista sacralis mediana at the same level. The subject performs a maximal knee flexion on the side of palpated PSIS, while keeping both feet on the floor. The ilium should move downward and rotate slightly in a dorsal direction. The angle between the body axis and the line through the examiner's thumbs should become greater than the original 90 degrees.
Standing Forward Flexion	Van Deursen et al.[21] described the test as the examiner sits behind the subject with the thumbs on the subject's two PSIS, the subject bends forward slowly as far as possible. A positive result for SIJ restriction is evidenced by one thumb being perceived as starting to move before the other and at the end of movement this thumb is found to be in a higher position than the other and remains there. Egan et al.[29] described the test similarly, but required the test to be performed at least three times and considered a positive result to be demonstrated by unequal excursion of the two PSIS.
Supine to Sitting	Not described.
Thigh Thrust SI Motion	Subject is supine with both the hip and knee of the side being tested are flexed just over 90 degrees. The examiner uses one hand to exert a force through the femur with short impulses in an axial and slightly adducted direction while the other hand palpates the SI joint groove and assesses the SI joint mobility.

Unilateral Hip Rotation	Subject is prone, a strap is used over the PSISs to prevent pelvic movement, the untested leg is abducted approximately 30 degrees, the test leg is not abducted but the knee is flexed to 90 degrees and passive external and internal rotation was conducted to ascertain ROM measurements. Passive ROM is stopped when a firm feeling of resistance is felt. Significantly greater external hip rotation than internal rotation unilaterally is indicative of SIJ dysfunction.

Passive Assessment

Angle of Innominate Torsion	The ASIS and PSIS heights are measured bilaterally using a horizontal arm of a pedestal mounted post. The degree of innominate torsion is determined as the absolute difference between the difference in the right PSIS and ASIS heights and the difference in the left PSIS and ASIS heights.
Finger Point Test	Fortin & Falco[13] asked the subjects with low back pain to point to the region of pain using one finger. A positive result was obtained when the subject could localise the pain with one finger in an area immediately inferomedially to the PSIS within 1 cm. And the subject consistently pointed to the same area over at least two trials. Dreyfuss et al.[11] considered a positive result when the subject pointed to within 2 measured inches of the PSIS to indicate the site of maximal pain.
SI Pain Mapping	Fortin et al.[1] had subjects complete a pain distribution diagram for their low back pain. These were compared with a previously determined SIJ pain referral map established using normal volunteers. A positive result was determined based on the following criteria: ▪ Point of maximal discomfort found to be within the referral zone of the pain referral map. ▪ Pain distribution consistent with the pain radiating through a 3 x 10 cm vertical area just inferior to the PSIS. ▪ Pain distributed predominantly to one side of the midline consistent with the pain referral map. ▪ Bilateral pain that could be determined to be asymmetric. Dreyfuss et al.[11] considered a positive result to be a subject drawing a pain diagram depicting pain over the sacroiliac joint.
Sitting with Partial Elevation of Buttock	The subject sits with partial elevation from the chair of the buttock on the affected side.

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