

Differential diagnosis of SIJ and pelvic motor control issues

Trish Wisbey-Roth
 Specialist Sports Physiotherapist (FACP).
 Masters Sports Physio. (AIS/UC)
 Active Rehabilitation Consultant ; FSMA

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Incidence of low back pain.

- 85% of people experience Low back pain (LBP) in life.
- 5% become chronic and unremitting.
- 70% have recurrent back problems.

(Garofalo and Polatin 1999)



Approx. 20% of chronic LBP patients have SIJ intra articular surfaces as a pain generator.

(Schwarzer et al 1995)



Functional Integration Module

(Lee & Vleeming 1998)

Form Closure
Bones, joints, ligaments



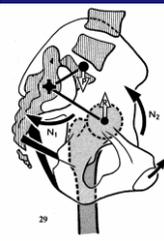
Force closure
Muscles, fasciae

FUNCTION

Motor control
Neural recruiting patterns



Emotions
Awareness



Kapanji 1979

SIJ passive movement amplitude.

- Research shows SIJ movt both possible and essential for shock absorption during wt bearing. (Sturesson et al 1999, Hungerford 2001).
- Quantity of movt reflects a wide anatomical variance. Angular motion is small by Sturesson et al 1999 (1-4 degrees), larger by Hungerford 2001(average 7 degrees).
- This movt. is coupled with a small amount of linear translation, approx 2mm by Sturesson et al in 1999.



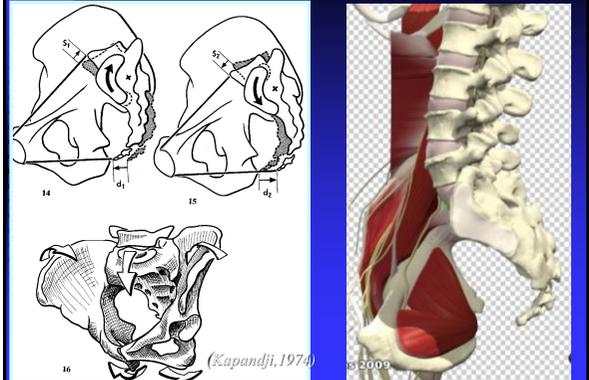
Stiffness values of the SIJ.

- The SIJ moves a little bit and varies between individuals.
- High variation in stiffness values in both symptomatic and asymptomatic population with colour doplar *(Buyruk et al 1997)*.
- Symptomatic subjects had different stiffness values for left and right SIJ. Manual testing should look at resistance of the joint to the applied force and how symmetrical the SIJ's are.

When is the SIJ most stable - Nutation.

- Sacral nutation (bilateral movement anterior of sacral promontory) occurs in sit to stand. Full nutation occurs during forward and backward bending of the trunk (Sturesson et al 1999).
- This movt tightens the major ligaments of the posterior pelvis and increases compressive force.
- Muscles also attach to lig therefore can increase their tension. (Lee,2001)

Biomechanics of the SIJ.



Stork Test SIJ movement in normals.

- Post rotation of both innominates relative to sacrum.
- Mean of 7° on non wt. bearing and 1.2° on weight bearing side.
- Contralateral coupling of Sacrum (Hungerford 2004).

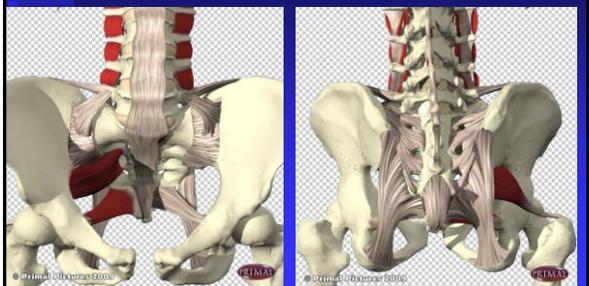
Why the difference in weight bearing?

- On the side of the hip flexion decompression of the SIJ occurs with lateral gapping of ilium away from sacrum.
- On stance leg – some glide happens in SIJ however combined with joint compression provided by Glut Max and synergistic stabilisers, locking / stabilising the SIJ (Hungerford 2004).

When is the SIJ most unstable – Counter nutation.

- Long dorsal SIJ lig is the main restraint to counter nutation of the sacrum or anterior rotation of the innominate (Vleeming 1998).
- Counter nutation is a relatively less stable position of the pelvis to resist horizontal or vertical loads.
- In counter nutation the SIJ is under less compression and is not self locked (Lee, 2001).

Iliolumbar, long dorsal SIJ and sacro-tuberous ligaments.



SIJ stability – A factor of compression.

- SIJ stability is not about amplitude of movement but how well the movement is controlled.
- When motion control is inadequate (too much or too little compression of joint surfaces), the resultant proprioceptive input is distorted.
- This proprioceptive input sustains an ineffective muscle recruitment pattern. (Lee; 2001)

The influence of muscles on SIJ Form closure (i.e. Force closure).

- Optimal SIJ function requires adequate and appropriately timed compression and release of the SIJ.
- With effective recruitment of the deep stabilising muscles, stiffness of the SIJ in testing should increase.

Dysfunctional mm recruitment in posterior pelvic pain.

- Internal Oblique & L/S Multifidus no longer feed forward on painful side, delayed bilaterally (CNS Changes).
- Glut Max. delayed on symptomatic side and increased tonicity of biceps femoris bilaterally.
- Above muscle action happens simultaneously with altered intra-pelvic motion. (Hungerford 2003).

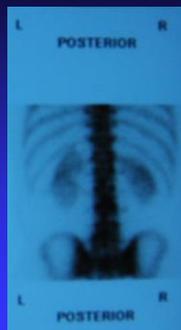
Failure of load transfer through the SIJ.

- Changes to joint compression alters muscle recruitment pattern (O'Sullivan 2002).
- Failure of passive structures may make optimal dynamic function unachievable, without medical intervention (Cusi, Saunders, Hungerford and Wisbey-Roth 2007)
- Diagnosed on the basis of history, clinical examination, diagnostic injections and imaging studies.



Causes of excessive compression.

- Fusion via systemic issues
- Capsular fibrosis (MVA, sport, old injury – pain often develops on opposite side of fixation).
- Overactive muscles (Superficial and deep gluteals, latissimus dorsi, pubococcygeus, iliacus, hamstrings, multifidus).



Bone scan of L/S and SIJ

Systemic influences.

- Ankylosing Spondylitis - first sign is sacroilitis.
- Psoriatic Arthritis – Always question about noticeable lesions of the skin.
- Visceral referred pain from Bowel, Uterus (particularly endometriosis), Ovaries.
- Tumours - Benign and malignant, Soft tissue or boney, Intra or extra articular.

 **Diagnosing primary SIJ dysfunction.**

Only 3 biomechanical problems occur at the SIJ:-

- > Movement is decreased, bilaterally or unilaterally (may be associated with inflammatory signs).
- > The movement available at the joint is poorly controlled or excessive (bilaterally or unilaterally).
- > Excessive articular compression with underlying instability. Occurs from trauma with subsequent muscle spasm compressing the joint. Causes marked asymmetry of the pelvic girdle. (Lee, 2001)

Clinical presentation and physical assessment of the SIJ and pelvis.

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A) History

- Typical presenting symptom is Low back pain (Vleeming, 2008; Merskey & Bogduk 1999).
- Pain maps: region of the SIJ to the superior surfaces of L5 area. Overlying area of the SIJ, buttocks, posterior thigh and lower leg to ankle (Vleeming, 2008; Merskey & Bogduk 1999).
- Evidence distribution posterior leg to ankle without frank neural compression, reflex changes or frank weakness (Fortin et al, 1994; 2003).
- May complain of deep pelvic clicking and giving way.

History

- Pain recurrent, due to trivial actions of bending twisting.
- Initial episode during/soon after pregnancy or trauma e.g. Fall, MVA or transverse pelvic 'crushing' type injury (Cusi, Saunders et al 2008, Cusi et al 2013).
- Increased pain with increased load e.g. sit, stand, stairs, difficulty weight bearing through one leg.
- Difficulties turning in bed and changes in bladder habits common (Cusi 2010).



Common clinical examination features

- Buttock pain (+/- radiation to thigh)
- "Hip" pain (lateral buttock to trochanter)
- Trochanteric pain (+/- bursitis)
- ITB tightness
- Glut med/piriformis failure excess demands on TFL / ITB
- Lateral knee pain (fatigue, overuse)
- Pain in groin / symphysis

Study Group

TOTAL	440	34 % ♂	66% ♀	
Duration of Sx	Mean	Minimum	Maximum	
	43 months	6 weeks	26 years	
Etiology	Trauma	Post partum	Undetermined	
	87.5% (n=385)	8% (n=35)	4.5% (n=20)	
Clinical scores (maximum=5)	Validated	SD	Other tests	SD
	3.28	1.12	2.59	1.19

Scan findings in Clinical SIJ incompetence

- 75% normal SIJ findings on MRI as lack of oedema.
- +ve CT findings only in advanced cases where calcium deposition is noted in posterior SIJ ligaments.
- Ultrasound studies not specific to metabolic changes in ligamentous tissue or intra articular structures.
- SPEC/CT: 95% sensitivity and 99% specificity. Provides precise anatomical location of soft tissue uptake, calcium deposition and metabolic changes.

Imaging Findings break up

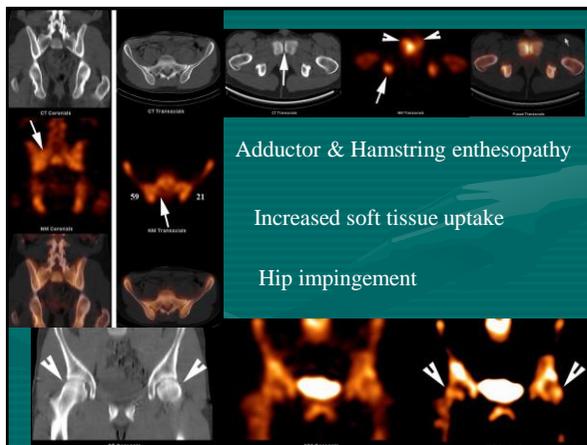
Increased uptake

Superior SIJ / posterior soft tissue ligaments and attachment to ilium	100%
Joint sclerosis	98.8%

Increased uptake other sites

	Same side	Opp. side	Bilateral
Hamstring enthesopathy	39%	61%	23%
Adductor enthesopathy	69%	57%	
Hip impingement	72%		
Other (Lx, #, OP etc.)	57%		

Others include sacroiliitis (3 cases), fractures, osteitis pubis, facet joint and disc disease, other enthesopathies.



B) Clinical Examination

- 2 categories of manual mechanical tests:
 - i) Pain provocation tests
 - ii) Palpation tests - position, movement and dynamic muscle recruitment.
- When mechanical tests are considered in 'cluster' or summation of battery of test findings, reliability significantly increases. (Laslett et al, 2005; Vander Wurff et al, 2006; Robinson et al 2007)
- No one gold standard mechanical test

Clinical Examination

- Manual tests attempt to identify structures/ relationships that give indication of functional cause of pain.
- 'Cluster' or summation of battery of test findings aims to assess different aspects of SIJ passive and dynamic function. (Laslett, 2005; Ostgaard et al 1997)
- Manual tests rely heavily on operator skill.



Battery of 9 tests for Clinical examination

Increased reliability when SIJ pain provocation tests (ppt's) are positive in clusters with minimum of 2 other (ppt's) (Laslett, 2005)

- a) **Posterior pelvic ppt** (4P or thigh thrust). Test reliable in pregnant women (Ostgood et al 1997)



i) Laslett's Pain provocation tests (ppt.)
maximum positive required 3 out of 5

b) Gaenslen's ppt
(Laslett et al, 2005)

c) Patrick Fabere ppt
of SIJ used in cluster



Also a ppt. for pubic symphysis but only positive for SIJ if SIJ pain.

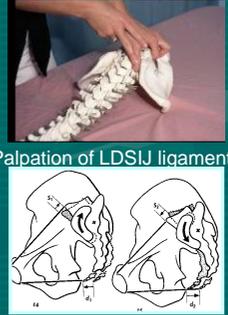
Also a ppt. test for the pubic symphysis and range test for the hip

ii) Palpation tests:

4) palpation of long dorsal SIJ lig.
(Vleeming et al, 2002;2008)

Ligament taut and under forces of viscoelastic creep when sacrum counter nutated. Can lead to painful irritation of the LDSIJ ligament and decreased SIJ compression.

Changes to joint compression alters muscle recruitment pattern (O'Sullivan 2001).



Palpation of LDSIJ ligament

sacrum counter nutation sacrum nutation

Movement/dynamic muscle recruitment tests

5) Trendelenburg Test:
Dynamic control of pelvic /hip muscles to control pelvic position with increased load through one leg.



In standing for a cyclist

In walk/run

- All loading requires compression of sacrum against ilia. (Richardson et al, 2002).

Clinical movement and dynamic muscle recruitment tests

6) Standing hip flexion (Stork test): Examines the movement of the pelvic girdle, lumbar spine and hip during stance phase. (Cusi et al, 2008).



- Assesses the ability of the weight bearing SIJ to transfer load.
- Inter tester reliability in 2 point scale on 33 subjects 89.9% (Hungerford et al, 2007)

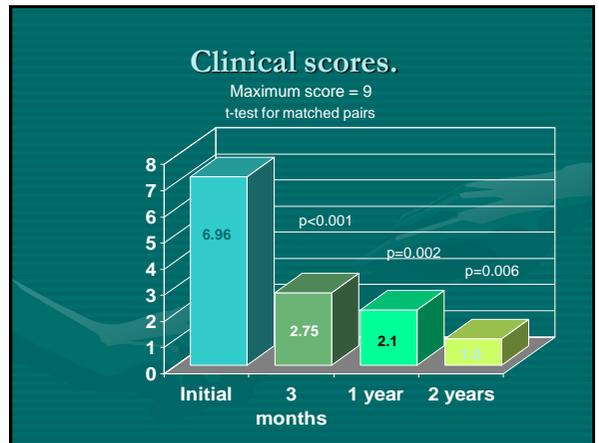
Clinical movement and dynamic muscle recruitment tests

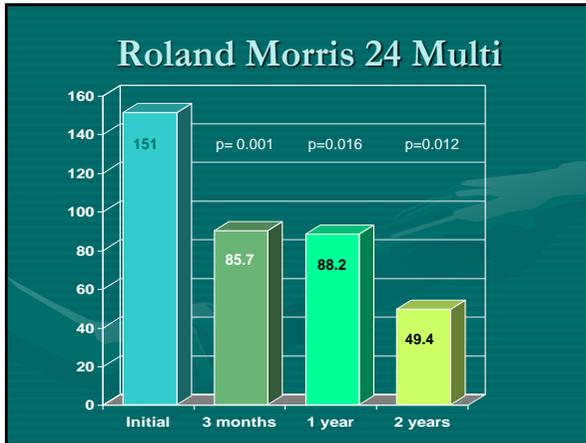
7. Active straight leg raise test (ASLR)
(Lee 2007)



- Supine patient lifts leg off plinth for 5 secs keeping the leg straight, compare with other side.
- Repeat with compression of SIJ's or with stabiliser muscle activation.

•Shown to be both reliable and reproducible clinical test (Mens et al 1999 and 2002; DeGoor et al 2008)





What type of exercise do Lumbo pelvic instability patients respond to?

Hides et al 2001; Moon et al 2001; Wisbey-Roth, 2000 & 2010; Zelle et al 2005)

- Specific muscle re-education program introducing tonic control (10% MVC) of the deep abdo., back, pelvic floor muscles, to control static postures.
- Teach neutral posture to protect injured/passive structures.
- SIJ belt may assist with proprioceptive compression to mimic muscles in early stages (Vleeming et al 1992; Richardson et al 1999).
- Progress to functional exercises using larger stabilising muscles (e.g. gluteals) and movements required for ADL and work.

A program to build confidence in normal movement

- Objective Measures
- Relaxation Strategies
- Progress Function
- Virtual Body Changes
- Environmental Input

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Goal: Optimal dynamic function

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