The Symptomatic SI Joint

Clinical Examination, Diagnosis and Treatment
Biagio Mazza, PT
DPT, MPT, OCS, SCS, COMT, CSCS, NSCA-CPT

- MPT - 2001, Rockhurst University, KC, MO
- DPT - 2010, EIM Institute of Health
- APTA Board Certified – Orthopedics and Sports
- Certified Orthopedic Manual Therapist (Spine) – IAOM
- Private Practice Owner: Elite Physical Therapy, KC, MO
- Residence: Prairie Village, KS
- 2 Boys – Anthony 10, Christian 6

- Paid consultant of SI-BONE, Inc.
Genne’ DeHenau McDonald  PT

• Physical Therapy Degree 1989
  • Oakland University, Rochester, Michigan

• 26 years clinical experience

• Former Adjunct Faculty and Clinical Lecturer
  • University of Florida DPT Curriculum

• Former Faculty Herman and Wallace Pelvic Health Institute

• Publications
  • Musculoskeletal LBP During Pregnancy
  • Piriformis Syndrome

• Program/Project Manager Medical Affairs SI-BONE
1. Understand the prevalence of SI joint pain.
2. Review anatomy and biomechanics of the SI joint.
3. Review the integrated model of SI joint function.
4. Understand the relationship between the lumbar spine, SI joint and hip.
5. Review subjective history for patient with SI joint pain.
6. Correctly perform SI joint provocation testing
7. Review SI joint rehabilitation.
Prevalence of SI Joint Pain

Is the SI Joint truly a problem?

15-30%
Component of LBP

32-43%
Symptomatic Post-Lumbar Fusion

Bernard 1987
22.6%

Schwarzer 1995
30.0%

Maigne 1996
18.5%

Irwin 2007
27.0%

Sembrano 2009
14.5%

Katz 2003
32%

Maigne 2005
35%

DePalma 2011
43%

Liliang 2011
40%
75% of post lumbar fusion patients showed SI joint degenerative changes on CT scan five (5) years after lumbar fusion. *Ha et al 2008*

Lumbar fusion leads to increases in angular motion and increases in joint stress at the sacroiliac joint. *Ivanov et al 2008*
Anatomy

Sacroiliac Joint

Articular Surface
**Biomechanics**

**Nutation**
Sacral base movement anteroinferior

**Counternutation**
Sacral base movement posterosuperior

**Translation**
Linear motion; motion in any one direction

Forst 2006
Multi-planar motion

– Simultaneously rotate and translate through 3 axes of motion

Motions (<4° in any plane)

– Nutation/Counternutation
  • Primary motion
    Males: 1 - 2°
    Females: 2 - 4°

Sacral Translation

– (A-P motion) up to 1.6mm

Sturesson 1989
Integrated Model of SI Joint Function

• Describes effective transfer of force and load across the SI joint from the lower extremities to the spine.

  Snijders & Vleeming 1993

• Requires a stable core (lumbar spine, pelvis and soft tissues)

• 3 Components of Functional Stability
  
  Passive (form closure)
  
  Active (force closure)
  
  Neuromuscular Control (motor control)

  Panjabi 1992
The Integrated Model of SIJ Function

Components

Form Closure/Structural Integrity: The shape of the sacrum and the integrity of the supporting ligaments contribute to SI joint stability

Lee 1998, Vleeming 1990a, Vleeming 1990b

Force Closure/Joint Compression: The external dynamic forces created by contraction of the stabilizing muscles and their fascial and ligamentous attachments

Lee 1998, Vleeming 1990a, Vleeming 1990b

Motor Control: Nervous system coordination / co-activation of deep stabilizing muscles (onset, duration, timing)

Snijders 1993, Hodges 1996, Richardson 2002

Core muscles should contract before load reaches the low back and pelvis to prepare the system for impending load.
Form Closure

Osseous Structures – Macro, Micro

Supporting Ligaments
The Integrated Model of SI Joint Function: Force Closure – Local Muscles

**Local System**: contracts prior to upper/lower limb movement regardless of direction  

**Local Core Muscles**
- Transversus Abdominus
- Multifidus
- Pelvic Floor Muscles
- Diaphragm
  - More research being done on other contributing muscles

Global System:
Contracts later and is direction dependent

Radebold 2000, 2001; Hodges 2003

Vleeming’s slings:

Large Muscle Groups and their Fascial Connections

- Posterior Oblique System
- Anterior Oblique System
- Deep Longitudinal System
- Lateral System

Radebold 2000, 2001; Hodges 2003
Caudal part of the TLF, in combination with efficient paraspinal muscles, plays major role in force closure of SI joint

Motor Control

• Optimal force closure of the SI joint

• Studies showing alteration of muscle activation patterns in low back, groin, and SI joint pain populations
  – TrA Delayed in LBP   Hodges & Richardson 1996
  – TrA Delayed in Groin Injuries   Cowen 2004
  – Altered Motor Control with SI joint Pain   O’Sullivan 2002

• Timing, sequence and amplitude of muscle firing
  – Afferent input from receptors in joints, ligaments, fascia and muscles
  – Efferent response of central and peripheral nervous systems   Hodges 2003
Evaluation of the Patient with Sacroiliac Joint Pain
Can we diagnose SI joint pain?

- **Common pain patterns from multiple conditions**
  - Spine (stenosis, facet, spondy, disc herniation, DDD, etc.)
  - SI Joint
  - Hip (OA, FAI, early AVN, etc.)
  - Pelvis (Glut tear, piriformis, pelvic floor)

- **Imaging not routinely helpful**

- **History and Physical Examination**
  - Provocative maneuvers \(^{Laslett 2005, Szadek 2009}\)
  - SI joint ROM & Position testing not reliable \(^{Freburger 1999, Robinson 2007}\)

- **Diagnostic Injection**
<table>
<thead>
<tr>
<th>Spinal Stenosis</th>
<th>SI Joint</th>
<th>Isolated Hip Pathology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buttock common</td>
<td>Buttock, PSIS (94%)</td>
<td>Buttock pain (71%)</td>
</tr>
<tr>
<td>Groin uncommon (except L1, L2)</td>
<td>Groin not uncommon (14%)</td>
<td>Thigh and Groin (55%)</td>
</tr>
<tr>
<td>Lower extremity common</td>
<td>Lower extremity common (28%)</td>
<td>Knee or below (47%)</td>
</tr>
<tr>
<td>Lateral hip – common</td>
<td>Lateral hip &amp; thigh common</td>
<td>Lateral hip – common</td>
</tr>
<tr>
<td>Lumbar region common</td>
<td>Lower lumbar region (72%)</td>
<td>Lumbar pain uncommon</td>
</tr>
</tbody>
</table>

Devin – JAAOS 2012  
Vanelderen – Evid Based Med 2010  
Devin – JAAOS 2012
Potential Causes of SIJ Pain: Traumatic

• MVA: Foot on Brake
• Slip and Fall
• Lifting and Twisting
• Traction Injuries
Potential Causes of SI Joint Pain: Gradual Onset

- Laxity of the SI joint / Pregnancy
- Repetitive Forces on SI joint and Supporting Structures
- Biomechanical Abnormalities
  - Leg length inequality
  - Pelvic obliquity/scoliosis
  - Iliac crest bone graft
- Adjacent Segment Degeneration
  - After lumbar spinal fusion
- Post Infection Degeneration
Hip and Adjacent Segment (SI Joint)

Hip and SI Joint

76% (25/33) of patients with symptomatic SI joint pathology had at least one abnormal finding on hip radiograph.

A significant number met the strict diagnostic criteria for FAI.

42% Hip OA
45% Subchondral cyst
21% Retroversion
12% Lateral CE* angle >40%
47% Coxa profunda
33% Cam impingement

* Center Edge

Morgan 2013
Elements of the Diagnosis

- Positive Subjective History
- Positive SI Joint Provocative Testing
- Lumbar Spine and Hip Exam
- Positive Response to Intra-articular Injection
History and Complaints

**HISTORY**

- **When did the pain start?**
- **Prior trauma**
  - A fall on the buttock
  - Car accident (T-bone, rear-end, head-on)
  - Lift/Twist
  - Other
- **Prior lumbar fusion**
  - Prior iliac bone graft harvest
- **Pregnancy**

**COMPLAINTS**

- Lower back pain
- Sensation of numbness, tingling or weakness
- Pelvis / buttock pain
- Hip / groin pain
- Feeling of leg instability, buckling, or giving way
- Disturbed sleep patterns
- Disturbed sitting patterns (unable to sit for long periods, on one side)
- Pain going from sitting to standing
Pain Diagram

- Pain in buttock and posterior thigh
  - Usually not midline
  - Usually below L5
  - At or lateral to PSIS
  - Occasionally groin

- Secondary pain in lateral thigh, groin, and/or lateral calf

Fortin 1999
Exacerbating Activities

**Unilateral Weight Bearing**
- Putting on Socks/Shoes
- Ascending/Descending Stairs
- Getting in and out of Car
- Prolonged Walking
  (85% of gait cycle is single leg stance)
  *Janda 1983*

**Sexual Intercourse**

**Pain with Transitional Motions**
- Supine to painful side
- Sit to stand
- Rolling over in bed
- Getting in/out of bed

**Pain while Stationary**
- Sitting on affected side
- Prolonged standing/sitting
Relieving Activities

• Bearing weight on unaffected side
• Lying on unaffected side
• Manual or belt stabilization
Lumbar Spine – Hip – SI Joint

Physical Examination
Assess Lumbar Spine: Facet Joint Pain

• Incidence 10-15% in patients with chronic LBP
  
  \textit{Saravanakumar 2008}

• Low back pain from the facet joints: radiates down into the buttocks and posterior thigh.

• Clinical Findings
  – Point tenderness overlying the inflamed facet joints
  – Loss in spinal muscle flexibility (guarding)
  – More discomfort leaning backward than forward.

• No history findings or examination maneuver has been found to be unique or specific to this entity
The McKenzie Procedure

• More accurate than MRI in:
  – Differentiating discogenic from non-discogenic LBP
  – Differentiating contained from non-contained discs
    (Donelson 1997, 1990)

• Measures patient's symptomatic response to repeated end-range movements

• Discogenic pain is associated with centralization with repeated end range movements
  (Young 2003, Hancock 2007)

• Most common direction of testing that centralizes pain is extension
Assess Lumbar Spine: Physical Exam

Standard tests to rule out lumbar radiculopathy
- DTRs
- Neuro Exam

Passive Straight Leg Raise
To rule out lumbar radicular pain + at 35-70°
- Sensitivity 91%
- Specificity 26%
  *Deville 2000*

Slump Test
To rule out lumbar disc herniation's
- Sensitivity 84%
- Specificity 83%
  *Majlesi 2008*

These can all be performed quickly in supine before performing provocative testing for the SI joint.
Assess Hip: Physical Examination

**FABER**: For Intra-articular hip pathology (if pain anterior)
- Hip flexion, abduction and ER with overpressure
- 88% sensitive *(Martin 2005)*

**Scour**: For Hip OA and other pathologies
- Sensitivity 62% - 91%
- Specificity 43% - 75% *(Konin 2006, Magee 2008)*

**FADIR**: For FAI and labral tears:
- Hip flexion, adduction, IR
- Sensitivity = 75%,
- Specificity = 43% *(Austin 2008)*

**FAIR**: For Piriformis Syndrome (assure pain is posterior)
- Sensitivity 88%
- Specificity 83% *(Fishman, 2002)*
Range of Motion Testing of the Hip  
(Birrell 2001)

- The most predictive finding for osteoarthritis is decreased range of motion with restriction in internal rotation
- For those patients with one plane of restricted movement, the sensitivity for severe osteoarthritis is 100% and specificity is 42%
- Used to rule in/out osteoarthritis

Femoral Neck Anteversion (FNA) Assessment

Compare bilaterally

- If IR is 30 degrees > then external rotation, predictor of FNA  
(Swanson 1963)
- Trochanteric Prominence Angle Test (TPAT) or Craig test
  
  TPAT predicted the FNA measured intraoperatively, more accurately than either the CT or Magilligan method  
(Ruwe 1992)
There is a strong association between early hip OA (osteoarthritis) and FAI (femoral acetabular impingement).

Altman Criteria for Hip OA:
- Hip IR ≥ 15 degrees, Pain with Hip IR
- Morning stiffness for ≤ 60 min and Age > 50 years OR
- Hip IR < 15 degrees, and Hip Flexion ≤ 115 degrees
  - (Sensitivity 86 % Specificity 75 %)  
  Altman 1991

Patients with hip OA often develop osteophytic changes and bony overgrowth of the acetabular rim and femoral head.
This would create FAI in and of itself

Clinical Presentation
- Both may present with positive tests for FABER and FADIR
- Both may present with a decrease in hip flexion and internal rotation (ROM)

Chibulka 2009, Phillippon 2007
Contact between the femoral head-neck junction and the acetabular rim

- **Insidious onset 50% of cases**  
  *Samora 2011*

- **Symptoms**
  - Persistent insidious deep groin, lateral hip or buttock pain
  - Pain increased with prolonged sitting or standing and hip flexion-type movements
  - Decreased hip ROM

**Two Types**

- **CAM** (More common in young males)
  - Anterior-superior aspect
- **Pincer** (More common in females)
  - Anterior acetabular labrum and chondral injury in posterior-inferior acetabular rim  
  *Ganz 2003*

**Confirmation**

- Arthroscopy: Gold Standard
- MRI
Assess Hip: Labral Tear Clinical Findings

- Morphological changes in proximal femur or acetabulum lead to abnormal contact during hip flexion  \textit{Samora 2011}

- Clinical Symptoms: anterior groin pain (96-100%), clicking, locking (58%), catching, instability, giving way and/or stiffness  \textit{Martin 2006, Lewis 2006}
  - Predisposing factor: Coxa Valga = 87% of cases

- Clinical Sign: FADIR TEST

**Method of Injury** – Hip external rotation + extension, direct trauma, abnormal loading patterns

**MRI** – May demonstrate labral tear, but often the bony articular pathology are missed

**MRA** – Gold standard is magnetic resonance arthrogram  \textit{Samora 2011}
Piriformis compresses or irritates the sciatic nerve
- Incidence: 17.2% among low back pain patient
  
  *Chen 2013*

**Clinical symptoms**
- A dull ache in the buttock.
- Pain down the back of the thigh, calf and foot (sciatica)
- Pain when walking up stairs or inclines.
- Increased pain after prolonged sitting.

**Clinical Sign**
- **FAIR Test**: Reproduction of symptoms when piriformis muscle is put on stretch.
  (hip flexion, adduction and internal rotation)
  
  *Fishman 2002, Loren 2010*

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**Magnetic Resonance Neurography:**
Type of MRI that highlights inflammation and compression of the nerves.

*Filler 2005*
Assess Hip: Gluteus Medius & Minimus Tears

Incidence
- Common finding on MR imaging in patients with buttock, lateral hip, or groin pain.

  Kingzett-Taylor 1999

Clinical Symptoms
- Dull lateral hip pain, buttock or groin pain

Clinical Signs
- Focal tenderness at the gluteal insertion
- Weak hip abduction
- Pain with passive and then resisted hip internal rotation with the hip flexed to 90°
  - Sen 88%, Spec 97.3%
- Pain on one-legged stance for 30 sec or more
  - Sen 100 % Spec 97.3%

  Lequesne 2008
SI Joint: Physical Exam
Fortin Finger Test

Point to pain while standing
• Able to localize pain with one finger
• Within 1 cm of PSIS (inferomedial)
• Consistent over at least 2 trials

Ask patient to point to location of primary pain

• **Below L5**: Consider SI joint
• **Above L5**: Consider lumbar spine etiologies

*Fortin & Falco 1997*
Active Straight Leg Raise
To assess functional pelvic stability

- **Sensitivity:** 87%
- **Specificity:** 94%

Mens 2001
The following five provocative tests, when performed in combination are proven to have a high degree of sensitivity and specificity:

1. Distraction* (Highest PPV**)
2. Thigh Thrust*
3. Compression*
4. FABER
5. Gaenslen’s Maneuver

* Most sensitive of tests  
** PPV = positive predictive value

<table>
<thead>
<tr>
<th></th>
<th>Laslett</th>
<th>Szadek</th>
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<tbody>
<tr>
<td>3 or more positive tests</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensitivity</td>
<td>91%</td>
<td>85%</td>
</tr>
<tr>
<td>Specificity</td>
<td>78%</td>
<td>76%</td>
</tr>
</tbody>
</table>

Laslett 2005, 2008  
Szadek 2009
Specificity increases when symptoms don’t centralize or peripheralize with thorough, multidirectional repeated movement assessment (McKenzie Assessment).

In some cases a patient may not tolerate having five (5) tests performed. Therefore, it’s recommended that the three (3) most sensitive, specific and reliable tests be performed first.

How to Interpret Your Results

1 Positive Test = Suspicion
2 Positive Tests = Fair Confidence
3+ Positive Tests = High Confidence

SI Joint: Provocative Tests

- Distraction
- Thigh Thrust
- FABER
- Compression
- Gaenslen’s Maneuver
Assure the tester position is above the patient by lowering table or standing on a sturdy stool in order to provide adequate force.

Start with light pressure and gradually increase, keeping hands cupped to minimize local contact pressure (30 second max).

Keep arms straight and lean forward with your upper body to create gentle steady force.

Stabilize patient on the table to prevent muscle guarding.

Stabilize contralateral ASIS during Thigh Thrust and FABER tests.

If pain is provoked with test, ask patient to identify pain location to confirm it is their typical pain.
SIJ Region Pain – Myofascial Causes

- Quadratus Lumborum
- Gluteus Maximus
- Piriformis
- Levator Ani

Travell and Simons 1992
Justification for SI Joint Injection

- Negative Lumbar and hip exam
- Positive History
- Positive Fortin Finger Test and Physical Exam
- Positive Pain Provocative Tests
What’s the Reference Standard for Diagnosis?

Diagnostic Injection
• Confirm with contrast and imaging
• Low volume, local anesthetic
• 50-75% pain reduction

Therapeutic Injection
• Local anesthetic + corticosteroid
• May provide intermediate or long term relief
• Results of therapeutic injections can be unpredictable
Injection Assessment

• Patient pain diary

• Significant positive clinical response
  – 50-75% VAS reduction indicates positive diagnosis of SI joint as pain generator
  – *Obtain copy of arthrogram to ensure accuracy*

• Equivocal or no relief
  – < 50% VAS reduction indicates a non-significant clinical response
  – May have SI joint pain, but consider other pain sources
Conservative Treatment Options for Sacroiliac Joint Pain
Symptom Management

- Medications (non steroidal anti-inflammatories, oral steroids, pain medications)
- External SI joint stabilization with belting
- Therapeutic SI joint injections (1-4 per year)
- Physical Therapy

Sembrano 2011
Cohen 2005
Conservative Treatment Options: Goal

Treat the joint by returning it to its normal relationships so outcomes may be enhanced.  

- Optimal SI joint function occurs with the SI Joint in neutral (mid-range) position.  


- Treatment goal should be restoration of normal movement and SI joint position.
Conservative Treatment Options: Physical Therapy

• **Modification of Activities of Daily Living (ADLs)**
  - specific focus on activities that may create or exacerbate symptoms.

• **Patient education regarding maintaining optimal alignment with positioning, posture and body mechanics**

• **Stabilization Exercise/ Neuromuscular Re-education**
  - Specific focus on timing and engagement of local and global core muscles

Conservative Treatment Options: Physical Therapy

• Achieve normal muscle strength balance where existing deficits (include gluteus medius assessment)
  

• Achieve normal muscle length balance where existing imbalances exist
  – Consideration of muscles that attach to the ilium and sacrum directly and indirectly, especially limiters of hip internal rotation.


• Adjacent segment joint and soft tissue restriction mobilization and manipulation as needed *
  – Consider the hip structures, lumbar and thoracic regions, knee and ankle joints.
Conservative Treatment Options: Physical Therapy

- Manual techniques to address myofascial pain
- Balance assessment and training
- Gait training
- Regain or maintain cardiovascular health
- Modalities for pain and muscle spasm
Surgical Treatment Options for Sacroiliac Joint Pain
Treatment Options: Surgical

Smith-Petersen 1926
Campbell 1927
Gaenslen 1927
Bloom 1937
iFuse 2008
Examples of existing and/or developing technologies.

The iFuse Implant System is the only technology supported by published clinical evidence.

(May 2015)
iFuse Implant System®

- **Unique Design**
  - Triangular shape – minimizes rotation
  - Interference press fit
  - Porous TPS coating – large surface area

- **Specifications**
  - 3X stronger than screw
    - (iFuse vs. 8.0mm cannulated screw, Mauldin 2009, SI-BONE)
  - 31X rotational resistance greater than screw
    - (Torsional Rigidity, iFuse vs. 7.3mm screw, 300191-A, SI-BONE)

- **Strength of Experience and Focus**
  - 17,000+ procedures worldwide (September 2015)
  - Outstanding training programs
  - Knowledge in the OR
  - Reimbursement support

- **Clinical Evidence**
iFuse Procedure Overview

1. Incision
2. Pin
3. Soft Tissue Protector
4. Measure
5. Drill
6. Broach
7. Insert Implant
8. Repeat
iFuse Implant System® Publications

- **RCT (INSITE, 102 iFuse vs. 46 NSM)**
- **Prospective, multicenter (SIFI) Systematic Review**
- **Open vs. iFuse**
- **Retrospective case series**
- **Complaints analysis Intraoperative neuromonitoring**
- **Stability achieved & maintained post-cycles Implant placement technique comparison**

Complete References in Bibliography

Proprietary and Confidential.
Rapid and Sustained Pain Relief – VAS SIJ Pain

- Rapid pain relief by 6 weeks
- Sustained pain relief out to 6, 12, 24 and 60 months
- Clinically significant pain relief at all follow-up time points (≥2 point drop from baseline)
Improvement in Back Function – Oswestry Disability Index

<table>
<thead>
<tr>
<th>Disability Level</th>
<th>Study</th>
<th>Follow-Up</th>
<th>Baseline</th>
<th>Follow-Up</th>
<th>Improvement</th>
<th>p-value</th>
</tr>
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<tbody>
<tr>
<td>Bed-bound</td>
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<tr>
<td>Crippled</td>
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<tr>
<td>Severe Disability</td>
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<tr>
<td>Moderate Disability</td>
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</tr>
<tr>
<td>Minimal Disability</td>
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</tbody>
</table>

- **Polly 2015**: 12 mo f/u (n=102)
- **Duhon 2015**: 12 mo f/u (n=172)
- **Vanaclocha 2014**: 54 mo f/u (n=24)
- **Ledonio 2014(b)**: Median 15 mo f/u (n=17)
- **Ledonio 2014(a)**: Mean 15 mo f/u (n=22)
- **Schroeder 2013**: Mean 10 mo f/u (n=6)
- **Gaetani 2013**: Mean 10 mo f/u (n=10)
- **Cummings 2013**: 12 mo f/u (n=18)

\* MCID: Minimum Clinically Important Difference ≥12.8 point drop [Copay 2008]

\* SCB: Substantial Clinical Benefit ≥18.8 point drop or final score of <31.3 [Glassman 2008]
# High Patient Satisfaction

<table>
<thead>
<tr>
<th>Study</th>
<th>Satisfaction Percentage</th>
<th>Duration</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polly 2015</td>
<td>94%</td>
<td>12 mo</td>
<td>102</td>
</tr>
<tr>
<td>Duhon 2015</td>
<td>87%</td>
<td>12 mo</td>
<td>172</td>
</tr>
<tr>
<td>Vanaclocha 2014</td>
<td>92%</td>
<td>12 mo</td>
<td>24</td>
</tr>
<tr>
<td>Rudolf 2014</td>
<td>82%</td>
<td>60 mo</td>
<td>17</td>
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<tr>
<td>Sachs 2014</td>
<td>91%</td>
<td>12 mo</td>
<td>144</td>
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<tr>
<td>Gaetani 2013</td>
<td>100%</td>
<td>10 mo mean</td>
<td>10</td>
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<tr>
<td>Cummings 2013</td>
<td>94%</td>
<td>12 mo</td>
<td>18</td>
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<td>12 mo</td>
<td>40</td>
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<tr>
<td>Rudolf 2012</td>
<td>82%</td>
<td>40 mo mean</td>
<td>45</td>
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</tbody>
</table>

Average: 91%
Post-Operative Considerations

Individual Treatment Plans

Considerations:
• Age
• Weight
• Bone quality
• Associated health factors

Post Surgical Decisions

• Plan for protected weight bearing
• Activity limitations
• Post op rehab plans
• Plan for return to activity
Post-Operative Guidelines

To assist HCPs with Patient Education
Weight-bearing Status

NOTE TO PHYSICIAN: These guidelines are provided to you to assist your patient on post-operative activities. Which activities apply will depend on your independent evaluation of your patient.

Your surgeon may recommend limited post-operative weight-bearing on the operated side to allow an optimal environment for healing. Limited weight-bearing may assist with better soft tissue and bone healing, biological fixation of your implants, balance, and pain control.

<table>
<thead>
<tr>
<th>Weight-Bearing Status</th>
<th>Operative Side</th>
</tr>
</thead>
<tbody>
<tr>
<td>No weight bearing: No weight on operated side</td>
<td>Right</td>
</tr>
<tr>
<td>Partial weight-bearing: Heel to Toe Roll Through</td>
<td>Right</td>
</tr>
<tr>
<td>Touch down weight-bearing: Touch Toe Only</td>
<td>Right</td>
</tr>
</tbody>
</table>

Your surgeon may determine that your ability to bear weight may increase by your first post-operative visit. This may be based on multiple factors because patients may have variations in balance, muscle strength, pain, and/or other conditions that affect their healing time and recovery.

Post-Operative Pain and Swelling:

It is normal to have some degree of pain and swelling following a sacroiliac joint fusion surgery. Your surgeon may recommend that you help minimize this by doing the following:

- Apply a cold pack to the operative site
- Use a cold pack for ___ minutes ___ times per day
- Avoid sleeping with the head of your bed elevated while in the hospital.
- Avoid sitting for prolonged periods of time the first week following your surgery.
- Limit duration of your sitting time to ___ minutes at a time
- Sleep on the non-operative side with a pillow between your knees, if possible.

Post-Operative Precautions:

Your surgeon may ask you to follow these guidelines until your first post-operative visit with your surgeon:

- Do not lift operated side leg off the bed with a straight knee.
- Do not lift over ten (10) pounds
- Avoid squatting

Activity:

Walk ___ times per day

You may be given a walker or crutches following surgery and instructed to put only the recommended amount of weight on your operative leg(s). Once you can walk safely and independently with your walker or crutches, gradually increase your walking distance a small amount each day. Several small walks are preferable to a single longer walk. Progress to walking short distances outdoors on even surfaces.
Circulation and Stabilization Exercises

NOTE TO PHYSICIAN: These guidelines are provided to you to assist your patient on post-operative activities. Which activities apply will depend on your independent evaluation of your patient.

Perform the exercises as indicated below by your surgeon or physical therapist. All exercises should be pain-free and performed without pelvic motion. The first two exercises below are to help maintain healthy circulation after your surgery. The last four exercises are to maintain circulation and re-educate the muscles that support your pelvis. Research has shown that optimal stability of the pelvis is achieved when certain core muscles, such as your Transverse Abdominus (TA), are contracted prior to movement.

Ankle Pumps:
- Repeat ___ times per day
- Alternate pushing your toes down and bringing them back up on each side.

Quad Sets:
- Repeat ___ times per day
- With a pillow under your knees, tighten the muscle on top of your thigh and push the back of your knee into your pillow. Alternate sides.

Activation of Transverse Abdominus (TA) (Core Muscle):
- Repeat ___ times per day
- With a pillow under your knees, place your fingertips inside the prominent bones at the front of your pelvis. Inhale, then as you exhale, draw in your abdominal muscles as if you are zipping tight pants without moving your pelvis. Hold for five (5) seconds.

Glut Sets:
- Repeat ___ times per day
- With a pillow under your knees, inhale and as you exhale activate your TA and then tighten your buttock muscles and hold both for five (5) seconds.

Hand Slides:
- Repeat ___ times per day
- Inhale and then as you exhale activate your TA to keep your pelvis from moving while you slowly move your hand and then your leg back to start positioning your TA contraction to keep your pelvis from moving. Alternate between each leg.

Glute Medius Re-Education:
- Repeat ___ times per day
- Lay on your operated side with a pillow between your knees. Place your upper fingertips inside your pelvic bone. Inhale, and then as you exhale, activate your TA to stabilize your pelvis. Gently lift your top knee only a few inches off the pillow and hold for five (5) seconds. Lower slowly.
NOTE TO PHYSICIAN: These guidelines are provided to you to assist your patient on post-operative activities. Which activities apply will depend on your independent evaluation of your patient.

Once you are able to activate your TrA, your surgeon or physical therapist may recommend that you practice contracting it before position changes such as getting out of bed, sitting, standing, or climbing stairs.

**Rolling from Back to Side and Getting Out of Bed**

**Step 1**
Prepare for Roll: Begin on your back. Inhale, then as you exhale contract your TrA to stabilize your pelvis. Holding your TrA contraction, slide up the non-operated side leg first and then the operated side leg until your hips and knees are flexed and your feet are resting on the bed.

**Step 2**
Roll to Side: Inhale, then as you exhale contract your TrA and use the momentum of the arm on your non-operated side to roll towards your operated side without twisting your torso.

**Step 3**
Slide lying to sitting: Inhale, and then as you exhale contract your TrA as you push off the table with your non-operated side arm and allow your legs to drop at the same time. The goal is to keep your body in a straight line and not bend your torso.

**Sit to Stand Transfer**

Move to the forward edge of the surface you are sitting on and pull your non-operated leg slightly behind your operated leg. Inhale, then as you exhale contract your TrA and push yourself to a standing position. The goal is to use your TrA contraction to limit the motion of your pelvis as you move.

**Getting In and Out of the Car**

Inhale and then as you exhale, contract your TrA to stabilize your pelvis. If possible, push down with your arms to elevate yourself slightly as you turn. Move your legs together as a single unit in small increments until you are facing outward. Avoid pushing one leg out too far from the other as you move. Then with the non-operated side leg pulled slightly behind, come from sitting to standing as described in the Sit to Stand Transfer section above.

**Stairs**

Minimize stair climbing until your first post-operative visit with your surgeon. When climbing stairs, contract your TrA to stabilize your pelvis while first moving the non-operated side up a step and then following with the operated side. Ascend one step at a time. When descending a step, contract your TrA and hold the contraction while knowing the operated side first, followed by the non-operated side. Descend one step at a time.
**Post-operative Physical Therapy Considerations**

**Review of common musculoskeletal problems affecting the SI joint or affected by chronic SI disorders**

- General deconditioning
- Weakness of core musculature
- Imbalance of muscle length and/or strength in the trunk, pelvis, and/or lower extremities
- Altered function of adjacent motion segments (lumbar spine and/or hip)
- Restriction and/or scarring in muscles and soft tissues near the SI joint
- Poor postural habits
- Poor movement patterns
- Underlying balance issues
- Abnormal gait
- Loss of proper motor control
- Pain.

Many surgeons and physical therapists offer a patient-specific rehabilitation program post-operatively to address one or more of these issues. This program may help to optimize the patient’s safety. The specifics of the rehabilitation program are dependent upon each individual patient’s history, physical findings, associated medical conditions, and their functional goals.

**Post-operative rehabilitation after iFuse surgery may include:**

- Instruction in patient positioning, posture and body mechanics.
- Instruction in optimal functional movement patterns for activities of daily living (ADLs).
- Gait training.
- Balance training.
- Activation, conditioning, and motor control training of core and global stabilizing muscles.
- Normalization of muscle length balance throughout trunk and extremities.
- Normalization of muscle strength balance throughout trunk and extremities.
- Soft tissue and scar mobilization in areas adjacent to, referent to, and including the surgical site and the sacroiliac joint on the operated side.
- Mobilization of restrictions in adjacent structures:
  - Hip capsule and musculature.
  - Knees, ankle, and foot structures.
  - Lumbar and thoracic spine.
- Cardiovascular conditioning.

Each patient’s treatment plan should be individualized based upon the patient’s history, physical findings, associated medical conditions, and their functional goals.
Post-Operative Considerations

Patient Education: Positioning, Posture and Body Mechanics

Gait Training

Balance Assessment and Training

Timing and Engagement of Core Local/Global Stabilizers

Achieve Normal Muscle Strength and Length Balance
Post-Operative Considerations

Eliminate Restrictions in Adjacent Structures

- Hip Capsule
- Lumbar and Thoracic Spine / Knee and Ankle Joints

Retraining of Functional Movement Patterns/Motor Control

- With Activities of Daily Living
- With Recreational Activities in Patient Population

Regain / Maintain Cardiovascular Health
Conclusion

• SI joint can be painful: pathology is prevalent and underdiagnosed

• SI joint stability depends on a complex integrated system – Form and Force Closure, Motor Control

• Must understand the lumbar spine-SI joint-hip complex and how they interact
Conclusion

• Diagnosis of SI joint pain
  – History
  – Physical Examination of spine, hip and SI joint
  – Correct Performance of SI joint provocative tests

• Treatment options for SI joint pathology
  – Non-surgical management
  – Surgical option – MIS SI joint fusion
  – Pre and post-operative considerations
THANK YOU
The iFuse Implant System® is intended for sacroiliac fusion for conditions including sacroiliac joint dysfunction that is a direct result of sacroiliac joint disruption and degenerative sacroiliitis. This includes conditions whose symptoms began during pregnancy or in the peripartum period and have persisted postpartum for more than 6 months.

There are potential risks associated with the iFuse Implant System. It may not be appropriate for all patients and all patients may not benefit. For information about the risks, visit: www.si-bone.com/risks

One or more of the individuals named herein may be past or present SI-BONE employees, consultants, investors, clinical trial investigators, or grant recipients. Research described herein may have been supported in whole or in part by SI-BONE.


DonTigny RL. Anterior dysfunction of the sacroiliac joint as a major factor in the etiology of idiopathic low back pain syndrome. Phys Ther 1990;70:250–65.


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References


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References


iFuse Implant System – Bibliography

LEVEL I – Randomized Clinical Trial

LEVEL IIb – Prospective, Multicenter

LEVEL III – Clinical Comparison (Open vs. MIS)

LEVEL IV – Clinical
iFuse Implant System – Bibliography (cont.)

Clinical – Other

Biomechanics