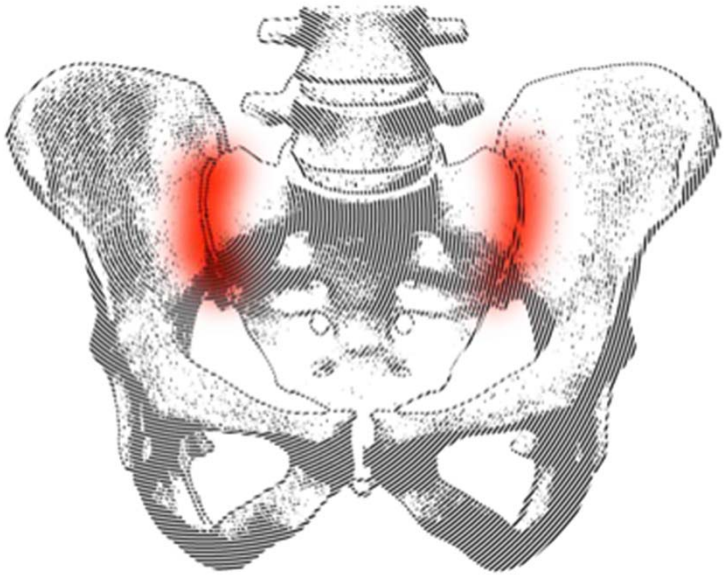
Diagnosis and Treatment of the Sacroiliac Joint



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Clay J. Frank MD

Medical School:

Medical College of Wisconsin

Residency:

Orthopedic Surgery

Nebraska University Health Foundation

Fellowship:

Orthopedic Spine Surgery,

Carolinas Medical Center, Charlotte, NC

Practice:

Injured Reserve!

Speaker Disclosures

Speaker Specific Disclosures:

- The speaker received no compensation for this presentation.
- Paid consultant of SI-BONE, Inc.
- Conducts clinical research for SI-BONE, Inc.

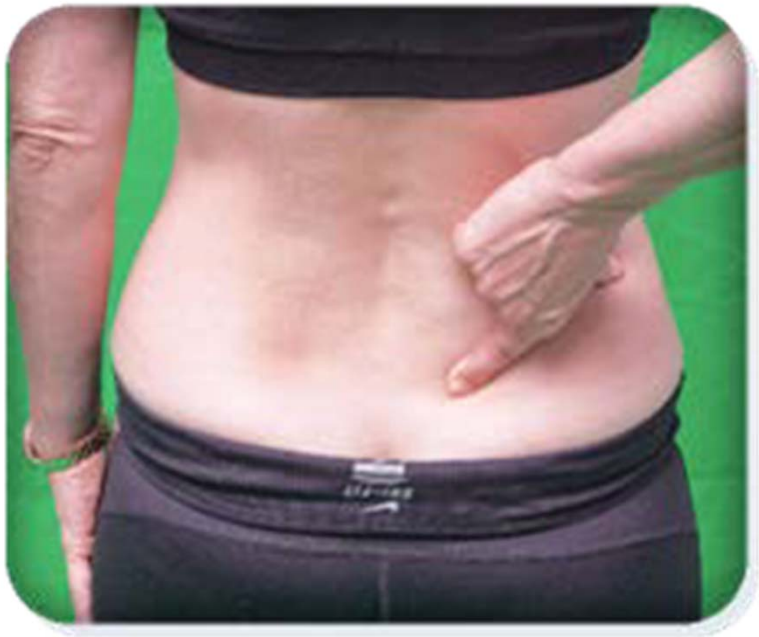
Program Objectives

1. Prevalence of SI Joint Pain
2. Biomechanics & Anatomy Review
3. Standard Protocol for SI Joint Diagnosis Based On:
    - Physical Exam
    - Provocative Testing
    - SI Joint Injection
4. SI Joint Surgery
5. Review Clinical Results
6. Reimbursement Overview

Fortin Finger Test

Where does it hurt in a patient with SI joint pain?

“Right Here Doc”



Fortin & Falco – Am Journal ofOrtho 1997

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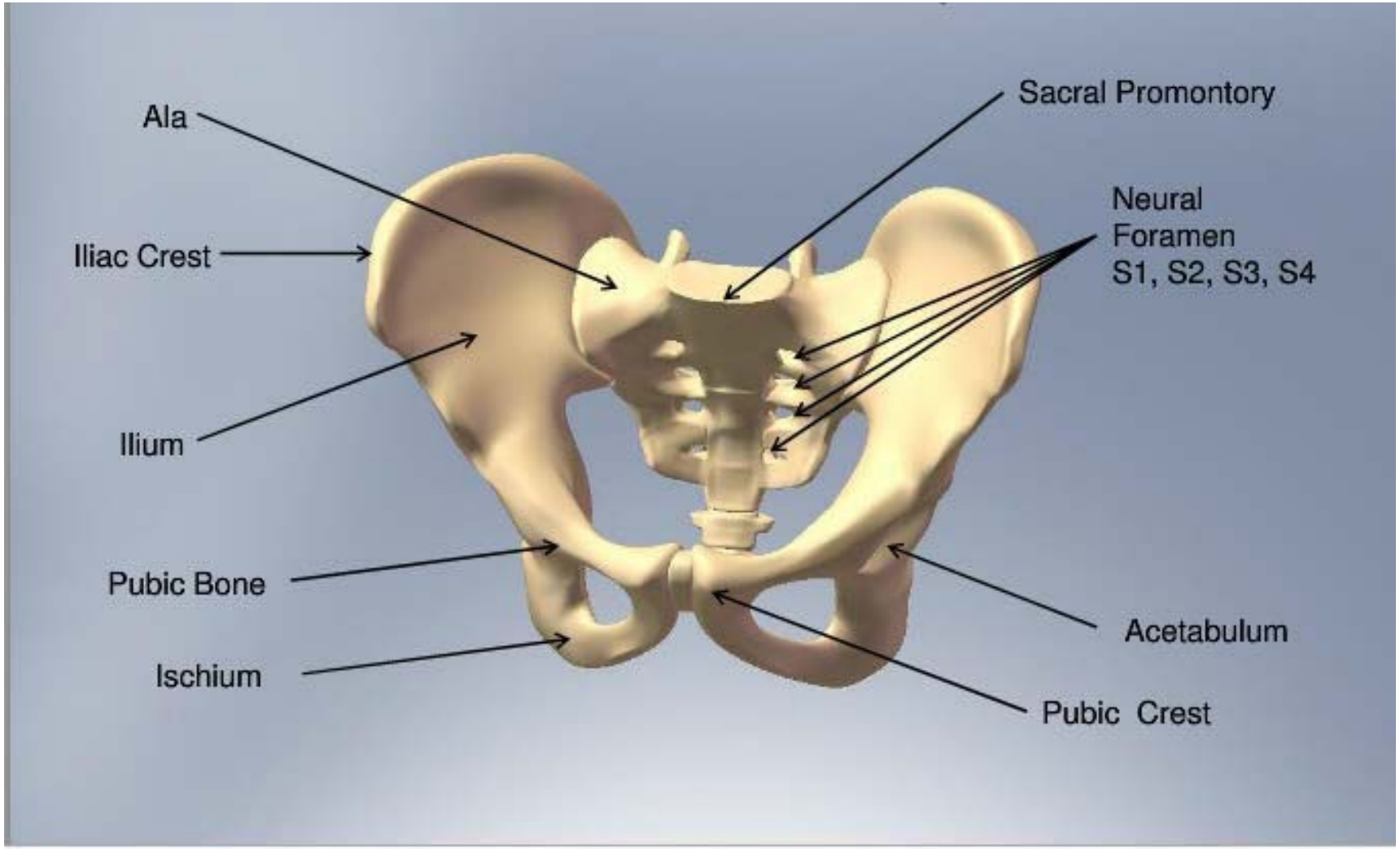
Anatomy

Sacroiliac Joint



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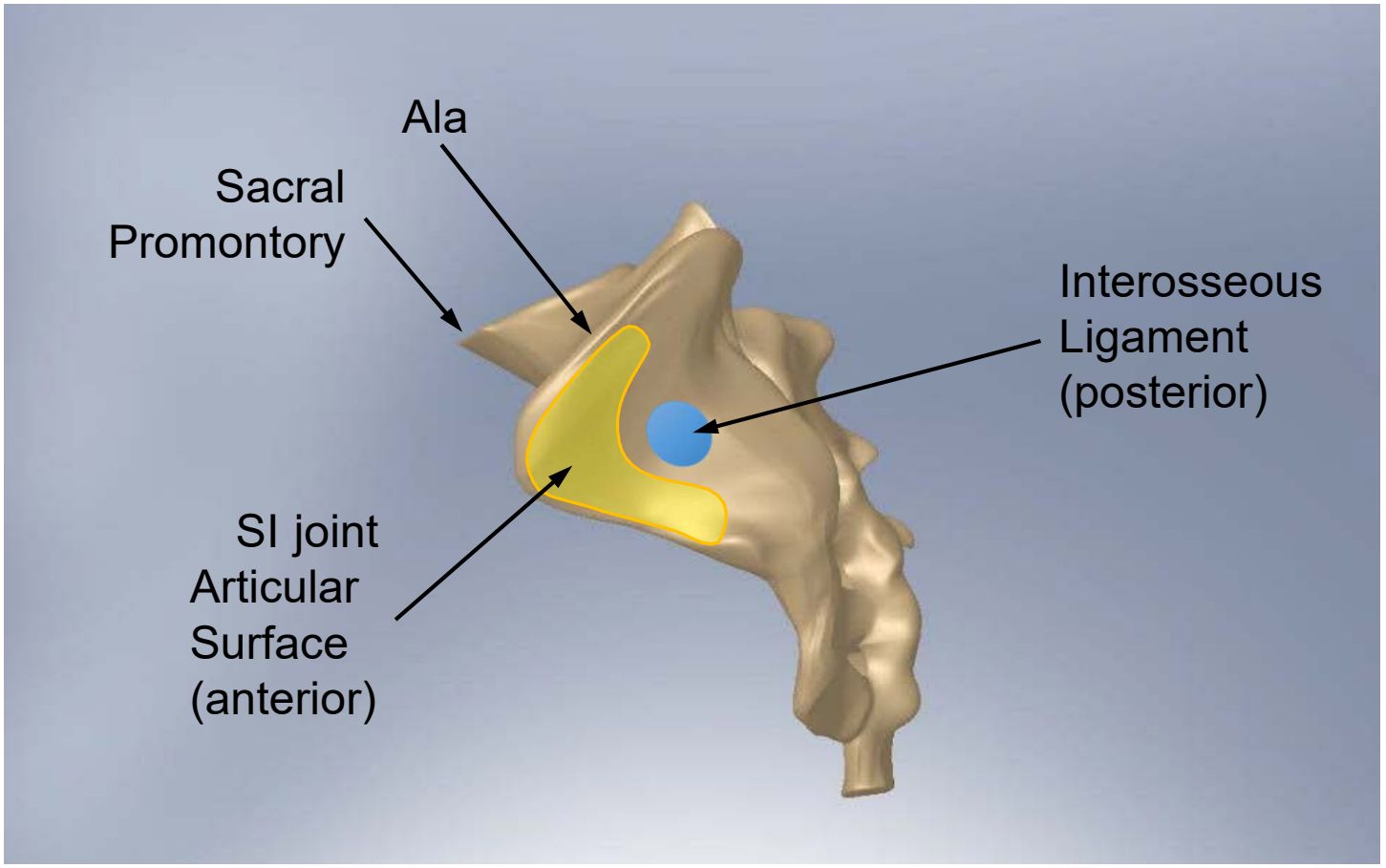
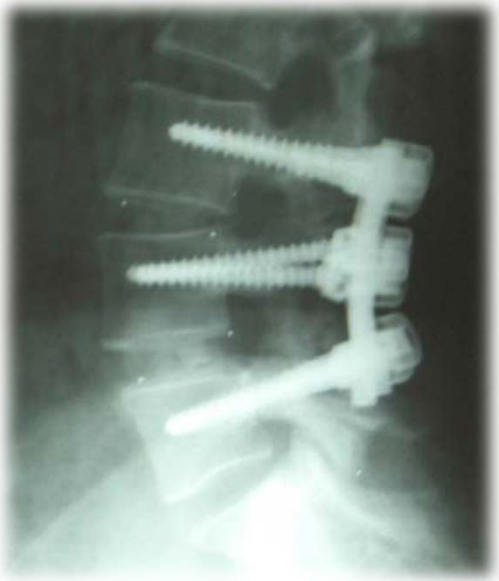
Anatomy

Lateral Sacrum



Prevalence of SI Joint Pain



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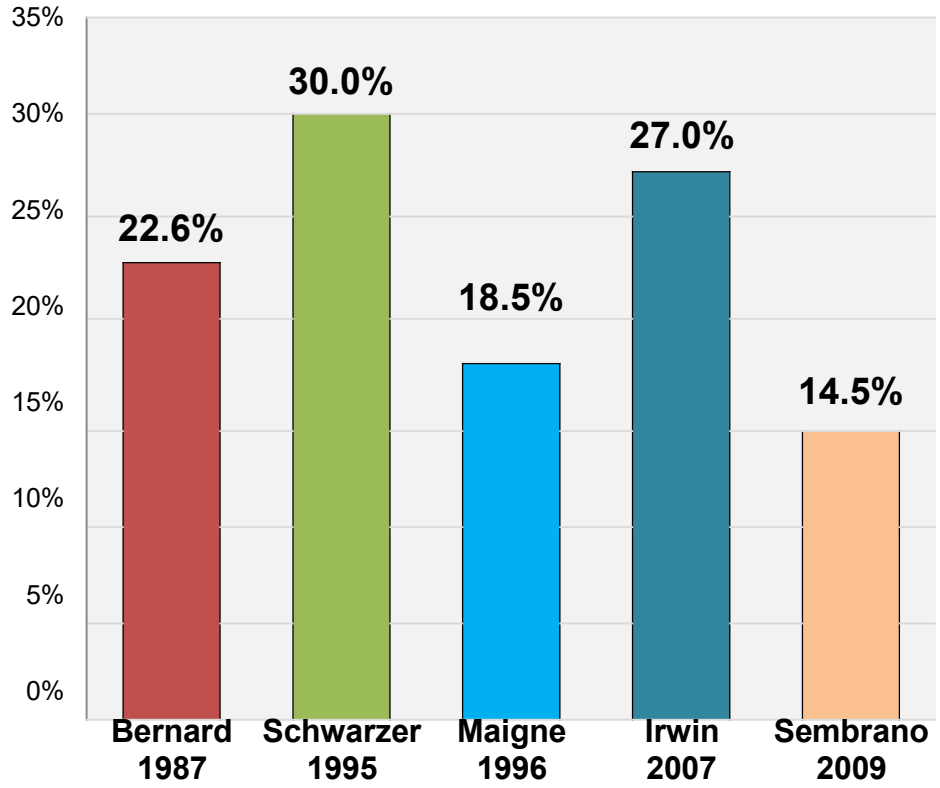
Prevalence of SI Joint Pain

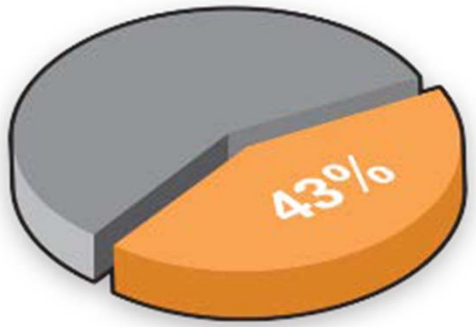
15-30%

Component of chronic LBP



32-43%

Symptomatic Post-Lumbar Fusion



DePalma – *Pain Med* 2011

32%	Katz 2003
35%	Maigne 2005
43%	DePalma 2011
40%	Liliang 2011

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Prevalence of Work-Related SIJ Patients

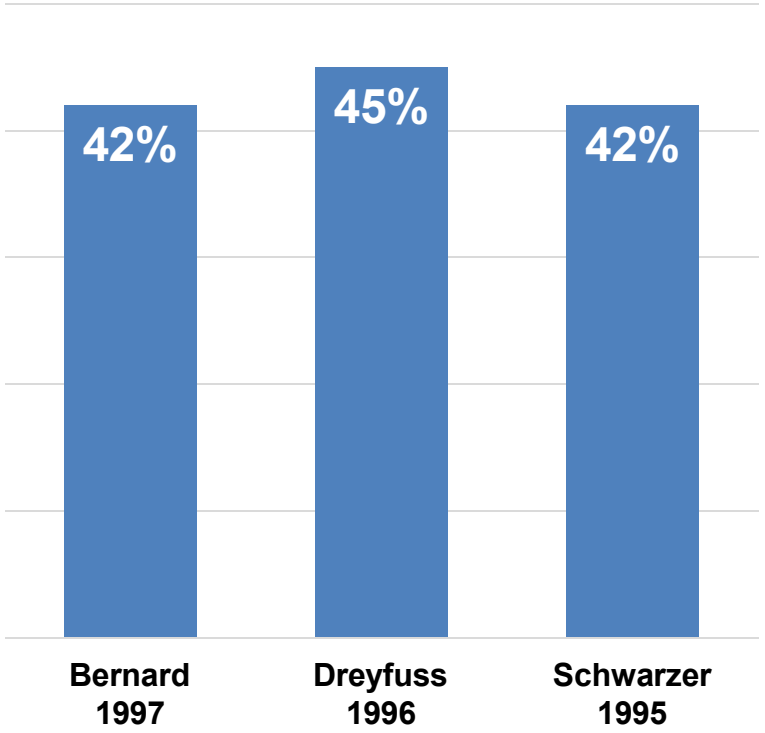
42% **Bernard 1997**

Compensable Injury = Worker's Comp

45% **Dreyfuss 1996**

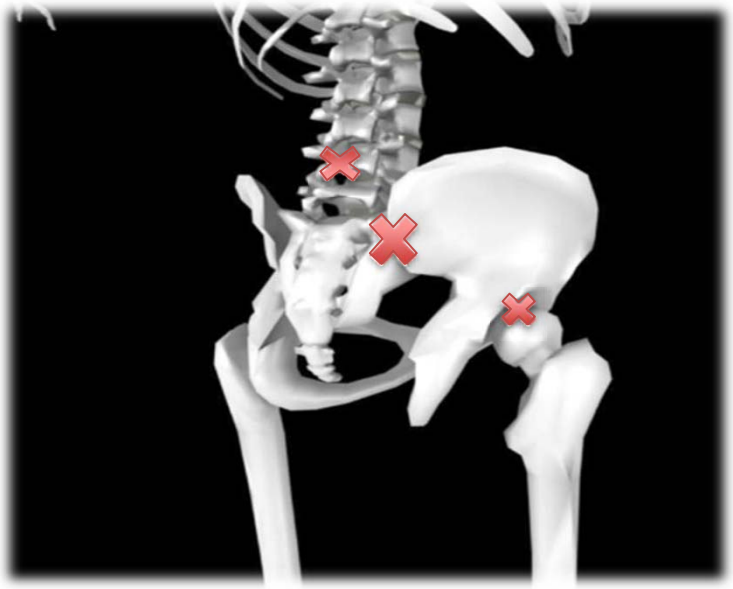
38 of 85 patients

42% **Schwarzer 1995**



1. *Bernard TN Jr, Cassidy JD. , Frymoyer JW, ed. Lippincott-Raven Publishers, Philadelphia, 1997.*
2. *Dreyfuss P, et al. Spine. 1996.*
3. *Schwarzer AC, et al. Spine.1995*

Adjacent Segment Degeneration



75% of post-lumbar fusion patients showed SI joint degenerative changes on CT scan 5 years after

vs.

only 38% age- and gender-matched controls without prior lumbar fusion

Ha et al. 2008

Lumbar fusion leads to increases in angular motion and joint stress at the SI joint

Ivanov et al. 2009

1. Ha – Spine 2008
2. Ivanov – Spine 2009

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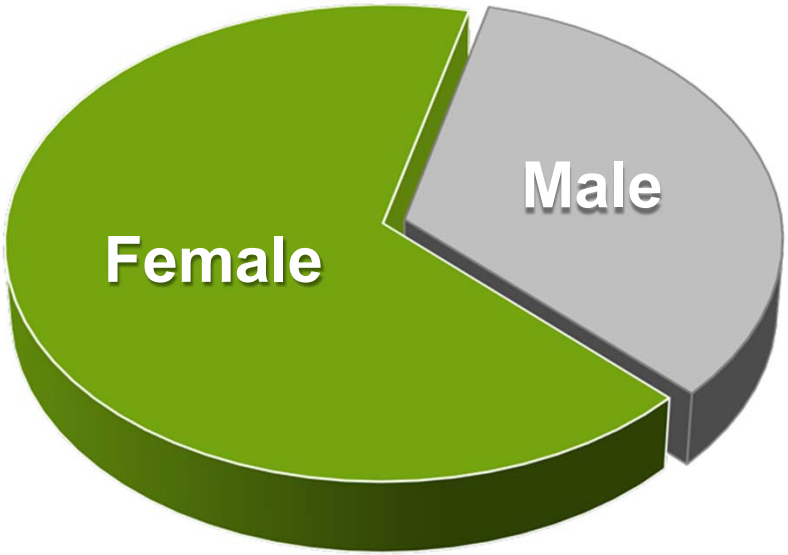
Higher Prevalence of SI Joint Pain in Females

Approximately 2/3 of patients with SI Joint Dysfunction are women*



Pregnancy-related Pelvic Girdle Pain (PPGP)

45% of pregnant women have lower back and/or pelvic pain[1]

25% of pregnant women report severe pain[1]

5% of ALL pregnant women had pain 3 years later [2]

** Based on multiple prevalence and treatment studies: Schwarzer 1995, Irwin 2007, Sembrano 2009, Katz 2003, Maigne 2005, DePalma 2011, Liliang 2011, Ha 2008, Rudolf 2012, Graham Smith 2013, Ledonio 2014, Polly 2016, Sturesson 2016, Duhon 2016, Bornemann 2016, Spain 2017 (1824 total patients, 1204 female = 66%)*

1. *Wu – Eur Spine J 2004*
2. *Norén – Eur Spine J 2002*

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Differential Diagnosis:
Shooting at the Right Target

Multiple Possible Pain Generators

Lumbar Spine

SI Joint

Hip

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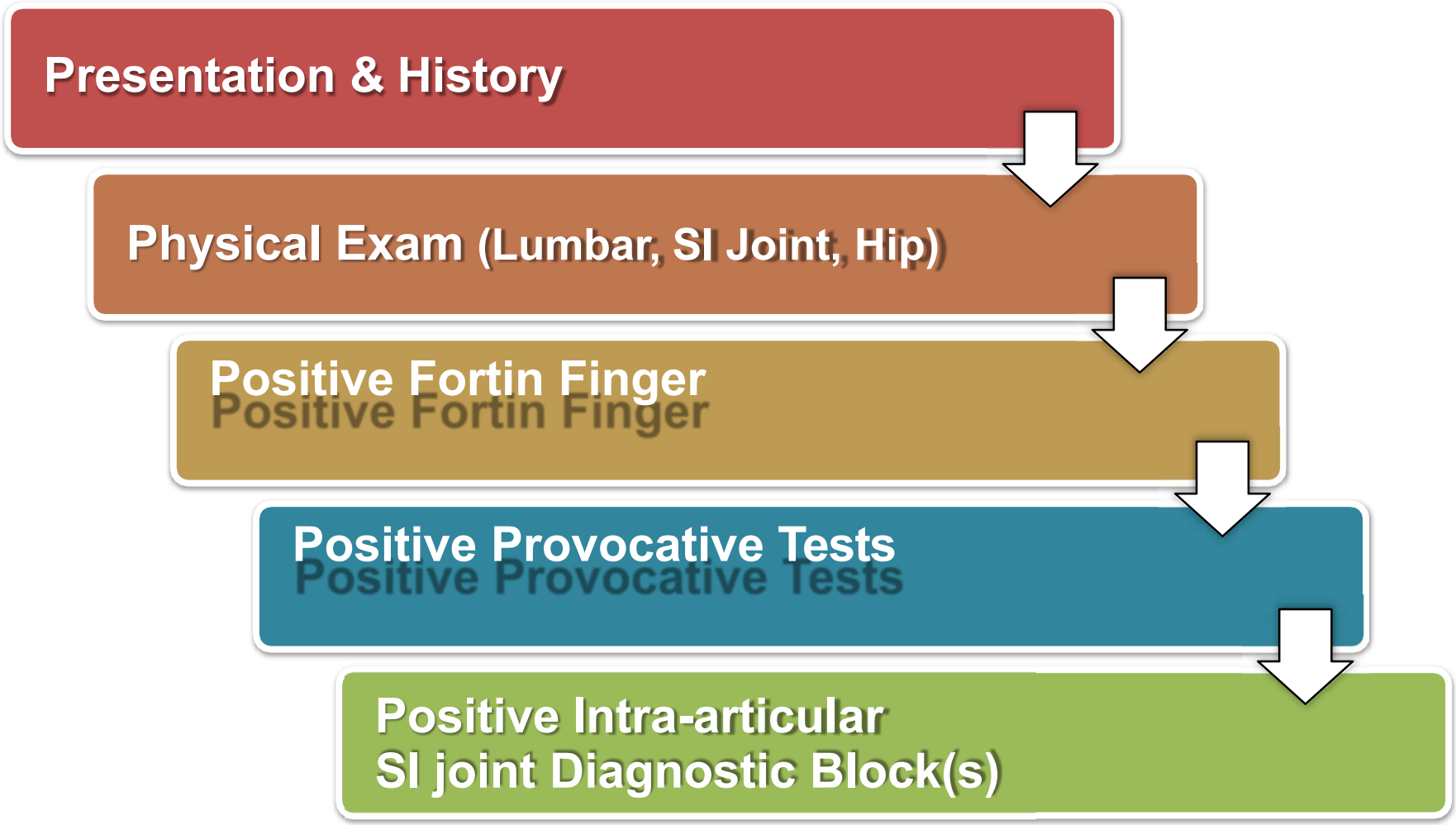
Diagnostic Algorithm



Differential Diagnosis, Physical Exam: Hip, SIJ, Lumbar

LUMBAR SPINE

- **Range of Motion:** Forward flexion, extension, lateral flexion, rotation, combination
- **Neuro Exam**
  - Motor, Sensory, Deep Tendon Reflexes (DTRs)
  - Dural tension tests

SI JOINT

- **Palpation**
  - PSIS
  - Iliac crest
  - Dorsal Ligament
  - Sacral Sulcus
- **Provocative Tests**
- **Active Straight Leg Raise (ASLR)**

HIP and PELVIS

- **Range of Motion:** Flexion, extension, internal / external rotation
- **Scour Test:** (loaded circumduction)
- **Gait evaluation**
- **Palpation:** Piriformis, trochanteric area

History and Complaints

HISTORY

When did the pain start?

- Prior trauma (examples)
  - 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

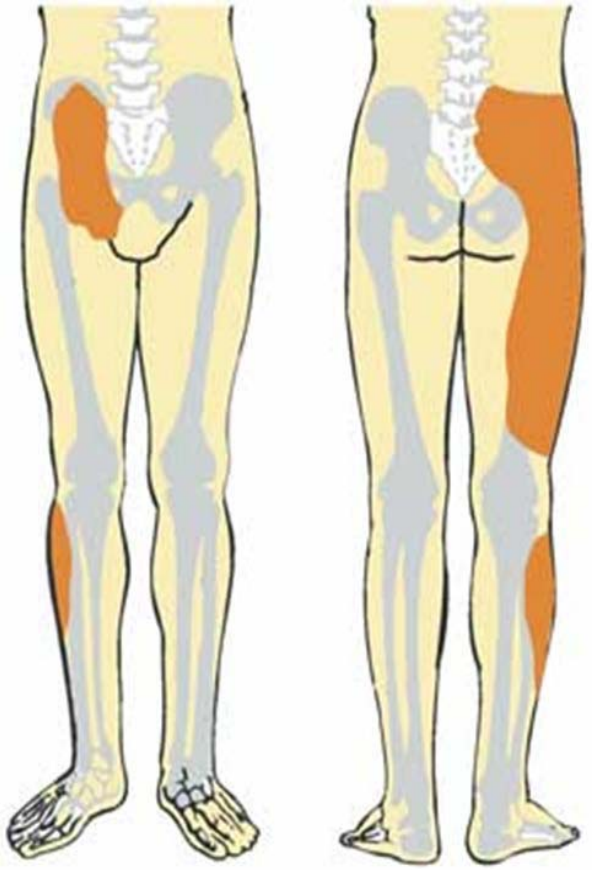
COMPLAINTS

- 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

SI Joint Pain Presentation

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 – Spine 1994

Potential Causes of SIJ Pain: *Traumatic*

- **MVA: Foot on Brake**
- **Slip and Fall**
- **Lifting and Twisting**
- **Traction Injuries**

Potential Causes of SIJ Pain: *Gradual Onset*

- **Laxity of the SIJ / Multiple Pregnancies**
- **Repetitive Forces on SIJ and Supporting Structures**
- **Biomechanical Abnormalities**
  - Leg Length Inequality
  - Pelvic Obliquity/Scoliosis
  - Iliac crest bone graft
- **Arthritis**
- **Adjacent Segment Degeneration**
  - After Lumbar Spinal Fusion
- **Post Infection Degeneration**

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Exacerbating Activities

Unilateral Weight Bearing

- Putting on Socks/Shoes
- Ascending/Descending Stairs
- Getting in and out of Car
- Prolonged Walking
  (85% of Gait is Single leg Stance)

Sexual Intercourse

Janda – Aust J Physiotherapy 1983

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

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Relieving Activities

- **Bearing weight on unaffected side**
- **Lying on unaffected side**
- **Manual or belt stabilization**

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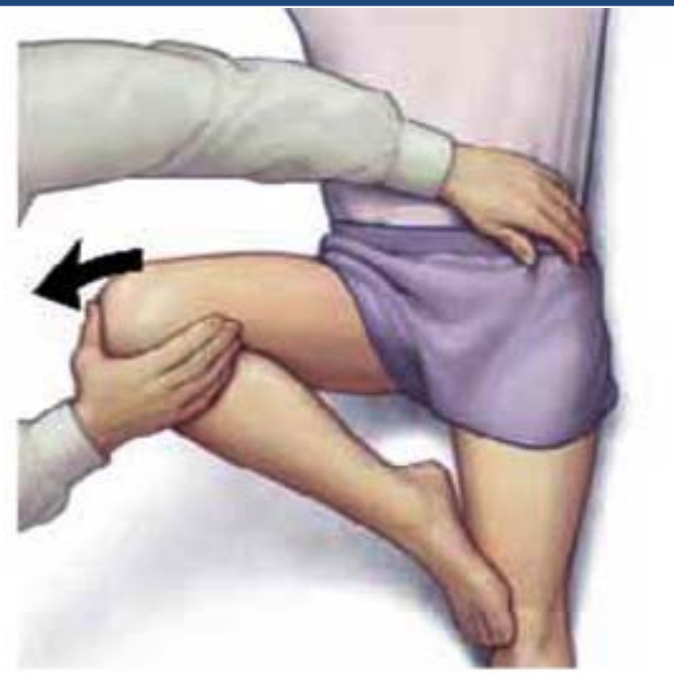
Physical Exam



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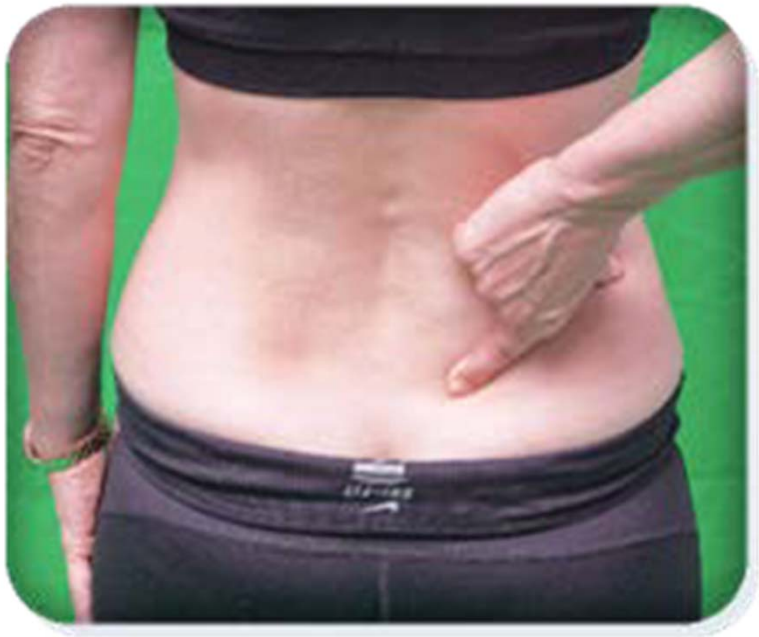
Fortin Finger Test

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 SIJ
- Above L5: Consider lumbar spine etiologies

Fortin & Falco – Am Journal of Ortho 1997

SI Joint: Provocative Tests

The following five provocative tests, when performed in <u>combination</u>, are proven to have a high degree of sensitivity and specificity:

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

	Laslett[1,2]	Szadek[3]
	3 or more positive tests	
Sensitivity	**91%**	**85%**
Specificity	**78%**	**76%**

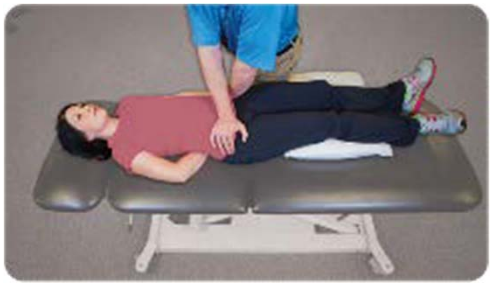
* Most sensitive of tests
** PPV = *positive predictive value*

1. Laslett – *Man Ther* 2005
2. Laslett – *J Man Manip Ther* 2008
3. Szadek – *J Pain* 2009

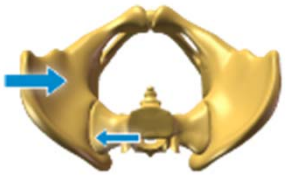
SI Joint Provocative Tests

Distraction

①

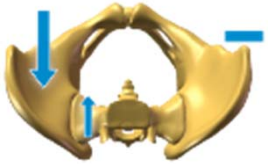


Compression



④

Thigh Thrust

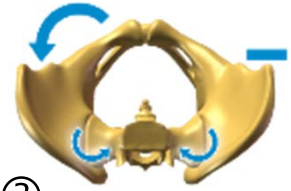


②

Gaenslen

⑤

FABER



③

3 of 5 positive tests
provides discriminative power
for diagnosing SI joint pain

Szadek – *J Pain* 2009
Laslett – *J Man Manip Ther* 2008

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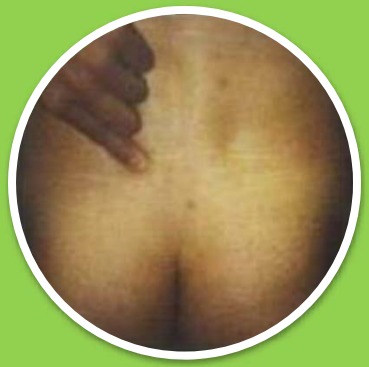
When to Proceed with SI Joint Injection

Positive
History

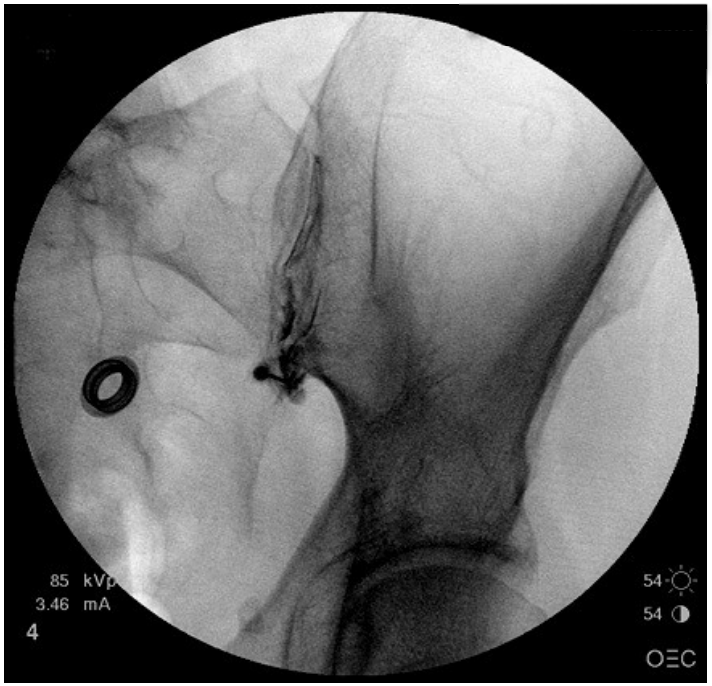


Positive
Fortin Finger Test
and
Physical Exam
(Lumbar Spine,
SI Joint, and Hip)

Positive
Provocation
Testing

What's the Reference Standard for Diagnosis?

Injection Under Fluoroscopy



Diagnostic Injection

- Confirm with contrast and imaging
- Low volume, local anesthetic
- Pain Reduction for positive test*
  - ≥ 75% require per NASS Recommendations[2]
  - ≥ 50% require per ISASS Guidelines[1]
  - < 50% = maybe SIJ, but consider other pain sources

Therapeutic Injection

- Local anesthetic + corticosteroid
- May provide intermediate or long-term relief
- Results of can be unpredictable

1. Lorio – IJSS 2016 (ISASS Policy 2016 Update - Minimally Invasive Sacroiliac Joint Fusion)
2. Bono, et al. NASS Coverage Policy Recommendations: Percutaneous Sacroiliac Joint Fusion. June 9, 2015.

* Check payor policy for positive test criteria

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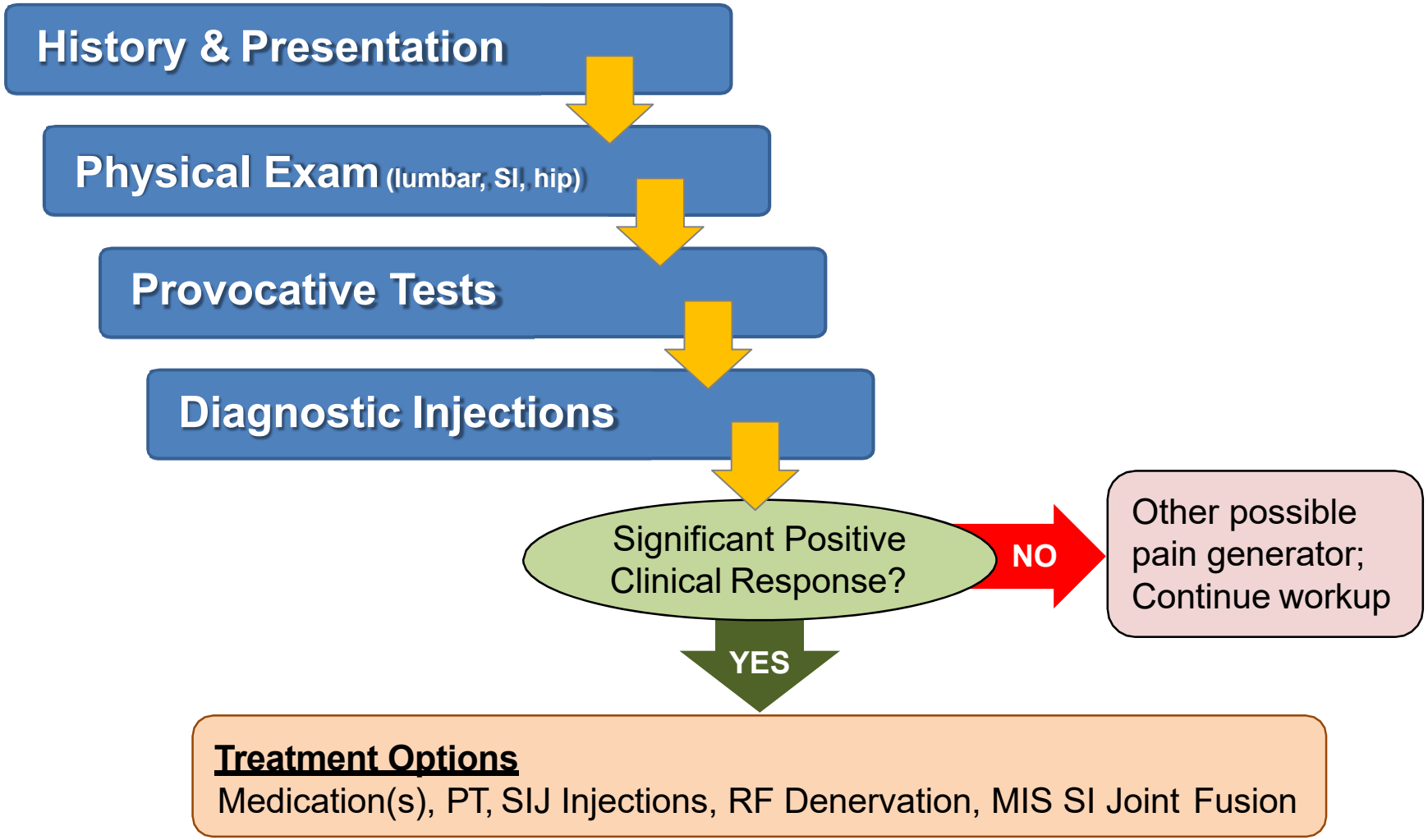
Diagnostic Algorithm for SI Joint Pain



Non-surgical Treatment Options

Symptom Management

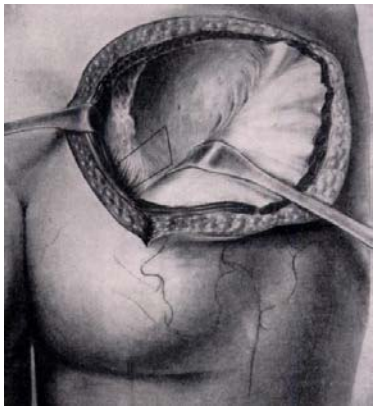
- **Medications** (Non-steroidal anti-inflammatory drugs [NSAIDs], Oral Steroids & Pain Medications)
- **External SI joint stabilization with belting**
- **Therapeutic SI Injections**
- **Radiofrequency Ablation (RFA)**

Physical Therapy (Patient Specific)

- **Motor control & core strength**
- **Restore normal functional movement patterns / proper gait**
- **Soft tissue mobilization**
- **Restore muscle length and balance**
- **Manual therapy** (muscle energy techniques/ mobilization etc.)
- **Modification of ADLs** (Patient education on posture, body mechanics, positioning)

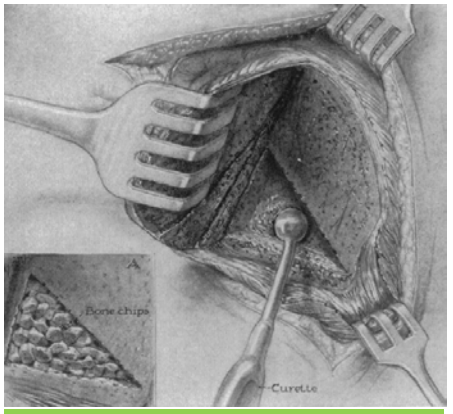
Sembrano – *Current Orthopedic Practice* 2011
Cohen – *Anesth Analg* 2005

Treatment Options: Surgical

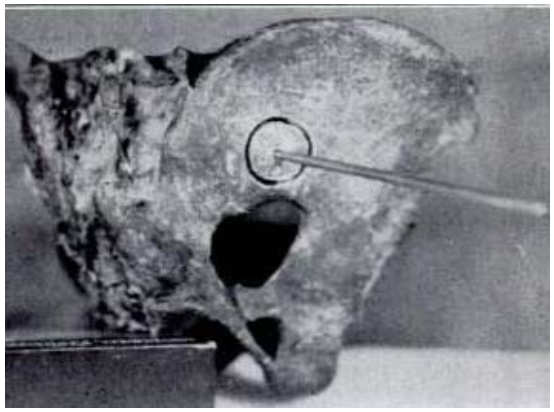


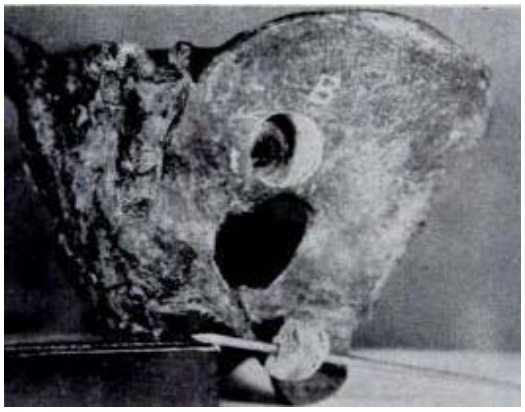
Smith-Petersen 1926

Campbell 1927

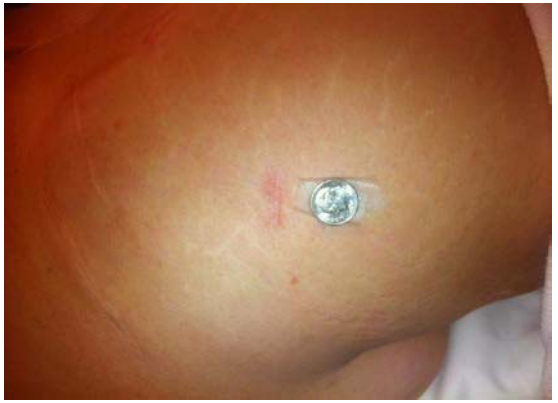


Gaenslen 1927





Bloom 1937

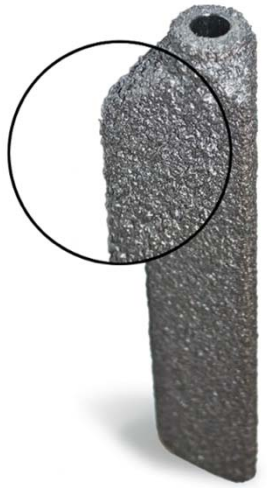


iFuse 2008

SI-BONE

iFuse Implant System®

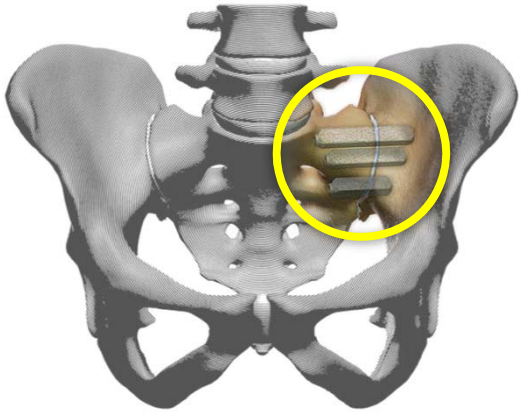
- **Unique Patented Design**
  - Triangular shape (minimizes rotation)
  - Interference press fit (immediate fixation)
  - Porous titanium surface
    (promotes bony ongrowth/ingrowth for long-term fusion)*



- **Strength of Experience**

  27,000+ procedures worldwide (August 2017)

- **Clinical Evidence**
  - iFuse Implant is the **ONLY** device for treatment of SI joint dysfunction supported by multiple prospective clinical studies including 2 RCTs
  - More than **50** peer-reviewed publications



* MacBarb G, et al. Int J Spine Surg. 2017:11;116-28.

SI-BONE®

iFuse *vs.* Open

iFuse Provided Better <u>Operative Measures</u> *vs.* Open

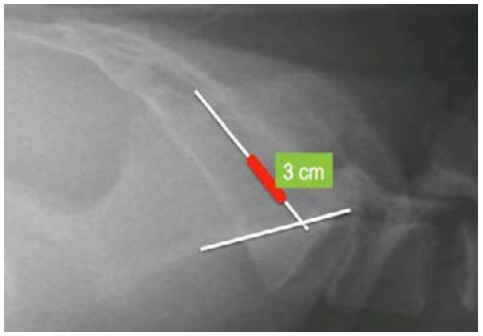
- Shorter surgery time[1,2,3]
- Less estimated blood loss[1,2]
- Fewer days in the hospital[1,2,3]

iFuse Provided Better <u>Clinical Outcomes</u> *vs.* Open

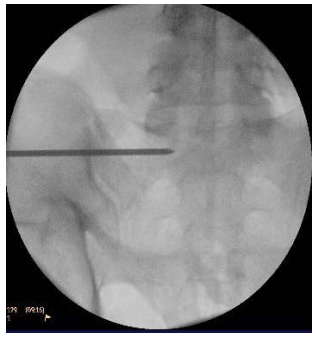
- Better pain relief (VAS) at 12 and 24 months[1]
- Better disability improvement (ODI)[2,3]

1. Graham Smith – *Ann Surg Innov Res* 2013
2. Ledonio – *Clin Orthop Relat Res* 2014
3. Ledonio – *Med Devices (Auckl)* 2014

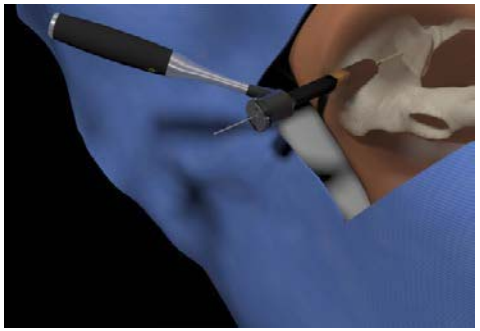
iFuse Procedure Overview



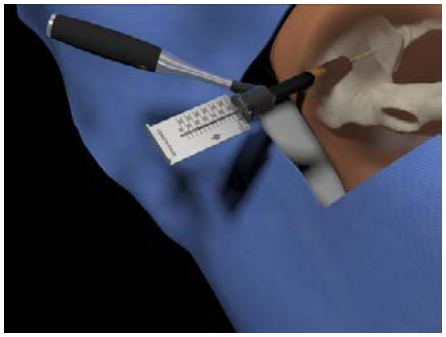
Incision
(~3 cm)



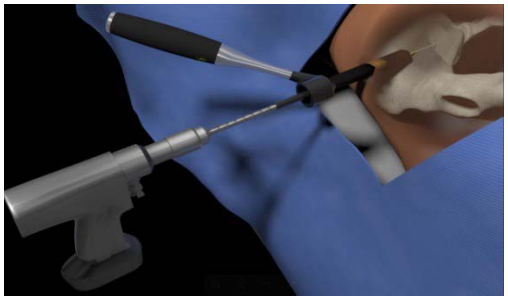
Pin



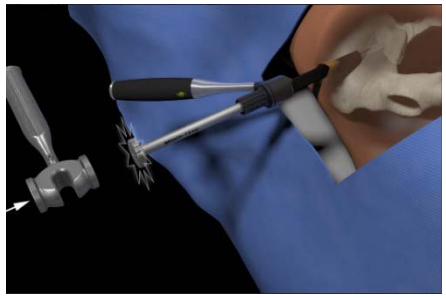
Soft Tissue Protector



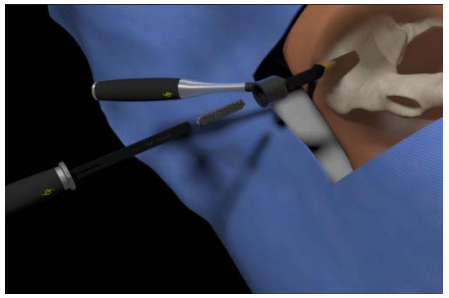
Measure



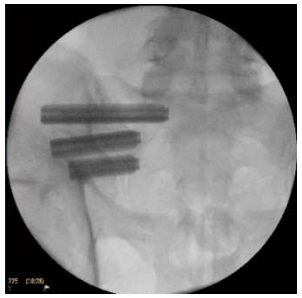
Drill
(*optional with sharp-tip broach)*



Broach



Insert Implant



Repeat
(2 more times)

SI-BONE®

Post-Operative Considerations

Individual Treatment Plans

- 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 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

Usual postoperative course:

Off work 2 weeks.

Limited duty at 2-6 weeks post op

Full Duty at 3 months

No permanent work restrictions

10% PPD based on comparable PPD for single level lumbar fusion

Clinical Evidence

SI-BONE®

Prospective Clinical Studies Overview

NCT01741025

iMIA: iFuse Implant System® Minimally Invasive Arthrodesis

Multicenter, Prospective, RCT (EU)
103 patients enrolled, 9 sites, 4 countries
24mo follow-up
iFuse vs. Conservative Management

6mo pub

1yr pub

NCT02270203

LOIS: Long-Term Follow-up in INSITE/SIFI

Extended follow-up for INSITE and SIFI to 5 years
Measuring safety and effectiveness

In Progress;
100+ enrolled
(3yr results submitted)

Completed

NCT01681004

INSITE: Investigation of Sacroiliac Fusion Treatment

Multicenter, Prospective, RCT (USA)
148 patients enrolled & treated
19 sites, 24mo follow-up
iFuse vs. Non-surgical Management

2yr pub

Completed

NCT01640353

SIFI: Sacroiliac Joint Fusion with iFuse Implant System

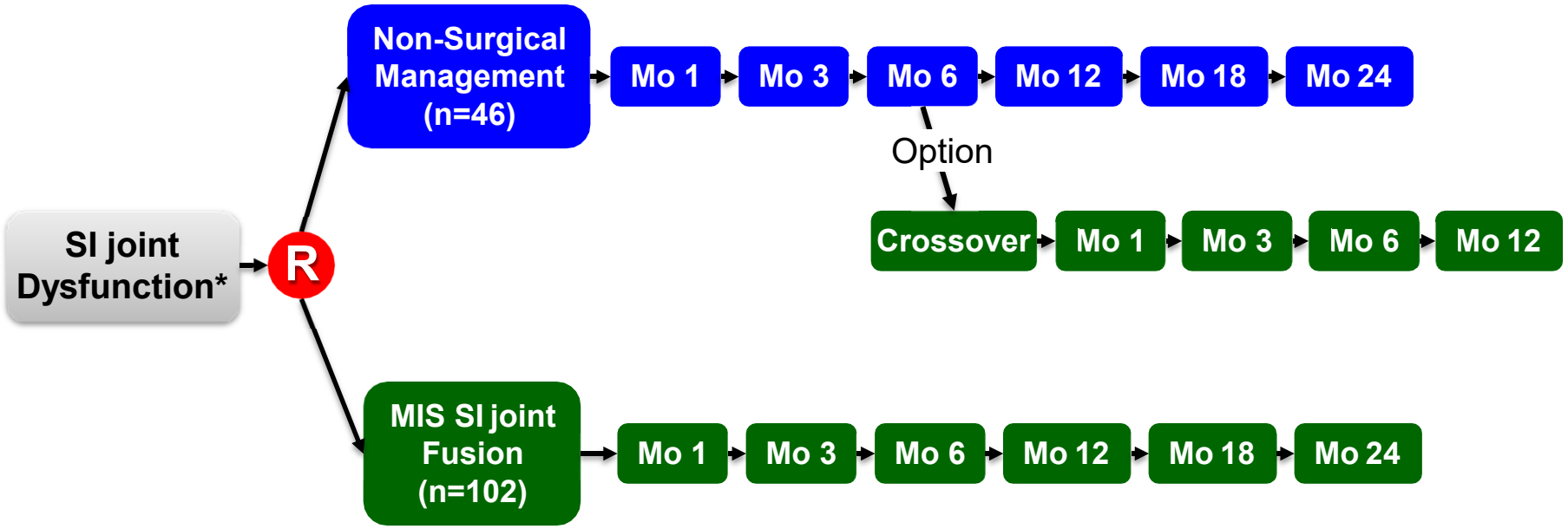
Multicenter, Prospective, Single-arm
172 patients enrolled & treated
26 sites, 24mo follow-up

First prospective study with iFuse Implant System

2yr pub

SI-BONE®

INSITE: Study Design



R = Randomization, 2:1 fashion to either MIS SI Joint Fusion or Non-surgical Management

* SI joint dysfunction due to sacroiliac joint disruption and degenerative sacroiliitis

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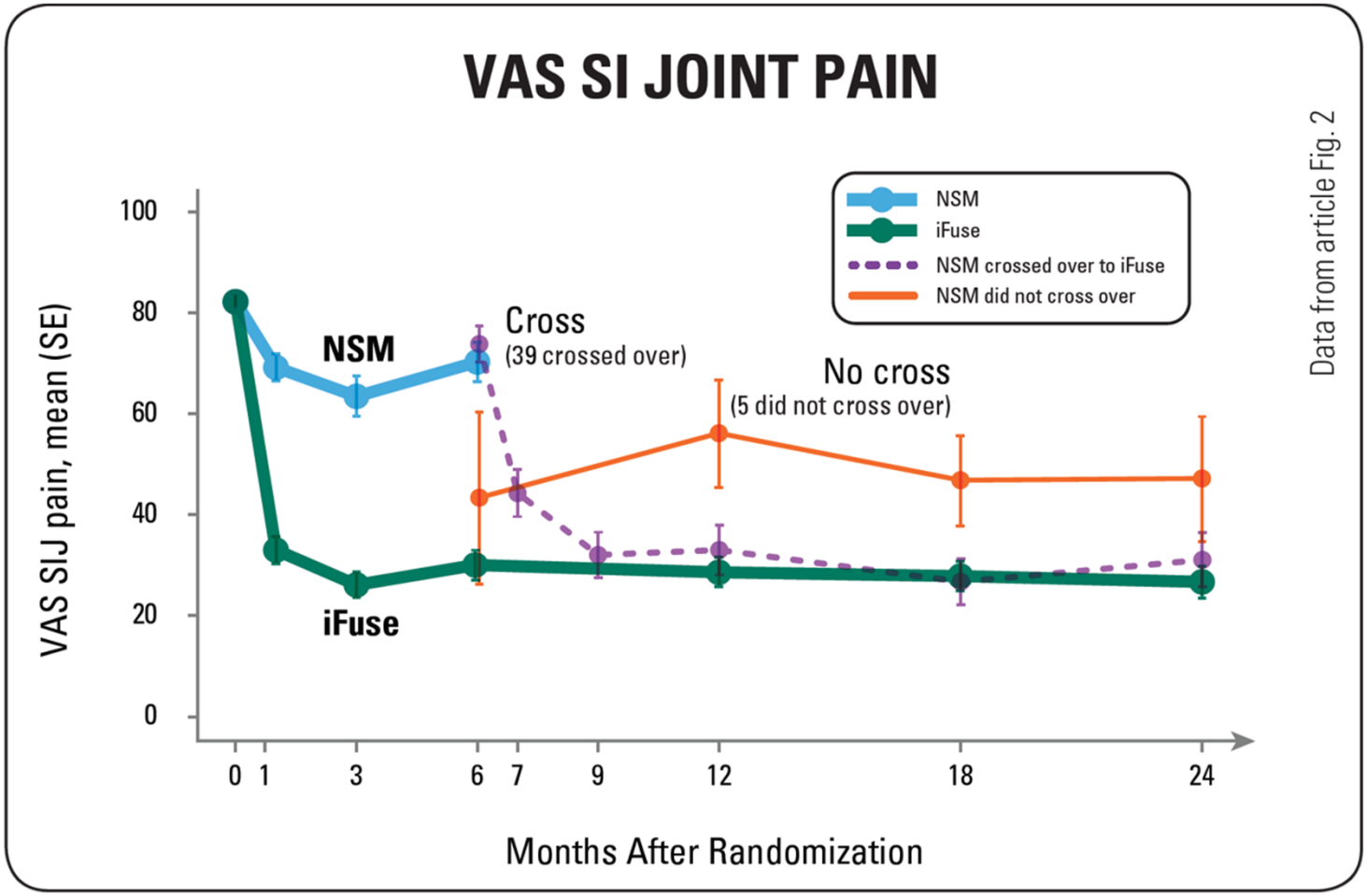
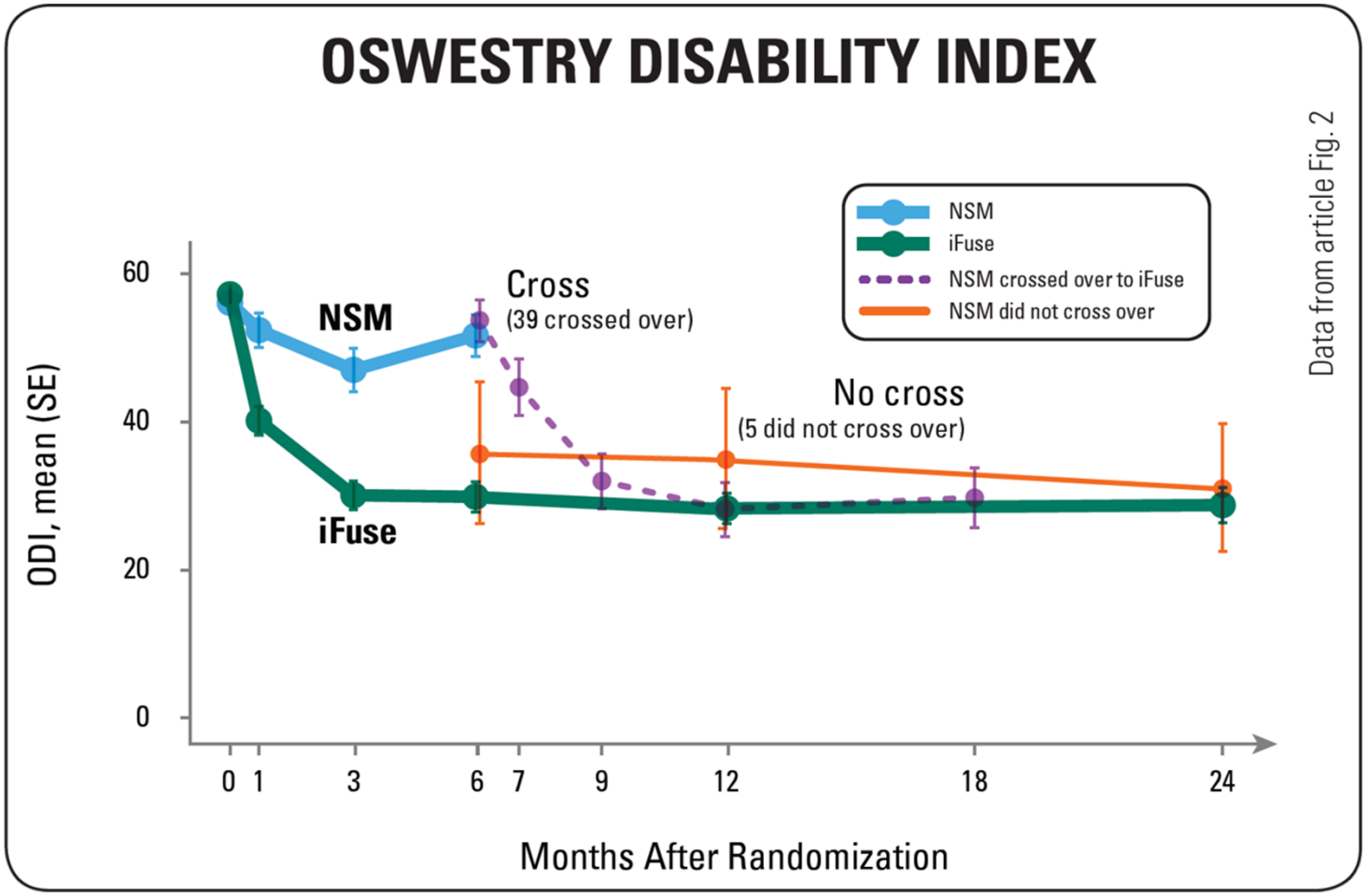
INSITE 2-year Results

Improves more after SI joint fusion than NSM



Polly – *Int J Spine Surg* 2016

INSITE 2-year Results:
Improves more after SI joint fusion than NSM



Polly – *Int J Spine Surg* 2016

INSITE 2-year Results

Safety Profile

Adverse Events per Subject Frequency (first 180 days)

1.5 iFuse *vs*. 1.3 NSM per subject (p=0.2253)

Device- or Procedure-Related Adverse Event

22 events: neuropathy (1), urinary retention (1), nausea/vomiting (2), atrial fibrillation (1), ipsilateral or contralateral SIJ pain and trochanteric bursitis (9), surgical wound problems (5), iliac fracture (1) and asymptomatic physical exam or radiographic findings (2).

Revision Surgery

3 iFuse subjects (3%) had a revision surgery through 2 years.

Polly – *Int J Spine Surg* 2016

INSITE: Summary

Superior Outcomes

iFuse superior to NSM for chronic SI joint pain at 6 months

- Pain — VAS, 53 *vs*. 12-point decrease (iFuse *vs*. NSM)
- Back Function — ODI, 30 *vs*. 5-point decrease (iFuse *vs*. NSM)

Sustained Improvement at 2 years

iFuse provided rapid & sustained 2-yr clinical improvement

- Pain — VAS, mean 55-point decrease at 2 years
- Back Function — ODI, mean 28-point decrease at 2 years
- Quality of Life — SF-36 and EQ-5D, improvement in all measures
- Satisfaction — 88% very/somewhat satisfied at 2 years

Opioid Reduction

30% fewer iFuse treated patients taking opioids (baseline to 2 yr)

Low Revisions

3% revision rate (only 3 iFuse subjects had revision surgery by 2 years)

Polly – *Int J Spine Surg* 2016

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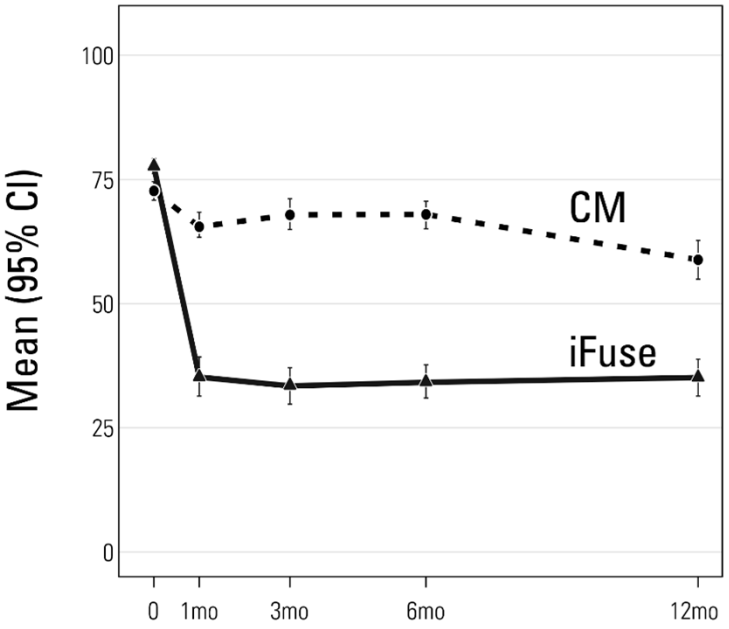
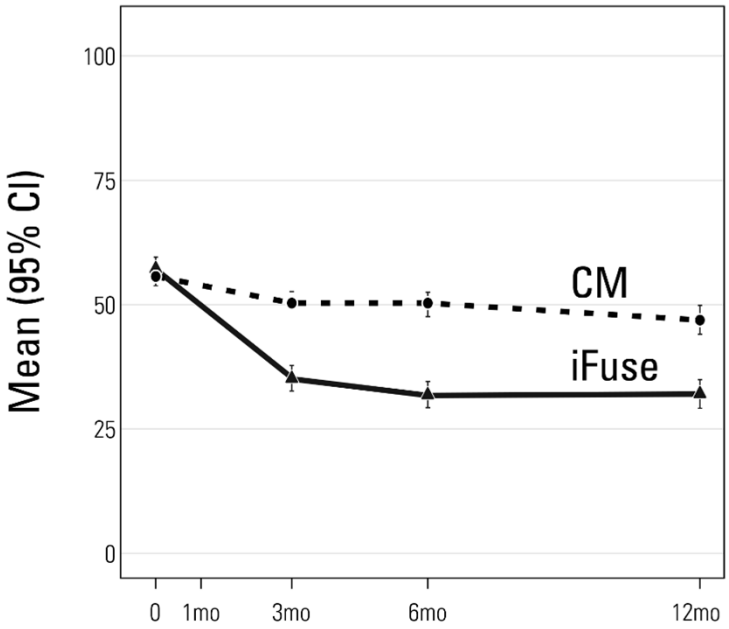
iMIA 1-year Results

Improves more after iFuse than CM

LBP



ODI



Mean change from baseline to 1 year	VAS LBP	ODI
iFuse	- 42	- 26
CM	- 14	- 8

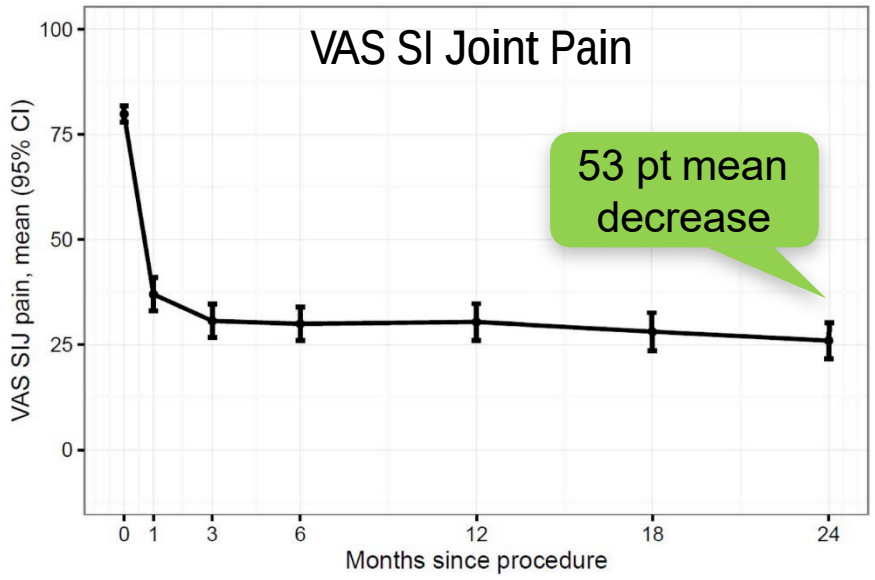
Dengler – Pain Physician 2017

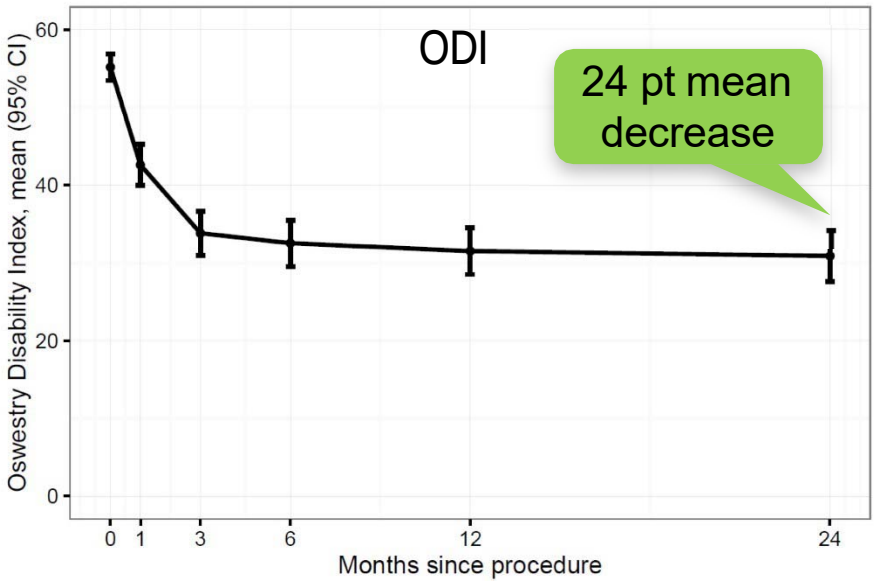
SI-BONE

SIFI 2-year Results

Prospective, Multicenter

- Sustained clinical outcomes (VAS, ODI)
- Radiographs show high rate (97%) of bony apposition
  (on at least 2 implants on both the iliac and sacral sides)





Duhon – *Int J Spine Surg* 2016

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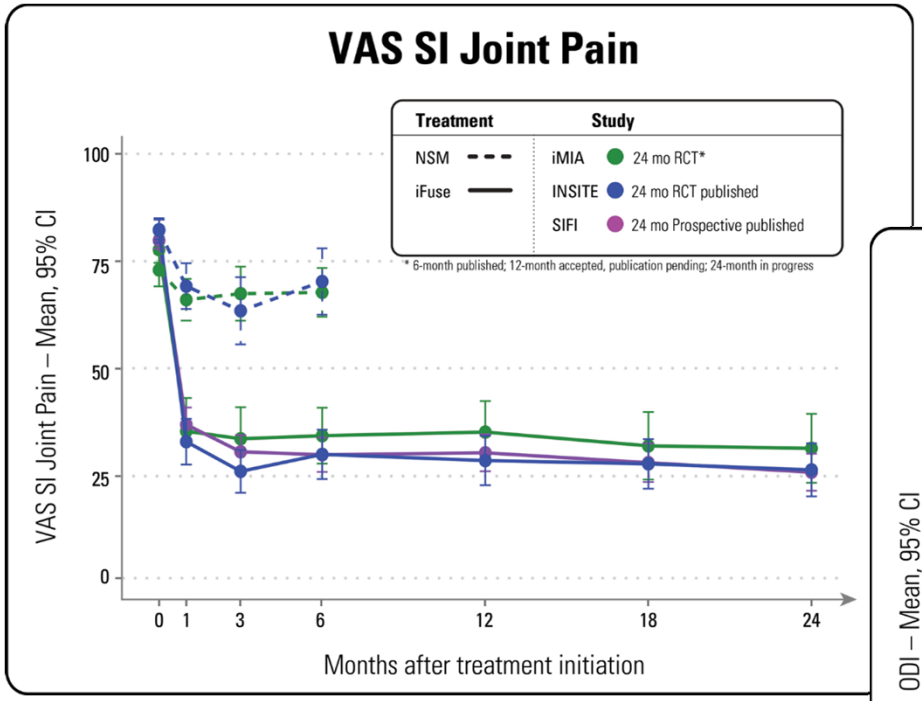
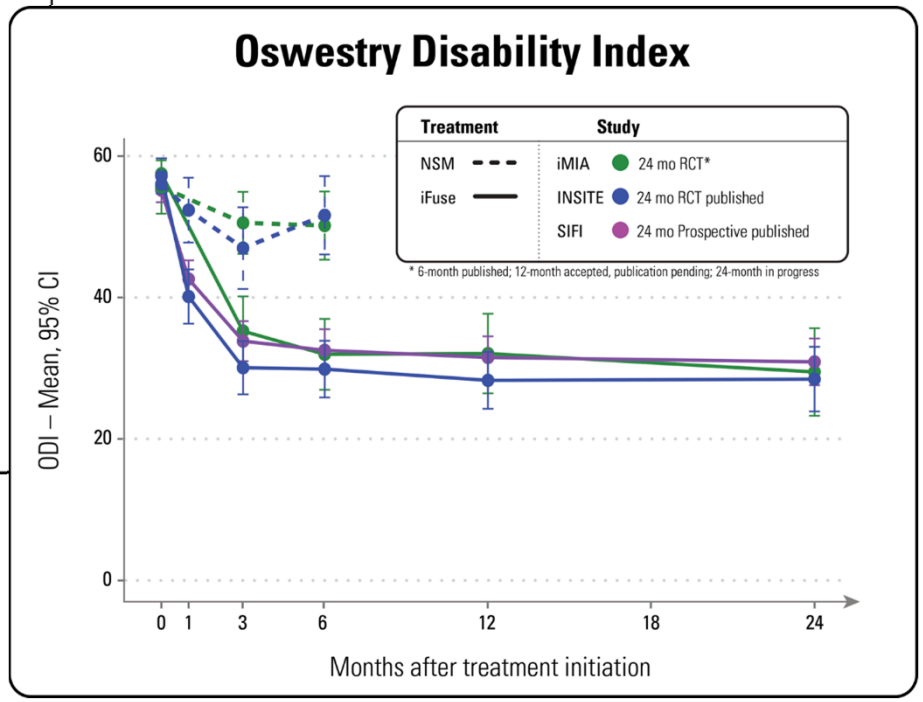
INSITE, iMIA, SIFI
Consistent Prospective Study Results



Spine

Pooled Analysis of INSITE, iMIA & SIFI
Published ahead-of-print in *SPINE* – 2017 March 27



Graphs using data from:

iMIA 24mo data as of August 17, 2017 (publication in progress)

Polly – *Int J Spine Surg* 2016 (INSITE 2yr)

Duhon – *Int J Spine Surg* 2016 (SIFI 2yr)

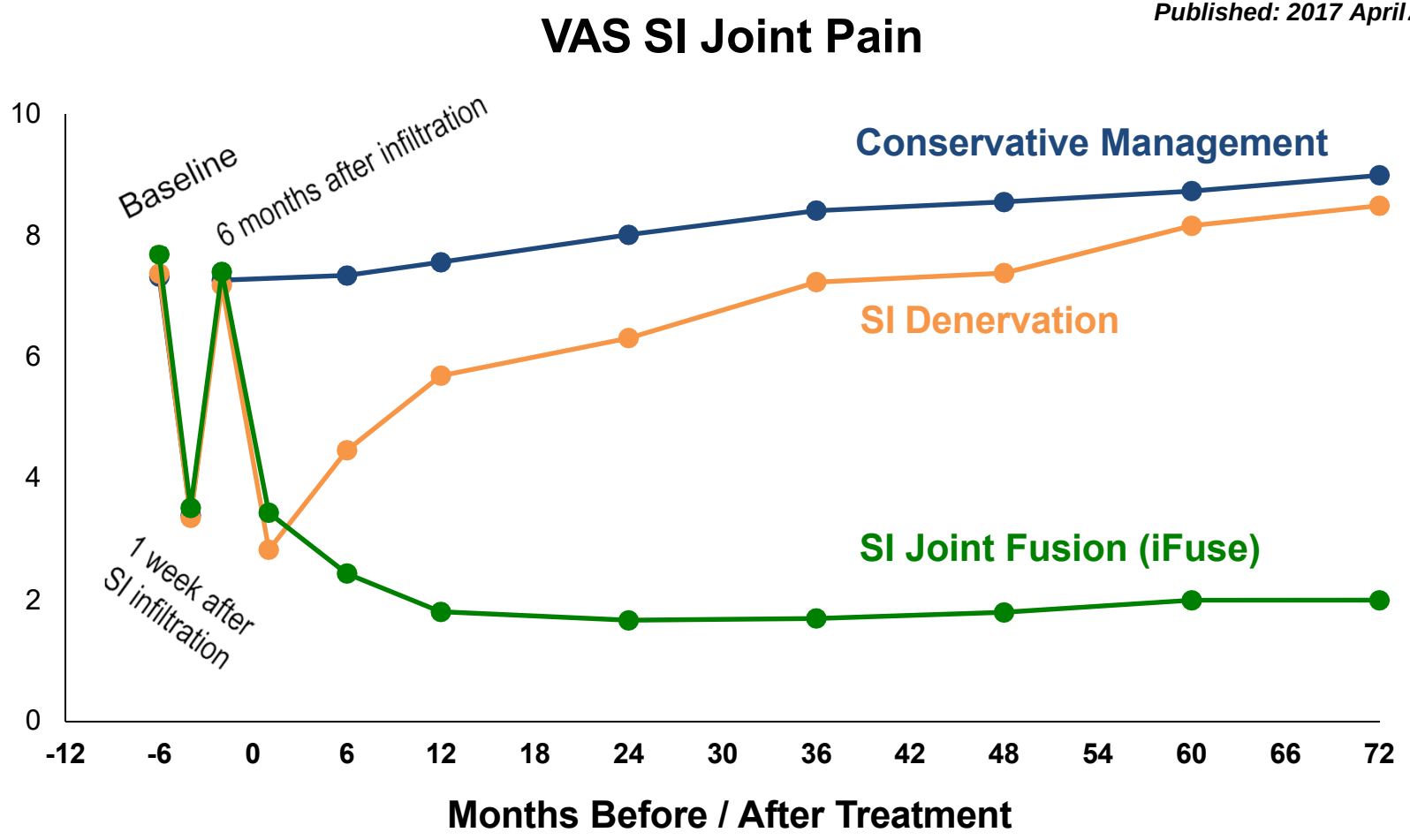
SI-BONE®

CM, RF, SI Joint Fusion (iFuse)

6-Year Comparative Cohort Study

NEUROSURGERY
THE REGISTER OF THE NEUROSURGICAL MEME

Published: 2017 April 20



Vanaclocha – *Neurosurgery* 2017

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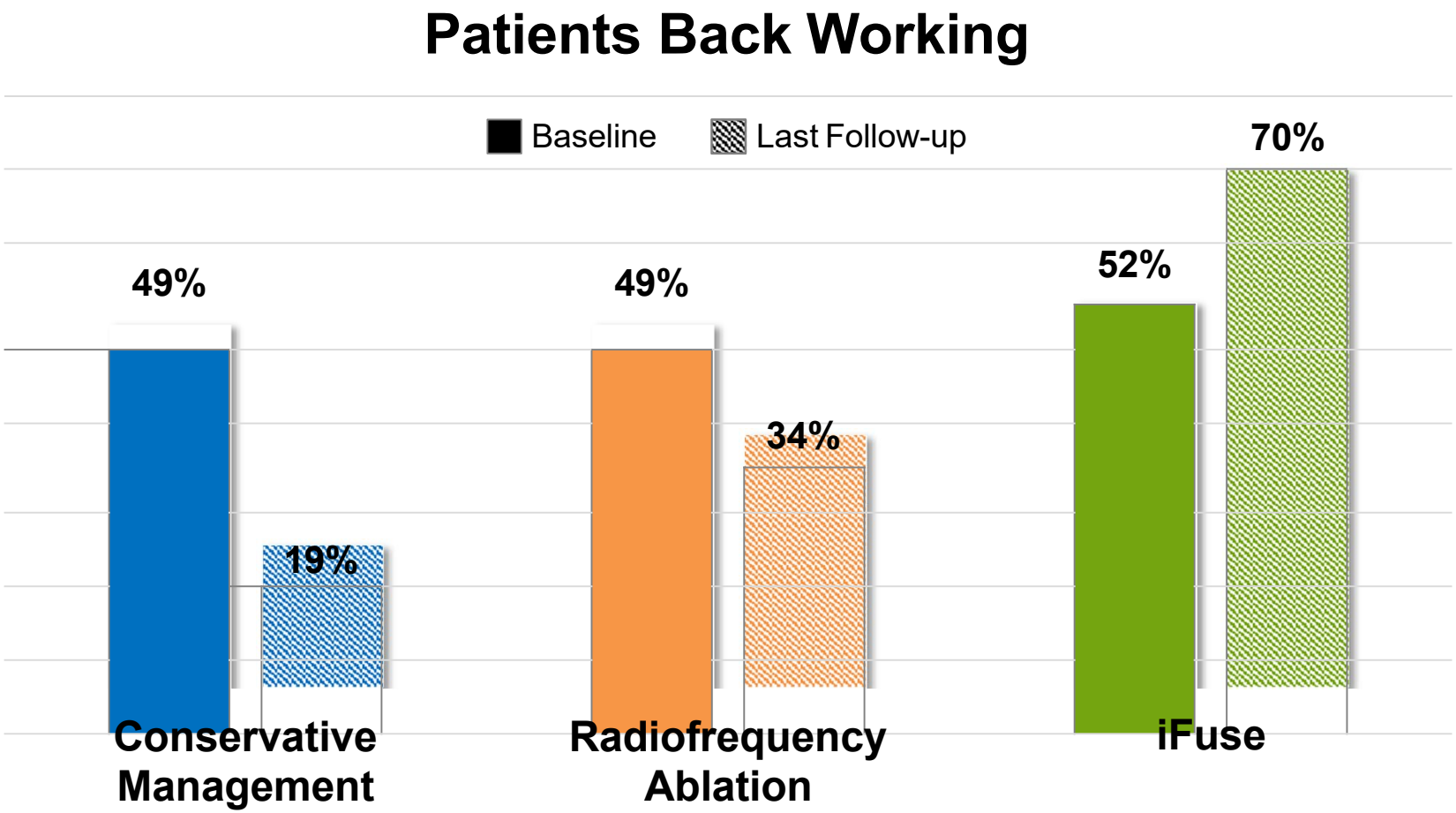
Back to Work

6-year Comparative Study (CM, RF, SI Joint Fusion (iFuse)



Vanaclocha – *Neurosurgery* 2017

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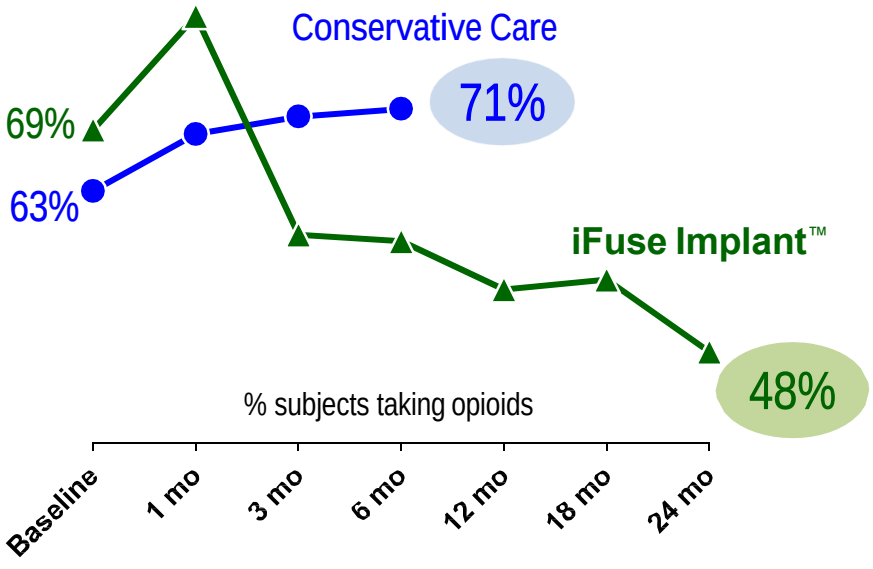
iFuse Patients Reduced Opioid Use

2-year RCT

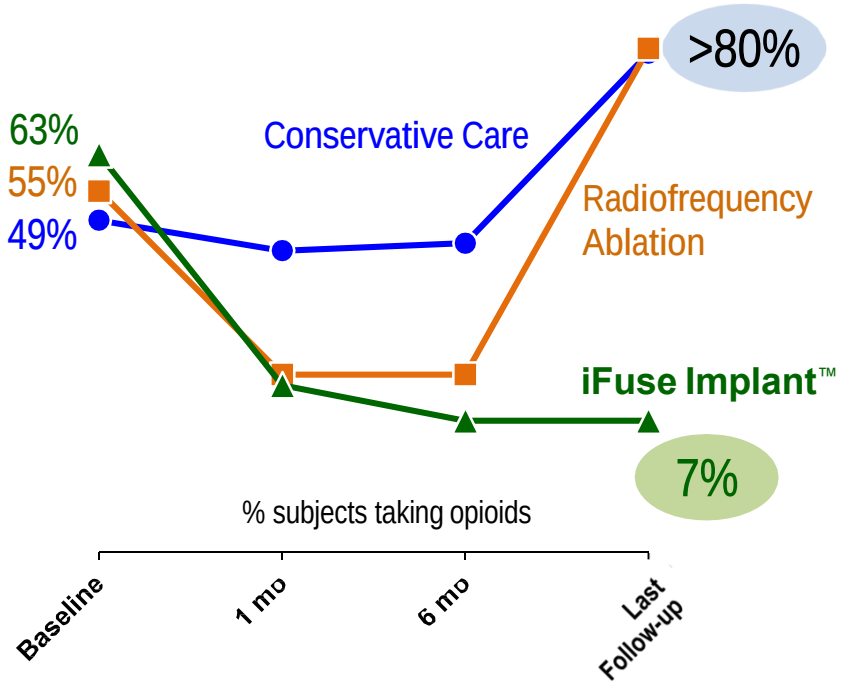
30% completely stopped opioid use



Polly – *Int J Spine Surg* 2016

6-year Follow-up, 2 controls

ONLY 7% long-term still on opioids



Vanaclocha – *Neurosurgery* 2017

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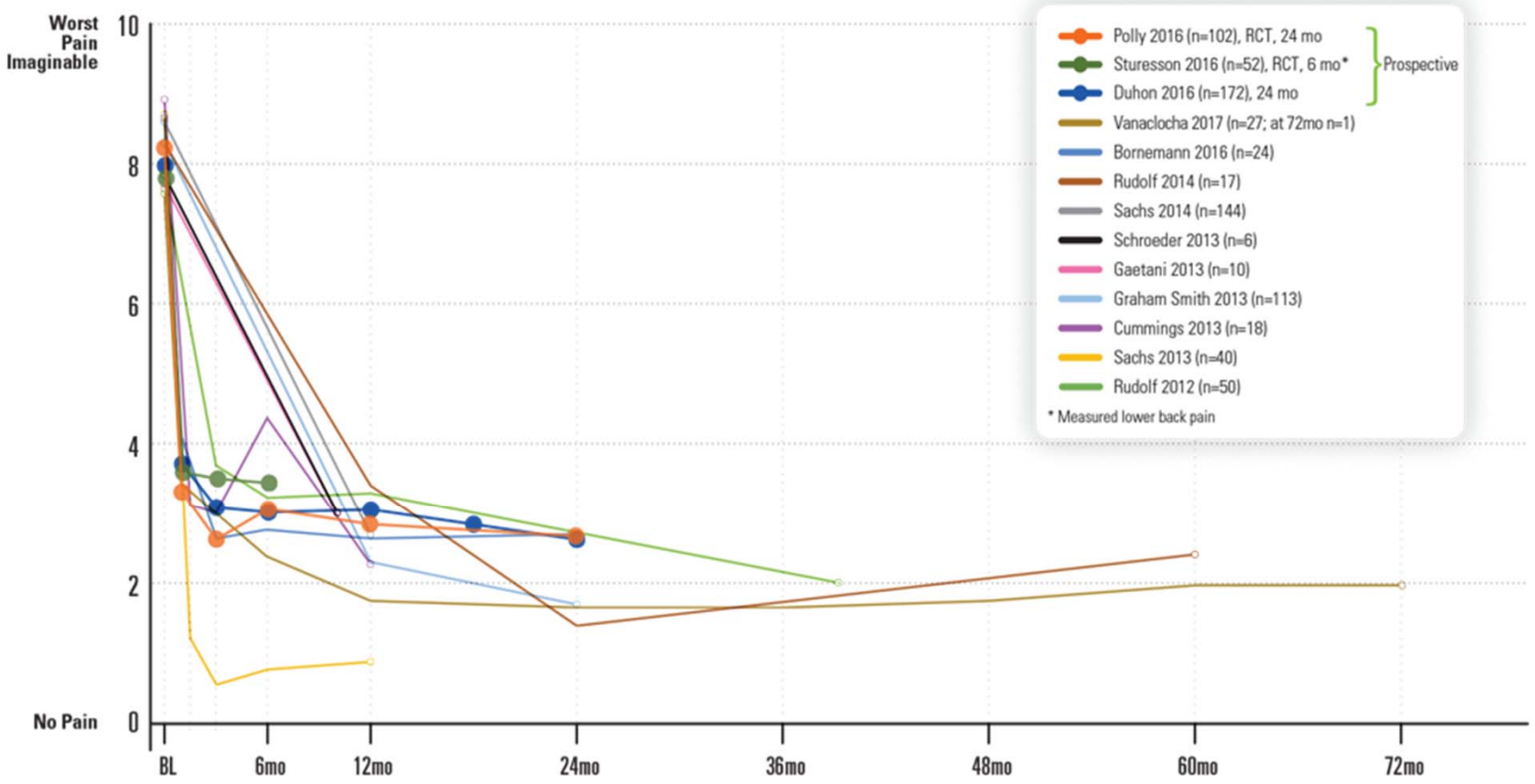
SI Joint Pain

Rapid and Sustained Pain Relief – VAS SI Joint Pain



Complete References in Bibliography

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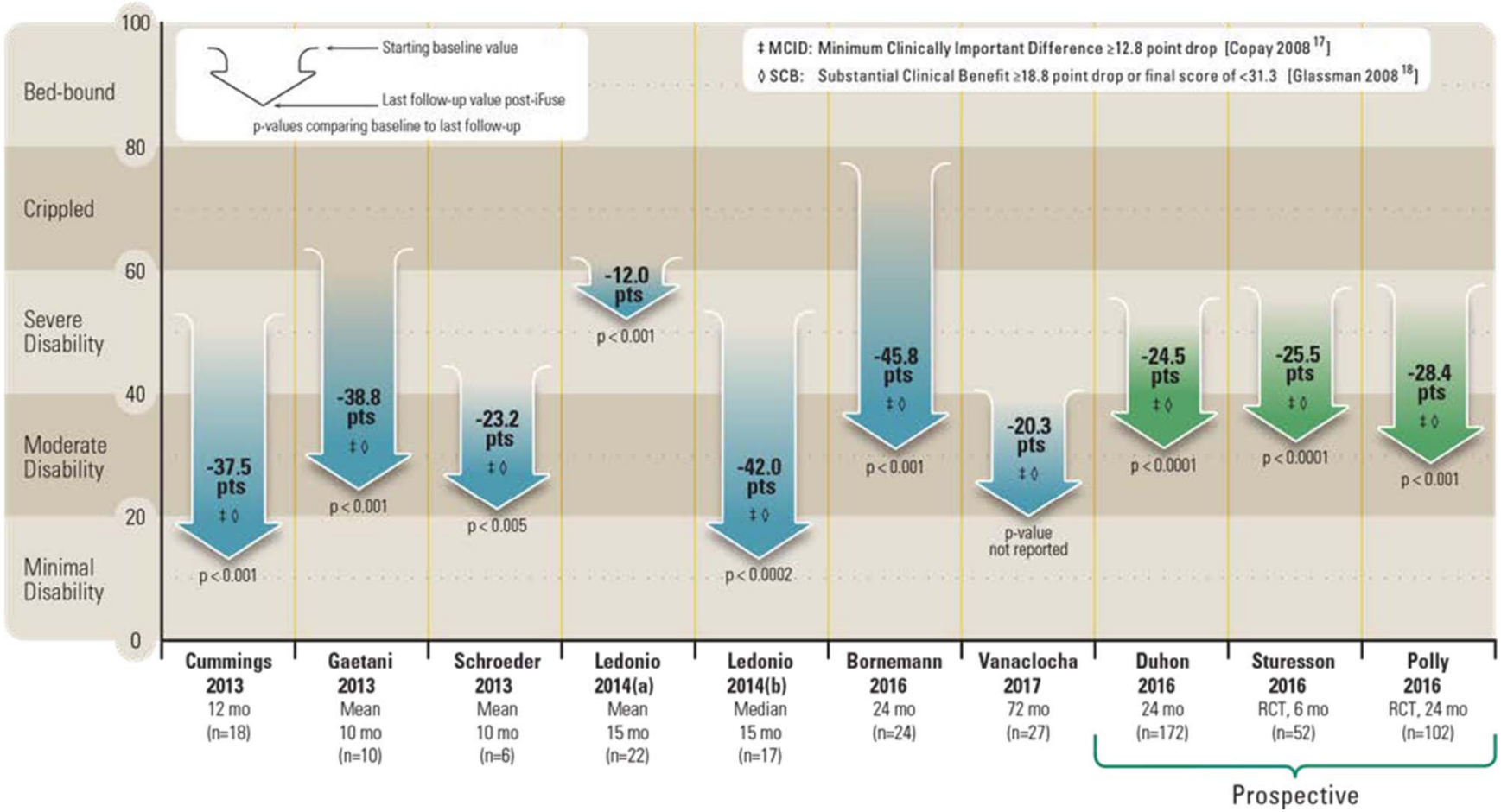
Disability

Reduction in Disability – Oswestry Disability Index



Complete References in Bibliography

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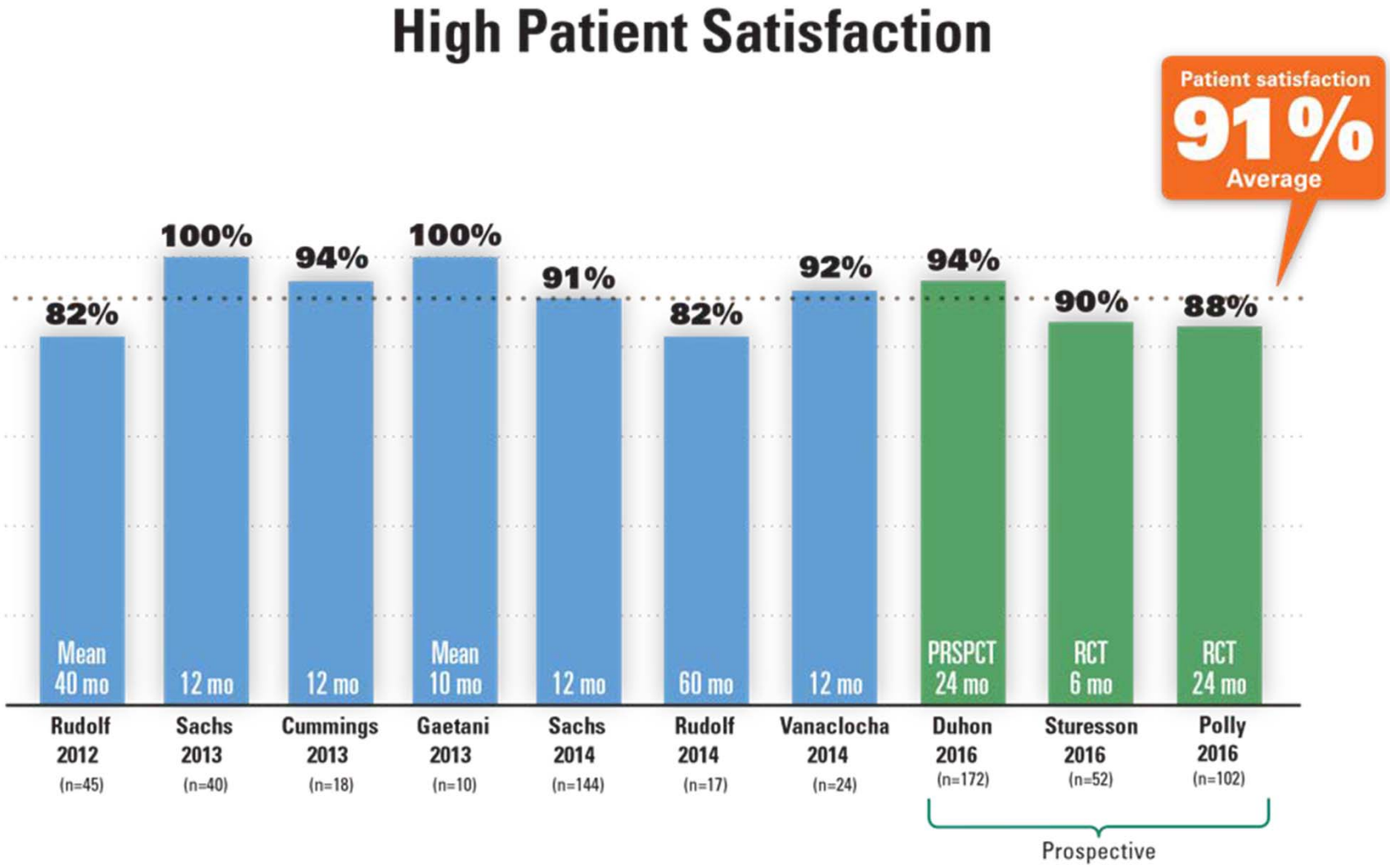
Satisfaction



Complete References in Bibliography

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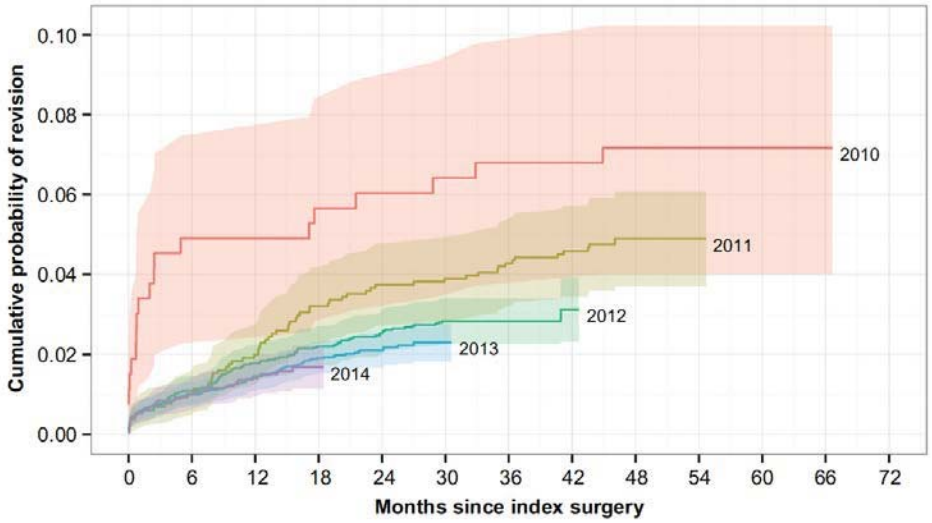
Revision Rate

4-yr Revision Rate Study[1]

11,388 patients (Apr 2009 – Aug 2014)

- **3.5% cumulative 4-yr revision rate** (96.5% free from revision, a.k.a. survivorship)*
- Rate decreased annually since 2009
- Revision rate did not differ by age (< or > 65) or sex



Cumulative probability of all-cause revision after iFuse Implant System. Shaded areas represent 95% confidence intervals.

4-year Cumulative Revision Rate Comparison

3.5%	iFuse, MIS SIJ Fusion (Cher – *MDER* 2015)[1]
10-12%	Lumbar Decompression (Deyo – *JBJS Am* 2011)
12-14%	Lumbar Fusion (Martin – *Spine* 2007)

2.6%

* iFuse Implant System Overall Revision Rate (August 2017)

SI-BONE corporate records

1. Cher – *Med Device Evid Res* 2015

SI-BONE®

Nationwide Medicare Coverage of MIS SIJ Fusion

8 Medicare Administrative Contractors (MACs)

cahaba℠

National Government Services

FIRST COAST SERVICE OPTIONS, INC.

WPS GOVERNMENT HEALTH ADMINISTRATORS

PALMETTO GBA®
A CELERIAN GROUP COMPANY

CGS®
A CELERIAN GROUP COMPANY

noridian
Healthcare Solutions

NOVITAS SOLUTIONS

Commercial Coverage

(Status as of August 2017)

iFuse Exclusive Policies

selecthealth

Geisinger Health Plan

HCSC Health Care Service Corporation

BlueCross BlueShield of Illinois

BlueCross BlueShield of Montana

Blue Cross and Blue Shield of New Mexico

BlueCross BlueShield of Oklahoma

BlueCross BlueShield of Texas

Blue Cross Blue Shield Blue Care Network of Michigan

BlueCross BlueShield Nebraska

BlueCross BlueShield of Vermont

Harvard Pilgrim Health Care

Health New England

IEHP A Public Entity INLAND EMPIRE HEALTH PLAN

KAISER PERMANENTE® California & Northwest

Minuteman Health

KERN HEALTH SYSTEMS

network health

HIGHMARK.

Priority Health

TRICARE

UnitedHealthcare®

(case-by-case)

Professional Society Guidelines

Coverage for **MIS SI joint fusion is recommended** for appropriately selected patients by the professional medical societies listed below. Patient selection criteria and recommendations for insurance coverage, can be accessed via the links below.

North American Spine Society (NASS)

The coverage recommendation outlines 8 criteria specifically intended to ensure patients are appropriately selected for the procedure. (June 2015)

https://si-bone.com/uploads/documents/PercutaneousSacroiliacJointFusion.pdf

International Society for the Advancement of Spine Surgery (ISASS)

ISASS has concluded that minimally invasive SI joint fusion is now the standard of care for a select subset of patients. ISASS concludes that minimally invasive SI joint fusion is a safe and effective procedure for patients with unremitting pain due to SI joint disorders. (Updated July 2016)

http://www.isass.org/public-policy/isass-policy-statement-minimally-invasive-sacroiliac-joint-fusion-july-2016/

Medical Necessity Documentation 1 of 2

1. **Comprehensive History**
   - Date of onset
   - Mechanism of onset
   - Aggravating/relieving actions
   - Location, type, of pain
   - Functional limitations
     - Walking, standing, sitting, stairs, lifting, etc.
   - Relevant history
     - Prior lumbar fusion, trauma, LBP with pregnancy, inflammatory arthropathy, scoliosis, leg length inequality, etc.

2. **Treatment to date (Include details)**
   - Treating physicians (duration, type, results)
   - Non surgical treatments
     - Medications, Physical Therapy, Chiropractic, etc.
   - Injections/Procedures – amount and duration of relief
     - Therapeutic Injections
     - RF Ablation
     - other

Medical Necessity Documentation 2 of 2

3. Diagnostic Imaging and Studies (Spine, Pelvis, Hip, etc.)

- Study performed (*e.g.*, CT Pelvis), date performed
  - Radiographic interpretation, key points, include report
  - Personal review / interpretation, describe SI joint findings
- EMG/NCV reports

4. Physical Examination

- Spine: inspection, palpation, ROM, neurologic exam
- Pelvis: inspection, palpation (piriformis, trochanter, symphysis, etc.)
- SI Joint: inspection, palpation, provocative maneuvers
- Hip: inspection, palpation, ROM

5. Diagnostic Injection (date, dictated report, images, results)

- Percentage of relief with injection
- Duration of relief with injection

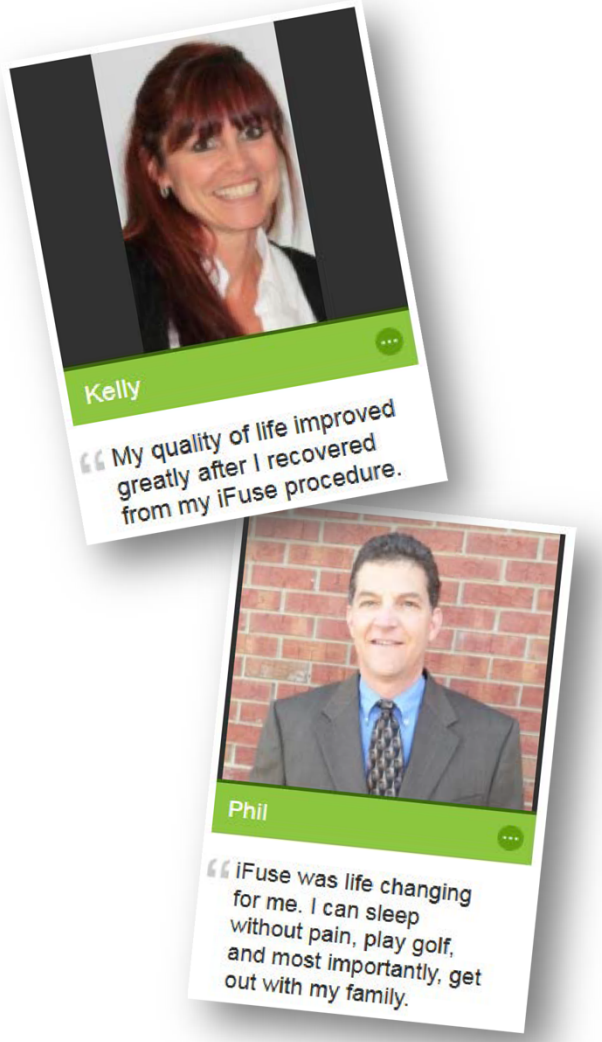
SI Joint Patient Resources

www.sijpc.org

- Patient Insurance Coverage Support (PICS)
- SI Buddy Program™
- Videos and other SI joint information

Call toll free (844) 742-8339 (844-SI-BUDDY)

Patient Stories



SI-BONE®

SI Joint Patient Community and the SI Buddy℠ Program

If you are interested in connecting your patients who are considering the iFuse Procedure™ with an SI Buddy, or if you have a successfully treated iFuse patient interested in becoming an SI Buddy, have the patient contact us today!

- SI Buddy volunteers have all had the iFuse Implant System and are at least six-month post-operative.
- SI Buddy participants want to support others who suffer with SI joint pain by sharing their personal story.

www.sijpc.org

The SI Buddy program is reserved for patients who have been diagnosed by a trained surgeon and recommended for the iFuse procedure. SI Buddy volunteers have been successfully treated with the iFuse Implant System®. They are not medical professionals and their statements should not be interpreted as medical advice.

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Important Information

This reimbursement information is provided for convenience only. It is neither legal advice nor official payor guidance. SI-BONE does not warrant or guarantee that the use of the information will result in coverage or payment. Providers are solely responsible for determining medical necessity and for being in compliance with Medicare and other payor rules and requirements, as well as for the information they submit with claims and appeals. Before any claims or appeals are submitted, providers should review official payor instructions and requirements, confirm the accuracy of their coding or billing practices with these payors, and use independent judgment when selecting codes that most appropriately describe the services or supplies provided to a patient.

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.

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Thank You

References (alphabetically)

Abramson D, Roberts SM, Wilson PD. Relaxation of the pelvic joints in pregnancy. Surg Gynecol Obstet. 1934;58(3):595-613.

Bernard TN Jr, Kirkaldy-Willis WH. Recognizing Specific Characteristics of Nonspecific Low Back Pain. Clin Orthop Relat Res. 1987 Apr;(217):266-80.

Bernard TN Jr, et al. The sacroiliac joint syndrome. Pathophysiology, diagnosis and management. In Frymoyer JW (ed). The Adult Spine: Principles and Practice, Second Edition. Lippincott-Raven Publishers, Philadelphia, 1997; pp 2343-63.

Bloom FA. Sacro-iliac fusion. Journal of Bone and Joint Surgery. 1937;19:704–8.

Campbell WC. An operation for extra-articular fusion of the sacro-iliac joint. Surgery, Gynecology and Obstetrics. 1927;45:218–9.

Cher D, Polly D, Berven S. Sacroiliac joint pain: burden of disease. Med Devices (Auckl). 2014;7:73-81.

Cohen SP. Sacroiliac joint pain: a comprehensive review of anatomy, diagnosis, and treatment. Anesth Analg [Internet]. 2005 Nov;101(5):1440–53.

Cohen, et al. Randomized Placebo-controlled Study Evaluating Lateral Branch Radiofrequency Denervation for Sacroiliac Joint Pain. Anesthesiology. 2008;109:279-88.

Copay AG, et al. Minimum clinically important difference in lumbar spine surgery patients: a choice of methods using the Oswestry Disability Index, Medical Outcomes Study questionnaire Short Form 36, and pain scales. Spine J. 2008;8(6):968-74. Epub 2008 Jan 16.

DePalma MJ, Ketchum JM, Saullo TR. Etiology of Chronic Low Back Pain in Patients Having Undergone Lumbar Fusion. Pain Med. 2011;12(5):732-739.

DePalma MJ, Ketchum JM, Saullo TR. Multivariable analyses of the relationships between age, gender, and body mass index and the source of chronic low back pain. Pain Med. 2012 Apr;13(4):498–506.

Deyo RA, Martin BI, Kreuter W, Jarvik JG, Angier H, Mirza SK. Revision surgery following operations for lumbar stenosis. J Bone Joint Surg Am. 2011 Nov 2;93(21):1979–86.

Dreyfuss P, et al. The Value of Medical History and Physical Examination in Diagnosing Sacroiliac Joint Pain. Spine. 1996;21:2594-602.

Fortin JD, Aprill CN, Ponthieux B, Pier J. Sacroiliac joint: pain referral maps upon applying a new injection/arthrography technique. Part II: Clinical evaluation. Spine. 1994;19(13):1483-9.

Fortin JD, Dwyer AP, West S, Pier J. Sacroiliac joint: pain referral maps upon applying a new injection/arthrography technique. Part I: asymptomatic volunteers. Spine. 1994;19(13):1475-82.

Fortin JD, Falco FJ. The Fortin Finger Test; an Indication of Sacroiliac pain. Am J Orthop. 1997;26(7):477-80.

Gaenslen FJ. Sacro-iliac arthrodesis: indications, author's technic and end-results. JAMA. 1927;89(24):2031–5.

References (alphabetically)

Glassman SD, et al. Defining substantial clinical benefit following lumbar spine arthrodesis. J Bone Joint Surg Am. 2008 Sep;90(9):1839-47.

Ha K-Y, Lee J-S, Kim K-W. Degeneration of sacroiliac joint after instrumented lumbar or lumbosacral fusion: a prospective cohort study over five-year follow-up. Spine. 2008;33:1192–8.

Irwin RW, et al. Age, body mass index, and gender differences in sacroiliac joint pathology. Am J Phys Med Rehabil. 2007;86(1):37-44.

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:E162–9.

Janda V. On the concept of postural muscles and posture in man. Aust J Physiotherapy. 1983;29:83-90

Katz V, et al. The Sacroiliac Joint: A Potential Cause of Pain After Lumbar Fusion to the Sacrum. J Spinal Disord Tech. 2003 Feb;16(1):96-9.

Laslett et al. Diagnosis of sacroiliac joint pain: Validity of individual provocation tests and composites of tests. Man Ther. 2005;10(3):207-18.

Laslett M. Evidence-based diagnosis and treatment of the painful sacroiliac joint. J Man Manip Ther. 2008;16(3):142-52.

Liliang P-C, Lu K, Liang C-L, Tsai Y-D, Wang K-W, Chen H-J. Sacroiliac joint pain after lumbar and lumbosacral fusion: findings using dual sacroiliac joint blocks. Pain Med. 2011;12:565–70.

MacLennan AH, Green RC, Nicolson R, Bath M. Serum relaxin and pelvic pain of pregnancy. The Lancet. 1986 Aug;328(8501):243–5.

Maigne JY, Aivaliklis A, Pfefer F. Results of sacroiliac joint double block and value of sacroiliac pain provocation tests in 54 patients with low back pain. Spine. 1996;21:1889–92.

Maigne JY, et al. Sacroiliac joint pain after lumbar fusion: A study with anesthetic blocks. Eur Spine J. 2005;14(7):654-8.

Martin BI, Mirza SK, Comstock BA, Gray DT, Kreuter W, Deyo RA. Reoperation rates following lumbar spine surgery and the influence of spinal fusion procedures. Spine (Phila Pa 1976). 2007 Feb 1;32(3):382-7.

Norén L, Ostgaard S, Johansson G, Ostgaard HC. Lumbar back and posterior pelvic pain during pregnancy: a 3-year follow-up. Eur Spine J. 2002 Jun;11(3):267–71.

Schwarzer AC. The Sacroiliac Joint in Chronic Low Back Pain. Spine. 1995:20(1):31-7.

Sembrano JN, Polly DW Jr. How Often is Low Back Pain Not Coming From the Back? Spine. 2009 Jan;34(1):E27-32.

Sembrano JN, Reiley MA, Polly DW, Garfin SR. Diagnosis and treatment of sacroiliac joint pain. Current Orthopaedic Practice [Internet]. 2011 [cited 2011 Aug 24];22(4):344–50.

References (alphabetically)

Smith-Petersen MN, Rogers WA. End-result study of arthrodesis of the sacro-iliac joint for arthritis - traumatic and non-traumatic. J Bone Joint Surg Am. 1926;8(1):118–36.

Szadek KM, et al. Diagnostic Criteria for Sacroiliac Pain, a Systemic Review. J Pain. 2009;Apr:10(4):354-68.

Walde J. Obstetrical and gynecological back and pelvic pains, especially those contracted during pregnancy. Acta Obstet Gynecol Scand Suppl. 1962;41(Suppl 2):11–53.

Wist A. Treatment of symphysiolysis with hydrocortisone procaine injections. Ann Chir Gynaecol Fenn. 1968;57(1):98–100.

Wu WH, Meijer OG, Uegaki K, Mens JMA, van Dieën JH, Wuisman PIJM, et al. Pregnancy-related pelvic girdle pain (PPP), I: Terminology, clinical presentation, and prevalence. Eur Spine J. 2004 Nov;13(7):575–89.

Society Guidelines

ISASS – Lorio MP, Rashbaum R. ISASS policy statement - minimally invasive sacroiliac joint fusion. Int J Spine Surg. 2014 Dec 1;8. doi: 10.14444/1025. eCollection 2014. (http://ijssurgery.com/10.14444/1025)

ISASS (Update July 2016) – Lorio MP. ISASS Policy 2016 Update - Minimally Invasive Sacroiliac Joint Fusion. Int J Spine Surg. 2016;10:Article 26. DOI: 10.14444/3026. (https://doi.org/10.14444/3026)
Policy Statement [http://www.isass.org/public-policy/isass-policy-statement-minimally-invasive-sacroiliac-joint-fusion-july-2016/]

NASS – NASS Coverage Recommendations: Percutaneous Sacroiliac Joint Fusion (June 9, 2015).
https://www.spine.org/Portals/0/Documents/PolicyPractice/CoverageRecommendations/PercutaneousSacroiliacJointFusion.pdf

iFuse Implant System – Bibliography

LEVEL I – Randomized Clinical Trial [7]

- Dengler J, Kools D, Pflugmacher R, Gasbarrini A, Prestamburgo D, Gaetani P, Cher D, Van Eeckhoven E, Sturesson B. Low back pain originating from the sacroiliac joint – 1 year results from a randomized controlled trial of conservative management vs. minimally invasive surgical treatment. Pain Physician. 2017;20:537-50.
- Dengler J, Sturesson B, Kools D, Prestamburgo D, Cher D, van Eeckhoven E, Erk E, Pflugmacher R, Vajkoczy P; and the iMIA study group. Referred leg pain originating from the sacroiliac joint: 6-month outcomes from the prospective randomized controlled iMIA trial. Acta Neurochir (Wien). 2016;158(11):2219-2224. Epub 2016 Sep 15. DOI: 10.1007/s00701-016-2953-7.
- Polly DW, Swofford J, Whang PG, Frank CJ, Glaser JA, Limoni RP, Cher DJ, Wine KD, Sembrano JN, and the INSITE Study Group. Two-Year Outcomes from a Randomized Controlled Trial of Minimally Invasive Sacroiliac Joint Fusion vs. Non-Surgical Management for Sacroiliac Joint Dysfunction. Int J Spine Surg. 2016;10.Article 28. DOI: 10.14444/3028.
- Sturesson B, Kools D, Pflugmacher R, Gasbarrini A, Prestamburgo D, Dengler J. Six-Month Outcomes from a Randomized Controlled Trial of Minimally Invasive SI Joint Fusion with Triangular Titanium Implants vs Conservative Management. Eur Spine J. 2016 May 14 [Epub]. DOI: 10.1007/s00586-016-4599-9.
- Polly D, Cher D, Whang PG, Frank C, Sembrano J, for the INSITE Study Group. Does Level of Response to SI Joint Block Predict Response to SI Joint Fusion? Int J Spine Surg. 2016;10:Article 4. DOI: 10.14444/3004.
- Polly DW, Cher DJ, Wine KD, Whang PG, Frank CJ, Harvey CF, Lockstadt H, Glaser JA, Limoni RP, Sembrano JN, and the INSITE Study Group. Randomized Controlled Trial of Minimally Invasive Sacroiliac Joint Fusion Using Triangular Titanium Implants vs. Non-Surgical Management for Sacroiliac Joint Dysfunction: 12-Month Outcomes. Neurosurgery. 2015;77:674-91. [Epub 2015 Aug 19]. DOI: 10.1227/NEU.0000000000000988.
- Whang P, Cher D, Polly D, Frank C, Lockstadt H, Glaser J, Limoni R, Sembrano J, on behalf of the INSITE Study Group. Sacroiliac Joint Fusion Using Triangular Titanium Implants vs. Non-Surgical Management: Six-Month Outcomes from a Prospective Randomized Controlled Trial. Int J Spine Surg. 2015;9:Article 6. DOI: 10.14444/2006.

iFuse Implant System – Bibliography

LEVEL II/IIb – Prospective, Multicenter [6]

- Dengler J, Duhon B, Whang P, Frank C, Glaser J, Sturesson B, Garfin S, Cher D, Rendahl A, Polly D, on behalf of the INSITE, iMIA and SIFI study groups. Predictors of Outcome in Conservative and Minimally Invasive Surgical Management of Pain Originating from the Sacroiliac Joint – a Pooled Analysis. Spine. 2017 March 27 [Epub ahead-of-print]. DOI: 10.1097/BRS.0000000000002169.
- Duhon B, Bitan F, Lockstadt H, Kovalsky D, Cher D, Hillen T, on behalf of the SIFI Study Group. Triangular Titanium Implants for Minimally Invasive Sacroiliac Joint Fusion: 2-Year Follow-Up from a Prospective Multicenter Trial. Int J Spine Surg. 2016;10:Article 13. DOI: 10.14444/3013.
- Capobianco R, Cher D. Safety and Effectiveness of Minimally Invasive Sacroiliac Joint Fusion in Women with Persistent Post-partum Posterior Pelvic Girdle Pain: 12-month Outcomes from a Prospective, Multi-center Trial. SpringerPlus. 2015 Oct 5;4(1):570. DOI: 10.1186/s40064-015-1359-y
- Duhon B, Cher D, Wine K, Kovalsky D, Lockstadt H. Triangular Titanium Implants for Minimally Invasive Sacroiliac Joint Fusion: A Prospective Study. Global Spine J. 2016;6(3):257-69. [Epub 2015 Aug 11]. DOI: 10.1055/s-0035-1562912.
- Cher DJ, Polly DW. Improvement in Health State Utility after Sacroiliac Joint Fusion: Comparison to Normal Populations. Global Spine J. 2016;6(2):100-7. [Epub 2015 Jun 25]; DOI: 10.1055/s-0035-1556581.
- Duhon B, Cher D, Wine K, Lockstadt H, Kovalsky D, Soo C-L. Safety and 6-month Effectiveness of Minimally Invasive Sacroiliac Joint Fusion: A Prospective Study. Med Devices (Auckl). 2013;6:219–29. DOI: 10.2147/MDER.S55197.

LEVEL III – Clinical Comparisons [5]

- Vanaclocha-Vanaclocha V, Herrera JM, Sáiz-Sapena N, Rivera-Paz M, Verdú-López F. Minimally Invasive Sacroiliac Joint Fusion, Radiofrequency Denervation and Conservative Management for Sacroiliac Joint Pain: Six Year Comparative Study. Neurosurgery. 2017 Apr 20. [Epub ahead of print]. DOI: 10.1093/neuros/nyx185.
- Spain K, Holt T. Surgical Revision after Sacroiliac Joint Fixation or Fusion. Int J Spine Surg. 2017;11(1):24-30. DOI: 10.14444/4005.
- Graham Smith A, Capobianco R, Cher D, Rudolf L, Sachs D, Gundanna M, et al. Open Versus Minimally Invasive Sacroiliac Joint Fusion: A Multi-center Comparison of Perioperative Measures and Clinical Outcomes. Ann Surg Innov Res. 2013;7:14. DOI: 10.1186/1750-1164-7-14.
- Ledonio CGT, Polly DW, Swiontkowski MF. Minimally Invasive Versus Open Sacroiliac Joint Fusion: Are They Similarly Safe and Effective? Clin Orthop Relat Res. 2014;472:1831–8. DOI: 10.1007/s11999-014-3499-8.
- Ledonio C, Polly D, Swiontkowski MF, Cummings J. Comparative Effectiveness of Open Versus Minimally Invasive Sacroiliac Joint Fusion. Med Devices (Auckl). 2014;2014:187–93. DOI: 10.2147/MDER.S60370.

iFuse Implant System – Bibliography

LEVEL IV – Clinical [17]

- Bornemann R, Roessler PP, Strauss A, Sander K, Rommelspacher Y, Wirtz DC, Pflugmacher R, Frey SP. 2-year clinical results of patients with sacroiliac joint syndrome treated by arthrodesis using a triangular implant system. *Technol Health Care*. 2016 Nov 4. [Epub ahead of print]. DOI: 10.3233/THC-161272
- Sachs D, Kovalsky D, Redmond A, Limoni R, Meyer SC, Harvey C, Kondrashov D. Durable intermediate- to long-term outcomes after minimally invasive transiliac sacroiliac joint fusion using triangular titanium implants. Med Devices (Auckl). 2016;9:213-22. DOI: 10.2147/MDER.S109276.
- Bornemann R, Pflugmacher R, Webler M, Koch EM, Dengler J, Wirtz DC, Frey SP. [Clinical Trial to Test the iFuse Implant System® in Patients with Sacroiliac Joint Syndrome: One Year Results]. Z Orthop Unfall. 2016 Jul 7. [Epub ahead of print] [Article in German]. DOI: 10.1055/s-0042-110207.
- Manfré L. Percutaneous Sacroiliac Joint Fixation in Sacroiliac Instability. The First Case Report Using a Fully CT-Guided Technique. Interv Neuroradiol. 2014;20:621–5. DOI: 10.15274/INR-2014-10049.
- Rudolf L, Capobianco R. Five-Year Clinical and Radiographic Outcomes After Minimally Invasive Sacroiliac Joint Fusion Using Triangular Implants. Open Orthop J. 2014;8:375–83. DOI: 10.2174/1874325001408010375.
- Vanaclocha-Vanaclocha V, Verdú-López F, Sánchez-Pardo M, Gozalbes-Esterelles L, Herrera JM, Rivera-Paz M, Martínez-Gómez D. Minimally Invasive Sacroiliac Joint Arthrodesis: Experience in a Prospective Series with 24 Patients. J Spine. 2014;03. DOI: 10.4172/2165-7939.1000185.
- Sachs D, Capobianco R, Cher D, Holt T, Gundanna M, Graven T, Shamie AN, Cummings J Jr. One-year Outcomes After Minimally Invasive Sacroiliac Joint Fusion with A Series of Triangular Implants: A Multicenter, Patient-level Analysis. Med Devices (Auckl). 2014;2014:299–304.
- Scheyerer MJ, Hüllner MS, Pietsch C, Veit-Haibach P, Werner CML. Implant-Bone Interface of Sacroiliac Joint Fusion Using iFuse Implant System. ISRN Minimally Invasive Surgery. 2014;2014:Article ID 571014. DOI: 10.1155/2014/571014.
- Schroeder JE, Cunningham ME, Ross T, Boachie-Adjei O. Early Results of Sacro–Iliac Joint Fixation Following Long Fusion to the Sacrum in Adult Spine Deformity. Hosp Spec Surg J. 2014;10:30–5. ePub 2013 Dec 11. DOI: 10.1007/s11420-013-9374-4.
- Gaetani P, Miotti D, Risso A, Bettaglio R, Bongetta D, Custodi V, Silvani V. Percutaneous Arthrodesis of Sacro-iliac Joint: A Pilot Study. J Neurosurg Sci. 2013;57:297–301.

iFuse Implant System – Bibliography

LEVEL IV – Clinical [17] (cont.)

- Cummings J, Capobianco RA. Minimally Invasive Sacroiliac Joint Fusion: One-year Outcomes in 18 Patients. Ann Surg Innov Res. 2013;7:12. DOI: 10.1186/1750-1164-7-12.
- Sachs D, Capobianco R. Minimally Invasive Sacroiliac Joint Fusion: One-year Outcomes in 40 patients. Adv Orthop. 2013;2013:536128. DOI: 10.1155/2013/536128.
- Rudolf L. MIS Fusion of the SI Joint: Does Prior Lumbar Spinal Fusion Affect Patient Outcomes? Open Orthop J. 2013;7:163–8.
- Kim JT, Rudolf LM, Glaser JA. Outcome of percutaneous sacroiliac joint fixation with porous plasma-coated triangular titanium implants: an independent review. *Open Orthop J*. 2013;7:51-6. DOI: 10.2174/1874325001307010051.
- Sachs D, Capobianco R. One Year Successful Outcomes for Novel Sacroiliac Joint Arthrodesis System. Ann Surg Innov Res. 2012;6:13. DOI: 10.1186/1750-1164-6-13.
- Lokietek J-C, Gaspar B-S. L'Articulation sacro-iliaque "adjacent level": Un probleme frequent et frequemment neglige. Le Rachis. 2012;24:11–6.
- Rudolf L. Sacroiliac Joint Arthrodesis-MIS Technique with Titanium Implants: Report of the First 50 Patients and Outcomes. Open Orthop J. 2012;6:495–502. DOI: 10.2174/1874325001206010495.

REVIEWS [3]

- Lingutla KK, Pollock R, Ahuja S. Sacroiliac joint fusion for low back pain: a systematic review and meta-analysis. Eur Spine J. 2016;25(6):1924-31. [Epub 2016 Mar 8]. DOI: 10.1007/s00586-016-4490-8.
- Heiney J, Capobianco R, Cher D. A Systematic Review of Minimally Invasive Sacroiliac Joint Fusion Utilizing A Lateral Transarticular Technique. Int J Spine Surg. 2015;9:Article 40. DOI: 10.14444/2040.
- Zaidi HA, Montoure AJ, Dickman CA. Surgical and clinical efficacy of sacroiliac joint fusion: a systematic review of the literature. J Neurosurg Spine. 2015;23:59-66. [Epub 2015 Apr 3]. DOI: 10.3171/2014.10.SPINE14516. Review.

iFuse Implant System – Bibliography

ECONOMICS [5]

- Frank C, Kondrashov D, Meyer SC, Dix G, Lorio M, Kovalsky D, Cher D. Work Intensity in SI Joint Fusion and Lumbar Microdiscectomy. Clinicoecon Outcomes Res. 2016;8:367-76. DOI: 10.2147/CEOR.S112006.
- Saavoss JD, Koenig L, Cher DJ. Productivity benefits of minimally invasive surgery in patients with chronic sacroiliac joint dysfunction. Clinicoecon Outcomes Res. 2016;8:77-85. DOI: 10.2147/CEOR.S101607.
- Polly DW, Cher D. Ignoring the sacroiliac joint in chronic low back pain is costly. Clinicoecon Outcomes Res. 2016;8:23–31. DOI: 10.2147/CEOR.S97345.
- Cher DJ, Frasco MA, Arnold RJG, Polly DW. Cost-effectiveness of minimally invasive sacroiliac joint fusion. Clinicoecon Outcomes Res. 2016;8:1-14. DOI:10.2147/CEOR.S94266.
- Garber T, Ledonio CG, Polly DW Jr. How Much Work Effort is Involved in Minimally Invasive Sacroiliac Joint Fusion? Int J Spine Surg. 2015;9:Article 58. DOI: 10.14444/2058. eCollection 2015.

OTHER [7]

- MacBarb RF, Lindsey DP, Woods SA, Lalor PA, Gundanna MI, Yerby SA. Fortifying the Bone-Implant Interface Part 2: An In Vivo Evaluation of 3D-Printed and TPS-Coated Triangular Implants. Int J Spine Surg. 2017;11:116-28. DOI: 10.14444/4016.
- Vanaclocha-Vanaclocha V, Verdú-López F, Sáiz-Sapena N, Herrera JM, Rivera-Paz M. Biplanar x-ray fluoroscopy for sacroiliac joint fusion. Neurosurg Focus. 2016;41(Video Suppl 1):1. DOI: 10.3171/2016.2.FocusVid.1687.
- Cher DJ, Reckling WC, Capobianco RA. Implant Survivorship Analysis after Minimally Invasive Sacroiliac Joint Fusion using the iFuse Implant System. Med Devices (Auckl). 2015;8:485-92. DOI: 10.2147/MDER.S94885.
- Copay AG, Cher DJ. Is the Oswestry Disability Index a valid measure of response to sacroiliac joint treatment? Qual Life Res. 2015 Aug 6.
- Woods M, Birkholz D, MacBarb R, Capobianco R, Woods A. Utility of Intraoperative Neuromonitoring During Minimally Invasive Fusion of the Sacroiliac Joint. Adv Orthop. 2014;2014:e154041. DOI: 10.1155/2014/154041.
- Geisler F. Stabilization of the sacroiliac joint with the SI-bone surgical technique. Neurosurg Focus. 2013;35(2 Suppl):Video 8. DOI: 10.3171/2013.V2.FOCUS13195.
- Miller L, Reckling WC, Block JE. Analysis of Postmarket Complaints Database for the iFuse SI Joint Fusion System: A Minimally Invasive Treatment for Degenerative Sacroiliitis and Sacroiliac Joint Disruption. Med Devices (Auckl). 2013;6:77–84. DOI: 10.2147/MDER.S44690.

iFuse Implant System – Bibliography

BIOMECHANICS [3]

- Lindsey DP, Kiapour A, Yerby SA, Goel VK. Sacroiliac Joint Fusion Minimally Affects Adjacent Lumbar Segment Motion: A Finite Element Study. Int J Spine Surg. 2015;9:Article 64. DOI: 10.14444/2064.
- Soriano-Baron H, Lindsey DP, Rodriguez-Martinez N, Reyes PM, Newcomb A, Yerby SA, Crawford NR. The Effect of Implant Placement on Sacroiliac Joint Range of Motion: Posterior vs Trans-articular. Spine. 2015;40:E525–30. DOI: 10.1097/BRS.0000000000000839.
- Lindsey D, Perez-Orribo L, Rodriquez-Martinez N, Reyes PM, Newcomb A, Cable A, Hickam G, Yerby SA, Crawford NR. Evaluation of A Minimally Invasive Procedure for Sacroiliac Joint Fusion – An in vitro Biomechanical Analysis of Initial and Cycled Properties. Med Devices (Auckl). 2014;2014:131–7. DOI: 10.2147/MDER.S63499.