Navigated SIJ Fusion
MIS lateral approach

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Disclosure:

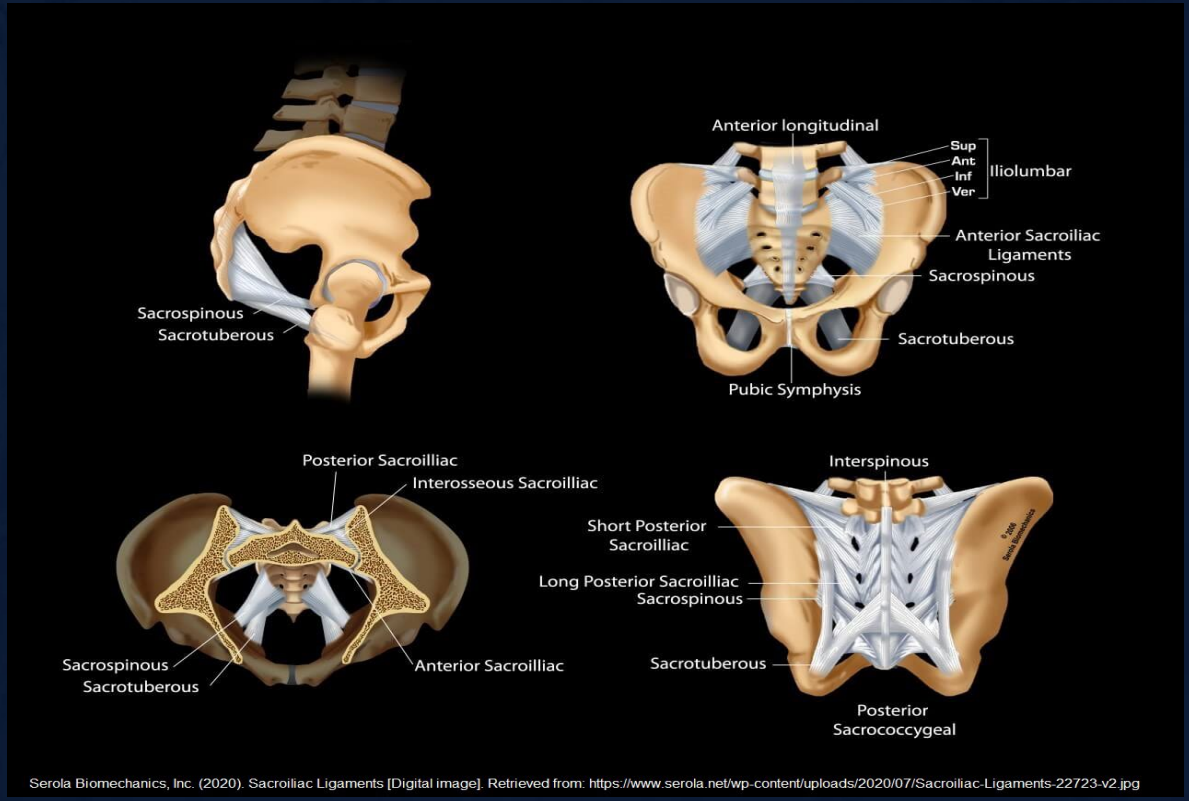
. None

Outline:

. What is the SIJ?
. Can it cause pain?
. How do I diagnose it?
. How do I fix it?
. Technical tips for MIS lateral approach
. How can I mess it up?
. Cases census & outcome

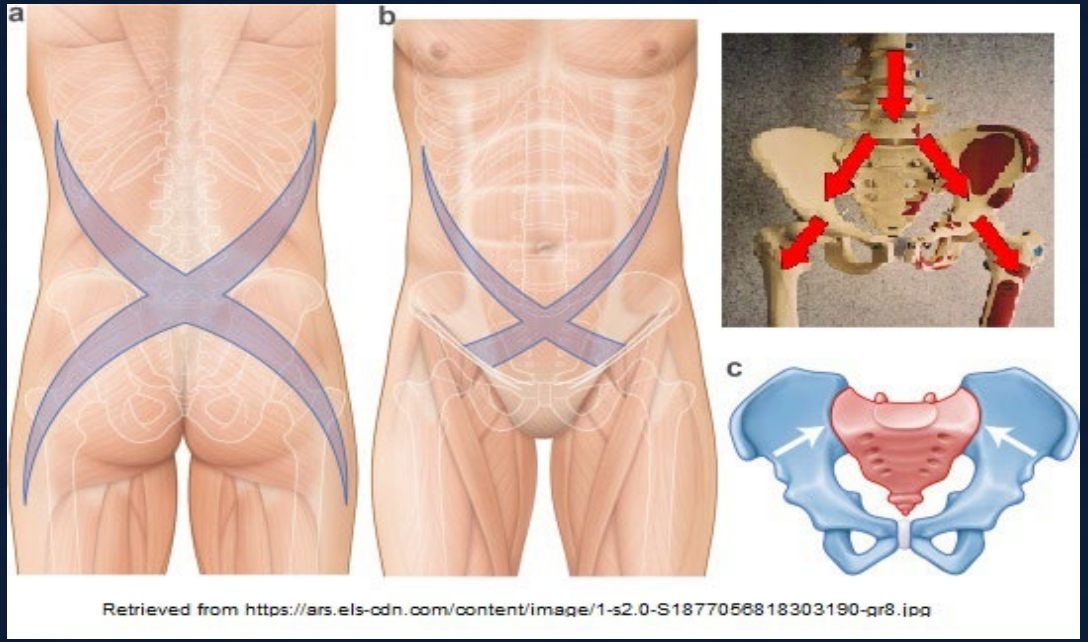
Anatomy

- Articulation
- Ligaments
- Muscles
- Vasculature
- Innervation



Serola Biomechanics, Inc. (2020). Sacroiliac Ligaments [Digital image]. Retrieved from: https://www.serola.net/wp-content/uploads/2020/07/Sacroiliac-Ligaments-22723-v2.jpg

Biomechanics & Function of SIJ



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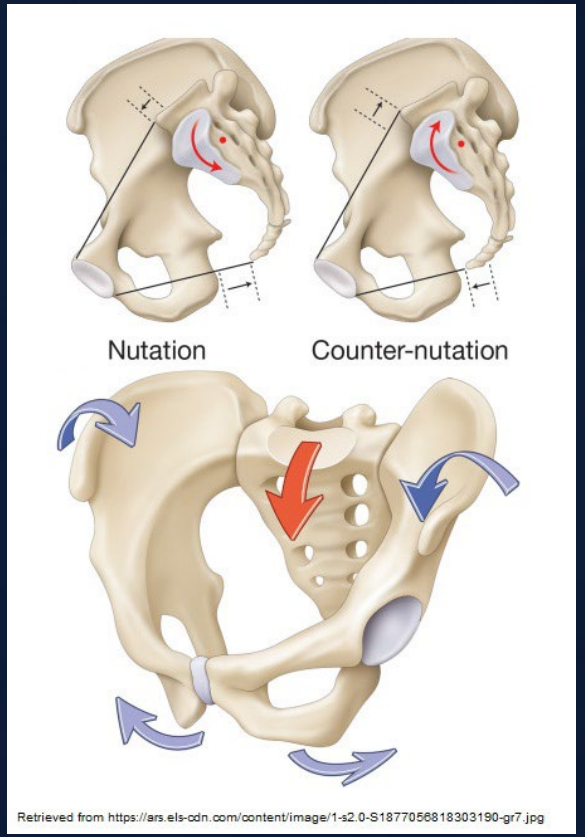

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SIJ Pain/Dysfunction

- Causes
- Prevalence
- Symptoms
- Signs
- Diagnosis

Causes

- Traumatic → MVA, Fall on buttock, lifting + twisting, childbirth

- Atraumatic → ASD post lumbar fusion, Biomechanical factors (leg length discrepancy, joint replacement, scoliosis), Pregnancy, OA, Degeneration post infection, Iatrogenic 2/2 ICBG harvest

Post lumbar fusion

Trauma

Postpartum

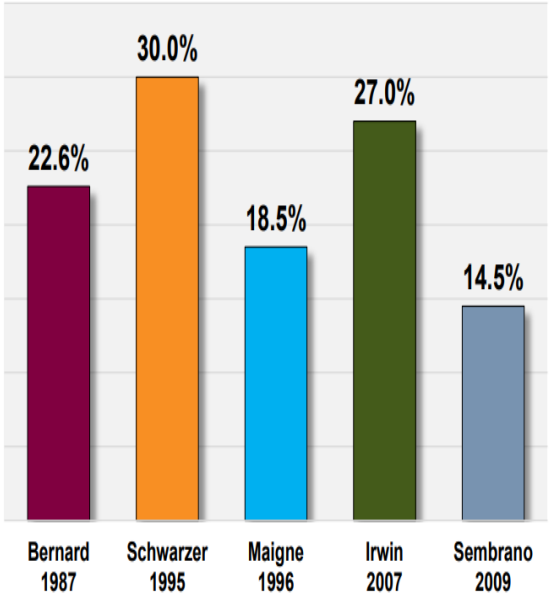
Prevalence

- 75% of post-lumbar fusion patients showed SIJ degenerative changes on CT scan 5 years after vs. only 38% age- and gender-matched controls without prior lumbar fusion. Ha – Spine 2008

- Lumbar fusion leads to increases in angular motion and joint stress at the SIJ. Ivanov – Spine 2009

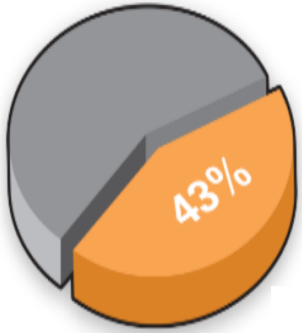
15-30%

Component of Chronic LBP



32-43%

Symptomatic Post-Lumbar Fusion



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

DePalma – *Pain Med* 2011

Symptoms

- History

- Aggravating factor → sitting on affected side, changing position (sit to stand, supine to sit), rolling over in bed, getting in/out of bed, going up/down stairs

- Relieving factor → lying away from affected side, manual or belt stabilization

Gluteal 94%
Lower lumbar 72%
Lower limb 28%
Groin 14%
Foot 12%
Upper lumbar 6%
Abdomen 2%

EVIDENCE-BASED MEDICINE
Evidence-based Interventional Pain Medicine
according to Clinical Diagnoses

13. Sacroiliac Joint Pain

Pascal Vanelderen, MD, FIPP*·†; Karolina Szadek, MD‡; Steven P. Cohen, MD§; Jan De Witte, MD‖; Arno Lataster, MSc**; Jacob Patijn, MD, PHD††; Nagy Mekhail, MD PhD, FIPP‡‡; Maarten van Kleef, MD, PhD, FIPP§§; Jan Van Zundert, MD, PhD, FIPP*·‖‖

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Pain Practice, Volume ••, Issue ••, 2010 ••–••

- SI joint symptoms are similar to those of other lumbar spine and hip conditions
- Referral pain patterns from the three structures overlap
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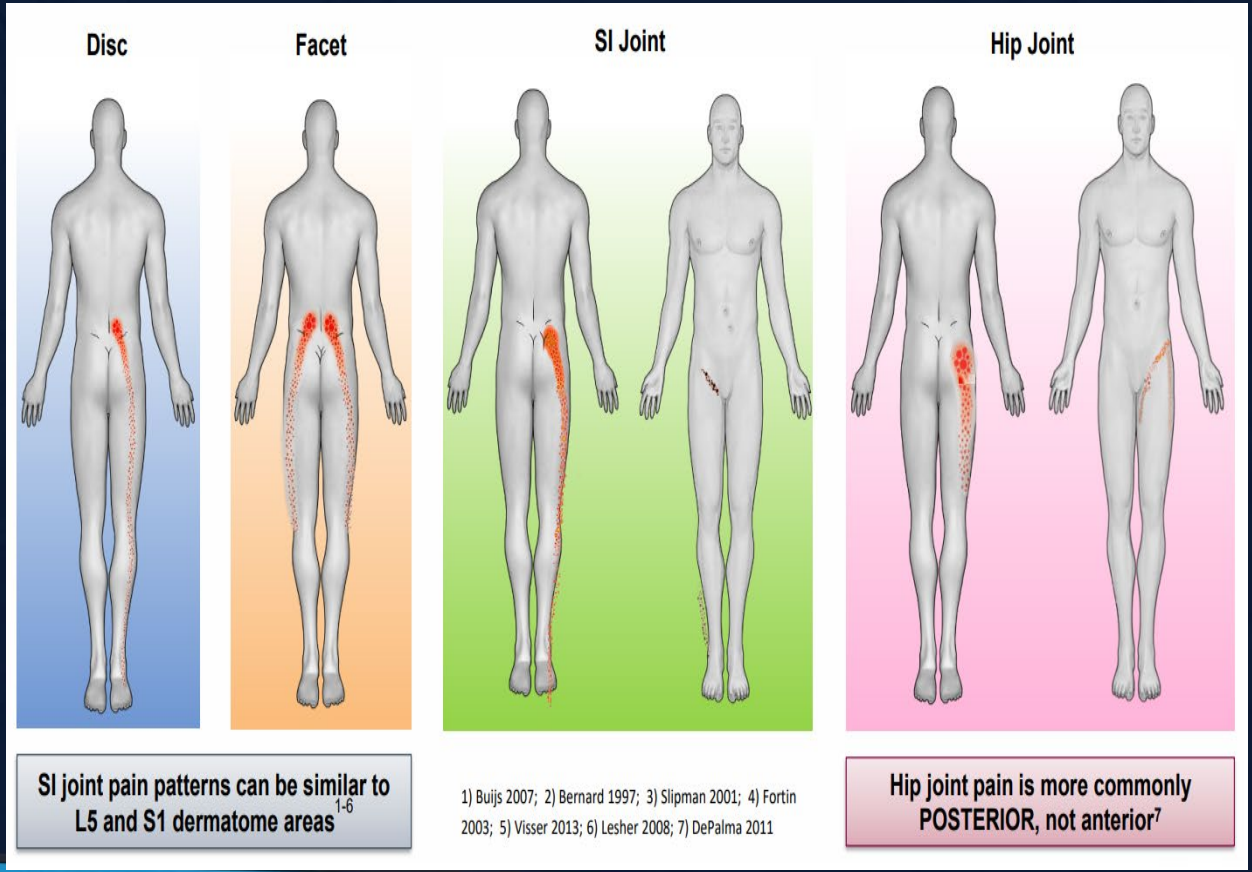
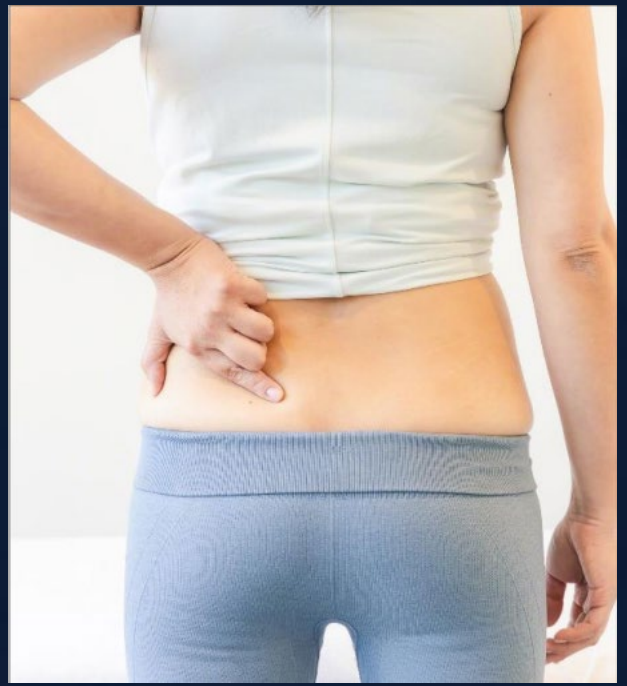


Signs

- Fortin Finger Test
- Physical Exam → Spine, Hip, SIJ
- Provocative tests

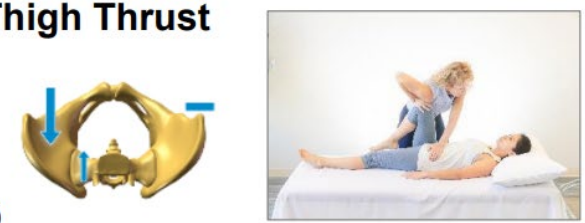


Provocative Tests

- Laslett – Man 2005
  → sensitivity 91%
  → specificity 78%
- Szadek – J pain 2009
  → sensitivity 85%
  → specificity 76%

Distraction ①

Thigh Thrust ②



FABER ③

Compression ④

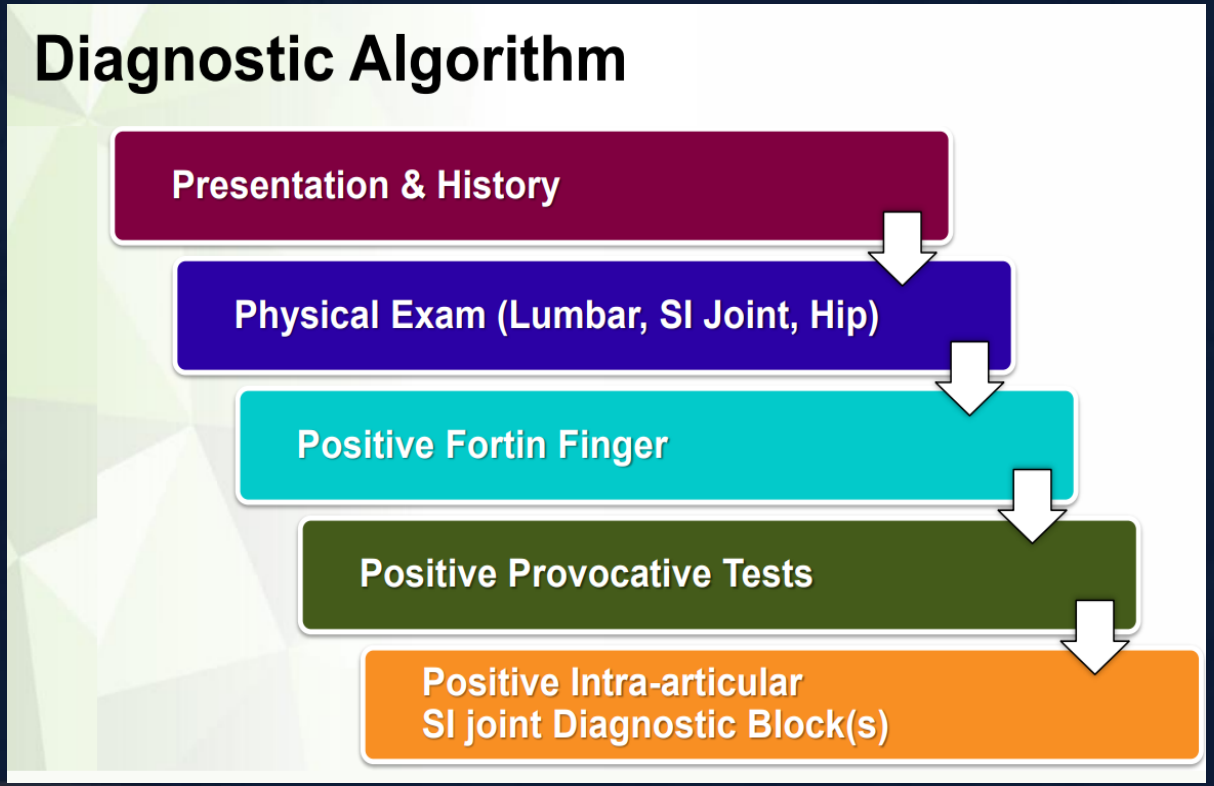
Gaenslen's ⑤

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

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

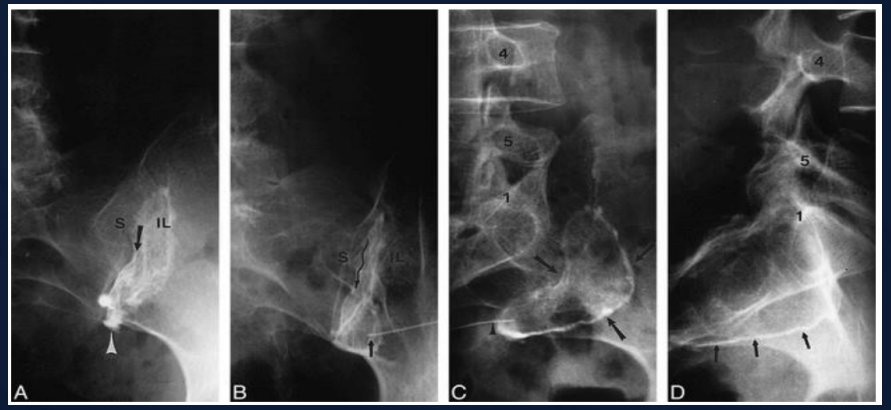
Diagnosis

- SI Joint Diagnostic Challenges
- Imaging studies often inconclusive
- Radiologic imaging is effective at excluding other causes, but low sensitivity
- 1 study showing CT 57.5% sensitivity and 69% specificity.



SIJ Diagnostic Injection x2

- It is the reference standard Fortin 2000, Szadek 2009, Laslett 2005
- Pre & Post Injection Functional Testing
  - Observation of Gait
  - Sit to Stand
  - Step up Test
  - Restored function?
- ISASS and ASIPP utilize ≥ 50% reduction in pain as a threshold
- NASS utilizes ≥ 75% reduction in pain as a threshold



Management

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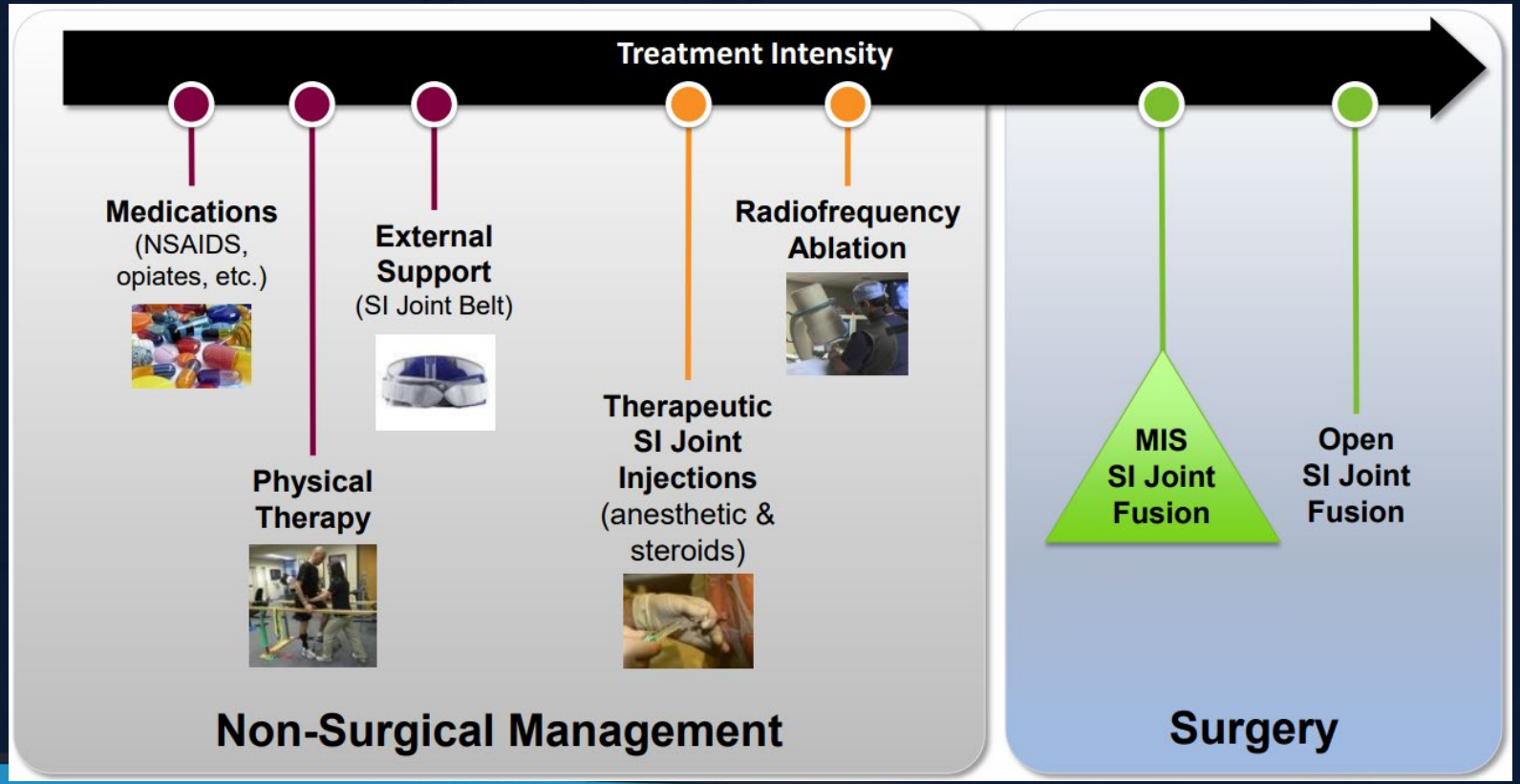

Treatment Intensity
Medications
(NSAIDS,
opiates, etc.)
External
Support
(SI Joint Belt)
Radiofrequency
Ablation
Physical
Therapy
Therapeutic
SI Joint
Injections
(anesthetic &
steroids)
MIS
SI Joint
Fusion
Open
SI Joint
Fusion
Non-Surgical Management
Surgery

Conservative treatment

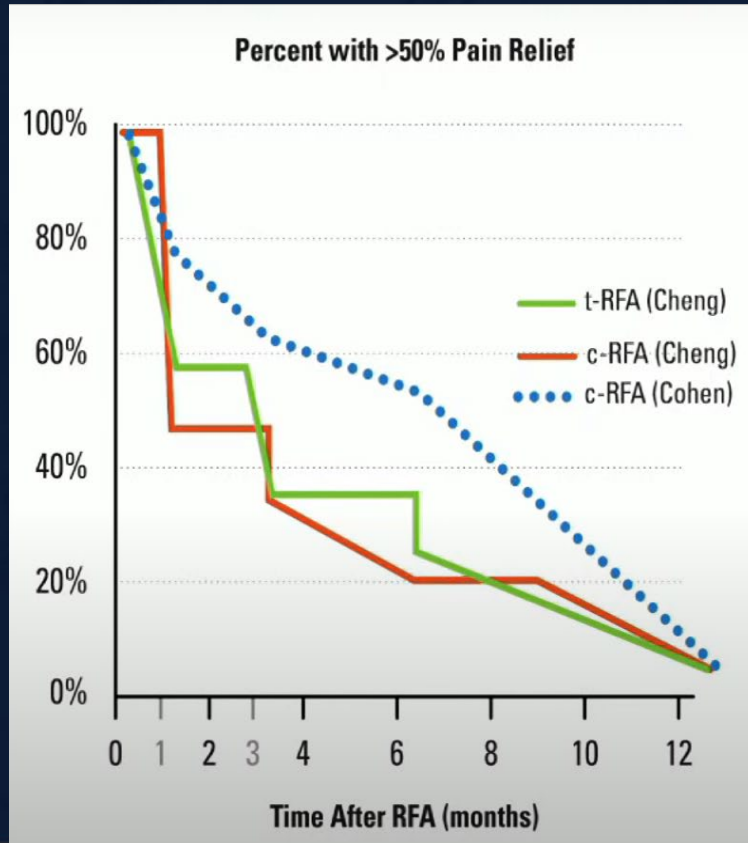
- NSAIDS
- Ice/Heat
- Activity modification
- PT & Chiropractor adjustment and manual therapy
- Orthotics, SIJ belt
- Acupuncture
- Steroid Injections
- RFA

Physical Therapy

- Restore alignment of the lumbar spine, sacroiliac and hip joints
- Restore length-tension balance in muscles that attach to the ilium and sacrum
- Functional stability of the lumbopelvic region
- Success is highly dependent on patient compliance

RFA

- No long-term improvements in pain



Cheng et al. 2012[1]

- 88 patients
  - 30 traditional RF
  - 58 cooled RF

Cohen et al. 2008[2]

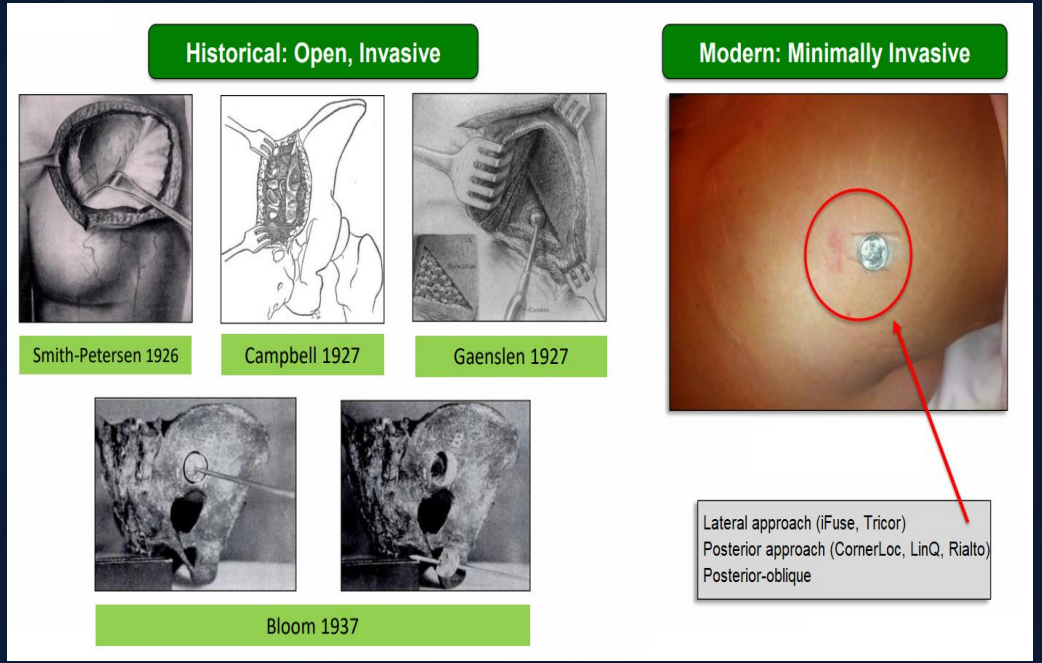
- 28 patients

"…benefit constrained by nerve regeneration to between 6 months and 1 yr."

1. Cheng 2013
2. Cohen 2008

Surgical Treatment

- Purpose → minimize SIJ movement for reduction of tissue irritation
- Short-Term goal → SIJ stabilization by instrument fixation
- Long-Term goal → implant-bone integration for ongoing stabilization → bone arthrodesis



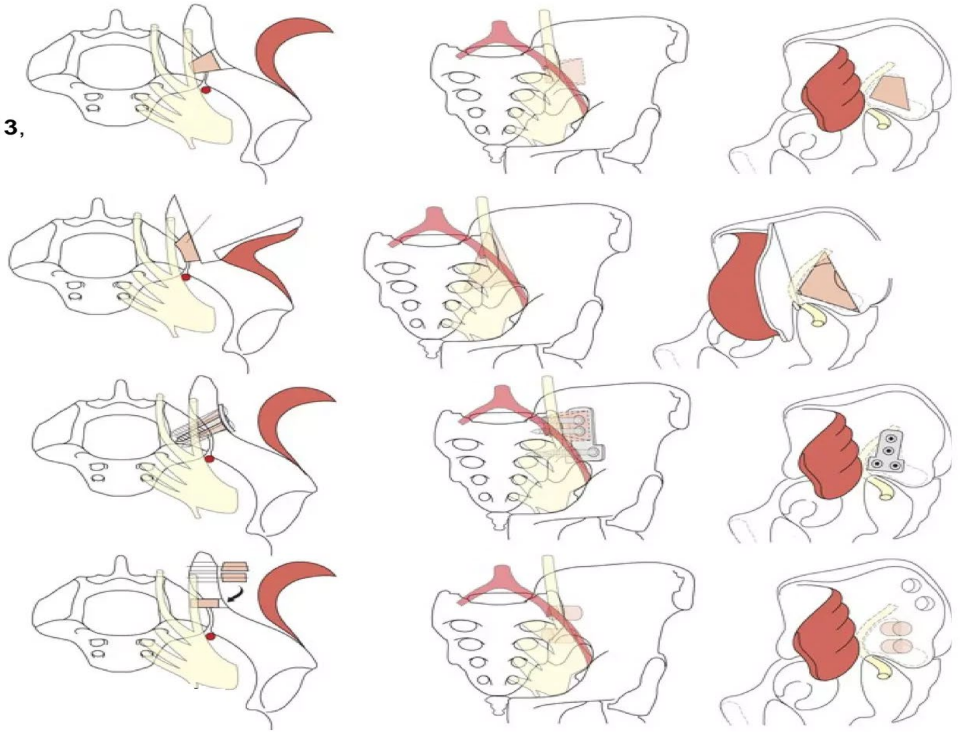
Posterolateral approach

SMITH-PETERSEN
1921 & 1926
"Uniformly successful" "Complete Recovery" 6/**13**,
"Partial Recovery" 3/13, "Failure" 4/13

GAENSLEN *1927*
"Firm fusion" in all, *"Very good" 3/**9**, "Good" 4/9, RTW 6/9*

BUCHOWSKI *2005*
20 patients
85% "Solid fusion" in one-year,
20% "major complications"(infection in 2 cases leading to nonunion),
15% required reoperation

GIANNIKAS *2004*
1/**5** "fusion" with CT confirmation
4/5: 10/10 on VAS (complete relief)



Posterior Approach

permanent weakness or pain by injury to the insertions of the long spinal extensors

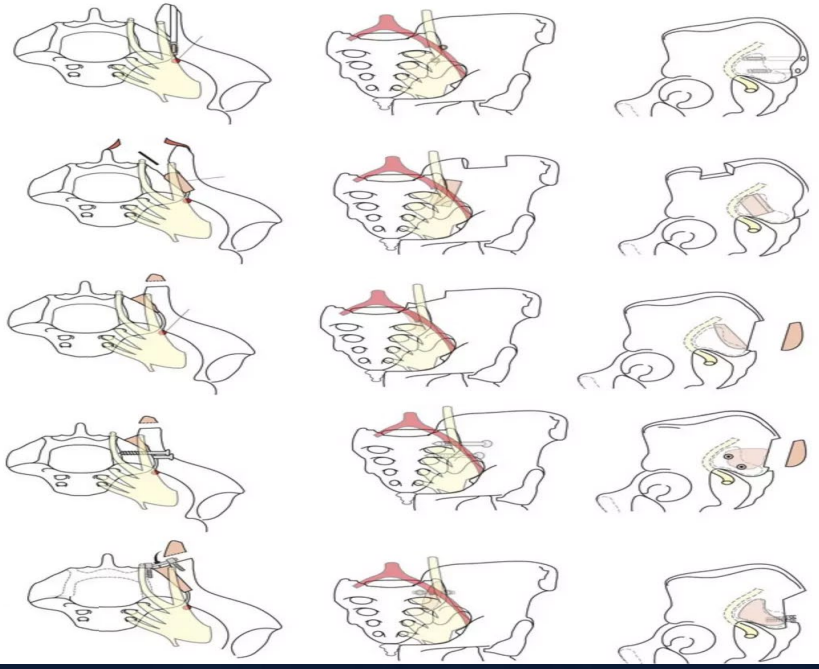
WISE-DALL *2008*
100% ‘‘fusion’’ at 6 mo (CT confirmation)
‘‘Satisfactory results’’ in 4/**4** pts

WAISBROD *1987*
pain <50%, off narcotics 11/**22**,
11/**22** ‘‘unsatisfactory’’

MITCHELL *1938*
‘‘Complete relief’’ 8/**15**,
‘‘Partial relief’’ 3/**15**, ‘‘No relief’’ 2/**15**

KEATING *1993*
26 pts.
VAS: avg. 6 preoperatively, decreased to 3 postoperatively

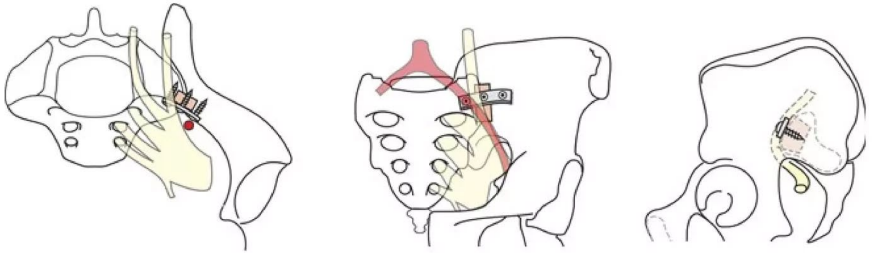
BELANGER-DALL *2001*
100% ‘‘fusion’’ at 6 months (CT confirmation)
‘‘Satisfactory results’’ in 4/**4** pts



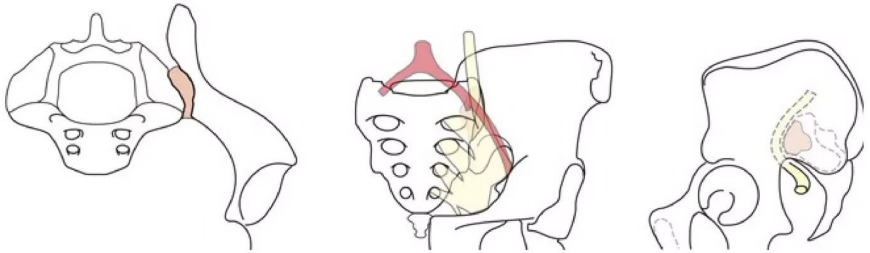
Anterior Approach

L5 nerve root & Ext. illiac art.

RAND *1985*



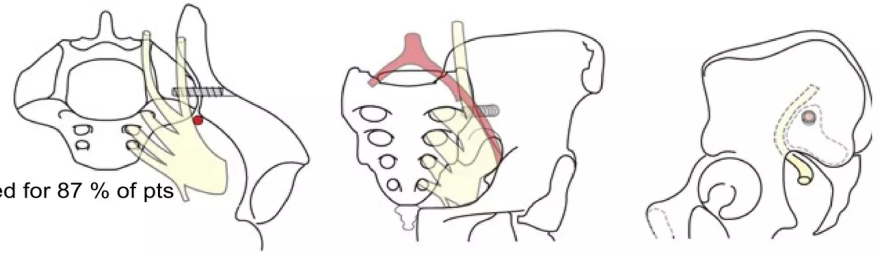
GUNER 1998
Endoscopic



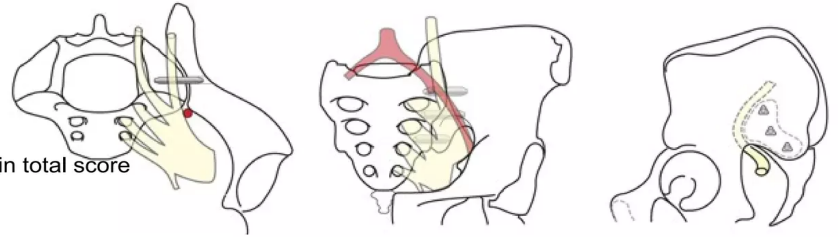
Percutaneous Approach

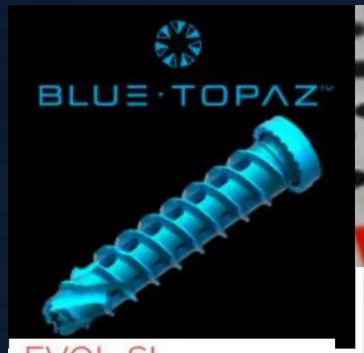
KHURANA *2009*
100 ‘‘fusion’’ (CT confirmation)
Majeed score: improved from 37 to 79

Good or excellent results were reported for 87 % of pts

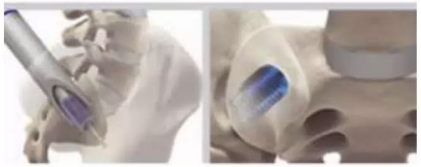


REILEY *2010*
75 pts
92% ‘‘fusion’’ (CT confirmation)
VAS: improvement in several areas and in total score (P<0.0001).
RTW 28/41 work candidates.
43% off all narcotics

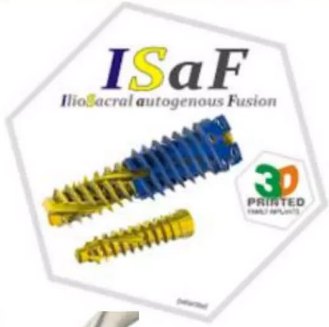


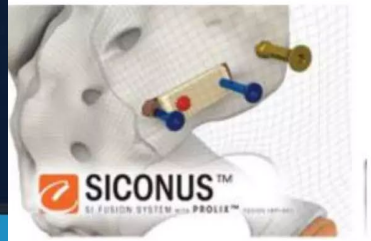


EVOL-SI



M.U.S.T. SI Joint Screw Sy

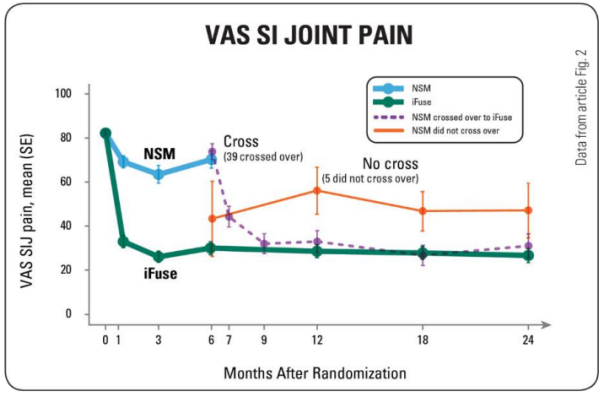


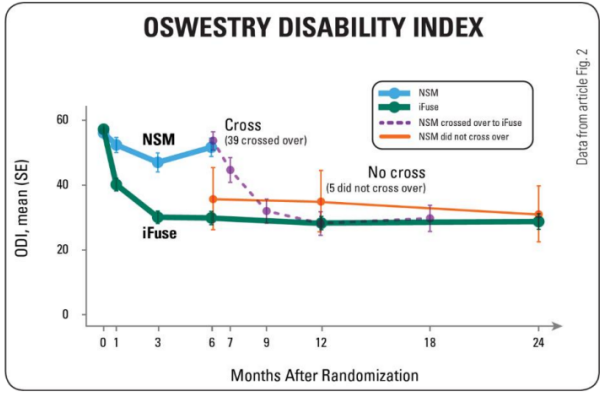


Outcome

. Significant improvement after SIJ Fusion than Non-Surgical Management (NSM)

Superior Outcomes	**iFuse Shown to be Superior to NSM for Chronic SI Joint Pain**
Sustained Improvement	**iFuse Provided Rapid & Sustained 2-year 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 year)
Low Revisions	**3% Revision Rate** (only 3 iFuse subjects had revision surgery by 2 years)





Polly - *Int Spine Surg 2016* (INSITE 2yr RCT)

Post Op Complication

- Infection
- Nerve Injury
- Hardware Complications
- Non-union or Pseudoarthrosis
- Dural Tear
- Blood Vessel Injury
- Persistent or Recurrent Instability
- DVT/PE

Table 4 Adverse events

Description	n
Fall	5
Trochanteric bursitis	4
Piriformis syndrome	3
Facet pain	3
Contralateral sacroiliac joint pain	2
Recurrent pain	2
Leg pain	1
Numbness in left foot	1
Toe numbness	1
Burning and numbness in upper thigh	1
Bladder incontinence	1
Hematoma	1
Increased pain	1
New lower-back pain	1
Nerve-root impingement requiring reposition of implant	1
Total reported adverse events	28

**Sachs et al 2014. One-year outcomes after minimally invasive sacroiliac joint fusion with a series of triangular implants: a multicenter, patient-level analysis. doi: 10.2147/MDER.S56491. PMID: 25210479; PMCID: PMC4155989.*

Initial Experience with Navigated MIS Lateral SIJ fusion using Cylindrical Self Harvesting Porous Titanium Screws at Insight Surgical Hospital

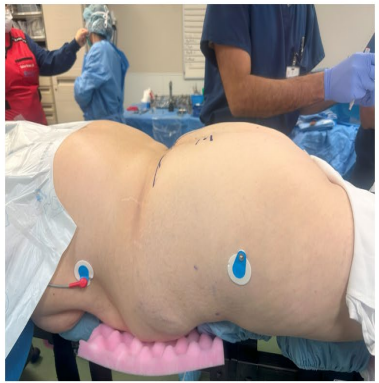
- N = 17 cases over 1 year
- Right side = 12 & Left Side = 5
- Male = 3 & Female = 14
- Age Range = 35-76 (mean 54.6 years old)
- Prior Lumbar Fusion = 9/17 (53%)
- Mean follow up= 16.6 weeks
- Mean Pre Op VAS = 8.1 → Mean Post Op VAS =4.2
- Complications= none
- Use of navigation allows for accurate and safe placement of screws
- Almost ZERO exposure to x-ray radiation

Surgical Technique

Surgical Steps:

- Positioning:

Prone position on Jackson table, with a bump under ipsilateral ASIS.

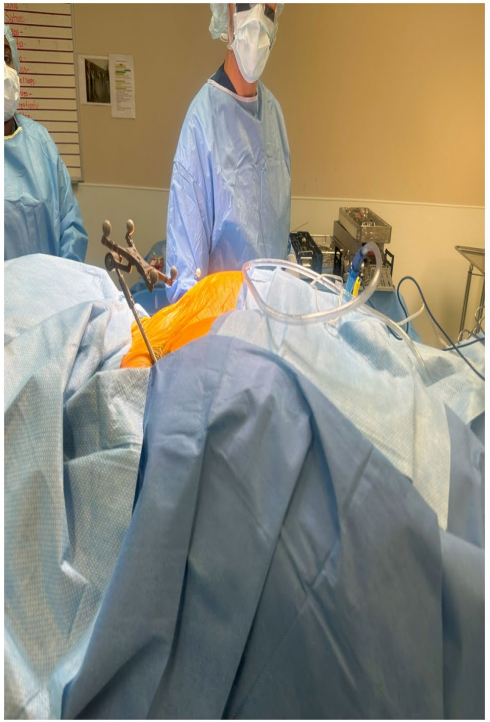


Reference Frame:

Reference frame is placed over opposite PSIS.

O- Arm Spin:

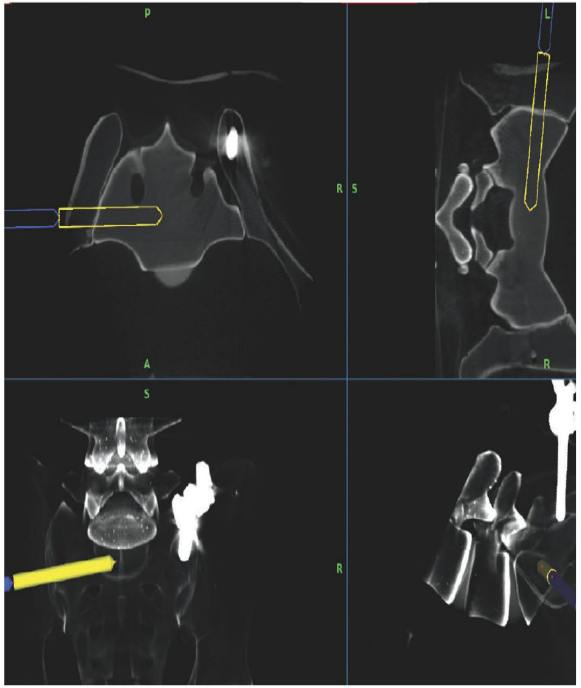
1st O-Arm spin is done, and images are obtained.



Surgical Technique

Four typical views are used:

1) Trajectory 1 (Axial)
   -Upper left
2) Trajectory 2 (Coronal)
   -Upper right
3) Synthetic AP
   -Lower left
4) Synthetic Lateral
   -Lower right

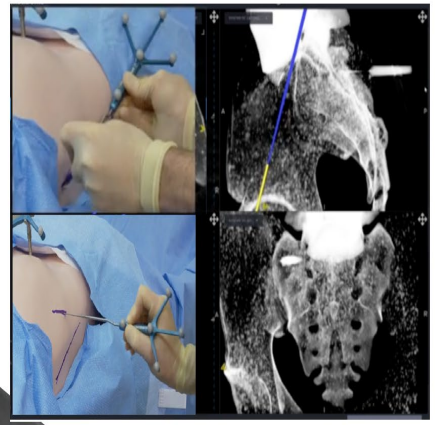


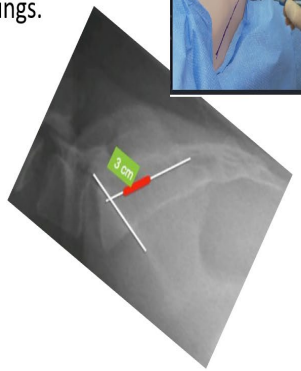
Marking of Incision:

1st Skin marking: parallel to ICD line

2nd Skin marking: parallel to mid-body of the sacrum

Connect both skin markings.

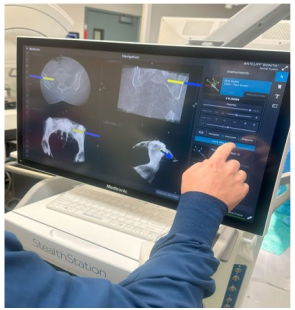


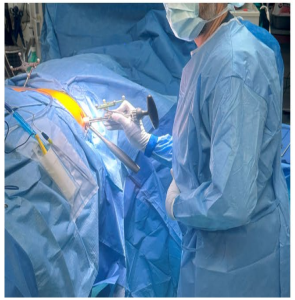


Surgical Technique

- Insert the universal navigated turkey foot pointer into the incision, and advance through the soft tissues until it is sitting on the lateral wall of the ileum
- Make stab incision in the facia and then bluntly dissect the muscle with finger.
- Insert the blunt dissector, parallel to the muscle fibers seated on ileum, rotate the dissector and gently remove it.
- Insert the tissue protector

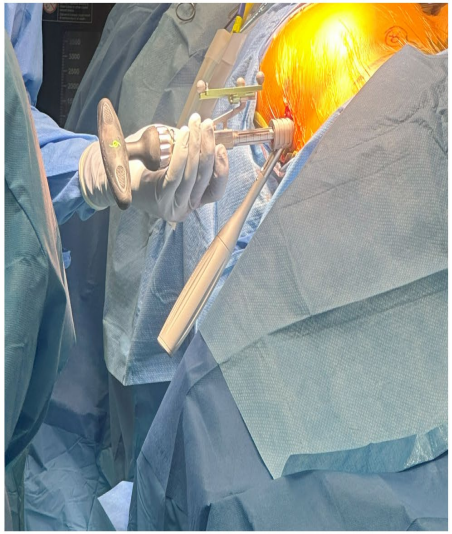
- Insert the sharp navigated non-canulated tap through the tissue protector and determine the trajectory, set the projection length and width.
- Use Mallet to anchor the tap on the ileum
- Advance the tap under navigation to the sacrum





Surgical Technique

- Retrieve the tap, and Insert the appropriate screw implant and advance it under navigation

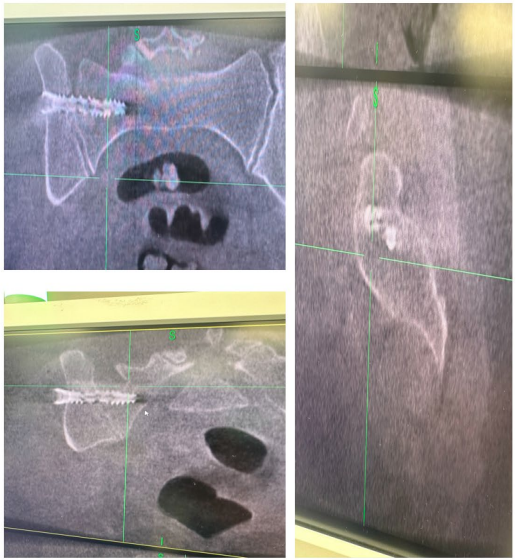


- Insert the blunt end of the pin in the screw, use drill guide to insert the pin parallel to the previous screw.

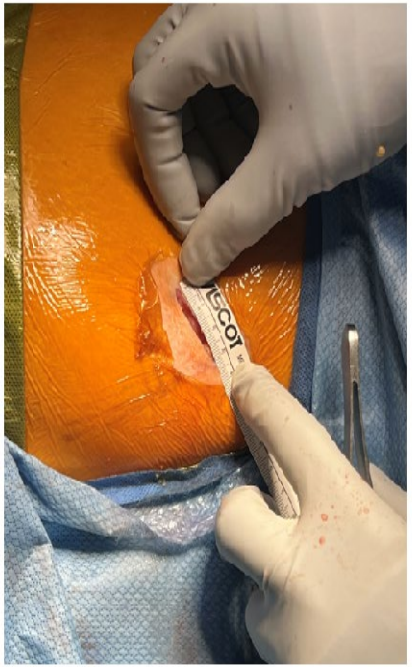
- Repeat the above steps

Surgical Technique

- Repeat the O-Arm spin



- Close the wound in layers

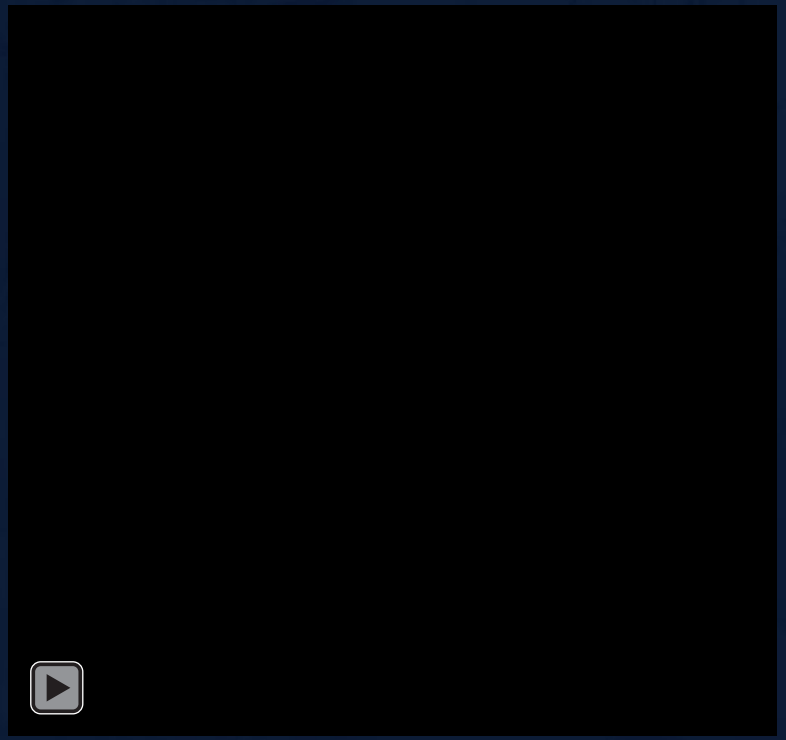


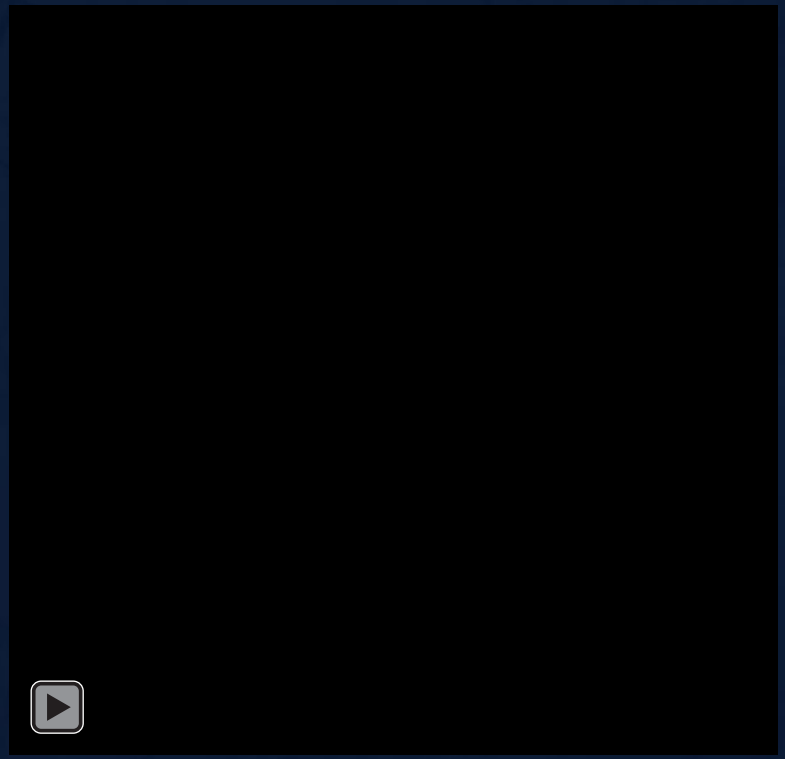

L


L
AB

Post-op Care:

- 50 percent weight bearing for next 2 weeks
- 75 percent weight bearing for next 2 weeks
- FWB at 6 weeks
- Follow-up visits- 2 weeks, 6 weeks, 3 months, 6 months, 1 year.





Thanks!