SI joint (techniques)

Last updated: October 17, 2025

ANATOMY 1
DIAGNOSTIC WORK UP 1
History 1
Physical exam 1
Provocative Tests 2
Differential 3
Imaging 3
Brace 4
Diagnostic Injection (True SI Arthrogram) 4
Spinal Injections 4
CONSERVATIVE TREATMENT 4
SURGICAL TREATMENT 5
INDICATIONS 5
Etiological Categories 5
PREOP 5
Bilateral vs. unilateral 5
TECHNIQUE – LATERAL 5
Position and Imaging 5
Imaging guidance 5
Position 6
Fluoroscopy views 6
O-arm views 8
Incision 8
Robot 8
C-arm 8
O-arm 9
Trajectories 9
LUMBOSACRAL TRANSITIONAL VERTEBRAE 10
POSTOP 10
OUTCOMES, FAILURES 10
HARDWARE SYSTEMS - LATERAL 10
SI-LOK (GLOBUS) 10
Anesthesia, Position 10
Technique with robot 11
Screws 11
iFUSE (SI-BONE) 11
Pin Placement 12
Radiolucent Clamp (optional) 12
Stimulating Pin (optional) 12
Creating cannal 13
Blunt Dissector (optional) 13
Soft Tissue Protector 13
Implant Length Determination 14
Orientation Guide 14
Drilling 15
Broaching 15
Implantation 16
Packing iFuse-3D with graft material (optional) 17
Stimulating Implant (optional) 18
Subsequent Pin Placement 18
Final (3rd) Implant 20
Repositioning / Removal 21
Closure 21
Outcomes 21

Add to my UAMS BIO
Sacroiliac (SI) joint pathology

ANATOMY

- SI joint's primary responsibility is to transfer the weight of the upper body to the lower extremities.
- articular surfaces are ear shaped, containing irregular ridges and depressions;
  - concave *sacral surface* is covered with thick hyaline cartilage.
  - convex *iliac surface* lined with thin fibrocartilage.
  - surface of 17.5 square cm
  - surface is smooth in juveniles and becomes irregular over time
- SI joint is a true diarthrodial joint:
  - in the *upper portion* of the joint, the sacrum and the ilium are not in contact but rather connected with powerful posterior, inter-osseous, and anterior ligaments.
  - *anterior and the lower half* of the joint is a typical synovial joint with hyaline cartilage on the joint surfaces.
- motion (primarily rotation) decreases with aging and increases in pregnancy.
  - normal motion is approximately 2-4 mm in any direction.

DIAGNOSTIC WORK UP

Patient self-diagnosis:
https://si-bone.com/si-joint-pain-quiz/

HISTORY

LBP below L5
Pelvis/buttock pain
Hip/groin/thigh pain
Sitting problems – patient avoids sitting on affected side
Pain with position changes or transitional motions (i.e., sit to stand, supine to sit)

Fortin finger test – patient points to PSIS area!

PHYSICAL EXAM

Tenderness over SIJ sulcus
Posterior SIJ tender to palpation
Single leg stance test may induce pain on supporting side.

SI belt – stabilizes SI joint and pain improves (esp. when climbing stairs – can try in clinic to diagnose).

Patients have same **SI joint mobility** as normal people:

translation < 1.6 mm
rotation < 4 degrees

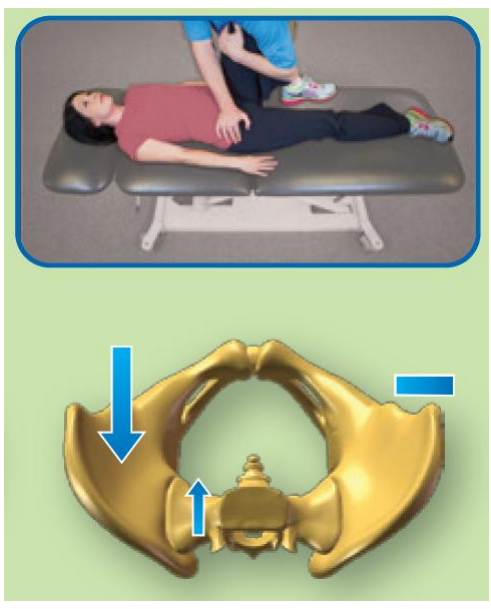
PROVOCATIVE TESTS

In order of reliability:

1. Thigh thrust
2. Distraction
3. FABER
4. Gaenslen's
5. Compression

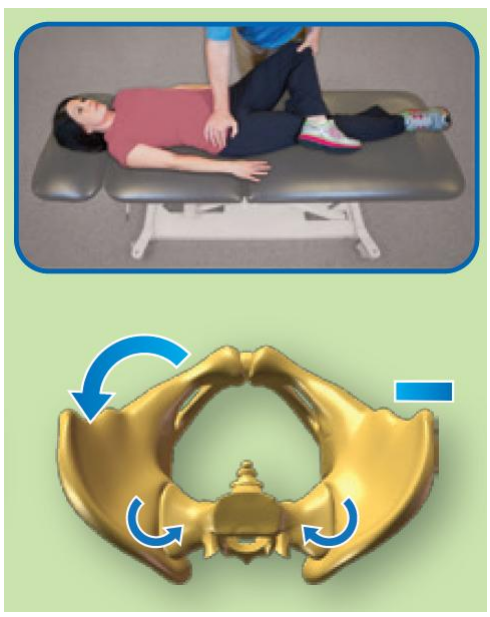
Need only **3 (out of 5) positive tests** to confirm SI pathology!
Suggestion: start with thigh thrust and distraction – if positive, choose and third test.

Thigh thrust – keep thigh absolutely vertical, avoid thigh rotation (otherwise, hip pain)

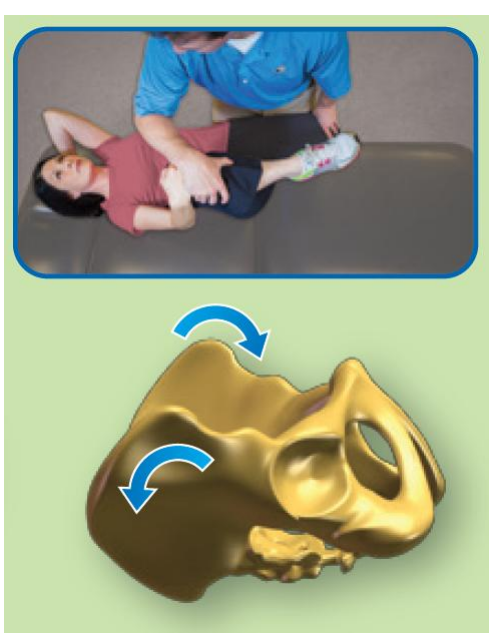


Distraction – examiner crosses his arms to apply true distraction!

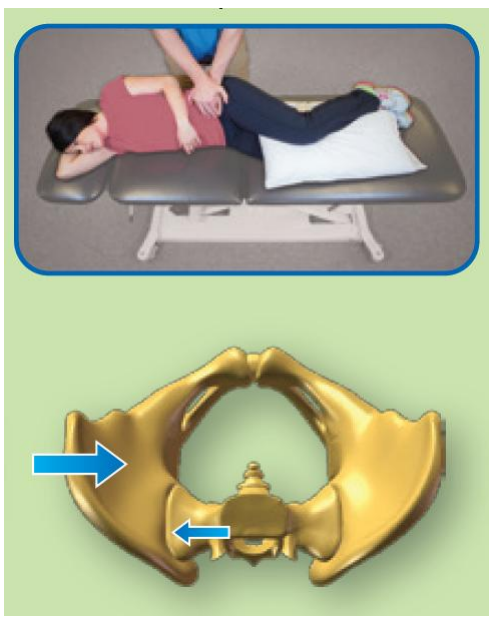
FABER – pain is posterior (vs. hip pathology – pain is anterior)



Gaenslen's



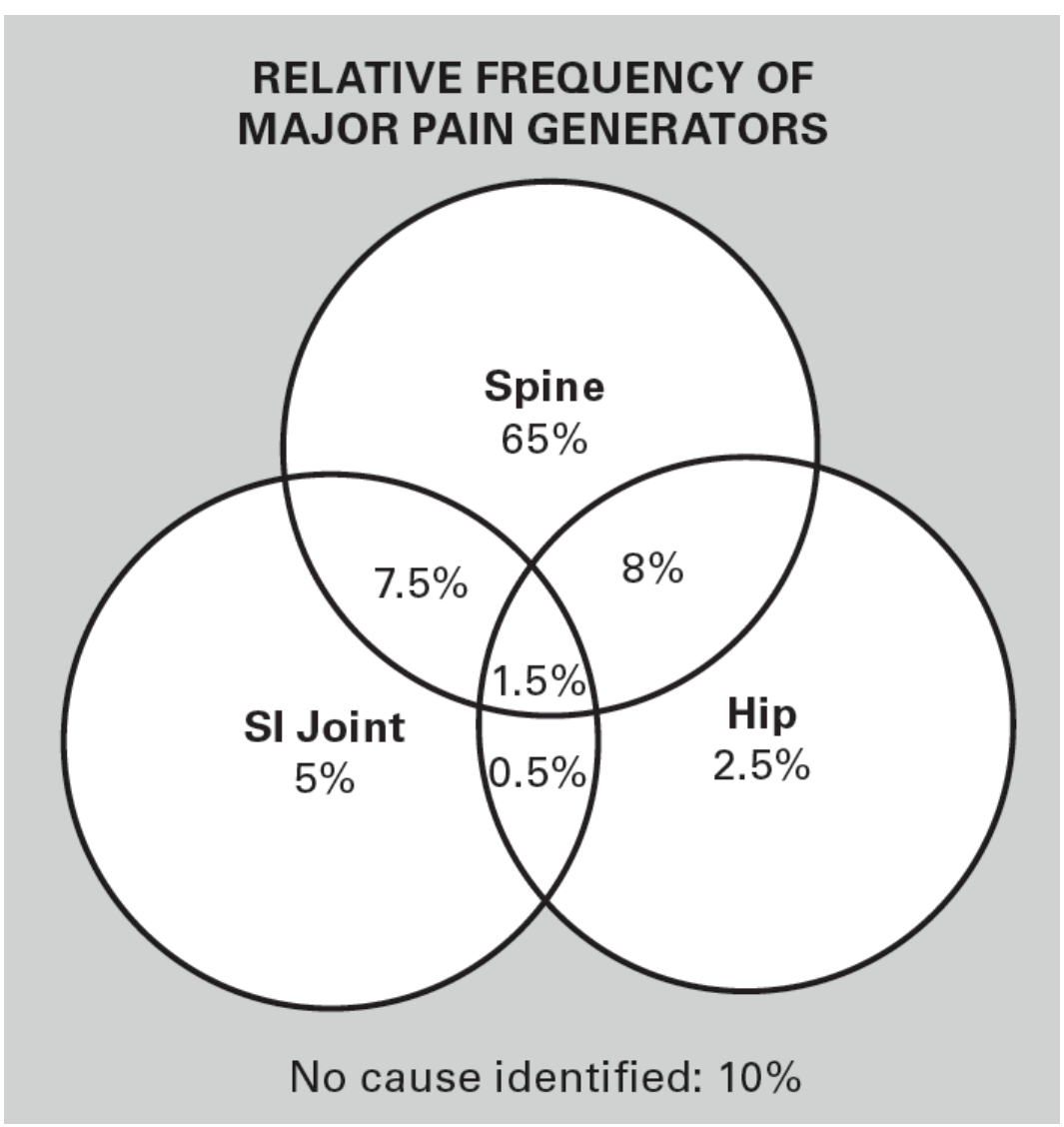
Compression



DIFFERENTIAL

If pain inferior to L5, negative neurological exam, and minimum of 3 positive provocative tests the SIJ is likely a pain generator.

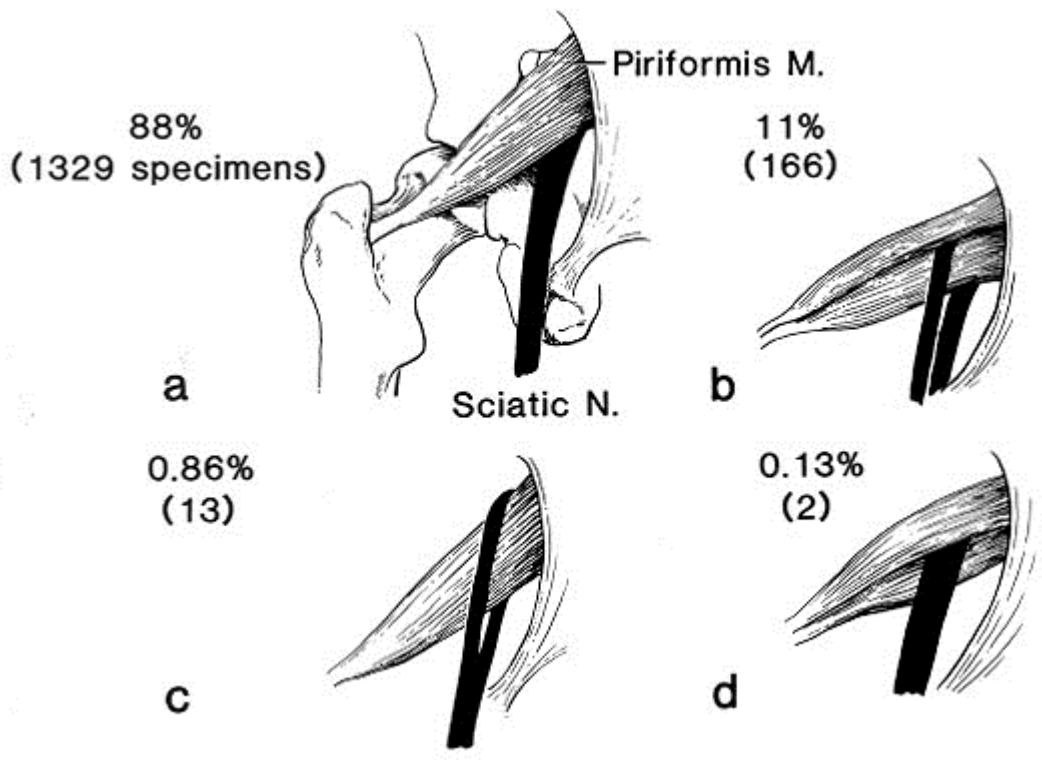
N.B. lumbar spine, hip, and SI joint pathology cam mimic each other



Hip pathology:
internal rotation of hip
FABER
Scour

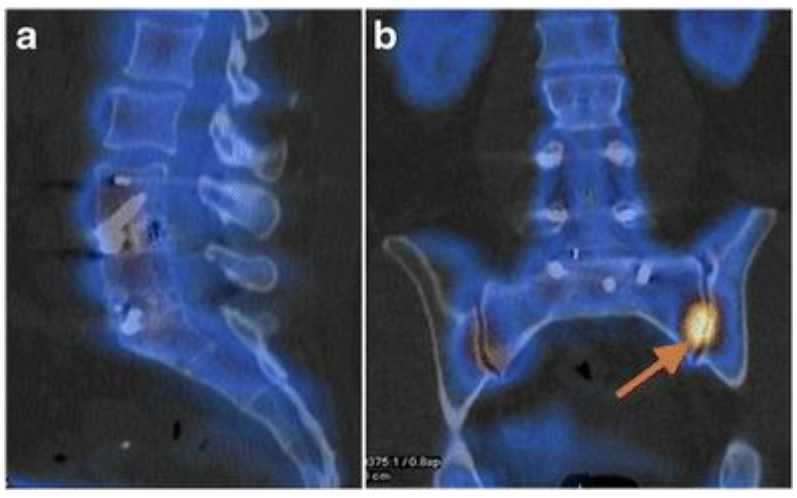
Piriformis syndrome:
FAIR test (maintain at least 10 seconds): https://youtu.be/9Q9YdBke3Kc

- lateral position with the tested hip on top.
- passively move leg into flexion (90 degrees), adduction, and internal rotation.
- examiner stabilizes the hip and applies downward pressure to the knee to internally rotate and adduct the hip - placing the piriformis on a stretch that compresses the sciatic nerve - positive test occurs when elicited pain is posterior (sciatic/gluteal area) + sciatica.
    - if pain in the anterior thigh - **femoral acetabular impingement**.



IMAGING

- may obtain if physical exam is difficult.
- generally not helpful (except **SPECT** – very helpful, especially in diagnostic challenges, such differentiating between SI joint pathology vs adjacent lumbar facet disease):



Findings
SI joint disruption - asymmetric SI joint widening
Degenerative sacroiliitis - sclerosis, osteophytes, subchondral cysts, or vacuum phenomenon

BRACE

a) pain improved = instability → fuse
b) pain worsened = inflammation → steroids

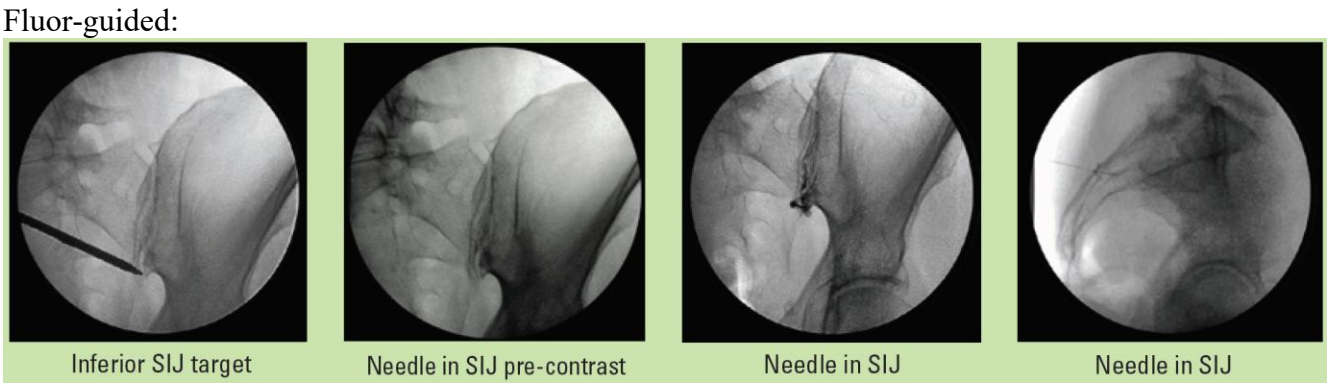
DIAGNOSTIC INJECTION (TRUE SI ARTHROGRAM)

Indication – no response to PT for > 6 mos (PT helps in up to 60% of SI joint cases).

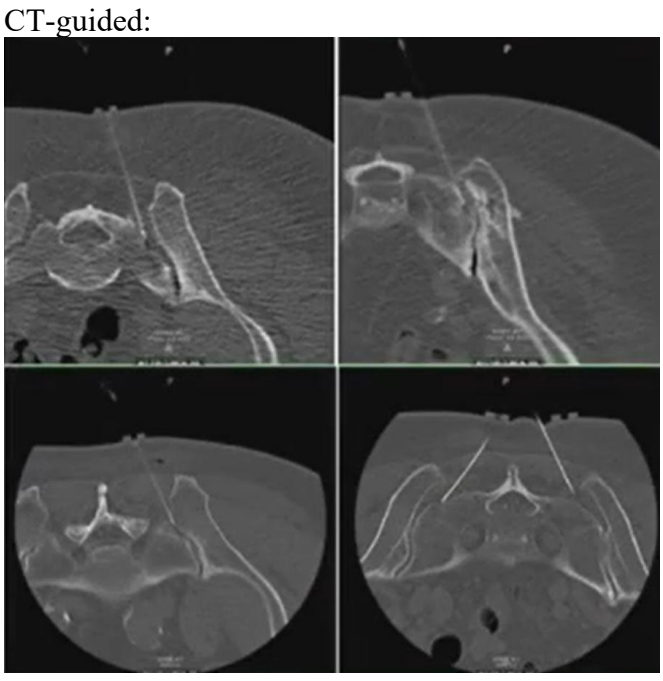
Indicate "For SI joint fusion work up"

Methodology
- done by interventional pain specialist (if unable to inject – refer to IR).
- posterior inferior approach
- 22 gauge styletted needle
- 0.25 ml contrast medium (Medicare mandates arthrogram!) + 1.25 ml local anesthetic (no enough joint space volume to add steroids!)
  N.B. use < 2.5 mL of contrast! (if > 2.5 mL, contrast spills into surrounding tissues).
- use 2 injections to reduce false positives (i.e. if 1st injection gives > 50% pain relief, administer second injection).

Fluor-guided:


Inferior SIJ target | Needle in SIJ pre-contrast | Needle in SIJ | Needle in SIJ

CT-guided:



Findings
SI joint disruption - leakage of contrast.

After injection
- do again provocative testing
- ask patient to move around as in normal daily life.
- best time to evaluate – 15-30 mins to 2 hours after injection (MAC effect has worn off).
- positive if pain improves ≥ 50% (NASS requires ≥ 75%, thus, ask to use NASS guidelines for post-injection evaluation).
- ask to send image copy to me for my review.
- ask patient to call my office to report the result.

If steroids are not helping – it is instability (not inflammation)

SPINAL INJECTIONS

Caveat: SI joint is innervated by L5-S4 nerve roots.
N.B. L5-S1 transforaminal injections block L5 nerve root – SI joint pain improves

CONSERVATIVE TREATMENT

1. **Medications**
2. **PT** (helps > 60% patients; if no response – refer for diagnostic injections)
3. **SI belt** – stabilizes SI joint and pain improves
4. **Therapeutic SI joint injections** (with steroids) – usually 2-3; if patient responds, most likely will progress to surgical treatment.
5. **RF denervation** – temporary measure (causes temporary demyelination and pain recurs in 3-4 months) and denervates only posterior* portion of SI joint.
   *20% SI joints get ventral innervation – RF will not work

SURGICAL TREATMENT

INDICATIONS

1. SI joint disruption (e.g. symptoms started during pregnancy and persisting postpartum for > 6 months)
2. Degenerative sacroiliitis

N.B. SI joint does not ankylose spontaneously!

- SCS is not a good option for SI pain.

ETIOLOGICAL CATEGORIES

Traumatic instability (sacroiliac disruption)

- combination of vertical compression and rapid rotation (i.e. carrying a heavy object and twisting)
- falls on the backside.
- traumatic birth
  26% of postpartum women suffer with SIJ dysfunction (esp. after full term vaginal delivery – 36% of such women affected, vs. 23% after C-section).
- lumbar spine surgery in which a large portion of the ilio-lumbar ligament is injured.
- long scoliosis fusions to the sacrum
  N.B. lumbar fusion puts lots of stress on SI joint – joint degenerates faster (75% patients vs. 38% in controls).
- leg length discrepancy, gait abnormalities
- prolonged, vigorous exercise

- injuries produce ligamentous laxity and allow painful abnormal motion.

Arthritis (sacroiliitis)

- ***autoimmune disorders***, such as ankylosing spondylitis, juvenile rheumatoid arthritis, Reiter's Syndrome, psoriatic arthritis.
- ***infections*** including staphylococcus, gonorrhea and TB.

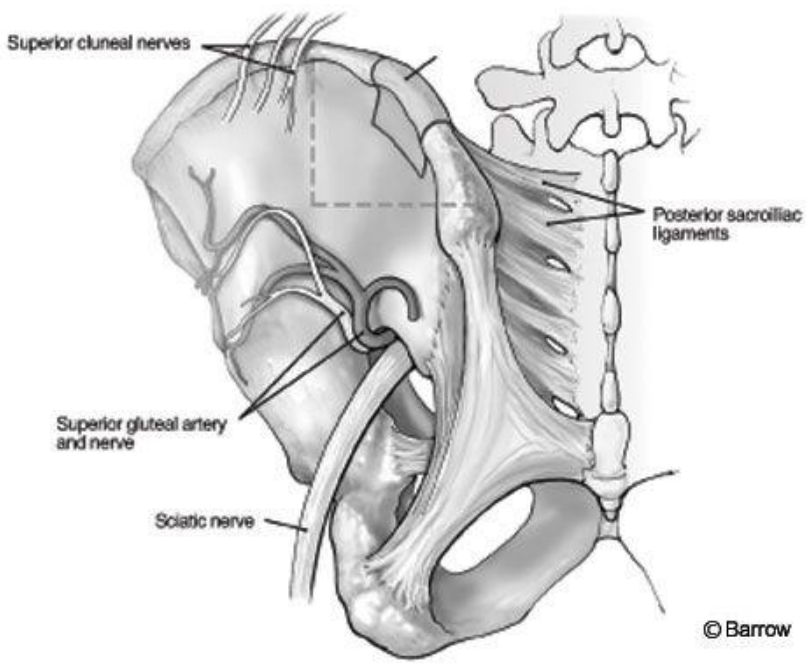
PREOP

CT is a must, esp. if anatomy unconventional (MRI with coronal reconstruction is good screening tool for abnormal anatomy).

Structures at risk

L5 nerve root runs in front of sacrum at proximity to the SI joint (SI joint inflammation may mimic L5 sciatica!)

Middle gluteal artery is lower but may take aberrant course and may be injured.

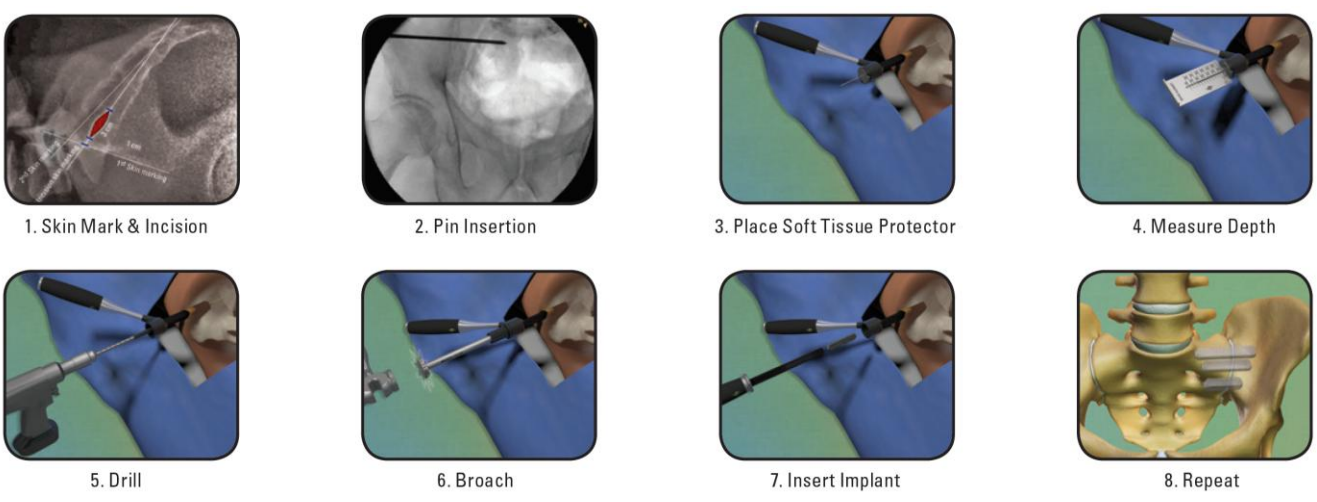


BILATERAL VS. UNILATERAL

Better to stage both sides 3 months apart (patient is NWB with crutches on operated side; if bilateral – may need wheelchair postop).

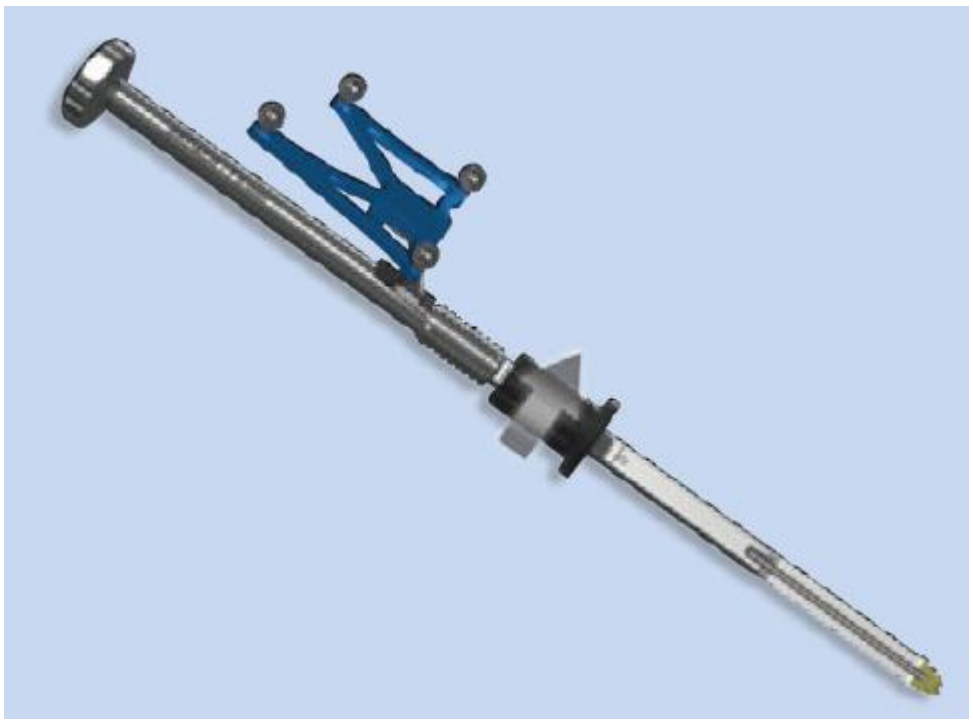
TECHNIQUE – LATERAL

POSITION AND IMAGING



IMAGING GUIDANCE

C-arm – most experts use it (might be too obscure in obese patient – use O-arm instead).
Robotic assistance – see below (Globus)
O-arm (iFuse Navigation Set plus Medtronic TeraTrackers)



POSITION

Table – Jackson (better – cradles patient and stabilizes to prevent movement while hammering implant) or flat.

A. Lateral position

B. Supine position

C. **Prone position** – keep spine and SI joint "neutral" (e.g. towel rolls under chest and waist, pillow under the feet); only position for O-arm – tracker goes into PSIS.

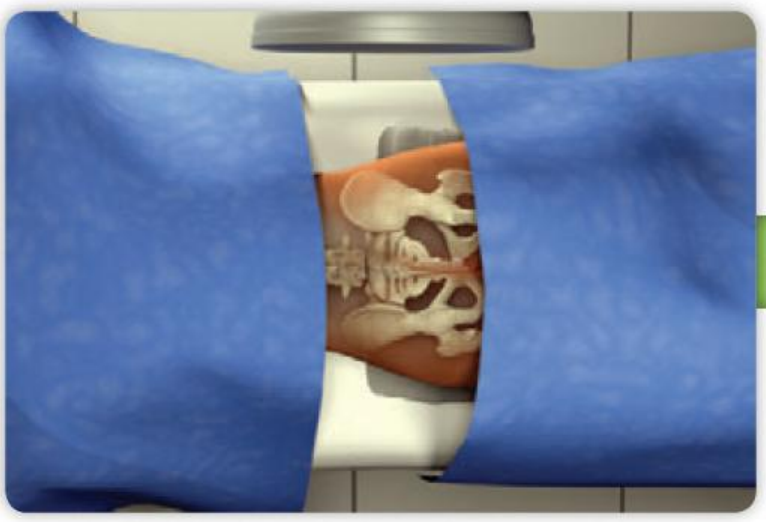
FLUOROSCOPY VIEWS

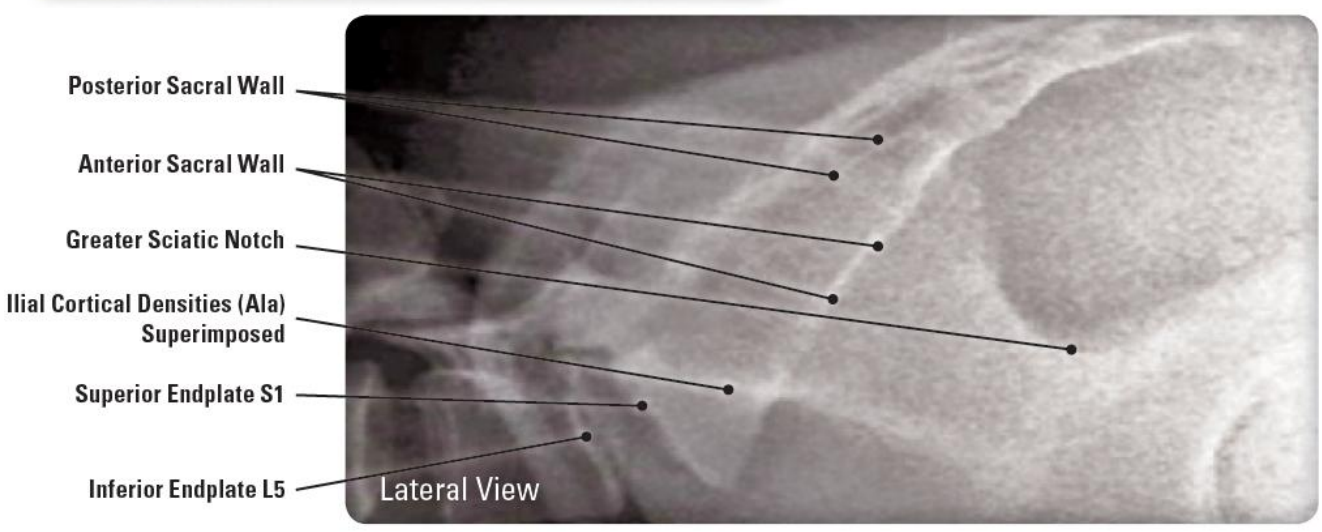
Lateral View

Lateral View

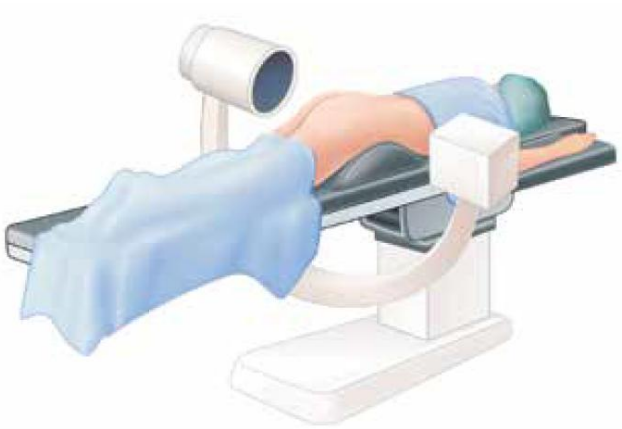
First align the disc space and end plates of L5-S1 to a true lateral view using C-arm swivel or "wig-wag." The sciatic notches should overlap once in correct alignment.

Finalize the alignment by superimposing the left and right iliac cortical densities (alar lines).

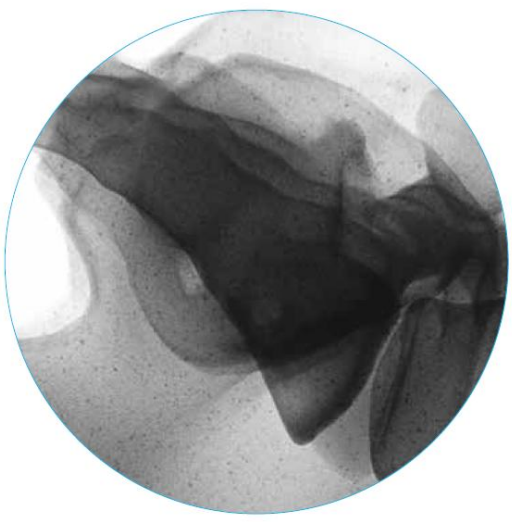




True lateral – make sure both alar lines are superimposed!



Lateral fluoroscopy is positioned directly to the sacrum

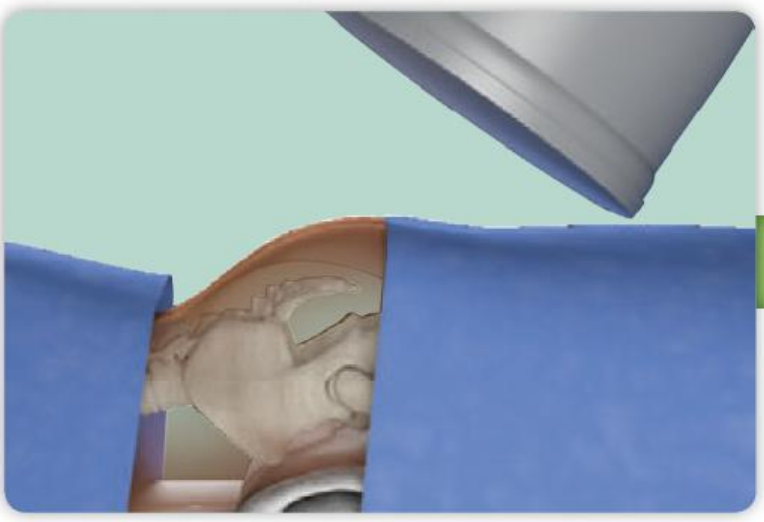


Inlet View

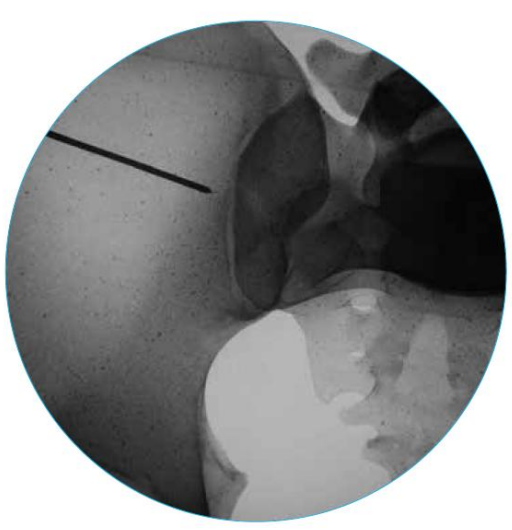
Inlet View

The inlet view is an anterior-to-posterior view to optimize visualization of the ventral cortex of the sacrum.

The fluoroscope is tilted toward the feet until the dense cortical line of the S1-S2 vestigial disc directly overlies the dense cortical line of the sacral promontory. The beam in this view should line up with the anterior cortex of the S1 sacral body.



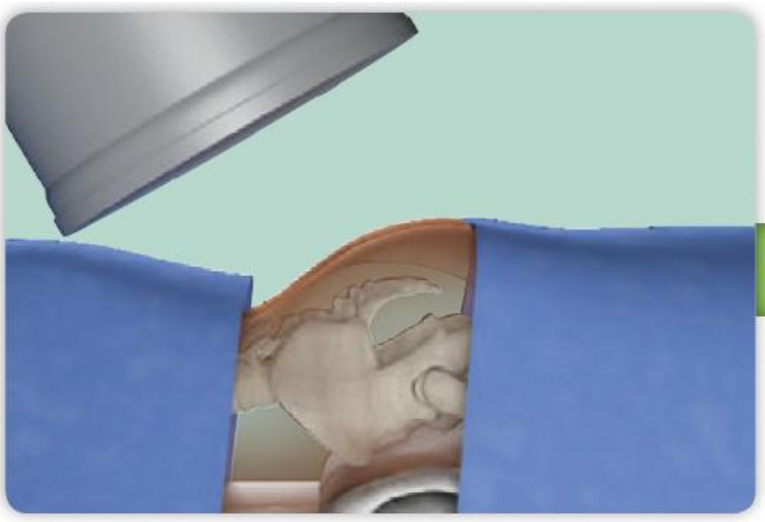
Inlet fluoroscopy is positioned 30-50° to the sacrum

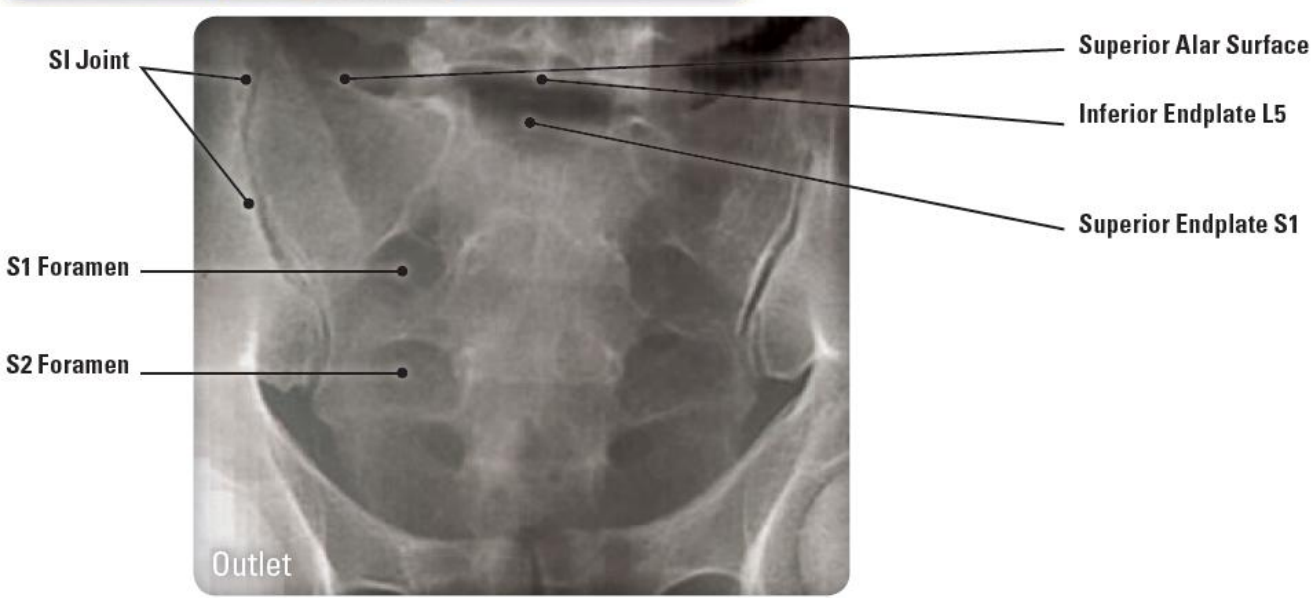


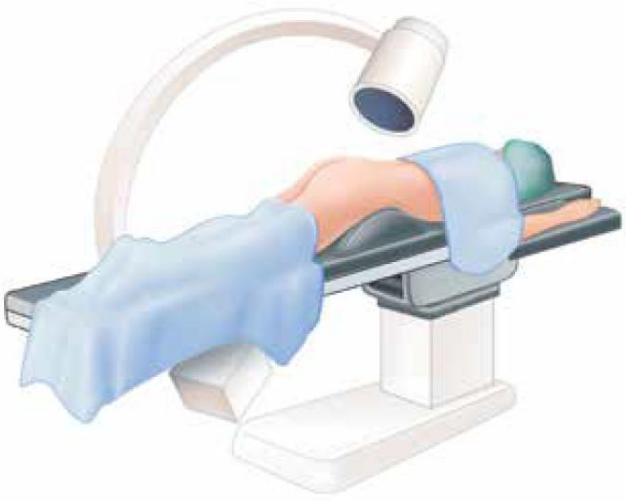
[Outlet view]

Outlet View

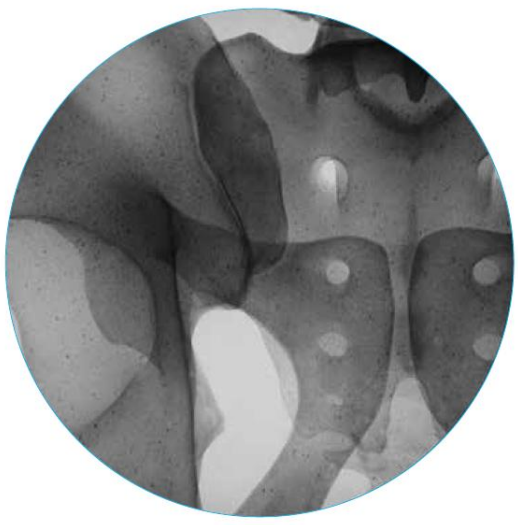
The outlet view is an anterior-to-posterior view to optimize visualization of the sacral neuroforamen.







Outlet fluoroscopy is positioned 30–50° to the sacrum



O-ARM VIEWS

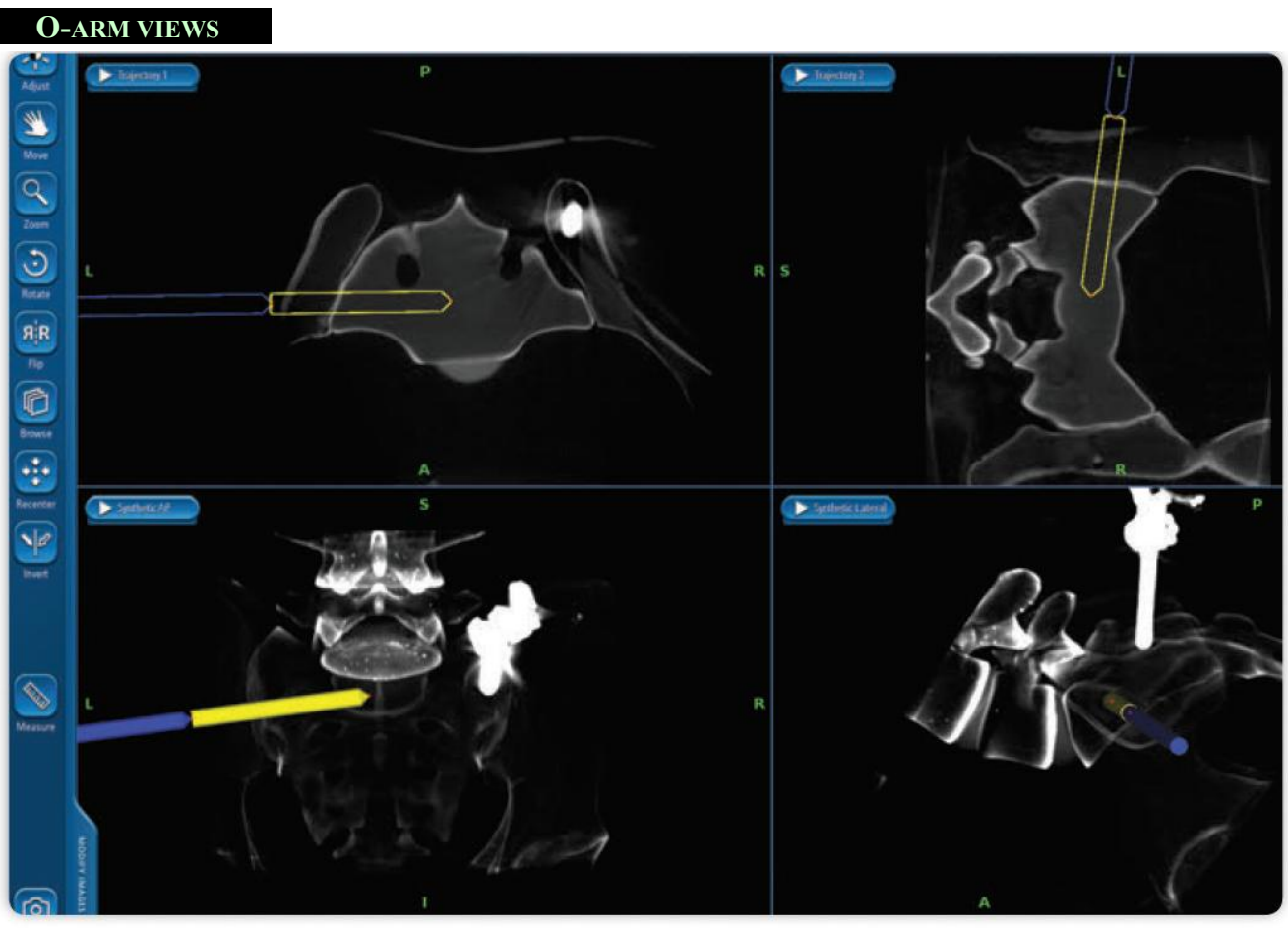


Figure 4. An example of Trajectory 1 – axial (upper left), Trajectory 2 – coronal (upper right), Synthetic AP (lower left), and Synthetic Lateral (lower right).

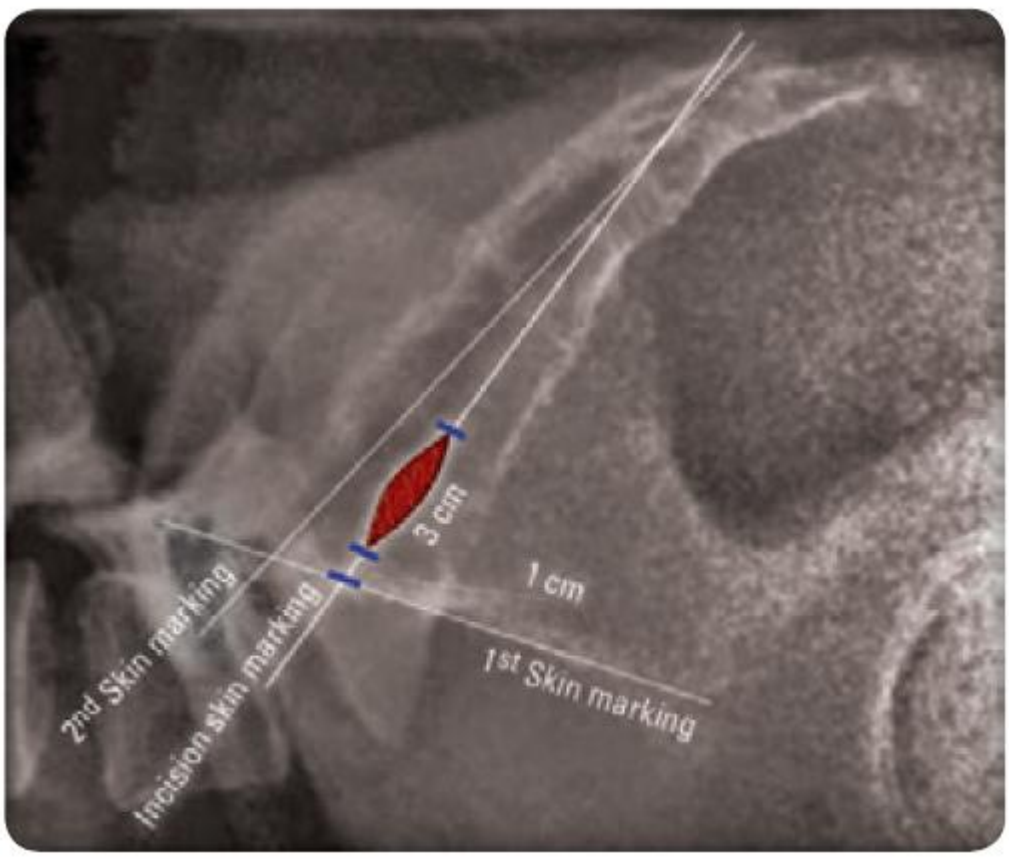
INCISION

ROBOT

- see below (Globus)

C-ARM

3 cm lateral incision (midbody-to-anterior 1/3)



First Skin Marking

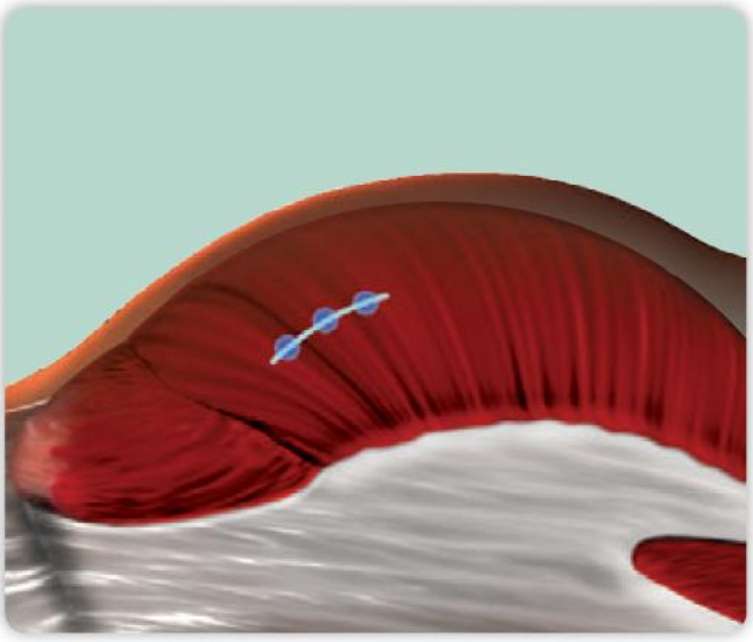
Use a Pin under fluoroscopy to localize the ala. Mark the skin overlying the ala and pelvic brim.

Second Skin Marking

Use a Pin under fluoroscopy to localize the posterior cortex of the sacral body. Mark the skin overlying the posterior sacral body.

Incision Skin Marking

- Use a Pin under fluoroscopy to mark the skin in line with the middle portion of the sacral body.
- Make a 3 cm skin incision along the sacral body incision line starting about 1 cm from the first skin marking.
- The incision should be made through the skin and subcutaneous tissue.



- The muscle fibers run perpendicular to the skin incision.
- Do not continue the skin incision through the muscle and fascia to the bone. Cutting muscle fibers may result in significant bleeding and/or muscle damage.
- Place Pin(s) through the fascia and seat them into the bone. The muscle may gently be spread in line with the muscle fibers to open the fascia and muscle tissue.

O-ARM

- Use the Probe to find the alar line (Figure 5).
- Mark the skin along the trajectory of the Planar Probe to indicate the alar line.
- **First Skin Marking:** Mark the first implant location at the superior portion of the SI joint, about 1 cm from the ala (Figure 6).
- **Second Skin Marking:** Mark the third implant position at the inferior portion of the SI joint, usually in the S2 body (Figure 6).
- Connect the two dots to create the incision line. The incision should be made through the skin and subcutaneous tissue (dotted green line).

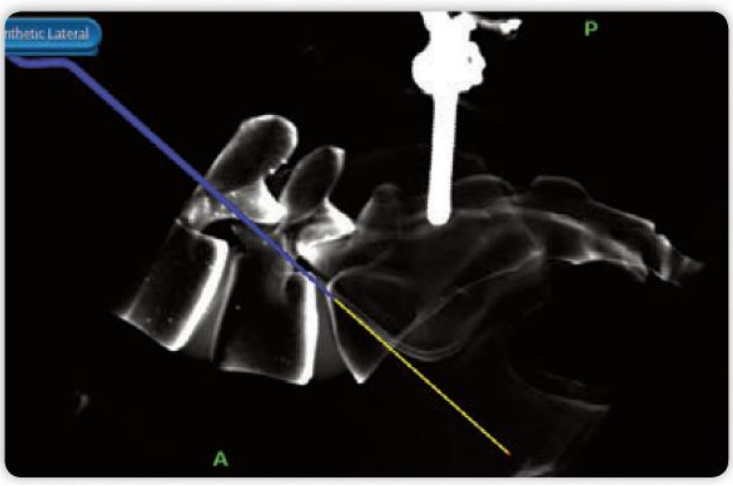


Figure 5. A synthetic lateral view with the Planar Probe projected along the alar line.

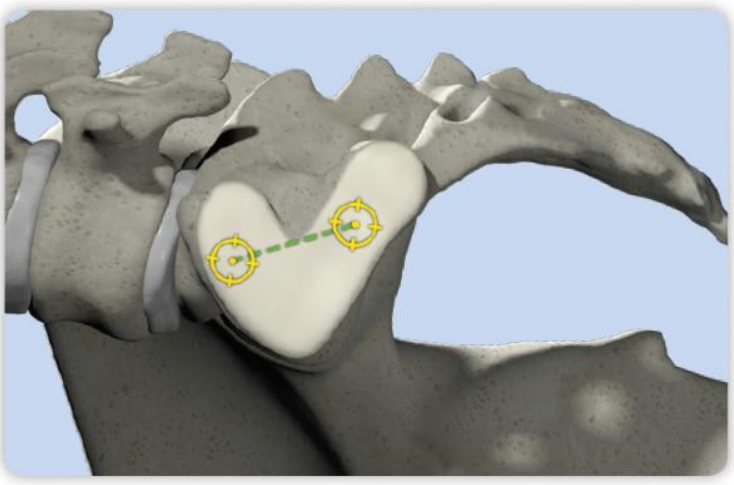


Figure 6. The location of the first and second incision points representing the first and third implant locations, respectively, and the incision line connecting both implants. Note, the incision line should be approximately 3 cm.

***Note**: The synthetic lateral view may require adjustment to align the alar lines to match the orientation of the patient.*

TRAJECTORIES

12, 6, and 6 o'clock

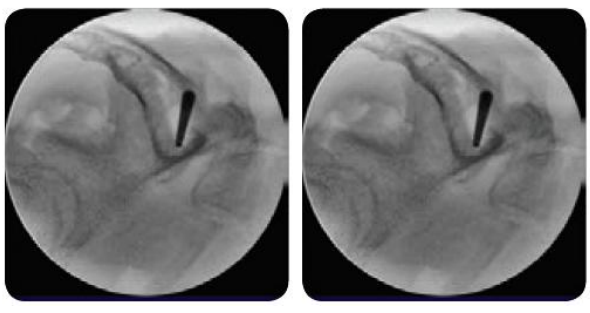
1st screw – aim above S1 foramen (1/2 of implant in sacrum)
2nd screw – aim to S1 foramen (be cautious not to penetrate into foramen, thus, only 1/3 of implant in sacrum)
N.B. due to shape of SI joint, start 2nd pin more anteriorly and aim dorsally!
3rd screw – aim below S1 foramen (1/2 of implant in sacrum)

- start perpendicular to iliac wing surface (just to dock the tip of pin) and then align to trajectory.

Lateral view

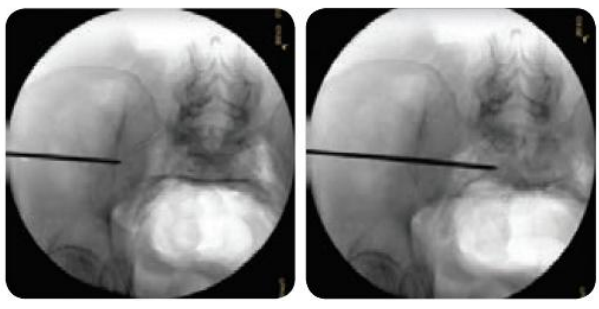
- Initial Pin position is always started distal to the alar line (iliac cortical density; ICD).
- The middle 1/3 of the first sacral body is the typical, but not the universal, starting point.
- Once the starting point is identified, dock the Pin into the lateral cortex of the ilium.

Initial Placement **Final Placement**



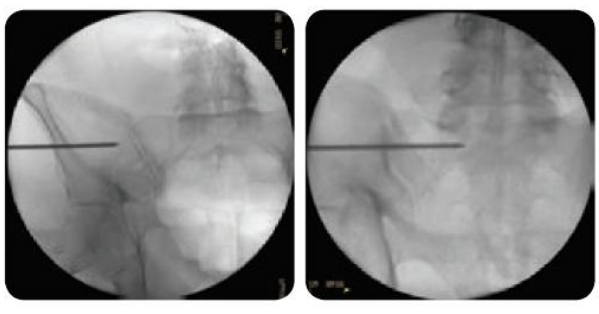
Inlet View

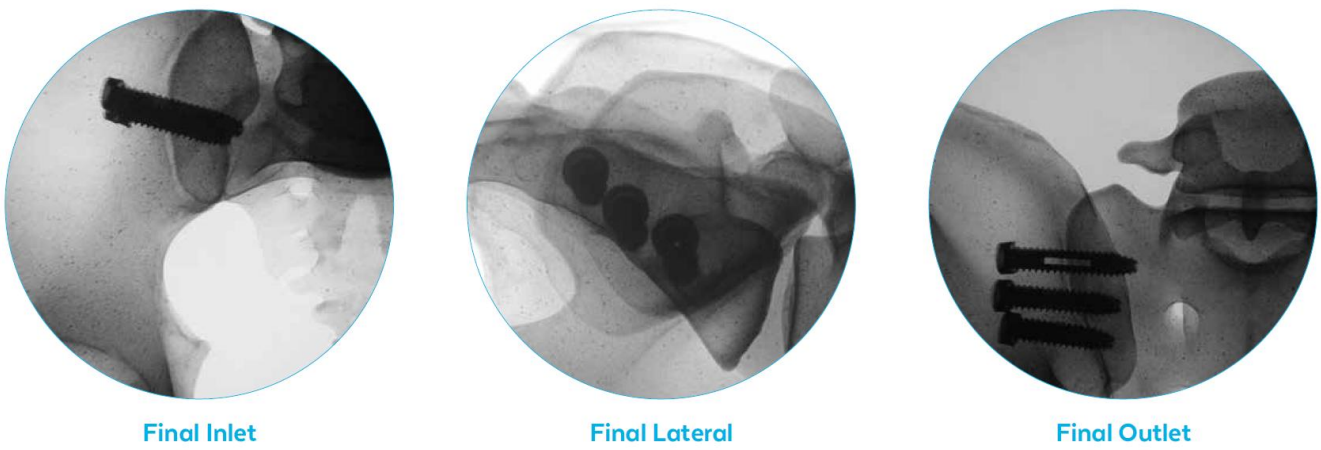
- Adjust the trajectory of the Pin so that the Pin is aiming towards the middle-to-anterior third of the sacral body.
- If the Pin is in an unfavorable position and cannot be advanced safely, adjust the Pin starting position before advancing.



Outlet View

- Adjust the trajectory of the Pin on the outlet view such that the Pin is parallel to the S1 endplate.
- Advance the Pin under the outlet view.
- The Pin may be advanced toward the mid-line if there is a favorable trajectory and adequate bony corridor.
- Re-check the Pin position on the inlet view.





Final Inlet | Final Lateral | Final Outlet

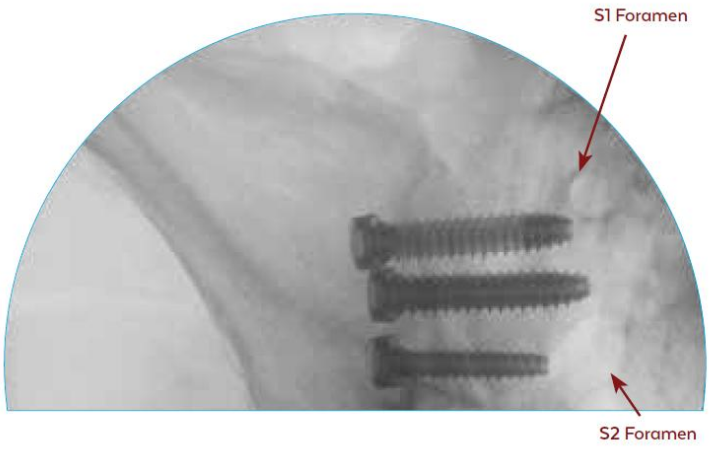
LUMBOSACRAL TRANSITIONAL VERTEBRAE

- incidence 4-24%
- source of pain may be external to SI joint, especially in asymmetrical anatomy - fusion may not be the solution.

Sacralized L5 – L5 vertebrae fused to sacrum

Lumbarized Sacrum – S1 vertebra that has failed to fuse with S2 (note presence of S1-2 disc and "squaring" of S1 vertebra)

- implants in the lumbarized S1 or transitional disc are not recommended
- first implant is placed just short of the S1 foramen:



Due to transitional S1 vertebra, note the caudal location of first and follow-on screws (relative to S1 foramen)

POSTOP

Materials for patients:
www.SiJPC.com/SI-Buddy

Outpatient procedure (vs. overnight stay).
3 weeks partial weight bearing (using crutches, normal foot progression – from heel to toe); experts say "weight bearing as tolerated, avoid stairs".

OUTCOMES, FAILURES

Studies show, it takes approx. 6 mos to get full surgery benefits.
If still pain after fusion → consider Octrode lead along SI joint (trial with TENS).

HARDWARE SYSTEMS - LATERAL

SI-LOK (Globus)

Brochure >>

ANESTHESIA, POSITION

- Jackson radiolucent table; rotate pelvis – operative side towards ceiling, opposite side buttressed against table.
- some consider dex 10 mg if nerve root injury is likely.

TECHNIQUE WITH ROBOT

technique with fluoro, screw removal technique – see brochure >>

- create trajectories on CT on robot software: use inlet and outlet views for planning.
- insert tracker into ipsilateral iliac crest (PSIS).
- fluoro registration (in lateral, inlet, outlet views).
- mark skin incision based on robot entry points (if entry points widely separated and not inline – use separate stab incisions).
- incise skin and subcutaneous tissue.
- insert guided-knife through robot port – incise fascia, muscle (down to bone; if bleeding – inject Surgiflo).
- drill starting point with small super-high-speed drill.
- drill 95%* of trajectory with small drill → large drill (2.5 mm** thinner than planned screw) – may collect bone from threads to pack into slotted screw (wrap with Vicryl to prevent graft dislodgement?)

*just past the cortices of the joint; for a lag screw, drill only through the three cortical walls and no further.

**for harder cortical bone drill 1.5 mm smaller than screw or to tap screw hole instead. SI-LOK® screws are self-tapping; however, in cases of hard or sclerotic bone the screw hole may be tapped to ease insertion

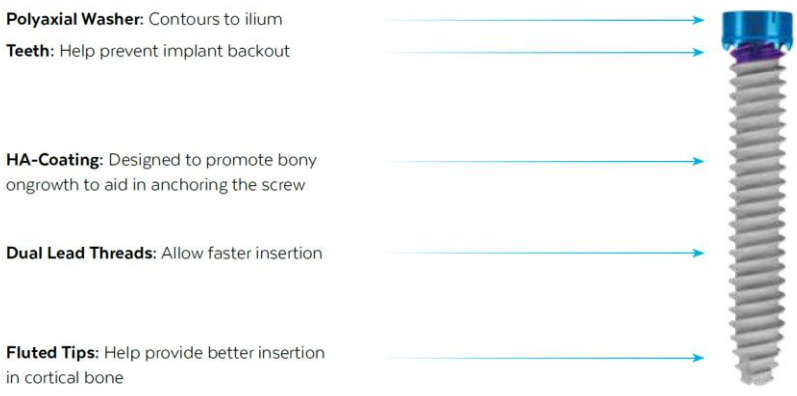
- may tap (8, 10, 12 mm taps available).
- insert screws.
- optional O-arm verification (else use fluoro final shot).
- close subcutaneous tissue and skin.

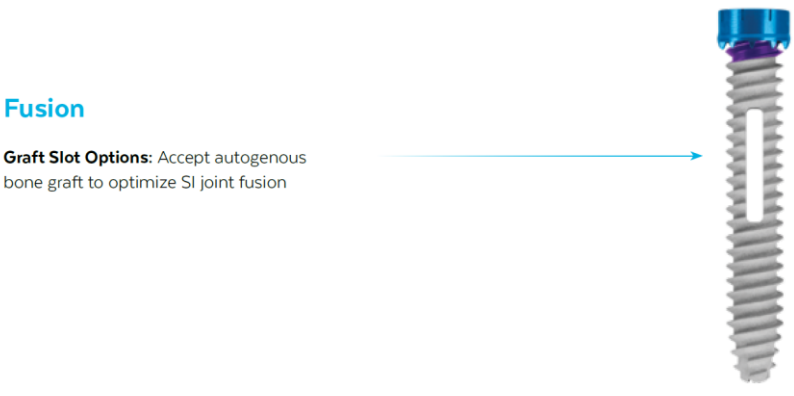
SCREWS

Note: A minimum of two screws bridging the sacroiliac joint are required to achieve stabilization. Three screws of the largest practical diameter, depending on the patient's anatomy, are recommended for the most rigid stabilization.

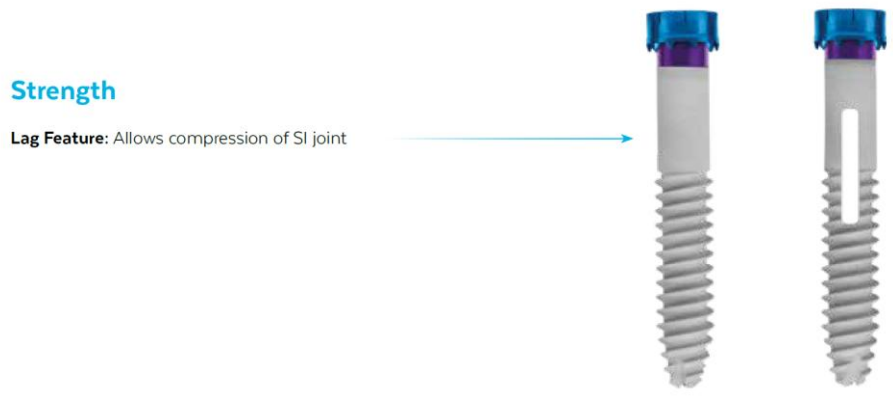
SI-LOK® Screws		Diameter (mm)	Length (mm)
Fully threaded	Standard	8, 10, 12	30-60
	Slotted	10, 12	25-60
Lag	Standard	8, 10, 12	40-60
	Slotted	10, 12	45-60

- hydroxyapatite (HA)-coated.
- sizes (up to 60 mm length): 8 mm (for small anatomy), 10 mm (standard), 12 (rescue).
- washer cap aligns (tilts) to iliac surface and prevents screw from going too deep (if it did, use rescue screw).
- options:





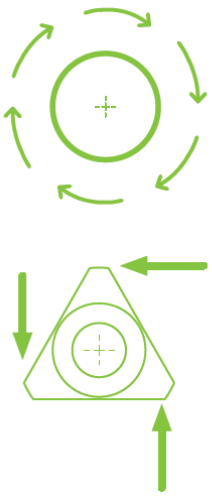
- slotted screws only 10 and 12 mm diameter.

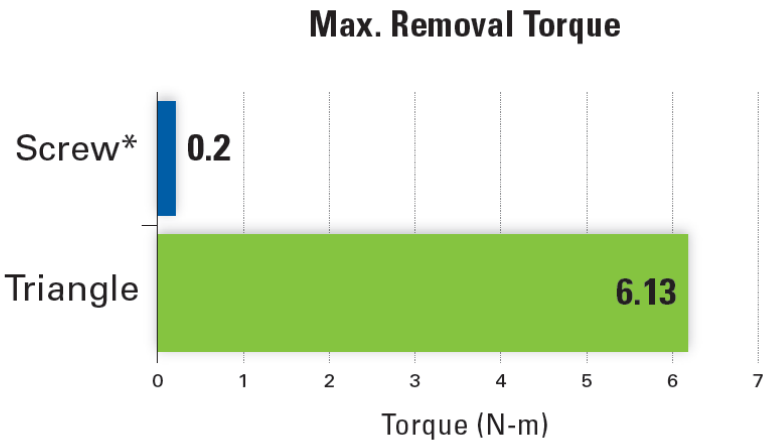


- if using lag screw to compress joint, use lag screw first (then other screws).

iFuse (SI-BONE)

Titanium, porous surface area allows promotes bony ongrowth and ingrowth.
Patented triangular implant profile minimizes rotation. Triangular design has 31X more rotational resistance than screws:

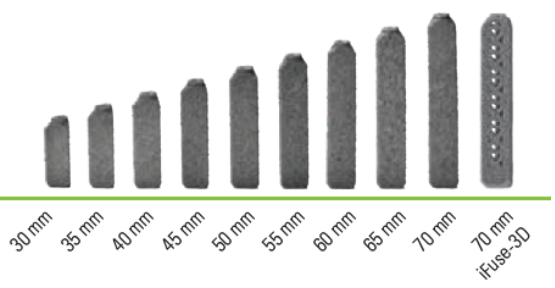


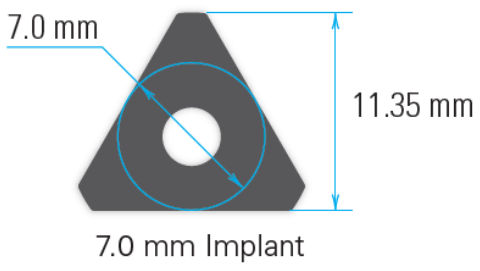


*7.3 mm cannulated screw

Implant Part Numbers

Length (mm)	Diameter (mm) 4.0	7.0	7.0 iFuse-3D
30	4030-90	7030-90	—
35	4035-90	7035-90	7035M-90
40	4040-90	7040-90	7040M-90
45	4045-90	7045-90	7045M-90
50	4050-90	7050-90	7050M-90
55	4055-90	7055-90	7055M-90
60	4060-90	7060-90	7060M-90
65	4065-90	7065-90	7065M-90
70	4070-90	7070-90	7070M-90





7.0 mm Implant

Disposables

Description	Part No.
Cannulated Drill Bit - 4.0 mm	400074
Cannulated Drill Bit - 7.0 mm	400146
Guide Pin - 3.2 mm	500373
Blunt Pin - 3.2 mm	500374
Exchange Pin - 3.2 mm	500375
Guide Pin - 2.0 mm	500376
Blunt Pin - 2.0 mm	500377
Exchange Pin - 2.0 mm	500378
Threaded-Tip Pin - 3.1 mm	500842
Blunt-Tip Pin - 3.1 mm	500845

PIN PLACEMENT

3 titanium implants (FDA says 2 implants but biomechanically it is better to use 3 implants).

Cannulated delivery system – to protect tissues

If a 4.0 mm Implant is to be placed, use a 2.0 mm Pin (use pin driver).
If a 7.0 mm Implant is to be placed, use a 3.2 mm (or 3.1 mm) Pin.

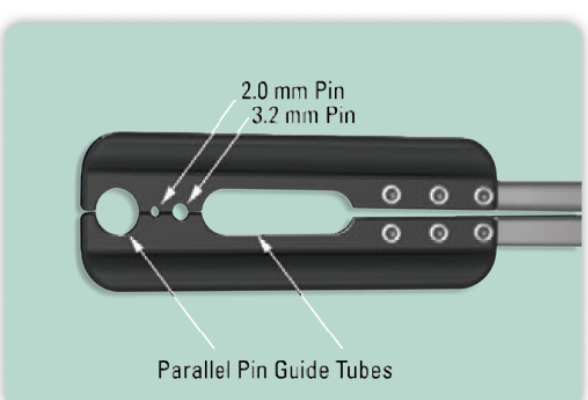
***NOTE**: Replace any bent Pins with new Pins immediately during the procedure to ensure proper trajectory before drilling. Consider using a pin driver if Pin advancement is difficult due to dense bone quality. If using a Guide Pin Repositioner to reposition the first Pin, use the Mallet to place the second Pin.*

RADIOLUCENT CLAMP (OPTIONAL)

The Radiolucent Clamp is designed to allow the user to hold the Pin and/or the Parallel Pin Guide (see p. 27) while keeping their hand away from the radiation source. The tips of the Clamp are radiolucent to allow for visualization of the Pin (and Parallel Pin Guide) under fluoroscopy.

Clamp onto the end of the Pin using the appropriate sized hole in the Clamp (3.2 mm or 2.0 mm).

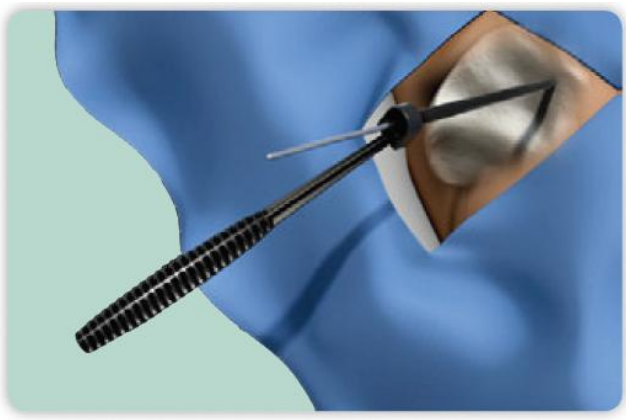
» If using a 3.1 mm Pin, clamp it in the hole for the 3.2 mm Pin.



STIMULATING PIN (OPTIONAL)

Using the Guide Pin Sleeve

With the Pin engaged in the bone, slide the Guide Pin Sleeve over the Pin until the distal tip is touching the ilium.



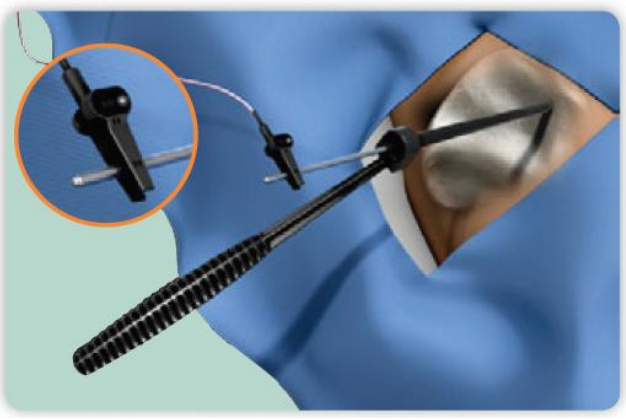
Stimulating the Pin

The SI-BONE Neuromonitoring Kit provides two methods to stimulate the Pin; use only one at a time.

1. Using the Guide Pin Clip

The Clip may be used with the 3.2 mm Pins, 3.1 mm Pins, or 2.0 mm Pins.

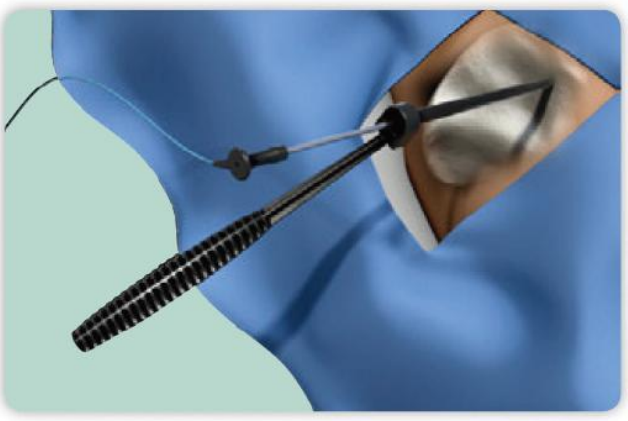
- » Insert the connector end of the Clip into the neuromonitoring system.
- » Place the Clip about 1 cm from the proximal end of the Pin, ensuring that the Clip is attached securely to the Pin (attach Clip at the joint, not at the tip of the jaws).
- » Stimulate the Clip to the desired level.
- » Advance the Pin by tapping on the proximal end of the Pin.



2. Using the Guide Pin Cap

The Cap may only be used with 3.2 mm Pins.

- » Insert the connector end of the Cap into the neuromonitoring system.
- » Place the Cap on the proximal end of the Pin, ensuring that the Cap is securely on the Pin.
- » Stimulate the Cap to the desired level.
- » The Pin may be advanced by tapping directly on the Cap without removing the Cap from the Pin.



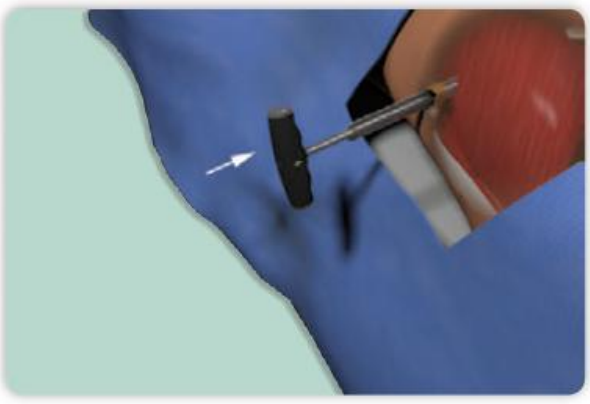
CREATING CANNAL

BLUNT DISSECTOR (OPTIONAL)

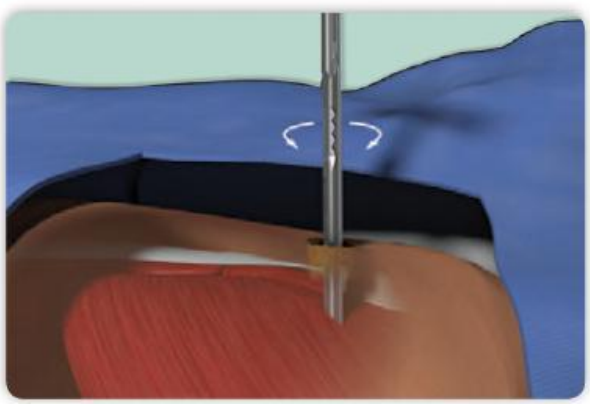
The Blunt Dissector is a cannulated paddle that allows for gentle dilation of the soft tissues prior to inserting the Soft Tissue Protector. It is an optional tool for this procedure.

Slide the Blunt Dissector over the Pin.

Gently advance the Blunt Dissector to the ilium, ensuring the blade is parallel to the muscle fibers.



Ensure the Blunt Dissector is seated on the ilium. Rotate gently to spread out the tissue around the Pin.

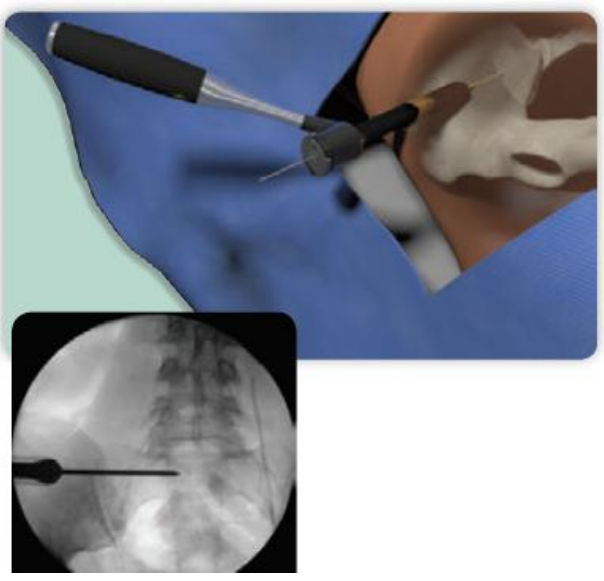


SOFT TISSUE PROTECTOR

The Soft Tissue Protector contains a moderately radiolucent tube to allow for visualization of the instruments inside the Soft Tissue Protector under fluoroscopy.

Snap the Pin Sleeve into the Soft Tissue Protector.

Slide the Soft Tissue Protector and Pin Sleeve assembly over the Pin until the distal tip of the Soft Tissue Protector engages with the ilium and bony contact is achieved.

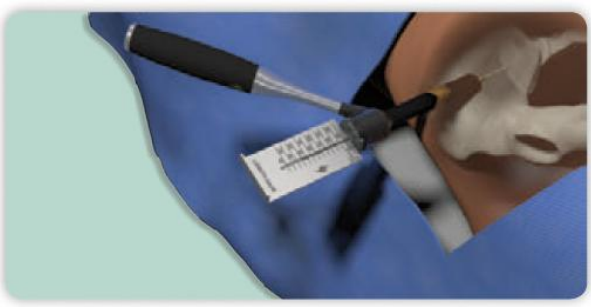


IMPLANT LENGTH DETERMINATION

2nd and 3rd implants are shorter.

Use the Length Gage to select the proper Implant length by positioning the Length Gage under the Pin, as shown in the top right figure.

The Length Gage measures the depth of the Pin that is beyond the lateral cortex of the ilium, providing an easy reference of which length of Implant to use.



Use the Implant length indicated in the range of where the Pin ends.

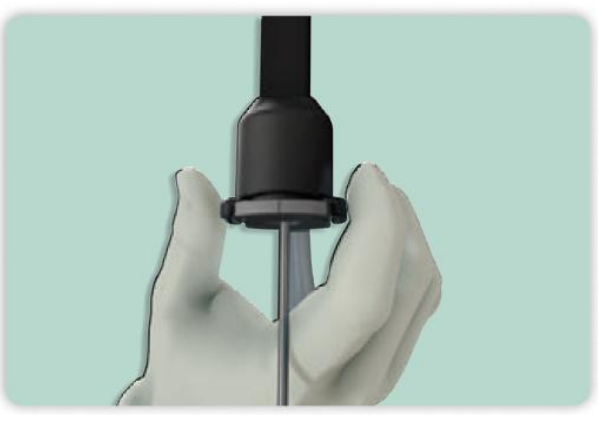
- If the end of the Pin is located in between the lines, then read the number on the left column of the Length Gage to determine the Implant length.
- If the Pin falls on a line, then read the number below the line to determine the appropriate Implant length.

In Example A, a 55 mm Implant should be used.

In Example B, a 70 mm Implant should be used.

***NOTE**: 4.0 mm Implants are only available in 35 mm, 45 mm, and 55 mm lengths. If the Length Gage measures a length between or above those sizes, the surgeon must choose the available Implant length that he/she determines is most appropriate for the particular situation.*

Once the Implant length is determined, compress the Pin Sleeve tabs and remove the Pin Sleeve from the Soft Tissue Protector.



NOTES:

- *Depth markings on the 3.1 mm Pin are only for reference when using an O-Arm System.*
- *The Length Gage is not compatible for use with the 3.1 mm Pin; it is up to the user to determine the proper Implant length (two-pin or other method).*

ORIENTATION GUIDE

- only for 4.0 mm implants!!!

The Orientation Guide is designed to ensure proper guidance and orientation of the 4.0 mm instruments and Implant.

Snap the Orientation Guide into the Soft Tissue Protector.

All 4.0 mm instruments have been made longer to go through the Orientation Guide.

***NOTE**: If the Orientation Guide is not used, the longer instruments may lead to unintended patient injury.*

DRILLING

Necessary for young / sclerotic bones (otherwise, it is optional).

The Drill Bit has a PEEK barrel that is designed to keep the Drill Bit collinear inside the Soft Tissue Protector to minimize the chances of pin binding or shearing.

It is possible to perform this procedure without drilling, as this instrumentation set is equipped with a sharp-tip Broach (see "Broaching with an Adjustable Broach Stop" on p. 20). The decision to skip the drilling step is at the surgeon's discretion. If the surgeon decides not to drill, skip to the next step "Preparing to Broach" (see p. 19).

For a 7.0 mm Implant, drilling takes place through the Soft Tissue Protector. For a 4.0 mm Implant, drilling takes place through the Orientation Guide.

Insert the Drill Bit over the Pin. To prevent binding ensure the Drill Bit can move easily back and forth over the Pin. Start applying power only after the PEEK bulb is completely engaged inside the Soft Tissue Protector. A Blunt Pin may be used in place of the Guide Pin if the Guide Pin is close to a foramen.

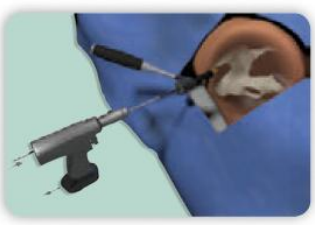
For 7.0 mm Implant
Drill over Pin with just the Soft Tissue Protector.

For 4.0 mm Implant
Drill over Pin with Soft Tissue Protector and Orientation Guide.

Commence drilling under fluoroscopy in the outlet view. Drill through the lateral cortex of the sacrum, but no more than 2-3 mm medial to the lateral sacral cortex. Watch for unwanted Pin advancement.

As the Drill Bit is removed, use the Exchange Pin to prevent the Pin from withdrawing.

Ensure collinearity of the Drill Bit over the Pin, before and during the use of power.



NOTES:

- *Ensure the cannula of the Drill Bit is free of debris prior to each use. Flushing the Drill Bit cannula with sterile saline prior to each subsequent use during the procedure may also minimize pin binding.*
- *Use care to avoid advancing the Pin. Do NOT push on the Pin. Applying a medial force to the Pin or the Exchange Pin may cause them to advance medially.*

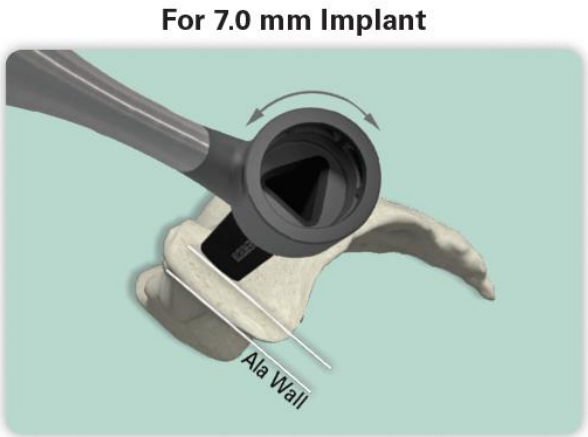
BROACHING

1st implant's flat surface should be parallel to alar line (prevents alar cortex fracture)

The orientation of the Soft Tissue Protector dictates the orientation of the Broach and Implant.

Align the Soft Tissue Protector so that one flat side is parallel to the ala.

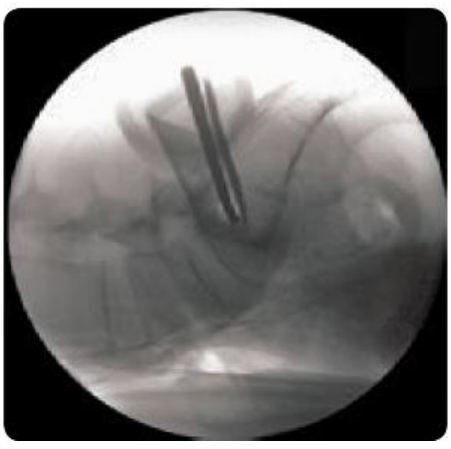
For 7.0 mm Implant



For 4.0 mm Implant with Orientation Guide

Verify under fluoroscopy that the alignment is correct.

The flat side of the Soft Tissue Protector should be parallel to the ala.



An adjustable Broach Stop is provided to prevent over-broaching.

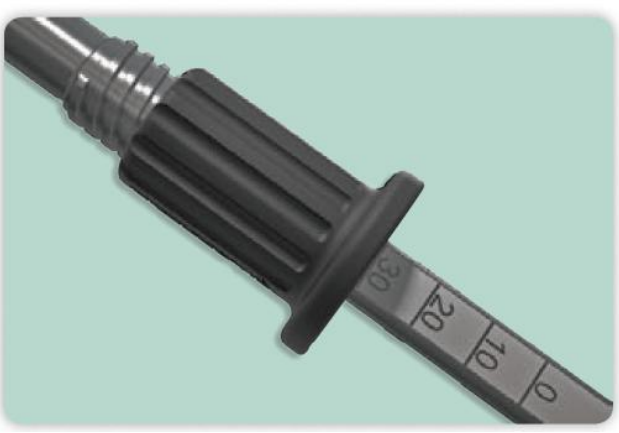
The Broach contains a sharp tip, coated with Titanium Nitride, which is an extremely hard ceramic material. Based on the surgeon's discretion, this sharp tip may remove the need to drill prior to broaching.

For a 7.0 mm Implant, broaching takes place through the Soft Tissue Protector. For a 4.0 mm Implant, broaching takes place through the Orientation Guide.

If the adjustable Broach Stop is used, thread the Broach Stop onto the Broach with the large end towards the patient. The Broach Stop may be used for both the 7.0 mm and 4.0 mm Broach.

If the adjustable Broach Stop is assembled with the large end furthest from the patient, the Broach Stop will not stop the Broach at the intended length. It may also get caught in the Soft Tissue Protector if using the instrumentation for the 7.0 mm Implant.

The Broach contains depth measurements. Adjust the Broach Stop on the Broach to the desired broaching depth. In the example on the right, the user has selected to adjust the Broach Stop to a broaching depth of 30 mm.



For 7.0 mm Implant **For 4.0 mm Implant**

Insert the Broach into the Soft Tissue Protector.

Advance the Broach using the Slotted Mallet.

***NOTE**: Take caution when advancing the Broach to ensure the Broach is not catching on and advancing the Pin.*

The slot of the Slotted Mallet may be used over the Exchange Pin if an Exchange Pin is used.

Tap the Broach across the joint until the last tooth of the Broach is past the SI Joint, but no more than 2-3 mm medial to the sacral cortex, in the outlet view.

Avoid penetrating the sacral canal, foramen and cortices.

When removing the Broach, use the Exchange Pin to prevent the Pin from withdrawing as the Broach is removed.

***NOTE**: Use care to avoid advancing the Pin. Do NOT push on the Pin. Applying a medial force to the Pin or the Exchange Pin may cause them to advance medially.*

IMPLANTATION

For a 7.0 mm Implant, insertion takes place through the Soft Tissue Protector.
For a 4.0 mm Implant, insertion takes place through the Orientation Guide.

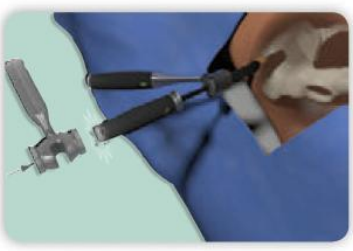
For 7.0 mm Implant **For 4.0 mm Implant**

Check for alignment of the Soft Tissue Protector and broached channel.

The Implant's tapered end must be toward the incision.

Advance the Implant using the Impactor.

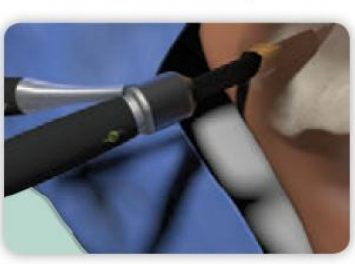
Always monitor the progress of the Implant and any movement of the Pin under fluoroscopy.

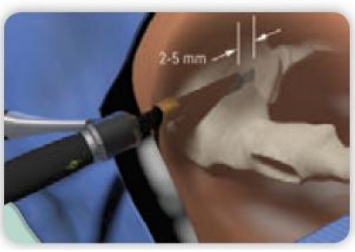


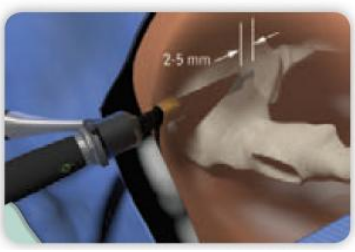
Continue until the Impactor contacts the shoulder of the Soft Tissue Protector.

For 7.0 mm Implant **For 4.0 mm Implant**

The Impactor is designed such that when it contacts the shoulder of the Soft Tissue Protector, the Implant is seated 2-5 mm proud of the ilium. Stop impaction when the Impactor contacts the shoulder of the Soft Tissue Protector.

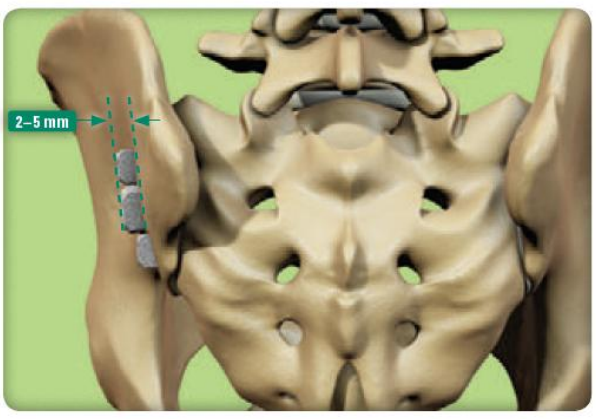




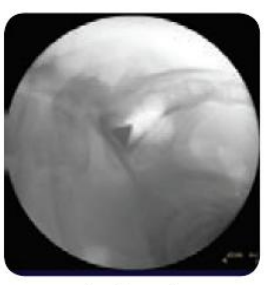


Palpate the end of the Implant to confirm final Implant placement.

The Implant should be slightly proud (2-5 mm), with all three sides of the Implant in contact with the lateral iliac cortex. A proud Implant provides another cortical wall for load bearing support.



Final first Implant placement:


Lateral

Inlet

Outlet

N.B. final X-ray of first implant:
lateral view - implant below alar line (parallel to it)
inlet view – implant posterior to anterior sacral ("L5") line
outlet view – implant ½ in solid sacrum, above S1 foramen

PACKING IFUSE-3D WITH GRAFT MATERIAL (OPTIONAL)

Most experts don't use packing.

- **Insert a Blunt Pin into the cannula of the iFuse-3D Implant prior to packing the Implant with graft material.**
  - » **This will limit the graft material from obstructing the Implant's cannula, which could result in Pin advancement during Implant insertion.**
- It takes 1.1 to 2.6 cc of graft material to pack each iFuse-3D Implant, depending on the Implant (see the table below for details).

Implant Length	Graft Vol (cc)
35	1.1
40	1.4
45	1.6
50	1.8
55	2.0
60	2.2
65	2.4
70	2.6

- When packing the Implant with autograft or allograft, a bone mill may be used to crush the graft material into a fine paste.
  - » A small amount of sterile blood may be added to the graft material to achieve a putty-like consistency.
- Use a surgical spatula to spread and pack the graft material into the Implant, one side at a time, firmly pressing the graft material into the Implant fenestrations.
  - » Avoid using fingers to pack bone material into/onto the Implant. The rough surface of the Implant could tear surgical gloves.
- Use a surgical spatula to remove excess material from the sides of the Implant prior to insertion.
  - » Excess graft material may cause the Implant to become lodged in the Soft Tissue Protector, or could get scraped off during Implant insertion and remain in the soft tissues lateral to the ilium.
- Remove the Blunt Pin from the Implant's cannula.

STIMULATING IMPLANT (OPTIONAL)

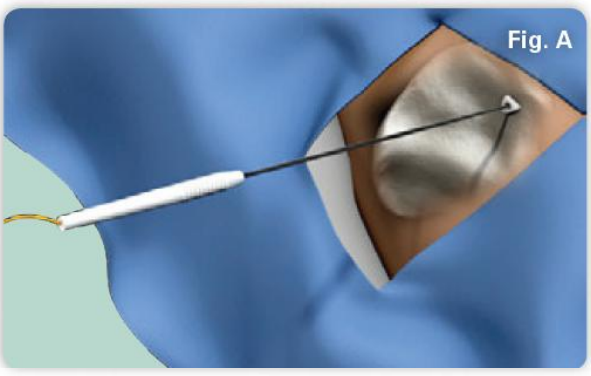
Implant Probe

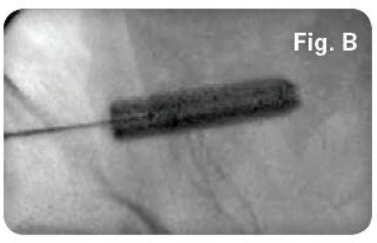
An Implant Probe is provided in the SI-BONE Neuromonitoring Kit to stimulate the Implant.

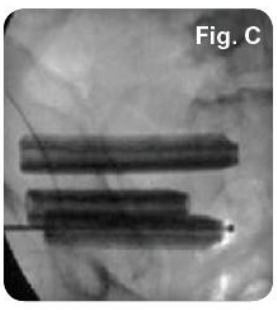
***NOTE**: Neuro-tech/operator should review the generator manual and Neuromonitoring Kit Instructions for Use before using the system.*

Stimulating the Implant

- Once the Implant has been placed to the desired depth as confirmed fluoroscopically, remove the Pin from the Implant.
- Insert the connector end of the Probe into the neuromonitoring system.
- Advance the Probe through the Soft Tissue Protector and touch the Probe's ball-tip to the inner cannula of the Implant (Fig. A-B).
- Stimulate the Probe to the desired level.
- Remove the Probe and Soft Tissue Protector if the neuromonitoring reading is determined to be at an acceptable level.
- **Optional:** To assess Implant proximity to the adjacent nerve structures, the Probe is inserted through the cannulated Implant and advanced past the distal end using a constant current; the Probe is slowly advanced under fluoroscopic guidance (Fig. C) until a response is noted, but no farther than 5-10 mm. Use care to avoid impinging on the nerve or lodging the Probe's ball-tip in the bone.







***Note**: **The optional step** does not apply to the 4.0 mm Implant, as the probe does not fit through the cannula of the 4.0 mm Implant.*

Repositioning the Implant (if necessary)

- If signal changes indicate neural structures at the tip of the Implant, the Implant can easily be retracted.
- The Implant may be laterally retracted a few millimeters using the Removal Adapter (see "Intraoperative Repositioning" on p. 31).
- Once the Implant is repositioned, repeat the stimulation steps above.

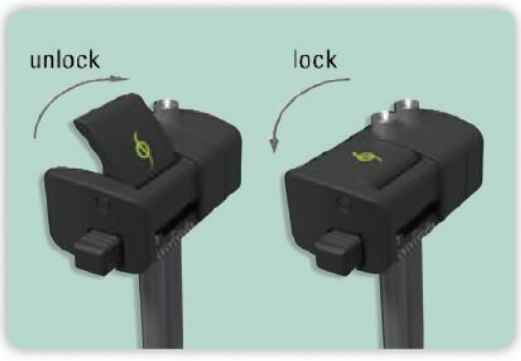
SUBSEQUENT PIN PLACEMENT

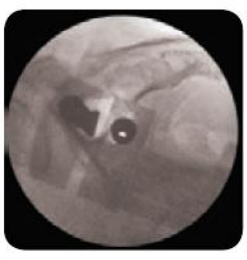
There is one Fixed Parallel Pin Guide and one Variable Parallel Pin Guide that comes in the instrument tray. Both have radiolucent heads to allow for better visualization under fluoroscopy. Both Parallel Pin Guides can be used for 3.2 mm Pins and 2.0 mm Pins.

The Fixed Parallel Pin Guide, shown on the right, has Pin Guide Tubes that are separated by 15 mm, center-to-center.

The Variable Parallel Pin Guide, shown on the right, allows for the Pin Guide Tubes to be separated anywhere from 13 mm to 31 mm center-to-center in 2 mm increments.

Once the desired distance is determined, the Variable Parallel Pin Guide can be locked into place by closing the cam-lock.

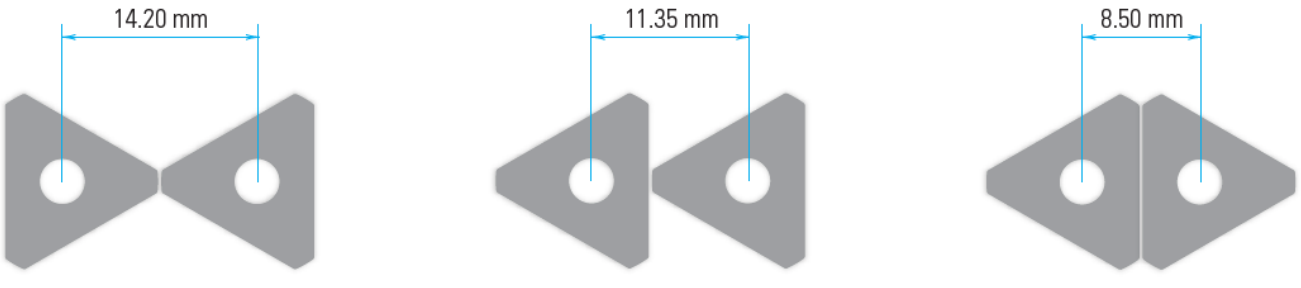




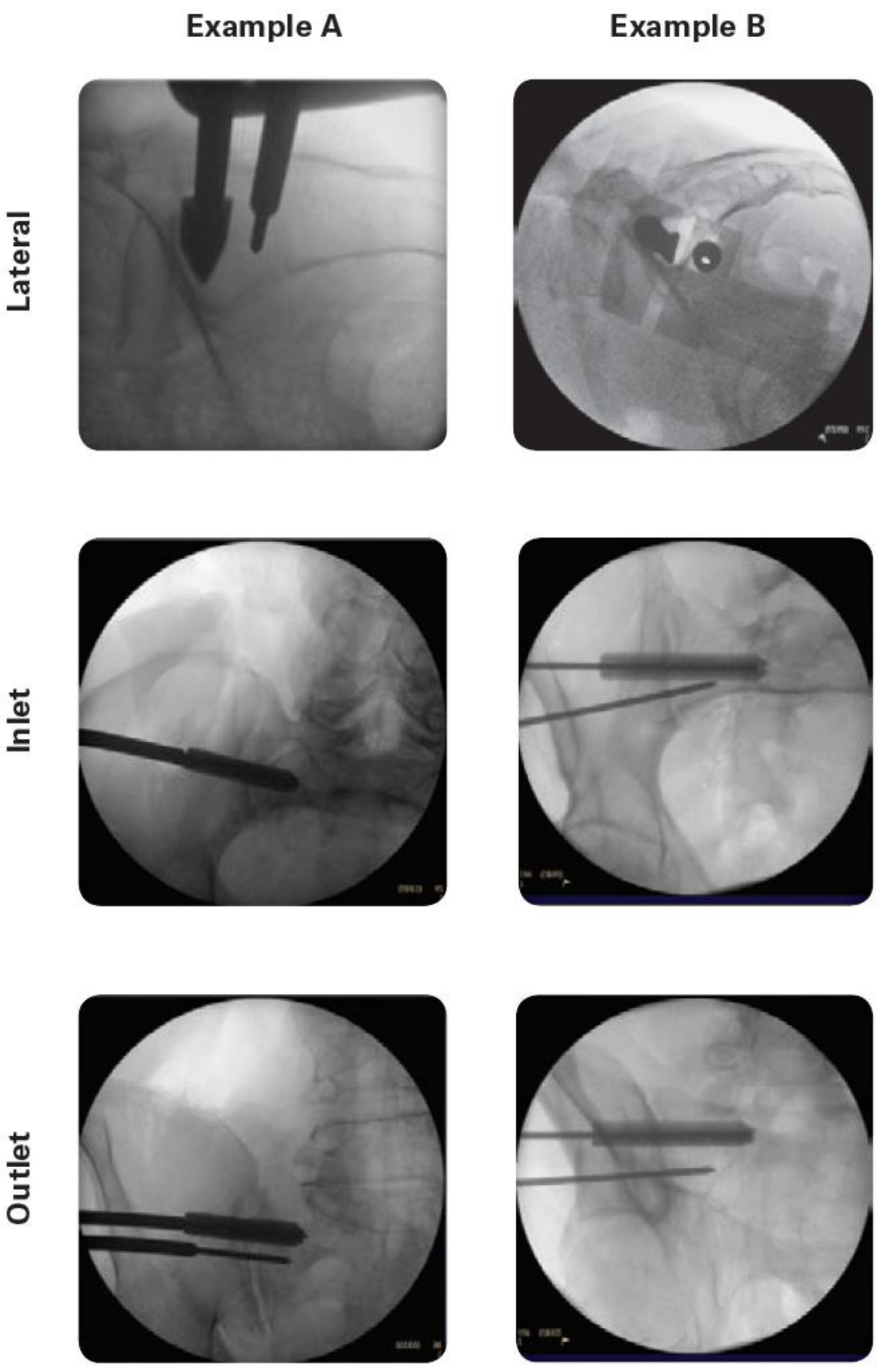
Variable Parallel Pin Guide radiolucent head

The Parallel Pin Guide can be held by the Radiolucent Clamp to keep the user's hand away from the radiation source.

***NOTE**: When placing subsequent Implants, avoid orienting Implants point-to-point. Implant-to-Implant contact may occur in any orientation. If there is Implant-to-Implant contact, the existing Implant may be inadvertently advanced during insertion of the current Implant. The minimum distances, measured center-to-center, before Implant contact in the various orientations are:*



- Depending on the patient's anatomy, placement of the 2nd and 3rd Pins may vary.
- Always check the inlet and outlet views to assess Pin/Implant trajectory and position.
- If using the Neuromonitoring Kit: Stimulate subsequent Pins in the same manner as the first Pin (see p. 12).



* A different SI-BONE instrument set was used in "Example A."

Drilling and broaching are the same as for the first implant.

FINAL (3RD) IMPLANT

Depending on the patient's anatomy, the placement of the third Pin may vary. Always check inlet and outlet views to assess Pin/ Implant trajectory and position.

Outlet View

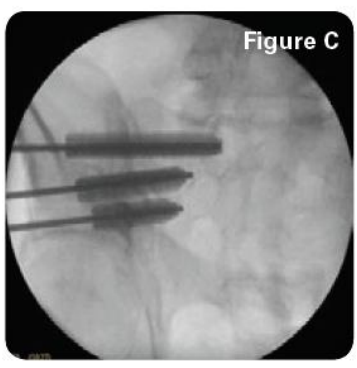
- Place the Variable Parallel Pin Guide (VPPG) over the 2nd Pin.
- Adjust the Variable Parallel Pin Guide so that the guide tube is aimed between the S1 and S2 neuroforamina toward the S2 body. **[Figure A]**
- Lock the VPPG.
- Insert a guide pin into the free arm of the VPPG *(do not dock pin yet)*.

Lateral View

- Rotate the Variable Parallel Pin Guide so that the starting pin position is at the anterior sacral cortical body line. **[Figure B]**
- Dock the pin.
- Remove the VPPG.

Inlet View

- Adjust the pin trajectory; aim for the middle to anterior third of the sacral body.

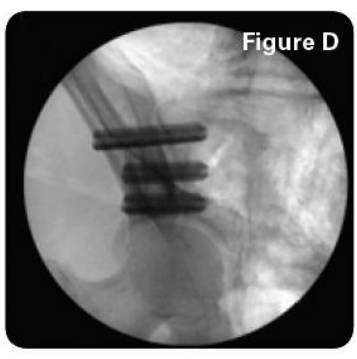


Outlet View

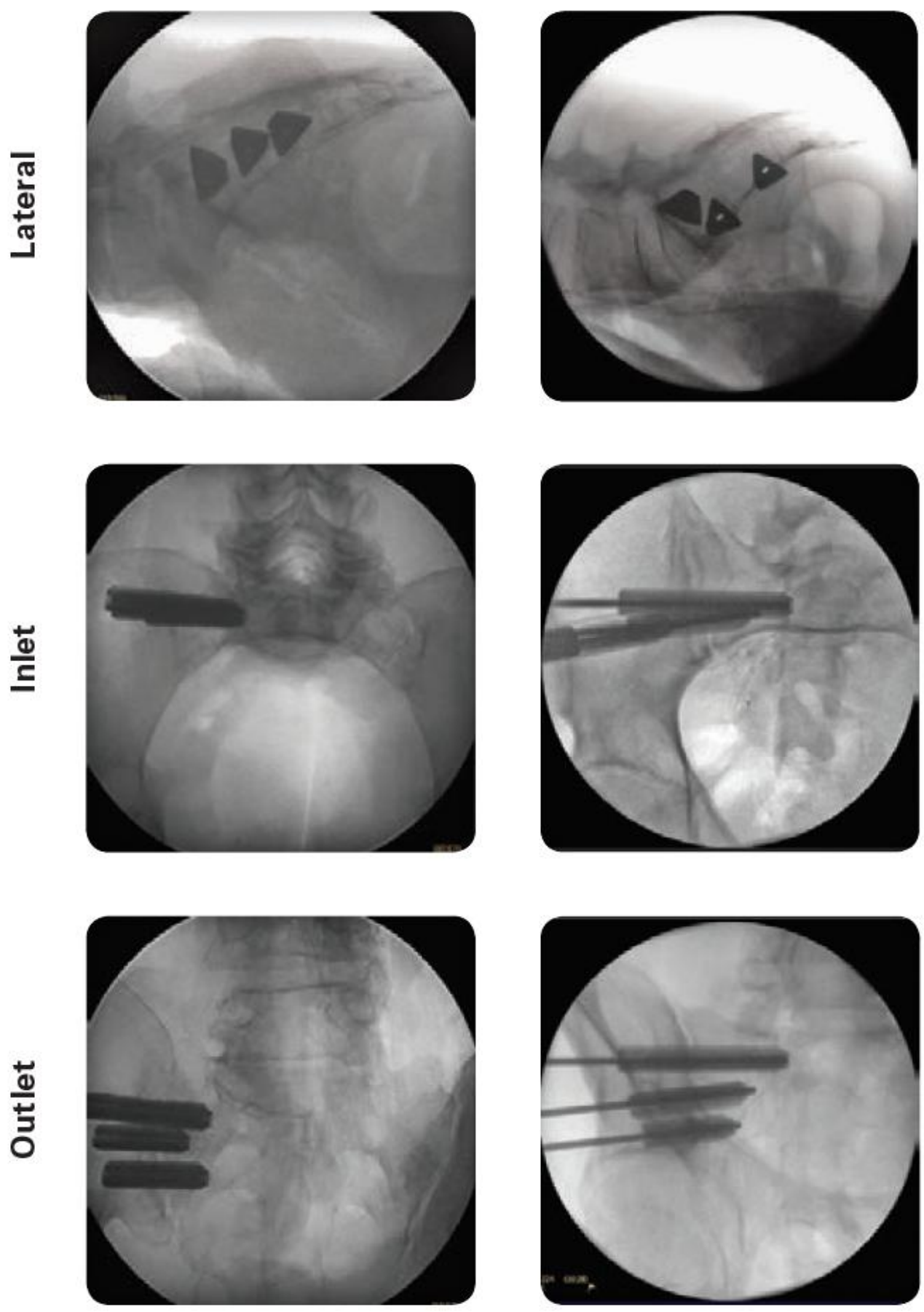
- Verify the trajectory of the 3rd pin; advance. **[Figure C]**
- Use the Length Gage to determine the implant size.
- Place and advance the 3rd implant.

Outlet Oblique View

- Confirm that all implants cross the sacroiliac joint. **[Figure D]**



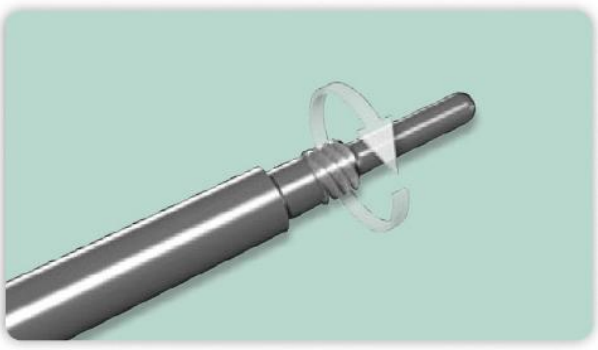
***NOTES**: When advancing pin or implant, avoid penetrating the sacral canal, foramen, and cortices. If visualization is difficult, do not advance pin beyond lateral walls of foramen.*



REPOSITIONING / REMOVAL

The instrument set includes a *Removal Adapter.* The Adapter has a blunt tip to find the cannula of the Implant with a threaded end that fastens to the end of the Implant.

- Fully advance blunt tip of the Removal Adapter into the Implant. Thread Removal Tool clockwise until fully seated.
- A fluoro shot may be needed to confirm the location.

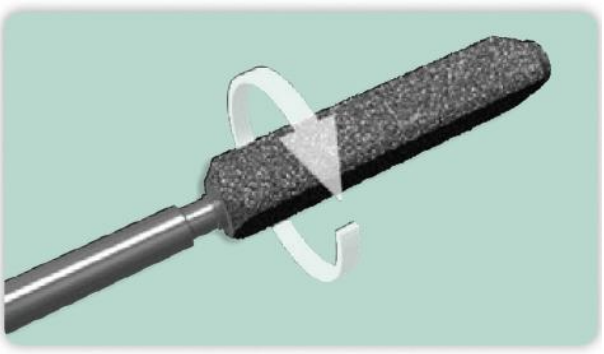


For repositioning or revising an Implant:

- Once the Removal Adapter is engaged with the Implant, the Implant can be repositioned backwards by impacting the handle with the slotted portion of the Slotted Mallet. Confirm final Implant placement using fluoroscopy.

For removing an Implant:

- The Slotted Mallet may be used to lightly tap and back out the Implant.
- The Implant can be unthreaded from the Removal Adapter by placing the Implant in the Soft Tissue Protector and rotating the Removal Adapter counter-clockwise by either hand or with the flattened surface on the shoulder of the Slotted Mallet.



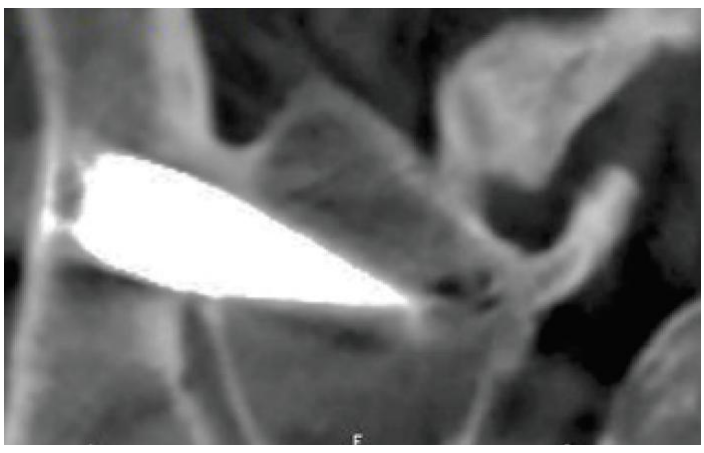
NOTES:

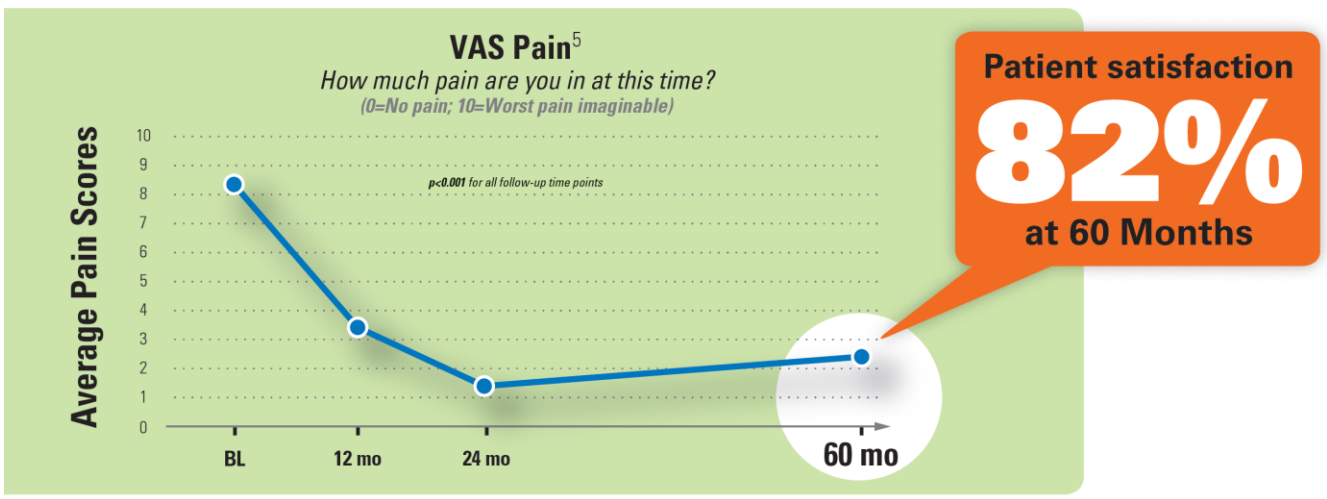
- *Do not over-tighten the Removal Adapter into the Implant, as the tip of the adapter may break off. Use the "two-finger" technique to tighten the 4.0 mm Removal Adapter into a 4.0 mm Implant.*
- *Avoid exerting excessive force in any direction, other than straight back, when using the Removal Adapter.*

CLOSURE

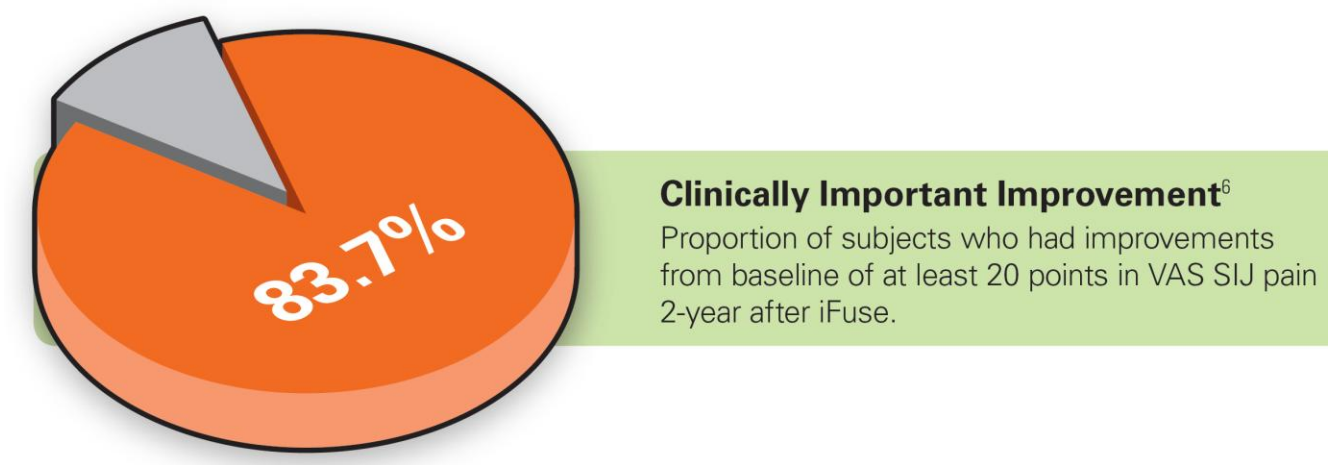
Muscle fascia and skin

OUTCOMES





Rudolf, L, et al., "Five-Year Clinical and Radiographic Outcomes After Minimally Invasive Sacroiliac Joint Fusion Using Triangular Implants." The Open Orthopaedics Journal, 2014, 8, 375-383.



Polly, D W, et al., "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.

Revision rate:
At 2 years – 3%
At 4 years – 5.7%

Major studies
Investigation of Sacroiliac Fusion Treatment (INSITE)
Sacroiliac Joint Fusion With iFuse Implant System (SIFI)

Postmarket complaints database study
- no iatrogenic vascular, GI, or genitourinary complications.