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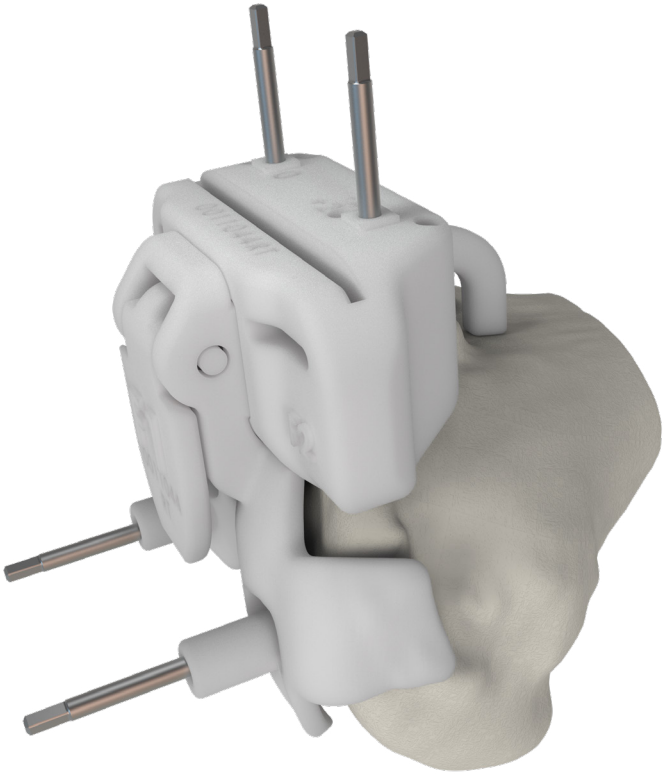
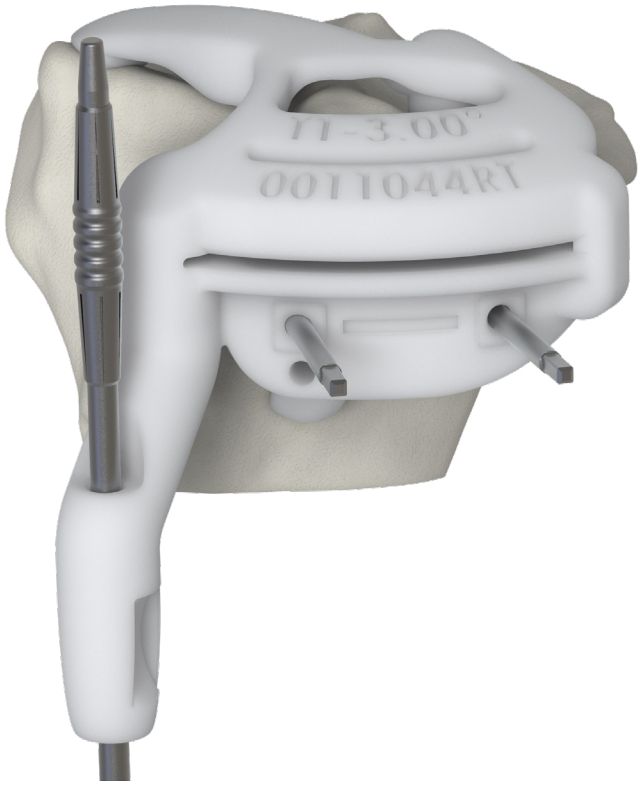
Triathlon® AS-1

Total Knee System

Surgical protocol





Special guidelines

Triathlon AS-1 follows a similar workflow to traditional TKA but does have some differences that are important to note. The following section outlines those distinctions.

- The Triathlon AS-1 patient-specific guides are single-use only and should be discarded, even if unused, after the procedure is complete.
- The Triathlon AS-1 guides are CT-based and require retention of osteophytic bone to position the guides per the surgical plan.
- Do not remove osteophytes or trim bone until femoral or tibial resections are made. Posterior osteophytes may be removed, as they are not utilized for guide referencing.
- Soft tissue removal will be necessary for cutting guide positioning on the distal femur and proximal tibia.
- The CT scan protocol is 200004.
- The Triathlon AS-1 guides have a shelf life of six months from the CT scan date.
- Ensure Triathlon AS-1 guides' pouches match the patient case ID, e.g., C-123456.
- The cutting guides can be re-sterilized up to one time with steam sterilization prior to use.
- Refer to the IFU for specific sterilization instructions.
- A full conventional reusable Triathlon instrument set may be needed and should be ready for usage.
- If you experience difficulties with the cutting guides, revert to conventional reusable Triathlon instrumentation.

Recommendation: After cuts have been made using the F1, F2 and T1 guides, mark all pin holes with a surgical pen for continued procedural reference, especially if adjustment blocks may be used.

Note on sawblade engagement to guides prior to bone cuts:

- **Do not** power on the sawblade until the sawblade is fully captured and engaged within the cutting slot.
- With the guide pinned to bone, fully insert the sawblade into the cut slot and contact bone. The sawblade may need to be angled slightly when entering the captured cut slot to advance the sawblade past the stabilization feature to contact bone.

Required instruments:

- Pin collets that fit the powered driver/drill used for surgery (7203-226-000, 7203-236-000, 8203-226-000 or 8203-236-000)

Recommended instruments:

- A ring curette is recommended. These curettes can be used to remove cartilage on the distal femur and proximal tibia.
- Stryker sawblade recommendations (part numbers):
  - Wide oscillating (4125-127-100)
  - Precision (6725-127-105)
  - Narrow oscillating (6118-119-110, 4118-127-100 and 2108-158-000)

This publication sets forth detailed validated procedures for using the Triathlon AS-1 Total Knee System. It offers instructions that you should heed, but, as with any such technical guide, each surgeon must consider the particular needs of each patient and make appropriate adjustments when and as required.

The manufacturer and/or distributor disclaim any liability arising from the use of Triathlon AS-1 instrumentation contrary to the Instructions for Use, the Surgical Plan, and/or the Surgical Technique Guide.

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Introduction

1. Product information

Triathlon AS-1 includes CT-based patient-specific single-use cutting guides and trials provided sterile for primary total knee arthroplasty procedures. The guides are kitted with one femoral implant, one tibial implant and three tibial insert implants of varying thicknesses, determined by the implant planning algorithm and preoperative plan. Triathlon AS-1 is planned for mechanical axis alignment based on the individual patient's hip center to knee center to ankle center identified from CT imaging.

2. Indications

The Triathlon AS-1 patient-specific cutting guides are disposable, single-use surgical instruments intended to assist orthopaedic surgeons in the positioning of femoral and tibial total knee arthroplasty components intraoperatively, provided that anatomic landmarks necessary for alignment and positioning of the implant are identifiable on patient imaging scans. They are intended for use with the Cruciate Retaining (CR), Condylar Stabilizing (CS), Posterior Stabilized (PS) and Tritanium components of the Triathlon Total Knee System and the Total Stabilizer (TS) and Posterior Stabilized Rotation (PSR) Triathlon tibial inserts.

3. Implants available for order with Triathlon AS-1

Implant type	Description	Part family
Femur	CR Cemented	5510-F
	CR Cementless	5517-F
	PS Cemented	5515-F
	PS Cementless	5516-F
Tibia	Cemented Primary	5520-B
	Cemented Low Profile Baseplate	5520-M
	Universal Baseplate	5521-B
	Tritanium Baseplate	5536-B
Insert	CR Insert	5530-G/ -P
	CS Insert	5531-G/ -P
	PS Insert	5532-G/ -P

4. Healthcare professional portal

Surgeons and relevant healthcare professionals can access Triathlon AS-1 order status, review preoperative plan(s) and manage orders through the healthcare provider web portal: as-1.jr.stryker.com.

5. Preoperative planning

The preoperative surgical plan is based on the patient's mechanical alignment measured from a CT scan. Patient anatomic landmarks and implant resection landmarks are selected based on Stryker's CT-based planning experience and Triathlon design principles. The implant positioning and sizing algorithm begins with the surgeon providing the patient's clinical varus or valgus deformity and surgical preferences chosen for each Triathlon AS-1 order.

The Triathlon AS-1 planning algorithm is designed to follow a validated workflow to generate implant sizing and positioning predicated on Triathlon design principles and Stryker's 3D planning experience.

During implant planning, some patient pathologies may not allow implant sizing and positioning to fall within established rules and boundaries set within the algorithm. For those specific scenarios, the surgeon will receive a notification message that describes the situation.

The sizing and positioning information that is determined from the validated workflow is translated into the surgical plan document for the surgeon to review prior to the surgery.

Based on this surgical plan, single-use patient-specific cutting guides will be manufactured. Also included are adjustment guides to aid in final implant positioning once the patient's soft tissue envelope is understood intraoperatively.

Single-use guide descriptions and pouch grouping

- Each patient-specific Triathlon AS-1 guide is marked with a unique patient number, e.g., C-123456, and guide name.
- For increased legibility, use a surgical marking pen to color over part markings for intraoperative usage (e.g., F1, T1, varus, etc.).
- Guides are grouped into pouches labeled (FP) Femoral Preparation, (TP) Tibial Preparation, (SA) Spacer and Adjustment kit, and, if required, (PS) Femoral PS Preparation.

Pouch group	Guide name	Description	Quantity
FP (Femoral Prep)	F1	Femoral Alignment Guide	1 each
FP (Femoral Prep)	F2	Distal Cutting Guide	1 each
FP (Femoral Prep)	F3	4-in-1 Cutting Guide	1 each
FP (Femoral Prep)	F3B	4-in-1 Femur Rotation 0° Bushing	1 each
FP (Femoral Prep)	F5PS	PS Femur Trial-Chisel	1 each (only required if PS femur selected)
FP (Femoral Prep)	F5CR	CR Femur Trial	1 each (only required if CR femur is selected)
TP (Tibial Prep)	T1	Tibial Cutting Guide	1 each
TP (Tibial Prep)	T2	Baseplate Trial	1 each
TP (Tibial Prep)	T2CR	CR Insert Trials	1 set of 3 thicknesses (only required if CR insert selected)
TP (Tibial Prep)	T2CS	CS Insert Trials	1 set of 3 thicknesses (only required if CS insert selected)
TP (Tibial Prep)	T2PS	PS Insert Trials	1 set of 3 thicknesses (only required if PS insert selected)
TP (Tibial Prep)	T3	Keel Prep Guide	1 each
TP (Tibial Prep)	T4	Cementless Peg Drill Guide	1 each (only required if Tritanium Baseplate selected)
SA (Spacers/Adj)	F2V	Femoral Varus/Valgus Adjustment Guide	1 each
SA (Spacers/Adj)	T1A	Tibial Adjustment Cutting Guide	1 each
SA (Spacers/Adj)	T1VR	Tibial Varus Cutting Guide	1 each
SA (Spacers/Adj)	T1VG	Tibial Valgus Cutting Guide	1 each
SA (Spacers/Adj)	S1	Modular Flexion Spacer	1 each
SA (Spacers/Adj)	S2	Modular Extension Insert	1 each
SA (Spacers/Adj)	SHIM	Flexion/Extension Spacer Shims	1 set of paired 2mm and 3mm shims
PS (PS Prep)	F4C	PS Femur Box Guide-Chisel	1 each (only required if PS femur selected)
PS (PS Prep)	F4G	PS Femur Box Check Gauge-Chisel	1 each (only required if PS femur selected)

Intraoperative adjustment options

+2/-2mm resection

The F2 Distal Cutting Guide allows for femoral resection depth adjustment of +2mm and -2mm from the surgical plan.

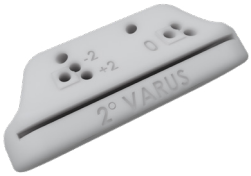
+2/-2mm resection

The T1A Tibial Adjustment Cutting Guide allows for proximal tibial resection depth adjustment of +2mm and -2mm from the surgical plan.

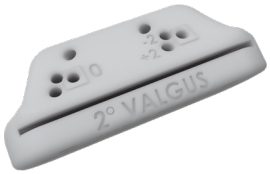
+3/-3° femoral rotation

The F3 4-in-1 Cutting Guide allows up to 3 degrees internal or 3 degrees external femoral rotation pivoting about the medial epicondyle.

2° varus | +2, 0, -2mm resection

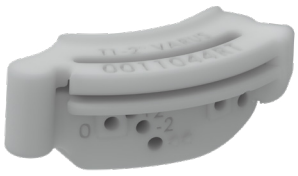


2° valgus | 2, 0, -2mm resection

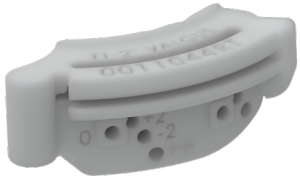


Femoral varus or valgus can be changed by 2 degrees relative to the surgical plan by positioning the F2V guide in both "0" holes, indicated also by raised squares surrounding the holes. The F2V guide is reversible, with 2 degree varus adjustment on one side and 2 degree valgus adjustment on the other side. The F2V guide is designed such that the cutting slot itself is angled to help ensure additional bone removal at "0" hole positions even when used as a recut guide. Additional resection depth adjustment of +2mm or -2mm can be achieved with the 2 degree varus or valgus angle relative to surgical plan with the F2V guide.

2° varus | +2, 0, -2mm resection



2° valgus | 2, 0, -2mm resection



Tibial varus and valgus can be changed by 2 degrees relative to the surgical plan by positioning the T1VR or T1VG guide in both "0" holes, indicated also by raised squares surrounding the holes. The T1VR guide will create a varus cut while the T1VG will create a valgus cut. The T1VR and T1VG guides are designed such that the cutting slot itself is angled to help ensure additional bone removal at the "0" hole positions. Additional resection depth adjustment of +2mm or -2mm relative to the surgical plan is also available with the T1VR or T1VG guide.

Note: Femur and tibia varus and valgus adjustment guides are designed to affect respective overall varus or valgus patient limb alignment.

Reusable instruments

Triathlon AS-1 offers a single reusable instrument case based on fixation type: cemented or cementless.

The cemented instrument case provides reusable instrumentation for all CR and PS femoral components, cemented Primary Baseplates, cemented Universal Baseplate and cemented patella preparation.

The cementless instrument case provides reusable instrumentation for all CR and PS femoral components, cementless Tritanium Baseplates and cementless patella preparation.

For instructions for cleaning, sterilization, inspection and maintenance of orthopaedic medical devices, refer to LSTPI-B and SLI0001 (ifu.stryker.com).

Operating room instruments not included in reusable instrument set:

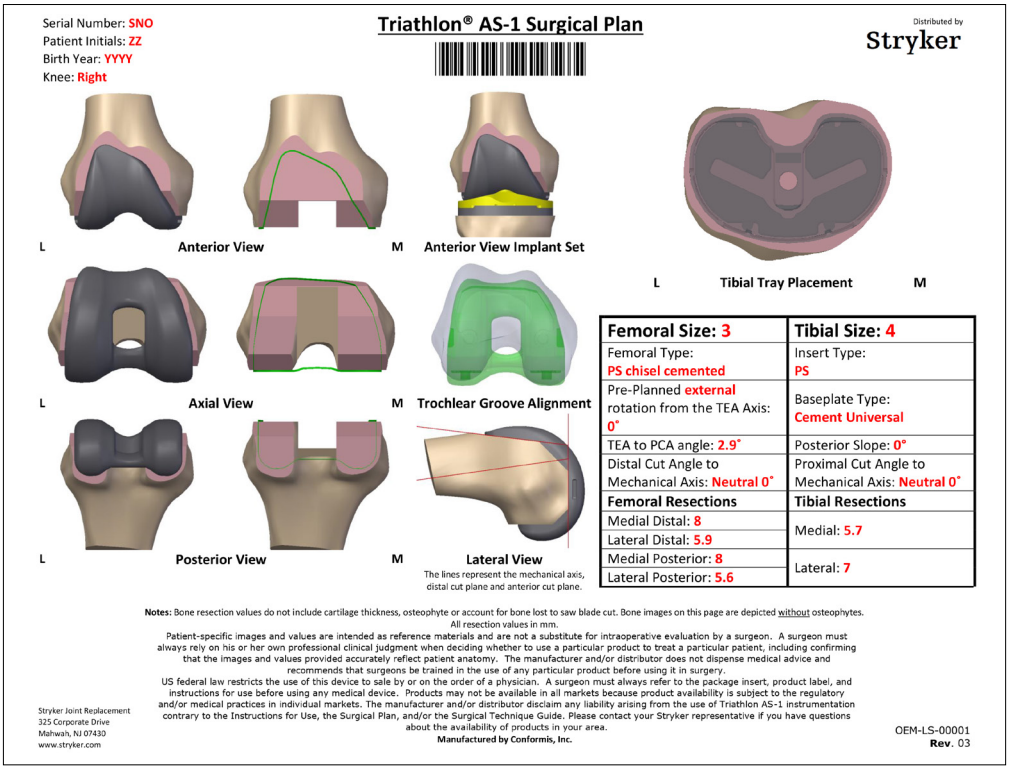
- Required: pin collets that fit powered driver/drill used for surgery (e.g., part numbers 7203-226-000, 7203-236-000, 8203-226-000 or 8203-236-000) which will be used to drive and remove pins.
- Recommended: Ring curette or similar instrument to remove cartilage.

See reusable instrument parts list section for additional details.

Surgical plan

Refer to your healthcare provider web portal, as-1.jr.stryker.com, for a digital copy.

- The surgical plan page 1 will be available prior to the surgery date via the web portal.
- The entire surgical plan will be provided as a hard copy within the Triathlon AS-1 box.
- Bone resection values indicated on the surgical plan do not include cartilage thickness or osteophytes, or account for bone lost to the sawblade cut.



Serial Number: SNO
Patient Initials: ZZ
Birth Year: YYYY
Knee: Right

Triathlon® AS-1 Surgical Plan

Distributed by Stryker

L Anterior View M

Anterior View Implant Set

L Tibial Tray Placement M

L Axial View M

Trochlear Groove Alignment

L Posterior View M

Lateral View

The lines represent the mechanical axis, distal cut plane and anterior cut plane.

Femoral Size: 3	Tibial Size: 4
Femoral Type: PS chisel cemented	Insert Type: PS
Pre-Planned external rotation from the TEA Axis: 0°	Baseplate Type: Cement Universal
TEA to PCA angle: 2.9°	Posterior Slope: 0°
Distal Cut Angle to Mechanical Axis: Neutral 0°	Proximal Cut Angle to Mechanical Axis: Neutral 0°
Femoral Resections	**Tibial Resections**
Medial Distal: 8	Medial: 5.7
Lateral Distal: 5.9	
Medial Posterior: 8	Lateral: 7
Lateral Posterior: 5.6	

Notes: Bone resection values do not include cartilage thickness, osteophyte or account for bone lost to saw blade cut. Bone images on this page are depicted without osteophytes.
All resection values in mm.
Patient-specific images and values are intended as reference materials and are not a substitute for intraoperative evaluation by a surgeon. A surgeon must always rely on his or her own professional clinical judgment when deciding whether to use a particular product to treat a particular patient, including confirming that the images and values provided accurately reflect patient anatomy. The manufacturer and/or distributor does not dispense medical advice and recommends that surgeons be trained in the use of any particular product before using it in surgery.
US federal law restricts the use of this device to sale by or on the order of a physician. A surgeon must always refer to the package insert, product label, and instructions for use before using any medical device. Products may not be available in all markets because product availability is subject to the regulatory and/or medical practices in individual markets. The manufacturer and/or distributor disclaim any liability arising from the use of Triathlon AS-1 instrumentation contrary to the Instructions for Use, the Surgical Plan, and/or the Surgical Technique Guide. Please contact your Stryker representative if you have questions about the availability of products in your area.
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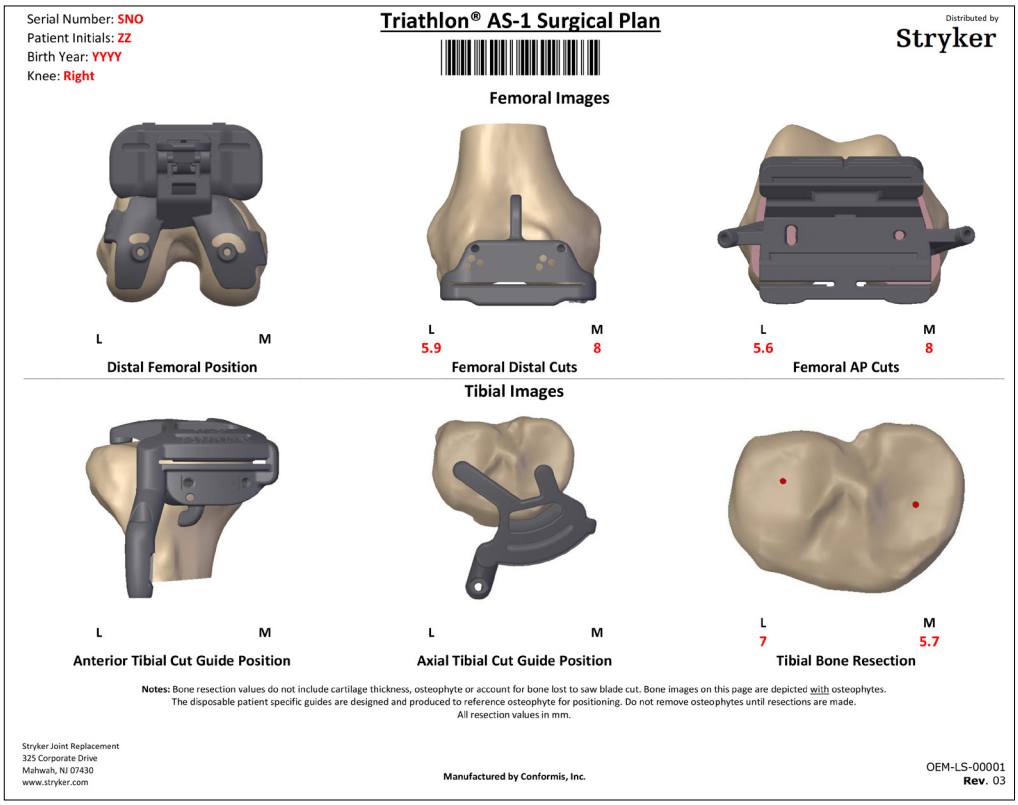
Page 1



Serial Number: SNO
Patient Initials: ZZ
Birth Year: YYYY
Knee: Right

Triathlon® AS-1 Surgical Plan

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Femoral Images

L M
Distal Femoral Position

L 5.9 M 8
Femoral Distal Cuts

L 5.6 M 8
Femoral AP Cuts

Tibial Images

L M
Anterior Tibial Cut Guide Position

L M
Axial Tibial Cut Guide Position

L 7 M 5.7
Tibial Bone Resection

Notes: Bone resection values do not include cartilage thickness, osteophyte or account for bone lost to saw blade cut. Bone images on this page are depicted with osteophytes.
The disposable patient specific guides are designed and produced to reference osteophyte for positioning. Do not remove osteophytes until resections are made.
All resection values in mm.

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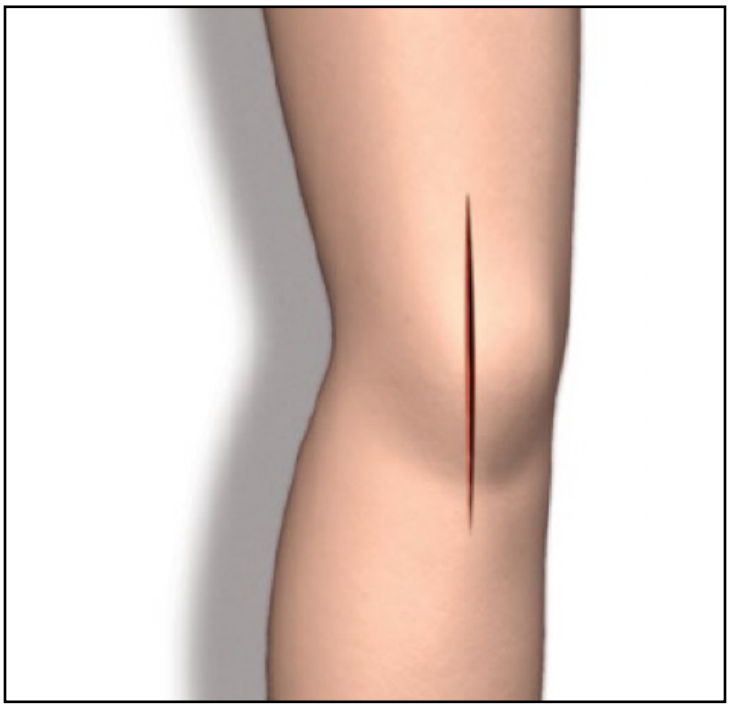
Page 2

The Triathlon AS-1 system allows for two different workflow options: hybrid workflow and measured resection workflow. The hybrid workflow is recommended to make best use of the available adjustment guides.



Hybrid workflow

This recommended workflow considers soft tissue balancing through use of spacer blocks in extension and flexion. This requires that the distal femur and proximal tibia resections be made first, allowing optional usage of the adjustment blocks prior to completing the femur 4-in-1 cuts.

To follow the measured resection workflow, skip to page 22.

Surgical exposure

Triathlon AS-1 patient-specific guides are CT-based and require osteophytic bone to position the guides per the surgical plan.

- **Do not remove osteophytes or trim bone until femoral or tibial resections are made.** Posterior osteophytes may be removed, as they are not utilized for guide referencing.
- Soft tissue removal will be necessary for distal femur and proximal tibia cutting guide positioning.

Triathlon Total Knee arthroplasty can be performed through any standard approach. A standard anterior midline incision or other suitable approaches, such as mid-vastus, sub-vastus or quadriceps-sparing, may be used based on surgeon preference.

Any previous incision can be used or incorporated to decrease the risk of skin slough. The capsule is entered through a medial parapatellar approach.

A femur-first workflow may be preferred for proper access into the joint.

Note: All pins referenced in the workflow below are the 3″ Headless Fluted Pins included in the instrument set. **Do not** use threaded pins with this system.

Step 1.

Distal femur cut

Assembly instructions for the F1 Femoral Alignment Guide and F2 Distal Cutting Guide:

With the large tab labeled F1 in the "up" position, insert and fully seat the F1 guide tabs into the associated F2 slots **(Figure 1)**.

Push down on the large F1 tab to lock the two guides together.

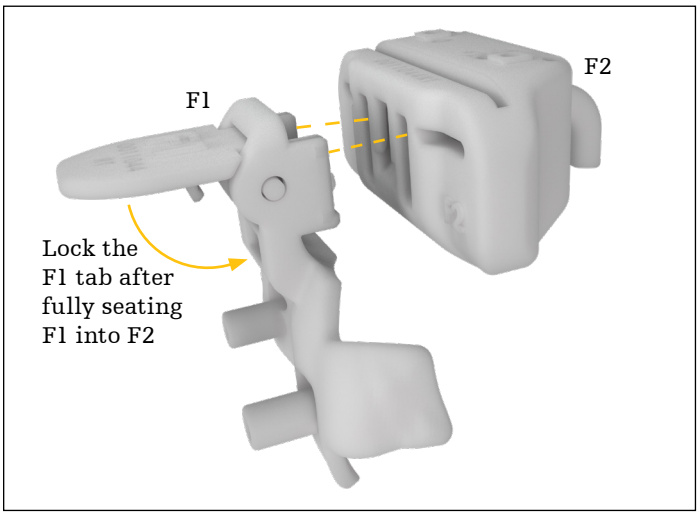


Figure 1. Assembling the F1+F2 guides

Note: Cartilage must be removed from the distal surface of the femur with a curette or other general OR instrument to allow the back side of the two feet on F1 and the anterior cortex stylus arm of F2 to sit on cortical bone. General areas of distal femur cartilage removal are represented in **Figure 2**.
The two distal legs on F1 control the distal-proximal position of the cut. The medial and lateral arms control medial-lateral position of the guide, and the anterior cortex arm and patient-specific surface on F2 control anterior-posterior position and flexion to plan.

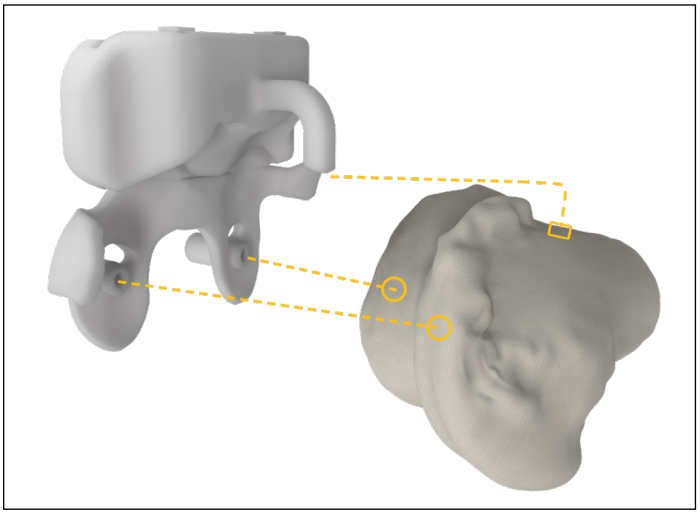


Figure 2. Femur cartilage removal for proper F1 + F2 assembly positioning

For F1+F2 positioning, place the F1+F2 assembly on the femur by locating the five reference points to ensure all are touching subchondral bone: the backside of the two distal pin towers, the medial and lateral wings, as well as the anterior cortex arm **(Figure 3)**.

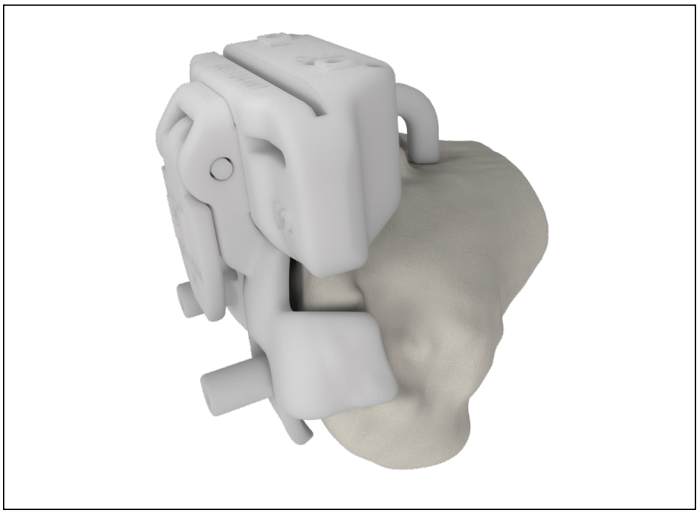


Figure 3. Completed F1+ F2 guide assembly positioned on bone

For F1+F2 guide pinning, firmly seat the F1+F2 assembly to bone and drill two pins deep into the F1 distal towers for future F3 4-in-1 Cutting Guide positioning **(Figure 4)**. Then, drill two pins in the "0" holes on the F2 guide. Remove the distal pins from the F1 guide during distal resection as they will interfere with the resection.

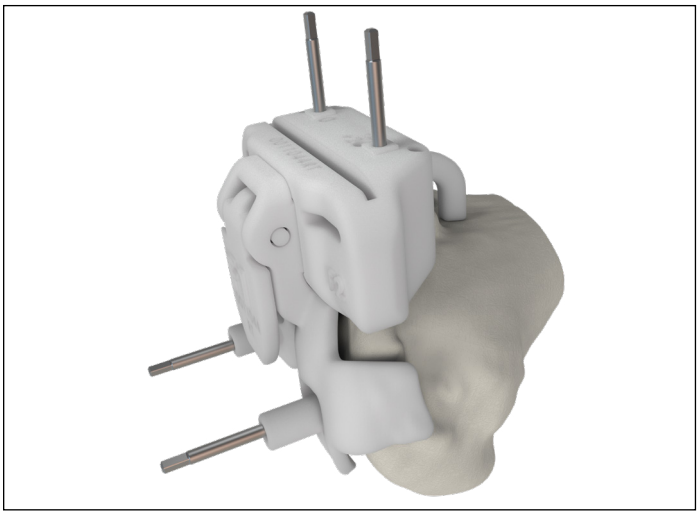


Figure 4. F1 + F2 assembly with distal and anterior pins

Note: If resection depth adjustment from the surgical plan is desired, the F2 guide offers +2mm and -2mm adjustments. This adjustment may be useful if the patient exhibits recurvatum or flexion contracture. If desired, prior to bone resection, remove the F2 guide from both "0" position holes and shift the F2 guide to both "+2" holes or both "-2" holes using the pins remaining in the bone. If "+2" or "-2" holes are utilized, remove the F1 guide from the F2 guide assembly before shifting F2.

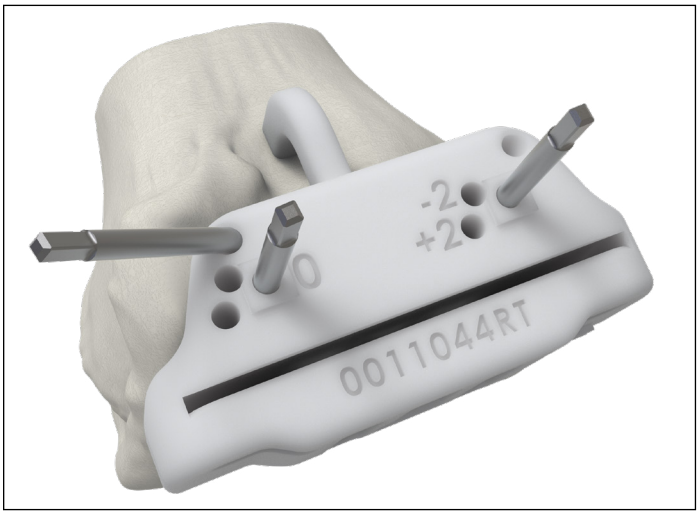


Figure 5. F2 pinned to femur through "0" holes

Once you have determined your resection depth, secure the F2 guide in place with a cross-pin **(Figure 5)**. Proceed with the distal femur cut ensuring the sawblade does not contact the F1 medial and lateral arms or distal pins. **Do not power on the sawblade until the sawblade is fully captured and engaged within the cutting slot.** The sawblade may need to be angled slightly when entering the captured cut slot while advancing the sawblade past the stabilization feature to contact bone. If potential contact with the F1 medial or lateral arm is a concern, remove the distal pins and remove the F1 guide, leaving just the F2 guide pinned in place. Mark the distal and anterior pin holes that were used with a surgical pen after the cut is made and guides are removed.

The flatness of the cut can be checked using the bottom surface of the S1 Flexion Spacer **(Figure 6)**. Alternatively, the Blade Runner can be placed through the F2 cut slot to check for cut flatness.

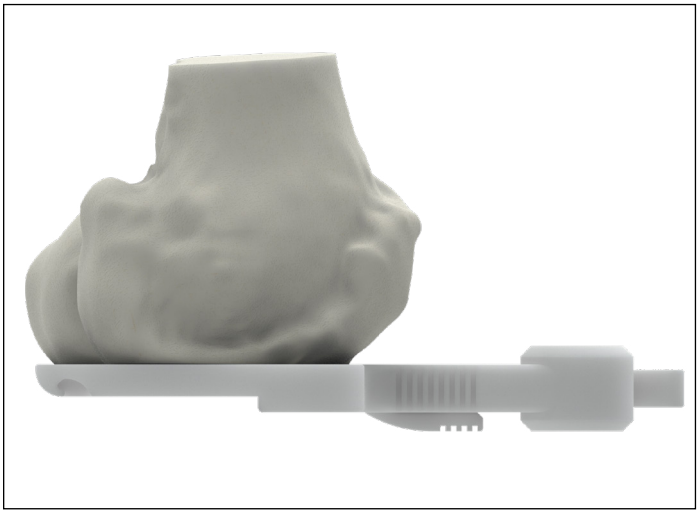


Figure 6. Check flatness of distal cut using S1 Flexion Spacer

Step 2.

Tibial guide positioning and resection

Note: Cartilage must be removed from the proximal surface of the tibia with a curette or other general OR instrument to allow the medial and lateral feet of T1 **(Figure 7)** to sit on cortical bone. Soft tissue at the central tibial eminence should be removed to ensure the T1 guide seats properly against bone.

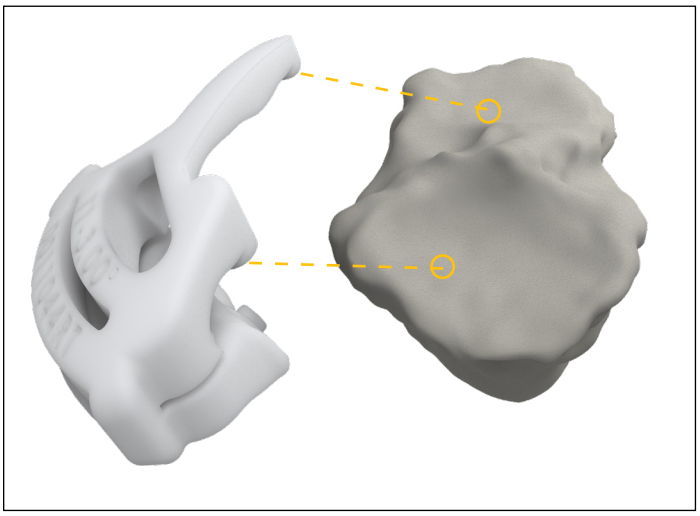


Figure 7. Tibial cartilage removal for proper T1 guide positioning

Insert the Alignment Rod into the T1 Alignment Rod arm **(Figure 8)**. Place both T1 proximal arms onto the tibia and apply pressure on the medial arm while pushing the guide posteriorly towards bone. Rotate about the medial arm until the T1 tubercle arm contacts the medial aspect of the tibial tubercle **(see arrow in Figure 8)**.

If desired, initial T1 stability can be achieved while checking alignment by driving a pin into the cross-pin-hole with minimal pin engagement for potential repositioning.

The recommendation for T1 positioning is to assess across coronal, sagittal and transverse views when the T1 guide with the Alignment Rod is placed on the proximal tibia prior to fully pinning the T1 guide.

The coronal alignment can be assessed by referencing the T1 guide with the Alignment Rod to the image of the anterior tibial cut guide position from the surgical plan. The Alignment Rod should be parallel with the tibia mechanical axis **(Figure 8)**.

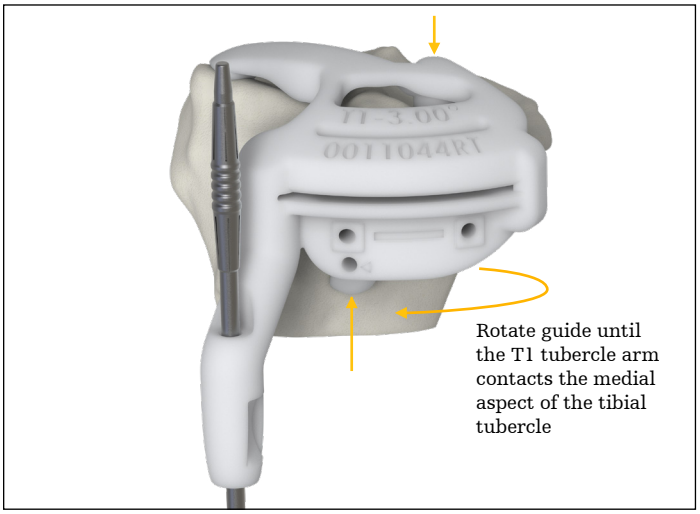


Figure 8. T1 with Alignment Rod in coronal view

The sagittal alignment can be assessed by viewing the Alignment Rod's relationship with the tibial crest, which should be parallel regardless of tibial slope **(Figure 9)**.

Tibial slope can be assessed with the Blade Runner placed through the T1 cut slot and rotated along the medial border of the tibia. The planned tibial slope can be found on the surgical plan.

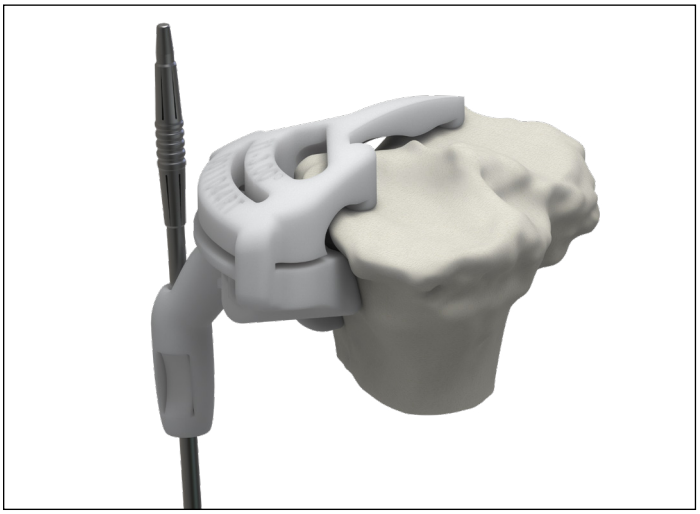


Figure 9. T1 tibial alignment in sagittal view

The transverse alignment can be assessed through the window cutout on top of T1. The inner guide surface should mate with the anterior medial tibial cortex **(Figure 10)**. Transverse alignment can also be assessed by referencing the image of the axial tibial cut guide position on the surgical plan.

With the T1 guide positioned and contacting bone with all three arms, remove the cross-pin if used for initial stability, then pin both parallel holes.

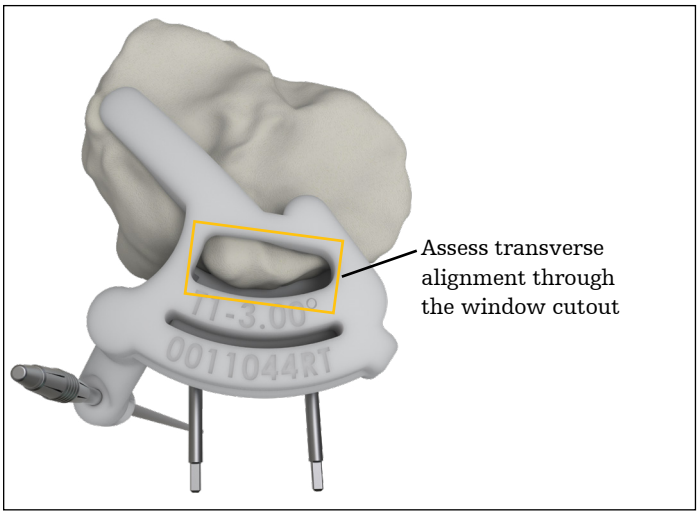


Figure 10. T1 tibial alignment in transverse view

Note: If resection depth adjustment from the surgical plan is desired, the T1A Adjustment guide offers +2mm and -2mm adjustments. If 2mm less proximal tibia resection relative to surgical plan is desired, remove the T1 guide and place the T1A Adjustment Guide onto the two parallel pins using both "-2" holes. If 2mm more proximal tibia resection relative to surgical plan is desired, remove the T1 guide and place the T1A Adjustment Guide onto the two parallel pins using both "+2" holes **(Figure 11)**.

Once the resection depth is determined, secure the proximal cutting guide with a cross-pin, then proceed with the proximal tibia resection.

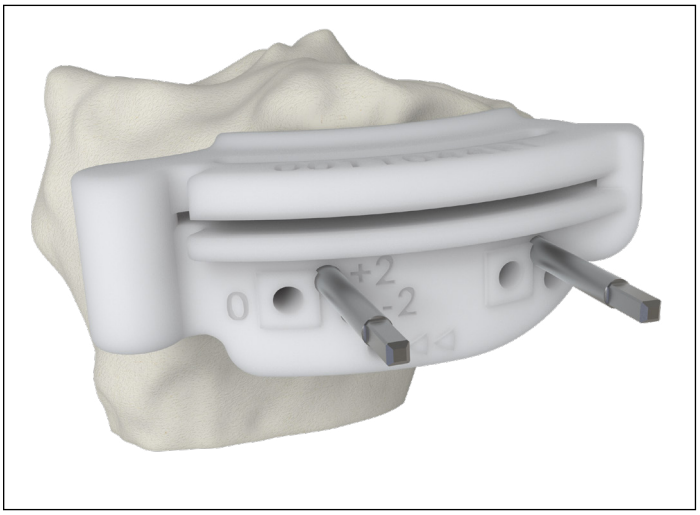


Figure 11. Optional T1A Adjustment Guide

Step 3.

Gap check: extension and flexion

After the distal femur and proximal tibia cuts are completed, the extension and flexion gaps can be assessed with the S1 and S2 Spacer Blocks. Pairs of 2mm or 3mm shims may be utilized to account for thicker inserts or to compensate for any cartilage and bone loss on the posterior condyles.

Recommended gap assessment sequence:

With the knee flexed to 90 degrees, place the S1 Flexion Spacer to assess medial and lateral compartment laxity in flexion **(Figure 12)**.

Remove the S1 Flexion Spacer.

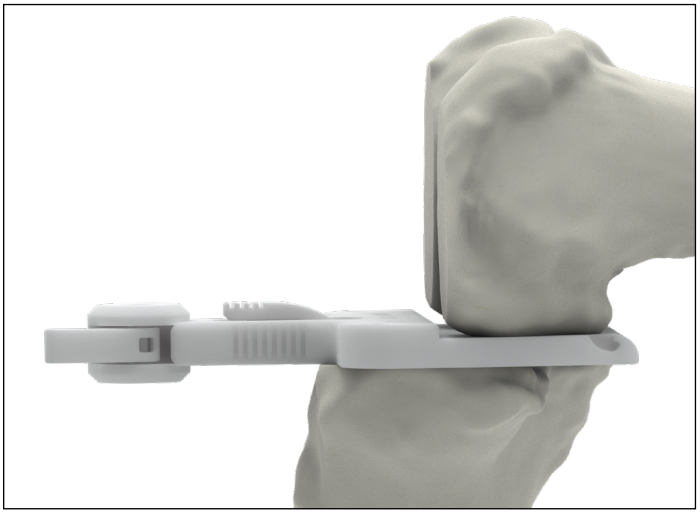


Figure 12. S1 Flexion Spacer for flexion gap assessment

Assemble the S2 Extension Insert onto the S1 Flexion Spacer by hooking both prongs furthest away from handle and pressing S1 and S2 together until the latch built into the handle fully engages **(Figure 13)**.

The Alignment Rod can be inserted into the S1 spacer handle to assess coronal and sagittal plane alignment in extension and flexion.

If Spacer Shims are desired, place both 2mm or both 3mm shims into the designated holes in the flexion and extension spacers and reassess the gaps **(Figure 13 - inset)**.

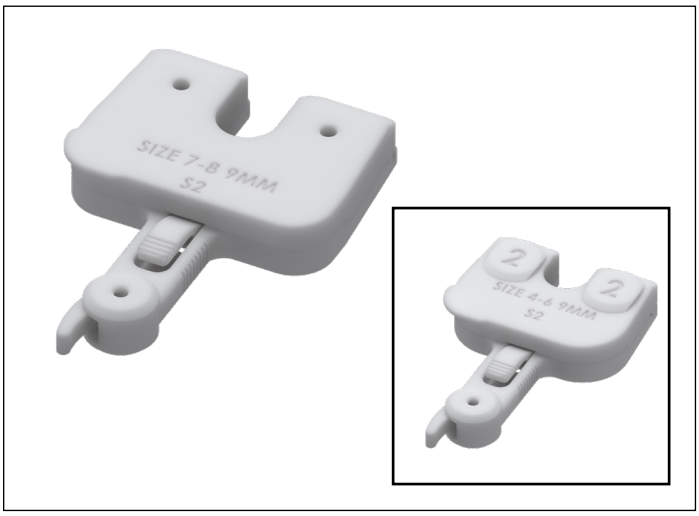


Figure 13. S1 Flexion Spacer with S2 Extension Insert

With the knee in full extension, the S1+S2 assembly can be inserted into the joint space to check medial and lateral compartment laxity **(Figure 14)**.

If needed, return to flexion gap assessment with only the S1 Flexion Spacer.

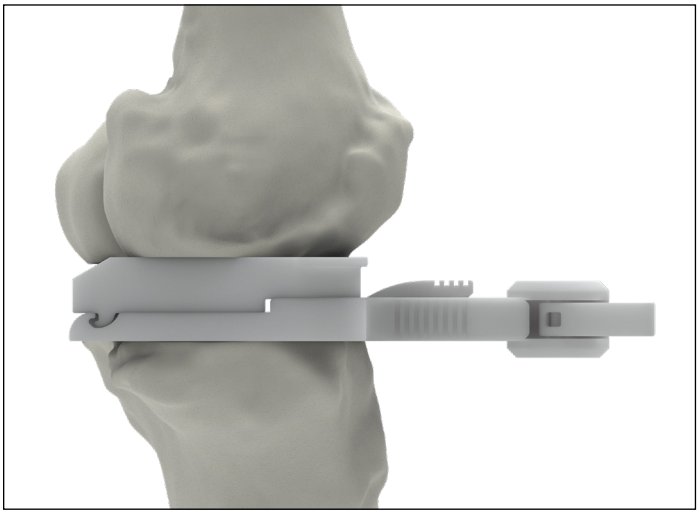


Figure 14. S1 Flexion Spacer and S2 Extension Insert assembled and inserted in extension

If the extension gap needs adjustment but the flexion gap is acceptable, proceed to step 4.

If the extension gap and flexion gap need adjustment, proceed to step 5.

If the extension and flexion gaps are acceptable, proceed to step 6.

Step 4.

Optional distal femur adjustment

If the extension gap needs adjustment but the flexion gap is acceptable, you have two options:

1. If the distal femur cut needs an additional 2mm resection relative to the surgical plan, locate the pin-holes created from the F2 guide and place pins into the previously created pin-holes **(Figure 15)**. Slide the F2 guide onto the pins at both "+2" pin-hole positions.
2. If the distal femur cut needs a 2 degree varus or 2 degree valgus adjustment to relieve medial or lateral compartment tightness in extension, use the F2V Adjustment Guide. Locate the pin-holes in the bone created from the F2 guide and place the pins into the previously created pin-holes. Slide the F2V Adjustment Guide onto the pin at both "0" pin-hole positions if no depth adjustment is desired or both "+2" pin-hole positions if a 2mm resection increase is desired.

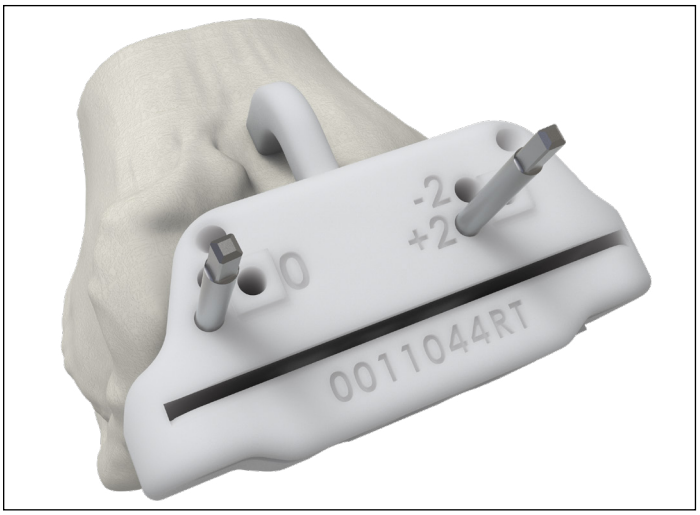


Figure 15. F2 placed onto previously created pin-holes

Note: If using the F2V Adjustment Guide, ensure the side facing the surgeon is legible with the varus or valgus marking. If a varus cut is desired, the surgeon must be able to read VARUS on the cutting guide **(Figure 16)**. If a valgus cut is desired, the surgeon must be able to read VALGUS on the cutting guide. Once varus or valgus selection is confirmed, slide the F2V Adjustment Guide onto the pins at both "0" or both "+ 2" pin-hole positions **(Figure 16)**.

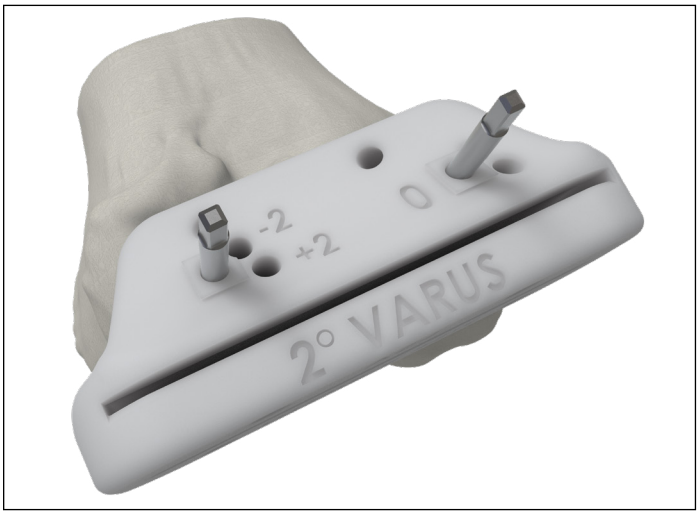


Figure 16. F2V Varus/Valgus Guide pinned to femur for varus cut adjustment

Once the appropriate adjustment is determined, cross-pin either the F2 or F2V Adjustment Guide prior to bone resection. Once femoral resection adjustment is completed, proceed to step 6.

Step 5.

Optional proximal tibia adjustment

If both the flexion and extension gaps need adjustment, you have three options:

1. If the proximal tibia cut needs an additional 2mm resection relative to the surgical plan, locate the pin-holes created from the T1 guide and place the pins into the previously created pin-holes. Slide the T1A guide onto the pins at both "+2" pin-hole positions **(Figure 17)**.

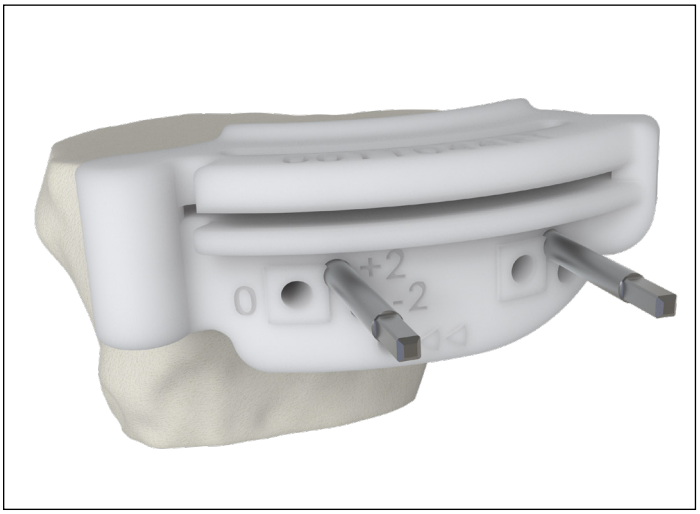


Figure 17. T1A guide placed over proximal pins at "+2"holes

2. If the knee is tight medially in both flexion and extension, use the 2 degree T1VR Varus Adjustment Guide **(Figure 18)**. Locate the pin-holes created from the T1 guide and place pins into the same holes. Slide the T1VR guide onto the pins at both "0" pin-hole positions. This tibial varus cut may create varus limb alignment in extension and flexion. Additional 2mm resection depth on plane with the 2 degree varus angle is available by placing T1VR onto pins at both "+2" pin-hole positions.

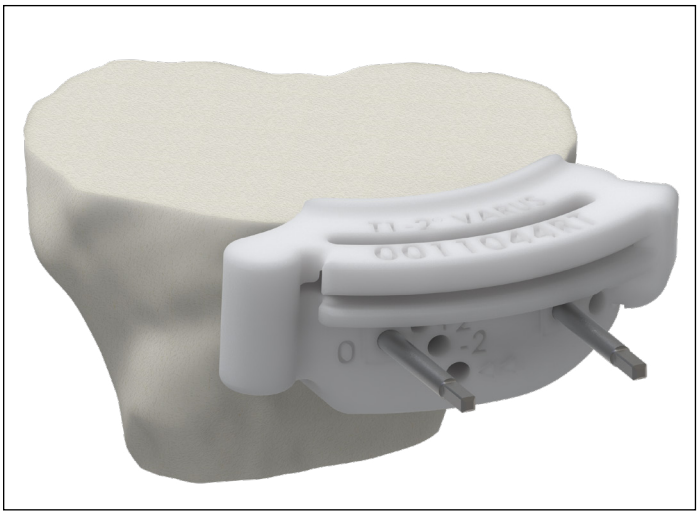


Figure 18. T1VR guide placed over pins at "0" holes

3. If the knee is tight laterally in both flexion and extension, use the 2 degree T1VG Valgus Adjustment Guide **(Figure 19)**. Locate pin-holes created from the T1 guide and place pins into those same holes. Slide the T1VG guide onto the pins at both "0" pin-hole positions. This tibial valgus cut may create valgus limb alignment in extension and flexion. Additional 2mm resection depth on plane with the 2 degree valgus angle is available by placing T1VG onto pins at both "+2" pin-hole positions.

Once appropriate adjustment is determined, cross-pin either T1A or T1VR or T1VG Adjustment Guide prior to bone resection.

The flatness of the cut can be checked using the bottom surface of the S1 Flexion Spacer.

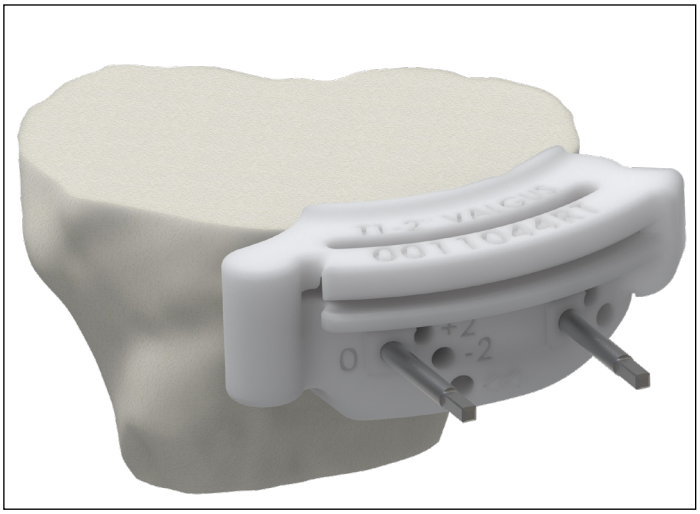


Figure 19. T1VG guide placed over pins at "0" holes

Step 6.

Femur 4-in-1 cuts

Once the extension and flexion gaps are acceptable, flex the knee to 90 degrees then identify the distal femur pin-holes created from the F1 guide.

To position the F3 4-in-1 Cutting Guide in the preoperatively planned rotation:

- Drive a pin into the previously prepared distal femur medial pin-hole.
- Place the F3 guide onto the medial pin through the appropriate hole.
- With the F3B bushing removed, locate the lateral pin-hole through the lateral slot and place the pin in the previously prepared distal femur lateral pin-hole **(Figure 20)**.
- Replace the F3B bushing by centering the lateral pin in the lateral slot of the F3 guide, then place the F3B bushing over the pin and into the slot **(Figure 23 on page 16)**. This will set the guide to the preoperatively planned femoral rotation.

Note: The F3 guide allows additional rotation of 3 degrees internal and 3 degrees external from the planned rotation identified on the surgical plan. As a reminder, Triathlon AS-1 femoral rotation is planned to the patient's surgical transepicondylar axis.

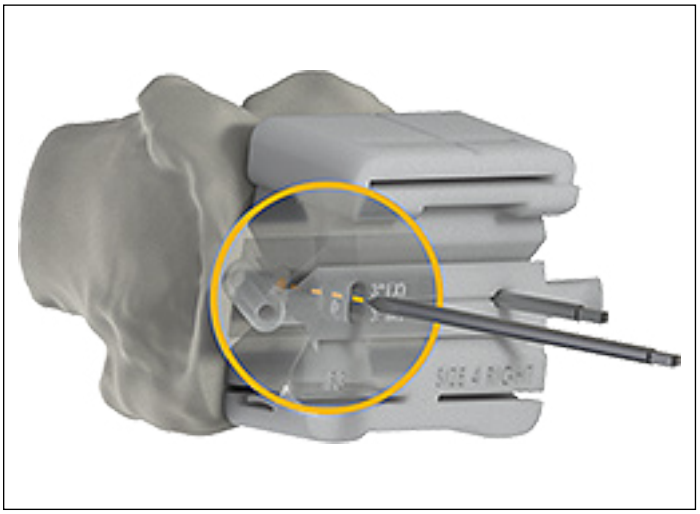


Figure 20. F3 guide with pin placement in previously prepared pin-holes

If needed, femoral rotation can be assessed via multiple methods:

Begin by removing the F3B bushing so that the F3 guide can rotate about the medial pin.

To assess rotation with the S1 Flexion Spacer, place the S1 Flexion Spacer under the F3 guide and rotate F3 guide so the posterior feet rest on the anterior step of the S1 Flexion Spacer **(Figure 21)**. This represents minimal implant construct thickness in flexion.

Or, to assess femoral rotation relative to Whiteside's line, identify the scribe line on the anterior surface of the F3 guide and rotate the F3 guide referencing the scribe line and patient's trochlear groove **(Figure 22)**.

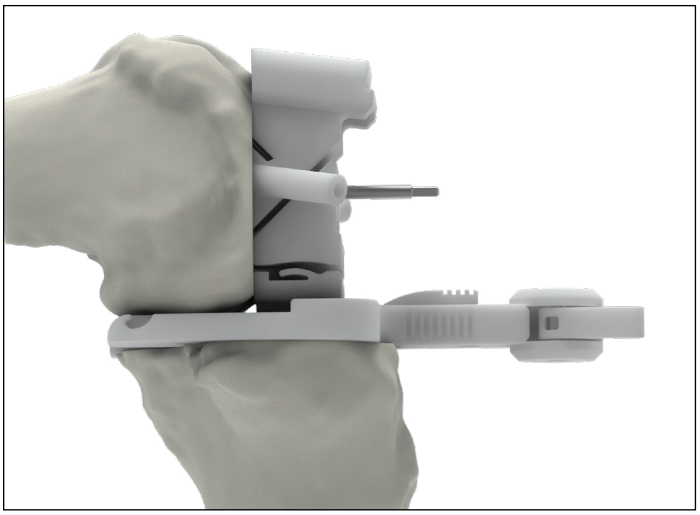


Figure 21. S1 Flexion Spacer under the F3 guide

Or, to assess femoral rotation relative to the patient's posterior condyles, rotate the F3 guide until the posterior feet on the F3 guide meet your desired position referencing the patient's posterior condyles.

Note: If adjusting femoral rotation from the surgical plan, the Blade Runner may be used by placing it into the F3 anterior cut slot to help verify that that femoral notching will not occur.

Once rotation is determined, drive two cross-pins into the F3 guide **(Figure 23)** while the F3 guide is fully seated against the distal femur.

Note: Remove the S1 Flexion Spacer prior to completing the F3 cross-pinning.

The two distal femur pins may be left in place for the anterior and posterior cuts, but they must be removed before making the respective anterior and posterior chamfer cuts.

Figure 22. F3 guide without F3B bushing for rotation adjustment

The recommended cut sequence for stability of the F3 guide is:

1. Cut the anterior cortex.
2. Cut the posterior condyles.
3. Remove the medial distal femur pin.
4. Cut the medial posterior chamfer.
   a. Be careful not to cut the post located between the medial and lateral posterior cut slots.
5. Cut the entire anterior chamfer from the medial aspect of the cutting slot, ensuring that you do not cut the lateral pin.
6. Remove the lateral distal femur pin.
   a. Place the pin in the medial distal pin-hole.
7. Cut the lateral posterior chamfer.

Note: The two distal femur pin-hole locations set by the F1 guide and used to place the F3 guide are in the same location as other Triathlon 4-in-1 guides' fixation pins. These pin-holes can be used if intraoperative assessments identify the need for a different sized femur than planned.

If using a PS femur, proceed to step 7. If using a CR femur, proceed to step 8.

Figure 23. F3 guide with cross-pins and F3B bushing

Step 7.

Optional PS femur box preparation

If a PS femur implant was selected, place and pin the F4C guide onto the femur **(Figure 24)**.

Note: The pin-holes created previously by the F1 guide can be used as visual guides to help line up the F4C distal peg holes to achieve the planned medial/lateral positioning of the implant. Distal peg prep holes will line up concentrically with previously created pin-holes.

The F4C guide matches the profile of the implant, so it can be used to adjust the medial-lateral position to help achieve the desired final position.

When the position is set, pin the guide via the distal and anterior holes **(Figure 24)**.

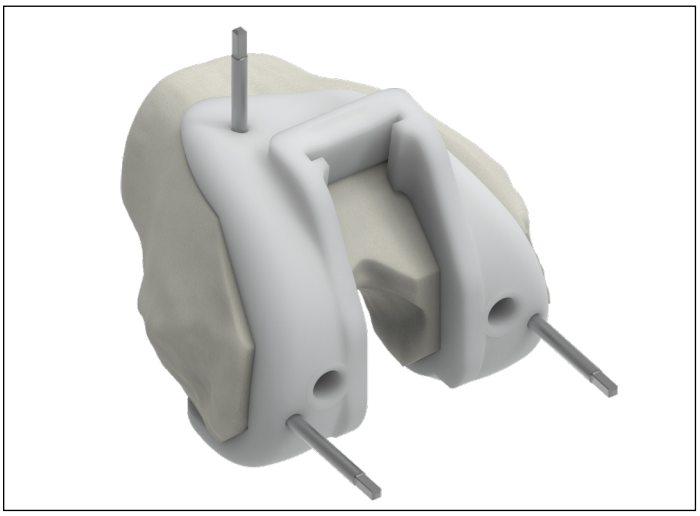


Figure 24. F4C pinned to femur

Cut the cortical rim on both sides of the posterior-most portion of the intercondylar notch using the oscillating saw. Assemble the Box Chisel and insert into the appropriate slot. Impact the Box Chisel with a mallet until seated to the stop. Leave the Box Chisel in place to act as a reference plane. Cut the medial and lateral edges of the box with an oscillating saw to complete the bone resection **(Figure 25)**. Avoid biasing the blade during resection to ensure a complete box preparation.

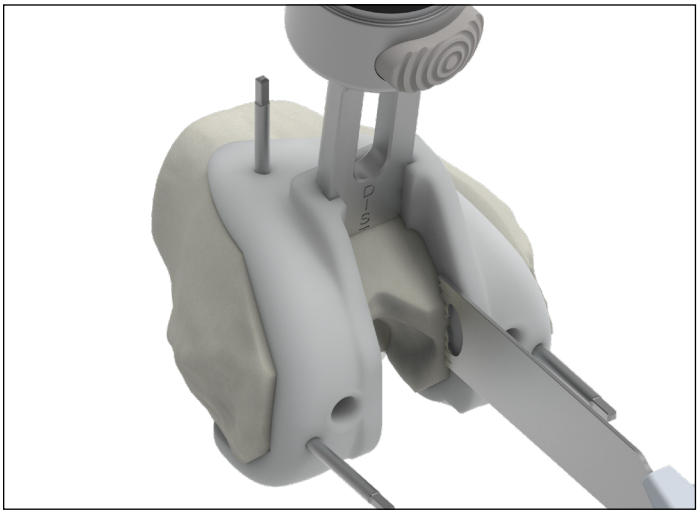


Figure 25. PS box preparation

The F4G box gauge should be used to check the prepared box. The gauge can be inserted through the chisel slot and rested on the prepared bone **(Figure 26)**. If the F4G gauge cannot be fully seated in the F4C guide, remove the F4G gauge and recut the bone, ensuring that all cuts are complete. Repeat the F4G gauge check and resection until the F4G gauge can be fully seated into the F4C guide.

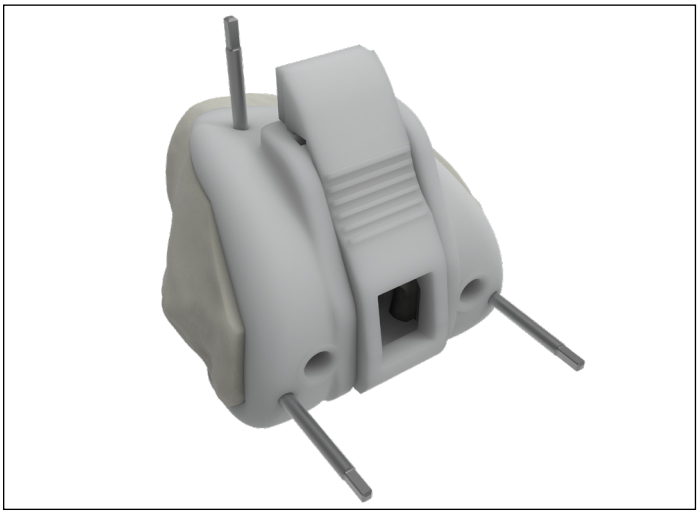


Figure 26. F4G gauge fully inserted into F4C guide

If Modular Femoral Distal Fixation Pegs are to be used, the location holes may be prepared at this stage using the 1/4" Peg Drill attached to the Universal Driver (the peg holes may also be prepared later through the PS Femoral Trial).

The PS Femur Trial should be placed by hand onto prepped bone and used to check the prepared box. If the box on the trial is preventing the femur from fully seating on the bone cuts, remove the F5PS Femur Trial and recut the bone, ensuring all cuts are complete. **(Figure 27)**.

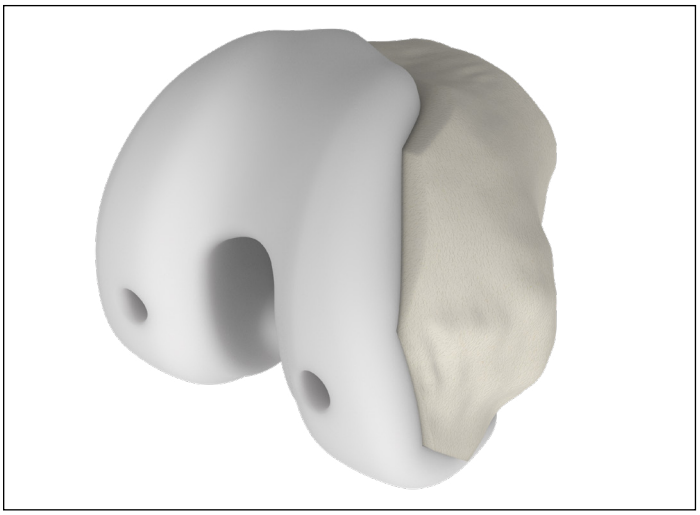


Figure 27. F5PS femur trial

Step 8.

Trial reduction and implant positioning

With all femur cuts and proximal tibia cuts complete, place the femur trial onto the prepared femur using hand pressure to seat the trial. **Do not impact the femur trial onto the bone to avoid fracturing the trial.** If the trial will not seat with hand pressure, place the joint into extension to apply pressure to the trial or revisit the femoral 4-in-1 cuts. After the femur trial is in place, insert the baseplate and insert trials so trial reduction can be performed to evaluate the fit and function of the implants **(Figure 28)**. The initial baseplate placement should be set by referencing the surgical plan. Three varying thicknesses of tibial inserts can be trialed at this stage.

Note: The Triathlon reusable insert trials are compatible with the T2 Baseplate Trial if additional insert constraints and/or thicknesses are desired for trial reduction.

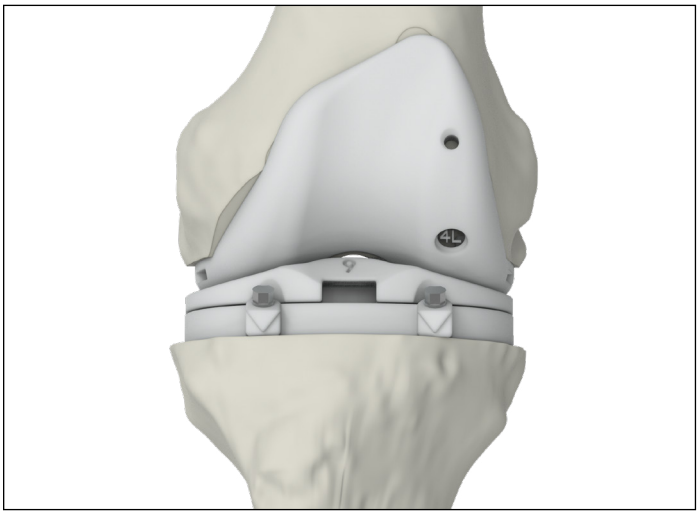


Figure 28. Femur and baseplate trials with insert trial

If insert implant thicknesses ordered are 9, 10 and 11mm, then 9, 10 and 11mm trials will be supplied.

If any other insert implant thickness combination is ordered (up to 14mm), then 9, 11 and 13mm insert trials will be supplied. For example, if 9, 10 and 12mm insert implants are ordered, use the provided 9 and 11mm insert trials to determine if the 10mm final insert implant should be used.

Once trial reduction is complete, the tibial tray rotation can be marked with two different methods:

1. The tibia can be marked with a surgical marker at the arrow markings located on the anterior portion of the T2 Baseplate Trial **(Figure 29)**.
2. Pins can be placed into the same two anterior rotation setting tabs **(Figure 29)**. Remove the T2 Baseplate Trial by sliding it along the pins. Remove pins if the T2 Baseplate Trial cannot be removed from the joint space by sliding along these pins.

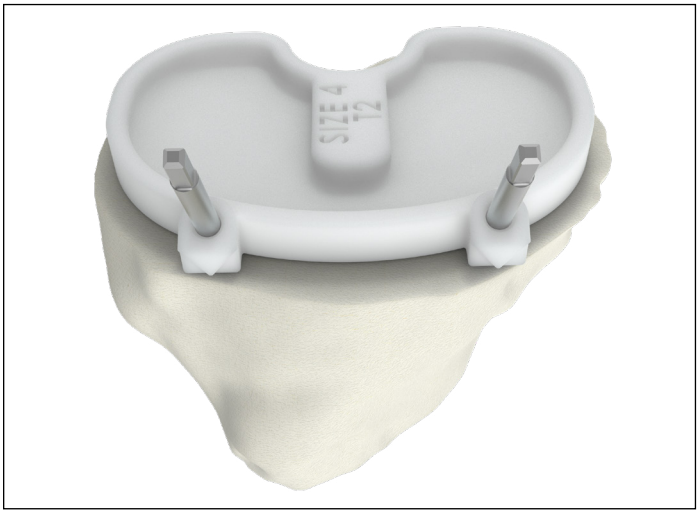


Figure 29. T2 Baseplate Trial pinned to the tibia

If a CR femur was selected, distal peg preparation must be completed at this step. With the knee flexed to 90 degrees, use the 1/4" Peg Drill to prepare the peg holes through the CR Femur Trial **(Figure 30)**.

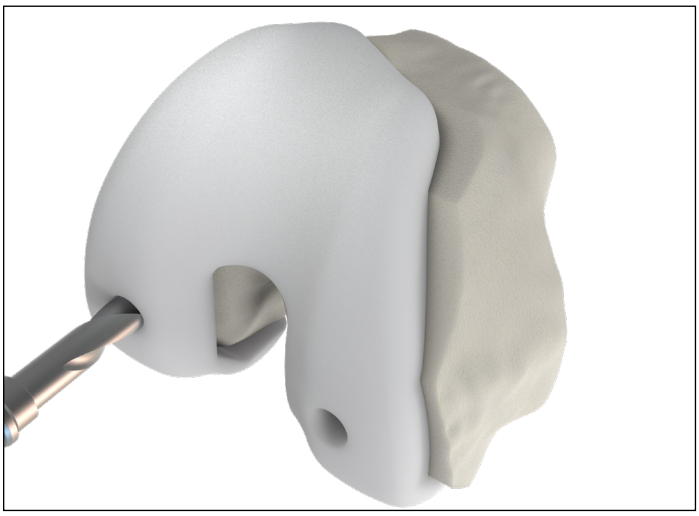


Figure 30. CR Femur Trial peg prep

Step 9.

Baseplate keel punch and optional Universal Baseplate boss ream

If tibial baseplate rotation was set by pins placed in the anterior holes of the T2 guide, the T3 Keel Punch Guide can utilize the same pin positions by sliding it along the pins or placing it on the proximal tibia and locating the pin positions through the anterior tabs **(Figure 31)**. If tibial baseplate rotation was set by marking the location of the anterior arrows of the T2 guide, position the T3 guide by aligning its anterior arrows with those same markings.

The recommended minimum pinning of T3 is one anterior pin-hole and one angled proximal tibia pin-hole before completing the keel punch, for instance, the anterior medial pin with the posterior lateral angled pin, although other pinning options are available **(Figure 31)**.

Ensure the T3 guide is completely seated and secure against the proximal tibia before pinning the T3 guide or using the Keel Punch.

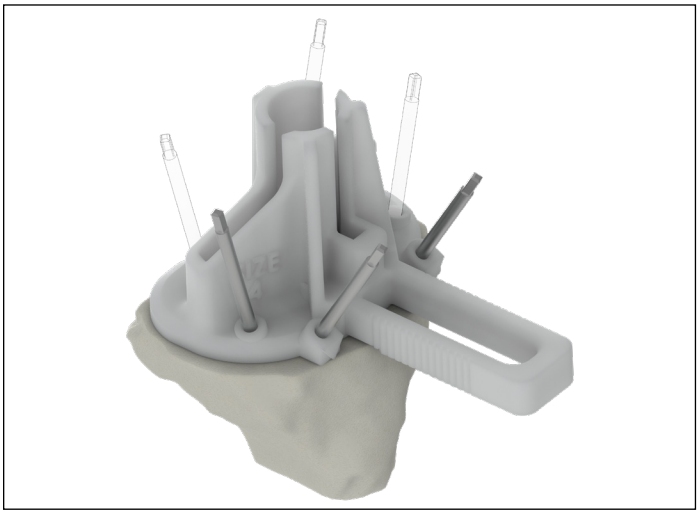


Figure 31. T3 Keel Punch Guide pinned to the tibia with additional pinning options shown as silhouettes

If a Universal Baseplate is chosen, the Boss Reamer must be reamed through the central hole of the T3 Keel Punch Guide. Ream until the depth stop reaches the top of the guide.

Place the corresponding size and appropriate Keel Punch (cemented or cementless) into the T3 Keel Punch Guide. Use a mallet to impact the Keel Punch. Advance the Keel Punch until it seats fully in the T3 Keel Punch Guide **(Figure 32)**.

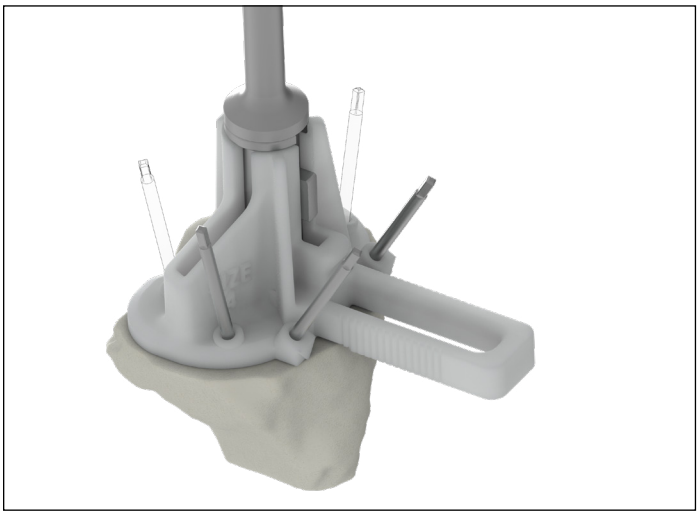


Figure 32. Keel Punch seated in T3 Keel Punch Guide

To extract the Keel Punch, lift up on the Keel Punch handle and pull the handle to cantilever the Keel Punch handle against the T3 guide and out of the tibia **(Figure 33)**.

Once the keel prep is complete and the Keel Punch is removed, the T3 guide and all pins must be removed.

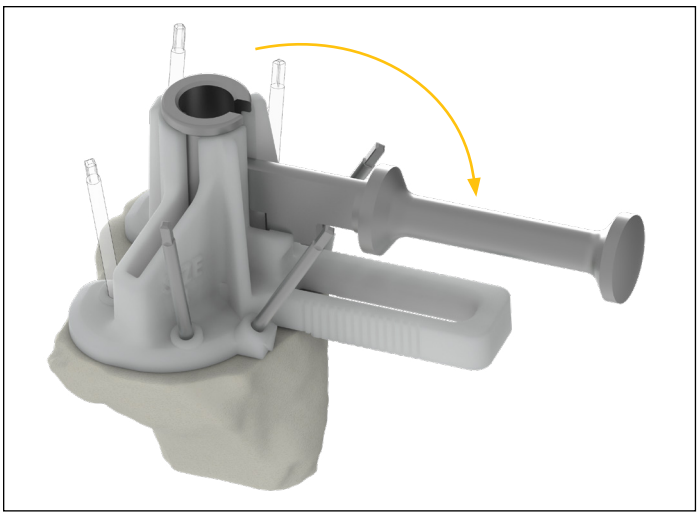


Figure 33. Lever motion to remove Keel Punch from tibia

Step 10.

Optional Tritanium Baseplate bone prep

If a cementless Tritanium Baseplate was chosen, the T4 Cementless Peg Drill Guide is used to prepare the baseplate pegs. The position of the four holes and the keel on the underside of the T4 Cementless Peg Drill Guide corresponds to the relative location of the keel and four pegs on the implant **(Figure 34)**.

Insert the keel on the T4 Cementless Peg Drill Guide into the prepared keel slot **(Figure 35)**. Ensure that the T4 Cementless Peg Drill Guide sits flush against the resected tibia to help ensure accurate peg preparation.

Drilling the tibial peg holes will facilitate seating of the implant. Utilize the 1/8″ Tibial Peg Drill.

Hold the T4 Cementless Peg Drill Guide in position by applying finger pressure to the template. Position the 1/8″ Tibial Peg Drill through a peg hole perpendicular to the resected tibia. **Drill through all four template holes using the 1/8″ Tibial Peg Drill taking care to ensure surgical glove and fingers are not in contact with the drill prior to drilling (Figure 35)**.

Drilling is complete when the drill stop has contacted the template surface.

Carefully remove the T4 Cementless Peg Drill Guide from the bone by lifting straight up and out of the keel slot.

If the surgeon feels the bone is too dense at any of the peg locations after preparing with the 1/8″ drill and template, the optional 7/32″ Tibial Peg Drill may be used to increase the size of the peg holes. Ensure the T4 Cementless Peg Drill Guide is removed prior to drilling with the 7/32″ Tibial Peg Drill.

When using the 7/32″ Tibial Peg Drill, take care to ensure surgical glove and fingers are not in contact with the drill prior to drilling. Ensure axial alignment before drilling. Drilling is complete after the drill stop has contacted bone. **Do not continue to drive the drill after the stop has been reached.**

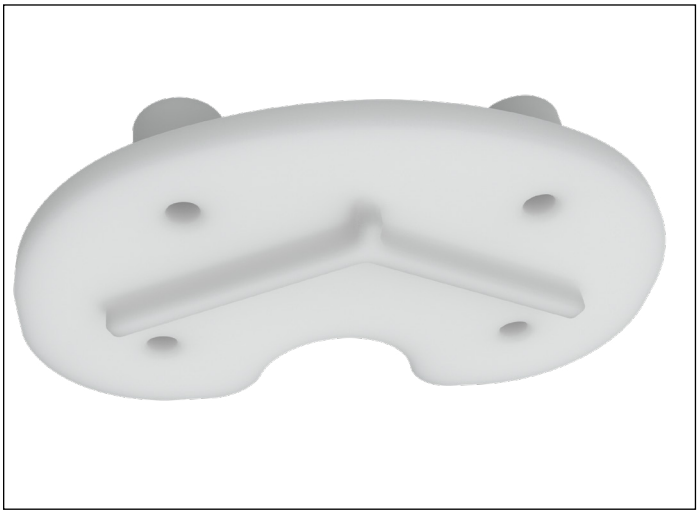


Figure 34. T4 guide bottom view of reduced keel

Figure 35. T4 guide with 1/8″ Tibial Peg Drill

Step 11.

Final implantation

Refer to the Triathlon surgical protocol TRIATH-SP-30 for further instructions and follow the surgical steps per implant chosen.

Note: If cementing the femoral and/or tibial implant, insert trials can be used to pressurize the joint as the cement cures. This may aid in cement removal from the posterior capsule prior to final insert implant placement.

Note: The trials must be removed and segregated from the implants prior to final implantation. Ensure that trials do not get mixed with final implants and that all trials are not implanted.

Step 12.

Patella prep and implantation

Refer to the Triathlon surgical protocol TRIATH-SP-30 for further instructions if patella resurfacing is desired.

Measured resection workflow

Surgical exposure

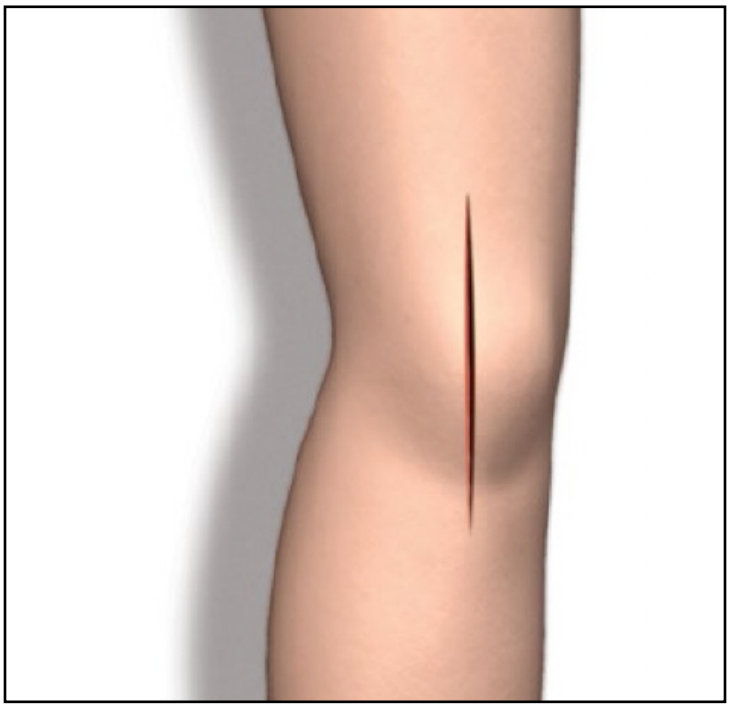
Triathlon AS-1 patient-specific guides are CT-based and require osteophytic bone to position the guides per the surgical plan.

- **Do not remove osteophytes or trim bone until femoral or tibial resections are made.** Posterior osteophytes may be removed, as they are not utilized for guide referencing.
- Soft tissue removal will be necessary for distal femur and proximal tibia cutting guide positioning.

Triathlon Total Knee arthroplasty can be performed through any standard approach. A standard anterior midline incision or other suitable approaches, such as mid-vastus, sub-vastus or quadriceps-sparing, may be used based on surgeon preference.

Any previous incision can be used or incorporated to decrease the risk of skin slough. The capsule is entered through a medial parapatellar approach.

A femur-first workflow may be preferred for proper access into the joint.



Note: All pins referenced in the workflow below are the 3" Headless Fluted Pins included in the instrument set. **Do not** use threaded pins with this system.

Step 1.

Distal femur cut

Assembly instructions for the F1 Femoral Alignment Guide and F2 Distal Cutting Guide:

With the large tab labeled F1 in the "up" position, insert and fully seat the F1 guide tabs into the associated F2 slots **(Figure 1)**.

Push down on the large F1 tab to lock the two guides together.

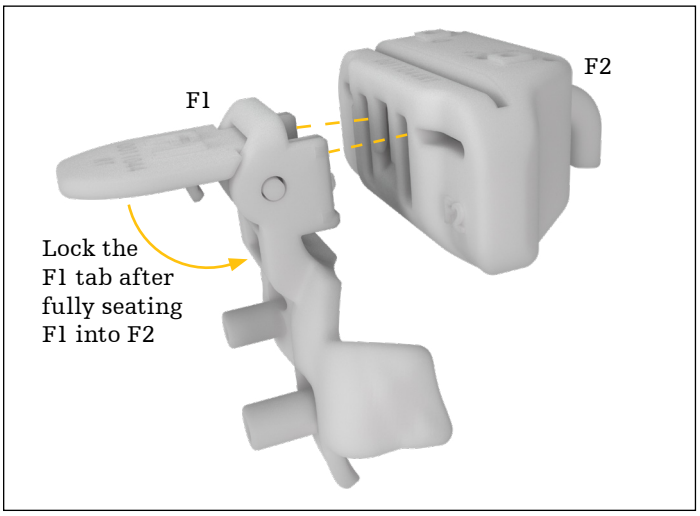


Figure 1. Assembling the F1+F2 guides

Note: Cartilage must be removed from the distal surface of the femur with a curette or other general OR instrument to allow the back side of the two feet on F1 and the anterior cortex stylus arm of F2 to sit on cortical bone. General areas of distal femur cartilage removal are represented in **Figure 2**. The two distal legs on F1 control the distal-proximal position of the cut. The medial and lateral arms control medial-lateral position of the guide, and the anterior cortex arm and patient-specific surface on F2 control anterior-posterior position and flexion to plan.

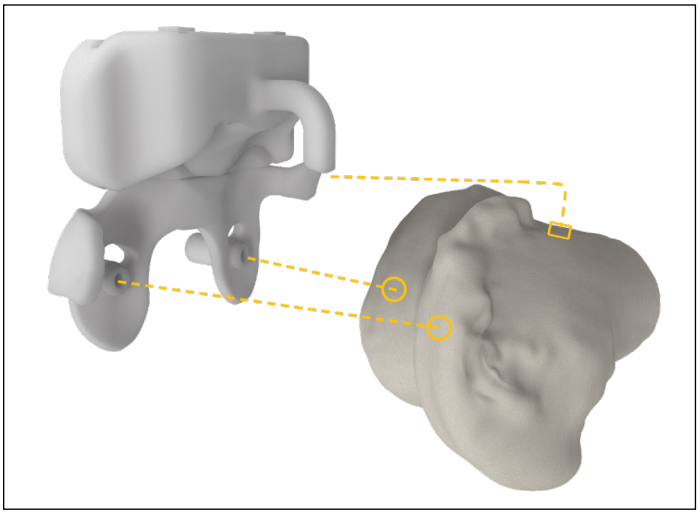


Figure 2. Femur cartilage removal for proper F1 + F2 assembly positioning

For F1+F2 positioning, place the F1+F2 assembly on the femur by locating the five reference points to ensure all are touching subchondral bone: the backside of the two distal pin towers, the medial and lateral wings, as well as the anterior cortex arm **(Figure 3)**.

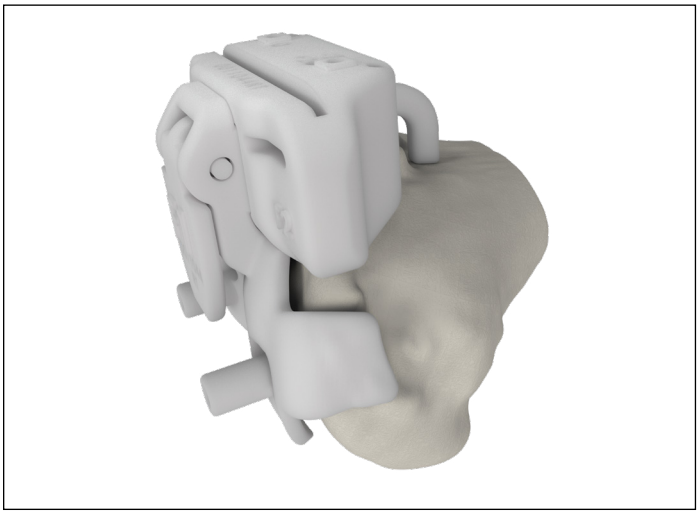


Figure 3. Completed F1+ F2 guide assembly positioned on bone

For F1+F2 guide pinning, firmly seat the F1+F2 assembly to bone and drill two pins deep into the F1 distal towers for future F3 4-in-1 Cutting Guide positioning **(Figure 4)**. Then, drill two pins in the "0" holes on the F2 guide. The distal pins can be left in the F1 guide for additional stability during distal resection but must be removed from the respective condyle when cutting as they will interfere with the resection.

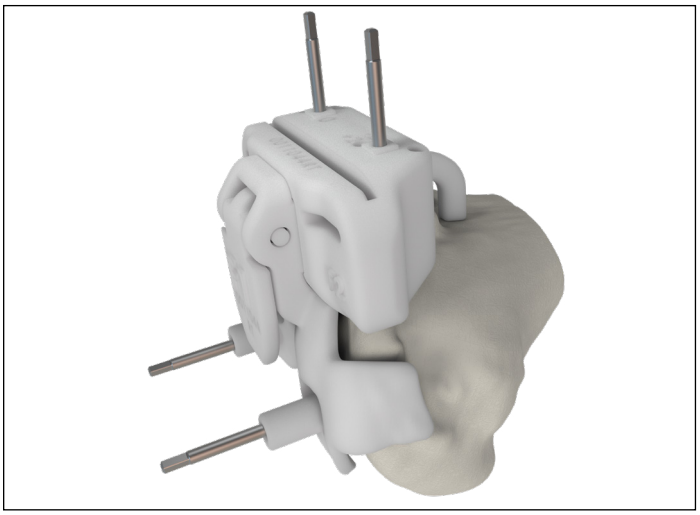


Figure 4. F1 + F2 assembly with distal and anterior pins

Note: If resection depth adjustment from the surgical plan is desired, the F2 guide offers +2mm and -2mm adjustments. This adjustment may be useful if the patient exhibits recurvatum or flexion contracture. If desired, prior to bone resection, remove the F2 guide from both "0" position holes and shift the F2 guide to both "+2" holes or both "-2" holes using the pins remaining in the bone. If "+2" or "-2" holes are utilized, remove the F1 guide from the F2 guide assembly before shifting F2.

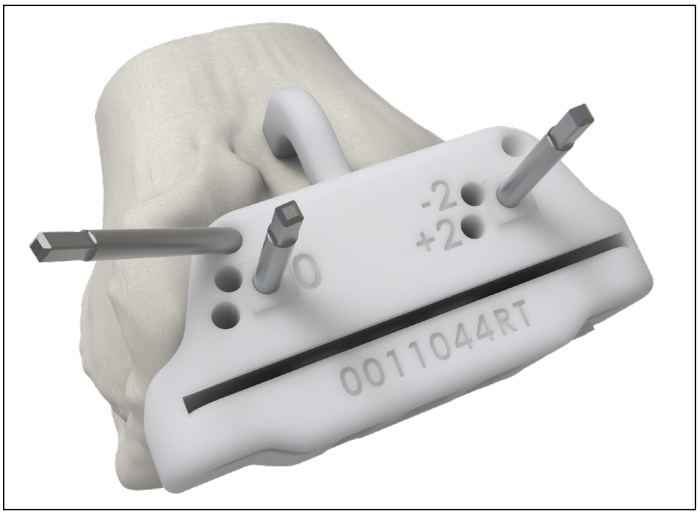


Figure 5. F2 pinned to femur through "0" holes

Once you have determined your resection depth, secure the F2 guide in place with a cross-pin **(Figure 5)**. Proceed with the distal femur cut ensuring the sawblade does not contact the F1 medial and lateral arms or distal pins. **Do not power on the sawblade until sawblade is fully captured and engaged within the cutting slot.** The sawblade may need to be angled slightly when entering the captured cut slot while advancing the sawblade past the stabilization feature to contact bone. If potential contact with the F1 medial or lateral arm is a concern, remove the distal pins and remove the F1 guide, leaving just the F2 guide pinned in place. Mark the distal and anterior pin holes that were used with a surgical pen after the cut is made and guides are removed.

The flatness of the cut can be checked using the bottom surface of the S1 Flexion Spacer **(Figure 6)**. Alternatively, the Blade Runner can be placed through the F2 cut slot to check for cut flatness.

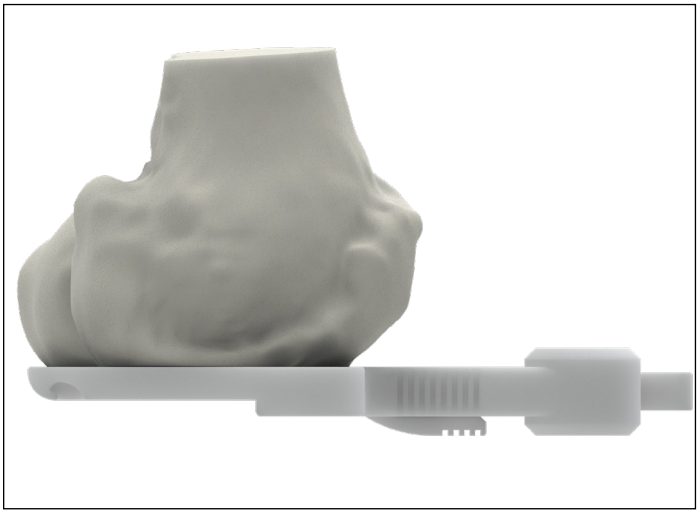


Figure 6. Check flatness of the distal cut using the S1 Flexion Spacer

Step 2.

Femur 4-in-1 cuts

Flex the knee to 90 degrees then identify the distal femur pin-holes created from the F1 guide.

To position the F3 4-in-1 Cutting Guide in the preoperatively planned rotation:

- Drive a pin into the previously prepared distal femur medial pin-hole.
- Place the F3 guide onto the medial pin through the appropriate hole.
- With the F3B bushing removed, locate the lateral pin-hole through the lateral slot and place the pin in the previously prepared distal femur lateral pin-hole **(Figure 7)**.
- Replace the F3B bushing by centering the lateral pin in the lateral slot of the F3 guide, then place the F3B bushing over the pin and into the slot **(Figure 9 on page 26)**. This will set the guide to the preoperatively planned femoral rotation.

Note: The F3 guide allows additional rotation of 3 degrees internal and 3 degrees external from the planned rotation identified on the surgical plan. As a reminder, Triathlon AS-1 femoral rotation is planned to the patient's surgical transepicondylar axis.

If needed, femoral rotation can be assessed via multiple methods:

Begin by removing the F3B bushing so that the F3 guide can rotate about the medial pin.

To assess femoral rotation relative to Whiteside's line, identify the scribe line on the anterior surface of the F3 guide and rotate the F3 guide referencing the scribe line and patient's trochlear groove **(Figure 8)**.

Or, to assess femoral rotation relative to the patient's posterior condyles, rotate the F3 guide until the posterior feet on the F3 guide meet your desired position referencing the patient's posterior condyles.

Note: If adjusting femoral rotation from the surgical plan, the Blade Runner may be used by placing it into the F3 anterior cut slot to help verify that femoral notching will not occur.

Note: Remove the S1 Flexion Spacer prior to completing the F3 cross pinning.

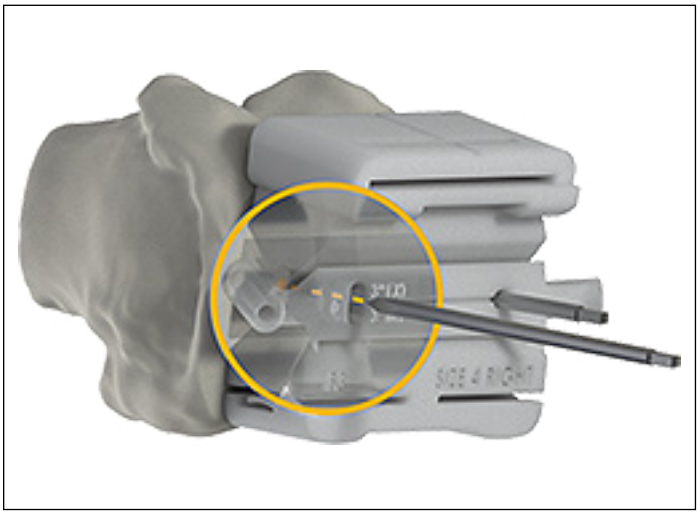


Figure 7. F3 guide with pin placement in previously prepared pin-holes

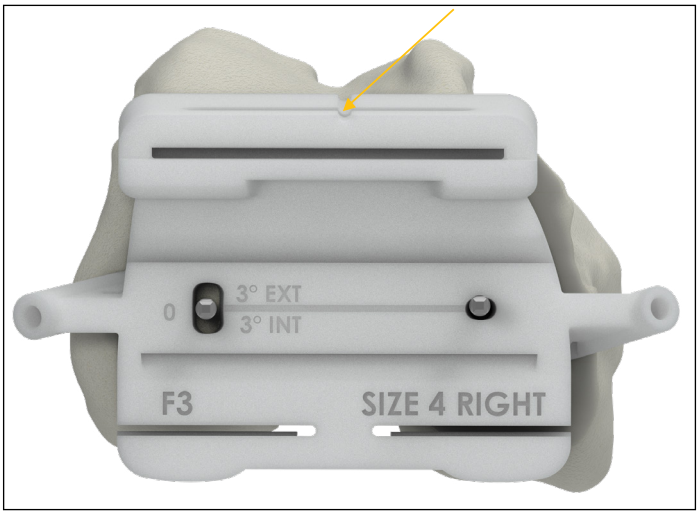


Figure 8. F3 guide without F3B bushing for rotation adjustment

Once rotation is determined, drive two cross-pins into the F3 guide **(Figure 9)** while the F3 guide is fully seated against the distal femur.

The two distal femur pins may be left in place for the anterior and posterior cuts, but they must be removed before making the respective anterior and posterior chamfer cuts.

The recommended cut sequence for stability of the F3 guide is:

1. Cut the anterior cortex.
2. Cut the posterior condyles.
3. Remove the medial distal femur pin.
4. Cut the medial posterior chamfer.
   a. Be careful not to cut the post located between the medial and lateral posterior cut slots.
5. Cut the entire anterior chamfer from the medial aspect of the cutting slot, ensuring that you do not cut the lateral pin.
6. Remove the lateral distal femur pin.
   a. Place the pin in the medial distal pin-hole.
7. Cut the lateral posterior chamfer.

Note: The two distal femur pin-hole locations set by the F1 guide and used to place the F3 guide are in the same location as other Triathlon 4-in-1 guides' fixation pins. These pin-holes can be used if intraoperative assessments identify the need for a different sized femur than planned.

Figure 9. F3 with cross-pins and F3B bushing

Step 3.

Tibial guide positioning and resection

Note: Cartilage must be removed from the proximal surface of the tibia with a curette or other general OR instrument to allow the medial and lateral feet of T1 **(Figure 10)** to sit on cortical bone. Soft tissue at the central tibial eminence should be removed to ensure the T1 guide seats properly against bone.

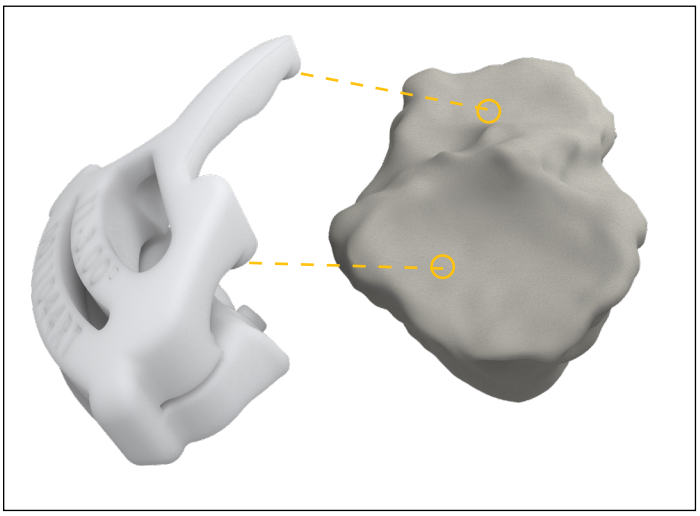


Figure 10. Tibial cartilage removal for proper T1 guide positioning

Insert the Alignment Rod into the T1 Alignment Rod arm **(Figure 11)**. Place both T1 proximal arms onto the tibia and apply pressure on the medial arm while pushing the guide posteriorly towards bone. Rotate about the medial arm until the T1 tubercle arm contacts the medial aspect of the tibial tubercle **(see arrow in Figure 11)**.

If desired, initial T1 stability can be achieved while checking alignment by driving a pin into the cross-pin-hole with minimal pin engagement for potential repositioning.

The recommendation for T1 positioning is to assess across coronal, sagittal and transverse views when the T1 guide with the Alignment Rod is placed on the proximal tibia prior to fully pinning the T1 guide.

The coronal alignment can be assessed by referencing the T1 guide with the Alignment Rod to the image of the anterior tibial cut guide position from the surgical plan. The Alignment Rod should be parallel with the tibia mechanical axis **(Figure 11)**.

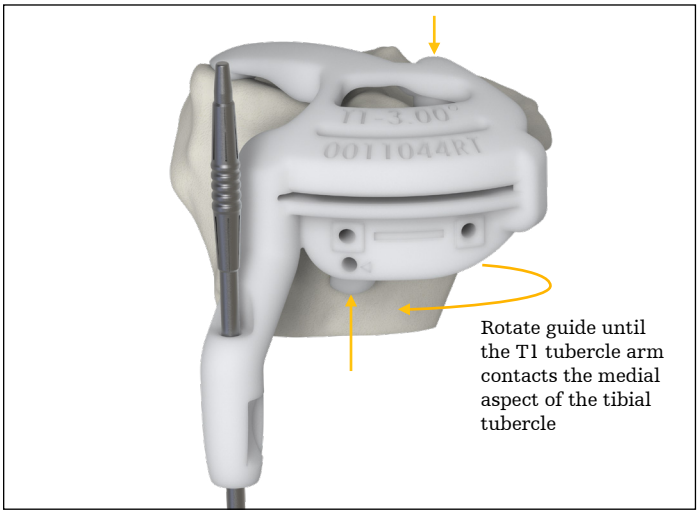


Figure 11. T1 tibial alignment in coronal view

The sagittal alignment can be assessed by viewing the Alignment Rod's relationship with the tibial crest, which should be parallel regardless of tibial slope **(Figure 12)**.

Tibial slope can be assessed with the Blade Runner placed through the T1 cut slot and rotated along the medial border of the tibia. The planned tibial slope can be found on the surgical plan.

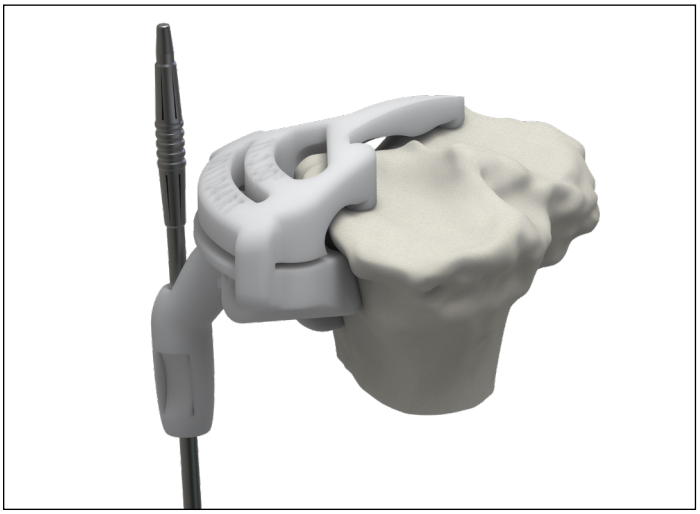


Figure 12. T1 tibial alignment in sagittal view

The transverse alignment can be assessed through the window cutout on top of T1. The inner guide surface should mate with the anterior medial tibial cortex **(Figure 13)**. Transverse alignment can also be assessed by referencing the image of the axial tibial cut guide position on the surgical plan.

With the T1 guide positioned and contacting bone with all three arms, remove the cross-pin if used for initial stability, then pin both parallel holes.

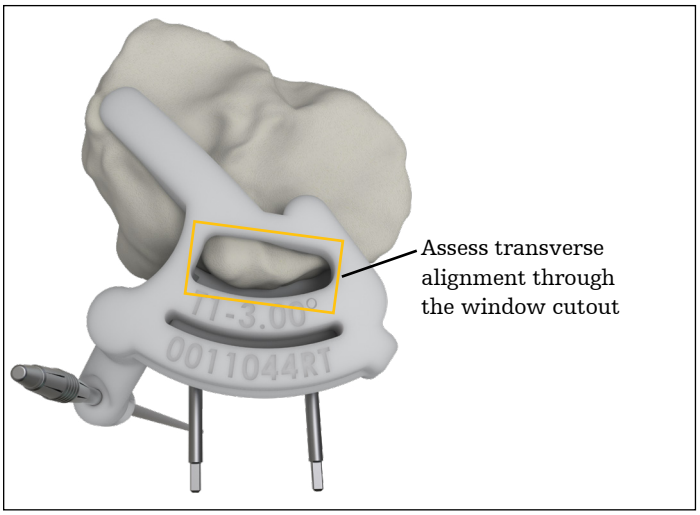


Figure 13. T1 tibial alignment in transverse view

Note: If resection depth adjustment from the surgical plan is desired, the T1A Adjustment Guide offers +2mm and -2mm adjustments. If 2mm less proximal tibia resection relative to surgical plan is desired, remove the T1 guide and place the T1A Adjustment Guide onto the two parallel pins using both "-2" holes. If 2mm more proximal tibia resection relative to surgical plan is desired, remove the T1 guide and place the T1A Adjustment Guide onto the two parallel pins using both "+2" holes **(Figure 14)**.

Once the resection depth is determined, secure the proximal cutting guide with a cross-pin. Then proceed with the proximal tibia resection.

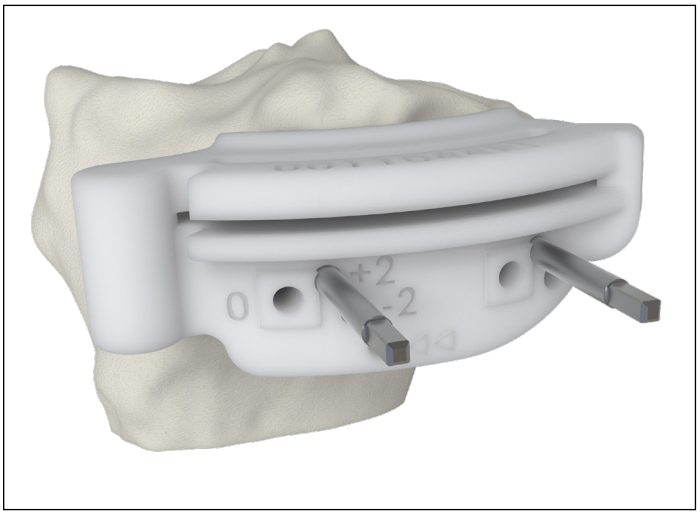


Figure 14. Optional T1A Adjustment Guide

Step 4.

Gap check: extension and flexion

After the femur and proximal tibia cuts are completed, the extension and flexion gaps can be assessed with the S1 and S2 spacer blocks. Pairs of 2mm or 3mm shims may be utilized to account for thicker inserts or to compensate for any cartilage and bone loss on the posterior condyles.

Assemble the S2 Extension Insert onto the S1 Flexion Spacer by hooking both prongs furthest away from handle and pressing S1 and S2 together until the latch built into the handle fully engages **(Figure 15)**.

The Alignment Rod can be inserted into the S1 spacer handle to assess coronal and sagittal plane alignment in extension and flexion.

If Spacer Shims are desired, place both 2mm or both 3mm shims into the designated holes in the flexion and extension spacers and reassess the gaps **(Figure 15 - inset)**.

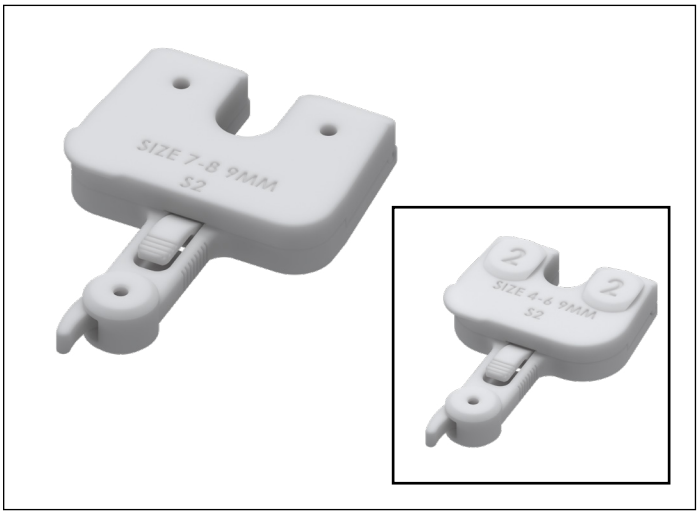


Figure 15. S1 Flexion Spacer with S2 Extension Insert

Recommended gap assessment sequence:

With the knee flexed to 90 degrees, place the S1 + S2 assembly to assess medial and lateral compartment laxity in flexion **(Figure 16)**.

Remove the S1 + S2 assembly.

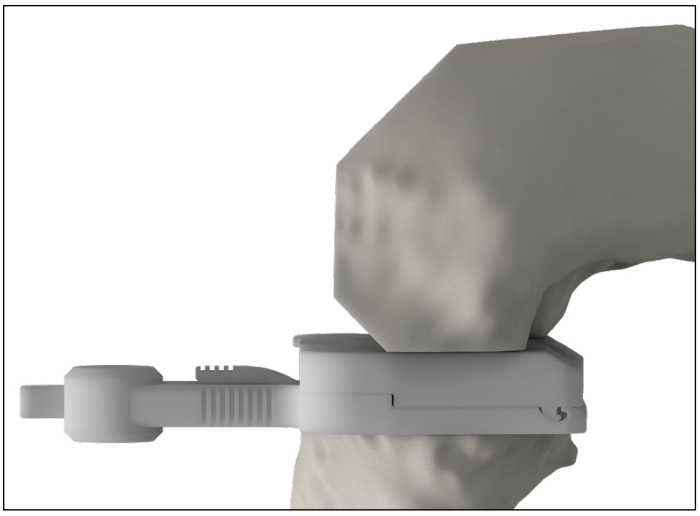


Figure 16. S1 + S2 assembled and inserted for flexion gap assessment

With the knee in full extension, the S1+S2 assembly can be inserted into the joint space to check medial and lateral compartment laxity **(Figure 17)**.

If needed, return to flexion gap assessment with the S1 + S2 assembly.

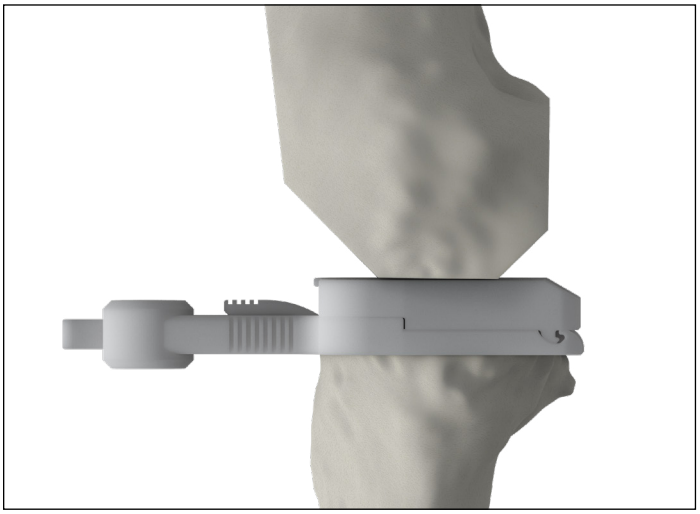


Figure 17. S1 Flexion Spacer and S2 Extension Insert assembled and inserted in extension

If the extension gap needs adjustment but the flexion gap is acceptable, proceed to step 5.

If the extension gap and flexion gap need adjustment, proceed to step 6.

If the extension and flexion gaps are acceptable, proceed to step 7.

Step 5.

Optional distal femur adjustment

If the extension gap needs adjustment but the flexion gap is acceptable, you have two options:

1. If the distal femur cut needs an additional 2mm resection relative to the surgical plan, locate the pin-holes created from the F2 guide and place pins into the previously created pin-holes **(Figure 18)**. Slide the F2 guide onto the pins at both "+2" pin-hole positions.
2. If the distal femur cut needs a 2 degree varus or 2 degree valgus adjustment to relieve medial or lateral compartment tightness in extension, use the F2V Adjustment Guide. Locate the pin-holes in the bone created from the F2 guide and place the pins into the previously created pin-holes. Slide the F2V Adjustment Guide onto the pin at both "0" pin-hole positions if no depth adjustment is desired or both "+2" pin-hole positions if a 2mm resection increase is desired.

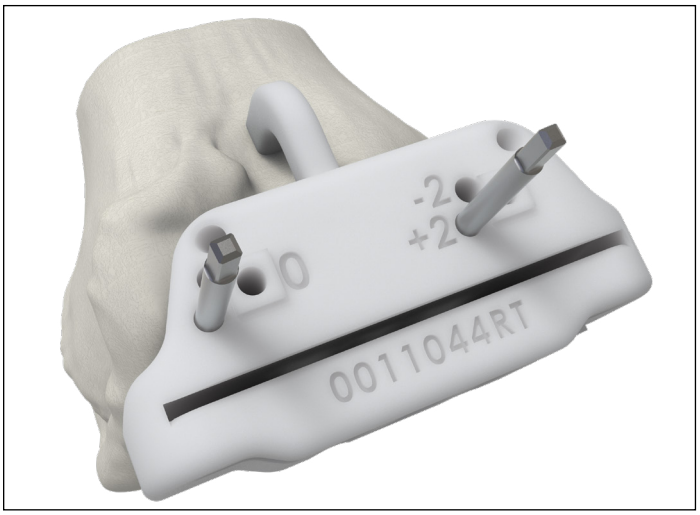


Figure 18. F2 placed onto previously created pin-holes

Note: If using the F2V Adjustment Guide, ensure the side facing the surgeon is legible with the varus or valgus marking. If a varus cut is desired, the surgeon must be able to read VARUS on the cutting guide **(Figure 19)**. If a valgus cut is desired, the surgeon must be able to read VALGUS on the cutting guide. Once varus or valgus selection is confirmed, slide the F2V Adjustment Guide onto the pins at both "0" or both "+ 2" pin-hole positions **(Figure 19)**.

Note: If additional resection or varus/valgus adjustment was made, the femoral 4-in-1 cuts need to be assessed for additional resection. Place the two distal femur pins back into the bone for F3 4-in-1 Cutting Guide positioning. Place the Blade Runner through the F3 cut slots to assess if 4-in-1 recuts are necessary in order to properly seat the femoral component.

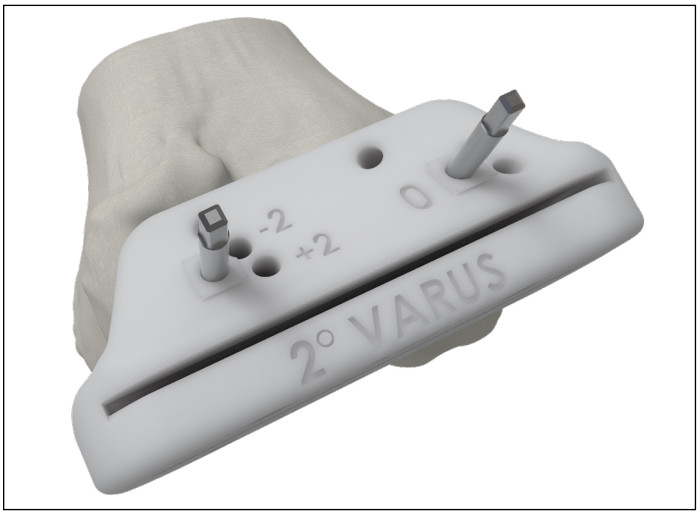


Figure 19. F2V Varus/Valgus Guide pinned to femur for varus cut adjustment

Once the appropriate adjustment is determined, cross-pin either the F2 or F2V Adjustment Guide prior to bone resection. Once femoral resection adjustment is completed, proceed to step 7: Optional PS femur box preparation.

Step 6.

Optional proximal tibia adjustment

If both the flexion and extension gaps need adjustment, you have three options:

1. If the proximal tibia cut needs an additional 2mm resection relative to the surgical plan, locate the pin-holes created from the T1 guide and place the pins into those same holes. Slide the T1A guide onto the pins at both "+2" pin-hole positions **(Figure 20)**.

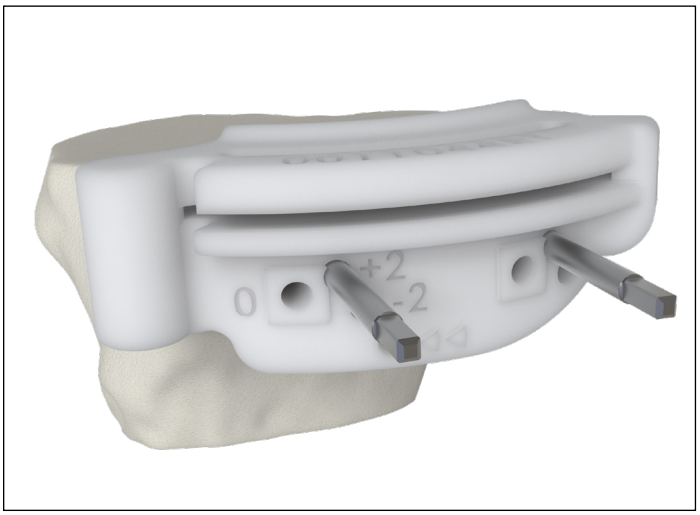


Figure 20. T1A guide placed over proximal pins at "+2" holes

2. If the knee is tight medially in both flexion and extension, use the 2 degree T1VR Varus Adjustment Guide **(Figure 21)**. Locate the pin-holes created from the T1 guide and place pins into the same holes. Slide the T1VR guide onto the pins at both "0" pin-hole positions. This tibial varus cut may create varus limb alignment in extension and flexion. Additional 2mm resection depth on plane with the 2 degree varus angle is available by placing the T1VR guide onto pins at both "+2" pin-hole positions.

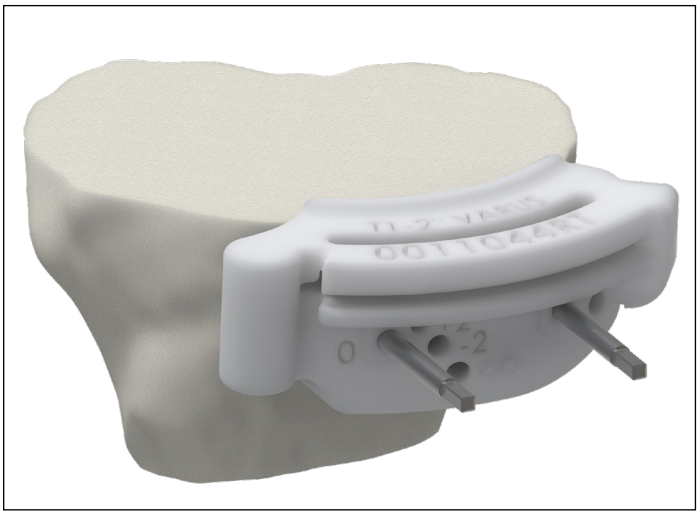


Figure 21. T1VR guide placed over pins at "0" holes

3. If the knee is tight laterally in both flexion and extension, use the 2 degree T1VG Valgus Adjustment Guide **(Figure 22)**. Locate pin-holes created from the T1 guide and place pins into those same holes. Slide the T1VG guide onto the pins at both "0" pin-hole positions. This tibial valgus cut may create valgus limb alignment in extension and flexion. Additional 2mm resection depth on plane with the 2 degree valgus angle is available by placing T1VG onto pins at both "+2" pin-hole positions.

Once appropriate adjustment is determined, cross-pin either the T1A or T1VR or T1VG Adjustment Guide prior to bone resection.

The flatness of the cut can be checked using the bottom surface of the S1 Flexion Spacer.

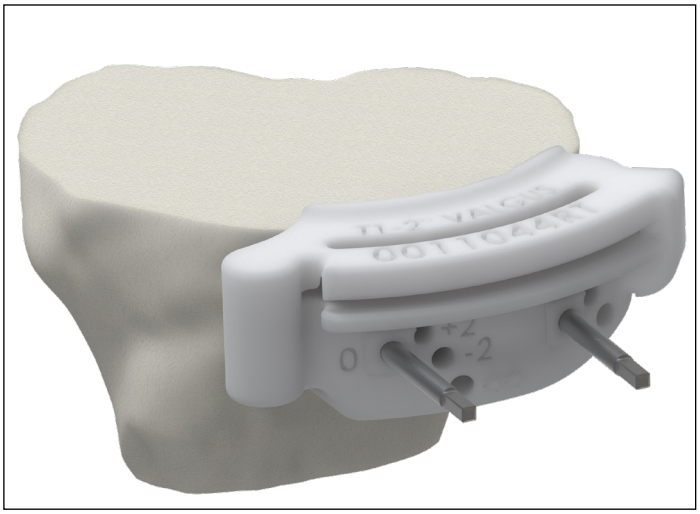


Figure 22. T1VG guide placed over pins at "0" holes

Step 7.

Optional PS femur box preparation

If a PS femur implant was selected, place and pin the F4C guide onto the femur **(Figure 23)**.

Note: The pin-holes created previously by the F1 guide can be used as visual guides to help line up the F4C distal peg holes to achieve the planned medial/lateral positioning of the implant. Distal peg prep holes will line up concentrically with previous pin-holes.

The F4C guide matches the profile of the implant, so it can be used to adjust the medial-lateral position to help achieve the desired final position.

When the position is set, pin the guide via the distal and anterior holes **(Figure 23)**.

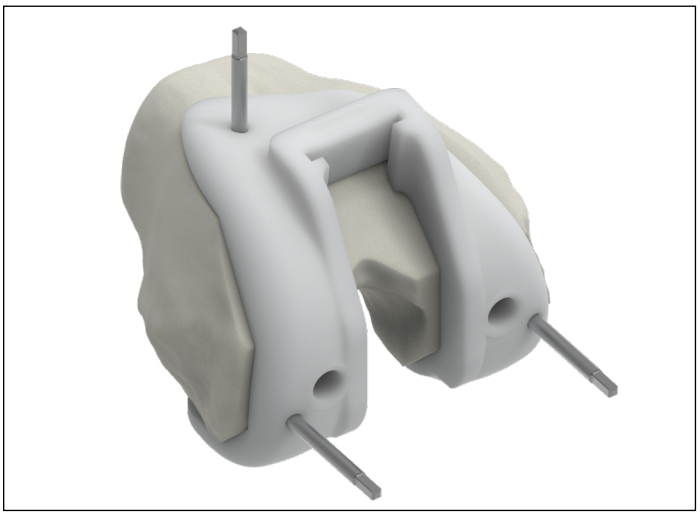


Figure 23. F4C pinned to femur

Cut the cortical rim on both sides of the posterior-most portion of the intercondylar notch using the oscillating saw. Assemble the Box Chisel and insert into the appropriate slot. Impact the Box Chisel with a mallet until seated to the stop. Leave the Box Chisel in place to act as a reference plane. Cut the medial and lateral edges of the box with an oscillating saw to complete the bone resection **(Figure 24)**. Avoid biasing the blade during resection to ensure a complete box preparation.

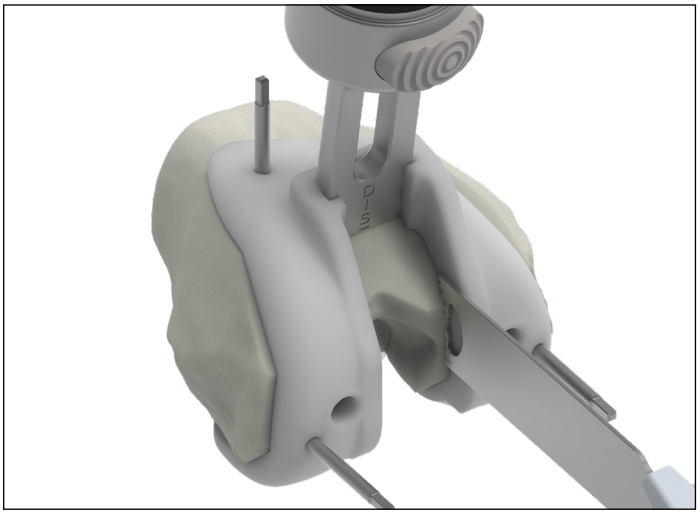


Figure 24. PS box preparation

The F4G box gauge should be used to check the prepared box. The gauge can be inserted through the chisel slot and rested on the prepared bone **(Figure 25)**. If the F4G gauge cannot be fully seated in the F4C guide, remove the F4G gauge and recut the bone, ensuring that all cuts are complete. Repeat the F4G gauge check and resection until the F4G gauge can be fully seated into the F4C guide.

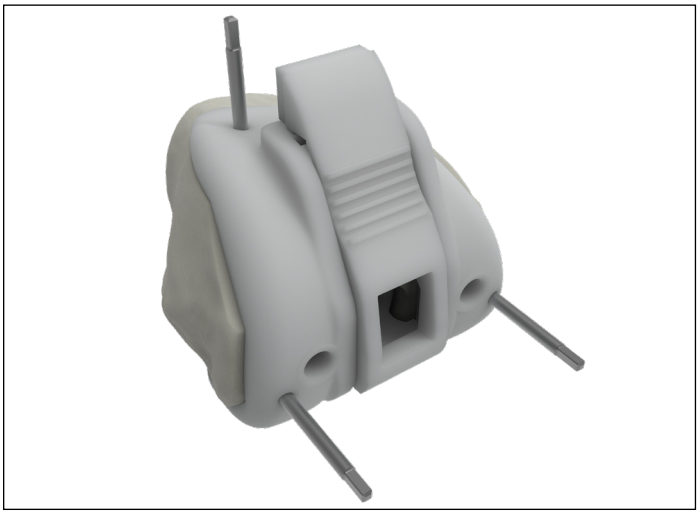


Figure 25. F4G gauge fully inserted into F4C guide

If Modular Femoral Distal Fixation Pegs are to be used, the location holes may be prepared at this stage using the 1/4" Peg Drill attached to the Universal Driver (the peg holes may also be prepared later through the PS Femoral Trial).

The PS Femur Trial should be placed by hand onto prepped bone and used to check the prepared box. If the box on the trial is preventing the femur from fully seating on the bone cuts, remove the F5PS Femur Trial and recut the bone, ensuring all cuts are complete. **(Figure 26)**.

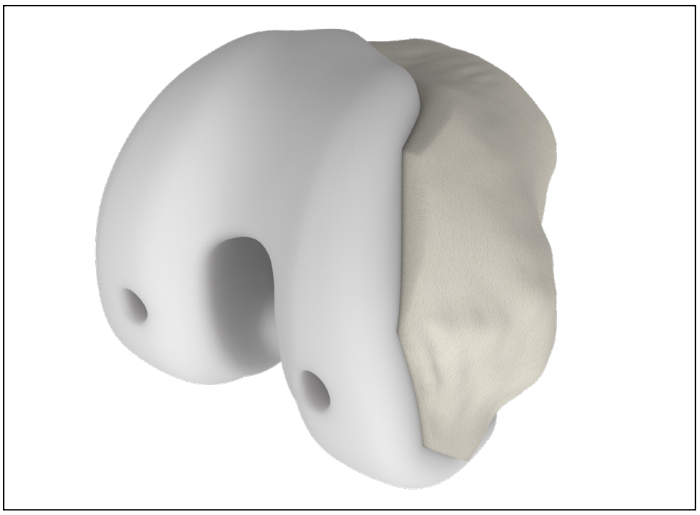


Figure 26. F5PS femur trial

Step 8.

Trial reduction and implant positioning

With all femur cuts and proximal tibia cuts complete, place the femur trial onto the prepared femur using hand pressure to seat the trial. **Do not impact the femur trial onto the bone to avoid fracturing the trial.** If the trial will not seat with hand pressure, place the joint into extension to apply pressure to the trial or revisit the femoral 4-in-1 cuts. After the femur trial is in place, insert the baseplate and insert trials so trial reduction can be performed to evaluate the fit and function of the implants **(Figure 27)**. The initial baseplate placement should be set by referencing the surgical plan. Three varying thicknesses of tibial inserts can be trialed at this stage.

Note: The Triathlon reusable insert trials are compatible with the T2 Baseplate Trial if additional insert constraints and/or thicknesses are desired for trial reduction.

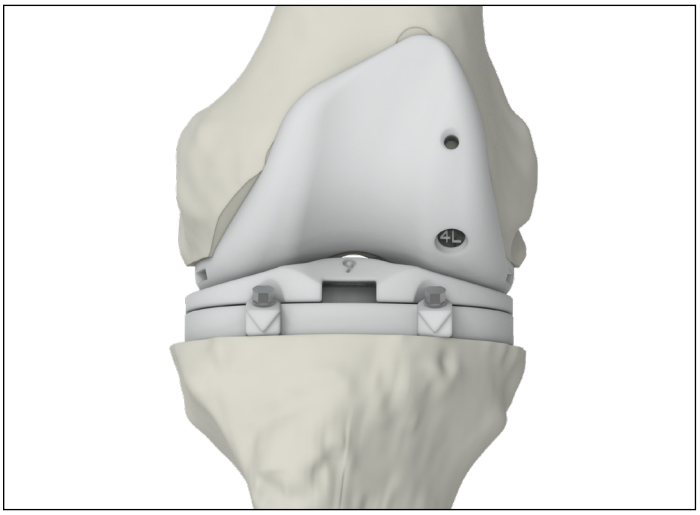


Figure 27. Femur and baseplate trials with insert trial

If insert implant thicknesses ordered are 9, 10 and 11mm, then 9, 10 and 11mm trials will be supplied.

If any other insert implant thickness combination is ordered (up to 14mm), then 9, 11 and 13mm insert trials will be supplied. For example, if 9, 10 and 12mm insert implants are ordered, use the provided 9 and 11mm insert trials to determine if the 10mm final insert implant should be used.

Once trial reduction is complete, the tibial tray rotation can be marked with two different methods:

1. The tibia can be marked with a surgical marker at the arrow markings located on the anterior portion of the T2 Tibial Baseplate Trial **(Figure 28)**.
2. Pins can be placed into the same two anterior rotation setting tabs **(Figure 28)**. Remove the T2 Baseplate Trial by sliding it along the pins. Remove pins if the T2 Baseplate Trial cannot be removed from the joint space by sliding along these pins.

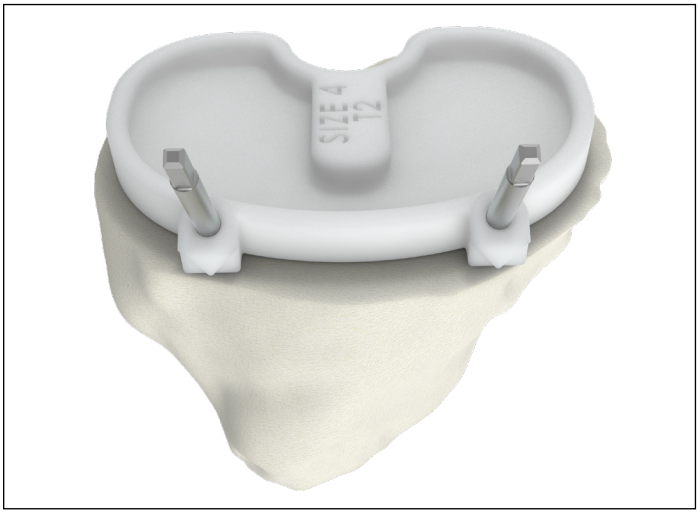


Figure 28. T2 Baseplate Trial pinned to the tibia

If a CR femur was selected, distal peg preparation must be completed at this step. With the knee flexed to 90 degrees, use the 1/4" Peg Drill to prepare the peg holes through the CR Femur Trial **(Figure 29)**.

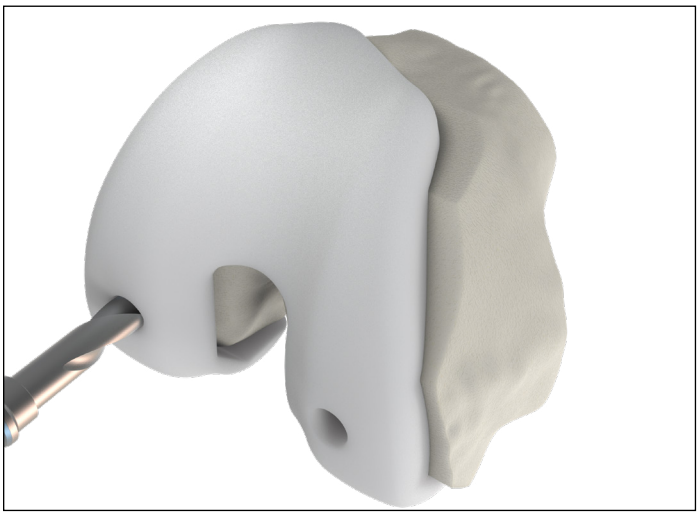


Figure 29. CR femur trial peg prep

Step 9.

Baseplate keel punch and optional Universal Baseplate boss ream

If tibial baseplate rotation was set by pins placed in the anterior holes of the T2 guide, the T3 Keel Punch Guide can utilize the same pin positions by sliding it along the pins or placing it on the proximal tibia and locating the pin positions through the anterior tabs **(Figure 30)**. If tibial baseplate rotation was set by marking the location of the anterior arrows of the T2 guide, position the T3 guide by aligning its anterior arrows with those same markings.

The recommended minimum pinning of T3 is one anterior pin-hole and one angled proximal tibia pin-hole before completing the keel punch, for instance, the anterior medial pin with the posterior lateral angled pin, although other pinning options are available **(Figure 30)**.

Ensure the T3 guide is completely seated and secure against the proximal tibia before pinning the T3 guide or using the Keel Punch.

If a Universal Baseplate is chosen, the Boss Reamer must be reamed through the central hole of the T3 Keel Punch Guide **(Figure 30)**. Ream until the depth stop reaches the top of the guide.

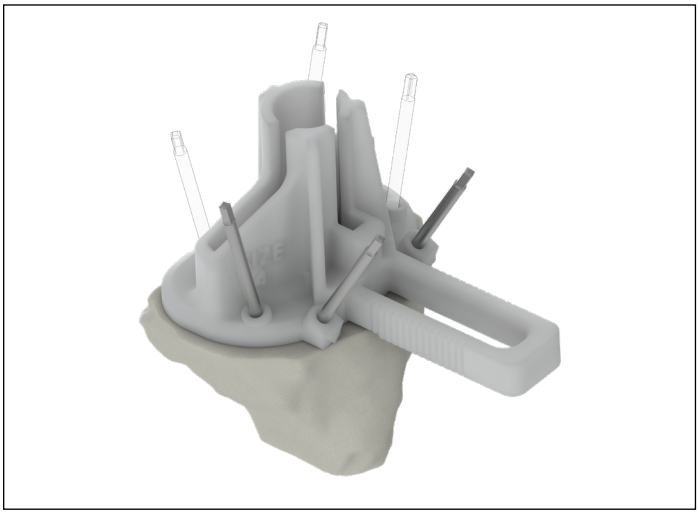


Figure 30. T3 Keel Punch Guide pinned to tibia with additional pinning options shown as silhouettes

Place the corresponding size and appropriate Keel Punch (cemented or cementless) into the T3 Keel Punch Guide. Use a mallet to impact the Keel Punch. Advance the Keel Punch until it seats fully in the T3 Keel Punch Guide **(Figure 31)**.

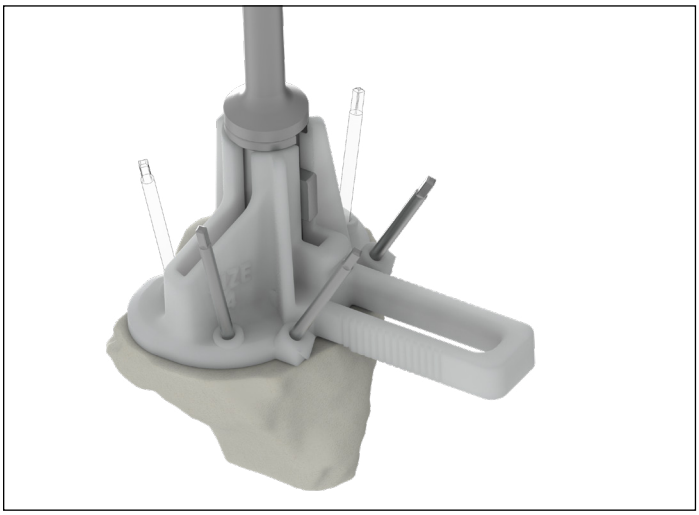


Figure 31. Keel Punch seated in T3 Keel Punch Guide

To extract the Keel Punch, lift up on the Keel Punch handle and pull the handle to cantilever the Keel Punch handle against the T3 guide and out of the tibia **(Figure 32)**.

Once the keel prep is complete and the Keel Punch is removed, the Keel Prep Guide and all pins must be removed.

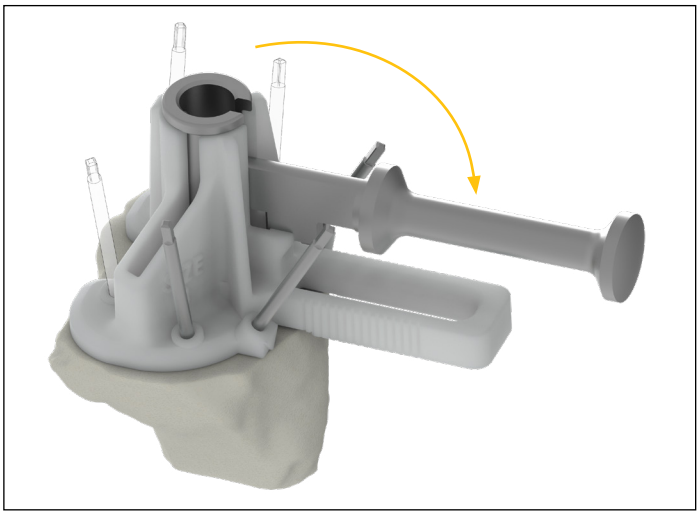


Figure 32. Lever motion to remove Keel Punch from tibia

Step 10.

Optional Tritanium Baseplate bone prep

If a cementless Tritanium Baseplate was chosen, the T4 Cementless Peg Drill Guide is used to prepare the baseplate pegs. The position of the four holes and the keel on the underside of the T4 Cementless Peg Drill Guide corresponds to the relative location of the keel and four pegs on the implant **(Figure 33)**.

Insert the keel on the T4 Cementless Peg Drill Guide into the prepared keel slot **(Figure 34)**. Ensure that the T4 Cementless Peg Drill Guide sits flush against the resected tibia to help ensure accurate peg preparation.

Drilling the tibial peg holes will facilitate seating of the implant. Utilize the 1/8″ Tibial Peg Drill.

Hold the T4 Cementless Peg Drill Guide in position by applying finger pressure to the template. Position the 1/8″ Tibial Peg Drill through a peg hole perpendicular to the resected tibia. **Drill through all four template holes using the 1/8″ Tibial Peg Drill taking care to ensure surgical glove and fingers are not in contact with the drill prior to drilling (Figure 34)**.

Drilling is complete when the drill stop has contacted the template surface.

Carefully remove the T4 Cementless Peg Drill Guide from the bone by lifting straight up and out of the keel slot.

If the surgeon feels the bone is too dense at any of the peg locations after preparing with the 1/8″ drill and template, the optional 7/32″ Tibial Peg Drill may be used to increase the size of the peg holes. Ensure the T4 Cementless Peg Drill Guide is removed prior to drilling with the 7/32″ Tibial Peg Drill.

When using the 7/32″ Tibial Peg Drill, take care to ensure surgical glove and fingers are not in contact with the drill prior to drilling. Ensure axial alignment before drilling. Drilling is complete after the drill stop has contacted bone. **Do not continue to drive the drill after the stop has been reached.**

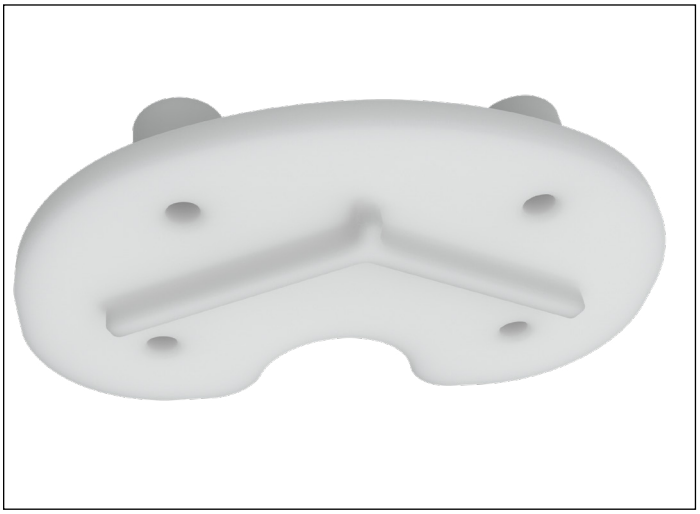


Figure 33. T4 guide bottom view of reduced keel

Figure 34. T4 guide with 1/8″ Tibial Peg Drill

Step 11.

Final implantation

Refer to the Triathlon surgical protocol TRIATH-SP-30 for further instructions and follow the surgical steps per implant chosen.

Note: If cementing the femoral and/or tibial implant, insert trials can be used to pressurize the joint as the cement cures. This may aid in cement removal from the posterior capsule prior to final insert implant placement.

Note: The trials must be removed and segregated from the implants prior to final implantation. Ensure that trials do not get mixed with final implants and that all trials are not implanted.

Step 12.

Patella prep and implantation

Refer to the Triathlon surgical protocol TRIATH-SP-30 for further instructions if patella resurfacing is desired.

Reusable instrument parts list by tray

Cemented Reusable Instrument Case 6556-9-111

Part number	Description	Qty	Alternative based on implant selection and surgeon preference
5550-T-278	Symmetric Patella Trial 27x8	1	
5551-T-299	Asymmetric Patella Trial 29x33x9	1	Symmetric Patella Trial S29x8 5550-T-298
5551-T-320	Asymmetric Patella Trial 32x36x10	1	Symmetric Patella Trial S31x9 5550-T-319
5551-T-350	Asymmetric Patella Trial 35x39x10	1	Symmetric Patella Trial S33x9 5550-T-339
5551-T-381	Asymmetric Patella Trial 38x42x11	1	Symmetric Patella Trial S36x10 5550-T-360
5551-T-401	Asymmetric Patella Trial 40x44x11	1	Symmetric Patella Trial S39x11 5550-T-391
	Empty bracket for future use	0	
	Empty bracket for future use	0	
6541-2-013	Cemented Keel Punch 1-3	1	MIS Keel Punch 6541-2-113
6541-2-046	Cemented Keel Punch 4-6	1	MIS Keel Punch 6541-2-146
6541-2-078	Cemented Keel Punch 7-8	1	MIS Keel Punch 6541-2-178
6541-3-524	All-Poly Patella Drill w/Stop	1	
6541-3-602	Patella Caliper	1	
6541-3-617E	Asymmetric Express Patella Drill Template 29mm	1	Symmetric Template 6541-3-629E
6541-3-618E	Asymmetric Express Patella Drill Template 32mm	1	Symmetric Template 6541-3-631E
6541-3-619E	Asymmetric Express Patella Drill Template 35mm	1	Symmetric Template 6541-3-633E
6541-3-620E	Asymmetric Express Patella Drill Template 38mm	1	Symmetric Template 6541-3-636E
6541-3-621E	Asymmetric Express Patella Drill Template 40mm	1	Symmetric Template 6541-3-639E
6541-3-627E	Symmetric Express Patella Drill Template 27mm	1	
6541-3-800E	Express Cement Cap	1	
6541-4-003 / 6541-4-003A	Fluted Pins	5	
6541-4-400	Blade Runner	1	
6541-4-525	1/4″ Peg Drill	1	
6541-4-602	Universal Alignment Rod	1	
6541-4-709	PS Box Chisel	1	
6541-4-801	Universal Driver	1	
6541-4-802	1/8″ Hex Drive	1	
6541-4-805	Tibial Baseplate Impactor/Extractor	1	
6541-4-807	Femoral Impactor/Extractor	1	
6541-4-810	Impaction Handle	1	
6541-4-811	Femoral Impactor	1	Tibial Impactor 6541-4-812
6541-4-813	Tibial Insert Impactor	1	
6541-4-825	Slip Torque Handle	1	Impaction Handle 6541-4-810
6543-4-517	Tibial Boss Reamer	1	
6543-4-800	Tibial Counter Wrench	1	
6543-4-818	Universal Torque Wrench	1	
6633-7-744	Patella Clamp	1	

Cementless Reusable Instrument Case 6556-9-222

Part number	Description	Qty	Alternative based on implant selection and surgeon preference
5550-T-278	Symmetric Patella Trial 27x8	1	
5551-T-299	Asymmetric Patella Trial 29x33x9	1	Symmetric Patella Trial S29x8 5550-T-298
5551-T-320	Asymmetric Patella Trial 32x36x10	1	Symmetric Patella Trial S31x9 5550-T-319
5551-T-350	Asymmetric Patella Trial 35x39x10	1	Symmetric Patella Trial S33x9 5550-T-339
5551-T-381	Asymmetric Patella Trial 38x42x11	1	Symmetric Patella Trial S36x10 5550-T-360
5551-T-401	Asymmetric Patella Trial 40x44x11	1	Symmetric Patella Trial S39x11 5550-T-391
	Empty bracket for future use	0	
	Empty bracket for future use	0	
6541-2-625	1/8″ Tibial Peg Drill	1	
6541-2-626	7/32″ Tibial Peg Drill	1	
6541-3-299	Asymmetric Patella Capture A29	1	
6541-3-320	Asymmetric Patella Capture A32	1	Symmetric Patella Capture S31 6541-3-319
6541-3-350	Asymmetric Patella capture A35	1	Symmetric Patella Capture S33 6541-3-339
6541-3-381	Asymmetric Patella Capture A38	1	Symmetric Patella Capture S36 6541-3-360
6541-3-401	Asymmetric Patella Capture A40	1	Symmetric Patella Capture S39 6541-3-391
6541-3-522	Metal-Backed Patella Drill w/Stop	1	
6541-3-524	All-Poly Patella Drill w/Stop	1	
6541-3-526	Tritanium Dense Bone Patella Drill	1	
6541-3-530	Tritanium Patella Inserter (clamp)	1	
6541-3-602	Patella Caliper	1	
6541-3-617E	Asymmetric Express Patella Drill Template 29mm	1	Symmetric Template 6541-3-629E
6541-3-618E	Asymmetric Express Patella Drill Template 32mm	1	Symmetric Template 6541-3-631E
6541-3-619E	Asymmetric Express Patella Drill Template 35mm	1	Symmetric Template 6541-3-633E
6541-3-620E	Asymmetric Express Patella Drill Template 38mm	1	Symmetric Template 6541-3-636E
6541-3-621E	Asymmetric Express Patella Drill Template 40mm	1	Symmetric Template 6541-3-639E
6541-3-627E	Symmetric Express Patella Drill Template 27mm	1	
6541-3-800E	Express Cement Cap	1	
6541-4-003 / 6541-4-003A	Fluted Pins	5	
6541-4-400	Blade Runner	1	
6541-4-525	1/4″ Peg Drill	1	
6541-4-602	Universal Alignment Rod	1	
6541-4-709	PS Box Chisel	1	
6541-4-801	Universal Driver	1	
6541-4-805	Tibial Baseplate Impactor/Extractor	1	
6541-4-807	Femoral Impactor/Extractor	1	
6541-4-810	Impaction Handle	1	
6541-4-811	Femoral Impactor	1	Tibial Impactor 6541-4-812
6541-4-813	Tibial Insert Impactor	1	
6541-6-013	Cementless Keel Punch 1-3	1	
6541-6-046	Cementless Keel Punch 4-6	1	
6541-6-078	Cementless Keel Punch 7-8	1	
6633-7-744	Patella Clamp	1	

Single-use guides parts list

Single-use guides ordering part numbers	
Part number	Description
6556-C-001	AS-1 CR Femur – CR Tibial Insert – Cemented Baseplate
6556-C-002	AS-1 CR Femur – CR Tibial Insert – Cementless Baseplate
6556-C-003	AS-1 CR Femur – CS Tibial Insert – Cemented Baseplate
6556-C-004	AS-1 CR Femur – CS Tibial Insert – Cementless Baseplate
6556-C-005	AS-1 PS Femur – CS Tibial Insert – Cemented Baseplate
6556-C-006	AS-1 PS Femur – CS Tibial Insert – Cementless Baseplate
6556-C-007	AS-1 PS Femur – PS Tibial Insert – Cemented Baseplate
6556-C-008	AS-1 PS Femur – PS Tibial Insert – Cementless Baseplate

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Howmedica Osteonics Corp.
325 Corporate Drive
Mahwah, NJ 07430, USA
A subsidiary of Stryker Corporation
t: 201 831 5000

stryker.com

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