stryker

GMRS Distal Femur and Revision Baseplate

Surgical protocol

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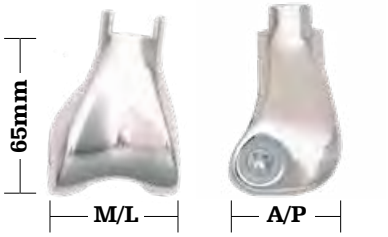
Surgical protocol

Contents

This publication sets forth detailed validated procedures for the GMRS Distal Femur and Revision Baseplate. 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.

Femoral component size options



Small	52mm	45mm
Standard	60mm	54mm

Femur used	Femur ref # (L/R)	Axle required	Bushings required
Small	6495-2-010/020	6495-2-115	6495-2-105
Standard	6495-2-030/040	6481-2-120 OR 5612-3-000	6481-2-110 OR 5612-3-000

Distal femoral components **Stem components**

Triathlon Revision Baseplate and GMRS Distal Femur surgical protocol

System description

The GMRS Distal Femur accepts the Triathlon Hinge System Bearing Component, Bushings and Axle for seamless integration with the Triathlon Revision Baseplate.

Description of the Global Modular Replacement System

The GMRS was developed for reconstruction of large segmental defects for tumors, failed previous arthroplasty, or trauma. This system is designed to:

- Reconstruct large segmental defects of the knee
- Reconstruct osteoarticular defects of varying sizes
- Allow for variation and intra-operative changes of the surgical plan.

The system consists of distal femoral components, extension pieces and stems.

It also includes a complete set of trial components and instrumentation. The modular implants are assembled by impacting a male/female taper design, securely locking them together.

Distal femoral components

All distal femoral components have a built-in 6° Valgus offset and utilize some of the Triathlon Hinge Knee components.

▸ **Note:** The small distal femoral component uses dedicated small bushings and a small axle.

Stem components

The GMRS cemented stems are available in six styles: straight, curved and long curved; each style with or without extra-cortical porous-coated body sections. The extra-cortical porous-coated body section has a 40mm replacement length. The stems are also available without the extra-cortical porous-coated body section, with an 11mm replacement length. All stems are available in 8mm, 9mm, 10mm, 11mm, 13mm, 15mm and 17mm diameters. Their respective seat diameters at the resection level are as follows:

Stem diameter	Seat diameter
Ø 8, 9mm	Ø 22mm
Ø 10, 11mm	Ø 24mm
Ø 13mm	Ø 28mm
Ø 15mm	Ø 32mm
Ø 17mm	Ø 36mm

The stems are designed to be cemented into the medullary canal.

▸ **Note: The small cemented stems (8mm, 9mm and 10mm diameters) are intended to be used with the small distal femoral component.**

Extension pieces

The Extension Pieces are used to customize the replacement length and are available in 30mm, 40mm, 50mm, 60mm, 70mm, 80mm, 100mm, 120mm, 140mm, 160mm, 180mm, 200mm and 220mm lengths. This component features a male and female taper, which attaches a stem to a distal femoral component.

Tibial components

The Triathlon Revision Baseplate is available in 7 sizes (1-7), with modular stem options. The Tibial inserts are available in Sizes 1-7 in 11, 13, 16, 19, 22mm thicknesses. The Triathlon Revision Baseplate is designed to accept the Triathlon Hinge Tibial Bearing Component.

Trial components

The implant system is complemented with a complete set of trial components. The trial components are replicas of their corresponding implants; however, they have non-locking trunnions. The trials are satin-finished and have no coatings, so that they can easily be distinguished from the implants. A 30mm Trial Extension Piece also functions as the Trial Extra-Cortical Body. Together with the Trial Cemented Stem, it forms the Trial Stem with extra-cortical porous-coated body.

Indications and contraindications

Indications

See Triathlon Revision Baseplate Indications.

The Global Modular Replacement System is intended for use in patients requiring extensive reconstruction of the hip joint and/or knee joint, including knee fusions, necessitated by extensive bone loss due to trauma, failed previous prosthesis and/or tumor resection.

Contraindications

See Triathlon Revision Baseplate Contraindications.

For the Global Modular Replacement System

A. As related to bone tumors: Not all bone tumors may be treated successfully by segmental resection. Any condition that may have already resulted in either local or distant spread of the tumor may be a contraindication. Examples of such conditions include:

- Pathological fracture;
- Overt infection;
- Inopportune placement of biopsy incision; and,
- Rapid disease progression beyond a respectable margin.

Each patient must therefore be individualized and carefully evaluated by appropriate staging techniques prior to consideration of segmental replacement.

B. As related to failed previous prosthesis and trauma:

- Any active or suspected latent infection in or about the operative joint.
- Any mental or neuromuscular disorder which would create an unacceptable risk of prosthesis instability, prosthesis fixation failure, or complication in postoperative care.
- Bone stock compromised by disease, infection, or prior implantation, which cannot provide adequate support and fixation of the prosthesis.
- HA coated stems are contraindicated in situations where bone stock is inadequate to support cementless application.

See package insert for warnings, precautions, adverse effects, information for patients and other essential product information.

Before using GMRS instrumentation, verify:

- Instruments have been properly disassembled prior to cleaning and sterilization;
- Instruments have been properly assembled post-sterilization;
- Instruments have maintained design integrity; and,
- Proper size configurations are available.

For Instructions for Cleaning, Sterilization, Inspection and Maintenance of Orthopaedic Medical Devices, refer to LSTPI-B and SLI0001.

Compatibility

GMRS Distal Femoral Component and Triathlon Revision Baseplate

All sizes of the Triathlon Revision Baseplate (5612-B-X00) are compatible with the Small and Standard GMRS Distal Femur. For all construct assemblies the Size 1-2 Tibial Bearing Component 5612-0-001 must be used.

Tibial insert/baseplate compatibility

The tibial insert size matches the baseplate size, e.g., size 4 insert to be used only with size 4 baseplate.

The Hinge insert can only be used with the cemented Revision Baseplate.

Triathlon Revision Baseplate Augments

Tibial Augments come in left medial/right lateral or right medial/left lateral configurations.

Tibial Augments are size specific, e.g., size 4 tibial augments are for the size 4 Revision Baseplate.

Tritanium Tibial Cone Augments

Size A tibial cone is not compatible with the Revision Baseplate due to the boss diameter.

Size B is the minimum size for tibial cone augment compatibility.

Triathlon TS Stems

The Triathlon Revision Tibial Baseplate (5612-B-X00) requires a 50mm or longer Stem Extension.

The Triathlon Revision Tibial Baseplate (5612-B-X00) is compatible with cemented and fluted stems.

Triathlon Stem Extenders

The 50mm Stem Extender cannot be used with the Triathlon Revision Tibial Baseplate Components (5612-B-X00) when used with a 150mm Triathlon TS Stem.

For all **Triathlon Revision Baseplate and GMRS SMALL Distal Femur** (6495-2-010/20) constructs use the following hinge implant accessories:

- Size 1-2 Tibial Bearing Component 5612-0-001
- Tibial Sleeve 5612-5-002 (packaged with the Hinge Insert); alternatively 6481-2-140
- Bushings (x2) 6495-2-105
- Axle 6495-2-115
- Bumper 6481-2-130 or 6481-2-133

For all **Triathlon Revision Baseplate and GMRS STANDARD Distal Femur** (6495-2-030/40) constructs use the following hinge implant accessories:

- Size 1-2 Tibial Bearing Component 5612-0-001
- Tibial Sleeve 5612-5-002 (packaged with the Hinge Insert); alternatively 6481-2-140
- Bushings (x2) from pack 5612-3-000 (alternatively 6481-2-110)
- Axle from pack 5612-3-000 (alternatively 6481-2-120)
- Bumper 6481-2-130 or 6481-2-133
- Optional alternative assembly package 6481-2-150: Contains 6481-2-140 Tibial Sleeve, 6481-2-130 Bumper Neutral, and two 6481-2-110 Femoral bushings.

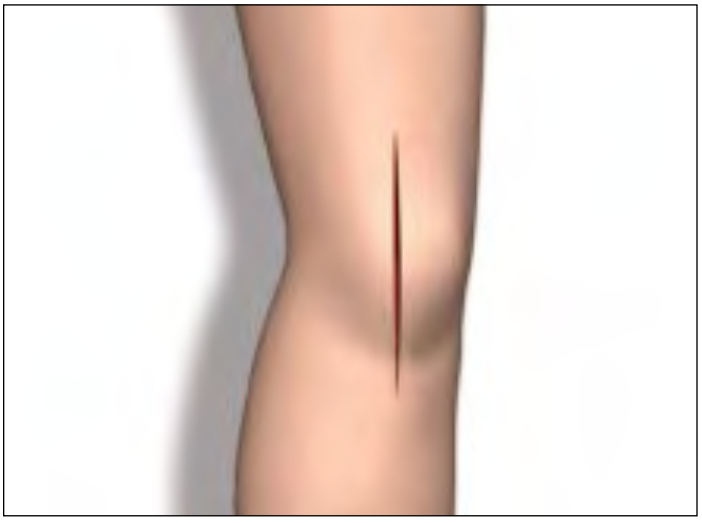


Figure 1

Preoperative templates

The surgeon may overlay the outlines on the following implant surgical templates to an X-ray image to assist in preoperative sizing.

LTEMK29	Global Modular Replacement System X-Ray Templates

Exposure

A standard anterior mid-line incision can be utilized **(Figure 1)**. Any previous incision can be used or incorporated to decrease the risk of skin slough and breakdown.

The capsule is entered through a medial parapatellar approach or using an approach that allows the surgeon to deal best with the underlying pathology.

For revision procedures: Component removal

When removing the components to be revised, great care must be taken to preserve as much of the remaining bone stock as possible and to avoid the risk of fracture of the residual bone. Bone preservation can usually be achieved using small flexible osteotomes, saws, and high-speed burring instruments.

Figure 2

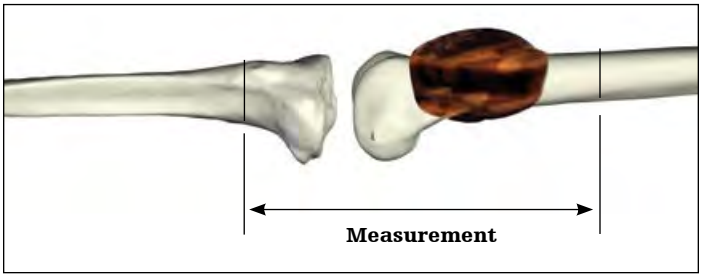


Figure 3

Measuring resection length

The Distal Femoral Template is designed to guide the resection to a level that can be reproduced by the available implants. The Distal Femoral Template is placed on the bone so that the silhouette of the template coincides with the distal condyles of the femur **(Figure 2)**.

The Distal Femoral Template is read at the appropriate marking depending on whether the stem being used is with or without extra-cortical porous-coated body section. The anterior cortex of the femur is marked with a bovie or similar device to indicate the resection level. It is important to note that if the condyles of the prosthesis are placed at the level of the pre-operative condyles (i.e., the femoral prosthesis is the exact length of the resected distal femur), a 16mm tibial resection is required for a Triathlon Revision baseplate. Typically, 10-12mm are removed from the proximal tibia. The femoral resection is therefore usually about 4-6mm longer than the prosthesis.

- **Note:** It is important to ensure proper patellar tracking. The length of the femoral resection and prosthetic replacement must be considered with the tibial resection to recreate leg length and establish proper patellar tracking. Patellar tracking, tibial cut and leg length must be taken into consideration when making the femoral resection.
- **Surgical tip:** As an aid to restoring leg length, a reference measurement can be established across the joint. With a bovie or similar device, a mark is made on the femur, proximal to the femoral resection, along with a mark on the tibia, distal to the tibial resection. The distance between these marks can be measured before the resection is made, and checked again, with the trials or implants in place, after the resection is made **(Figure 3)**.

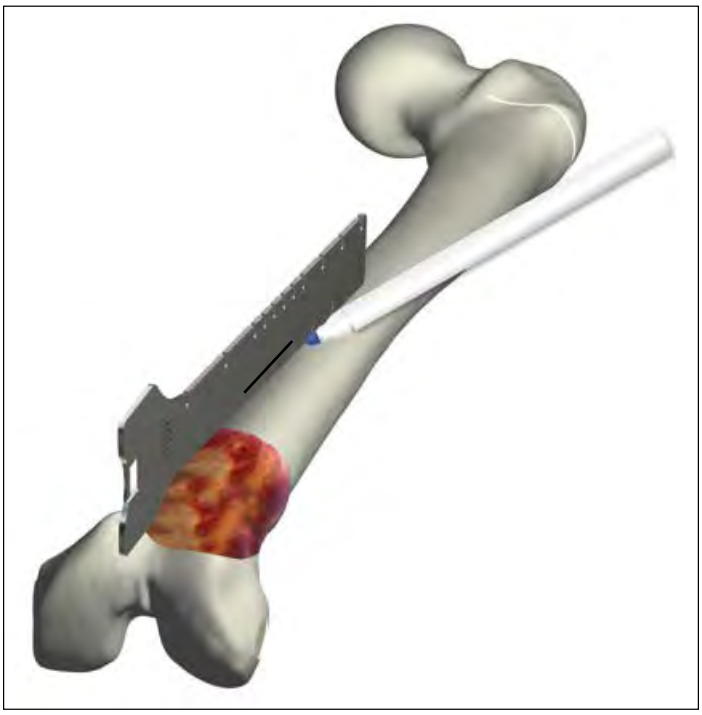


Figure 4

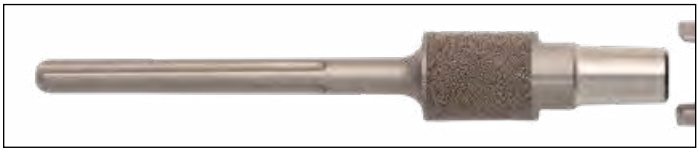


Figure 5

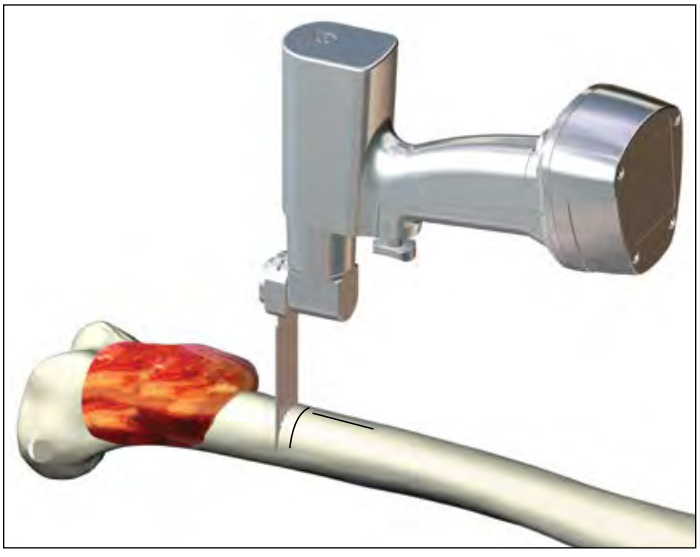


Figure 6

Rotational alignment

Using a straight edge (e.g., the Distal Femoral Template), the anterior cortex of the distal femur is marked above the resection level in line with the trochlear groove of the distal femur **(Figure 4)**.

The line should be directly anterior to the linea aspera. This reference mark will be used later to aid in rotational orientation of the prosthetic components. Rotational alignment can also be determined or verified during trial evaluation.

The stem implants and trials are marked in line with the trochlear groove of the Distal Femoral Component.

As a guide to rotational orientation, the alignment marking on the implant stem can be oriented to the mark made on the anterior cortex above the resection level **(Figure 5)**.

Femoral osteotomy

All remaining soft tissue at the level of transection is cleared. The osteotomy, perpendicular to the femoral shaft, is performed after the posterior and medial structures have been protected and retracted **(Figure 6)**; special care is taken to protect the Femoral Artery.

- **Surgical tip:** It is preferable to resect the femur a millimeter or two distal to the marked resection level. This will allow the facing reamer **(Figure 7)** to plane accurately up to the mark at a 90° angle.
- **Note:** It is extremely important not to distract the extremity following the resection. The end of the femoral osteotomy should be kept well padded to avoid injuring the femoral vessels. The length of the resected specimen should be checked and measured again following resection.

Preparation of the femur

A Flexible Guide Wire is inserted into the femoral canal. Flexible Reamers are utilized to progressively ream the canal to the appropriate diameter. To permit an adequate cement mantle, the canal should be reamed to 2mm larger than the selected stem of the prosthesis.

- **Note:** The seven stem diameters are 8mm, 9mm, 10mm, 11mm, 13mm, 15mm and 17mm.

The appropriate Facing Reamer **(Figure 7)** is used to plane the osteotomy site so as to facilitate direct contact and accurate seating of the prosthesis upon the cortices.

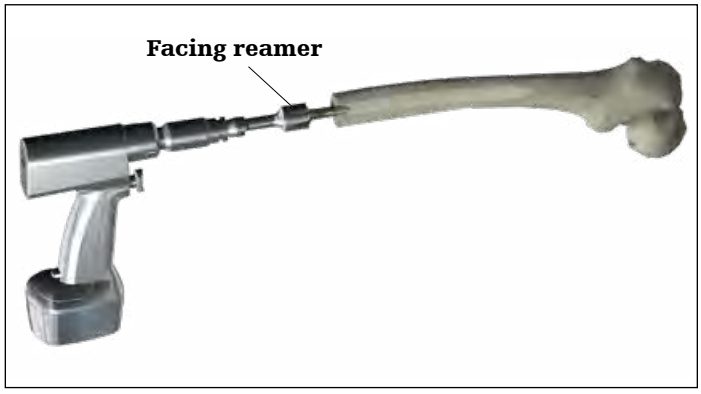


Figure 7

The chosen Trial Stem is inserted to evaluate ease of insertion and an appropriate cement mantle. The trial cemented stems are designed to be exactly size for size as compared to the implant and do not include the cement mantle.

If there is any difficulty inserting the trial stem, continue reaming until the Trial Stem fits freely into the canal, or re-assess the Trial Stem size. It is extremely important to verify the close apposition of the seat of the Trial Stem to the cortex.

Stem diameter	Suggested Flexible Reamer diameter	Seat diameter
Ø 8mm	Ø 10mm	Ø 22mm
Ø 9mm	Ø 11mm	Ø 22mm
Ø 10mm	Ø 12mm	Ø 24mm
Ø 11mm	Ø 13mm	Ø 24mm
Ø 13mm	Ø 15mm	Ø 28mm
Ø 15mm	Ø 17mm	Ø 32mm
Ø 17mm	Ø 19mm	Ø 36mm

Tibial preparation: Revision Baseplate

Revision Baseplate with Cemented Stems

Cemented stems come in 9, 12, and 15mm diameters in 50, 100 and 150mm lengths.

If Fluted stems are preferred, use the technique described in the Fluted stem section. Revision Baseplate with Fluted stems.

If the tibial preparation is on a native tibia removal of the anterior portion of the central eminence will be required after IM reaming to allow the Resection Guide Tower to fully seat. General surgical instruments can be used to remove the necessary bone **(Figure 8)**. Alternatively, the Triathlon Primary IM referencing tibial resection instruments can be used, see the Addendum 1: Revision Baseplate Tibial Preparation with Primary tibial instrumentation portion of this protocol.

- **Attention:** The Revision Baseplate is not indicated for use with Size A Tibial Cones. The smallest compatible size is Size B.

Figure 8

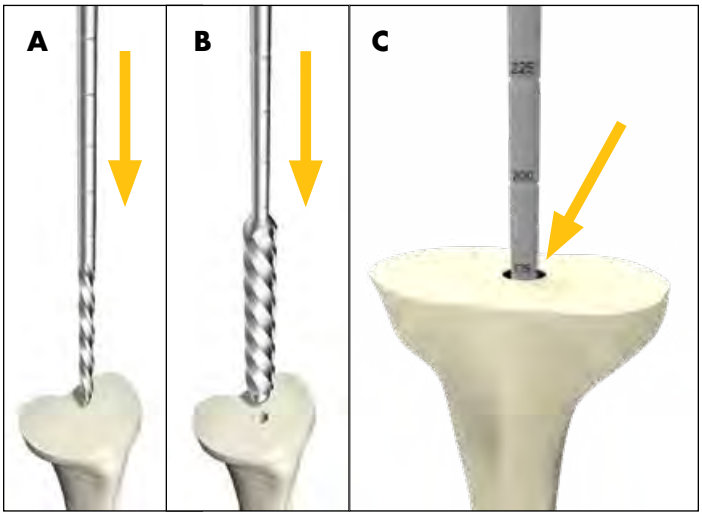


Figure 9

Revision Baseplate: Intramedullary tibial preparation

Assemble the 8mm Starter Awl to either the T-handle or power unit using the Universal Driver.

Ream the tibial intramedullary canal **(Figure 9A)**.

Technical points

If determining the appropriate pilot hole is challenging, considering using AP and lateral x-rays to determine the appropriate starting point.

Referencing the desired tibial resection, ream to desired stem depth (refer to depth chart) or to a length of fixation preferred for tibial alignment. Grooves along the shank of the reamer indicate the depth of the reamer in the canal **(Figure 9C)**.

- **Note:** If Cone Augment usage is anticipated, a 175mm reamer depth will be required.

Progressively ream, increasing diameter in 1mm increments until adequate purchase is achieved, and leave the final reamer in the canal **(Figure 9B)**. Tap the final reamer gently with a mallet to assure that it is firmly seated.

Depth markings: Cemented Stem components

Stem length	Depth marking
50mm	125
100mm	175
150mm	225

- **Note:** The Revision Baseplate is not compatible with offset adapters.

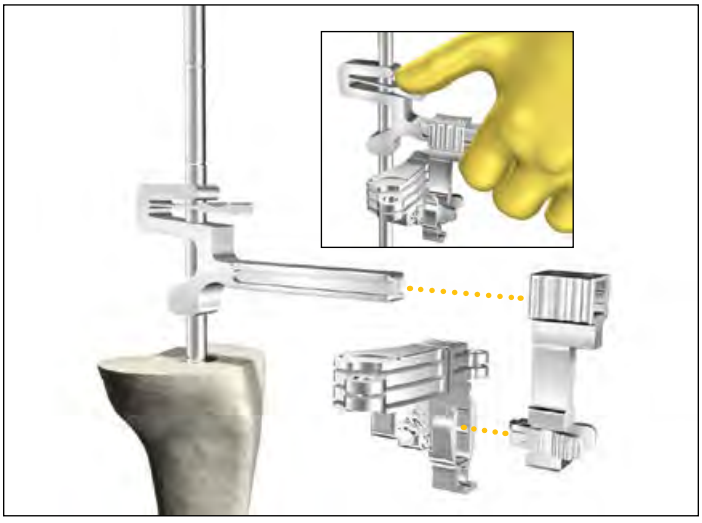


Figure 10

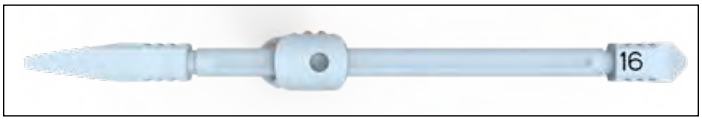


Figure 11

Figure 12

Figure 13

Technical points

- **Attention:** Tibial offsetting with the Revision baseplate is not possible.

If Tibial Augments are to be used, ream until the depth marking is flush with the expected augment cut. Use the bottom of the line marking as the depth reference.

When using a cemented stem, it is not necessary to gain cortical chatter as cancellous bone may be unnecessarily removed.

Be sure to completely remove cement and sclerotic bone from the center of the canal.

Revision Baseplate: Proximal tibial resection

Slide the Resection Guide Tower over top of the IM Reamer by depressing the finger tab as shown **(Figure 10)**. Assemble the Revision Tibial Resection Guide to the Support Arm. Slide the assembly on to the Resection Guide Tower.

Depress the finger tab on the Resection Guide Tower and slide the assembly to the desired distal/proximal position on the IM Reamer.

Use the Blade Runner through the cutting slot to approximate the resection level.

- When determining the tibial resection consider the native joint line and patella tracking.
- In a revision procedure a **2mm cleanup** resection cut can be performed. 2mm of bone will be resected with the initial proximal resection when using the "2" end of the Triathlon Stylus.
- In a native joint for a hinge procedure, where Triathlon Revision Baseplate is used, to maintain the joint line, the minimum tibial resection from the **native joint line is 16mm**. 16mm of bone will be resected with the initial proximal resection when using the "16" end of the Hinge Tibial Stylus **(Figure 11)**.
  - In a native joint the Hinge Tibial Stylus "11" end of the Hinge Tibial Stylus may be used for a reduced resection. 11mm of bone will be resected with the initial proximal resection when using the "11" end of the Hinge Stylus.

Use the Blade Runner through the cutting slots to approximate any augment resection level and rotational alignment of the guide when planning for an augment on one side of the tibia **(Figure 12)**.

The Universal Alignment Rod can be used to aid in setting the final component position by inserting it through the Universal Alignment Handle and assembling the Universal Alignment Handle to the Revision Tibial Resection Guide **(Figure 13)**.

- **Note:** In a bowed tibia, a surgeon may need to retract the reamer from 175mm depth to set the proper tibial cut slope.

Pin the Revision Tibial Resection Guide to the proximal tibia when the resection level has been determined.

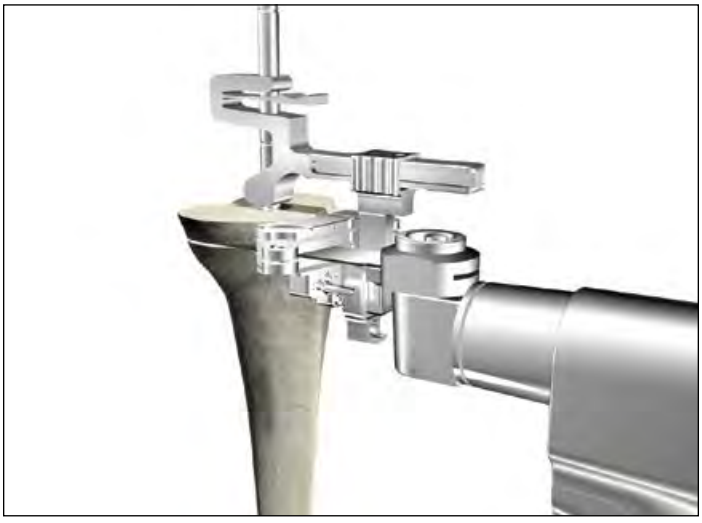


Figure 14

Figure 15

Figure 16

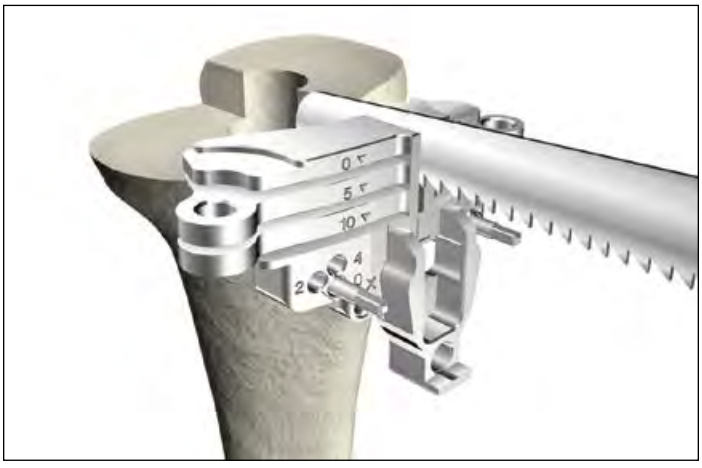


Figure 17

Technical points

- **Tip:** To help facilitate easy removal of the Resection Guide Tower and Support Arm, place pins perpendicular to the bone.

Make a cut to produce a resected surface with a neutral slope **(Figure 14)**.

Tibial augment resections can be made at this point with the Revision Tibial Resection Guide using a narrow, 15mm -wide, 0.050" thick oscillating saw blade. Make a 5mm or 10mm augment resection as appropriate.

After completing the cut around the reamer shaft, remove the Support Arm, Resection Guide Tower, and IM Reamer before completing the tibial resection. To do so, depress the tabs on the Support Arm to disengage it from the Revision Tibial Resection Guide. Slide the Support Arm anterior **(Figure 15)**. Depress the tab on the Resection Guide Tower and slide it off the IM Reamer **(Figure 16)**. Use a T-handle to remove the IM Reamer.

Once the IM reamer is removed, an additional cross pin can be added to the Revision Tibial Resection Guide.

Using a reciprocating saw blade through the Revision Tibial Resection Guide **(Figure 17)**, complete the sagittal augment resection.

Remove the pins and Tibial Resection Guide.

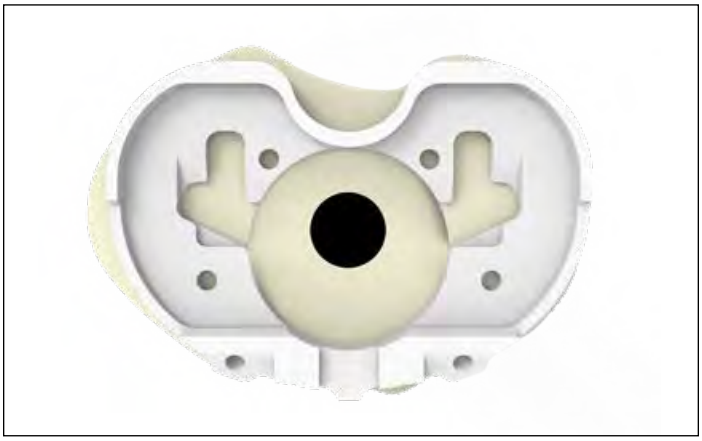


Figure 18

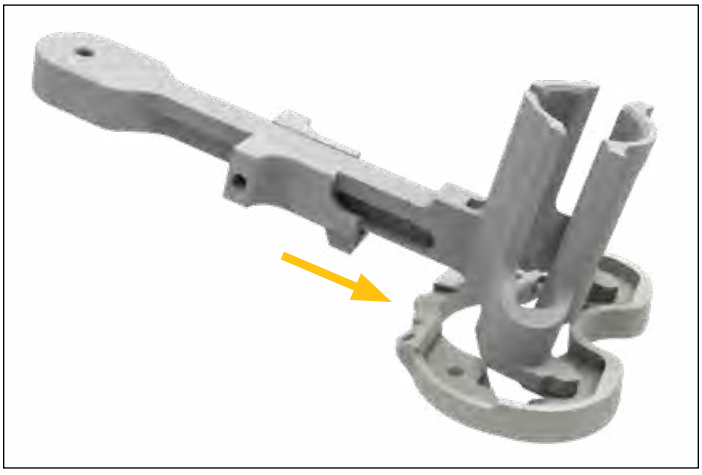


Figure 19

Figure 20

Technical points

Surgeons who prefer a non-captured cut can use the top of the resection guide. The 0mm and 5mm cut slots can then be used for 5mm and 10mm augment resections, respectively.

- **Note:** The 10mm slot should not be used if executing a non-captured cut.
- **Note:** If a tibial stylus is used to ascertain resection depth, the depth will not correspond with the non-captured top surface.

Revision Baseplate: Tibial Template sizing and positioning

- **Attention:** Tibial offsetting with the Revision baseplate is not possible.

Size the proximal tibia with a Universal Tibial Template **(Figure 18)**.

The Tibial Alignment Handle can be attached to the Universal Tibial Template if desired for tibial sizing.

- Attach Tibial Augment Trials (if tibial augment cuts were made) to the underside of the Universal Tibial Template.

Rotational alignment of the Universal Tibial Template should be checked. An alignment rod can be used to aid in setting the final component position. To check alignment, attach the Revision Keel Punch Guide to the Universal Tibial Template ensuring the slider is engaged **(Figure 19)**. Insert the Universal Alignment Rod through the hole in the Revision Keel Punch Guide **(Figure 20)**.

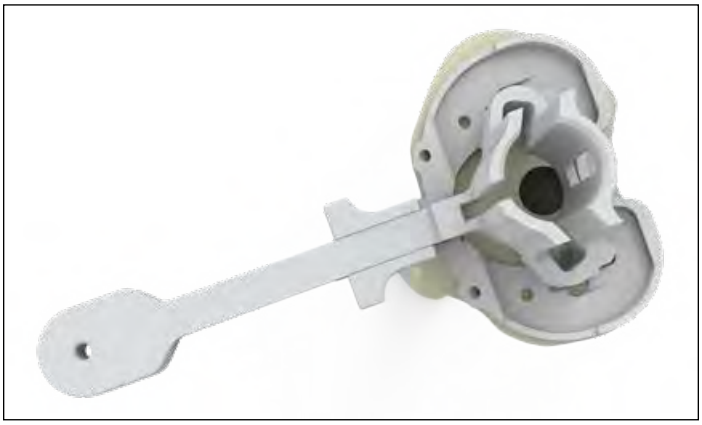


Figure 21

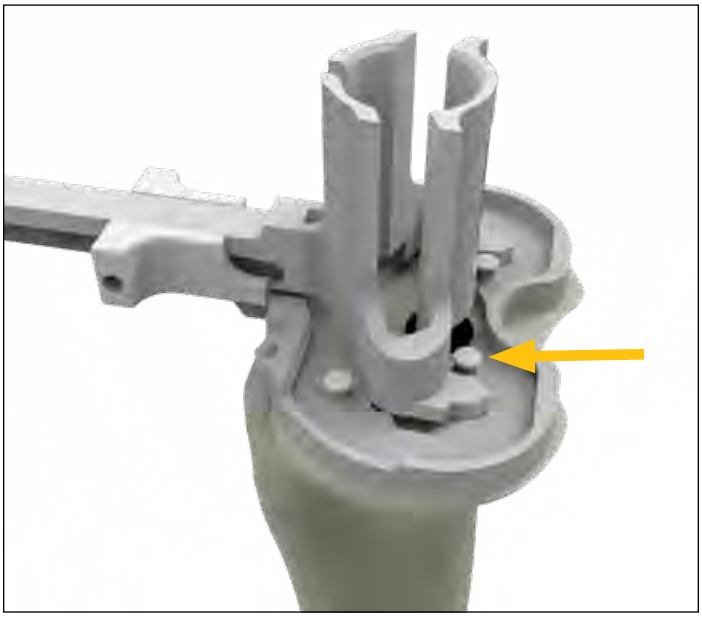


Figure 22

Figure 23

Technical points

Offsetting is not possible with the Revision Baseplate. In some tibias, especially small tibias, prior to pinning the template it is recommended to visually assess if downsizing and/or repositioning the tibial template or downsizing the stem may be required to avoid impingement with the anterior cortices in subsequent reaming or keel punching steps. In order to assess this, complete the steps as follows:

- Insert last size reamer into the canal and lightly tap to seat it.
- Assemble the appropriately sized tibial template and keel punch guide. Assemble the template and guide over the shaft of the reamer onto the resected tibia.
- The magnitude of the offset observed between the IM reamer and the diameter of the keel punch guide should be used as a reference to determine if downsizing and/or repositioning the template may be required.

If adequate coverage and position is attained, pin the Universal Tibial Template to the proximal tibia using headed pins in the anterior template tray pin holes or headless pins in the anterior angled pin holes **(Figure 21)**.

Technical points

If additional fixation is needed for the Universal Tibial Template to the proximal tibia, remove the Revision Keel Punch Guide from the template (if assembled) and place headed nails into the posterior template pin holes **(Figure 22)**. Once completed, reassemble the Revision Keel Punch Guide.

It is optional to mark the anterior surface of the tibia. Align the marks to the two engravings on the template to ensure that rotation in subsequent steps matches the planned rotation **(Figure 23)**.

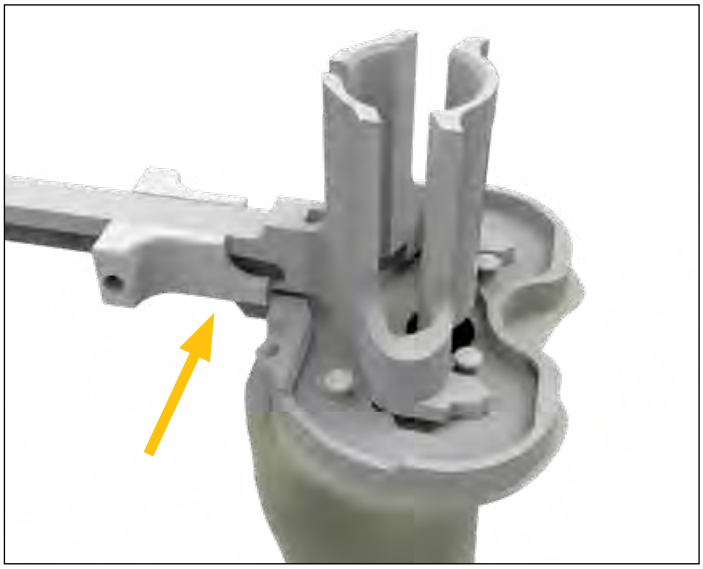


Figure 24

Figure 25

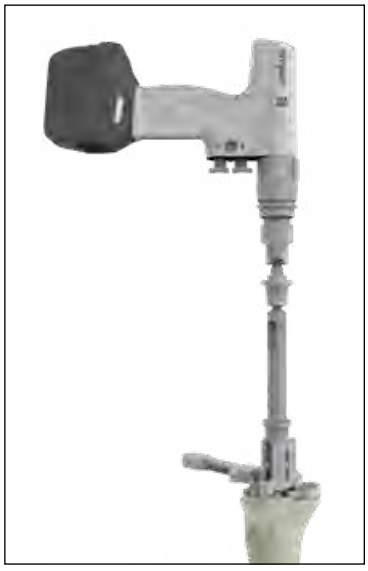


Figure 26

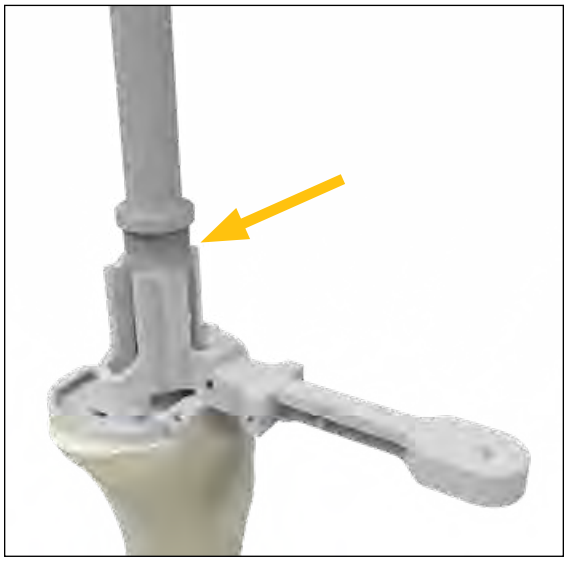


Figure 27

Revision Baseplate: Boss preparation

If not already assembled, assemble the Revision Keel Punch Guide to the Universal Tibial Template. Ensure the slider is engaged with the tibial template **(Figure 24)**.

Attach the Modular T-Handle to the Revision Boss Reamer and ream by hand until the physical stop is reached **(Figure 25)**. If fully seating the reamer is difficult, the Revision Boss Reamer may be attached to power only if the solid cylinder of the boss reamer has engaged the Revision Keel Punch Guide **(Figures 26** and **27.)**. Attach the Revision Boss Reamer to the power unit using the Universal Driver.

- **Attention:** Caution should be used to avoid perforating the anterior cortices during reaming.

Remove Revision Boss Reamer.

Technical points

- **Attention:** If the Revision Boss Reamer engages cortical bone or the pinned template begins to lift off the tibia, consider downsizing and/or repositioning the tibial template. In this position, the boss of the Revision Baseplate may prevent the baseplate from fully seating. This may happen in small tibias or tibias with a significant bow. Caution should be used to avoid perforating the anterior cortices.

In sclerotic bone, the use of a saw prior to the Revision Keel Punch may be advisable.

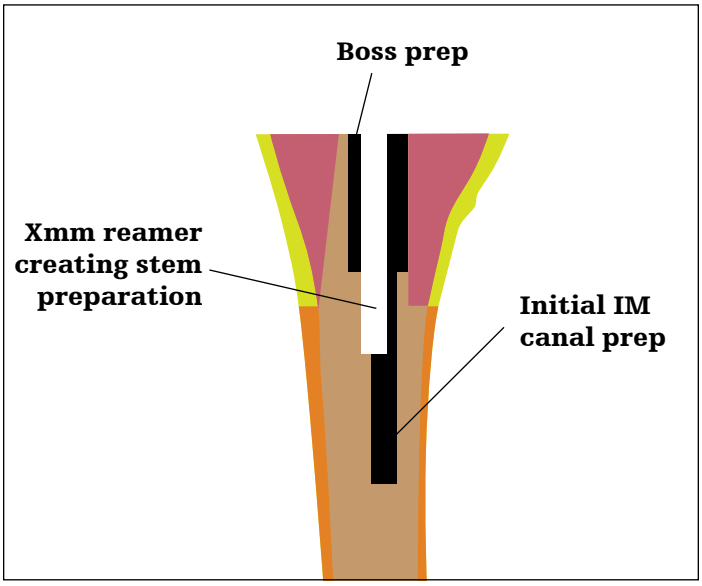


Figure 28

Revision Baseplate: Cemented Stem preparation

To facilitate proper stem preparation coaxial to the boss preparation **(Figure 28)**, the Neutral Bushing Guide should be used to ream for the stem.

Assemble the Neutral Bushing Guide to the 8mm Starter Awl (or downsized reamer size of choice) and insert the reamer through the keel punch guide. Once the reamer is seated in the boss preparation, allow the Neutral Bushing Guide to bottom out in the Revision Keel Punch Guide **(Figure 29)**. This will help ensure the stem preparation will be coaxial to the Revision Boss Reamer preparation.

▶ **Note:** Do not impact the Neutral Bushing Guide into the Keel Punch Guide.

Ream using the T-handle or power unit attached to the Universal Driver.

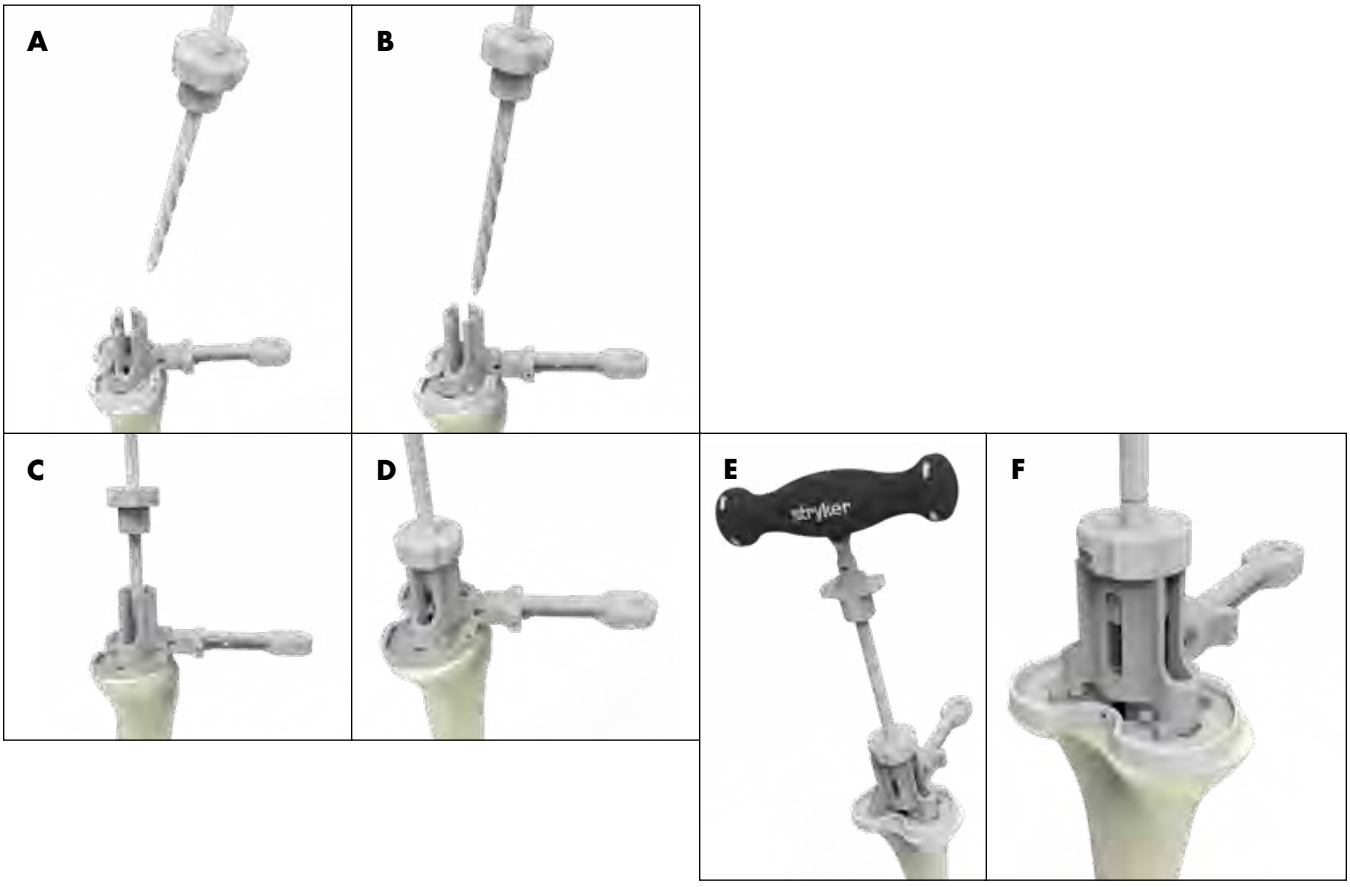


Figure 29

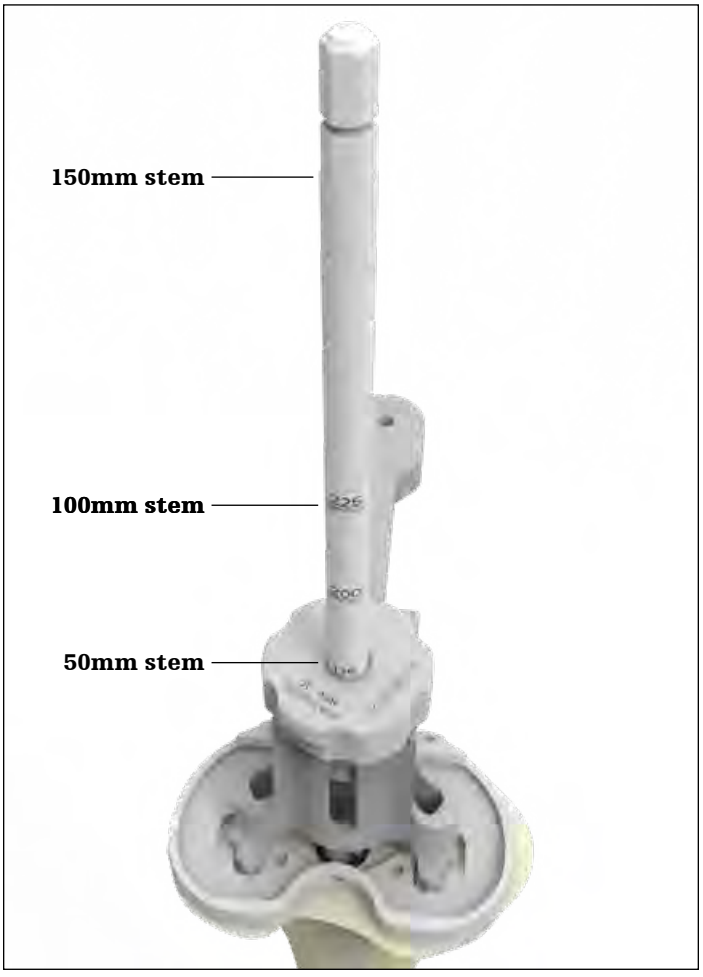


Figure 30

For a 50mm stem, ream until the 175mm marker on the IM reamer is flush with the proximal surface of the Neutral Bushing Guide **(Figure 30)**. For other stem lengths refer to the table below. Incrementally ream until the desired stem diameter and cement mantle is reached.

Technical point

If the reamer cannot reach 175mm, consider downsizing and/or repositioning the tibial baseplate. In this position, the stem may prevent the baseplate from fully seating. If repositioning is desired, preparation of the bone will be required again.

Depth markings: Cemented stem components

Stem length	Depth marking
50mm	175
100mm	225
150mm	Bottom of the power tool where it attaches to the reamer

- **Note:** The Revision Baseplate is not compatible with offset adapters.
- **Note:** If using stem extender implants (5571-S-025 and 5571-S-050), ream an additional 25mm or 50mm. Note that the stem extender implants have a 16mm diameter; ream accordingly based on desired stem type. **The 50mm Stem Extender cannot be used with the Triathlon Revision Tibial Baseplate Components (5612-B-X00) when used with a 150mm Triathlon TS Stem.**

Remove the reamer.

Figure 31

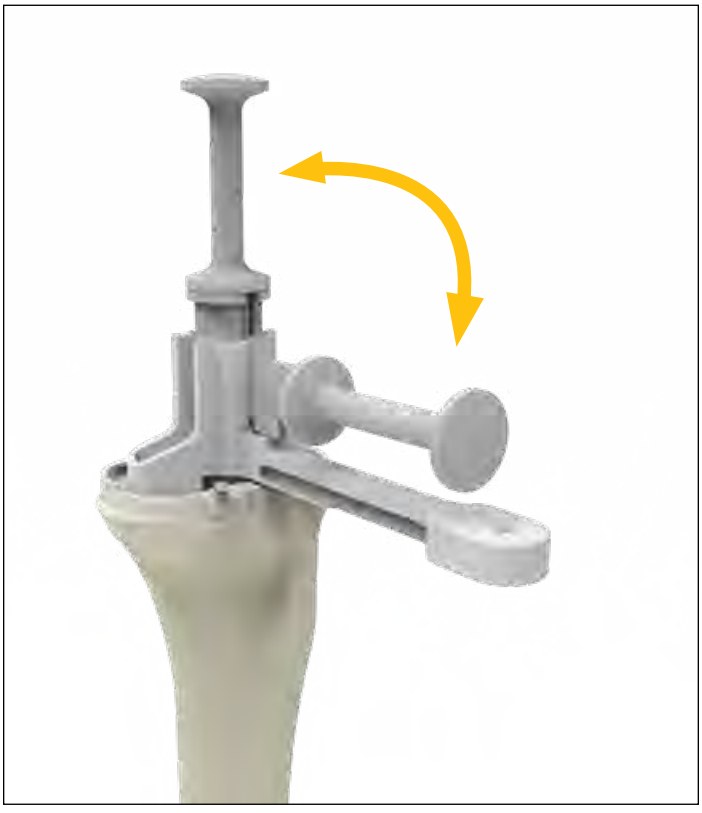


Figure 32

Keel preparation

Place the appropriate Revision Keel Punch into the Revision Keel Punch Guide, and ensure the tab is engaged with the guide. Use a mallet to impact the punch. Advance the Revision Keel Punch until it seats fully in the Revision Keel Punch Guide **(Figure 31)**.

To extract the Revision Keel Punch, lift the Revision Keel Punch handle slightly proximal and rotate the handle anteriorly, engaging the anterior tab of the Revision Keel Punch Guide, to cantilever the Revision Keel Punch out of the tibia **(Figure 32)**.

Remove the Revision Keel Punch Guide, Keel Punch and Universal Tibial Template.

If desired, a Trial Baseplate and Stem trial can be used to confirm the tibial preparation is appropriate for the desired construct.

If using cones proceed to the Triathlon Tritanium Tibial Cone Augment Preparation section of this protocol. If cones are not being used proceed to the Femoral Preparation: Hinge Femur section of this protocol.

Figure 33

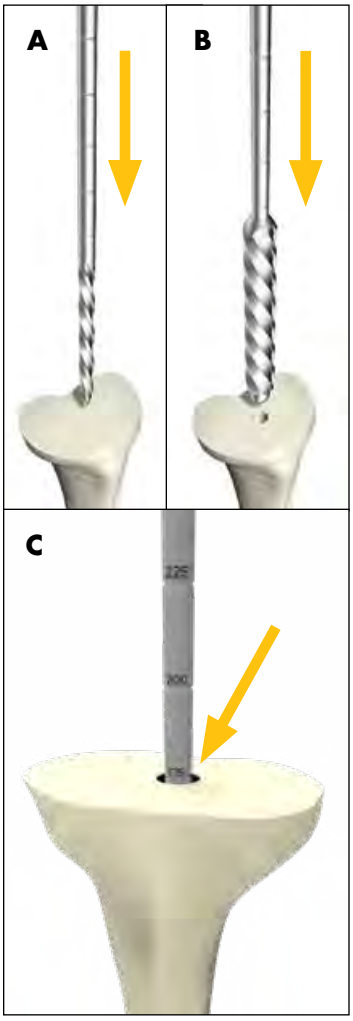


Figure 34

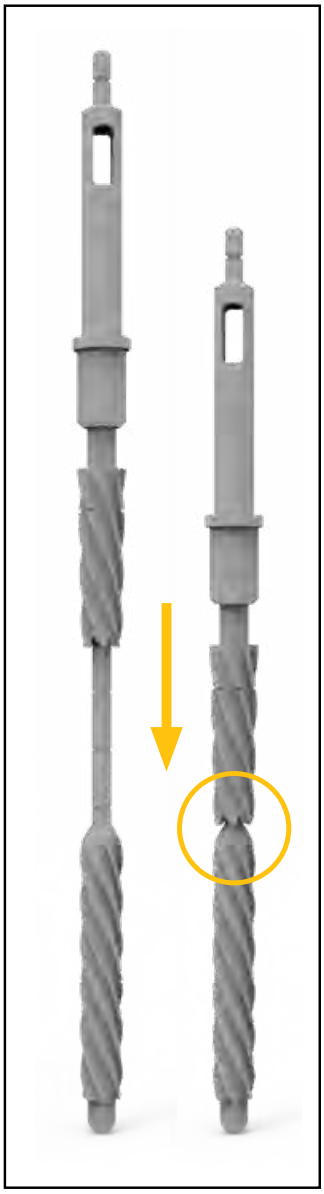


Figure 35

Revision Baseplate with Fluted Stems

- **Attention:** Tibial offsetting with the Revision baseplate is not possible. In clinical scenarios where baseplate overhang may occur, consider using cemented stems.

If the tibial preparation is on a native tibia, removal of the anterior portion of the central eminence will be required after IM reaming to allow the Resection Guide Tower to fully seat. General surgical instruments can be used to remove the necessary bone **(Figure 33)**. Alternatively, the Triathlon Primary IM referencing tibial resection instruments can be used, see the Addendum 1: Revision Baseplate Tibial Preparation with Primary tibial instrumentation portion of this protocol.

- **Attention:** The Revision Baseplate is not indicated for use with Size A Tibial Cones. The smallest compatible size is Size B.

Revision Baseplate: Intramedullary tibial preparation

Assemble the 8mm Starter Awl to either the T-Handle or power unit using the Universal Driver.

Ream the tibial intramedullary canal **(Figure 34A)**.

Technical points

If determining the appropriate pilot hole is challenging, considering using AP and lateral x-rays to determine the appropriate starting point.

Referencing the desired tibial resection, ream to the desired stem depth (refer to depth chart) or to a length of fixation preferred for tibial alignment. Grooves along the shank of the reamer indicate the depth of the reamer in the canal **(Figure 34C)**.

Progressively ream, increasing diameter in 1mm increments until adequate purchase is achieved, and leave the final reamer in the canal **(Figure 34B)**. Tap the final reamer gently with a mallet to assure that it is firmly seated.

Ream depth (mm): Fluted Stem components

Stem length	Depth marking
100mm	175*
Tibial Cone	175*
150mm	225

* If the final IM reamer is 16-18mm in diameter, an additional 25mm of reaming is required, resulting in a 200mm ream depth. This is required to avoid interference between the Revision Boss Reamer and the IM reamer cutting flutes **(Figure 35)**.

- **Note:** The Revision Baseplate is not compatible with offset adapters.
- **Note:** When reaming for stem extenders (5571-S-025 and 5571-S-050), ream an additional 25mm or 50mm accordingly. Note that the stem extender implants have a 16mm diameter; ream accordingly based on desired stem type. **The 50mm Stem Extender cannot be used with the Triathlon Revision Tibial Baseplate Components (5612-B-X00) when used with a 150mm Triathlon TS Stem.**

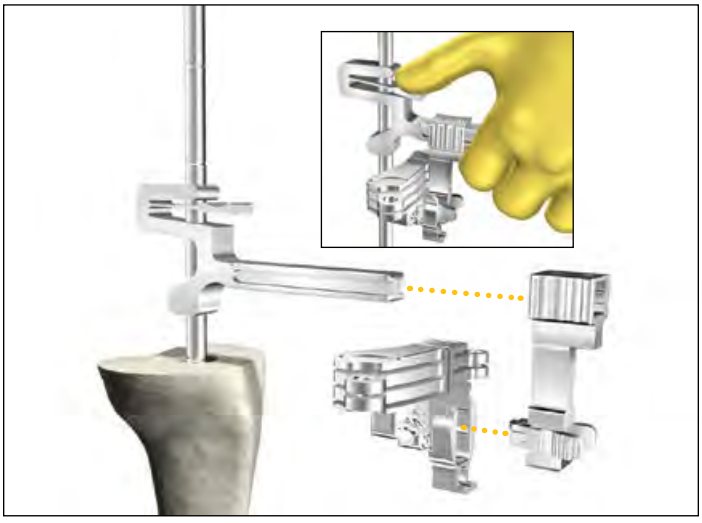


Figure 36

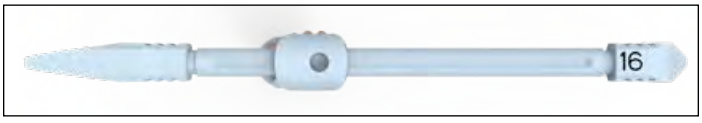


Figure 37

Figure 38

Figure 39

Technical points

If Tibial Augments are to be used, ream until the depth marking is flush with the expected augment cut. Use the bottom of the line marking as the depth reference.

Be sure to completely remove cement and sclerotic bone from the center of the canal.

Revision Baseplate: Proximal tibial resection

Slide the Resection Guide Tower over top of the IM Reamer by depressing the finger tab as shown **(Figure 36)**. Assemble the Revision Tibial Resection Guide to the Support Arm. Slide the assembly on to the Resection Guide Tower.

Depress the finger tab on the Resection Guide Tower and slide the assembly to the desired distal/proximal position on the IM Reamer.

Use the Blade Runner through the cutting slot to approximate the resection level.

- When determining the tibial resection consider the native joint line and patella tracking.
- In a revision procedure a **2mm cleanup** resection cut can be performed. 2mm of bone will be resected with the initial proximal resection when using the "2" end of the Triathlon Stylus.
- In a native joint for a hinge procedure, where Triathlon Revision Baseplate is used, to maintain the joint line, the minimum tibial resection from the **native joint line is 16mm.** 16mm of bone will be resected with the initial proximal resection when using the "16" end of the Hinge Tibial Stylus **(Figure 37)**.
  - In a native joint the Hinge Tibial Stylus "11" end of the Hinge Tibial Stylus may be used for a reduced resection. 11mm of bone will be resected with the initial proximal resection when using the "11" end of the Hinge Stylus.

Use the Blade Runner through the cutting slot to approximate any augment resection level and rotational alignment of the guide when planning for an augment on one side of the tibia **(Figure 38)**.

The Universal Alignment Rod can be used to aid in setting the final component position by inserting it through the Universal Alignment Handle and assembling the Universal Alignment Handle to the Revision Tibial Resection Guide **(Figure 39)**.

▸ **Note:** In a bowed tibia, a surgeon may need to retract the reamer from 175mm depth to set the proper tibial cut slope.

Pin the Revision Tibial Resection Guide to the proximal tibia when the resection level and rotational alignment has been determined.

Figure 40

Figure 41

Technical points

- **Tip:** To help facilitate easy removal of the Resection Guide Tower and Support Arm, place pins perpendicular to the bone.

Make a cut to produce a resected surface with a neutral slope.

After completing the cut around the reamer shaft, remove the Support Arm, Resection Guide Tower, and IM Reamer before completing the tibial resection. To do so, depress the tabs on the Support Arm to disengage it from the Revision Tibial Resection Guide. Slide the Support Arm anterior **(Figure 40)**. Depress the tab on the Resection Guide Tower and slide it off the IM Reamer **(Figure 41)**. Use a T-Handle to remove the IM Reamer.

Once the IM reamer is removed, an additional cross pin can be added to the Revision Tibial Resection Guide.

Tibial augment resections can be made at this point with the Revision Tibial Resection Guide using a narrow, 15mm-wide, 0.050" thick oscillating saw blade. Make a 5mm or 10mm augment resection as appropriate.

Using a reciprocating saw blade through the Revision Tibial Resection Guide, complete the sagittal augment resection **(Figure 42)**.

Remove the pins and Tibial Resection Guide.

Technical points

Surgeons who prefer a non-captured cut can use the top of the resection guide. The 0mm and 5mm slots can then be used for 5mm and 10mm augment resections, respectively.

- **Note:** The 10mm slot should not be used if executing a non-captured cut.
- **Note:** If a tibial stylus is used to ascertain resection depth the depth will not correspond with the non-captured top surface.

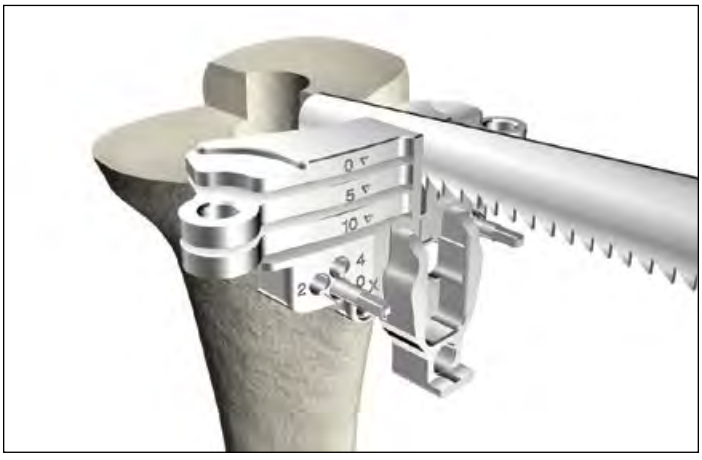


Figure 42

Figure 43

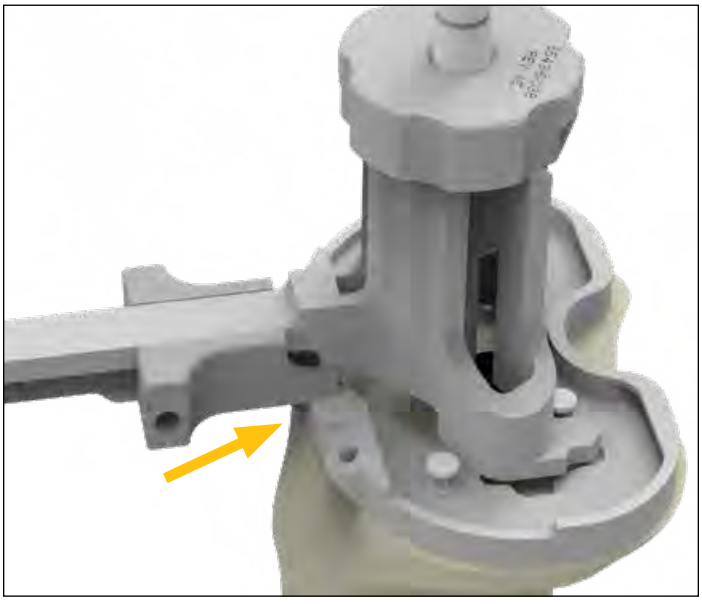


Figure 44

Revision Baseplate: Tibial Template sizing and positioning

Reinsert the last IM reamer.

Size the proximal tibia with a Revision Tibial Template, Revision Keel Punch Guide, and Neutral Bushing Guide placed over the reamer and onto the resected surface of the tibia **(Figure 43)**. Ensure that the slider is engaged with tibial template **(Figure 44)**.

- Attach Tibial Augment Trials (if tibial augment cuts were made) to the underside of the Universal Tibial Template.

▸ **Attention:** Tibial offsetting with the Revision Baseplate is not possible.

Figure 45

Figure 46

Rotational and alignment of the Universal Tibial Template should be checked. An alignment rod can be used to aid in setting the final component position.

- To check alignment, attach the Revision Keel Punch Guide to the Universal Tibial Template ensuring the slider is engaged. Insert the Universal Alignment Rod through the hole in the Revision Keel Punch Guide **(Figure 45)**.

If adequate coverage and position is attained, pin the Universal Tibial Template to the proximal tibia using headless pins in the anterior angled pin holes or headed pins in the anterior template tray pin holes.

If adequate coverage and position is not attained, consider downsizing the tibial template.

Technical points

If additional fixation is needed for the Universal Tibial Template to the proximal tibia, remove the IM Reamer Neutral Bushing Guide and Revision Keel Punch Guide and place headed nails into the posterior template pin holes **(Figure 46)**. Once completed, reassemble the Revision Keel Punch Guide.

It is optional to mark the anterior surface of the tibia. Align the marks to the two engravings on the template to ensure that rotation in subsequent steps matches the planned rotation **(Figure 47)**.

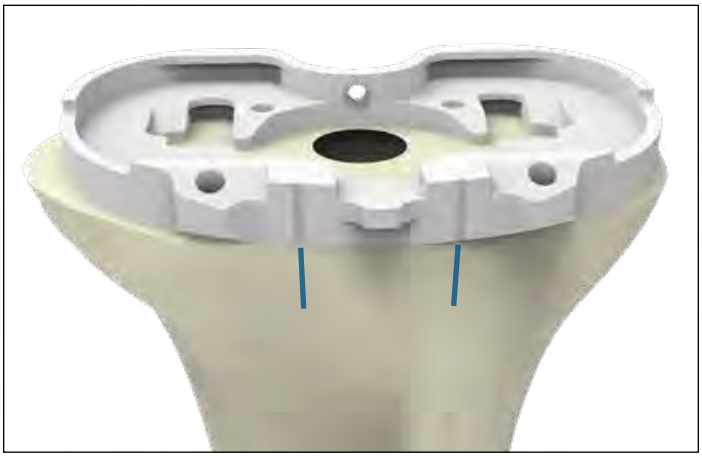


Figure 47

Figure 48

Figure 49

Figure 50

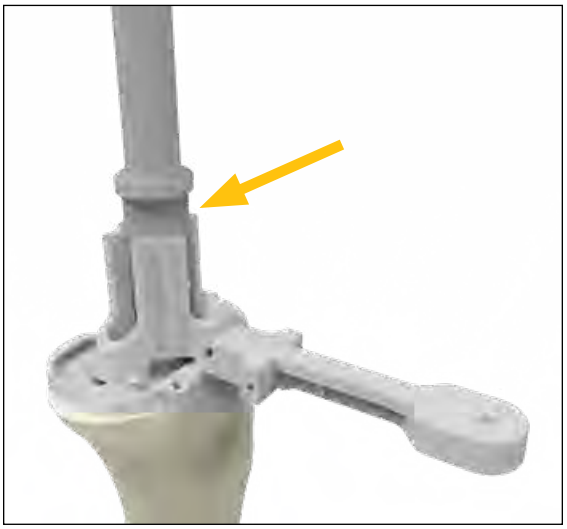


Figure 51

Revision Baseplate: Boss preparation

If the IM reamer is greater than or equal to 19mm, the Revision Boss Reamer is not necessary. The IM reamer has prepared for the Revision Baseplate boss diameter.

Remove the Neutral Bushing Guide from the Revision Keel Punch Guide, leaving the IM reamer and Revision Keel Punch Guide in place.

Attach the Modular T-Handle to the Revision Boss Reamer. Place the Revision Boss Reamer over the shank of the IM reamer and into the Revision Keel Punch Guide **(Figures 48** and **49)**. Ream until the physical stop is reached.

If reaming is difficult, the Revision Boss Reamer may be attached to power only if the solid cylinder of the boss reamer has engaged the Revision Keel Punch Guide **(Figures 50** and **51)**. Attach the Revision Boss Reamer to the power unit using the Universal Driver.

- **Attention:** Caution should be used to avoid perforating the anterior cortices.

Remove Revision Boss Reamer and IM Reamer.

Technical points

In sclerotic bone, the use of a saw prior to the Revision Keel Punch may be advisable.

Figure 52

Keel preparation

Place the appropriate Revision Keel Punch into the Revision Keel Punch Guide, and ensure the tab is engaged with the guide. Use a mallet to impact the punch. Advance the Revision Keel Punch until it seats fully in the Revision Keel Punch Guide **(Figure 52)**.

To extract the Revision Keel Punch, lift the Revision Keel Punch handle slightly proximal and rotate the handle anteriorly, engaging the anterior tab of the Revision Keel Punch Guide, to cantilever the Revision Keel Punch out of the tibia **(Figure 53)**.

Once the tibia is fully prepared, remove the Universal Tibial Template and Revision Keel Punch Guide Assembly **(Figure 54)**.

If using cones proceed to the Triathlon Tritanium Tibial Cone Augment Preparation section of this protocol.

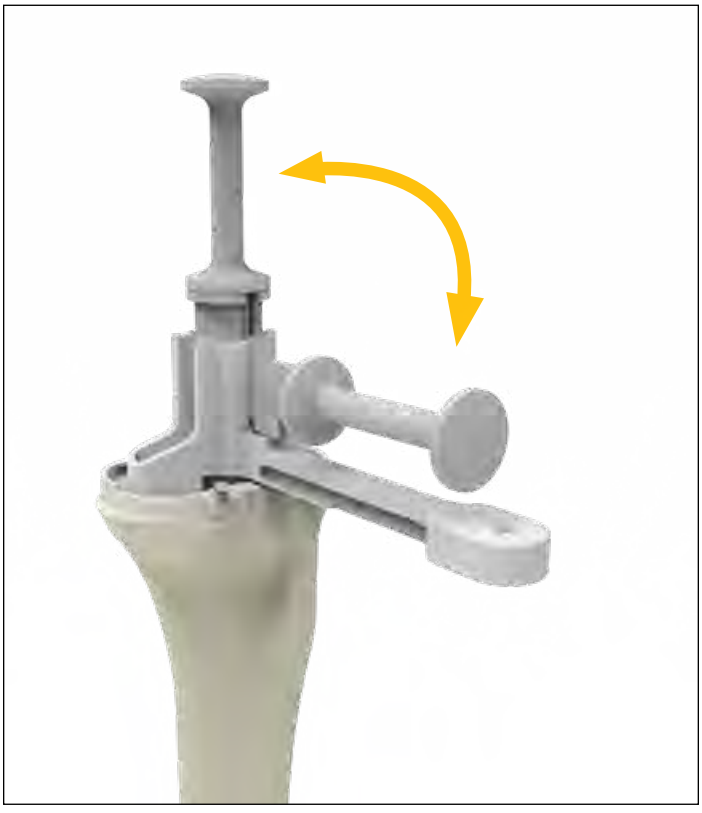


Figure 53

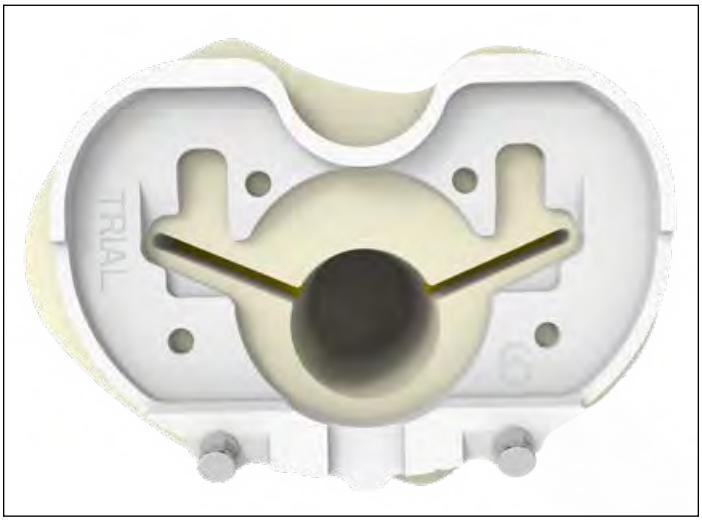


Figure 54

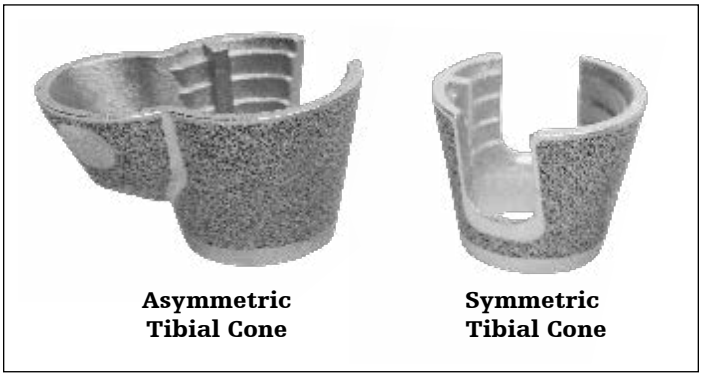


Figure 55

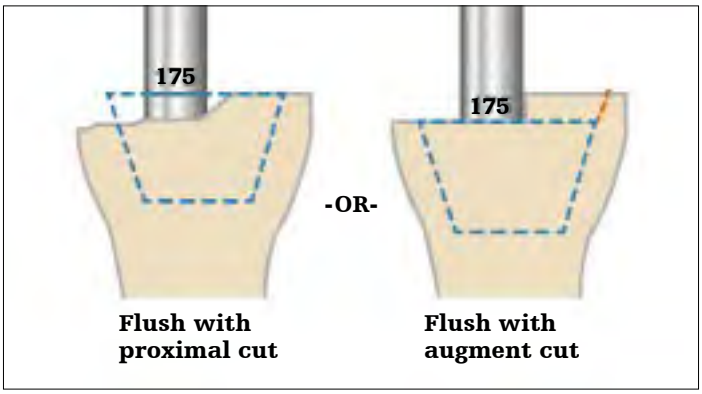


Figure 56

Triathlon Tritanium Tibial Cone Augment preparation

Triathlon Tritanium Tibial Cone Augments come in two different shapes **(Figure 55)**.

Tibial Canal Preparation for Tibial Cone Augments

- **Attention:** Tibial Cone size A is not intended for use with the Revision Baseplate.

Option 1: Reamer-based

When using a Symmetric/Asymmetric Cone, a minimum depth of 175mm is recommended for the IM reamer to facilitate accurate cone reaming and to ensure that the flutes on the Tibial Symmetric Cone Reamer do not interfere with the flutes on the IM Reamer.

Tap the final IM Reamer gently with a mallet to ensure that it is fully seated.

- **Note:** If Tibial Augments are to be used, ream until the 175mm marking is flush with the augment cut. Use the bottom of the 175mm line marking as the depth reference. See **Figure 56**.

Option 2: Stem Extender Shaft-based

If desired, the IM reamer can be removed and subsequent preparation can be based off of a Stem Trial utilizing the required Stem Trial and the Stem Extender Shaft.

Assemble the Stem Extender Shaft (6543-4-516) to the appropriate diameter Stem Trial and place the assembly into the canal.

Continue with Tibial Preparation as described in the protocol.

Ream depth: Tibial components with cones

Stems (with Cones)	Depth
100mm	175 (3rd groove)
150mm	175 (3rd groove)

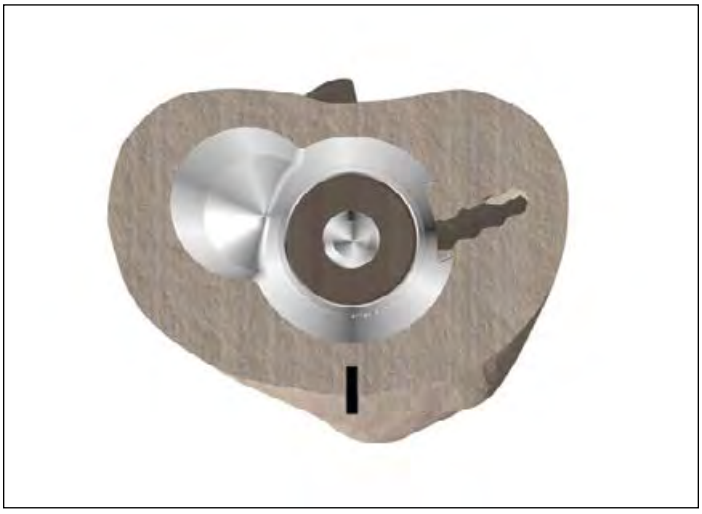


Figure 57

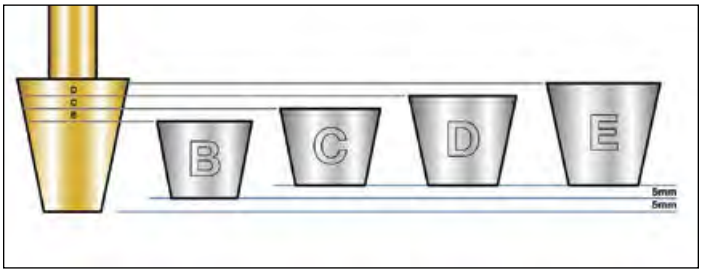


Figure 58

Figure 59

Figure 60

Preliminary Cone sizing

Depending on the size and geometry of bone defect, either a symmetric or asymmetric tibial cone augment may be selected. Inverting a contralateral leg cone trial may help determine bone defect, assess cone coverage, and determine if symmetric or asymmetric cone is required.

- **Note:** Invert the Cone Trial over the resected tibial bone and ensure that the trial is centered on the IM Reamer **(Figure 57)**. Centering the trial helps to ensure proper positioning.

Revision Baseplate with Symmetric Tibial Cone

Symmetric Tibial Cone preparation

Ensure that the Tibial Symmetric Cone Reamer is being used. This can be confirmed by checking that the reamer shaft reads "TIBIA."

Grooves on the reamer specify cone size **(Figure 58)**. Reference the sizing chart to help determine appropriate cone sizing (See chart on the next page for Cone and Baseplate sizing options).

- **Note:** Use the top line of the groove (of the desired size) as the depth reference.

Insert the Tibial Symmetric Cone Reamer over the IM Reamer **(Figure 59)**. If reaming under power, confirm that the drill is set to ream mode before reaming begins. Start the reamer before engaging the bone. Ream down to the desired depth/size **(Figure 60)**.

- **Caution:** If the bone is soft, osteopenic, fractured, or sclerotic, consider initially reaming by hand using the T-Handle.

Remove both the Tibial Symmetric Cone Reamer and the IM Reamer.

If using an augment, see the next page to help determine proper preparation depth.

- **Note:** If the Cone needs to be placed in a slightly more posterior position, remove the IM Reamer and replace it with an IM Reamer of a smaller diameter. Place the Tibial Symmetric Cone Reamer over the IM reamer and gently flex it posteriorly. Ream down to the desired depth/size.
- **Note:** Confirm that the Tibial Symmetric Cone Reamer is not being hindered by the cutting surface of the flutes on the IM Reamer. If so, the IM Reamer may need to be placed in a more distal position.
- **Note:** Reamer depth increases by 5mm per size.

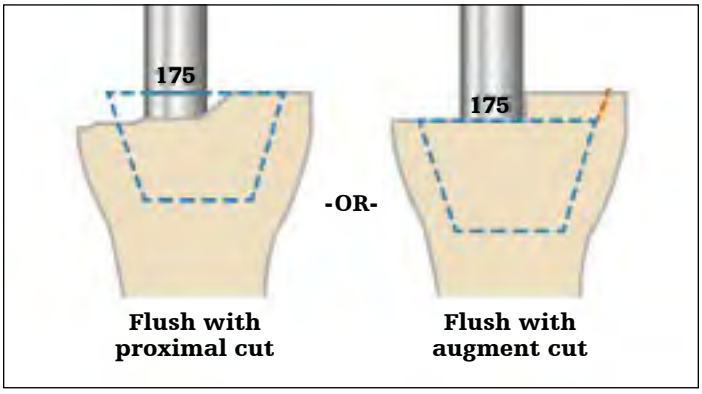


Figure 61

Tibial Cone sizes

			B	C	D	E
Implant sizes	Size 1		*			
	Size 2		*			
	Size 3		X			
	Size 4		X	X		
	Size 5		X	X	X	
	Size 6		X	X	X	X
	Size 7				X	X
Distal Diameter (OD)			23mm	25mm	25mm	25mm
Max Stem Diameter (ID)			19mm	21mm	21mm	21mm

Revision Baseplate and Tibial Cone Augment compatibility

Tibial Cone sizing per Tibial Baseplate. Blue represents optimal size conditions.

- **Note:** Cones B, C, D and E also have an asymmetric lobed option. Cones smaller than those marked with an X are still compatible but need to be positioned at least 5mm deeper. If these sizes are to be used, rotational freedom between the tibial implant and the cone may be limited with non size on size combinations. Trial to assess compatibility.
- ***Note:** Cone B, with baseplate sizes 1 and 2, has less freedom between the tibial implant and the cone than other sizes. The cone may protrude anteriorly with respect to the baseplate.

If augments are to be used, the size marking of the Tibial Symmetric Cone Reamer will indicate where the Cone will sit. Ream until the marking is flush with the augment cut **(Figure 61)**.

Technical points

- **Attention:** Tibial Cone size A (Symmetric) are not intended for use with the Revision Baseplate.
- **Attention:** The Revision Baseplate is not intended for use with offset adapters.

Remove both the Tibial Symmetric Cone Reamer and the IM Reamer.

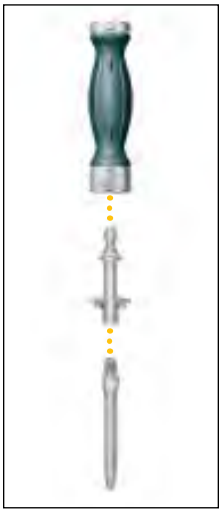


Figure 62

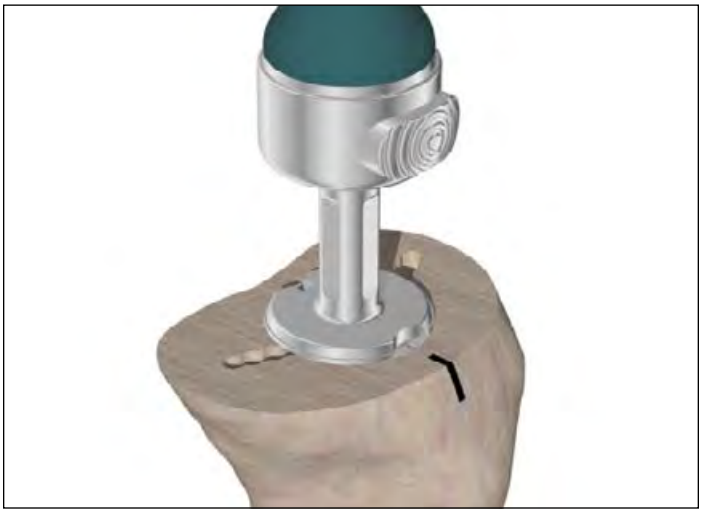


Figure 63

Symmetric Cone trialing

If bone voids are such that Asymmetric Cone preparation is necessary, refer to the Asymmetric Cone Preparation section of the protocol.

- **Note:** Cone trial may be placed in the prepared bone prior to assembling the instruments as described below.

Assemble the desired Stem Trial with the Tibial Cone Introducer, TS Impaction Handle, and the selected Symmetric Cone Trial (100mm stem maximum).

Tibial Cone Introducers are size specific.

- **Note:** Downsize the Trial Stem by 1mm.

Align the orientation key on the trial with the key feature on the Cone Introducer. The orientation key is located posteriorly on the trial **(Figure 62)**.

- **Note:** There is no positive lock on the Cone Trial and the Cone Introducer. The trial may disconnect from the introducer.
- **Note:** The Cone Trial can be placed into the prepared bone before the Stem Trial and the Cone Introducer.

When inserting the Cone Trial, ensure that the anterior rotational alignment marking on the trial is aligned with the anterior surface marking previously determined by the Universal Tibial Template **(Figure 63)**.

Insert the trial until it is seated at the appropriate depth. Remove the Cone Introducer and the Stem Trial so that only the Cone Trial remains in the void.

- **Caution:** Do not impact or implant the Cone Trials.
- **Note:** Stem trials with product code 5560-T-XXX cannot be used with cone augment instrumentation. This includes trials 5560-T-109, 5560-T-112 and 5560-T-115.

Options if added cone stability is required:

Ream to a larger Symmetric Cone (Repeat steps from the Symmetric Cone Preparation section of the protocol).

Or prepare for an Asymmetric Cone (Follow the steps from the Asymmetric Cone Preparation section of the protocol).

Or implant the Cone with cement.

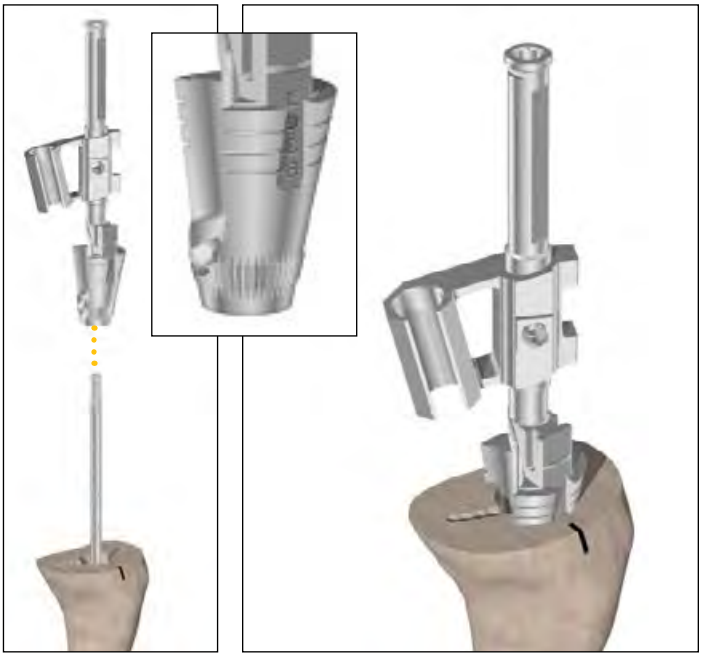


Figure 64

Revision Baseplate and Asymmetric Tibial Cone preparation

Asymmetric Tibial Cone preparation

Asymmetric Cone preparation is an option for increased stability and void filling after Symmetric Cone reaming has been completed.

Symmetric Cone preparation must be performed before Asymmetric Cone preparation can begin. Refer to the Symmetric Cone Preparation section of the protocol.

During Asymmetric Cone preparation, be sure to properly set cone rotation to ensure proper alignment with the Baseplate.

Slide the appropriate Tibial Cone Reamer Guide over the IM Reamer and into the prepared tibia **(Figure 64)**.

- **Note:** There are two Tibial Cone Reamer Guides. One is designed for left medial / right lateral use, and the other is designed for right medial / left lateral use.
- **Note:** Do not fully seat the Tibial Cone Reamer Guide until after rotation is set.

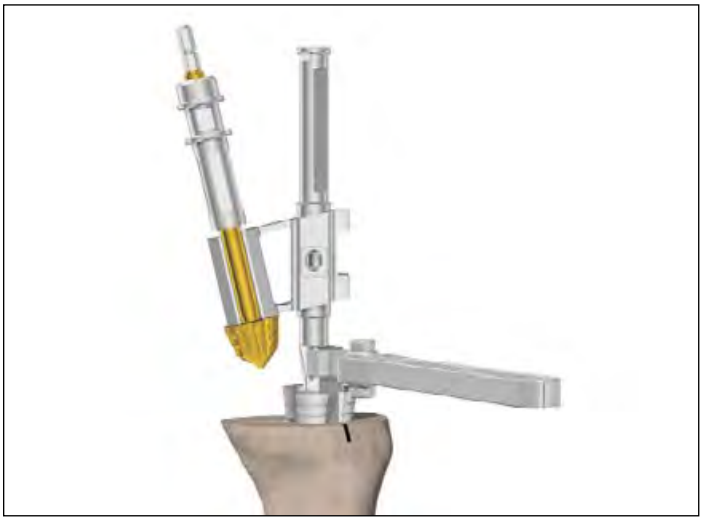


Figure 65

Attach the Tibial Cone Alignment Guide Handle to the Tibial Cone Reamer Guide **(Figure 65)**.

Insert the Tibial Asymmetric Cone Reamer into the Tibial Cone Reamer Guide to assist in visualization of guide positioning.

Select the correct reamer to match the cone size.

Slide back the bushing on the reamer and place the reamer into the slot of the guide **(Figures 65** and **66)**.

Figure 66

Insert the Alignment Rod into the bushing on the Tibial Cone Alignment Guide Handle.

- **Note:** The Universal Alignment Rod is only intended to help align anterior rotation markings to help ensure proper cone positioning/rotation.

Lower the Tibial Asymmetric Cone Reamer down to the desired location.

Use the Tibial Cone Alignment Guide Handle to position the reamer and rotate the guide. The assembly can be rotated by using the built-in rotational constraints (+/-10 degrees) **(Figure 67)**.

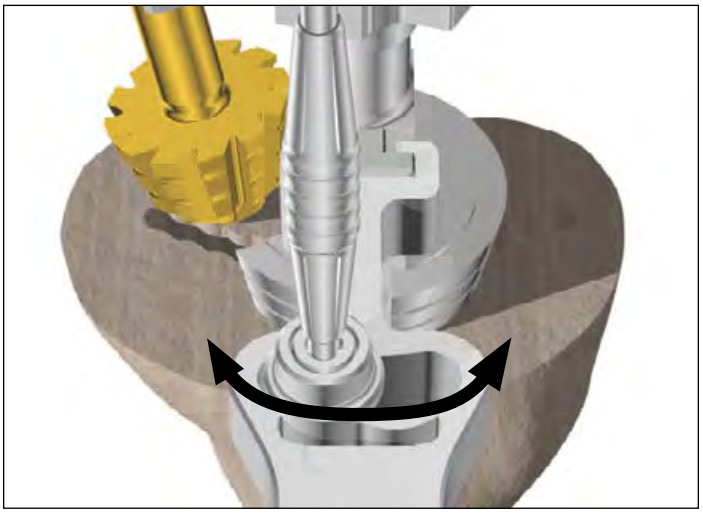


Figure 67

Figure 68

Figure 69

Once the desired positioning is established, move the Alignment Rod so that it aligns with the anterior rotational marking previously set using the Universal Tibial Template. This will ensure that desired tibial rotation is maintained.

If the Alignment Rod does not line up with the anterior marking, reduce rotation until it does so.

The Tibial Cone Reamer Guide has micro-flutes at its base to maintain rotation once set.

After alignment has been set, seat the Tibial Cone Reamer Guide so that it sits at the same depth/size as the Tibial Symmetric Cone Reamer **(Figure 68)**.

If reaming under power, confirm that the drill is set to ream mode before reaming begins.

Before reaming begins, ensure that the bushing is fully engaged.

- **Caution:** If the bone is soft, osteopenic, fractured, or sclerotic, consider initially reaming by hand using the T-Handle.

Hold the Tibial Cone Alignment Guide Handle in the previously determined location to maintain rotation.

Start the reamer before engaging the bone. Ream down to the stop **(Figure 69)**.

Remove the reamer from the guide. If necessary, the slap hammer can be connected to the end of the Tibial Cone Alignment Guide to assist with guide removal.

Remove the IM Reamer.

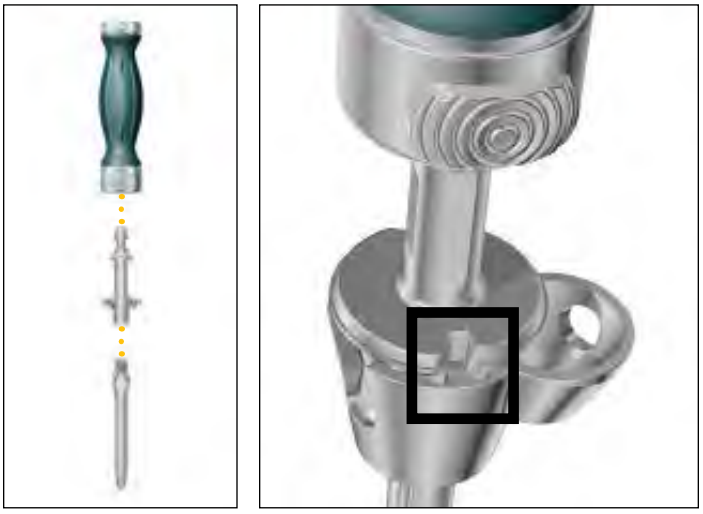


Figure 70

Figure 71

Asymmetric Cone trialing

- **Note:** The Cone Trial can be placed into the prepared bone before the Stem Trial and the Cone Introducer.

Assemble the desired Stem Trial with the Tibial Cone Introducer, TS Impaction Handle, and the selected Asymmetric Cone Trial (100mm stem maximum).

Tibial Cone Introducers are intended for use with both Symmetric and Asymmetric Cones.

- **Note:** Downsize the Stem Trial by 1mm.

Align the orientation key on the trial with the key feature on the Cone Introducer. The orientation key is located posteriorly on the trial **(Figure 70)**.

- **Note:** There is no positive lock on the Cone Trial and the Cone Introducer. The trial may disconnect from the introducer.

Insert the trial until it is seated at the appropriate depth **(Figure 71)**. Remove the Cone Introducer and the Stem Trial so that only the Cone Trial remains in the void.

- **Caution:** Do not impact or implant Cone Trials.
- **Note:** Stem trials with product code 5560-T-XXX cannot be used with cone augment instrumentation. This includes trials 5560-T-109, 5560-T-112 and 5560-T-115.

Options if added Cone stability is required:

Ream for a larger Asymmetric Cone (Repeat steps from the Asymmetric Cone Preparation section of the protocol).

Or implant the Cone with cement.

Component trialing

The purpose of the trial reduction is to determine the ease of insertion of the femoral and tibial components prior to cementing, and to determine whether the length of the prosthesis is appropriate. If the prosthesis is too long, too much tension will be placed upon the neurovascular structures when the knee is extended. In addition, the extensor mechanism will be tight, causing loss of flexion and difficulty in closing the soft tissues.

To determine the appropriate length, one must extend the knee and monitor the distal pulse with the trial prosthesis in place.

In a case of a revision scenario where one component is well fixed and trial reduction is desired, refer to the tables below for the trialing construct definition.

Trialing GMRS Distal Femur (trial) and Revision Baseplate (implant) compatibility

			Insert Trials	**GMRS Distal Femoral Component Trial**	
				GMRS **Small** Distal Femur Trial 6496-2-010/20	GMRS **Standard** Distal Femur Trial 6496-2-030/40
				Bushing trial N/A **Axle trial** 6496-2-115 **Bumper trial** 6543-6-101/3	**Bushing trial** N/A OR 6543-6-018 **Axle trial** 6496-2-115 OR 6543-6-020 **Bumper trial** 6543-6-101/3
Triathlon Revision Tibial Baseplate	5612-B-100	No sleeve	6543-6-061	**Bearing Post Trial** 6543-6-058 **Trial Bearing Plate** 6543-6-071	
	5612-B-200		6543-6-062		
	5612-B-300		6543-6-063		
	5612-B-400		6543-6-064		
	5612-B-500		6543-6-065		
	5612-B-600		6543-6-066		
	5612-B-700		6543-6-067		

Trialing GMRS Distal Femur (implant) and Revision Baseplate (trial) compatibility

			Insert Trials	**GMRS Distal Femoral Component**	
				GMRS **Small** Distal Femur 6495-2-010/20	GMRS **Standard** Distal Femur 6495-2-030/40
				Bushing trial N/A **Axle trial** 6496-2-115 **Bumper trial** 6543-6-101/3	**Bushing trial** N/A OR 6543-6-018 **Axle trial** 6496-2-115 OR 6543-6-020 **Bumper trial** 6543-6-101/3
Triathlon Revision Tibial Baseplate Trial	5612-T-100	No sleeve	6543-6-061	**Bearing Post Trial** 6543-6-058 **Trial Bearing Plate** 6543-6-071	
	5612-T-200		6543-6-062		
	5612-T-300		6543-6-063		
	5612-T-400		6543-6-064		
	5612-T-500		6543-6-065		
	5612-T-600		6543-6-066		
	5612-T-700		6543-6-067		

Figure 72

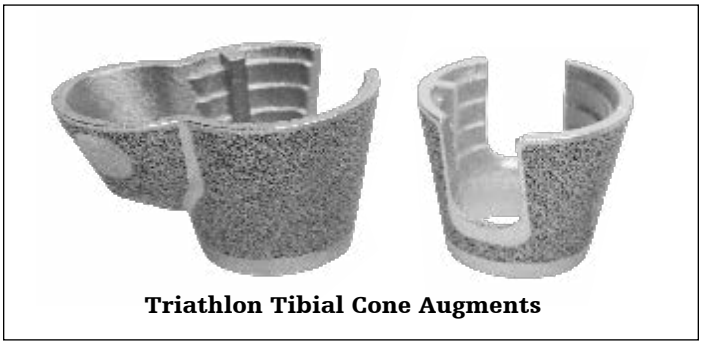


Figure 73

Tibial Trial assembly

If you are planning for Cone Augments, begin with Cone Augment trialing if it has not already been completed.

Figure 74

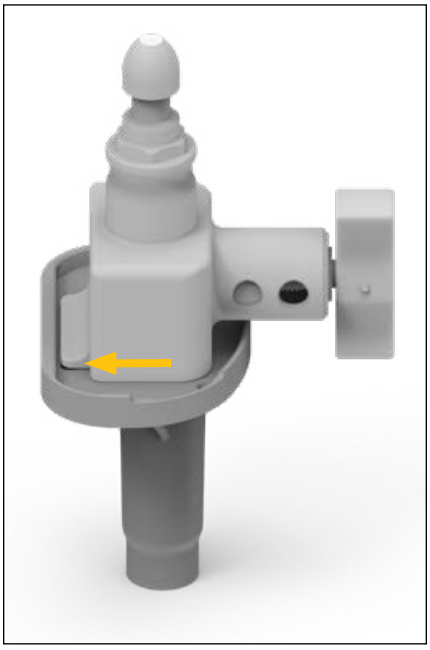


Figure 75

Revision Baseplate Trial assembly

- **Attention:** The Revision Baseplate is not available with offset adaptors.

Assemble all Tibial Augment Trials to the appropriate size Tibial Baseplate Trial.

Thread the appropriate size Stem Trial into the Tibial Baseplate Trial.

Assemble the tibial trial construct to the Revision Baseplate Impactor/Extractor and impact onto the Tibia **(Figure 74)**. Ensure the tab of the Impactor/Extractor is engaged under the posterior lip of the baseplate before impacting **(Figures 75-77)**.

Assemble the appropriate size Hinge Insert trial into the Revision Tibial Baseplate Trial. Do not impact the Insert Trial during assembly.

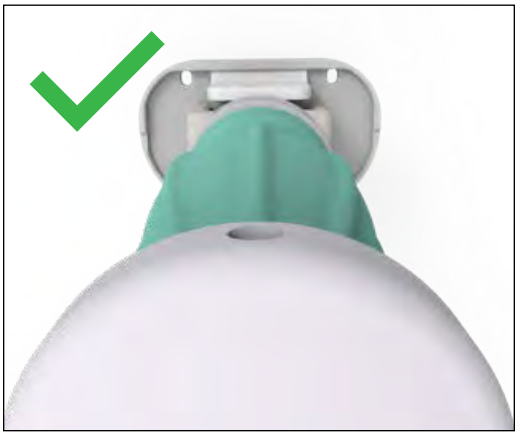


Figure 76

Figure 77

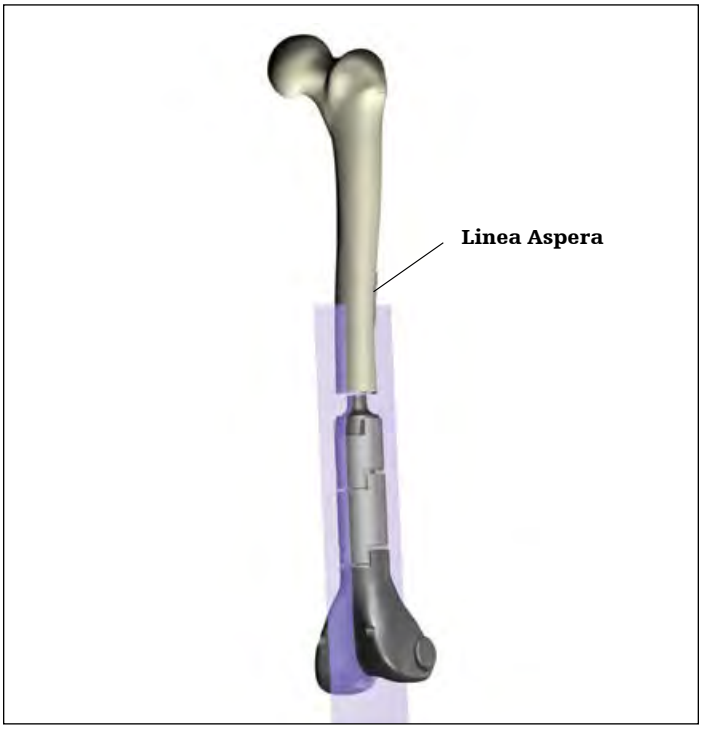


Figure 78

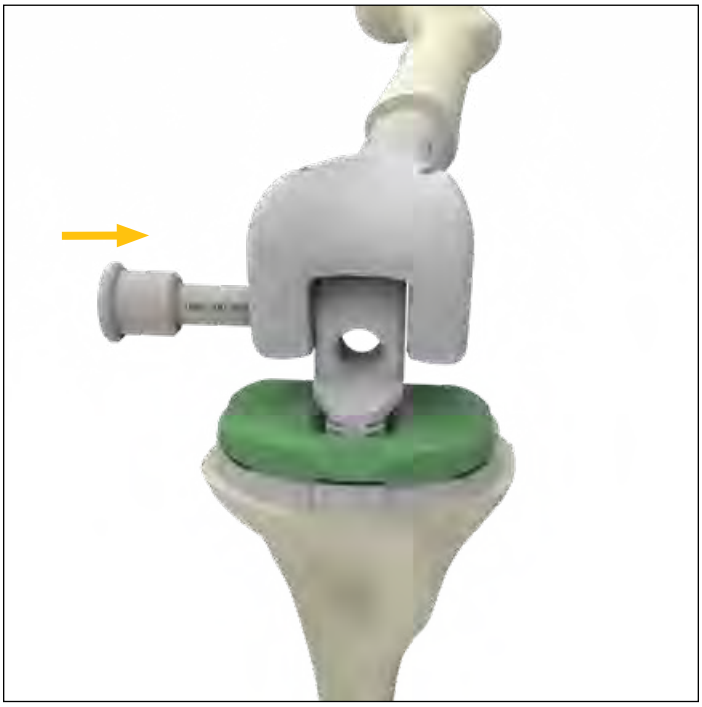


Figure 79

Femoral Trial assembly

Assemble the trial femoral construct by joining the Trial Cemented Stem with the Trial Extension Piece, if required, and with the Trial Distal Femoral Component.

Insert the stem of the trial femoral assembly into the femur. As a guide to rotational orientation, align the rotational alignment mark on the femoral stem segment with the rotational reference mark previously made on the anterior cortex of the femur **(Figure 78)**.

Trial reduction

With the correct Revision Baseplate trial in place, insert the Hinge Tibial Bearing Post Trial (6543-6-058) into the baseplate trial.

With the knee in 90 degrees of flexion and the GMRS Distal Femoral trial in place, bring the Hinge Tibial Bearing Post Trial into the intercondylar notch of the GMRS Distal Femoral Trial.

Slide the appropriate GMRS Trial Axle (see the table on the next page) through the GMRS Distal Femoral Component Trial and Hinge Tibial Bearing Post Trial **(Figure 79)**. Do not impact the Trial Axle during assembly.

GMRS Distal Femur (trial) and Revision Baseplate (trial) compatibility

			Inserts Trials	GMRS Distal Femoral Component Trial	
				GMRS **Small** Distal Femur Trial 6496-2-010/20	GMRS **Standard** Distal Femur Trial 6496-2-030/40
				Bushing trial N/A **Axle trial** 6496-2-115 **Bumper trial** 6543-6-101/3	**Bushing trial** N/A OR 6543-6-018 **Axle trial** 6496-2-115 OR 6543-6-020 **Bumper trial** 6543-6-101/3
Triathlon Revision Tibial Baseplate Trial	5612-T-100	No sleeve	6543-6-061	**Bearing Post Trial** 6543-6-058 **Trial Bearing Plate** 6543-6-071	
	5612-T-200		6543-6-062		
	5612-T-300		6543-6-063		
	5612-T-400		6543-6-064		
	5612-T-500		6543-6-065		
	5612-T-600		6543-6-066		
	5612-T-700		6543-6-067		

Assemble the appropriately angled Trial Bumper (6543-6-101/103) in the Hinge Tibial Bearing Post Trial by hand.

Assemble the Insertion Removal Handle (or surgical forceps) to the Hinge Trial Bearing Plate (6543-6-071).

With the knee at 90 degrees, manually distract the knee and insert the Hinge Trial Bearing Plate into the desired slot of the Bearing Post. Each slot represents the thickness of the definitive insert **(Figure 80)**. The insert thickness should be dictated by the desired leg length rather than tension.

If utilized, remove the Insertion Removal Handle, and bring the knee to full extension (0 degrees). Determine if the extension gap is adequately filled.

Perform the trial reduction and evaluate patella tracking.

Adjust the insert thickness as required by reattaching the Insertion Removal Handle to the Hinge Trial Bearing Plate and shifting the bearing plate to the next increment in flexion or fully disassociate the Femoral Trial and Bearing Post assembly from Revision Tibial Baseplate trial to shift the bearing plate to the next increment.

Adjust the Trial Bumper angle as required.

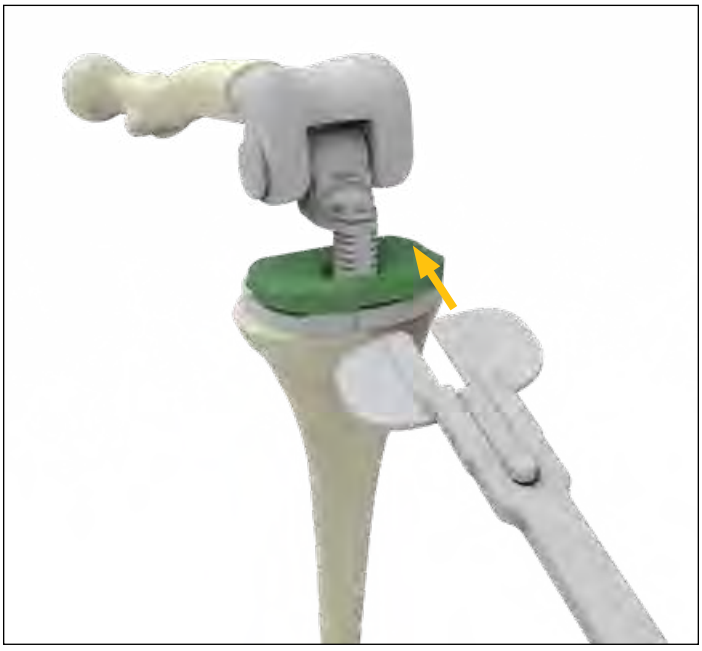


Figure 80

Technical points

Manipulating the knee through its range of motion may be used to determine the appropriate rotation of the femoral component. If the evaluation identifies a rotation different than that already marked, an additional mark should be made or the rotation should be noted relative to the existing mark. Slight external rotation may aid in patellar tracking.

Hold the trial femoral assembly in one hand to prevent rotation and extend the leg fully. Palpate the femoral vessels to determine the status of the pulse. If the pulse is diminished, flex the knee to determine if it increases. This will indicate the need for either modifying the length of the prosthesis or for removing additional bone from the distal femur or proximal tibia.

As an aid in checking leg length, the distance between the leg-length reference marks on the tibia and femur can now be rechecked.

If it is determined that the prosthetic construct is too long, the length of the distal femoral bone resected should be rechecked against the length of the assembled prosthesis. If the prosthesis is too long, either additional bone can be removed from the femur, the length of the prosthesis can be adjusted, or a thinner insert can be evaluated.

If the surgeon feels that removing additional bone from the femur or shortening the femoral prosthesis will have a negative effect on patellar tracking, additional bone must be removed from the tibial side.

A final test of the range of motion of the knee with the patella in place is then performed. If the patella will be resurfaced, this must be done with the patellar trial in place. A full range of motion should be obtained. Note whether the capsular mechanism can be closed. These factors, taken together, will determine the adequacy of the length of the resection.

The two most important factors in accepting final length are:

1. Proper patellar tracking

2. Distal pulses

The decision can now be made if a gastrocnemius flap or muscle transfer will be required, dependent upon the presence or absence of the capsule or portions of the quadriceps.

Trial and Cone Augment Trial removal

Extract the GMRS Femoral Trial and Revision Baseplate trial using the corresponding impactor/extractor instruments.

Use the Cone Extractor to remove the Cone Trials **(Figure 81)**.

Insert the extractor into the Cone Trial (jaws closed). Squeeze the extractor handles to open the jaws. The jaws will engage the slots within the proximal end of the Cone Trial.

Once the jaws engage with the slots, remove the trial. Strike the handle of the extractor to assist in removal of the Cone Trial.

Technical points

A Lamina Spreader (with narrow fixed pads) or a Curette (reverse angle) may also be used to remove the Cone Trials. Insert the Lamina Spreader or Curette into the Cone Trial and apply back pressure.

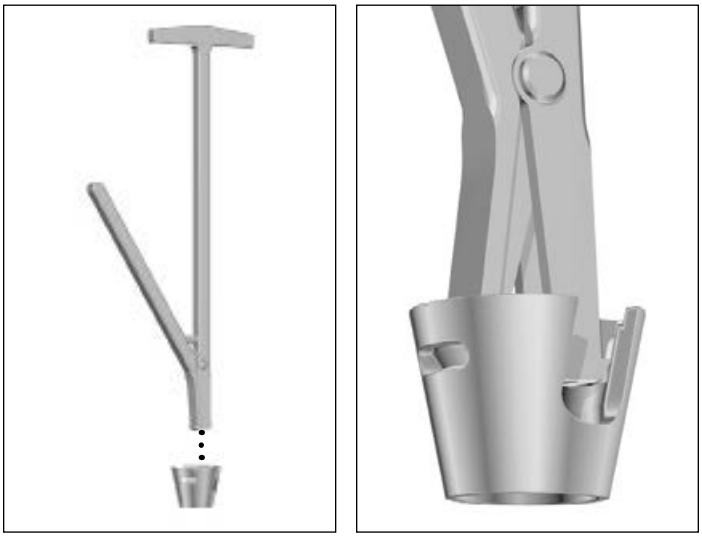


Figure 81

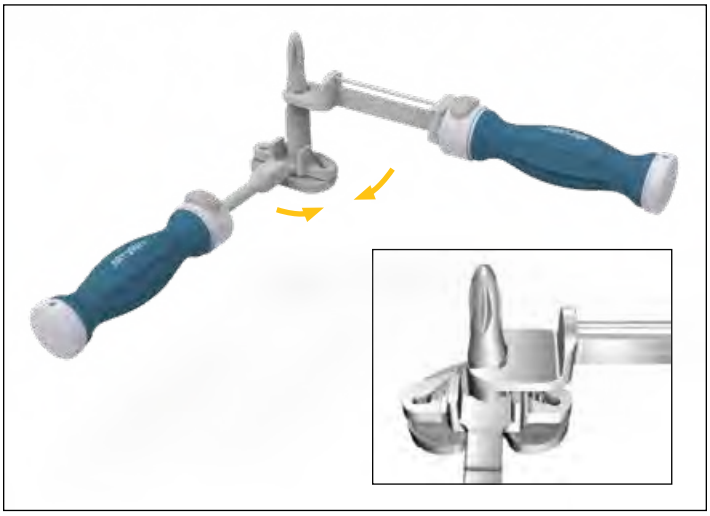


Figure 82

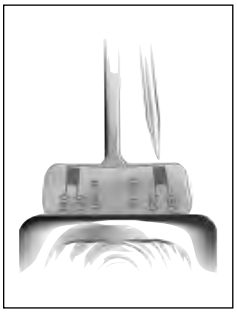


Figure 83

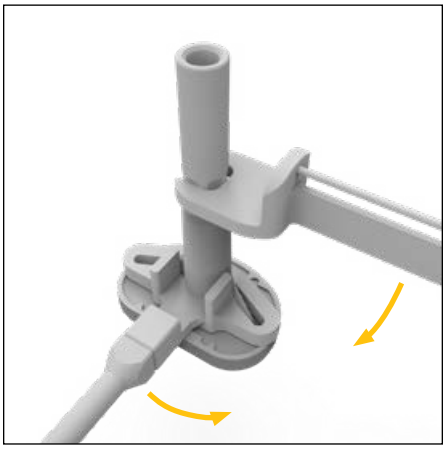


Figure 84

Definitive component assembly

Revision Baseplate Tibial Implant assembly

Assemble the stem to the baseplate prior to assembling augments.

Tibia with stem

Using the Universal Counter Wrench with the **tibia** side up, hold the Revision Baseplate in place by placing the slots of the counter wrench down over the keel fins of the baseplate.

Thread the appropriate size stem into the Tibial Baseplate Boss.

Place the open face end of the Torque Wrench on the flats of the stem **(Figure 82)**.

Tighten by pulling the wrenches **together**. Torque Stem to 120 in-lbs. as indicated on the Torque Wrench **(Figure 83)**.

Optional Tibia with Stem Extender

Using the Universal Counter Wrench with the **tibia** side up, hold the Revision Baseplate in place by placing the keel fins into the slots. Thread the Stem Extender into the Tibial Baseplate boss.

Place the open face end of the Universal Torque Wrench on the flats of the Stem Extender. Tighten by pulling the wrenches together **(Figure 84)**.

Torque stem extender to 120 in-lbs. as indicated on the Universal Torque Wrench **(Figure 83)**.

Thread the appropriate size stem into the Stem Extender.

Place the open face end of the Torque Wrench on the flats of the stem.

Tighten by pulling the wrenches **together**. Torque Stem to 120 in-lbs. as indicated on the Torque Wrench **(Figure 83)**.

Figure 85

Figure 86

Tibial Augmentation Revision Baseplate

Assemble the 1/8″ Universal Joint (or Straight) Hex Drive into the Slip Torque Handle.

Place the Tibial Augment on the distal side of the Baseplate. Verify both pins of the Tibial Augment are engaged into the slots on the underside of the Revision Baseplate and that the Tibial Augment is seated flush **(Figure 85)**.

Using the 1/8″ Universal Joint (or Straight) Hex Drive, torque the helical bolt captured within the tibial augment until the torque driver slips, at that time the driver is designed to emit an audible click **(Figure 86)**.

Verify that the helical bolt is engaged into the slot on the keel of the Revision Baseplate. Repeat on a second augment if required on the other side.

Technical points

Triathlon Tibial Augments are not intended to be cemented together and stacked to fill voids.

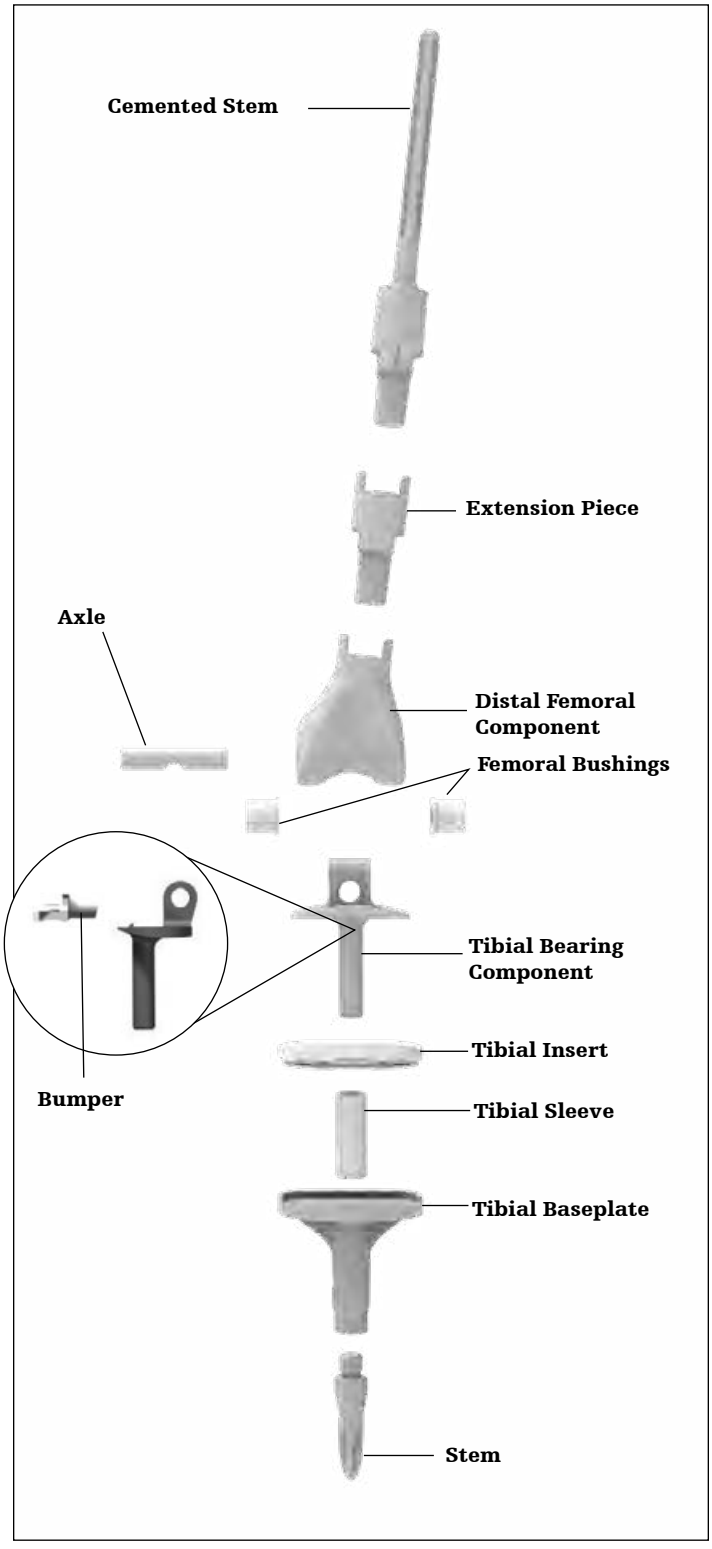


Figure 87

Assembly of the femoral prosthesis

The femoral prosthesis consists of the Stem, Extension Piece (when needed based on the length of the reconstruction), and the Distal Femoral Component (**Figure 87**). Check that the correct side (left or right) and size (standard or small) of the Distal Femoral Component and the correct sizes of all components have been chosen before assembly. If necessary, it is acceptable to stack two Extension Pieces to construct the necessary length. The instruments used for the assembly of the prosthesis are the Impaction Tube, the appropriate Impaction Tube Insert, the 5-in-1 Impactor and the Impaction Block, if necessary, along with a Mallet.

- **Note: If the small Distal Femoral Component is selected, the small Femoral Bushings (6495-2-105) and the small Axle (6495-2-115) must be used.**

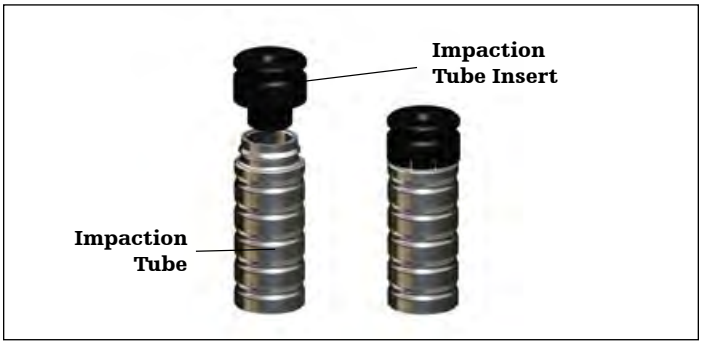


Figure 88

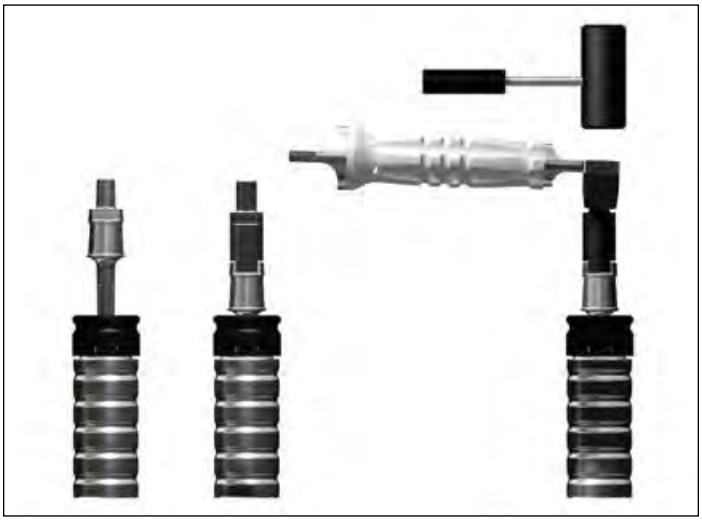


Figure 89

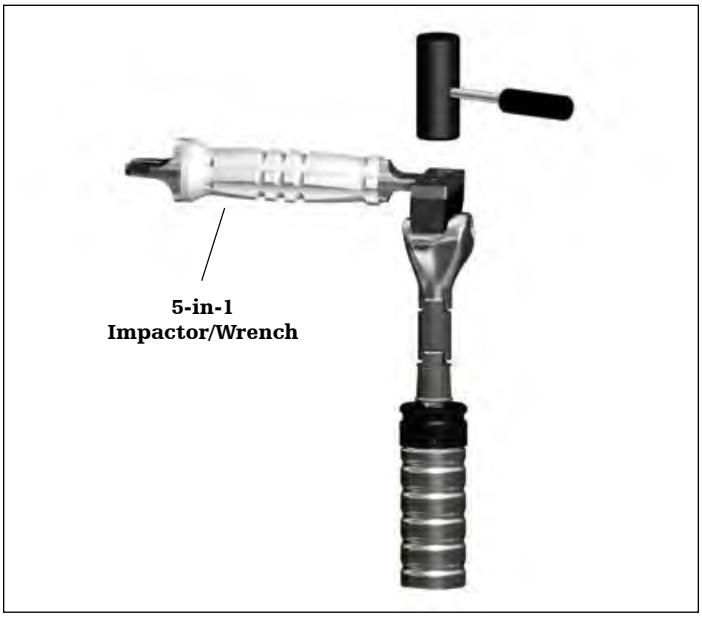


Figure 90

The Impaction Tube Insert corresponding to the stem diameter is assembled to the Impaction Tube (**Figure 88**).

The Extension Piece, if required, and the cemented Stem are assembled first. The cemented Stem is placed into the Impaction Tube and the Extension Piece is mated with it. The 5-in-1 Impactor is placed over the taper of the Extension Piece and impacted with several swift blows of a heavy Mallet to lock the tapers (**Figure 89**).

Next, the Stem/Extension piece construct is assembled to the Distal Femoral Component. Place the Distal Femoral Component onto the Extension Piece or Stem. The 5-in-1 Impactor is inserted between the condyles of the Distal Femoral Component so that its handle is parallel to the axis of the bushing holes and impacted with a Mallet (**Figure 90**).

If a 203mm long curved cemented Stem is to be implanted, the Distal Femoral Component is inserted into the Impaction Support Block. An Extension Piece, if required, is inserted into the Distal Femoral Component and then the appropriate diameter cemented Stem is inserted into the Extension Piece or Distal Femoral Component. Verify that the bow of the cemented Stem curves towards the posterior of the Distal Femoral Component. The Impaction Tube is inverted and placed over the cemented Stem and impacted with several blows of a heavy mallet, or by sliding the Impaction Tube over the stem like a Slap Hammer (**Figure 91**).

Figure 91

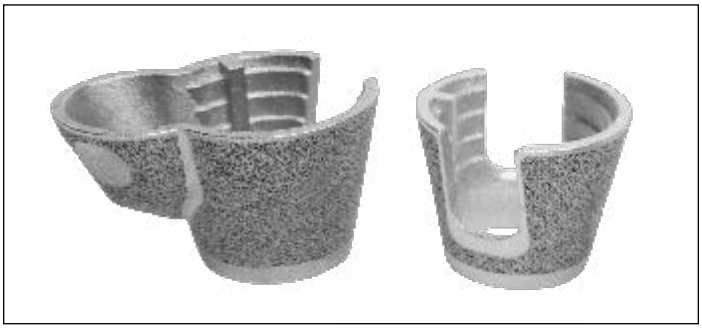


Figure 92

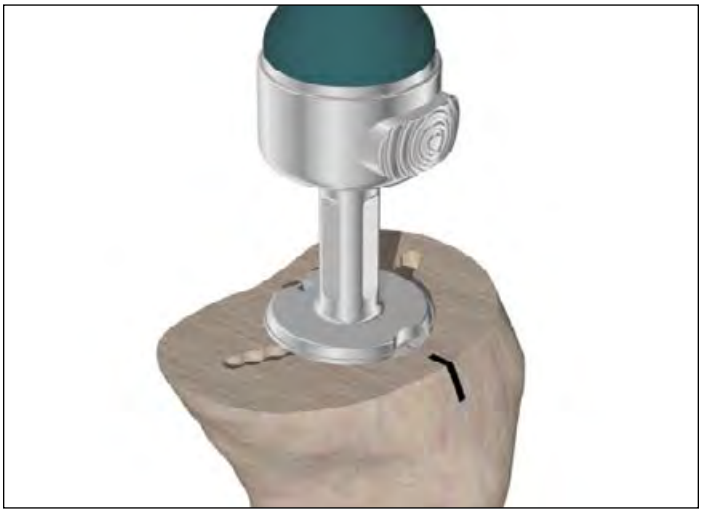


Figure 93

Implantation

If needed, further prepare resected bone surfaces using an osteotome, oscillating saw blade, or bone file.

If using a cemented stem, it is advised to implant a cement restrictor prior to Cone implantation.

Tritanium Tibial Cone Augment implantation

Tritanium Tibial Cone implantation

- **Reminder:** The Revision Baseplate is only compatible with Symmetric and Asymmetric Tibial Cones sizes B-E.

Assemble the desired Stem Trial (1mm smaller than reamed for) to the Tibial Cone Introducer, TS Impaction Handle, and the selected Symmetric/Asymmetric Cone Implant **(Figure 92)**.

Tibial Cone Introducers are size specific.

Align the orientation key on the implant with the key feature on the Cone Introducer. The orientation key is located posteriorly on the implant.

- **Note:** There is no positive lock on the Cone Implant and the Cone Introducer. The implant may disconnect from the introducer.
- **Note:** The Cone can be placed into the prepared bone before the Stem Trial and the Cone Introducer.
- **Note:** When inserting a Symmetric Cone Implant, ensure that the anterior rotational alignment marking on the implant is aligned with the anterior surface marking previously determined by the Universal Tibial Template **(Figure 93)**.

Gently impact the Symmetric/Asymmetric Cone Implant and confirm that it is fully seated at the appropriate depth.

- **Note:** Stem trials with product code 5560-T-XXX cannot be used with cone augment instrumentation. This includes trials 5560-T-109, 5560-T-112 and 5560-T-115.

Figure 94

Adjustment of Cone Implant before cementation

Cone Implants

For Tibial Trial assembly, refer to Symmetric Cone Trialing and Asymmetric Cone Trialing sections of the protocol.

Introduce Tibial Trials.

Perform final trial reduction with the Cone implants and evaluate joint stability.

Remove the trial components.

Tibial component implantation with Cone Implants

For assembly of Tibial Components refer to Revision Baseplate Tibial Implant Assembly section of the protocol.

Cone implants must be fully seated before cementing the entire construct.

- **Caution:** Only use the Cone Extractor if the implant is seated in the wrong orientation and must be re-positioned (before cementing).

  Insert the extractor into the Cone Implant (jaws closed). Ensure that the flared edges of the jaws are positioned outside of the distal
  end of the cone. Squeeze the extractor handles to open the jaws.

- **Note:** A lamina spreader (with fixed narrow pads) or a curette (reverse angle) may also be used to remove the Cone Implants. Insert the lamina spreader or curette into the Cone ensuring that the ends of either instrument are positioned outside of the distal end of the implant. Apply back pressure.

- **Caution:** If the Cone Implant is extracted (before cementing), **(Figure 94)** inspect the Cone for damage before reinsertion.

See next section for component and cone cementing techniques.

- **Note:** All stem implants are compatible with the cone augments. Refer to sizing charts to see maximum stem diameter per cone size.

Revision Baseplate implantation

Revision Baseplate with Cemented Stem and Cone Augment

Attach Revision Baseplate Impactor/Extractor to the Impaction Handle.

Assemble the Tibial Implant Assembly to the Revision Baseplate Tibial Impactor/ Extractor by turning the knob.

Ensure the tab of the Impactor/Extractor is engaged under the posterior lip of the baseplate **(Figures 95-97)**.

Irrigate the joint and then dry.

Mix cement.

Technical points

Tibial Cone Implant used with a cemented stem will require at least two doses without major bone voids. The same is true for bones with IM canals greater than 20mm to fill the cone volume and help facilitate solid fixation to the cone.

Apply a thin layer of wet cement on the underside of the baseplate. Allow the cement to dough.

Use the standard cementing technique with a cement gun to retrograde fill the canal and cone.

Pressurize the cement into the cone, the metaphysis and onto the flat tibial surface.

Impact the tibial implant assembly onto the tibia until fully seated (do so when the cement is in its doughy state) and remove excess cement. Ensure proper rotation and alignment of the baseplate prior and during impaction.

Figure 95

Figure 96

Figure 97

Revision Baseplate with Cemented Stem without Cone Augment

Assess length of the construct and determine the appropriate depth of cement restrictor.

Insert corresponding restrictor.

Attach Revision Baseplate Impactor/Extractor to the Impaction Handle.

Assemble the Tibial Implant Assembly to the Revision Baseplate Tibial Impactor/Extractor by turning the knob.

Ensure the tab of the Impactor/Extractor is engaged under the posterior lip of the baseplate **(Figures 98-100)**.

Irrigate the joint and then dry.

Mix cement.

Apply cement to the appropriate sections of the tibial implant assembly and the proximal tibia.

- Use the standard cementing technique with a cement gun to retrograde fill the canal.
- Apply doughy cement to the back surface of the baseplate and build the cement up along the stem implant junction proximally.

Pressurize the cement into the metaphysis and onto the flat tibial surface.

Impact the tibial implant assembly onto the tibia until fully seated (do so when the cement is in its doughy state) and remove excess cement. Ensure proper rotation and alignment of the baseplate prior and during impaction.

Figure 98

Figure 99

Figure 100

Revision Baseplate with Fluted Stem and Cone Augment

Attach Revision Baseplate Impactor/Extractor to the Impaction Handle.

Assemble the Tibial Implant Assembly to the Revision Baseplate Tibial Impactor/Extractor by turning the knob.

Ensure the tab of the Impactor/Extractor is engaged under the posterior lip of the baseplate **(Figures 101-103)**.

Irrigate the joint and then dry.

Mix cement.

Technical points

Tibial Cone Implant used with a Fluted stems will require at least one dose of cement for Cone sizes B and C and 2 doses for Cone sizes D and E will be required in the absence of major bone voids.

When using Fluted Stems with Cone implants, wipe the inside surface of the cone with a thin layer of wet cement (avoid cement moving distally beyond the inferior edge of the cone). Apply doughy cement to the back surface of the baseplate and build the cement up along the stem implant junction proximally so that the cement can fill the full depth of the cone.

Make sure the stem tray construct has enough cement coating the implant, with enough volume to fill the Cone and cover the stem tray junction.

Pressurize the cement into the flat tibial surface.

Impact the tibial implant assembly onto the tibia until fully seated (do so when the cement is in its dough-like state) and remove excess cement. Ensure proper rotation and alignment of the baseplate prior and during impaction.

Figure 101

Figure 102

Figure 103

Revision Baseplate with Fluted Stem without Cone Augment

Assess length of the construct and determine the appropriate depth of cement restrictor.

Insert corresponding restrictor.

Attach Revision Baseplate Impactor/Extractor to the Impaction Handle.

Assemble the Tibial Implant Assembly to the Revision Baseplate Tibial Impactor/ Extractor by turning the knob.

Ensure the tab of the Impactor/Extractor is engaged under the posterior lip of the baseplate **(Figures 104-106)**.

Irrigate the joint and then dry.

Mix cement.

Apply cement to the appropriate sections of the tibial implant assembly and the proximal tibia.

Pressurize the cement into the flat tibial surface.

Impact the tibial implant assembly onto the tibia until fully seated (do so when the cement is in its dough-like state) and remove excess cement. Ensure proper rotation and alignment of the baseplate prior and during impaction.

Figure 104

Figure 105

Figure 106

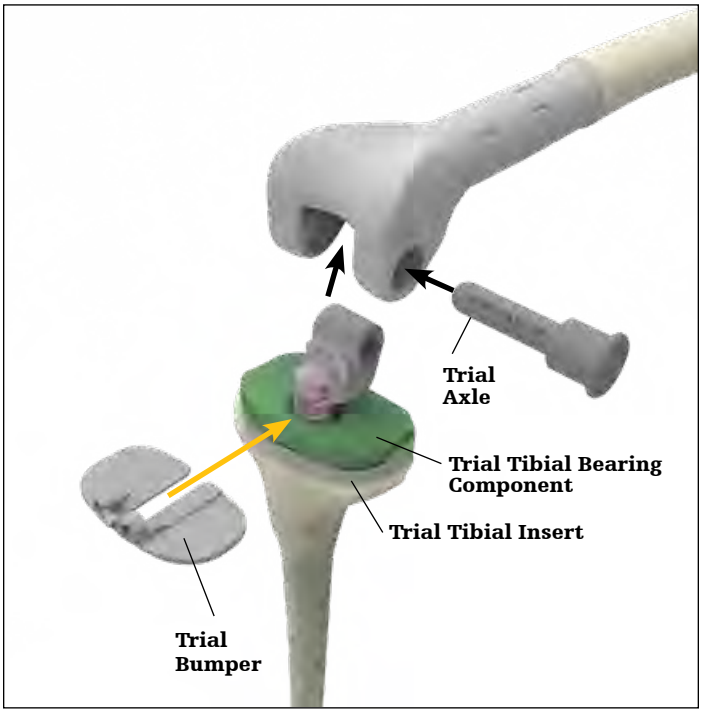


Figure 107

GMRS Femoral Implant implantation

The femoral canal is thoroughly irrigated. A cement restrictor is placed at the appropriate depth. This depth is checked by inserting the trial femoral stem and verifying complete seating. The femoral canal is again irrigated and dried. The soft tissues, especially those that are near the neurovascular structures, are protected and packed off with wet lap pads. Bone cement is mixed and injected into the canal to facilitate proper filling of the canal. Some cement is then placed around the stem of the prosthesis.

- **Surgical tip:** If a stem centralizer is not being used, plug the hole in the stem with bone cement.

The prosthesis is then inserted into the femoral canal until the stem seat is flush with the host bone at the osteotomy site. Excess cement is removed from around the prosthesis. Care is taken to prevent cement from getting into the extra-medullary porous-coated section. It is firmly held in place at the rotational orientation determined by the trial reduction while the cement cures.

With the Femoral Prosthesis and Tibial Baseplate implanted, it is possible to use the Trial Axle (**6496-2-115**) with the Bearing Post Trial (**6543-6-058)**, Trial Bearing Plate **(6543-6-071**), the Trial Bumper (**6543-6-101/3**) and Hinge Insert Trial (**6543-6-06X**) to verify that the appropriate motion, stability, and patellar tracking have been achieved **(Figure 107)**. Having the knee in full extension while the cement is curing assists in loading the femoral and tibial baseplate components to provide the desired bond between implant and bone.

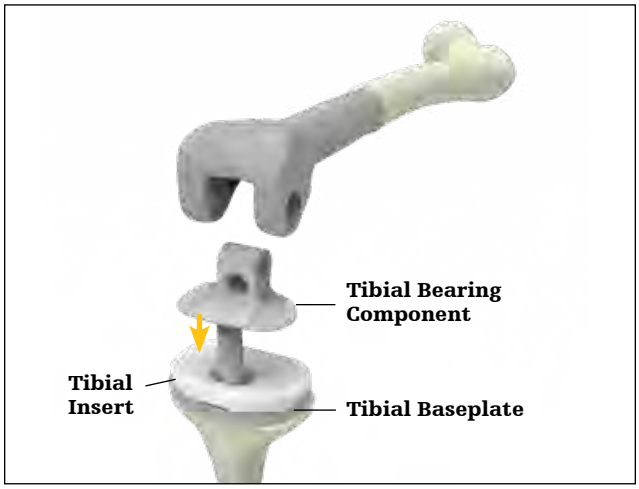


Figure 108

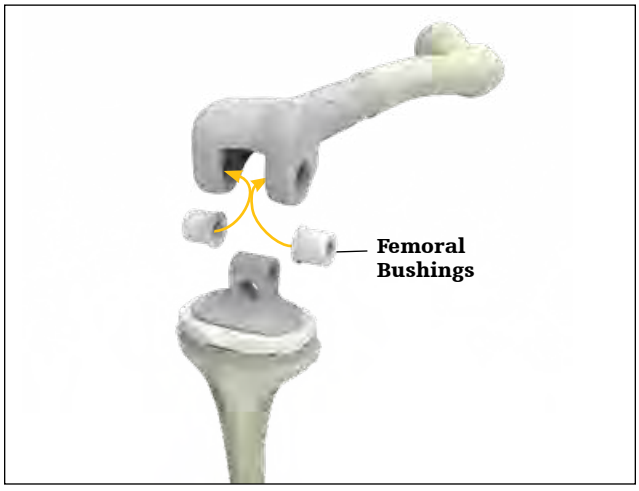


Figure 109

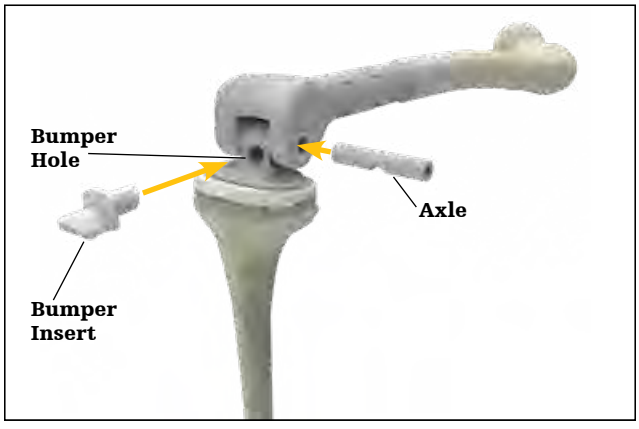


Figure 110

Final Hinge Mechanism assembly

Once the appropriate Tibial Baseplate and GMRS Distal Femur is implanted, flex the knee to 90 degrees, insert the Tibial Sleeve (5612-5-002) into the baseplate until it is flush with the surface.

Ensure that the Baseplate is completely free of debris. Once the definitive Hinge Tibial Insert is selected, attach the Tibial Insert Impactor to the Impaction Handle.

Angle the Hinge Tibial Insert posteriorly into the Bearing Baseplate.

Impact the insert to snap it into place anteriorly.

Place the appropriate Triathlon Hinge Tibial Bearing Component into the Revision Baseplate Insert construct **(Figure 108)**.

Place both Bushings into the GMRS Femur with the flanges facing the inside of the intercondylar notch **(Figure 109)**.

With the knee in 90 degrees of flexion, line up the Tibial Bearing Component with the holes of the Femoral Component Bushings and slide the implant Axle into the assembly **(Figure 110)** until the "recess" in the Axle can be seen through the Tibial Bearing Component from the front. Rotate the axle so that the "recess" is inferior. The Axle Guide Rod can be used to align the Axle.

With the Axle correctly oriented, the Bumper can now be inserted. This should be impacted into the Tibial Bearing Component until it is flush with the hinge housing and has cleared the locking tab on the Tibial Bearing Component **(Figure 110)**.

The Bumper implant is available in two options, neutral and 3° flexion.

- **Note:** With the Bumper inserted, the axle should not be further rotated.

If a patellar component is used, it is implanted by applying sufficient amount of bone cement to the patellar implant and bone. Cement should be applied to both the bone surface and the back of the patellar implant, including the pocket.

- **Surgical tip:** Application of cement in a doughy state will allow the implant to fully seat and facilitate interdigitation of cement into bone.

Closure

After cement polymerization and removal of all residual cement, thoroughly irrigate the joint. Hemostasis is achieved after deflation of the tourniquet.

Close soft tissues in the normal, layered fashion.

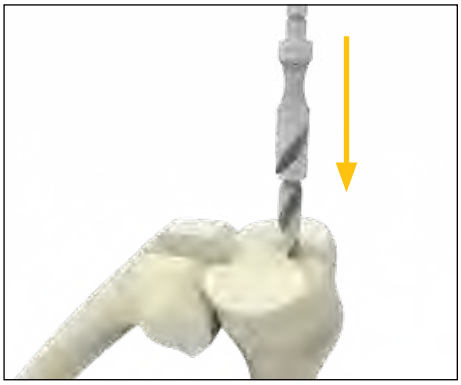


Figure 111

Figure 112

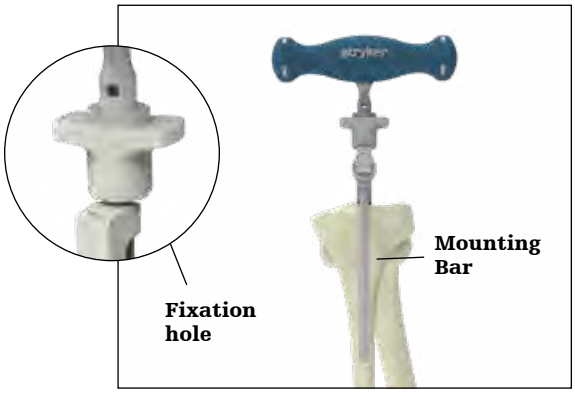


Figure 113

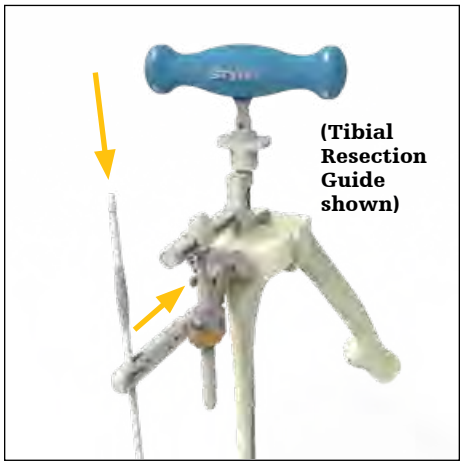


Figure 114

Addendums

Addendum 1

Revision Baseplate Tibial preparation with Primary Tibial Instrumentation

To alleviate the potential for tibial eminence interference with the Hinge tibial resection guide tower, follow the Triathlon primary tibial IM workflow per TRIATH-SP-30 using the Hinge Tibial Stylus as substitute to help ensure proper resection depth is created. The workflow is also detailed below.

Revision Baseplate: Proximal tibial resection IM workflow

For the Revision Baseplate with Hinge Insert, the minimum tibial resection from the native bone is 16mm. For primary bone resections, a Hinge Tibial Stylus with corresponding 16mm depth has been included.

Attach the 3/8" IM Drill to the Universal Driver and create a hole in the location determined by the preoperative X-rays **(Figure 111)**.

Attach the T-Handle Driver to the 5/16" IM Rod and slowly pass into the canal, ensuring clearance. Remove the 5/16" IM Rod and insert it into the body of the Tibial Alignment Jig IM. The assembly is then inserted into the canal until the isthmus is engaged **(Figure 112)**.

With the body of the tibial alignment jig IM resting on the proximal tibia, proper rotational alignment can be achieved by rotating the instrument about the 5/16" IM rod so that the vertical mounting bar is over the medial 1/3 of the tibial tubercle. A headless pin or the 1/8" drill is then inserted into the fixation hole to fix rotation (see inset **Figure 113**).

Assemble the appropriate Tibial Resection Guide (left or right) on the Tibial Adjustment Housing.

Ensure posterior slope is set to 0 degrees.

Attach the assembly onto the mounting bar by pressing the bronze wheel on the Tibial Adjustment Housing. Attach the Universal Alignment Handle to the Tibial Resection Guide and slide a Universal Alignment Rod through the handle for sagittal assessment **(Figure 114)**. When alignment is confirmed, the Universal Alignment Handle should be centered over the ankle.

The Hinge Tibial Stylus with corresponding 16mm depth attaches to the Tibial Resection Guide referencing the lowest level of the unaffected compartment **(Figure 115)**.

The height of the Tibial Resection Guide, Tibial Stylus and Tibial Adjustment Housing can be adjusted using the bronze wheel on the Tibial Adjustment Housing. For coarse adjustment, press the bronze wheel and slide the assembly up or down. For fine adjustment, turn the bronze wheel to the right to move the assembly up the Proximal Rod or turn left to move the assembly down the Proximal Rod **(Figure 116)**.

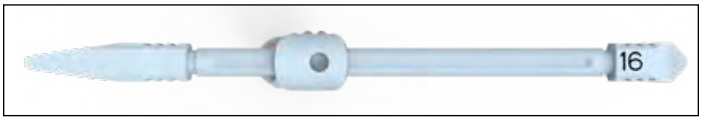


Figure 115

Figure 116

Place two Headless Pins into the “0” [neutral] holes, fixing the level of the Tibial Resection Guide.

If additional stability of the guide is required, utilize the oblique “X” pin-hole.

Remove all alignment instruments leaving only the Tibial Resection Guide in place. Squeeze the bronze tabs on the Tibial Adjustment Housing to disengage the assembly from the Tibial Resection Guide. Slide the Tibial Adjustment Housing anteriorly. Remove the 5/16” IM Rod, the Tibial Alignment Jig IM, the Tibial Adjustment Housing and the Universal Alignment Handle.

Resection of the proximal tibia is now completed. An optional Tibial Resection Guide Modular Capture (Left or Right) may be added.

Remove the Tibial Resection Guide.

For the remaining tibial preparation technique proceed to the Tibial Template sizing section of the desired technique guide.

Triathlon Revision instruments

For all GMRS instrument part numbers see GMRS_SP_3

Item number	Description	Quantity in set
6543-6-501	Revision IM Reamers (8-19mm)—Tray	1
6543-7-527	Boss/Offset Reamer	1
6543-6-019	Revision Boss Reamer	1
6543-7-508	8mm Starter Awl	1
6543-7-509	IM Reamer - 9mm	1
6543-7-510	IM Reamer - 10mm	1
6543-7-511	IM Reamer - 11mm	1
6543-7-512	IM Reamer - 12mm	1
6541-4-800	T-Handle Driver	1
6541-4-538	3/8" IM Drill	1
6543-7-513	IM Reamer - 13mm	1
6543-7-514	IM Reamer - 14mm	1
6543-7-515	IM Reamer - 15mm	1
6543-7-516	IM Reamer - 16mm	1
6543-7-517	IM Reamer - 17mm	1
6543-7-518	IM Reamer - 18mm	1
6543-7-519	IM Reamer - 19mm	1
5560-T-109	Cemented Stem Trial 9 x 50mm	2
5560-T-112	12 x 50mm Stem Trial	2
5560-T-115	15 x 50mm Stem Trial	2
6543-6-502	Revision General-- Tray	1
6541-4-602	Universal Alignment Rod	1
6541-4-806	Universal Alignment Handle	1
6541-4-803	Slap Hammer	1
6541-4-801	Universal Driver	1
6541-4-400	Blade Runner	1
6543-1-603	Size 1-8 Femoral Sizing Templates	1
6541-4-804	Headless Pin Extractor	1
6541-4-518	1/8" Drill	1
6541-4-300	Headed Nail Impactor/Extractor	1
6541-4-003A	Headless Pins - 3"	4
6541-4-515	Headed Nails - 1 1/2″	2
6541-4-575	Headed Nails - 3/4″	2
6541-4-809	Headless Pin Driver	1

Triathlon Revision instruments (continued)

For all GMRS instrument part numbers see GMRS_SP_3

Item number	Description	Quantity in set
6543-6-503	Revision Tibial Prep—Tray	1
5545-T-102	Tibial Augment Trial, Size 1 RM/LL - 5mm	1
5545-T-101	Tibial Augment Trial, Size 1 LM/RL - 5mm	1
5545-T-202	Tibial Augment Trial, Size 2 RM/LL - 5mm	1
5545-T-201	Tibial Augment Trial, Size 2 LM/RL - 5mm	1
5545-T-302	Tibial Augment Trial, Size 3 RM/LL - 5mm	1
5545-T-301	Tibial Augment Trial, Size 3 LM/RL - 5mm	1
5545-T-402	Tibial Augment Trial, Size 4 RM/LL - 5mm	1
5545-T-401	Tibial Augment Trial, Size 4 LM/RL - 5mm	1
5545-T-502	Tibial Augment Trial, Size 5 RM/LL - 5mm	1
5545-T-501	Tibial Augment Trial, Size 5 LM/RL - 5mm	1
5545-T-602	Tibial Augment Trial, Size 6 RM/LL - 5mm	1
5545-T-601	Tibial Augment Trial, Size 6 LM/RL - 5mm	1
5545-T-702	Tibial Augment Trial, Size 7 RM/LL - 5mm	1
5545-T-701	Tibial Augment Trial, Size 7 LM/RL - 5mm	1
5545-T-802	Tibial Augment Trial, Size 8 RM/LL - 5mm	1
5545-T-801	Tibial Augment Trial, Size 8 LM/RL - 5mm	1
5546-T-102	Tibial Augment Trial, Size 1 RM/LL - 10mm	1
5546-T-101	Tibial Augment Trial, Size 1 LM/RL - 10mm	1
5546-T-202	Tibial Augment Trial, Size 2 RM/LL - 10mm	1
5546-T-201	Tibial Augment Trial, Size 2 LM/RL - 10mm	1
5546-T-302	Tibial Augment Trial, Size 3 RM/LL - 10mm	1
5546-T-301	Tibial Augment Trial, Size 3 LM/RL - 10mm	1
5546-T-402	Tibial Augment Trial, Size 4 RM/LL - 10mm	1
5546-T-401	Tibial Augment Trial, Size 4 LM/RL - 10mm	1
5546-T-502	Tibial Augment Trial, Size 5 RM/LL - 10mm	1
5546-T-501	Tibial Augment Trial, Size 5 LM/RL - 10mm	1
5546-T-602	Tibial Augment Trial, Size 6 RM/LL - 10mm	1
5546-T-601	Tibial Augment Trial, Size 6 LM/RL - 10mm	1
5546-T-702	Tibial Augment Trial, Size 7 RM/LL - 10mm	1
5546-T-701	Tibial Augment Trial, Size 7 LM/RL - 10mm	1
5546-T-802	Tibial Augment Trial, Size 8 RM/LL - 10mm	1
5546-T-801	Tibial Augment Trial, Size 8 LM/RL - 10mm	1
6543-7-601	Resection Guide Tower	1
6543-7-600	Support Arm Assembly	1
6543-6-700	Revision Tibial Resection Guides - Slotted -Left	1
6543-6-701	Revision Tibial Resection Guides - Slotted -Right	1
6541-2-807	Alignment Handle	1
6541-2-429Y	Tibial Stylus	1
6541-2-601	Universal Tibial Template Size 1	1
6541-2-602	Universal Tibial Template Size 2	1
6541-2-603	Universal Tibial Template Size 3	1
6541-2-604	Universal Tibial Template Size 4	1
6541-2-605	Universal Tibial Template Size 5	1
6541-2-606	Universal Tibial Template Size 6	1
6541-2-607	Universal Tibial Template Size 7	1
6541-2-608	Universal Tibial Template Size 8	1

Triathlon Revision instruments (continued)

For all GMRS instrument part numbers see GMRS_SP_3

Item number	Description	Quantity in set
6543-6-504	Revision 100mm Stem Trial (9-25mm)-- Tray	1
5565-T-009A	9 x 100mm Stem Trial	1
5565-T-010A	10 x 100mm Stem Trial	2
5565-T-011A	11 x 100mm Stem Trial	2
5565-T-012A	12 x 100mm Stem Trial	2
5565-T-013A	13 x 100mm Stem Trial	2
5565-T-014A	14 x 100mm Stem Trial	2
5565-T-015A	15 x 100mm Stem Trial	2
5565-T-016A	16 x 100mm Stem Trial	2
5565-T-017A	17 x 100mm Stem Trial	2
5565-T-018A	18 x 100mm Stem Trial	2
5565-T-019A	19 x 100mm Stem Trial	2
5565-T-020A	20 x 100mm Stem Trial	2
5565-T-021A	21 x 100mm Stem Trial	1
5565-T-022A	22 x 100mm Stem Trial	1
5565-T-023A	23 x 100mm Stem Trial	1
5565-T-024A	24 x 100mm Stem Trial	1
5565-T-025A	25 x 100mm Stem Trial	1
6543-6-505	Revision Finishing-- Tray	1
6541-4-810	Impaction Handle	2
6541-4-813	Tibial Insert Impactor	1
6543-4-818	Universal Torque Wrench	1
6543-6-801	Universal Counter Wrench	1
6541-4-807	Femoral Impactor/Extractor	1
6541-4-811	Femoral Impactor	1
6541-4-812	Baseplate Impactor	1
6543-6-850	Revision Baseplate Impactor/Extractor	1
6543-6-030	Hinge Femoral Counter Wrench	1
6541-4-825	Slip Torque Handle	1
6541-4-805	Tibial Baseplate Impactor/Extractor	1
6541-4-802	1/8" Hex Drive	1
6543-4-802	Universal 1/8" Hex Driver	1
6543-4-600	Stabilizer Post Impactor	1

Triathlon Revision instruments (continued)

For all GMRS instrument part numbers see GMRS_SP_3

Item number	Description	Quantity in set
6543-6-512	Revision Baseplate Finishing-- TRAY	1
6543-6-038	IM Reamer Neutral Bushing Guide	1
5612-T-100	Revision Baseplate Trial, Size 1	1
5612-T-200	Revision Baseplate Trial, Size 2	1
5612-T-300	Revision Baseplate Trial, Size 3	1
5612-T-400	Revision Baseplate Trial, Size 4	1
5612-T-500	Revision Baseplate Trial, Size 5	1
5612-T-600	Revision Baseplate Trial, Size 6	1
5612-T-700	Revision Baseplate Trial, Size 7	1
6543-6-313	Revision Baseplate Keel Punch, Size 1-3	1
6543-6-346	Revision Baseplate Keel Punch, Size 4-6	1
6543-6-347	Revision Baseplate Keel Punch, Size 7	1
6543-6-413	Revision Baseplate Keel Punch Guide, Size 1-3	1
6543-6-447	Revision Baseplate Keel Punch Guide, Size 4-7	1
6543-6-039	Hinge Tibial Stylus	1
6543-6-513	Hinge Insert Trials-- TRAY	1
6543-6-018	Femoral Bushing Trial	2
6543-6-020	Hinge Trial Axle	1
6543-6-049	Filler Bushing Removal Tool	1
6543-6-050	Alignment Guide	1
6543-6-058	Hinge Tibial Bearing Post Trial, Size 1-2	1
6543-6-059	Hinge Tibial Bearing Post Trial, Size 3-4	1
6543-6-060	Hinge Tibial Bearing Post Trial, Size 5-6	1
6543-6-061	Hinge Bearing Insert Trial, Size 1	1
6543-6-062	Hinge Bearing Insert Trial, Size 2	1
6543-6-063	Hinge Bearing Insert Trial, Size 3	1
6543-6-064	Hinge Bearing Insert Trial, Size 4	1
6543-6-065	Hinge Bearing Insert Trial, Size 5	1
6543-6-066	Hinge Bearing Insert Trial, Size 6	1
6543-6-067	Hinge Bearing Insert Trial, Size 7	1
6543-6-071	Hinge Trial Bearing Plate, Size 1-2	1
6543-6-073	Hinge Trial Bearing Plate, Size 3-4	1
6543-6-075	Hinge Trial Bearing Plate, Size 5-6	1
6543-6-101	Triathlon Hinge Trial Bumper 0°	1
6543-6-103	Triathlon Hinge Trial Bumper 3°	1
6481-1-008	Axle Guide Rod	2
6543-6-070	Triathlon Hinge Insertion/Removal Handle	1

Triathlon Revision instruments (continued)

For all GMRS instrument part numbers see GMRS_SP_3

Item number	Description	Quantity in set
6543-6-517	Revision IM Reamers (20-25mm)-- TRAY	1
6543-7-520	IM Reamer - 20mm	1
6543-7-521	IM Reamer - 21mm	1
6543-7-522	IM Reamer - 22mm	1
6543-7-523	IM Reamer - 23mm	1
6543-7-524	IM Reamer - 24mm	1
6543-7-525	IM Reamer - 25mm	1
5571-T-025	Triathlon Stem Extender Trial - 25mm	2
5571-T-050	Triathlon Stem Extender Trial - 50mm	2
6543-6-518	Revision 150mm Stem Trial (9-25mm)	1
5566-T-009A	9 x 150mm Stem Trial	1
5566-T-010A	10 x 150mm Stem Trial	1
5566-T-011A	11 x 150mm Stem Trial	2
5566-T-012A	12 x 150mm Stem Trial	2
5566-T-013A	13 x 150mm Stem Trial	2
5566-T-014A	14 x 150mm Stem Trial	2
5566-T-015A	15 x 150mm Stem Trial	2
5566-T-016A	16 x 150mm Stem Trial	1
5566-T-017A	17 x 150mm Stem Trial	1
5566-T-018A	18 x 150mm Stem Trial	1
5566-T-019A	19 x 150mm Stem Trial	1
5566-T-020A	20 x 150mm Stem Trial	1
5566-T-021A	21 x 150mm Stem Trial	1
5566-T-022A	22 x 150mm Stem Trial	1
5566-T-023A	23 x 150mm Stem Trial	1
5566-T-024A	24 x 150mm Stem Trial	1
5566-T-025A	25 x 150mm Stem Trial	1

Triathlon Revision instruments (continued)

For all GMRS instrument part numbers see GMRS_SP_3

Item number	Description	Quantity in set
6543-5-200	Tibial Symmetric Cone Reamer	1
6543-5-220	Tibial Asymmetric Cone Reamer Size B	1
6543-5-230	Tibial Asymmetric Cone Reamer Size C	1
6543-5-240	Tibial Asymmetric Cone Reamer Size D	1
6543-5-250	Tibial Asymmetric Cone Reamer Size E	1
6543-5-201	Tibial Cone Reamer Guide LM/RL	1
6543-5-202	Tibial Cone Reamer Guide RM/LL	1
6543-5-203	Tibial Cone Alignment Guide	1
6543-8-017	Tibial Cone Upper Tray	1
6543-5-211	Tibial Cone Introducer Size A	1
6543-5-221	Tibial Cone Introducer Size B	1
6543-5-231	Tibial Cone Introducer Size C	1
6543-5-241	Tibial Cone Introducer Size D	1
6543-5-251	Tibial Cone Introducer Size E	1
6541-5-100	Cone Extractor	1
5549-T-110	Tibial Symmetric Cone Augment Trial Size A	1
5549-T-120	Tibial Symmetric Cone Augment Trial Size B	1
5549-T-130	Tibial Symmetric Cone Augment Trial Size C	1
5549-T-140	Tibial Symmetric Cone Augment Trial Size D	1
5549-T-150	Tibial Symmetric Cone Augment Trial Size E	1
5549-T-221	Tibial Asymmetric Cone Augment Trial Size B LM/RL	1
5549-T-222	Tibial Asymmetric Cone Augment Trial Size B RM/LL	1
5549-T-231	Tibial Asymmetric Cone Augment Trial Size C LM/RL	1
5549-T-232	Tibial Asymmetric Cone Augment Trial Size C RM/LL	1
5549-T-241	Tibial Asymmetric Cone Augment Trial Size D LM/RL	1
5549-T-242	Tibial Asymmetric Cone Augment Trial Size D RM/LL	1
5549-T-251	Tibial Asymmetric Cone Augment Trial Size E LM/RL	1
5549-T-252	Tibial Asymmetric Cone Augment Trial Size E RM/LL	1
6543-8-117	Tibial Cone Lower Tray	1
5900-8114	Stryker Case	1

Triathlon Revision implants

For all GMRS implant part numbers see GMRS_SP_3

Triathlon Hinge accessory implant part numbers

Item number	Description
5612-0-001	Triathlon Hinge Tibial Bearing Component Size 1-2
6481-2-110	MRH Femoral bushings
6481-2-120	MRH Axle
6481-2-150	MRH bushings, Sleeve, Neutral Bumper Package *Optional package used for sleeve and bushings and bumper
5612-3-000	Triathlon Bushings and Axle Standard Assembly Pack
6481-2-130	MRH Neutral bumper
6481-2-133	MRH 3 degree bumper

Triathlon Revision Tibial Baseplate part numbers

Item number	Description
5612-B-100	Triathlon Revision Tibial Baseplate Size 1
5612-B-200	Triathlon Revision Tibial Baseplate Size 2
5612-B-300	Triathlon Revision Tibial Baseplate Size 3
5612-B-400	Triathlon Revision Tibial Baseplate Size 4
5612-B-500	Triathlon Revision Tibial Baseplate Size 5
5612-B-600	Triathlon Revision Tibial Baseplate Size 6
5612-B-700	Triathlon Revision Tibial Baseplate Size 7

Triathlon Revision implants

For all GMRS implant part numbers see GMRS_SP_3

Triathlon Revision Tibial Augment part numbers

Item number	Description
5612-A-110	Triathlon Revision Tibial Augment Size 1, RM/LL, 10mm
5612-A-111	Triathlon Revision Tibial Augment Size 1, LM/RL, 10mm
5612-A-150	Triathlon Revision Tibial Augment Size 1, RM/LL, 5mm
5612-A-151	Triathlon Revision Tibial Augment Size 1, LM/RL, 5mm
5612-A-210	Triathlon Revision Tibial Augment Size 2, RM/LL, 10mm
5612-A-211	Triathlon Revision Tibial Augment Size 2, LM/RL, 10mm
5612-A-250	Triathlon Revision Tibial Augment Size 2, RM/LL, 5mm
5612-A-251	Triathlon Revision Tibial Augment Size 2, LM/RL, 5mm
5612-A-310	Triathlon Revision Tibial Augment Size 3, RM/LL, 10mm
5612-A-311	Triathlon Revision Tibial Augment Size 3, LM/RL, 10mm
5612-A-350	Triathlon Revision Tibial Augment Size 3, RM/LL, 5mm
5612-A-351	Triathlon Revision Tibial Augment Size 3, LM/RL, 5mm
5612-A-410	Triathlon Revision Tibial Augment Size 4, RM/LL, 10mm
5612-A-411	Triathlon Revision Tibial Augment Size 4, LM/RL, 10mm
5612-A-450	Triathlon Revision Tibial Augment Size 4, RM/LL, 5mm
5612-A-451	Triathlon Revision Tibial Augment Size 4, LM/RL, 5mm
5612-A-510	Triathlon Revision Tibial Augment Size 5, RM/LL, 10mm
5612-A-511	Triathlon Revision Tibial Augment Size 5, LM/RL, 10mm
5612-A-550	Triathlon Revision Tibial Augment Size 5, RM/LL, 5mm
5612-A-551	Triathlon Revision Tibial Augment Size 5, LM/RL, 5mm
5612-A-610	Triathlon Revision Tibial Augment Size 6, RM/LL, 10mm
5612-A-611	Triathlon Revision Tibial Augment Size 6, LM/RL, 10mm
5612-A-650	Triathlon Revision Tibial Augment Size 6, RM/LL, 5mm
5612-A-651	Triathlon Revision Tibial Augment Size 6, LM/RL, 5mm
5612-A-710	Triathlon Revision Tibial Augment Size 7, RM/LL, 10mm
5612-A-711	Triathlon Revision Tibial Augment Size 7, LM/RL, 10mm
5612-A-750	Triathlon Revision Tibial Augment Size 7, RM/LL, 5mm
5612-A-751	Triathlon Revision Tibial Augment Size 7, LM/RL, 5mm
5612-A-810	Triathlon Revision Tibial Augment Size 8, RM/LL, 10mm
5612-A-811	Triathlon Revision Tibial Augment Size 8, LM/RL, 10mm
5612-A-850	Triathlon Revision Tibial Augment Size 8, RM/LL, 5mm
5612-A-851	Triathlon Revision Tibial Augment Size 8, LM/RL, 5mm

Triathlon Revision implants (continued)

For all GMRS implant part numbers see GMRS_SP_3

Triathlon Hinge Inserts

Item number	Description
5612-P-111	Triathlon Hinge Insert Size 1, 11mm
5612-P-113	Triathlon Hinge Insert Size 1, 13mm
5612-P-116	Triathlon Hinge Insert Size 1, 16mm
5612-P-119	Triathlon Hinge Insert Size 1, 19mm
5612-P-122	Triathlon Hinge Insert Size 1, 22mm
5612-P-211	Triathlon Hinge Insert Size 2, 11mm
5612-P-213	Triathlon Hinge Insert Size 2, 13mm
5612-P-216	Triathlon Hinge Insert Size 2, 16mm
5612-P-219	Triathlon Hinge Insert Size 2, 19mm
5612-P-222	Triathlon Hinge Insert Size 2, 22mm
5612-P-311	Triathlon Hinge Insert Size 3, 11mm
5612-P-313	Triathlon Hinge Insert Size 3, 13mm
5612-P-316	Triathlon Hinge Insert Size 3, 16mm
5612-P-319	Triathlon Hinge Insert Size 3, 19mm
5612-P-322	Triathlon Hinge Insert Size 3, 22mm
5612-P-411	Triathlon Hinge Insert Size 4, 11mm
5612-P-413	Triathlon Hinge Insert Size 4, 13mm
5612-P-416	Triathlon Hinge Insert Size 4, 16mm
5612-P-419	Triathlon Hinge Insert Size 4, 19mm
5612-P-422	Triathlon Hinge Insert Size 4, 22mm
5612-P-511	Triathlon Hinge Insert Size 5, 11mm
5612-P-513	Triathlon Hinge Insert Size 5, 13mm
5612-P-516	Triathlon Hinge Insert Size 5, 16mm
5612-P-519	Triathlon Hinge Insert Size 5, 19mm
5612-P-522	Triathlon Hinge Insert Size 5, 22mm
5612-P-611	Triathlon Hinge Insert Size 6, 11mm
5612-P-613	Triathlon Hinge Insert Size 6, 13mm
5612-P-616	Triathlon Hinge Insert Size 6, 16mm
5612-P-619	Triathlon Hinge Insert Size 6, 19mm
5612-P-622	Triathlon Hinge Insert Size 6, 22mm
5612-P-711	Triathlon Hinge Insert Size 7, 11mm
5612-P-713	Triathlon Hinge Insert Size 7, 13mm
5612-P-716	Triathlon Hinge Insert Size 7, 16mm
5612-P-719	Triathlon Hinge Insert Size 7, 19mm
5612-P-722	Triathlon Hinge Insert Size 7, 22mm

Triathlon Revision implants (continued)

For all GMRS implant part numbers see GMRS_SP_3

Triathlon Tritanium Cone Augments part numbers

Item number	Description
5549-A-120	Triathlon Tritanium Symmetric Cone Augment Size B
5549-A-130	Triathlon Tritanium Symmetric Cone Augment Size C
5549-A-140	Triathlon Tritanium Symmetric Cone Augment Size D
5549-A-150	Triathlon Tritanium Symmetric Cone Augment Size E
5549-A-221	Triathlon Tritanium Asymmetric Cone Augment Size B LM/RL
5549-A-222	Triathlon Tritanium Asymmetric Cone Augment Size B RM/LL
5549-A-231	Triathlon Tritanium Asymmetric Cone Augment Size C LM/RL
5549-A-232	Triathlon Tritanium Asymmetric Cone Augment Size C RM/LL
5549-A-241	Triathlon Tritanium Asymmetric Cone Augment Size D LM/RL
5549-A-242	Triathlon Tritanium Asymmetric Cone Augment Size D RM/LL
5549-A-251	Triathlon Tritanium Asymmetric Cone Augment Size E LM/RL
5549-A-252	Triathlon Tritanium Asymmetric Cone Augment Size E RM/LL

Triathlon TS Stems – Cemented – part numbers

Item number	Description
5560-S-109	Triathlon Cemented Stem 9mm x 50mm
5560-S-112	Triathlon Cemented Stem 12mm x 50mm
5560-S-115	Triathlon Cemented Stem 15mm x 50mm
5560-S-209	Triathlon Cemented Stem 9mm x 100mm
5560-S-212	Triathlon Cemented Stem 12mm x 100mm
5560-S-215	Triathlon Cemented Stem 15mm x 100mm
5560-S-309	Triathlon Cemented Stem 9mm x 150mm
5560-S-312	Triathlon Cemented Stem 12mm x 150mm
5560-S-315	Triathlon Cemented Stem 15mm x 150mm

Triathlon Revision implants (continued)

For all GMRS implant part numbers see GMRS_SP_3

Triathlon TS Stems – Fluted – part numbers

Item number	Description
5565-S-010	Triathlon Fluted Stem, Titanium 10mm x 100mm
5565-S-011	Triathlon Fluted Stem, Titanium 11mm x 100mm
5565-S-012	Triathlon Fluted Stem, Titanium 12mm x 100mm
5565-S-013	Triathlon Fluted Stem, Titanium 13mm x 100mm
5565-S-014	Triathlon Fluted Stem, Titanium 14mm x 100mm
5565-S-015	Triathlon Fluted Stem, Titanium 15mm x 100mm
5565-S-016	Triathlon Fluted Stem, Titanium 16mm x 100mm
5565-S-017	Triathlon Fluted Stem, Titanium 17mm x 100mm
5565-S-018	Triathlon Fluted Stem, Titanium 18mm x 100mm
5565-S-019	Triathlon Fluted Stem, Titanium 19mm x 100mm
5565-S-020	Triathlon Fluted Stem, Titanium 20mm x 100mm
5565-S-021	Triathlon Fluted Stem, Titanium 21mm x 100mm
5565-S-022	Triathlon Fluted Stem, Titanium 22mm x 100mm
5565-S-023	Triathlon Fluted Stem, Titanium 23mm x 100mm
5565-S-024	Triathlon Fluted Stem, Titanium 24mm x 100mm
5565-S-025	Triathlon Fluted Stem, Titanium 25mm x 100mm
5566-S-010	Triathlon Fluted Stem, Titanium 10mm x 150mm
5566-S-011	Triathlon Fluted Stem, Titanium 11mm x 150mm
5566-S-012	Triathlon Fluted Stem, Titanium 12mm x 150mm
5566-S-013	Triathlon Fluted Stem, Titanium 13mm x 150mm
5566-S-014	Triathlon Fluted Stem, Titanium 14mm x 150mm
5566-S-015	Triathlon Fluted Stem, Titanium 15mm x 150mm
5566-S-016	Triathlon Fluted Stem, Titanium 16mm x 150mm
5566-S-017	Triathlon Fluted Stem, Titanium 17mm x 150mm
5566-S-018	Triathlon Fluted Stem, Titanium 18mm x 150mm
5566-S-019	Triathlon Fluted Stem, Titanium 19mm x 150mm
5566-S-020	Triathlon Fluted Stem, Titanium 20mm x 150mm
5566-S-021	Triathlon Fluted Stem, Titanium 21mm x 150mm
5566-S-022	Triathlon Fluted Stem, Titanium 22mm x 150mm
5566-S-023	Triathlon Fluted Stem, Titanium 23mm x 150mm
5566-S-024	Triathlon Fluted Stem, Titanium 24mm x 150mm
5566-S-025	Triathlon Fluted Stem, Titanium 25mm x 150mm

Triathlon TS Stem Extender part numbers

Item number	Description
5571-S-025	Triathlon Stem Extender 25mm
5571-S-050	Triathlon Stem Extender 50mm

X-ray Templates

Item number	Description
LTEMK29	Global Modular Replacement System X-ray Templates