Tibial Replacements

ORTHOPAEDIC SALVAGE SYSTEM

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BIOMET ORTHOPEDICS, INC.
Primary Tibial Resection

A minimal resection (8mm) of the tibial plateau is accomplished via an intramedullary or extramedullary tibial resection guide (the I/M tibial resector is shown).

Drill and ream the tibia in the following sequence:
- I/M 0.375 diameter drill
- I/M reamer
- I/M rod

Set the depth of resection on the cutting block scale to the desired level. Tighten the gold-colored bolt to secure the resection level. Slide the entire assembly onto the I/M rod until the stylus touches the deepest portion of the unaffected tibial condyle. Secure the resection guide to the I/M rod by tightening the anterior silver bolt (Figure 1).

Pin the resection block and release the block from the guide. Remove the I/M rod and resection guide body. Resect the tibial plateau through the slot to create a flat surface perpendicular to the mechanical axis of the lower leg. Remove the cutting guide.

Select the tibial template that provides maximum surface coverage without overhang. Secure the template to the tibial surface (in correct rotational alignment with the tibial tubercle) with medium bone nails. Add the tibial punch guide tower and secure to the template with the anterior thumbscrew (Figure 2).
Revision Tibial Resection

All previous steps in preparing a primary tibia are followed, with the exception being the resection level of the tibial resector.

For a revision tibial resection, a flat clean-up cut of the tibial plateau is accomplished by setting the tibial resector at the “2” level and resecting as usual (Figure 1).

**Note:** If the I/M rod or a flare reamer is not sufficient in accommodating the tibial resection instrumentation, it may be necessary to perform a free-hand ream with the bullet tip reamers. This will allow the stem trial/resection planer insert assembly to be used with the I/M tibial resector (Figures 2 & 3).
Preparation

Short Non-modular Tibial Base Plate

The tibial starter reamer provides an entry hole into the tibia (Figure 1).

The short spiral reamer achieves the desired depth and diameter for the non-modular eminence of the tibial base plate (Figure 2).

The keel stem punch prepares the tibial plateau to accommodate the anti-rotational keels of the tibial base plate (Figure 3).

Remove the tibial punch guide tower and the template.
Preparation

Long Non-modular Tibial Base Plate

The tibial starter reamer provides an entry hole into the tibia (Figure 1).

The long tapered spiral reamer achieves the desired depth and diameter for the non-modular eminence and stem of the tibial base plate (Figure 2).

The keel stem punch prepares the tibial plateau to accommodate the anti-rotational keels of the tibial base plate (Figure 3).

Remove the tibial punch guide tower and the template.
OSS Tibial Base Plates

Preparation

Modular Tibial Base Plate (No Stem)

The tibial starter reamer provides an entry hole into the tibia (Figure 1).

The modular spiral reamer achieves the desired depth and diameter for the modular eminence of the tibial base plate (Figure 2).

The keel stem punch prepares the tibial plateau to accommodate the anti-rotational keels of the tibial base plate (Figure 3).

Remove the tibial punch guide tower and the template.
Preparation

Modular Tibial Base Plate with 90mm Stem

**Note:** All previous steps in preparing a modular tibial base plate are followed; the additional steps are required when using a 90mm stem.

After reaming with the modular spiral reamer, select a tibial tower reamer sleeve and a bullet tip reamer (Figures 1 & 2).

- Small tibial tower reamer sleeve is utilized for 8–12.5mm bullet tip reamers.
- Large tibial tower reamer sleeve is utilized for 13–20mm bullet tip reamers.

Place the bullet tip reamer into the horizontal insert slot of the tibial tower reamer sleeve and rotate the reamer in a clockwise motion until the reamer is vertical within the reamer sleeve (Figures 3–5).
Preparation
Modular Tibial Base Plate
with 90mm Stem

With the bullet tip reamer positioned within the tibial tower reamer sleeve, place the assembly into the tibial punch guide tower and ream to the 90mm stem etch line located on the shaft of the reamer *(etch line must be flush with the recessed shelf within the top of the reamer sleeve)* (Figures 2, 6 & 7).

Ream sequentially to cortical chatter and remove the reamer/sleeve assembly.

Select a 90mm tibial tower flare reamer (based on the final bullet tip reamer in the preceding step), to prepare the unique taper flare junction of the 90mm stems.

- **-12.5**: 90mm tibial tower flare reamer is utilized for 9mm–12.5mm diameter stems.

- **+13.0**: 90mm tibial tower flare reamer is utilized for 13mm–19.5mm diameter stems.
Preparation

Modular Tibial Base Plate with 150mm Straight Stem

Note: All previous steps in preparing a modular tibial base plate are followed; the additional steps are required when using a 150mm straight stem.

After reaming with the modular spiral reamer, select a tibial tower reamer sleeve and a bullet tip reamer:

- Small tibial tower reamer sleeve is utilized for 8mm–12.5mm bullet tip reamers.
- Large tibial tower reamer sleeve is utilized for 13mm–20mm bullet tip reamers.

With the bullet tip reamer locked into the chosen tibial tower reamer sleeve, place the assembly into the tibial punch guide and ream distally until the retaining stop on the reamer comes in contact with the reamer sleeve’s recessed shelf (Figure 1).

Ream sequentially to cortical chatter and remove reamer sleeve assembly.

Select a tibial tower flare reamer (based on the final bullet tip reamer in the preceding step), to prepare the unique taper flare junction of the 150mm straight stems (Figure 2).
**OSS Tibial Base Plates**

**Trial Assembly**

**Short Non-Modular Tibial Base Plates**
No assembly is necessary (Figure 1).

**Long Non-Modular Tibial Base Plates**
No assembly is necessary (Figure 2).

**Modular Tibial Base Plates (no Stem)**
No assembly is necessary (Figure 3).

**Modular Tibial Base Plates (with Stem)**
Secure the selected stem trial (90mm or 150mm Straight) to the modular tibial base plate with the 3.5mm short shaft screwdriver (Figure 4).
**Implant Assembly**

**Short Non-Modular Tibial Base Plates**
No assembly is necessary (Figure 1).

**Long Non-Modular Tibial Base Plates**
No assembly is necessary (Figure 1).

**Modular Tibial Base Plates (No Stem)**
No assembly is necessary (Figure 2).

**Modular Tibial Base Plates (with Stem)**
When opening the sterile stem implant box at the back table, make certain to remove and set aside the large-head/small-thread locking screw from the stem. The stems are pre-packaged with the screws threaded into the male tapers: *Do Not Discard* (Figure 3).

After aligning the stem with the modular tibial base plate, vigorously impact the taper using the stem holder and the modular impactor; secure with the large-head/small-thread locking screw that was set aside (Figures 4–6).

The tibial base plate is implanted using contemporary techniques for either a cemented or press-fit application.
Proximal Tibial Resection

Measure the proximal tibia and make a reference resection mark and a rotation mark for the proximal tibial component to be used with either methylene blue or a cautery device (Figure 1).

Using a transverse cut, resect the tibia at the reference resection mark (Figures 2 & 3).

Figure 1

Figure 2

Figure 3
**Canal Preparation**

**3cm Non-Modular Proximal Tibia**
Prepare the tibial canal using incremental bullet tip reamers until cortical contact is achieved (reaming depth must be equivalent to the 240mm stem length) (Figure 1).

Based on the diameter of the final bullet tip reamer, select the flare reamer of equivalent size and ream the canal opening until the entire flat of the flare reamer cutting head rests flush with the resected proximal tibia. Remove the flare reamer (Figures 2 & 3).
Canal Preparation

5cm/7cm Non-Modular Proximal Tibia
Prepare the tibial canal using incremental bullet tip reamers until cortical contact is achieved (reaming depth must be equivalent to the 150mm stem length) (Figures 1 & 2).

Based on the diameter of the final bullet tip reamer, select the flare reamer of equivalent size and ream the canal opening to the “depth etch” located on the reamer body (Figures 3 & 4).
Canal Preparation

9cm Modular Proximal Tibia

Prepare the tibial canal using incremental bullet tip reamers until cortical contact is achieved (reaming depth must be equivalent to the selected stem length) (Figures 1 & 2).

Based on the diameter of the final bullet tip reamer, select the flare reamer of equivalent size and ream the canal opening to the “depth etch” located on the reamer body (Figures 3 & 4).
Utilizing the OSS Resection Planer

**Note:** This operational step involves the 5cm/7cm non-modular and 9cm modular proximal tibial components.

**Option One**
Leave the flare reamer within the canal and remove the power source.

Place the resection planer over the shaft of the flare reamer and plane the resected proximal tibia (Figures 1 & 2).

**Option Two**
Remove the flare reamer and attach the resection planer insert to the exposed threaded male taper of the stem trial (Figure 3).

Insert the assembly into the prepared tibial canal until the resection planer insert is flush with the resected proximal tibia (Figure 4).

Place the resection planer over the exposed shaft of the resection planer insert and plane the resected proximal tibia (Figures 5 & 6).
OSS Proximal Tibials

**Trial Assembly**

3cm Non-Modular Proximal Tibia
No assembly is necessary (Figures 1 & 2).

5cm / 7cm Non-Modular Proximal Tibia
Secure the 150mm straight stem trial to either the 5cm or 7cm proximal tibial trial with the 3.5mm short shaft screwdriver (Figures 3 & 4).
**Trial Assembly**

**9cm Modular Proximal Tibia**

Assemble the 9cm proximal tibial trial to the diaphyseal segment trial using the 3.5mm short shaft screwdriver (Figure 1).

Attach the stem trial to the diaphyseal segment trial by tightening the locking wheel (this may be accomplished either digitally or with the diaphyseal segment wheel wrench) (Figures 2 & 3).
Implant Assembly

3cm Non-Modular Proximal Tibia
No assembly is required (Figure 1).

5cm/7cm Non-Modular Proximal Tibia
No assembly is required (Figure 2).

9cm Modular Proximal Tibia
The 9cm proximal tibial component may be joined with a diaphyseal segment and a stem (Figure 3).

When opening the sterile stem implant box, make certain to locate and remove the large-head/small-thread locking screw from the stem; it will not be used (the stems are pre-packaged with the screws threaded into the male tapers) (Figures 4 & 5).
Implant Assembly (cont’d)

9cm Modular Proximal Tibia
When opening the sterile diaphyseal segment implant box, be sure to locate the two locking screws (small-head/small-thread and large-head/large-thread) that are individually packaged with the implant. Set these two screws aside, as they will be used for securing the implants (Figure 6).

After aligning the stem with the diaphyseal segment vigorously impact the taper using the diaphyseal taper holder and the stem impactor handle. Secure with the small-head/small-thread locking screw that was previously set aside, (when using larger diaphyseal segments, it will be necessary to use the 3.5mm long shaft screwdriver) (Figures 7–9).
Implant Assembly (cont’d)

Position the proximal tibial component onto the diaphyseal segment/stem assembly and, using the stem holder and the modular impactor, vigorously impact the taper (Figure 10).

Secure with the large-head/large-thread locking screw that was previously set aside (Figure 11).
Utilizing the OSS Segmental Stacking Adapter (Optional)

**Note:** In the event that two diaphyseal segments are necessary to form a specific reconstruction length, the following steps should be taken to achieve a taper/locking screw interface between the two segments.

After a diaphyseal and stem have been impacted together and secured with a small-head/small-thread locking screw, a segmental stacking adapter (Figure 1) is threaded into the male taper of the diaphyseal segment/stem construct with the axle screwdriver (Figures 2–4).

With the segmental stacking adapter fully seated, the second diaphyseal segment is vigorously impacted onto the initial diaphyseal segment using the diaphyseal taper holder and the stem impactor handle. Secure with the small-head/small-thread locking screw that was previously set aside (Figures 5 & 6).

The proximal tibial component is now secured to the double segment construct using the standard impaction technique.
L. Daniel Wurtz, M.D.

“It is strongly suggested that a gastrocnemius muscle transposition flap be used during the reconstruction for limb-sparing surgery of the proximal tibia to reestablish the extensor mechanism and lessen the risk of soft tissue complications.”

Operative Technique for A Medial Gastrocnemius Flap

The midline incision is extended down the leg, just medial to the tibia (Figure 1).

The superficial fascia is incised, and a plane is developed between the medial gastrocnemius and soleus muscles, where the plantaris tendon usually is visualized. The medial gastrocnemius is divided at its distal insertion to the Achilles tendon (Figure 2).

Proximally, the median raphe is identified between the bellies of the medial and lateral gastrocnemius muscle. With blunt and sharp dissection, the medial gastrocnemius is divided up to the level of the tibial condyles to provide an adequate arc of rotation (Figure 3).

Throughout the procedure, the medial sural artery must be preserved to provide an adequate blood supply to the medial gastrocnemius (Figure 2).

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The muscle is transposed anteriorly at the level of the knee joint to cover the tibial tubercle and is sutured to the fascia of the anterior compartment. The patellar tendon and the anterior aspect of the joint capsule are sutured to the medial border of the medial gastrocnemius flap (Figures 4 & 5).

A split thickness skin graft may be necessary to cover part of the medial gastrocnemius flap if approximation of the skin is not possible.

The technique can be altered to include reconstruction of the entire extensor mechanism for patients in whom a repair of a rupture of the quadriceps tendon has failed, such as those who have had a patellectomy or a patellar fracture with a disruption of the extensor mechanism, those who have had loss of the extensor mechanism secondary to infection, and those who have had takedown of a fusion. In these situations, the incision is extended distally and the medial one third to one half of the Achilles tendon is obtained in continuity with the medial gastrocnemius muscle (Figure 6).

The entire flap then is transposed anteriorly as already described, and the deep fascia of the gastrocnemius is approximated to the proximal aspect of the tibial with suture or wires placed through drill holes (Figure 7).

With the knee in full extension, the Achilles tendon portion of the flap is rotated superiorly and is approximated to the remaining portion of the quadriceps tendon under as much tension as possible. A split thickness skin graft can be used for closure when necessary.

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