

Surgical technique for cemented tibial fixation





# **EVOLUTION® REVISION KNEE SYSTEM**

#### **Indications & Warnings**

Proper surgical procedures and techniques are the responsibility of the medical professional. The following guidelines are furnished for information purposes only. Each surgeon must evaluate the appropriateness of the procedures based on his or her personal medical training, experience, and patient condition. Prior to use of the system, the surgeon should refer to the product package insert for additional warnings, precautions, indications, contraindications and adverse effects. Instructions for Use package inserts are also available by contacting the manufacturer. Contact information can be found on the back of this surgical technique and the package insert is available on the website listed.

Package inserts can be found under: Prescribing Information on ortho.microport.com/ifus

Please contact your local MicroPort Orthopedics representative for product availability.

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# **Product information**

The Evolution<sup>®</sup> Revision Knee System builds on the clinical history of the Advance<sup>®</sup> revision knee system design. The Evolution<sup>®</sup> revision knee system is designed to offer surgeons intra-operative flexibility to meet individual anatomic patient needs, and address fixation issues caused by poor bone stock while maintaining the proven kinematic benefits of the medial-pivot design.

# **Device description**

#### **TIBIAL BASE IMPLANT**

- Assymetric for improved bone coverage
- 0° posterior slope relative to trunnion
- Enhanced locking mechanism
  - Angled 8° in direction of the incision approach (anterior-medial direction)

#### **TIBIAL BASE AUGMENT**

- 5, 10 and 15mm thick, medial and lateral options
- Allows for +/-6° modular keel rotation
- Can be independently placed on tibial base to address varying degrees of bone loss
- 10 and 15mm augments taper to match the natural tibial geometry

#### **TIBIAL BASE MODULAR KEEL**

- Two sizes to optimize rotational stability
- Can be positioned to provide fixation with given location of residual bone stock

## **OFFSET ADAPTER**

- Allows 360° of offset rotation for bone coverage of the proximal tibia
  - 4mm and 8mm offset
  - 25mm length





## **Stem adaptors**

- Extends total length of the stem for additional fixation
- 25 and 50mm length

## **Canal filling stems**

- Contains splines and flutes to provide immediate fixation and torsional resistance
- Flexible coronal slot provides dynamic structure to address long-term endosteal bone changes
- Diameters of 10-24mm in 1mm increments
- Lengths of 100 and 150mm

## **Cemented stems**

- 17mm diameter in lengths of 25 and 50mm
- 10, 12, 14, 16, and 18mm diameters in a length of 75mm

# Tibial insert implant: CS (Cruciate Substituting), CR (Cruciate Retaining), PS (Posterior Stabilized)

- Asymmetric to position mating femur more posterior
- 1-up interchangeability with plus size insert options
- 1-down interchangeability with standard insert
- 15° of permissible femoral rotation













Keel preparation



Tibial trial reduction



# Tibial surgical technique

# **Tibial preparation**

The Evolution<sup>®</sup> revision knee system uses intramedullary tibial resection guides. The tibial slope is set at 0° to accommodate the complexity of the tibial components.

# Starter hole preparation/alignment rod insertion

If necessary, use a 9.5mm starter drill (P/N E5001002) to initiate an opening in the proximal tibia just posterior to the original attachment point of the anterior cruciate ligament. | A in FIGURE 1 Begin an incremental reaming process with the 10mm or appropriate size reamer to establish the anatomic axis of the proximal tibia. | FIGURE 1 During the reaming process, the intramedullary canal of the tibia should be repeatedly irrigated and aspirated to reduce the chance of fat emboli. Hand reaming may be appropriate to avoid a thin tibial cortex that could result in a fracture.

The Evolution® reamers (P/N E2431XXX) are available in 10mm through 24mm diameters in 0.5mm increments and are marked for lengths of 100mm through 225mm in 25mm increments | A in FIGURE 2 These lengths correspond to the total length of all components that are to be used in the procedure. For example, a construct of a tibial base (25mm trunnion), a 25mm offset adapter, and a 100mm stem extension would result in a total length of 150mm. Specific reamers are provided to prepare for stem lengths of 25mm and 50mm. | ADDENDUM

For a 12mm cemented stem extension, reaming to 13mm will provide a 0.5mm per side cement mantle while reaming to 14mm will provide a 1mm per side cement mantle. Reaming to a 16mm diameter for a 16mm canal filling stem will provide 0.5mm press-fit per side while reaming to a 15mm reamer will provide a 1mm press-fit per side. | ADDENDUM

With desired reaming complete, ensure the reamer provides a stable construct for additional tibial preparation.

# Extramedullary (EM) check

Varus/valgus angulation can be checked to the ankle using the external extramedullary check guide (P/N E2230001)and alignment rod (P/N E5101001). With the final reamer in place, slide the extramedullary check guide over the reamer and position above the tibia | **FIGURE 3** The alignment rod can be used to confirm alignment through any of the multiple holes including a pivoting hole.

## Intramedullary (IM) tibial resection

# NOTE: The Evolution<sup>®</sup> revision tibial resection guides are designed for use with a 1.27mm (.05") thick saw blade.

Assemble the intramedullary alignment guide (P/N E2230002) and the appropriate tibial resection guide (P/N E223000L/R). Attach the entire construct to the fixed reamer. Adjust the alignment guide to the desired resection level with the aid of a saw blade or the "angel wing" dual reference gauge (P/N E5001006) | **A in FIGURE 4**, ensuring a minimal resection will be made off the tibial plateau. Turn the anterior lock knob to secure the guide to the IM reamer. | **B in FIGURE 4** Ensure the resection guide is adjacent to the anterior surface of the tibia by adjusting the proximal lock knob. | **C in FIGURE 4** Once secure, pin the resection guide to the proximal tibia through the "STD" holes. | **A in FIGURE 5** 

Using the lever, release the resection guide from the intramedullary alignment guide. Remove the alignment guide assembly by connecting a T-handle (P/N E5001001) to the fixed reamer and pulling up. Varus/valgus angulation to the ankle can be checked again with the external alignment guide (P/N E5101002) | FIGURE 6 and alignment rod. A divergent pin can be placed in the resection guide for additional stability. | B in FIGURE 5

NOTE: Proximal tibial resection can be made with or without the intramedullary guide and reamer in place. To keep only the fixed reamer in place, use the anterior lock knob to release the intramedullary guide from the reamer.

Ensure the tibial plateau is flat after resection.

NOTE: Lubrication of the crosshead connection cam hinge is particularly important to maintenance of the mechanism. Regular lubrication with surgical-grade lubricant intended for heat sterilized medical instruments per MicroPort Orthopedics cleaning instructions should be part of the routine instrument maintenance.



P/N E2230001

P/N E5101001

P/N F2230002

P/N E223000L/R

P/N E5001006

P/N E5001001

P/N E5101002



#### FIGURE 7



P/N E2330001



P/N E253XXXX



P/N E203000X





# **Block augmentation**

If block augmentation is needed, the tibial resection guide provides 3 resection slots at 5mm increments from the top of the guide | **A in FIGURE 7** This provides the ability to make a standard, 5, 10 or 15mm augment cut. Using a freehand cut, the sagittal cut can be completed after removing the tibial resection guide and the fixed reamer. There is a center mark on the resection guide for reference | **B in FIGURE 7** 

# **Tibial sizing**

If the fixed reamer was removed during resection, insert the selected reamer back into the intramedullary canal. Verify the reamer is positioned at the correct depth. If augments were resected for both medial and lateral compartments, place the appropriate augment trial on the resected surface to ensure correct reamer depth. Assemble the appropriate trial tibial base (P/N E2331XXL/R) to the trial base handle (P/N E2330001) and place it against the proximal tibial surface | **A in FIGURE 8** If applicable, assemble the selected trial tibial base with the appropriate tibial augment trial(s) (P/N E253XXXX) | **B in FIGURE 8** 

# **Offset rotation**

Place the trial tibial base assembly on the proximal tibia | **FIGURE 9** Determine the appropriate offset and rotation by using the offset bushings (P/N E203000X) and adjusting the assembly for optimal bone coverage with electrocautery | **A IN FIGURE 10** Offset bushings are available in 0, 4 and 8mm. To verify varus/valgus alignment, the alignment rod can be used with the trial tibial base handle. Mark the location of the trial tibial base using the three anterior marks coverage with electrocautery | **B IN FIGURE 10** Record the amount of offset and rotation. This will be used again to position the final implant.

# **Trunnion preparation**

Secure the position of the trial tibial base by pinning to the resected surface. Remove the fixed reamer and offset bushing. If the reamer is too large, the trial tibial base assembly needs to be removed to allow for removal of the reamer. Using the three anterior marks, reposition the trial tibial base and pin to the tibia. Attach the trunnion bushing (P/N E2030004) and rotate clockwise to lock into position | **FIGURE 11** Ream for the modular keel and tibial trunnion using the trunnion reamer (P/N E2431001) | **FIGURE 12** 

If using the 25mm cemented stem or the 25mm straight stem extension use the long trunnion reamer (P/N E2431002).

NOTE: If a reamer larger than 21mm has been used, the use of the trunnion reamer is optional.

### **Offset preparation**

If offset is desired remove the trial tibial base assembly but leave the fixed reamer in place. Prepare for offset with the offset reamer (P/N E2431003) by aligning to the fixed reamer and reaming until the solid line | A IN FIGURE 13 If the proximal surface has been prepared for augments on both medial and lateral compartments, ream to the appropriate depth grooves (5, 10, or 15mm) for the specific compartment | B IN FIGURE 13





#### FIGURE 14









P/N E253XXXX







## **Trial and keel preparation**

NOTE: Broaching option 2 (keel referencing is not applicable when augments are present due to limited keel rotation.

#### Broaching option 1 (base referencing)

Assemble the broach construct utilizing the appropriate monolithic base trial (P/N E2332XXL/R), modular keel broach (P/N E223001X), offset or extension adapter broach (P/N E2230XXX), and stem extension trials (P/N E273XXXX or E2831XXX), if applicable | **FIGURE 14** Attach augment trials (P/.N E253XXXX) to the assembly, if applicable.

If an offset is to be used, assemble the correct offset adapter broach to the monolithic tibial base trial at the orientation determined during tibial sizing.

Secure the entire construct by using the lock screw | A IN FIGURE 15 with the 3.5mm hex driver (P/N E5001005).

IMPORTANT NOTE: The keel can be positioned according to surgeon preference. It is important to remember that keel rotation is limited with use of an augment trial. Marks are provided on the monolithic tibial base trial for keel rotation.

Impact the broach construct using the trial base impactor (P/N E253XXXX) | A IN FIGURE 16 until the construct is flush with the resected surface | FIGURE 17

# Broaching option 2 (keel referencing)

Assemble the appropriate offset or extension adapter broach and stem extension trial to the broach impactor adapter (P/N E2030006) | **FIGURE 18** Secure the assembly with the lock screw within the broach impactor adapter.

Attach the assembly to the broach handle impactor (P/N E2030005). Impact the broach assembly into the bone until the bottom of the broach impactor adapter is flush with the resected surface. Remove the broach handle impactor and broach impactor adapter. Attach the thread extension (P/N E2030008) to the offset or extension adapter broach using the 3.5mm hex drive. Assemble the modular keel broach to the broach handle impactor. Prepare for the modular keel by aligning the broach handle impactor over the thread extension until a complete stop | **FIGURE 20** Remove the broach handle impactor and thread extension, leaving the modular keel broach in place | **FIGURE 21** 

#### NOTE: If augments are used on either medial and lateral compartments, use caution to ensure proper depth is achieved with the broach construct.

Place the appropriate monolithic base trial in its desired position and secure the construct by tightening the lock screw. Ensure the rotation of the modular keel broach does not exceed maximum allowable rotation | FIGURE 22













FIGURE 20



**FIGURE 22** 





P/N E340XXXX

Arrent A

P/N E5002001

#### **FIGURE 23**





#### **FIGURE 24**



#### **FIGURE 25**

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## **Trial reduction**

The Evolution® revision tibia system allows for 1-up, 1-down interchangeability between the femur and tibia for all styles. Refer to the sizing chart above for size interchangeability, and see the implant dimension charts in the Addendum for a more detailed look at the options available for use | FIGURE 23, ADDENDUM Be aware of the size 2+, 6+, and 8+ tibial bases; these are required for the articular surface groupings built into this system.

Insert the trial tibial insert (P/N E3XXXXX) of the appropriate size and thickness onto the monolithic base trial | FIGURE 24

#### NOTE: When assembling the tibial insert trial, slightly angle the insert trial with some posterior slope during insertion to clear the anterior lip of the trial base.

To achieve an insert trial with a thickness of more than 14mm, use the trial insert spacers (P/N E340XXXX) which make 17, 20 and 24mm increments. Trial insert spacers work in conjunction with the size 14mm insert trials FIGURE 25

Trial inserts may be assembled in conjunction with the final tibia base implant to allow the surgeon to continue to trial.

After the trial reduction is complete, remove the monolithic base trial with the slaphammer (P/N E5002001) by attaching the trial base impactor into the available slots.

Verify the rotational position of the keel and offset adapter on the monolithic base trial assembly with the offset and rotation recordings. This will be transferred to the implant.

NOTE: Trial reduction can also be performed with the tibial trial base.

# FINAL TIBIAL IMPLANT AND INSERT IMPLANTATION

# Implant assembly/insertion

Follow one of the four assembly methods dictated by the previous preparations.

### 1. Stem extension only

Place the appropriate Evolution® revision tibial base implant (P/N ETRKNXXL/R) onto the impaction platform (P/N E2030010) and impaction platform insert (P/N E2030013) | **FIGURE 26** 

# NOTE: Identify left vs right base implant and ensure correct side is facing up.

Align the Evolution® revision modular keel implant (P/N ETRKMKXX) according to the trial assembly using the keel alignment guide | FIGURE 27 Once the rotation is determined, remove the keel alignment guide (P/N E2030015), leaving the modular keel implant in place. Impact the modular keel implant with three strong blows using the keel impactor (P/N E2030009) | FIGURE 28 The thread extension can be connected to the keel impactor for alignment to the tibial base implant during impaction, if preferred. Place the appropriate Evolution® revision stem extension (P/N ESCXXXXX or ESPXXXXX) into the trunnion of the implant and impact with three strong blows of the mallet | FIGURE 29 Insert the pass through screw at the proximal end of the tibial base implant and tighten with the 3.5 hex driver | FIGURE 30

NOTE: If augments are not being used, the polyethylene plugs should not be removed from the tibial base implant

#### FIGURE 26











FIGURE 29



FIGURE 30















P/N ESCXXXXX or ESPXXXXX





# **FIGURE 31**



P/N ETRKMKXX













P/N ESCXXXXX or ESPXXXXX



**FIGURE 33** 



**FIGURE 34** 



**FIGURE 36** 



#### 2. Augments and stem extension

Place the assembled tibial base onto the impaction platform (P/N E2030010) and impaction platform insert (P/N E2030013) | FIGURE 31

#### NOTE: Identify left vs right base implant and ensure correct side is facing up.

Align the Evolution® revision modular keel implant (P/N ETRKMKXX) according to the trial assembly using the keel alignment guide | FIGURE 32 Once the rotation is determined, remove the keel alignment guide (P/N E2030015), leaving the modular keel implant in place. Impact the modular keel implant with three strong blows using the keel impactor (P/N E2030009) **FIGURE 33** The thread extension can be connected to the keel impactor for alignment to the tibial base implant during impaction, if preferred.

#### NOTE: Remove the polyethylene plugs from the side of the tray the augment is being added to.

Remove the construct from the impaction platform and assemble the appropriate Evolution® revision tibial augments (P/N ETHXXXXX) | FIGURE 34 Tibial augments are attached by aligning the three centering pegs on the tibial augment with the three corresponding depressions on the tibial base. Utilizing the packaged screws, secure the augments to the tibial base. Plastic starter handles are provided with each augment screw and should be removed once the screw is tightened | FIGURE 34 Continue to tighten with the 3.5 hex driver. Replace the construct onto the impaction platform.

#### NOTE: The rotation of the modular keel implant is limited if an augment implant is present.

Place the appropriate Evolution<sup>®</sup> revision stem extension (P/N ESCXXXXX or ESPXXXXX) into the trunnion of the implant and impact with three strong blows of the mallet | FIGURE 35 Insert the pass through screw at the proximal end of the tibial base implant and tighten with the 3.5 hex driver | FIGURE 36

### 3. Adapter and stem extension

Place the appropriate Evolution<sup>®</sup> revision tibial base implant (P/N ETRKNXXL/R) onto the impaction platform (P/N E2030010) and impaction platform insert (P/N E2030013) | FIGURE 37

#### NOTE: Identify left vs right base implant and ensure correct side is facing up.

Align the Evolution® revision modular keel implant (P/N ETRKMKXX) according to the trial assembly using the keel alignment guide | FIGURE 38 Once the rotation is determined, remove the keel alignment guide (P/N E2030015), leaving the modular keel implant in place. Impact the modular keel implant with three strong blows using the keel impactor (P/N E2030009) | FIGURE 39 The thread extension can be connected to the keel impactor for alignment to the tibial base implant during impaction, if preferred.

Screw the secondary locking screw that was packaged with the adapter into the top of the appropriate stem extension (P/N ESCXXXXX or ESPXXXXX) and tighten with the 3.5 hex driver FIGURE 40 Place the straight stem adapter or offset adapter implant (P/N ESRK0XXX), onto the tibial base. If using an offset use the offset alignment guide (P/N E2030014) to position the offset adapter implant in the proper orientation as previously determined by the broach construct | FIGURE 41 Place the appropriate Evolution® revision stem extension assembled with the secondary locking screw into the adpater and impact with three strong blows of the mallet | FIGURE 42 Insert the pass through screw at the proximal end of the tibial base implant and tighten with the 3.5 hex driver. Tighten the side set screws with the hexalobular driver (P/N E2030017).

NOTE: the side set screws in the straight and offset adapters may need to be loosened just slightly to allow for stem extension assembly. Be careful not to lose or drop the side set screws

NOTE: Do not over-tighten side-set screws. The driver tip is small and may fracture if over-torqued.

# **FIGURE 37**



**FIGURE 39** 



**FIGURE 41** 



**FIGURE 42** 



**FIGURE 43** 



**FIGURE 38** 















































P/N E2030017







**FIGURE 47** 



#### 4. Augment(s), adapter and stem extension

Place the assembled tibial base onto the impaction platform (P/N E2030010) and impaction platform insert (P/N E2030013) | FIGURE 44 Align the Evolution® revision modular keel implant (P/N ETRKMKXX) according to the trial assembly using the keel alignment guide | FIGURE 45 Once the rotation is determined, remove the keel alignment guide (P/N E2030015), leaving the modular keel implant in place. Impact the modular keel implant with three strong blows using the keel impactor (P/N E2030009) | FIGURE 46 The thread extension can be connected to the keel impactor for alignment to the tibial base implant during impaction, if preferred.

#### NOTE: Remove the polyethylene plugs from the side of the tray the augment is being added to.

Remove the construct from the impaction platform and assemble the appropriate Evolution® revision tibial augments (P/N ETHXXXXX) | FIGURE 47 Tibial augments are attached by aligning the three centering pegs on the tibial augment with the three corresponding depressions on the tibial base. Utilizing the packaged screws, secure the augments to the tibial base. Plastic starter handles are provided with each augment screw and should be removed once the screw is tightened | FIGURE 47 Replace the construct onto the impaction platform.

Screw the secondary locking screw that was packaged with the adapter into the top of the appropriate stem extension (P/N ESCXXXXX or ESPXXXXX) and tighten with the 3.5 hex driver | FIGURE 48 Place the straight stem adapter or offset adapter implant (P/N ESRK0XXX), onto the tibial base. If using an offset use the offset alignment guide (P/N E2030014) to position the offset adapter implant in the proper orientation as previously determined by the broach construct | FIGURE 49 Place the appropriate Evolution® revision stem extension assembled with the secondary locking screw into the adapter and impact with three strong

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blows of the mallet | **FIGURE 50** Insert the pass through screw at the proximal end of the tibial base implant and tighten with the 3.5 hex driver | **FIGURE 51** Tighten the side set screws with the hexalobular driver (P/N E2030017).

NOTE: The rotation of the modular keel implant is limited if an augment implant is present.

# **Tibial insert seating**

Ensure the posterior and peripheral captures of the tibial base implant are completely clear of soft tissue and bone.

If these captures are not clear, the tibial insert will not be able to seat. The tips of the dual reference "angel wing" gauge are contoured to fit in the lock detail to help clear debris.

Once the cement has cured, the appropriate Evolution<sup>®</sup> medial-pivot tibial insert (P/N EIXXXXX) may be locked into place. Initial seating is accomplished by pushing the insert as far posterior as possible with hand pressure, paying special attention to engage the medial and lateral dovetails. The 45° insert impactor (P/N E3005101) may be utilized by placing the impactor tip in the anterior slot of the tibial insert at approximately a 45° angle to the tibial base. While maintaining this 45° angle, apply several strong mallet blows directing the insert posteriorly. After the anterior edge of the insert has been pushed past the anterior capture of the tibial base, it will automatically drop behind the anterior capture and the insert face will be flush against the surface of the tibial base.

If implanting the Evolution® medial-pivot PS insert, initial seating of the insert is performed with the knee in flexion, but final insertion is easier if the knee is in

#### FIGURE 50



FIGURE 51







P/N EIXXXXXX



P/N E3005101

# **Addendum**

#### **OVERALL CONSTRUCT LENGTH** WITH A 25MM TRUNNION

		OFFSET/STEM EXTENDER LENGTH		
		None	25mm	50mm
5	25mm	50mm	75mm	100mm
Ž	50mm	75mm	100mm	125mm
ξ	75mm	100mm	125mm	150mm
S	100mm	125mm	150mm	175mm
	150mm	175mm	200mm	225mm

#### **CANAL REAMING DIAMETER CEMENTED STEMS**

		CEMENT MANTEL PER SIDE		
		.5mm	1mm	
Ľ	10mm	11mm	12mm	
<b>NET</b>	12mm	13mm	14mm	
A	14mm	15mm	16mm	
ž	16mm	17mm	18mm	
STE	17mm	18mm	19mm	
	18mm	19mm	20mm	

# **REAMER DIAMETER**

#### **CANAL REAMING DIAMETER PRESS-FIT STEMS**

		PRESS-FIT PER SIDE		
		.5mm	1mm	
_	10mm	10mm	-	
_	11mm	11mm	10mm	
_	12mm	12mm	11mm	
_	13mm	13mm	12mm	
_	14mm	14mm	13mm	
2	15mm	15mm	14mm	
Ę.	16mm	16mm	15mm	
	17mm	17mm	16mm	
ם צ	18mm	18mm	17mm	
STE	19mm	19mm	18mm	
	20mm	20mm	19mm	
	21mm	21mm	20mm	
_	22mm	22mm	21mm	
_	23mm	23mm	22mm	
	24mm	24mm	23mm	

#### **REAMER DIAMETER**

# **Implant dimensions**





#### **Evolution® Revision Tibial Base**

Size	Α	В	С	
3	62	46	25	
4	66	49	25	
5	70	52	25	
6	74	55	25	
6+	78	58	25	
7	78	58	25	
8	82	61	25	
8+	86	64	25	

Dimensions are in mm







**Evolution® CS Insert** Available Thicknesses 10, 12, 14, 17, 20, 24mm

CS	Α
1	11
1+	11
2	11
2+	11
3	11
3+	11
4	11
4+	11
5	11
5+	11
6	11
6+	11
7	11
7+	11
8	12

Dimensions are in mm





**Evolution®** Revision Keel

Size	С
Medium	21
Large	23

Dimensions are in mm







**Evolution® CR Insert** Available Thicknesses 10, 12, 14, 17mm

**Evolution® PS Insert** Available Thicknesses 10, 12, 14, 17, 20, 24mm

CR/PS	Α	В	С
1	9	19	14
2	9	19	14
2+	9	20	16
3	9	20	16
4	9	20	16
5	9	21	16
6	10	22	16
6+	10	23	19
7	10	23	19
8	11	24	19

Dimensions are in mm



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