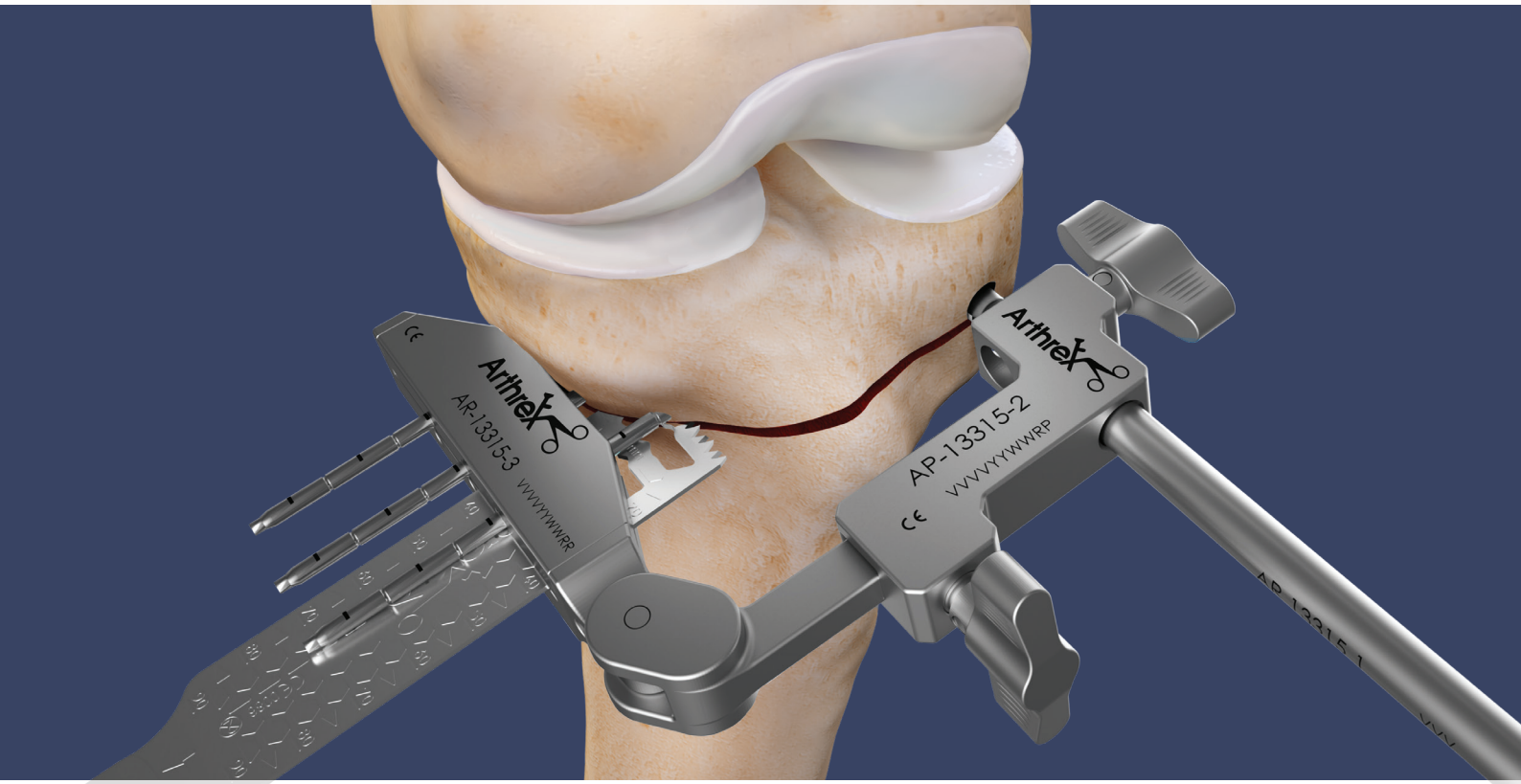
# High Tibial Osteotomy (HTO) Hinge Pin System

Surgical Technique




Arthrex®

## Introduction

Medial opening wedge high tibial osteotomy (HTO) is a commonly used treatment option for medial unicompartimental osteoarthritis with associated varus axis of the lower extremity.[1] The maintenance of adequate correction achieved after high tibial osteotomy is primarily dependent on factors associated with the surgical technique and the surgical implants used. Intraoperative fractures during medial opening wedge HTO is a known complication of this procedure.[2-4] Kessler et al described an osteotomy terminating in a 5 mm drill hole. When compared to a conventional osteotomy, they demonstrated a significant increase of potential wedge angle without lateral fracture when a drill hole is used at the end of an osteotomy.[5] **Note: Fluoroscopic confirmation should be used repeatedly throughout this procedure.**

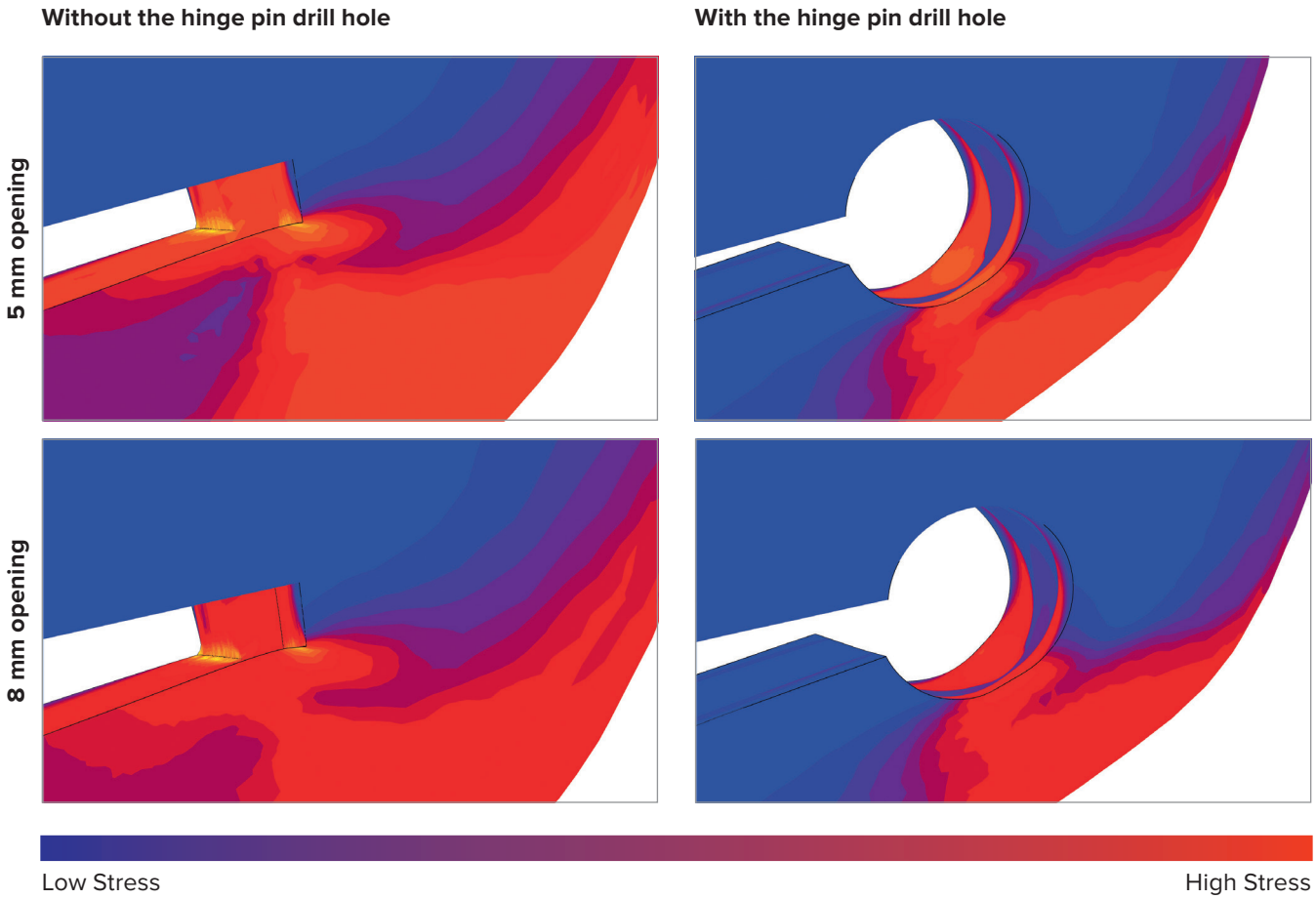
**The aim of the HTO Hinge Pin System is to:**

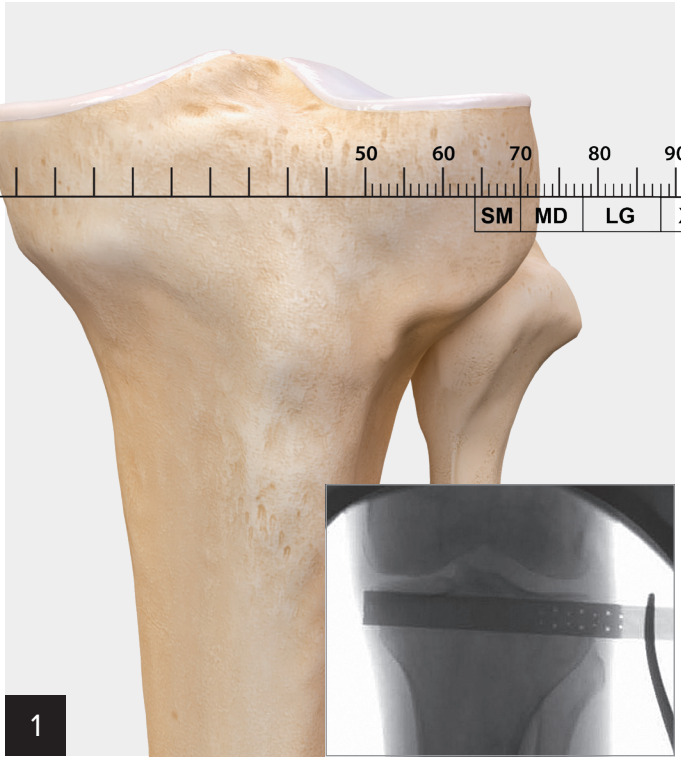
- Determine the end of an osteotomy with regard to bony references
- Saw toward a terminal hinge pin while performing the osteotomy
- Reduce the risk of lateral hinge breakage while opening the osteotomy

## FEA (Finite Element Analysis) on Hinge Pin

**FEM (Finite Element Model):** Analysis with and without hinge pin (see white paper “Hinge Pin Reduces Fracture Risk in Medial Opening Wedge Procedures”)

The HTO hinge pin technique reduces the risk of lateral cortex fracture by stress homogenization in the area of the drill hole, and therefore avoids local high stress risers in the region of the sharp cutting notch, leading to early crack initiation and fracture.



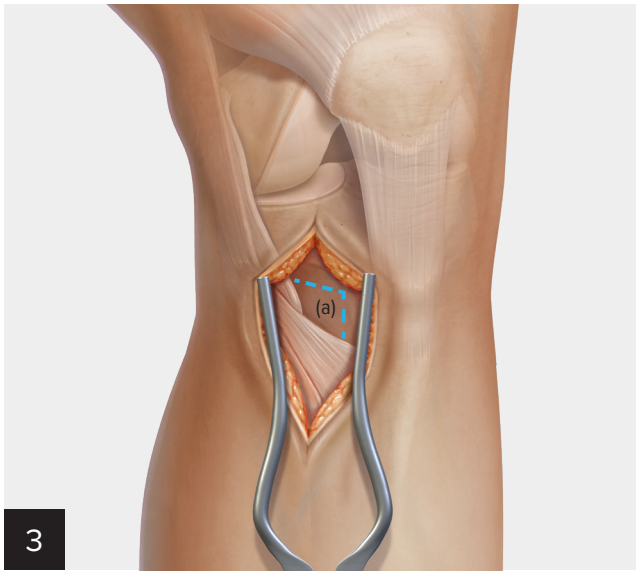



**HTO FreeCut Technique**
If the HTO hinge pin guide is combined with HTO FreeCut technique to implant an iBalance® wedge, the first surgical step is to measure the width of the tibial plateau. Confirm the tibial width measurement intraoperatively using AP fluoroscopic imaging and the iBalance steel rule. Obtain measurements both anterior and posterior to the proximal tibia and average the two readings for the tibial plateau width. This method provides compensation for parallax and magnification of the fluoroscope image and confirms the preoperative planning.

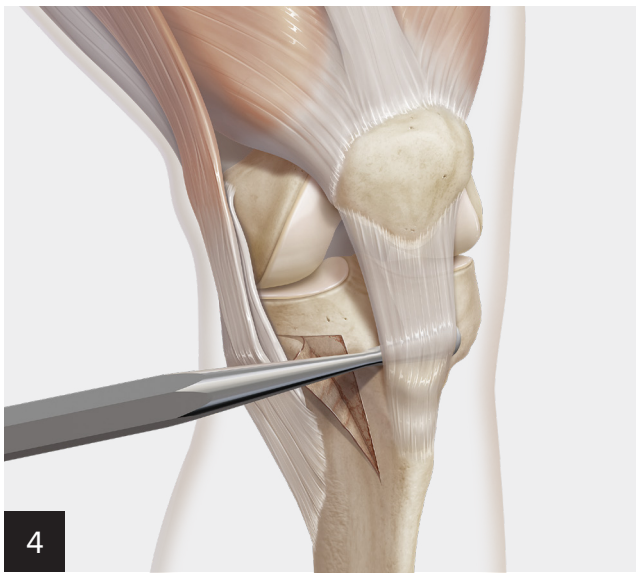
**Tibial width = (width anterior + width posterior) / 2**

The intraoperative measurement is then used to confirm the iBalance HTO instrument and implant size: SM (small), MD (medium), LG (large), or XL (extra large).

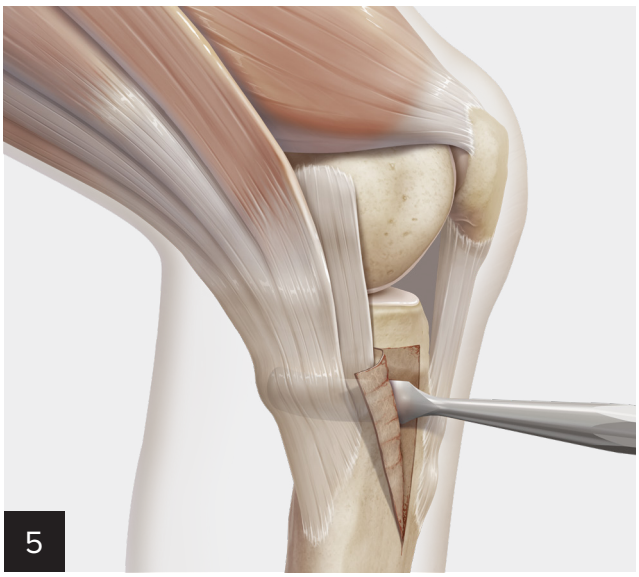

The patient is positioned supine with the knee in 30° flexion. Anatomic landmarks are defined and clearly marked (tibial tuberosity, border of the pes anserinus, medial joint line, medial collateral ligament). Plan a longitudinal incision midway between the tibial tubercle and the posterior border of the tibia. Start the incision just distal to the joint line and extend distally 7 cm to 9 cm.



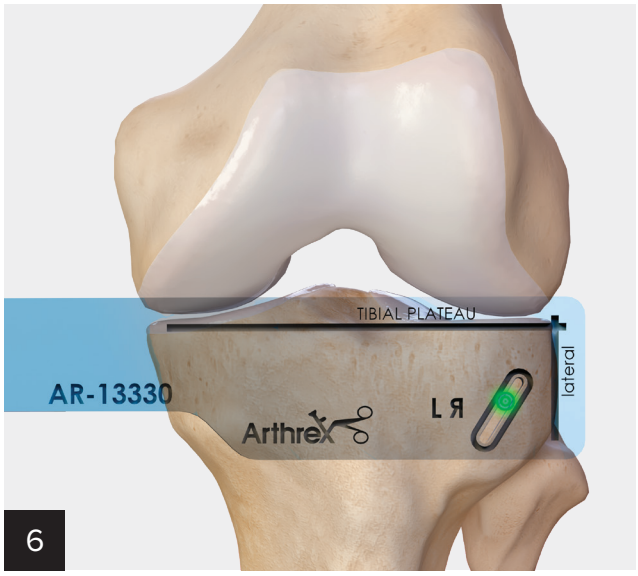

Clear/dissect tissue to the level of the pes/sartorius fascia. Plan an inverted L-shaped incision through the periosteum **(a)** and upper aspect of the sartorius attachment on the pes anserine bursa. The inverted portion of the L-shaped incision should be at least 1 cm distal to the joint line and parallel to the tibial slope to ensure avoidance of the joint space.




Identify the retropatellar tendon space and expose with the Cobb elevator. Partially elevate the proximal aspect of the pes anserine tendons from their distal insertion through the inverted L-shaped incision. Sharply dissect deeply to the proximal and anterior fibers of the superficial MCL. The Cobb elevator may be used to complete the dissection.

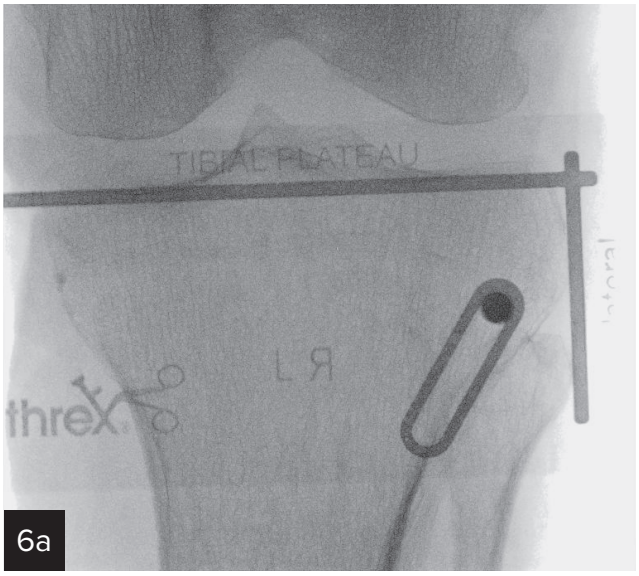



Advance the posterior elevator along the medial aspect of the tibia to the posterior border. Slide the tip of the elevator deep to the popliteus musculature, fascia tissue, and periosteum. From the posterior border, continue to advance the elevator deep to the popliteus musculature and toward the fibular head. When fully inserted, the elevator tip should rest under the popliteus muscle. Remove the elevator and palpate along the posterior margin of the tibia to ensure adequate elevation of the popliteus musculature, fascia, and periosteum.

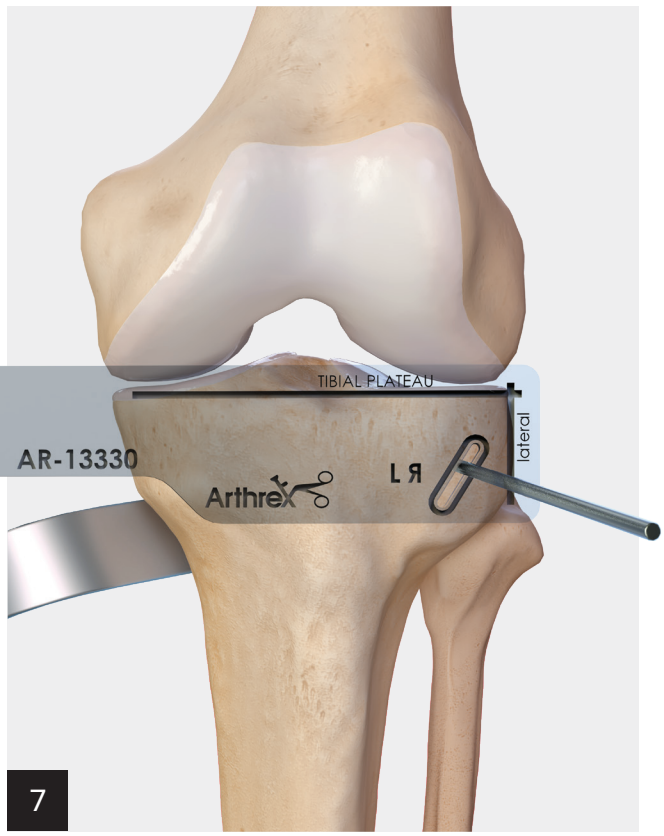



**Patient Positioning**
In order to drill the proper hinge axis, it is recommended to position the patient as follows: The radiolucent hinge pin template is placed onto the skin in anteroposterior AP direction, that is:

- Position the knee at ~30° flexion
- Keep the tibia in a neutral position




Under x-ray, the lateral tibial plateau has to be seen in line and ⅓ of the fibula head is projected through the tibia.



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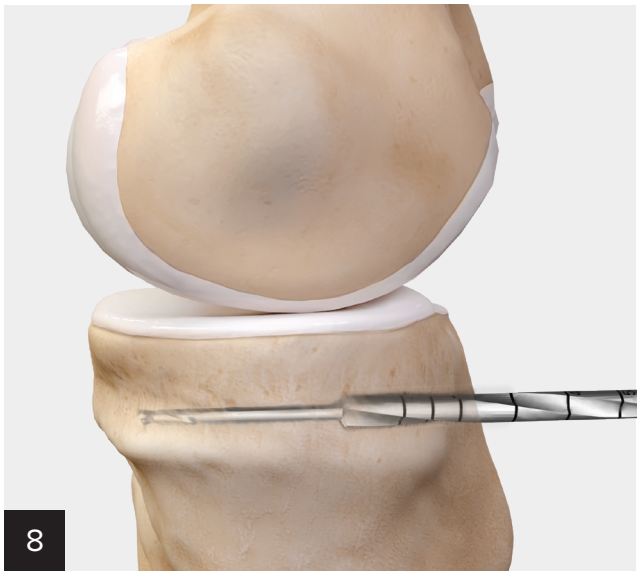
**Hinge Pin Positioning**
The radiolucent hinge pin template references bony landmarks: the lateral tibial plateau, the lateral tibial cortex, and a desired hinge pin position at the level of the proximal fibular head.

**Surgical Steps for Hinge Pin Positioning in an AP Direction**

1. Position the hinge pin template under fluoroscopic guidance referencing tibial platau and lateral tibial margin.
2. Hold a 2.4 mm guide pin against the skin through the oblique slot on template at the desired location.
3. Make a small skin incision at this location and dissect down to bone.
4. Realign radiolucent hinge pin template under fluoroscopy in true anterior-posterior orientation.
5. Place 2.4 mm guide pin in oblique slot on template at desired location in true anterior-posterior trajectory, parallel with tibial plateau.
6. Advance guide pin up to, but not penetrating, far cortex.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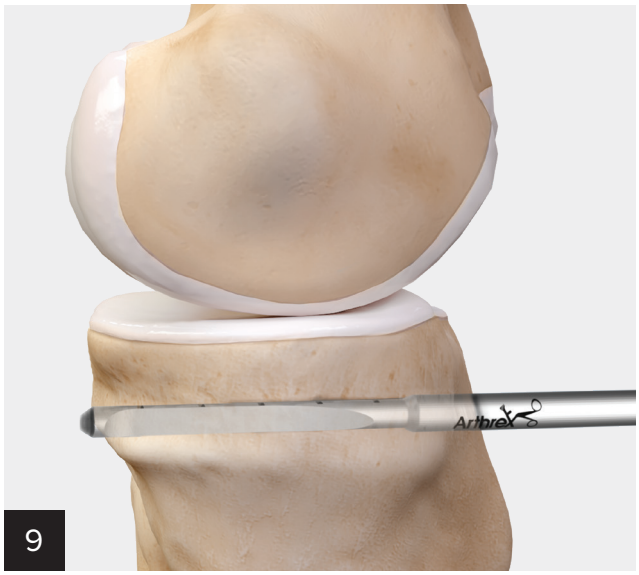
**Maintaining the Slope**
Under lateral x-ray (tibial plateau in line, medial and femoral condyles overlapping), Verify that the 2.4 mm guide pin is positioned parallel to the lateral tibial plateau to preserve the tibial slope. In case of mismatch, the direction of the guide pin has to be changed. If the guide pin is parallel, use a 5 mm cannulated headed reamer to overdrill.



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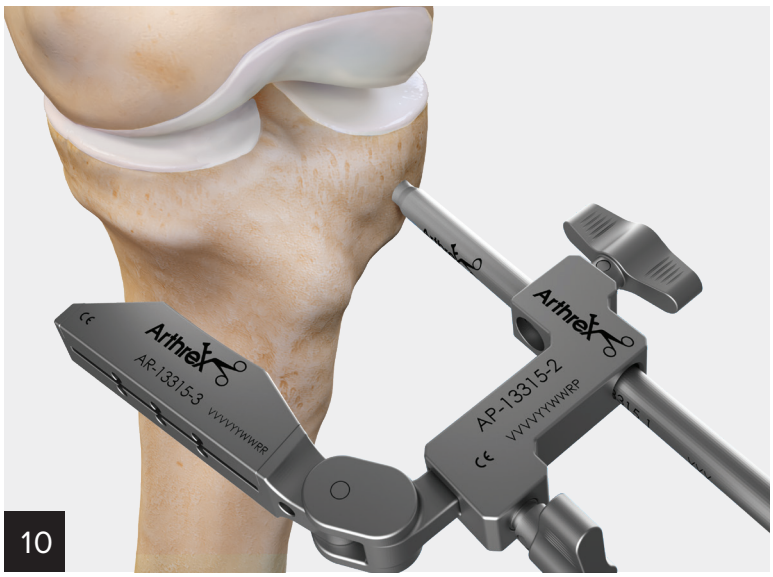
**HTO Hinge Pin**
Note the laser marks on the cannulated reamer to measure the tibial tunnel length. Remove the 2.4 mm drill tip guide pin and the 5 mm cannulated reamer. Insert the HTO hinge pin, filling the tibial tunnel completely and use the laser mark on the hinge pin to confirm.



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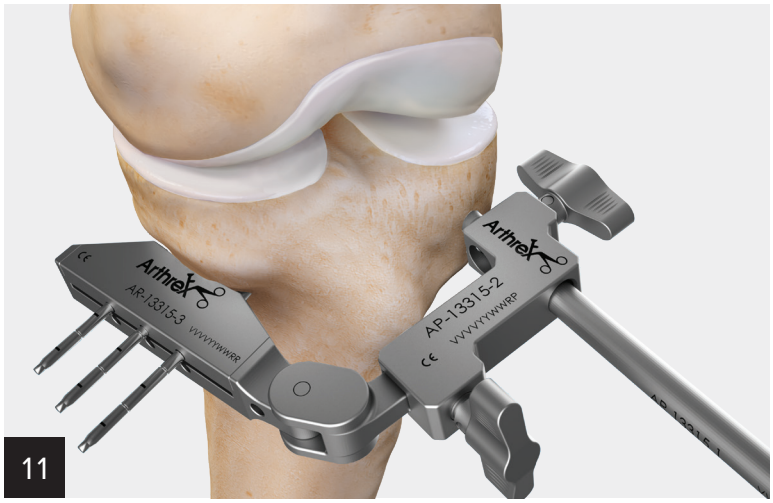
**HTO Hinge Pin**
Assemble the HTO hinge pin cutting guide and the HTO hinge pin saw guide onto the HTO hinge pin. Place the pin guide on the HTO hinge pin as close to skin as possible.

The saw guide should be placed as parallel as possible to the HTO hinge pin axis. Tighten all knobs of the HTO Hinge Pin System.



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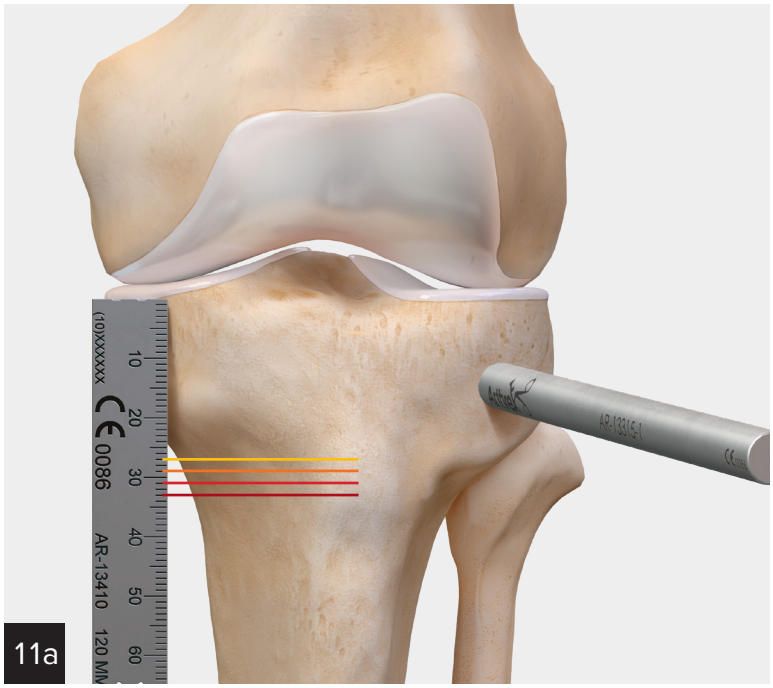
**HTO Hinge Pin Guide**
Place 2.4 mm breakaway guide pins through proximal drill holes in the HTO hinge pin saw guide. At least two breakaway pins are needed for stability while sawing. Breakaway pins should be broken as close as possible to the HTO hinge pin guide.



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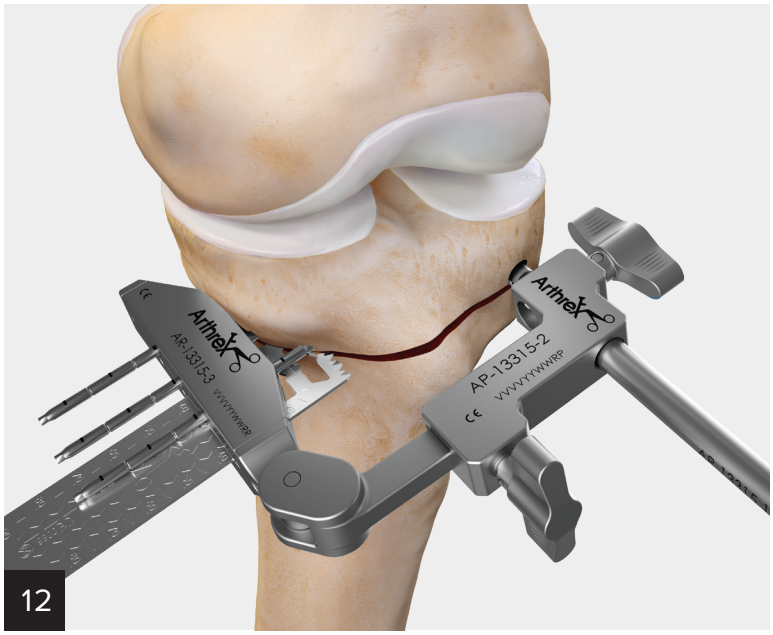
**HTO FreeCut Technique (if using the iBalance® implant)**
If the HTO hinge pin is combined with HTO FreeCut technique to implant an iBalance wedge, the starting level for placing breakaway pins must be measured (and marked with a pen) before drilling the breakaway pins. Position of breakaway pins with reference to the tibia plateau is determined by the iBalance steel rule under AP fluoroscopic control (first hole in the steel rule is 25 mm, following holes with 5 mm increments):

Distance to tibial plateau corresponding to measured size with the steel rule (see surgical step 1).
SM = 27, MD = 29, LG = 31, XL = 33 [mm]



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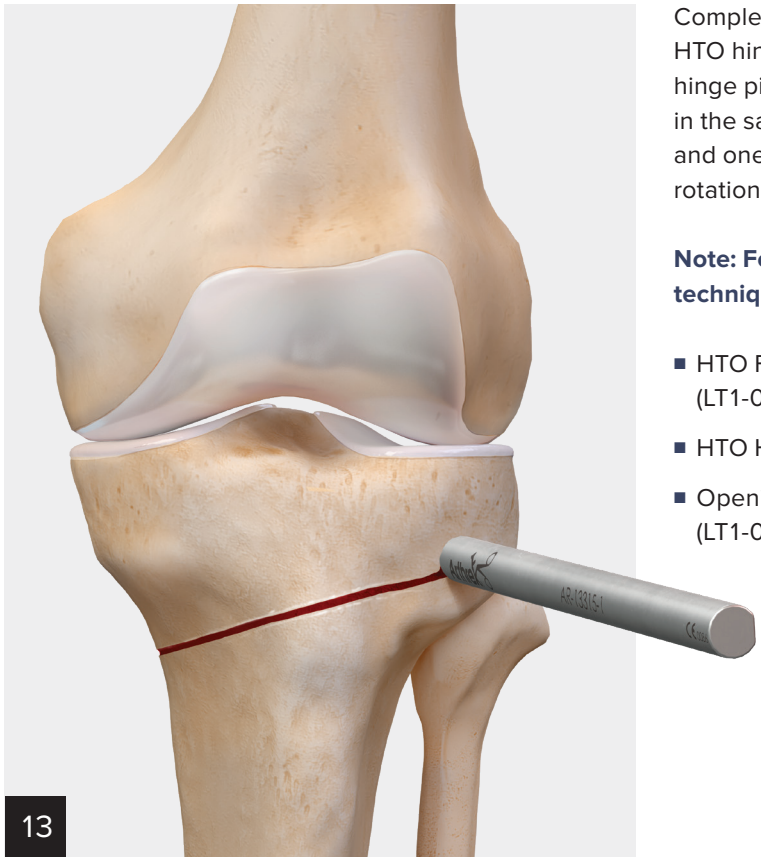
**Osteotomy**
Choose a saw blade to make the osteotomy (reference Saw Blades section within Ordering Information on page 8).

Tighten all knobs again on the HTO hinge pin guide before sawing. A metal retractor should be used for the posterior tibia to retract soft tissue and protect neurovascular structures. Perform the osteotomy using the saw blade through the notch of the HTO hinge pin saw guide. Stop when the saw blade makes contact with the HTO hinge pin. For disassembling, remove breakaway pins before loosening the knobs. Remove the HTO hinge pin guide and saw guide. The HTO hinge pin is still in position.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Complete the osteotomy using an osteotome and the HTO hinge pin as the lateral endpoint. Remove the HTO hinge pin. Place two guide pins parallel to each other in the sagittal plane of the proximal tibia (one proximal and one distal to the osteotomy cut) to control potential rotation when opening the osteotomy.

**Note: For implants, refer to the corresponding surgical technique guides.**

- HTO FreeCut technique for iBalance® Osteotomy (LT1-0121-EN)
- HTO Hinge Pin and FreeCut Systems (LT1-00051-EN)
- Opening Wedge Osteotomy Using ContourLock (LT1-00056-EN)

## Ordering Information

### HTO Hinge Pin System (AR-**13315S**)

| Product Description | Item Number |
|---|---|
| HTO Hinge Pin Template | AR-**13330** |
| Osteotomy Guide Pin, 2.4 mm | AR-**13303-2.4** |
| Osteotomy Guide Pin, 2.4 mm × 216 mm, sterile | AR-**13303-2.4S** |
| Drill Tip Guide Pin, 2.4 mm × 311 mm | AR-**1250L-1** |
| Drill Tip Guide Pin, 2.4 mm × 311 mm, sterile | AR-**1250LS** |

### Saw Blades

| Product Description | Item Number |
|---|---|
| Arthrex Power System 600, 105 mm × 19 mm × 1.27 mm Sagittal Saw Blade for Arthrex 600 | AR-**600-012S** |
| Arthrex Power System 600, 90 mm × 25.4 mm × 1.27 mm Sagittal Saw Blade for Arthrex 600 | AR-**600-005S** |
| Arthrex Power System 600, 90 mm × 13 mm × 1.27 mm Sagittal Saw Blade for Arthrex 600 | AR-**600-001S** |

Products may not be available in all markets because product availability is subject to the regulatory approvals and medical practices in individual markets. Please contact your Arthrex representative if you have questions about the availability of products in your area.

## References


1. Jacobi M, Wahl P, Jakob RP. Avoiding intraoperative complications in open-wedge high tibial valgus osteotomy: technical advancement. *Knee Surg Sports Traumatol Arthrosc.* 2010;18(2):200-203. doi:10.1007/s00167-009-0928-4
2. Han SB, Lee DH, Shetty GM, Chae DJ, Song JG, Nha KW. A “safe zone” in medial open-wedge high tibia osteotomy to prevent lateral cortex fracture. *Knee Surg Sports Traumatol Arthrosc.* 2013;21(1):90-95. doi:10.1007/s00167-011-1706-7
3. Kessler OC, Jacob HA, Romero J. Avoidance of medial cortical fracture in high tibial osteotomy: improved technique. *Clin Orthop Relat Res.* 2002;(395):180-185. doi:10.1097/00003086-200202000-00020
4. Koyonos L, Slenker N, Cohen S. Complications in brief: osteotomy for lower extremity malalignment. *Clin Orthop Relat Res.* 2012;470(12):3630-3636. doi:10.1007/s11999-012-2392-6
5. Arthrex, Inc. Data on file. (LA2-00030-EN_B). Naples, FL; 2017.


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