High Tibial Osteotomy Hinge Pin System

Surgical Technique
Medial opening wedge high tibial osteotomy (HTO) is a commonly used treatment option for medial unicompartmental osteoarthritis with associated varus axis of the lower extremity (Jacobi et al. 2009). 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 (Han 2012, Koyonos 2012). Kessler et al. (2002) described an osteotomy terminating in a 5 mm drill hole. When compared against 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. Fluoroscopic confirmation should be used repeatedly throughout this procedure.

The aim of the Arthrex® HTO Hinge Pin System is to:

- Determine the end of an osteotomy with regard to bony references
- Saw towards 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.

![Comparison of HTO hinge pin drill holes](image)
**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.

\[
\text{Tibial width} = \text{width anterior} + \text{width posterior} ÷ 2
\]

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).

**Skin Incision**

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). A skin incision (7-8 cm) running from the insertion of the pes anserinus to the posteromedial corner of the medial tibial plateau is made. The incision follows the proximal border of the pes anserinus. The fascia at the cranial border of the pes anserinus is incised and tendons retracted distally. The long fibers of the superficial medial collateral ligament (sMCL) are detached from the tibia with a periosteal elevator. A retractor is inserted behind the tibial level of the osteotomy and used for all following surgical steps. The tuberosity is exposed at the insertion of the patella tendon.

**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 nearly extension (~20°)
- Rotate the knee to outer rotation (~10°)

Under X-ray, the lateral tibial plateau has to be seen in line and 1/3 of the fibula head is projected through the tibia.
**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 AP Direction**

1. The Hinge Pin Template is positioned under fluoroscopic control referencing bony landmarks.

2. Hold a 2.4 mm guide pin between the patient’s skin and the template at the desired hinge pin position under fluoroscopic control.

3. Mark this position with a sterile pen.

4. 5 mm skin incision at the level of the desired hinge pin position.

5. 2.4 mm guide pin is drilled 1 - 2 cm into the bone.

6. Check the guide pin position using the template under fluoroscopic control.

7. In case of malpositioning of the drill pin, steps 5-6 are repeated.

8. The guide pin has to be seen as a small dot under fluoroscopic control.

9. In case of mismatch (see step 8), the angle of the guide pin has to be changed.

10. With final position and direction of the guide pin, it is drilled up to the far cortex, but not completely through the bone.

**Remaining the Slope**

Under lateral X-ray (tibial plateau in line, medial and femoral condyles overlapping), it is verified that the 2.4 mm guide pin is positioned parallel to the lateral tibial plateau to remain the tibial slope. In case of mismatch, the direction of the guide pin has to be changed. If the guide pin is parallel, a 5 mm Cannulated Headed Reamer is used to overdrill.
**HTO Hinge Pin**

Note the laser marks on the Cannulated Headed Reamer at the skin entrance point. The 2.4 mm drill tip guide pin and the 5 mm cannulated reamer are removed. The HTO Hinge Pin is inserted filling the tibial tunnel completely.

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**HTO FreeCut Technique**

If the HTO Hinge Pin Guide is combined with HTO freecut technique to implant an iBalance® wedge, the starting level for placing break-away pins has to be measured (and marked with a pen) before drilling the break-away pins.

Position of break-away 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).

\[ SM = 27, \quad MD = 29, \quad LG = 31, \quad XL = 33 \text{ [mm]} \]

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**HTO Hinge Pin**

The HTO Hinge Pin cutting guide and the HTO Hinge Pin Saw Guide are assembled onto the HTO Hinge Pin. The pin guide is tightened 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. All knobs of the HTO Hinge Pin System are tightened.
HTO Hinge Pin Guide

2.4 mm Osteotomy Guide Pins are placed through proximal drill holes in HTO Hinge Pin Saw Guide. At least two break-away pins are needed for stability while sawing. Break-away pins should be broken as near as possible to the HTO Hinge Pin Guide.

Osteotomy

A saw blade (90 or 105 mm length, 1.27 mm thickness) is chosen corresponding to the depth of the break-away pins. Tighten all knobs again on the HTO Hinge Pin Guide before sawing. A radiolucent retractor may to be used for the posterior tibia to retract soft tissue. The osteotomy is performed using the saw blade through the notch of the HTO Hinge Pin Saw Guide. Stop sawing when hitting the HTO Hinge Pin. Anteriorly, the cut is finalized after removing the saw guide using a patellar retractor or performing a biplanar cut. For disassembling, remove break-away pins before loosening the knobs. HTO Hinge Pin Saw Guide and guide are removed. HTO Hinge Pin is still in position.

Biplanar Cut

A biplanar osteotomy can be performed with an ascending or descending cut. Patella tendon has to be retracted. A smaller (13 mm width) saw blade can be used for the cut. The osteotomy is completed using osteotomes. The HTO Hinge Pin is removed. Two guide pins are placed parallel to each other (one proximal and one distal of the osteotomy cut) in the sagittal plane of the proximal tibia to control potential rotation when opening the osteotomy.

Note: For implants, refer to the corresponding surgical technique and fill the osteotomy with Quickset™:

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

*Quickset™ is owned by Graftys, S.A.
### Ordering Information

**HTO Hinge Pin System**

HTO Hinge Pin System (AR-13315S) includes:

<table>
<thead>
<tr>
<th>Item Description</th>
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<tbody>
<tr>
<td>HTO Hinge Pin</td>
<td>AR-13315-1</td>
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<tr>
<td>HTO Hinge Pin Guide</td>
<td>AR-13315-2</td>
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<tr>
<td>HTO Hinge Pin Saw Guide</td>
<td>AR-13315-3</td>
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<td>HTO Hinge Pin Template</td>
<td>AR-13330</td>
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<tr>
<td>Osteotomy Guide Pin, 2.4 mm</td>
<td>AR-13303-2.4</td>
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<td>Osteotomy Guide Pin, 2.4 mm x 216 mm, sterile</td>
<td>AR-13303-2.4S</td>
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<tr>
<td>Drill Tip Guide Pin, 2.4 mm x 311 mm</td>
<td>AR-1250L-1</td>
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**Saw Blades**

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<td>Arthrex Power System 600, 105 mm x 19 mm x 1.27 mm Sagittal Saw Blade for Arthrex 600</td>
<td>AR-600-012S</td>
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<td>Arthrex Power System 600, 90 mm x 25.4 mm x 1.27 mm Sagittal Saw Blade for Arthrex 600</td>
<td>AR-600-005S</td>
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<td>Arthrex Power System 600, 90 mm x 13 mm x 1.27 mm Sagittal Saw Blade for Arthrex 600</td>
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**Bone Graft Substitutes**

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<td>Arthrex Quickset, 5 cc Kit</td>
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<tr>
<td>Arthrex Quickset, 8 cc Kit</td>
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<tr>
<td>Arthrex Quickset, 16 cc Kit</td>
<td>ABS-3016</td>
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### References


White Paper. Data on file
This description of technique is provided as an educational tool and clinical aid to assist properly licensed medical professionals in the usage of specific Arthrex products. As part of this professional usage, the medical professional must use their professional judgment in making any final determinations in product usage and technique. In doing so, the medical professional should rely on their own training and experience and should conduct a thorough review of pertinent medical literature and the product’s Directions For Use.

View U.S. patent information at www.arthrex.com/corporate/virtual-patent-marking

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