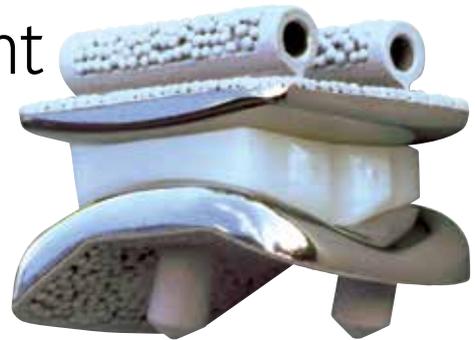




Tel +32 496 260 639 [xavier@exmedical.be](mailto:xavier@exmedical.be)

**BOX<sup>®</sup>**  
Total Ankle Replacement  
*Operative Technique*



***BOX Total Ankle Replacement***

Developed in association with Professor S. Giannini, Professor F. Catani and Doctor A. Leardini from the Istituti Ortopedici Rizzoli (Bologna, Italy) and Professor J.J. O'Connor from the University of Oxford.

***Contents***

Section 1   <b><i>Pre-operative Planning and Surgical Approach</i></b>	<b>4</b>
Section 2   <b><i>Initial Talar Preparation</i></b>	<b>5</b>
Section 3   <b><i>Tibial Preparation</i></b>	<b>9</b>
Section 4   <b><i>Talar Finishing</i></b>	<b>18</b>
Section 5   <b><i>Trial Reduction</i></b>	<b>21</b>
Section 6   <b><i>Final Implantation</i></b>	<b>27</b>
Section 7   <b><i>Closure</i></b>	<b>30</b>
Section 8   <b><i>Inventory</i></b>	<b>31</b>
Section 9   <b><i>Sizing Chart</i></b>	<b>35</b>

**Acknowledgements:**

We would like to thank Professor S. Giannini, Doctor A. Leardini, Professor F. Catani, and Professor J.J. O'Connor for their valuable contribution to this technique.

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European Patent Number 1180989 USA Patent Number 6,926, 739,B1

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## System Rationale

Prior extensive research has demonstrated that physiological mobility at the ankle involves rolling as well as sliding, guided by the retained ligament apparatus. The BOX Total Ankle Replacement is devised to reproduce physiological mobility so that the ligaments continue to function normally. The unique 3 component articulating geometry is designed to be compatible with the movement of isometric fibres within the calcaneofibular and tibiocalcaneal ankle ligaments. Sophisticated instruments have been developed to achieve accurate positioning of components relative to the ligament apparatus. Physiological motion and correct position are demonstrated by characteristic motion of the meniscal bearing component, forward on the tibial component in dorsiflexion and backward in plantarflexion. The BOX Total Ankle Replacement is capable of restoring physiological motion in the replaced joint with full congruence at the articulating surfaces over the entire motion arc. Full congruence should result in minimum wear of the components.

The instrumented technique involves removing a measured amount of bone from the talus (usually 4 mm) and minimal bone from the tibia (Range 5-10 mm). A joint tensioning device is used so that ligament balance and tension is taken into account prior to performing the tibial cuts. The thickness of the meniscal implant is set via this device so that the appropriate amount of bone is resected. The amount of tension applied with this instrument will represent the initial tension in the replaced joint.

## Indications

Primary or post-traumatic osteoarthritic patients with a low functional demand, usually in patients over 50 years of age.

All rheumtoid arthritic patients.

All patients rejecting arthrodesis, compatible with the following Contraindications.

## Contraindications

Severe morphological defects of the ankle. Significant osteoporosis or osteonecrosis, particularly affecting the Talus. Previous or current infections of the foot. Vascular pathologies or severe neurological disorders.

The following are also contraindications, unless resolved before or during total ankle replacement: Capsulo-ligamentous instability. Hind or fore-foot deformities affecting a correct posture. Severe homolateral hip and knee deformities or previous arthrodesis at these joints.

## Step 1

### Pre-operative Planning

Both Anterior/Posterior (A/P) and Medial/Lateral (M/L) X-rays should be employed. Always verify X-ray magnification, using an X-ray scaling technique, or by comparing a measurement on the X-ray and the subject, such as foot length or ankle width. X-ray Templates are provided from 100% – 120% in 5% intervals. With the templates provided, assess the best fit of tibial/talar implants and the meniscal implant thickness. For the tibia component, assess A/P length at the level of resection and M/L fit between the malleoli. For the talar component assess A/P fit. It is recommended that the tibia and talar implants be matched within one size up or down (e.g. small tibia with medium talar or large tibia with medium talar, but preferably not small tibia with large talar). The Meniscal Implant should correspond with the size and colour code of the Talar Implant.

**Note:** Always verify X-ray magnification.

## Step 2

### Surgical Approach

Position the patient in a supine position on the operating table. Inflate the Tourniquet in the upper third of the thigh after the foot and ankle have been exsanguinated with an Esmarch elastic wrap. The leg must be sterile up to the knee.

Perform an 8-10 cm antero-lateral skin incision leaving 1/3 distal and 2/3 proximal to the joint line respectively.

Dissect the subcutaneous tissue, identifying and protecting the Superficial Peroneal nerve. Incise the superior and inferior extensor retinaculum. Identify the third peroneal tendon and continue the incision between this and the Extensor Digitorum Communis tendons. Expose the tibia and talus bones at the level of the ankle joint. Retractors are inserted outside the malleoli after careful dissection of the capsule and soft tissue medially and laterally to the tibia and fibula.

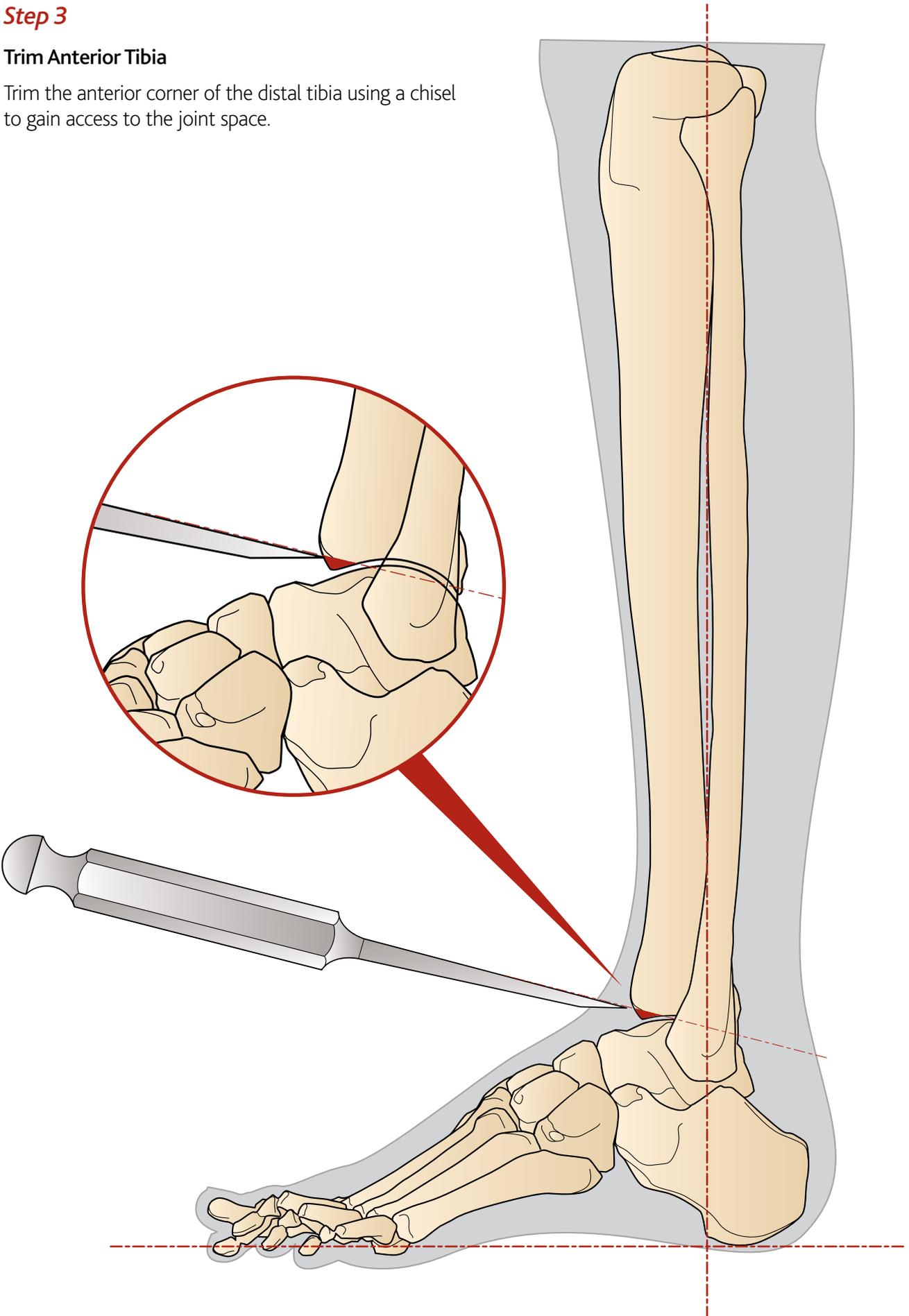
It is important to open the joint and clear it of all the fibrous tissues and osteophytes to identify clearly the medial and lateral aspects of the joint for referencing the tibial cuts. The tibia also needs to be cleared of tissue and muscle to accept the Tibia Alignment Guide. The deep incision is extended to the neck of the talus to identify the transition between the head and the neck of the talus.

All the osteophytes must be removed. The ankle is positioned in maximum dorsiflexion and the most anterior borders of the articulating surfaces are marked, together with the most central line medio-laterally.

**Step 3**

**Trim Anterior Tibia**

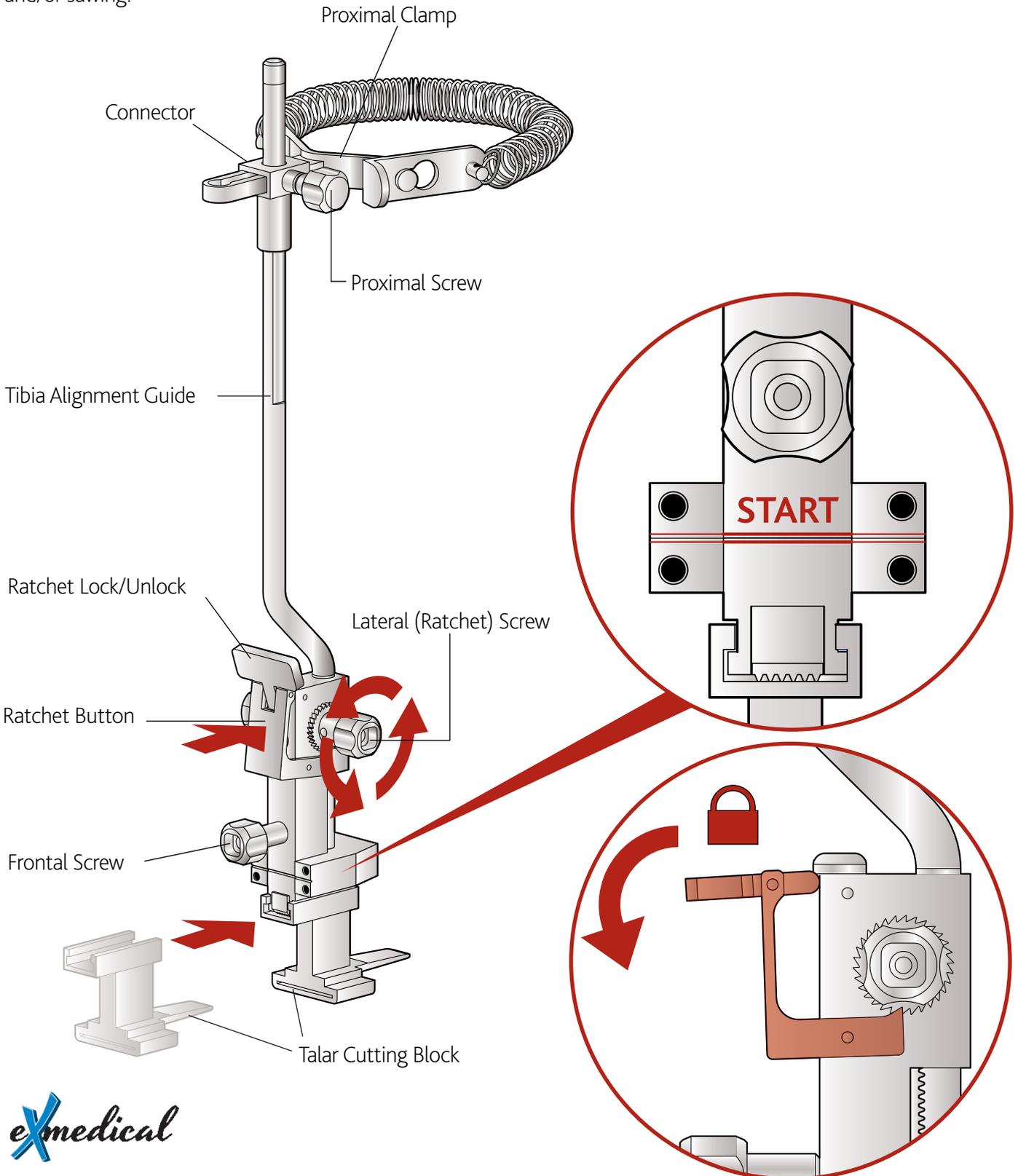
Trim the anterior corner of the distal tibia using a chisel to gain access to the joint space.



**Step 4**

**Prepare Tibia Alignment Guide:**

Assemble the Tibia Alignment Guide with Proximal Clamp and Connector; tighten with the Proximal Screw. Insert the Talar Cutting Block onto the Tibia Alignment Guide and tighten with the Frontal Screw. With the button in the unlocked position and depressed, adjust the ratchet to the START position. Lock the ratchet to prevent it moving out of position during positioning and/or sawing.

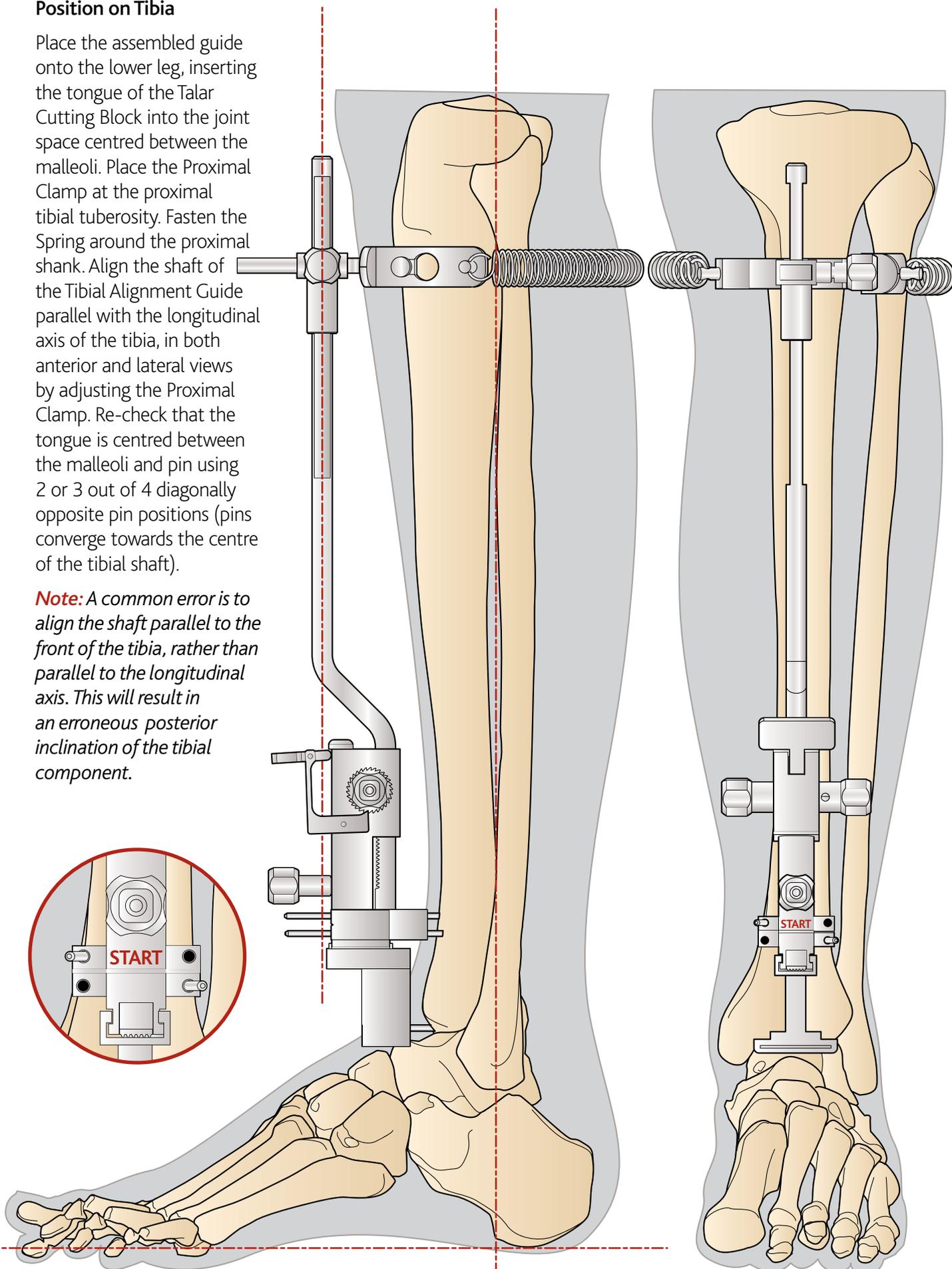


## Step 5

### Position on Tibia

Place the assembled guide onto the lower leg, inserting the tongue of the Talar Cutting Block into the joint space centred between the malleoli. Place the Proximal Clamp at the proximal tibial tuberosity. Fasten the Spring around the proximal shank. Align the shaft of the Tibial Alignment Guide parallel with the longitudinal axis of the tibia, in both anterior and lateral views by adjusting the Proximal Clamp. Re-check that the tongue is centred between the malleoli and pin using 2 or 3 out of 4 diagonally opposite pin positions (pins converge towards the centre of the tibial shaft).

**Note:** A common error is to align the shaft parallel to the front of the tibia, rather than parallel to the longitudinal axis. This will result in an erroneous posterior inclination of the tibial component.

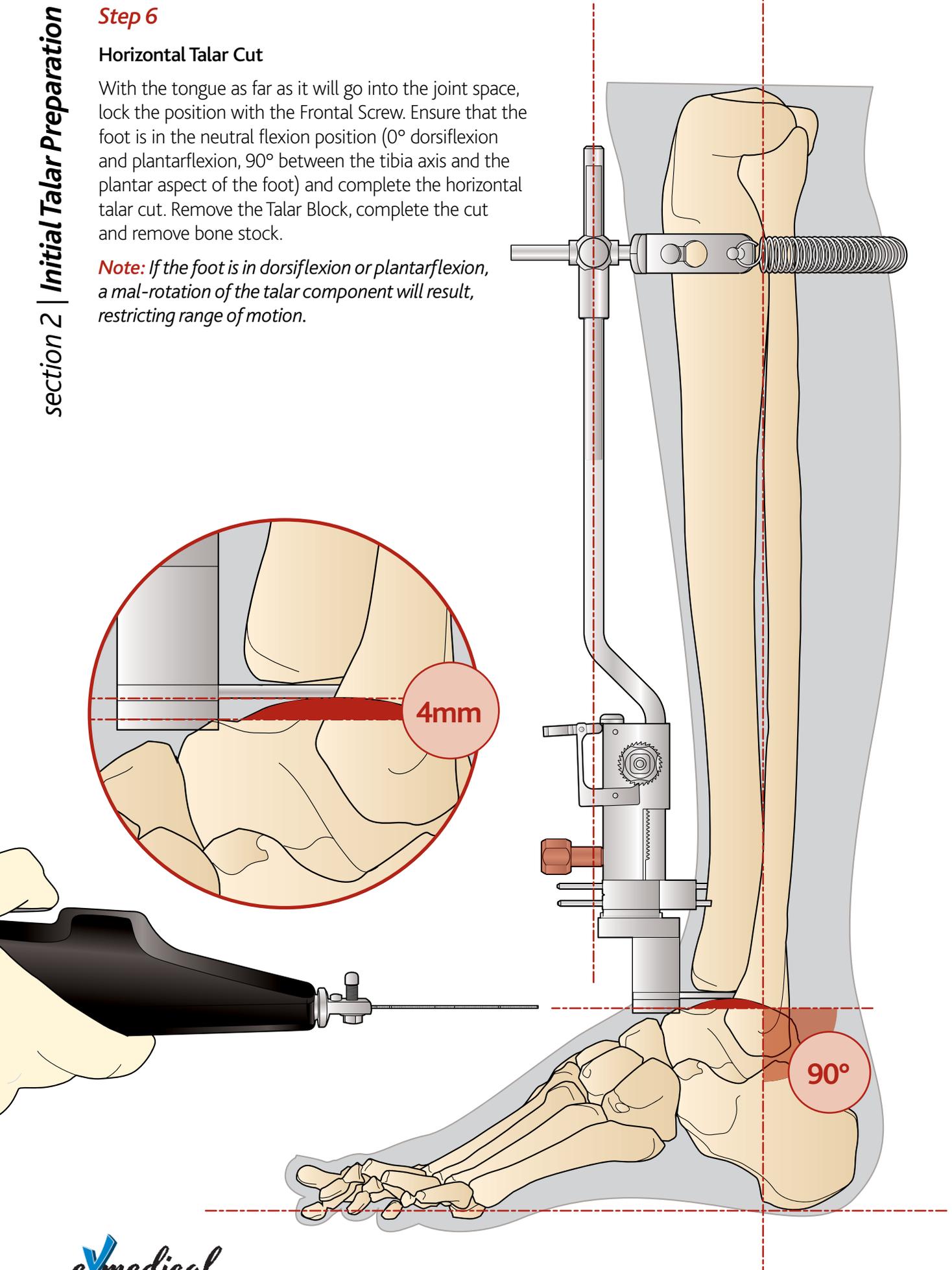


**Step 6**

**Horizontal Talar Cut**

With the tongue as far as it will go into the joint space, lock the position with the Frontal Screw. Ensure that the foot is in the neutral flexion position (0° dorsiflexion and plantarflexion, 90° between the tibia axis and the plantar aspect of the foot) and complete the horizontal talar cut. Remove the Talar Block, complete the cut and remove bone stock.

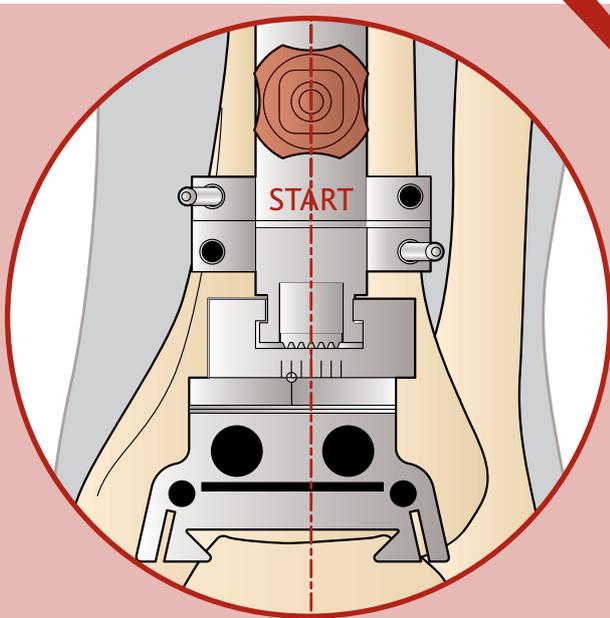
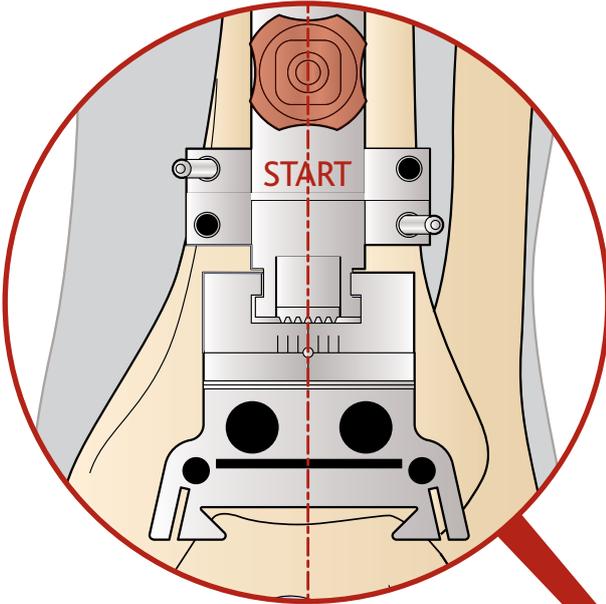
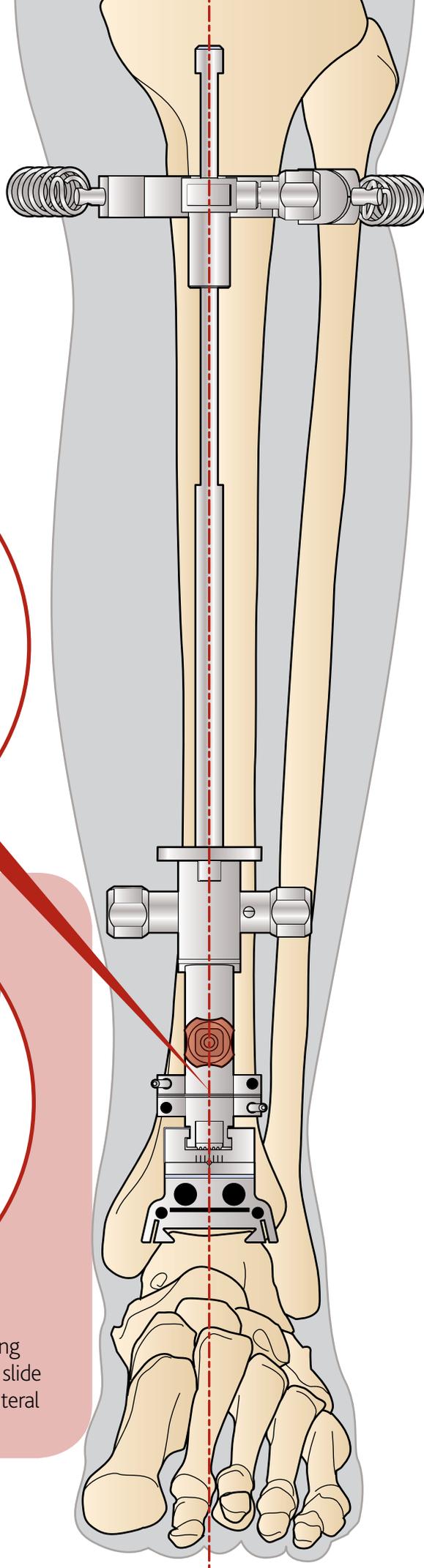
**Note:** If the foot is in dorsiflexion or plantarflexion, a mal-rotation of the talar component will result, restricting range of motion.



**Step 7**

**Attach Tibial Cutting Block**

Insert the selected size of Tibial Cutting Block onto the Tibial Alignment Guide in neutral M/L adjustment (centre of scale). Assess central position of the block relative to the malleoli.

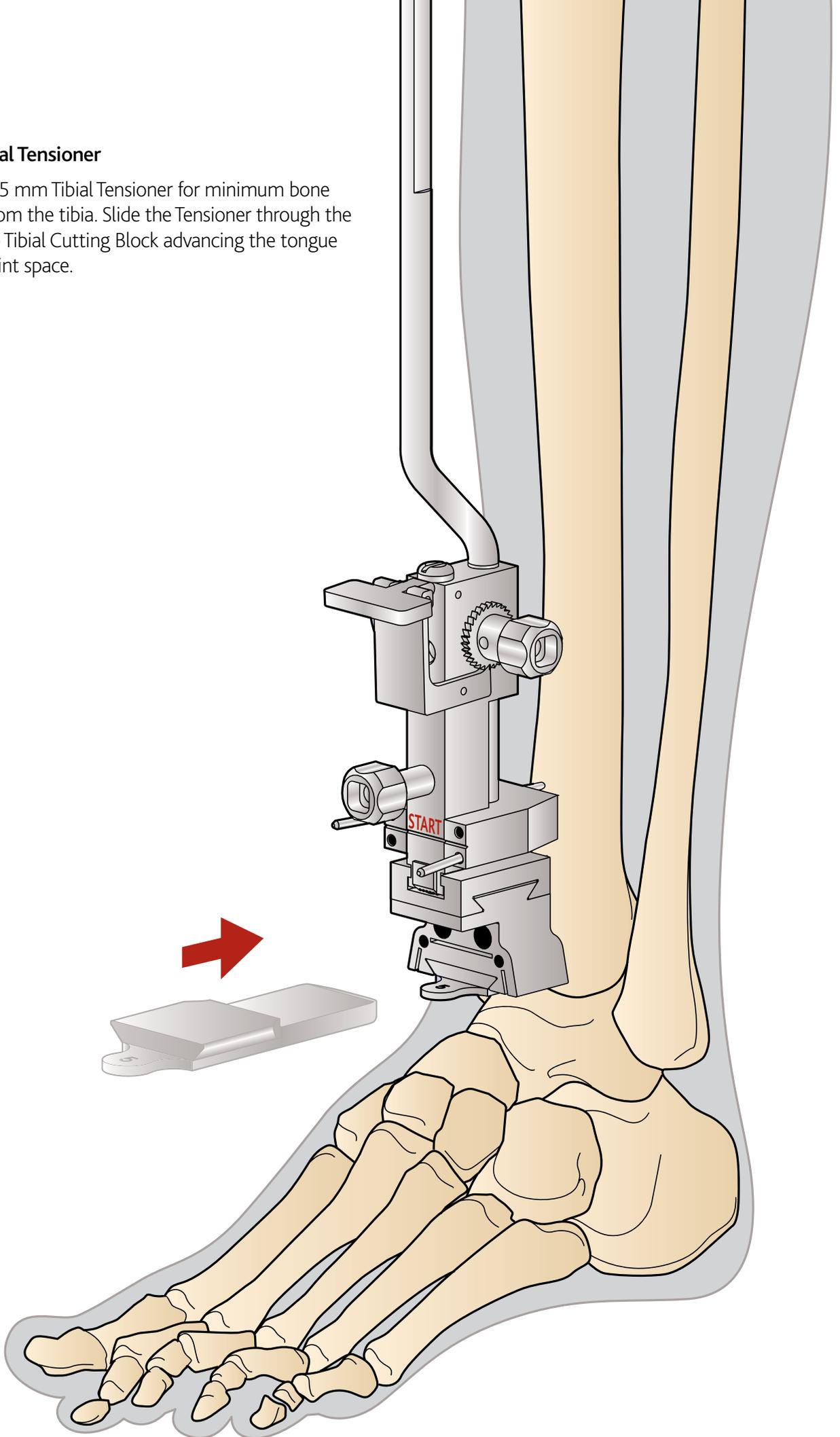


Adjust on the fine scale by moving the Tibial Cutting Block forward (as if to remove it) until it is free to slide M/L. Reinsert the block in the desired medial or lateral adjustment. Tighten with the Frontal Screw.

**Step 8**

**Insert Tibial Tensioner**

Select the 5 mm Tibial Tensioner for minimum bone removal from the tibia. Slide the Tensioner through the slot on the Tibial Cutting Block advancing the tongue into the joint space.

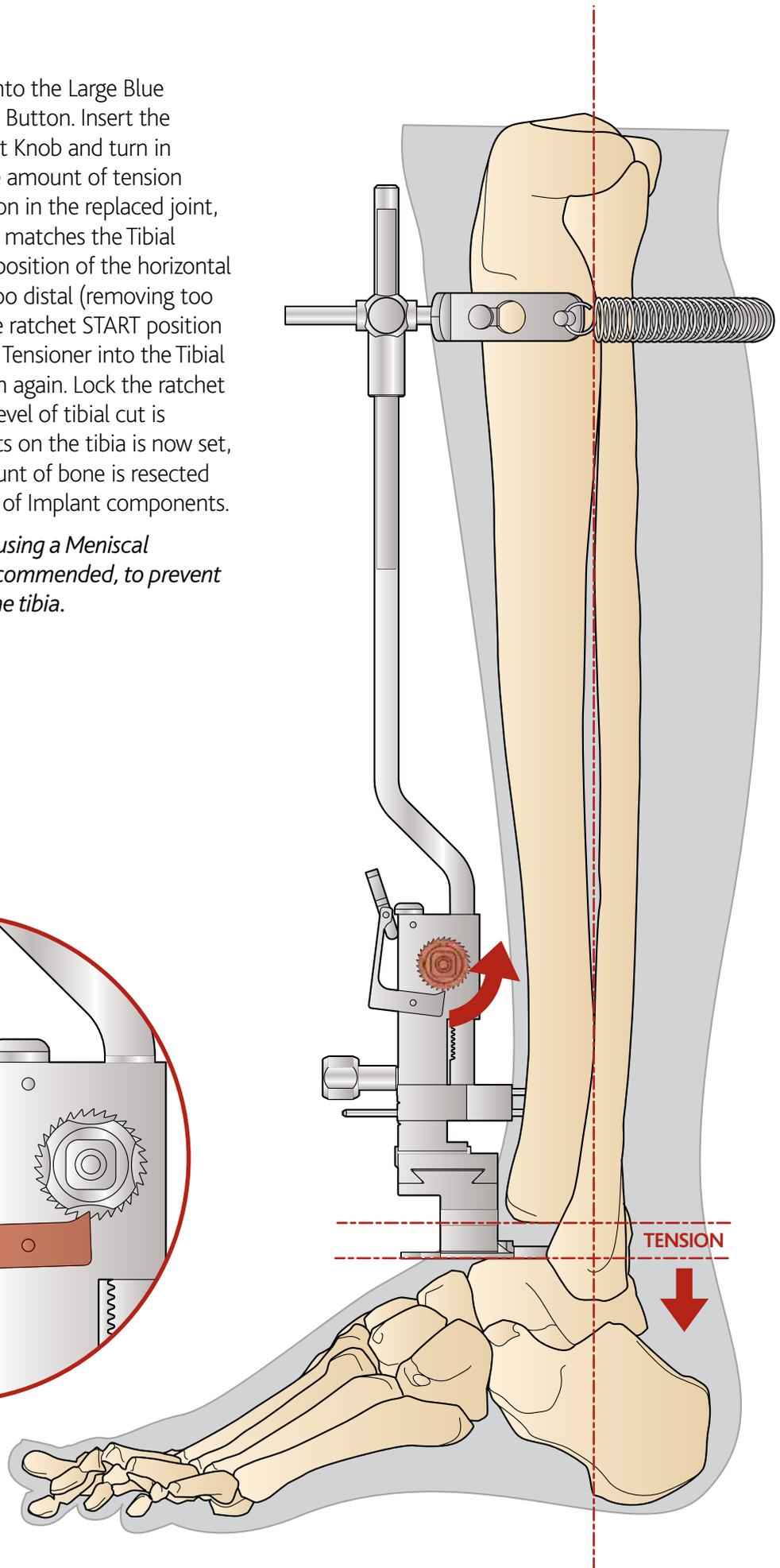


## Step 9

### Apply Tension

Assemble the Knob Tightener into the Large Blue Handle and unlock the Ratchet Button. Insert the Knob Tightener into the Ratchet Knob and turn in an anti-clockwise direction. The amount of tension applied will represent the tension in the replaced joint, providing the Meniscal Implant matches the Tibial Tensioner used. If the selected position of the horizontal cut on the tibia is considered too distal (removing too little tibial bone) go back to the ratchet START position and insert the 6 or 7 mm Tibial Tensioner into the Tibial Cutting Block and apply tension again. Lock the ratchet when the desired tension and level of tibial cut is reached. The position of the cuts on the tibia is now set, so that precisely the right amount of bone is resected to suit the combined thickness of Implant components.

**Note:** *Tensioning the joint and using a Meniscal Implant as thin as possible is recommended, to prevent excessive bone removal from the tibia.*

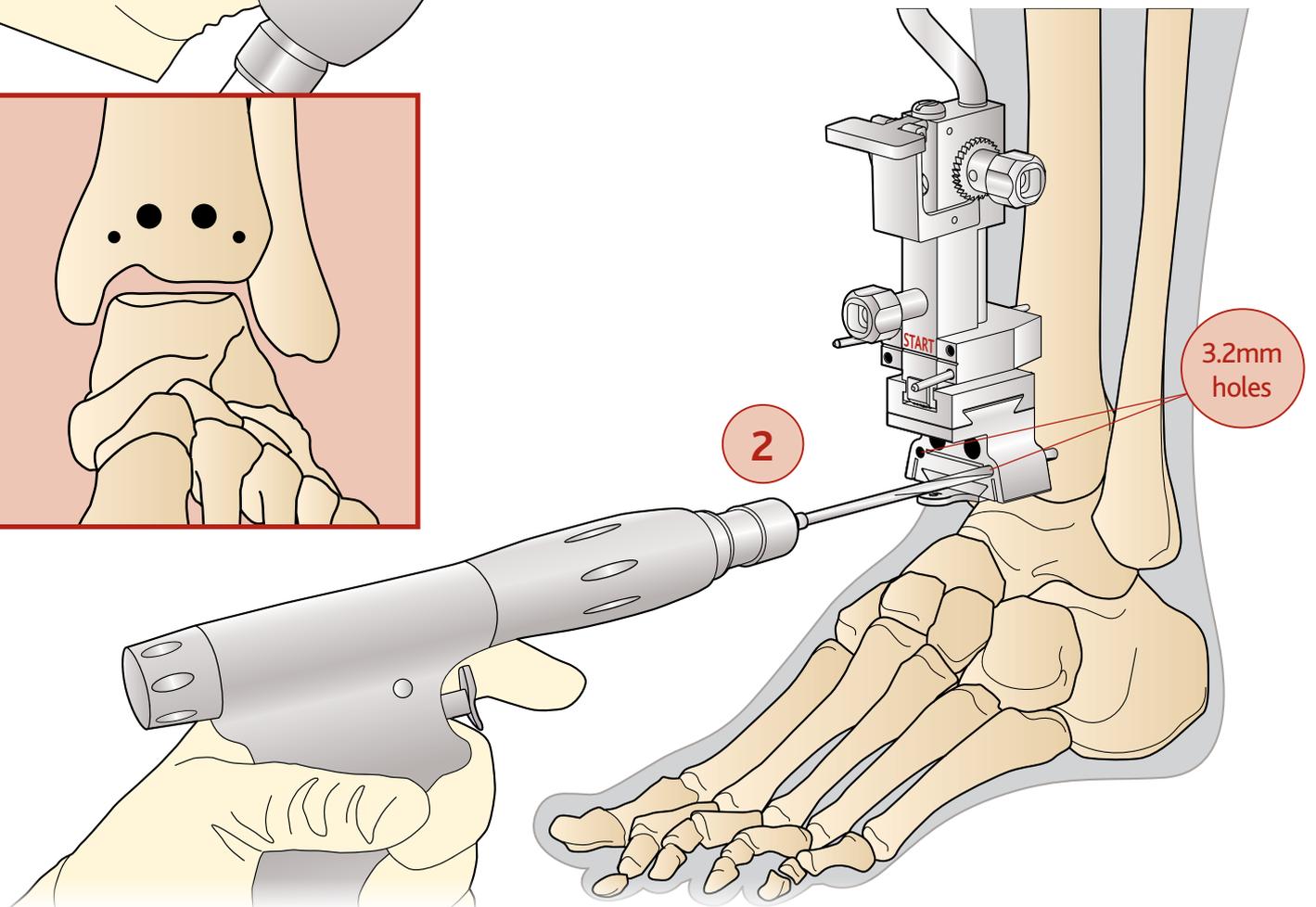
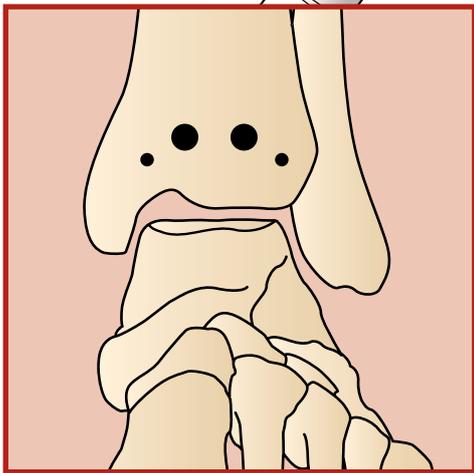
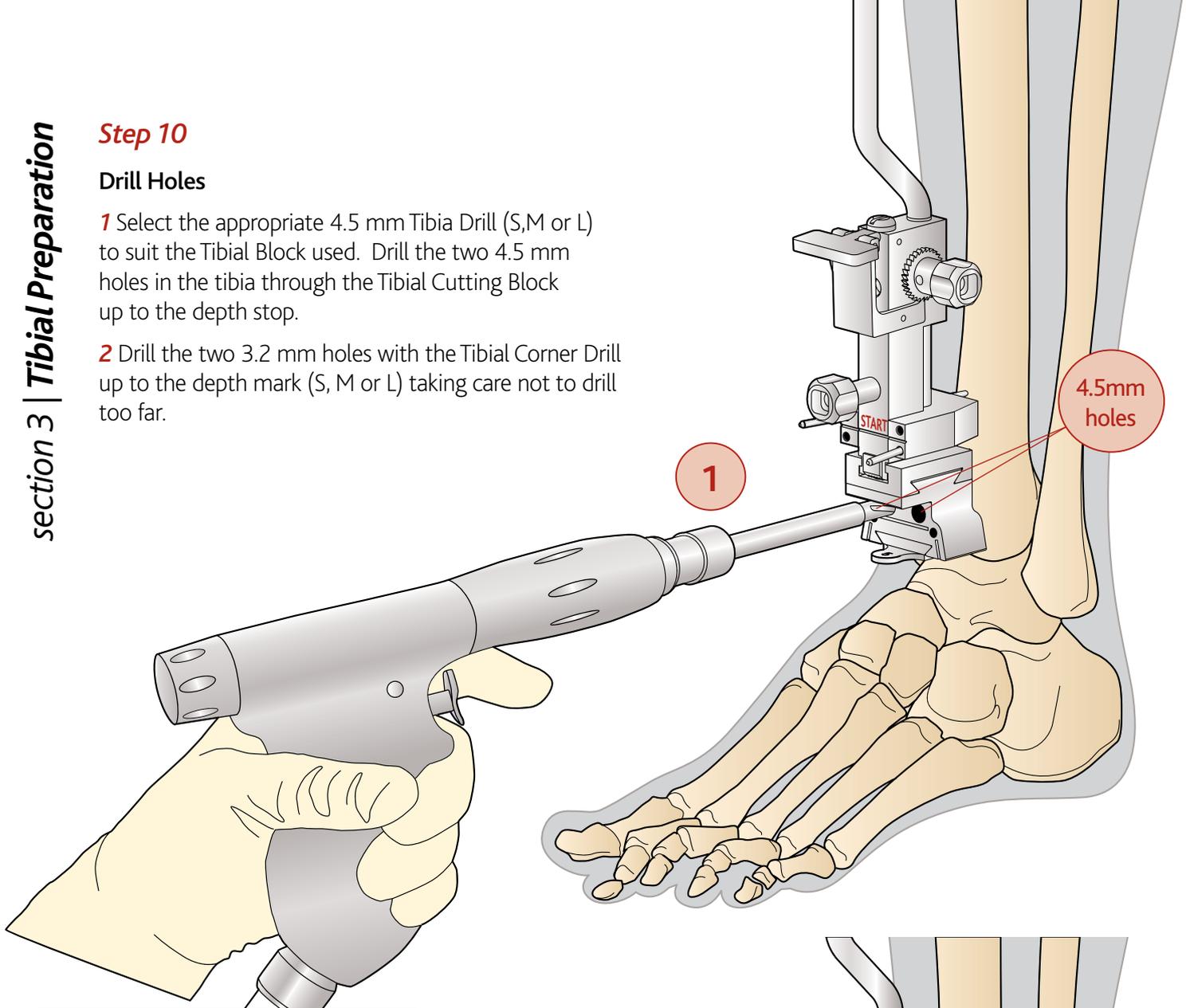


**Step 10**

**Drill Holes**

**1** Select the appropriate 4.5 mm Tibia Drill (S,M or L) to suit the Tibial Block used. Drill the two 4.5 mm holes in the tibia through the Tibial Cutting Block up to the depth stop.

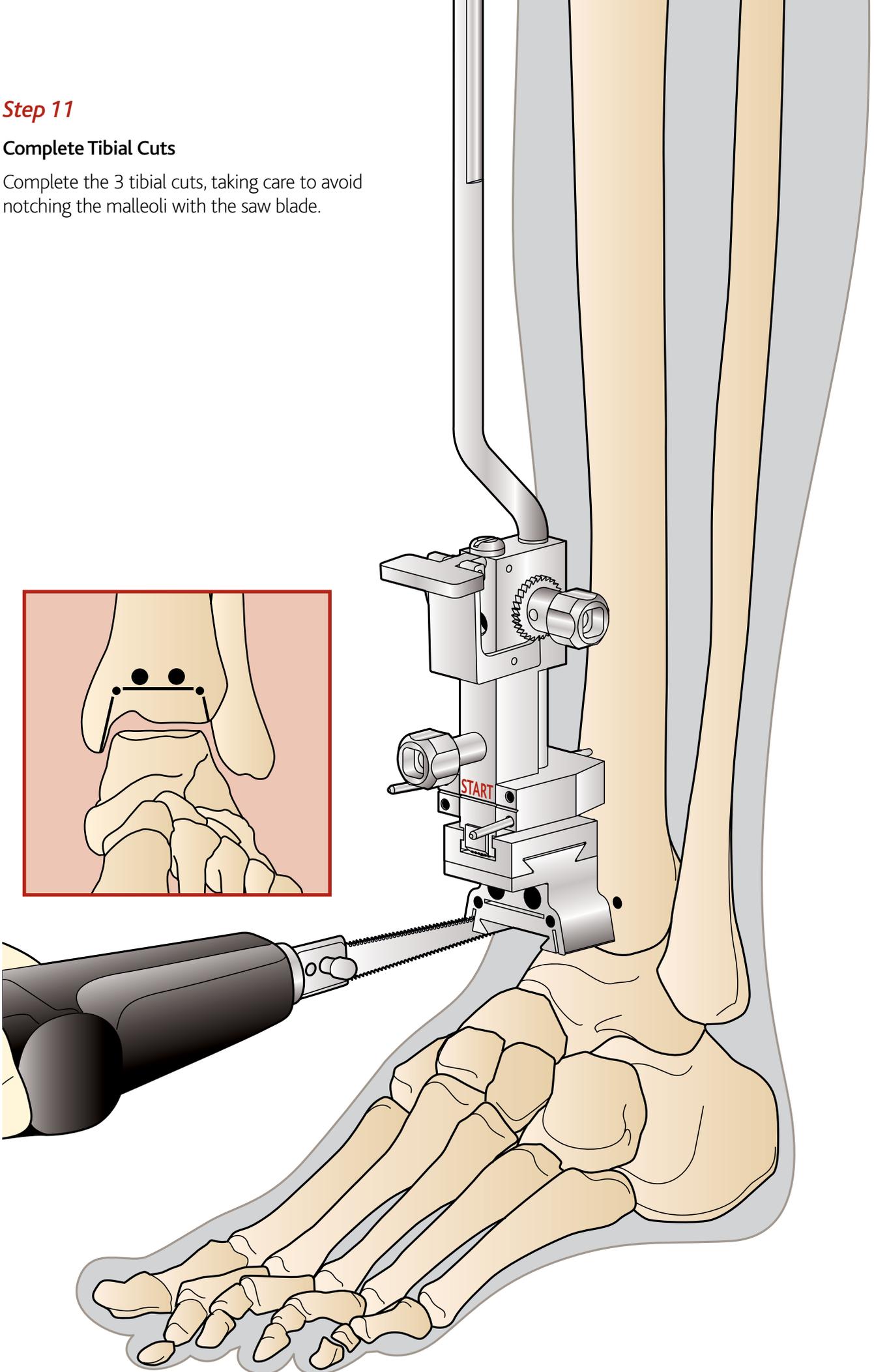
**2** Drill the two 3.2 mm holes with the Tibial Corner Drill up to the depth mark (S, M or L) taking care not to drill too far.



**Step 11**

**Complete Tibial Cuts**

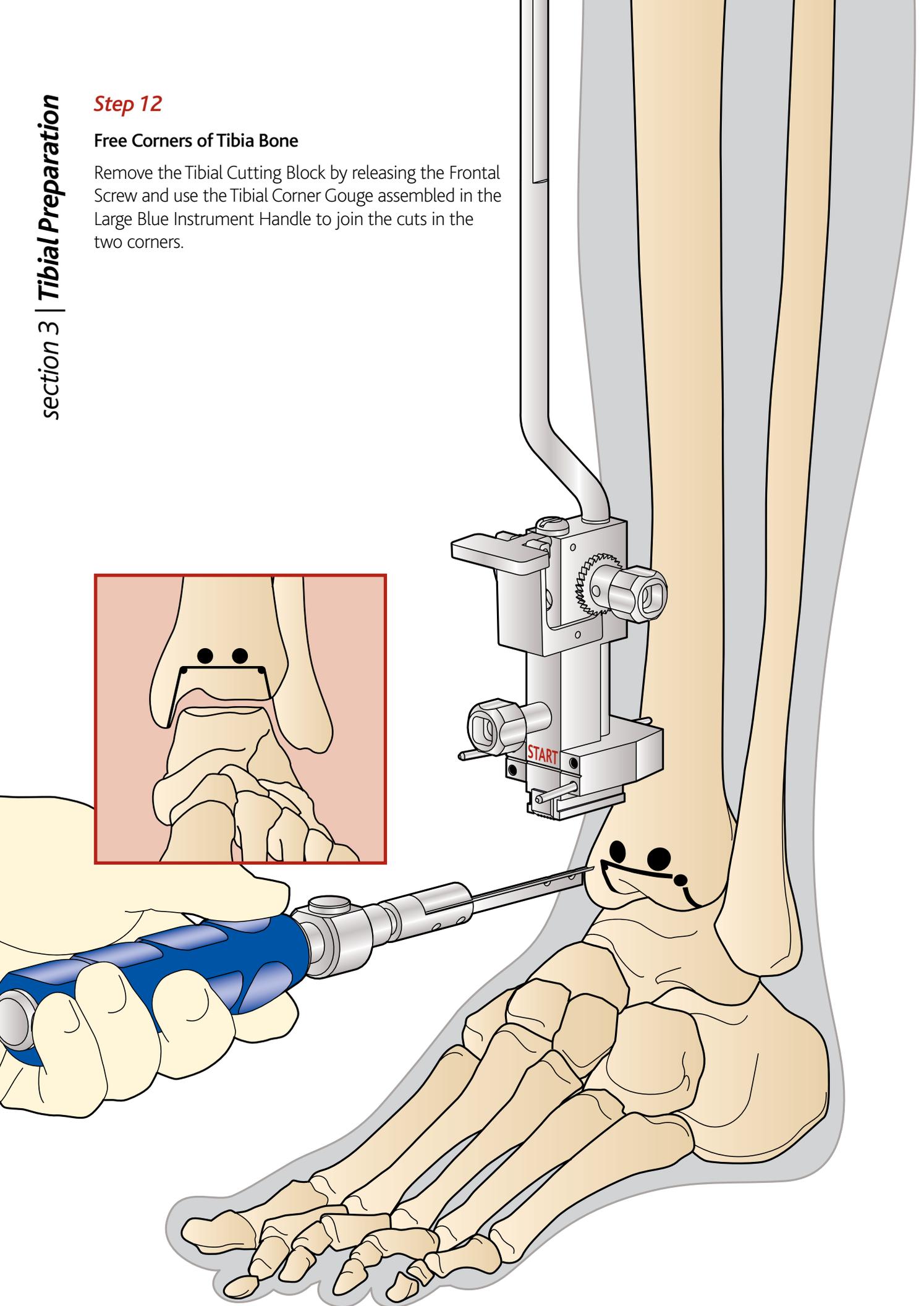
Complete the 3 tibial cuts, taking care to avoid notching the malleoli with the saw blade.



**Step 12**

**Free Corners of Tibia Bone**

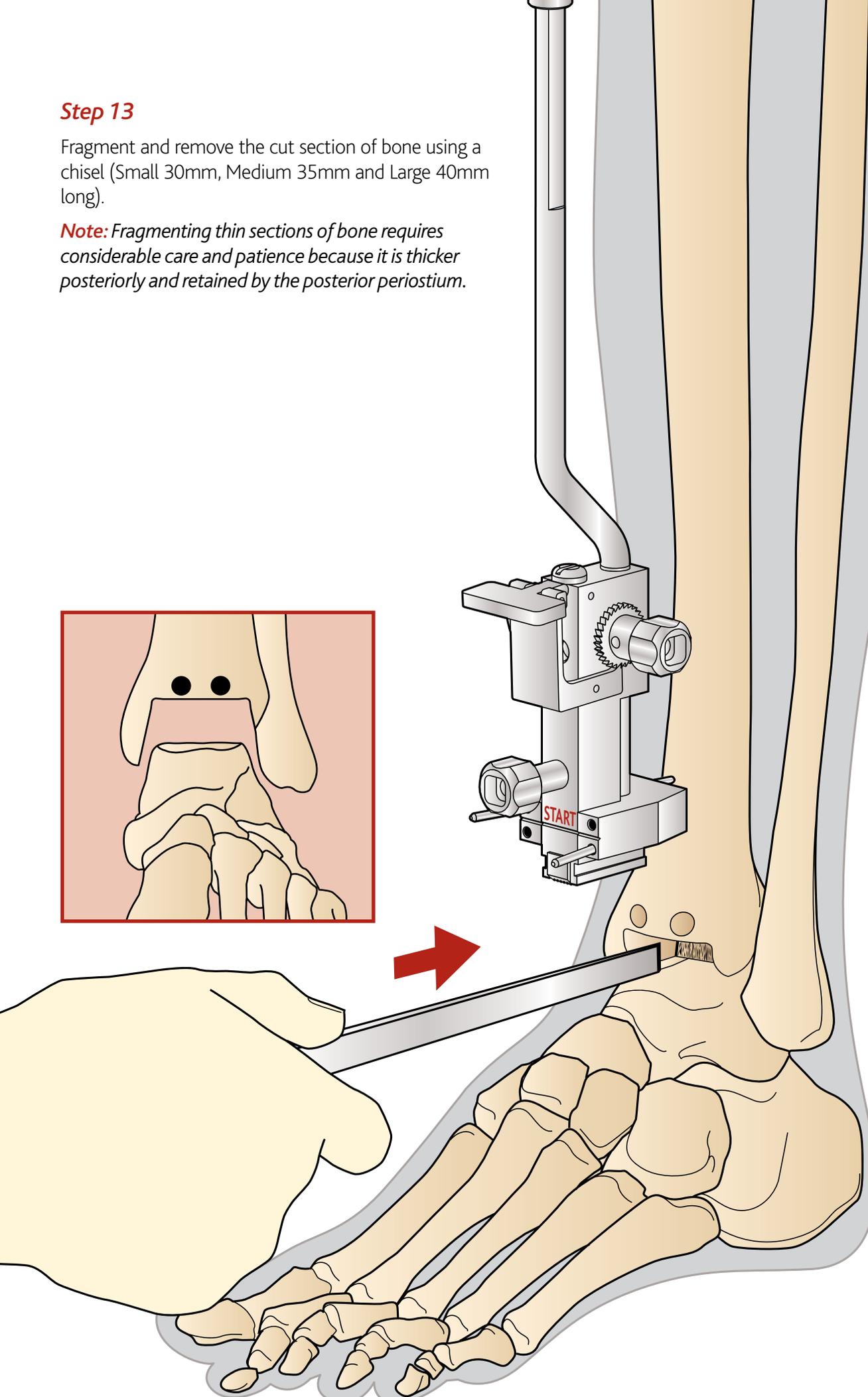
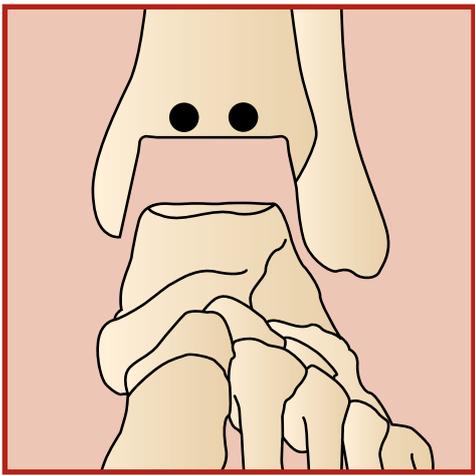
Remove the Tibial Cutting Block by releasing the Frontal Screw and use the Tibial Corner Gouge assembled in the Large Blue Instrument Handle to join the cuts in the two corners.



**Step 13**

Fragment and remove the cut section of bone using a chisel (Small 30mm, Medium 35mm and Large 40mm long).

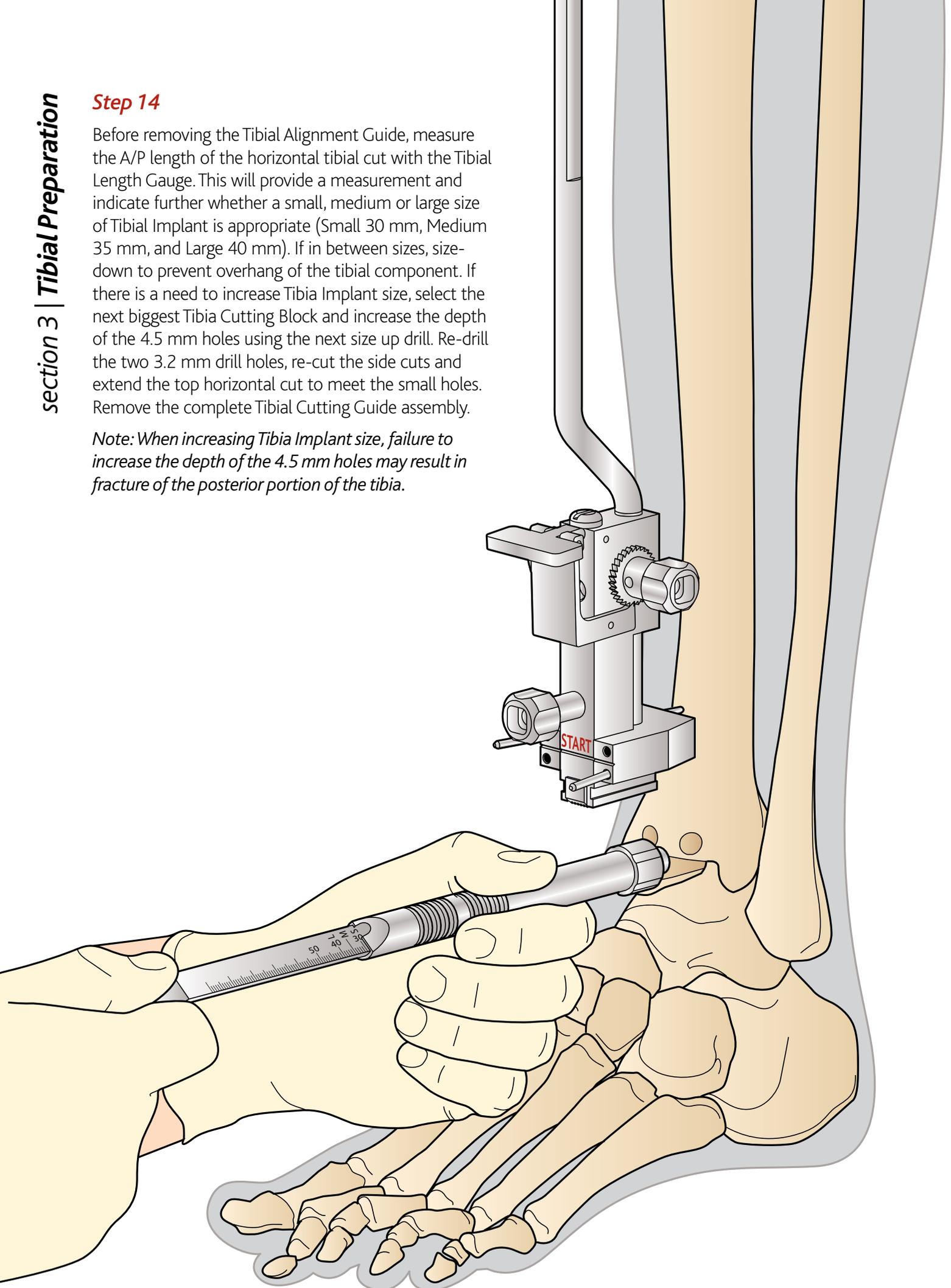
**Note:** Fragmenting thin sections of bone requires considerable care and patience because it is thicker posteriorly and retained by the posterior periosteum.



**Step 14**

Before removing the Tibial Alignment Guide, measure the A/P length of the horizontal tibial cut with the Tibial Length Gauge. This will provide a measurement and indicate further whether a small, medium or large size of Tibial Implant is appropriate (Small 30 mm, Medium 35 mm, and Large 40 mm). If in between sizes, size-down to prevent overhang of the tibial component. If there is a need to increase Tibia Implant size, select the next biggest Tibia Cutting Block and increase the depth of the 4.5 mm holes using the next size up drill. Re-drill the two 3.2 mm drill holes, re-cut the side cuts and extend the top horizontal cut to meet the small holes. Remove the complete Tibial Cutting Guide assembly.

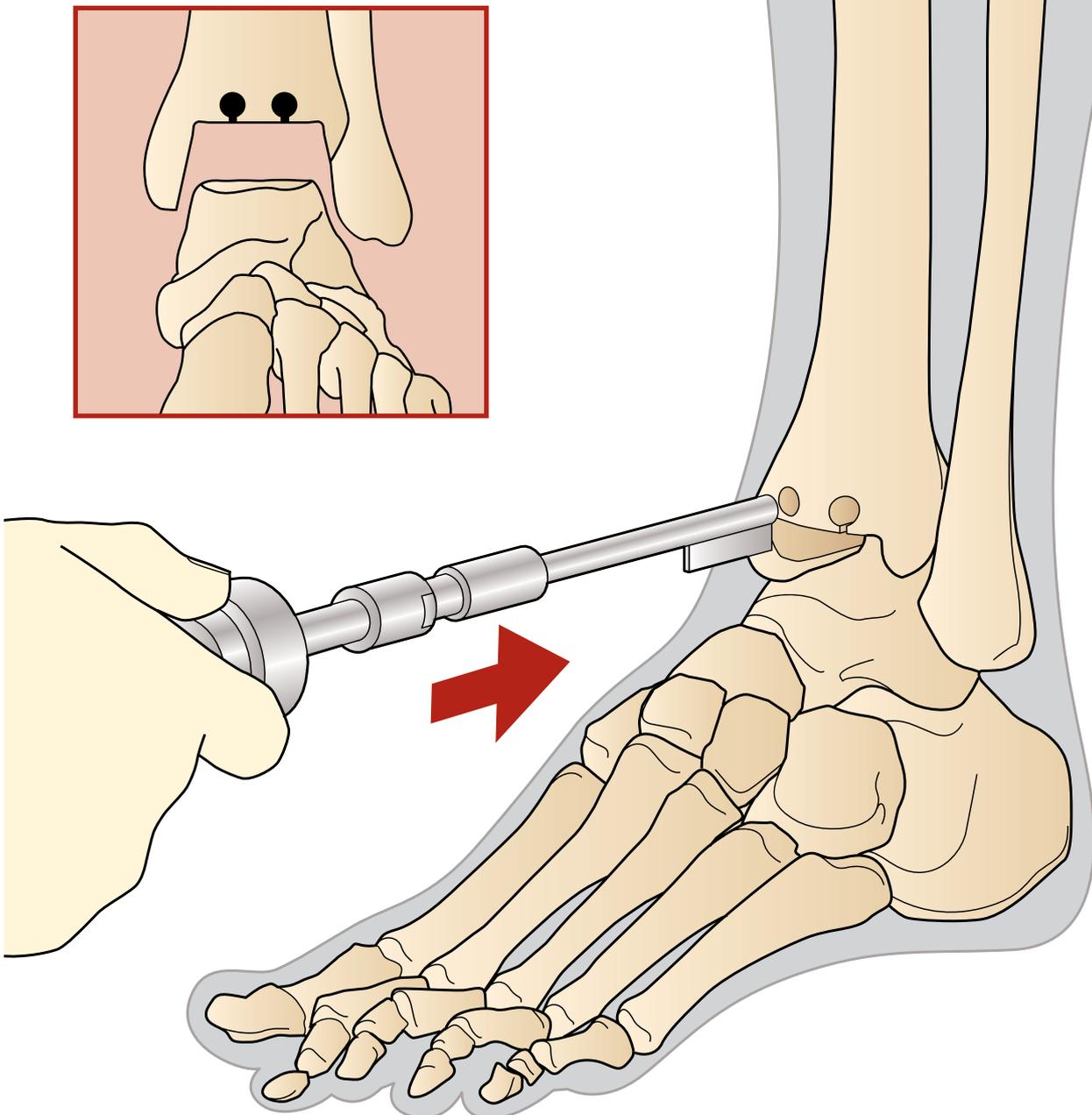
*Note: When increasing Tibia Implant size, failure to increase the depth of the 4.5 mm holes may result in fracture of the posterior portion of the tibia.*



**Step 15**

**Cut Keyway**

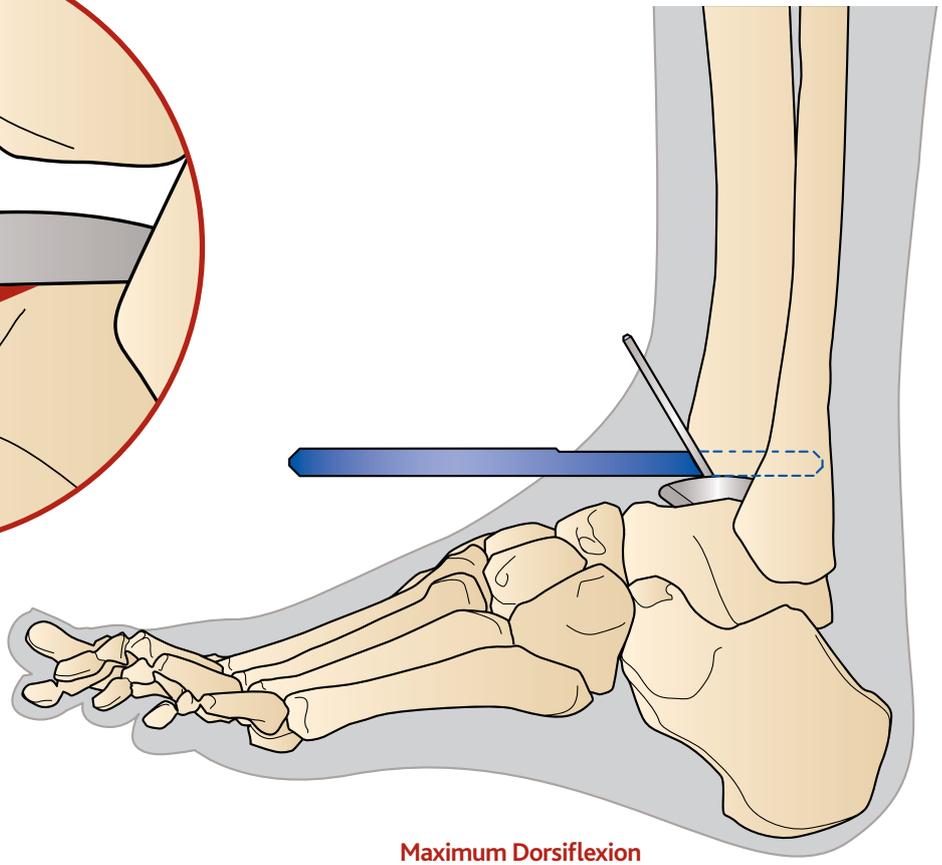
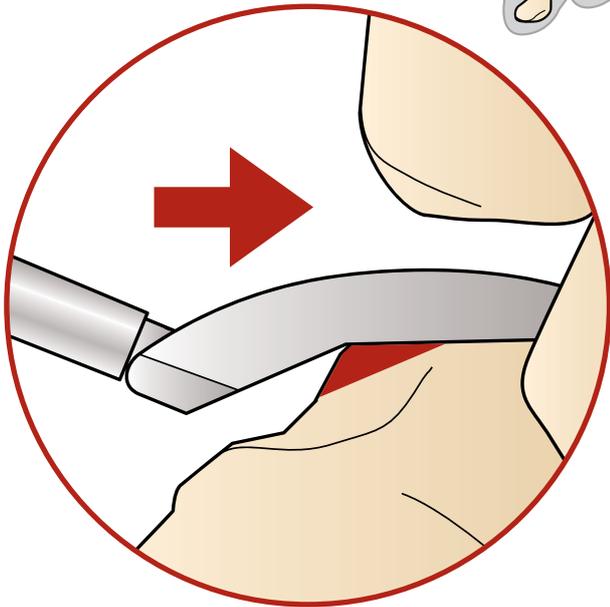
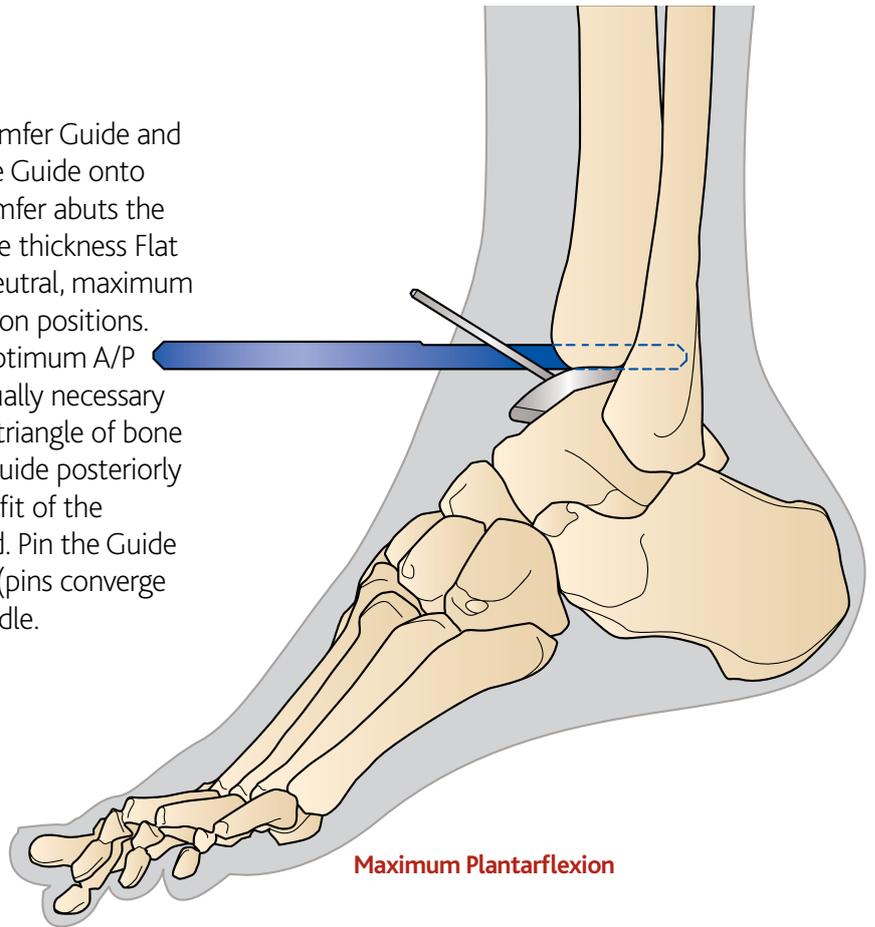
Use the Tibial Keyhole Cutter assembled in the Slide Hammer to join the two 4.5 mm holes to the horizontal tibia cut. Care should be taken not to 'break-out' the holes by biasing the cutter up or down. The tibial preparation is now complete.



**Step 16**

**Position Talar Chamfer Guide**

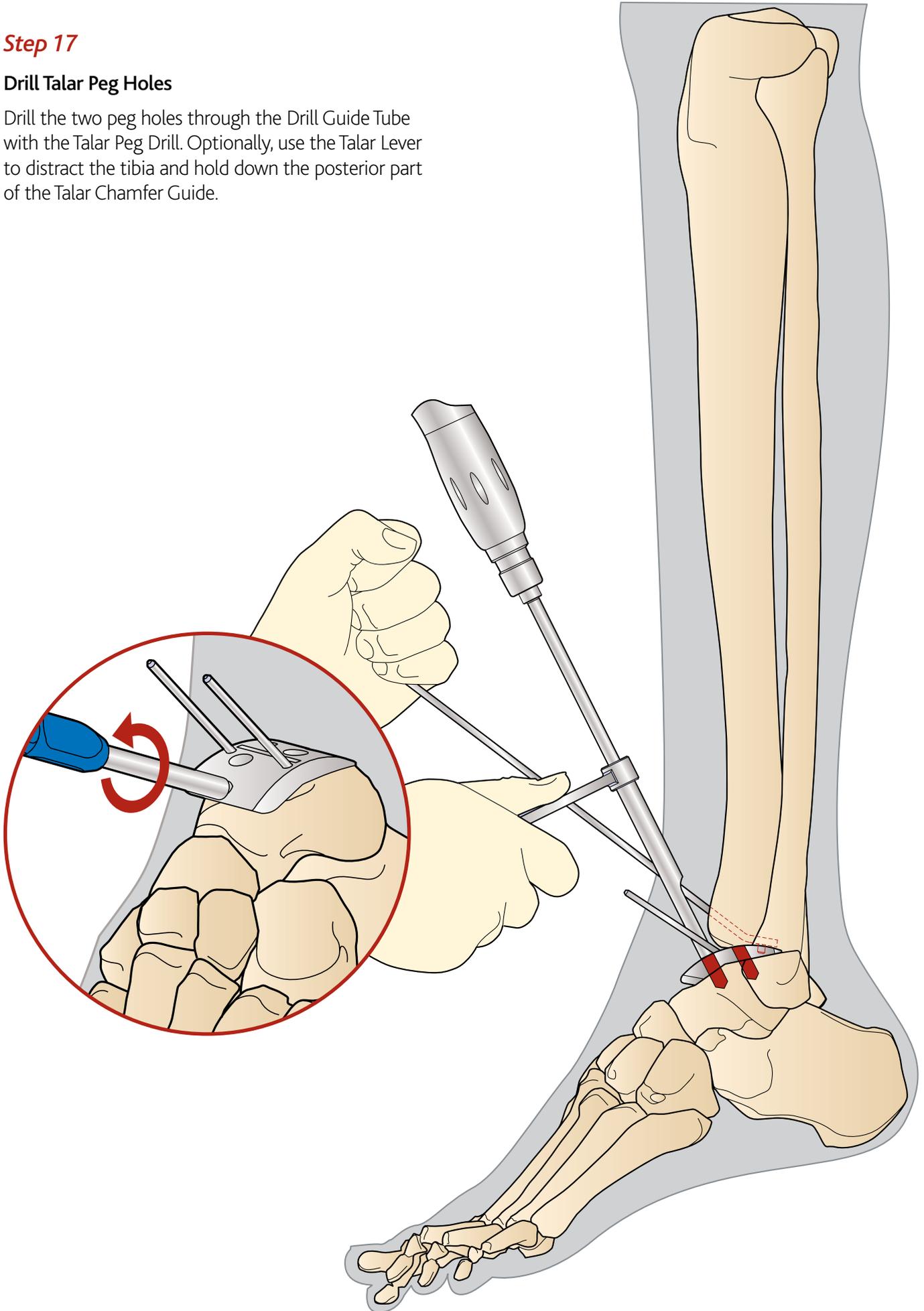
Select the appropriate size of Talar Chamfer Guide and attach the Small Blue Handle. Slide the Guide onto the flat talar cut until the anterior chamfer abuts the front of the talus. Using the appropriate thickness Flat Spacer (blue), assess the joint gap in neutral, maximum dorsiflexion and maximum plantarflexion positions. With the Talar Chamfer Guide in the optimum A/P position the gaps will be equal. It is usually necessary to trim the anterior talus (remove the triangle of bone shown in orange below), moving the Guide posteriorly to gain this optimum position. A good fit of the anterior chamfer on the talus is desired. Pin the Guide in the final position using 2 short pins (pins converge centrally) and remove the anterior handle.



**Step 17**

**Drill Talar Peg Holes**

Drill the two peg holes through the Drill Guide Tube with the Talar Peg Drill. Optionally, use the Talar Lever to distract the tibia and hold down the posterior part of the Talar Chamfer Guide.

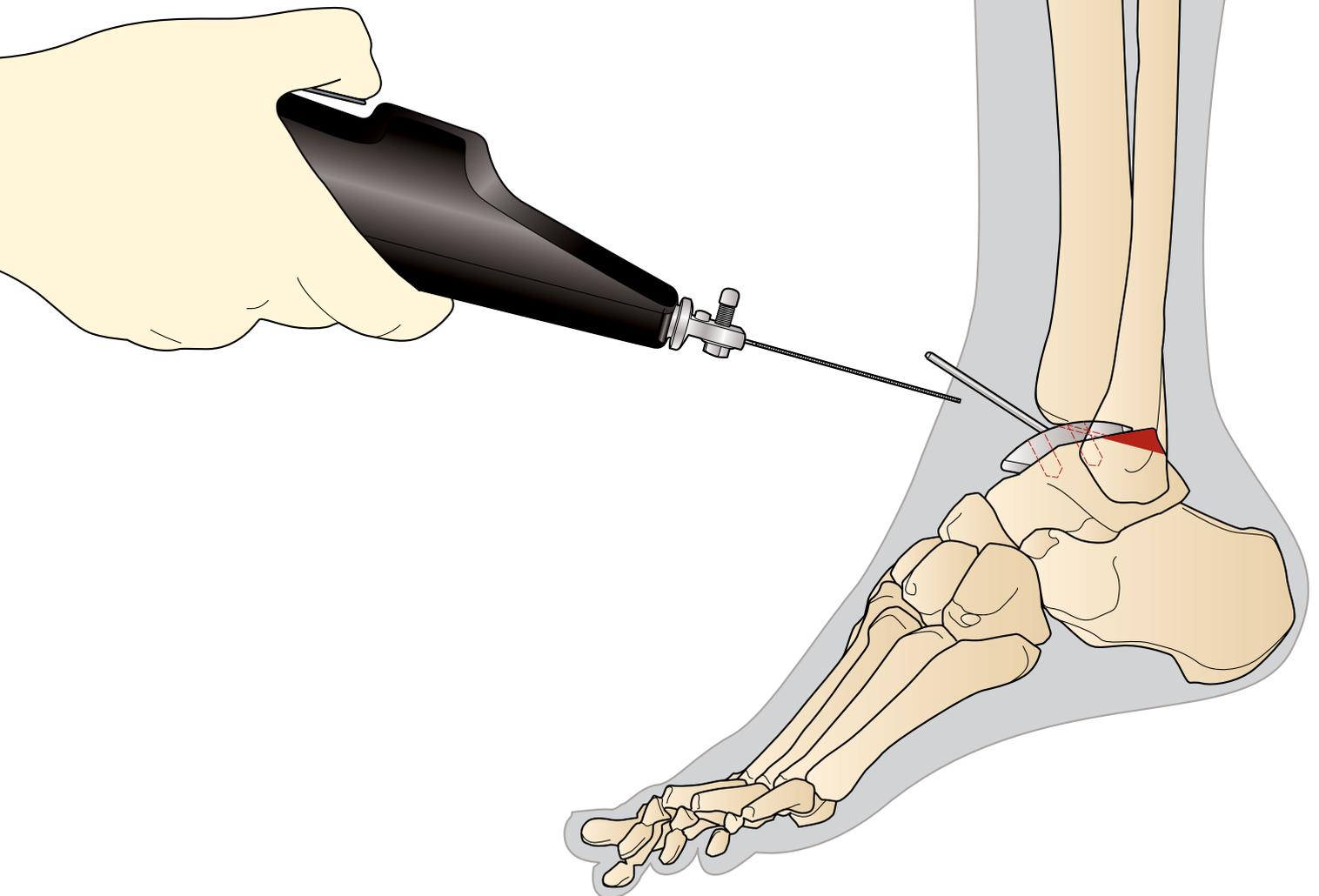


**Step 18**

**Complete Talar Posterior Chamfer**

Complete the posterior chamfer cut. Optionally, continue using the Talar Lever to hold down the posterior part of the Talar Chamfer Guide. Remove the Guide and complete the cut, removing the section of bone.

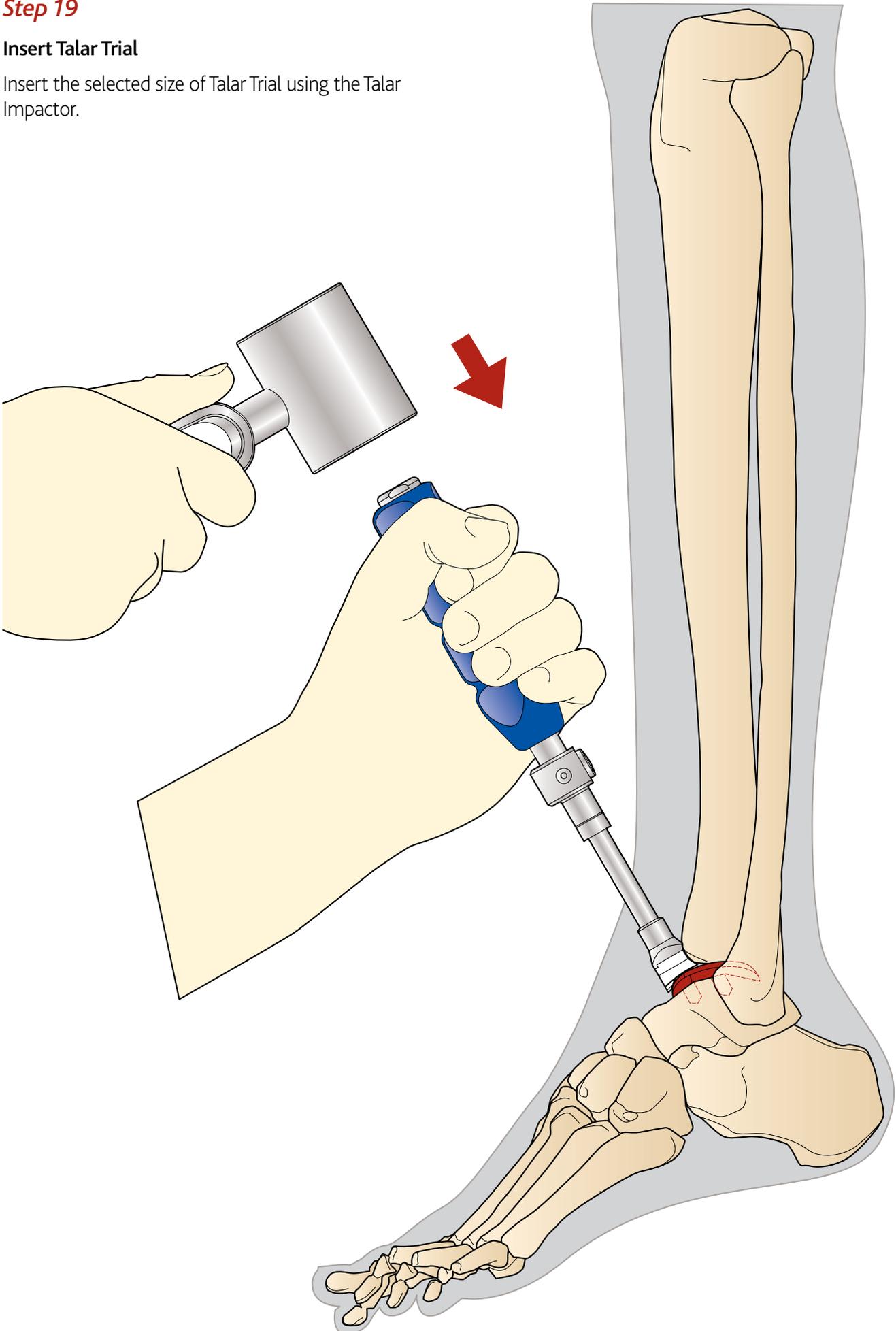
*The talar preparation is now complete.*



**Step 19**

**Insert Talar Trial**

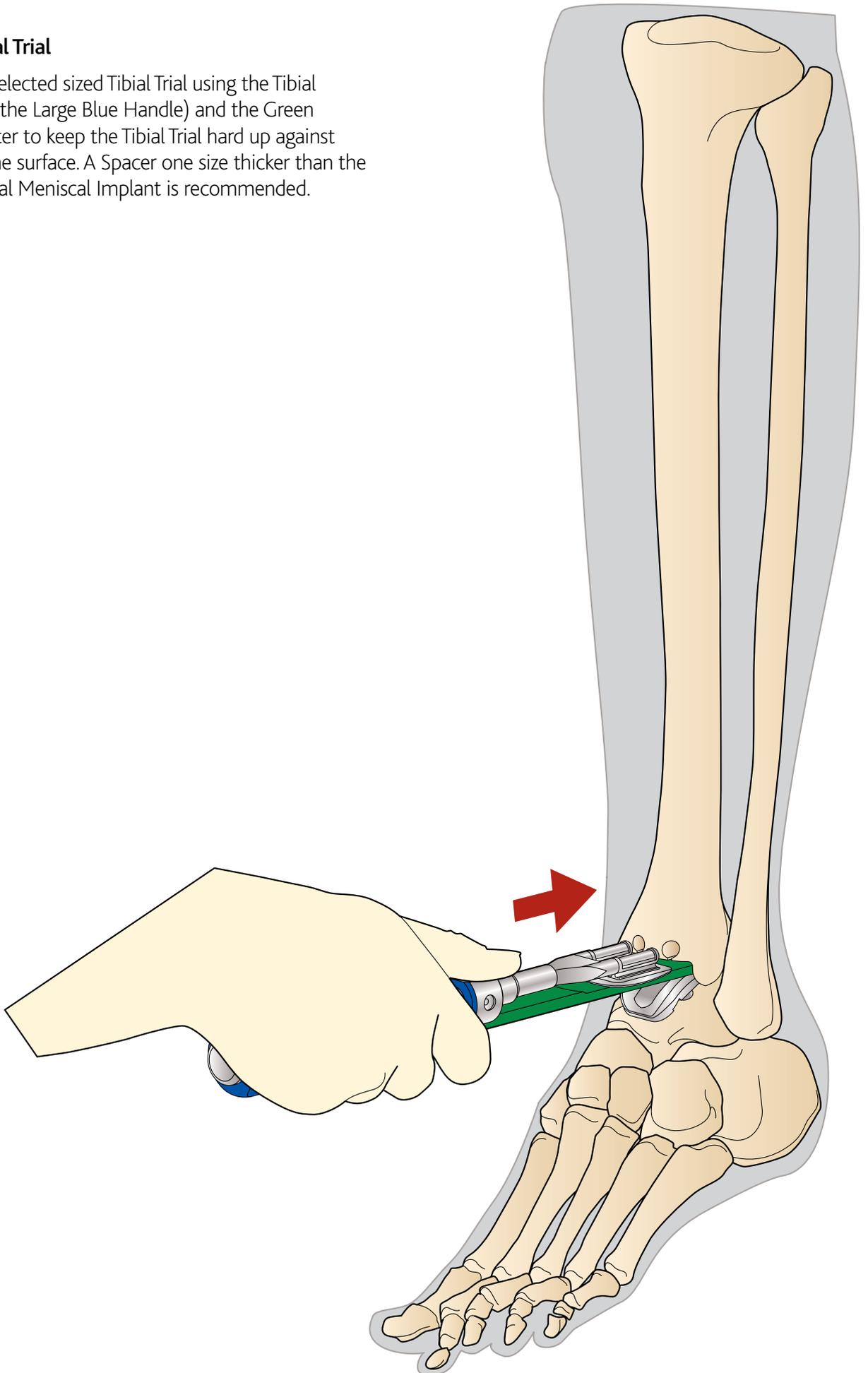
Insert the selected size of Talar Trial using the Talar Impactor.



**Step 20**

**Insert Tibial Trial**

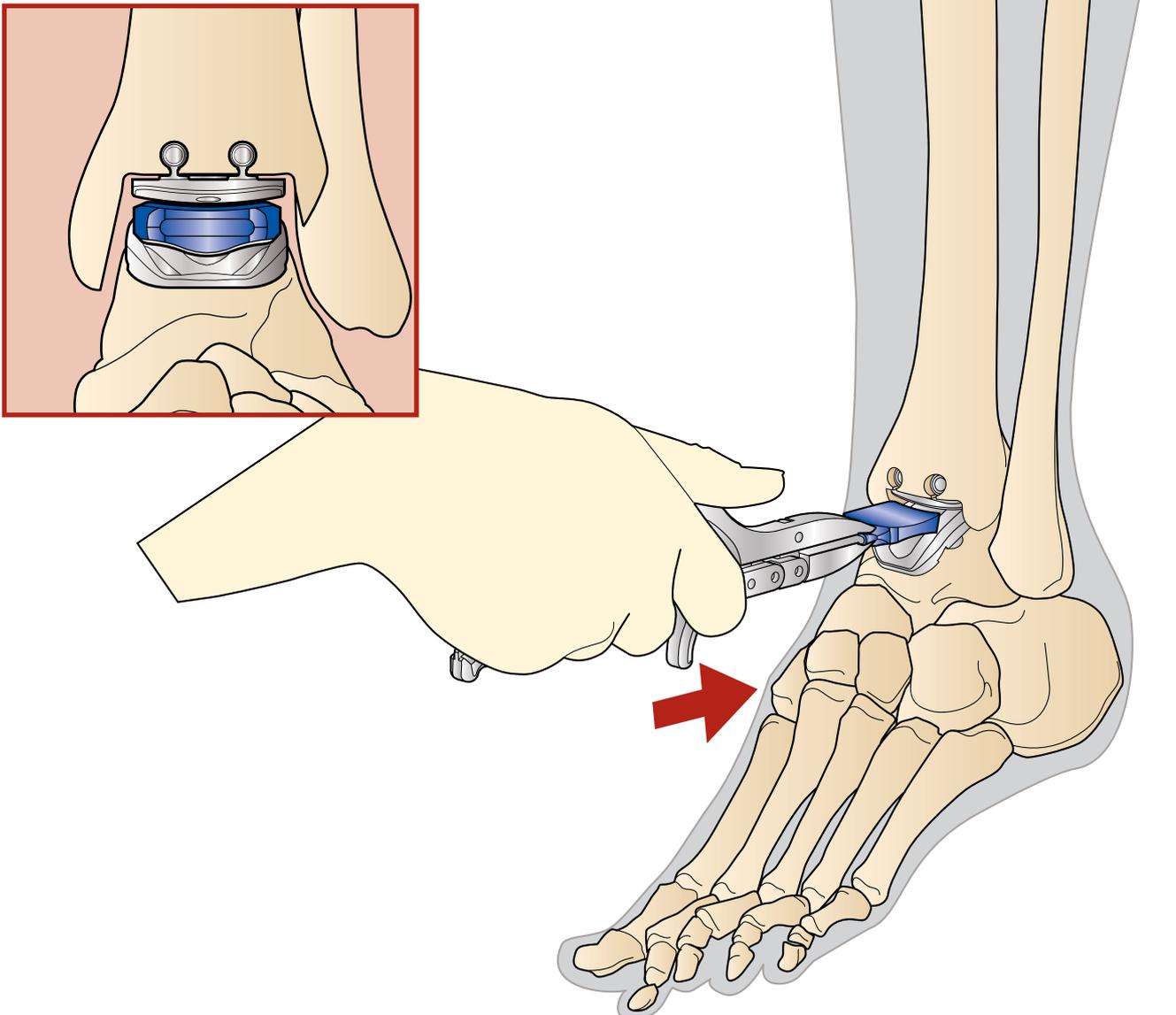
Insert the selected sized Tibial Trial using the Tibial Inserter (in the Large Blue Handle) and the Green Profile Spacer to keep the Tibial Trial hard up against the cut bone surface. A Spacer one size thicker than the planned final Meniscal Implant is recommended.



**Step 21**

**Insert Meniscal Trial**

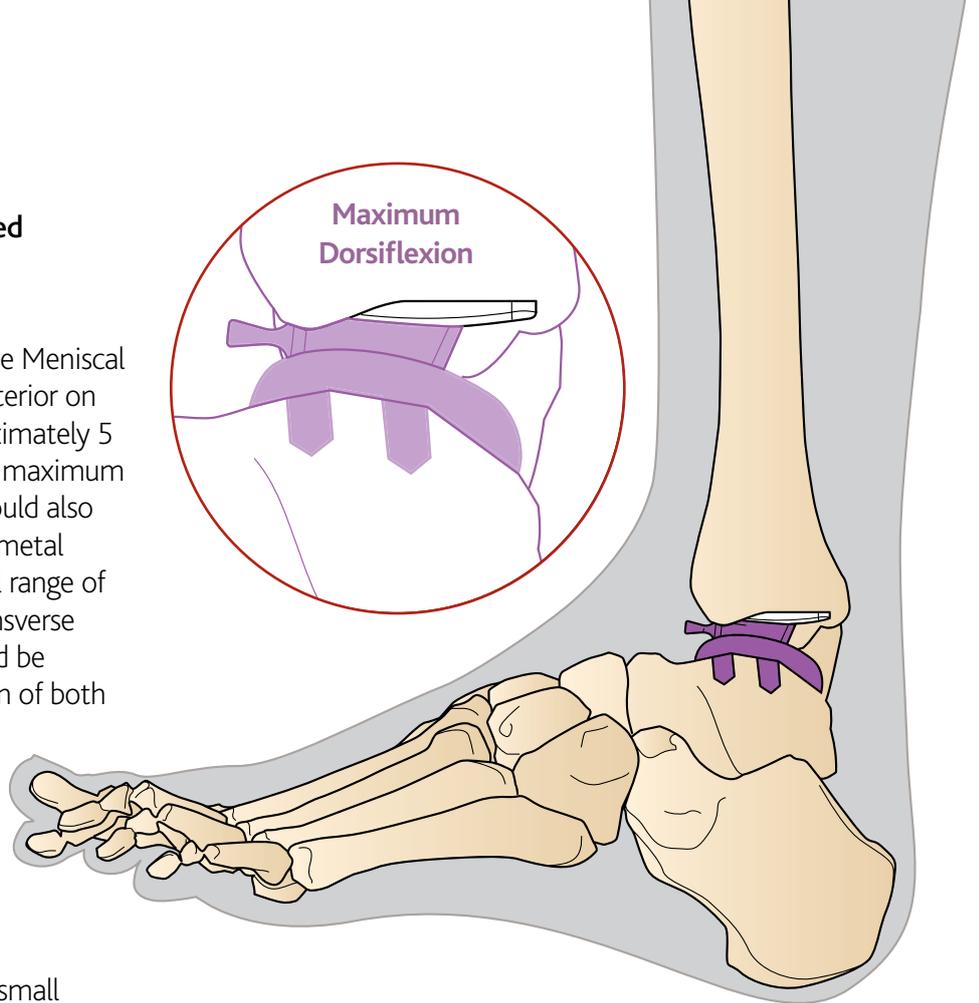
Select the appropriate sized Meniscal Trial matching the size of the Talar Trial used and the thickness of Tibial Tensioner used. Insert with the Meniscal Trial Inserter/Remover.



**Step 22**

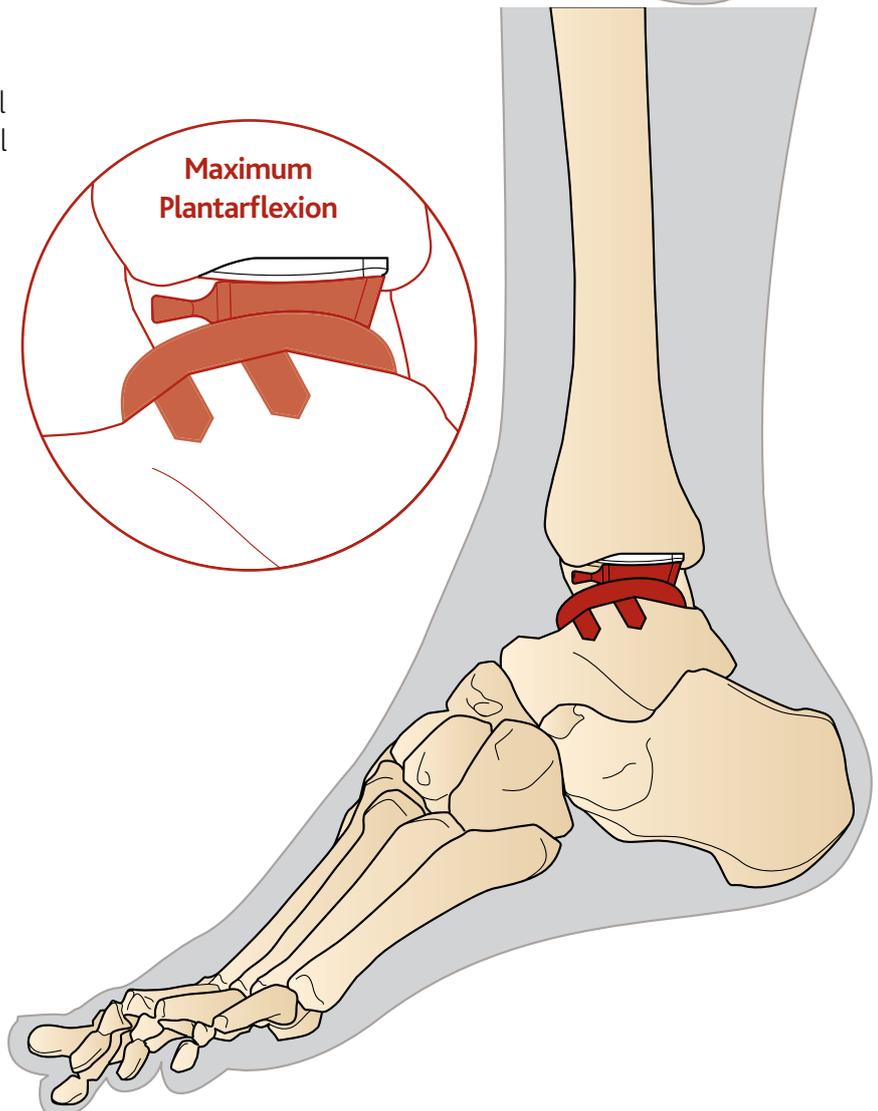
**Assess Motion at the joint replaced with the Trials**

Assess overall range of dorsiflexion/ plantarflexion, and joint function. The Meniscal Trial should traverse anterior-to-posterior on the Tibial Trial component by approximately 5 mm from maximum dorsiflexion to maximum plantarflexion. The Meniscal Trial should also remain in full contact with the two metal trials throughout flexion and the full range of internal-external rotation in the transverse plane. An intraoperative X-ray should be considered to assess the A/P position of both tibial and talar implants.



If range of motion or stability is not satisfactory, it is possible to make a small adjustment in Tibial Trial A/P position or to try an alternative thickness of Meniscal Trial. A common requirement is to move the Tibial Trial posteriorly to centre it A/P. It is essential to increase the depth of the two drill holes before attempting to move the Tibial Trial.

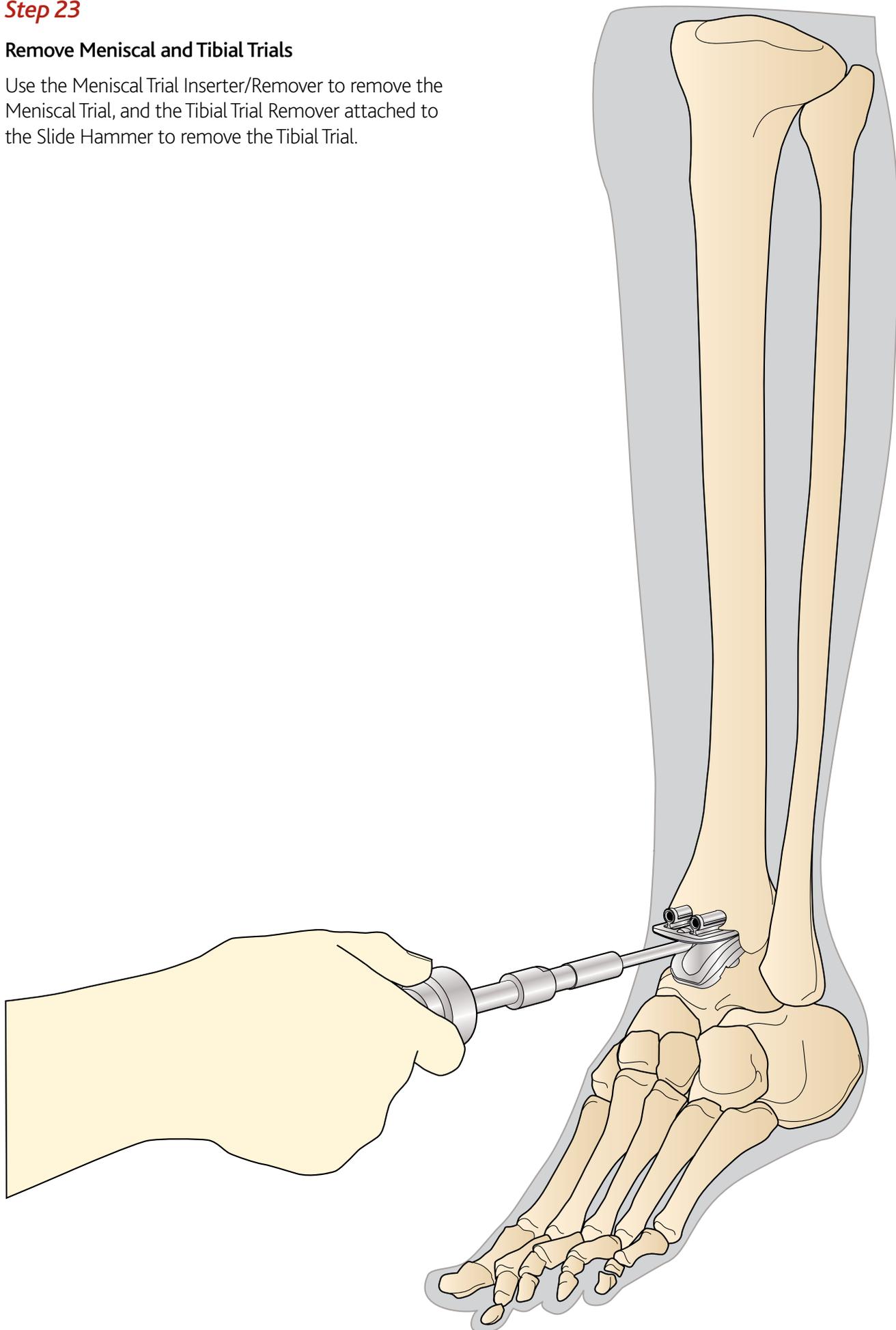
*Note: Failure to do this may result in fracture of the posterior portion of the tibia.*



**Step 23**

**Remove Meniscal and Tibial Trials**

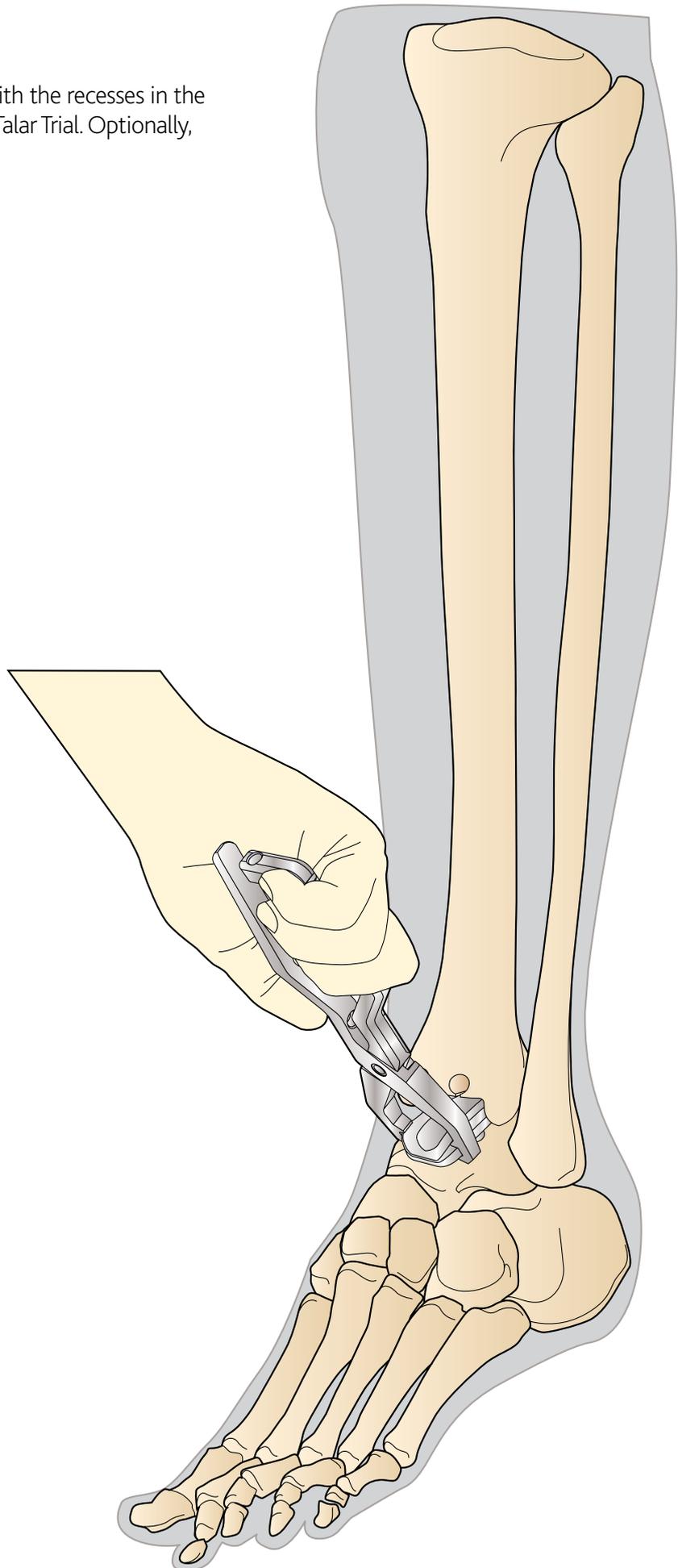
Use the Meniscal Trial Inserter/Remover to remove the Meniscal Trial, and the Tibial Trial Remover attached to the Slide Hammer to remove the Tibial Trial.



**Step 24**

**Remove Talar Trial**

Use the Talar Extractor aligned with the recesses in the anterior chamfer to remove the Talar Trial. Optionally, attach the Slide Hammer.

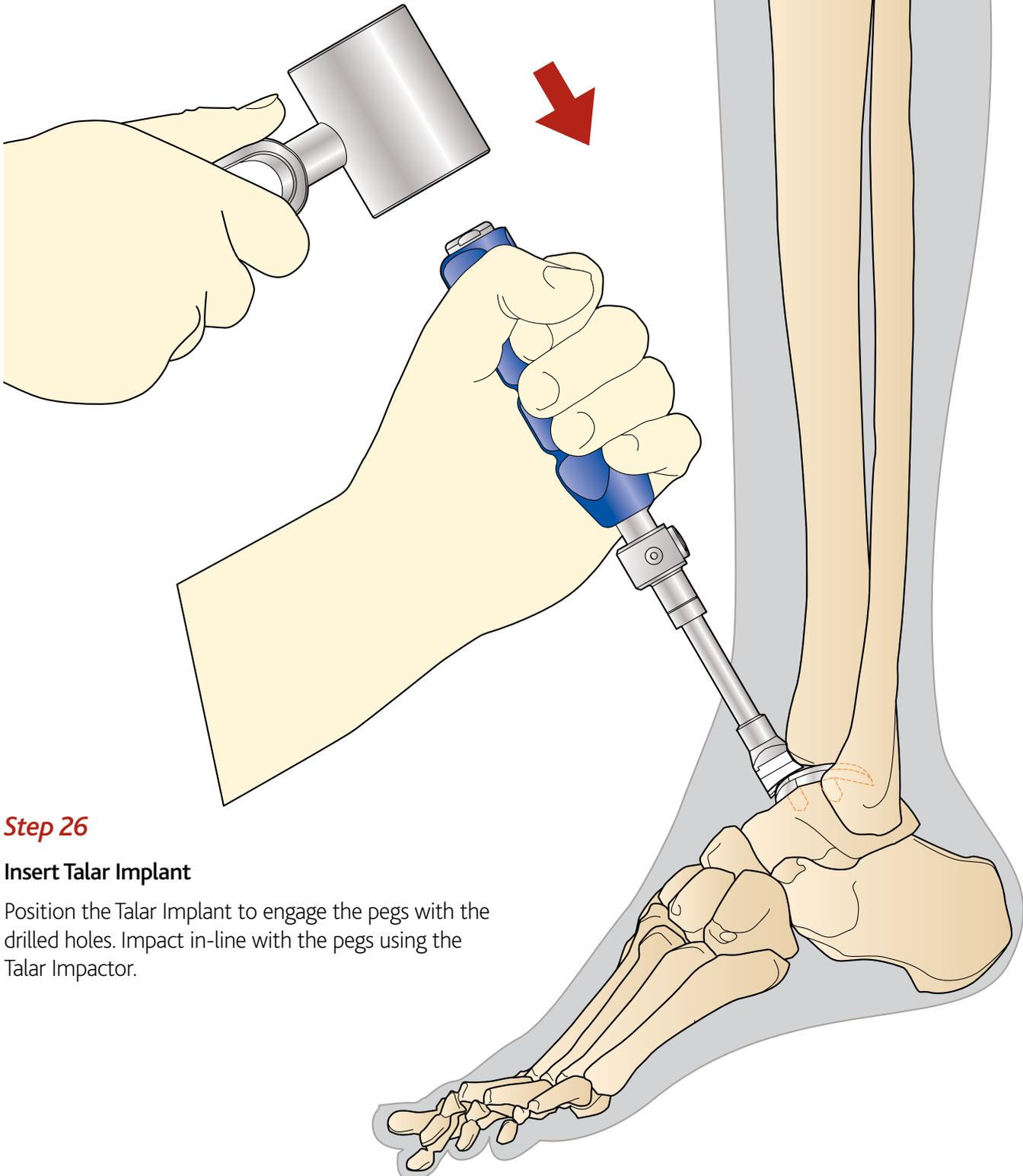


## Final Implantation

When selecting the implant components, ensure the Meniscal Implant matches Talar Implant size and colour code. Both tibial and talar components are cementless. Clean the resected bone surfaces with a bone brush or pressurised lavage. Use suction to remove the debris and liquid. Dry thoroughly.

### Step 25

Clean bone surfaces



### Step 26

**Insert Talar Implant**

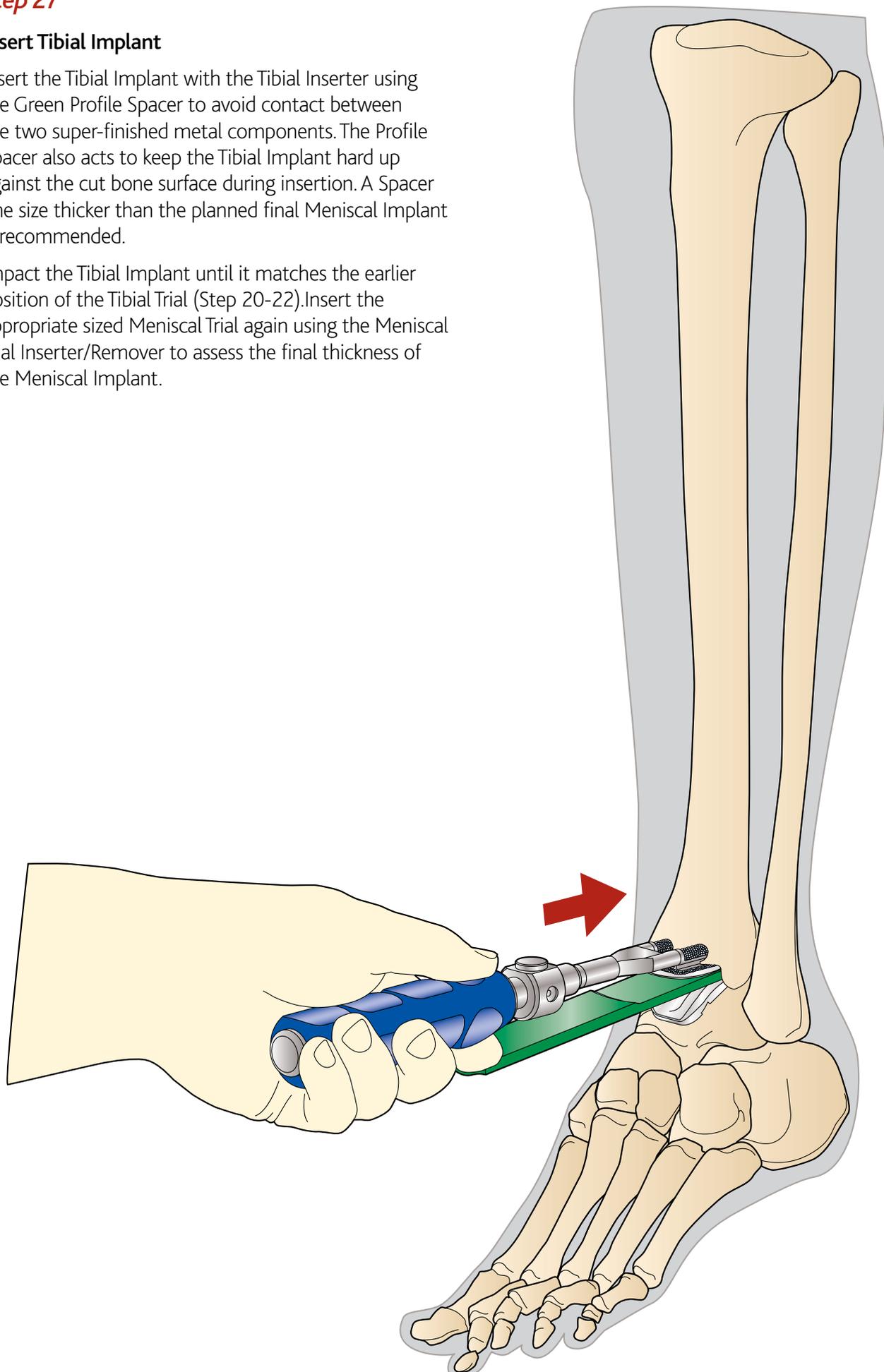
Position the Talar Implant to engage the pegs with the drilled holes. Impact in-line with the pegs using the Talar Impactor.

## Step 27

### Insert Tibial Implant

Insert the Tibial Implant with the Tibial Inserter using the Green Profile Spacer to avoid contact between the two super-finished metal components. The Profile Spacer also acts to keep the Tibial Implant hard up against the cut bone surface during insertion. A Spacer one size thicker than the planned final Meniscal Implant is recommended.

Impact the Tibial Implant until it matches the earlier position of the Tibial Trial (Step 20-22). Insert the appropriate sized Meniscal Trial again using the Meniscal Trial Inserter/Remover to assess the final thickness of the Meniscal Implant.

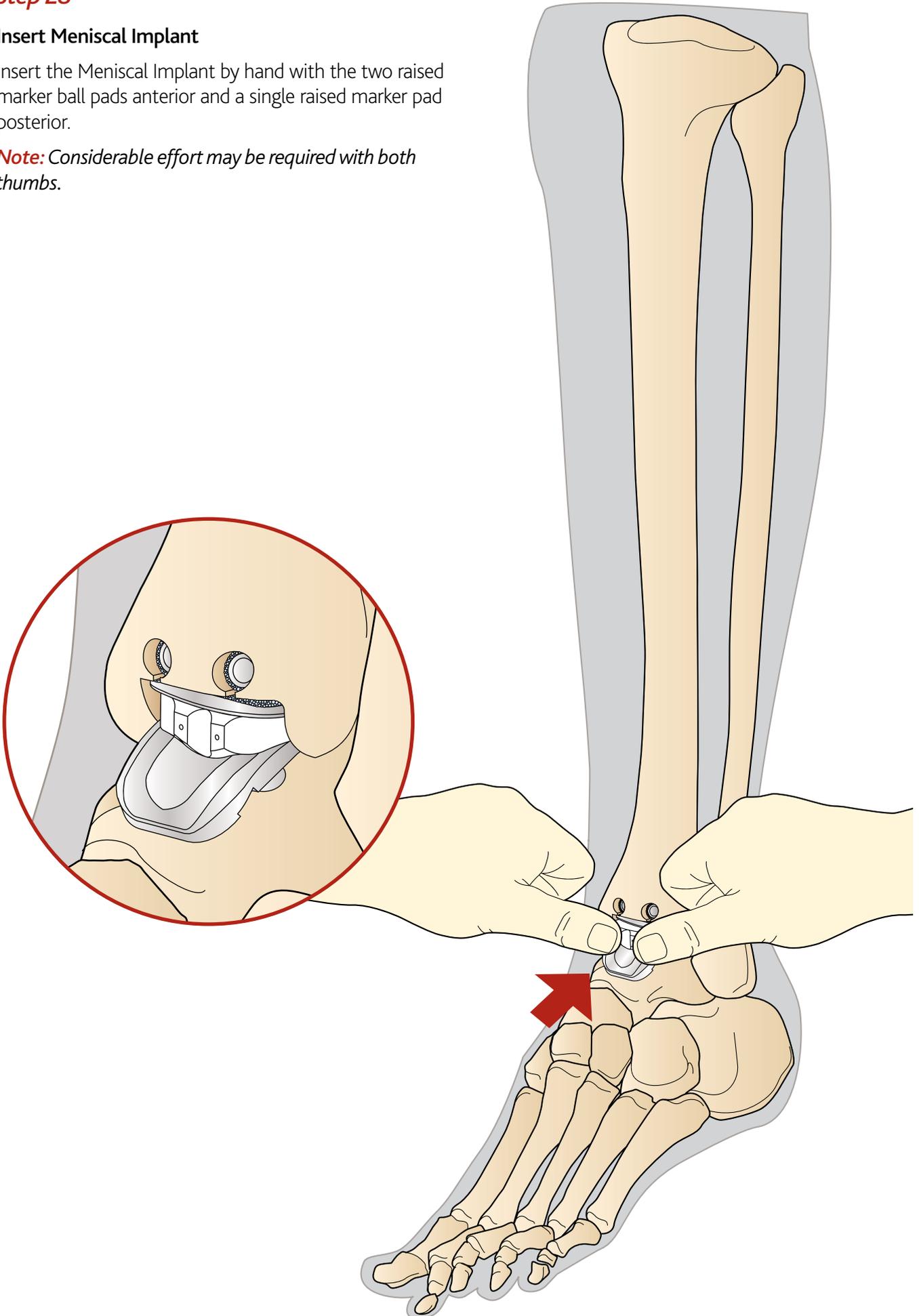


**Step 28**

**Insert Meniscal Implant**

Insert the Meniscal Implant by hand with the two raised marker ball pads anterior and a single raised marker pad posterior.

**Note:** Considerable effort may be required with both thumbs.



### Step 29

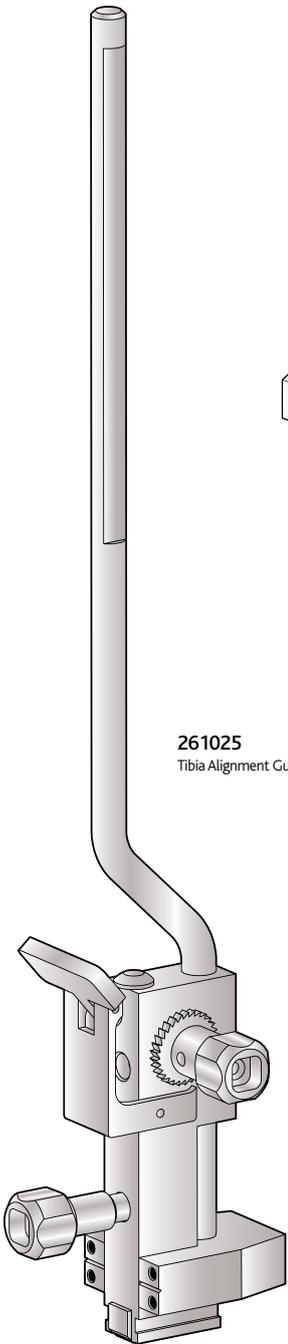
#### Assess Motion

Assess the overall range of dorsiflexion/plantarflexion, and joint function. The Meniscal Component should traverse anterior to posterior on the Tibial Implant Component by approximately 5 mm from maximum dorsiflexion to maximum plantarflexion. The Meniscal Implant should also remain in full contact with the two metal trials throughout flexion and the full range of internal-external rotation in the transverse plane.

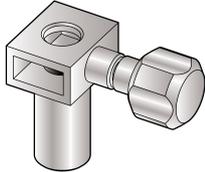
### Step 30

#### Closure

The tourniquet is released and careful cauterization of the vessels is carried out. A Drain is inserted and suture of the anatomical planes is performed. Closure of the retinaculum is crucially important as is attention to the Superficial Peroneal nerve. After closure, lateral and frontal X-Ray pictures are taken and the joint is cast in the neutral position.



**261025**  
Tibia Alignment Guide



**261027**  
Tibia Alignment Guide Connector



**261026**  
Tibia Alignment Guide  
Proximal Clamp

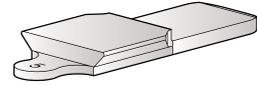
**261011**  
Tibia Drill  
(Small)



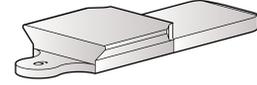
**261012**  
Tibia Drill  
(Medium)



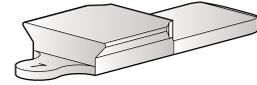
**261013**  
Tibia Drill  
(Large)



**261087**  
Tibial Tensioner Size 5



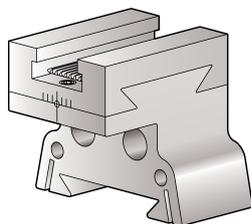
**261088**  
Tibial Tensioner Size 6



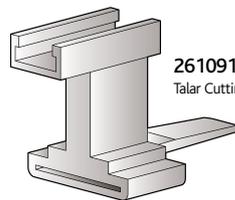
**261089**  
Tibial Tensioner Size 7



**261090**  
Tibial Tensioner Size 8



**261084 - 86**  
Tibial Block (Small, Medium & Large)



**261091**  
Talar Cutting Block

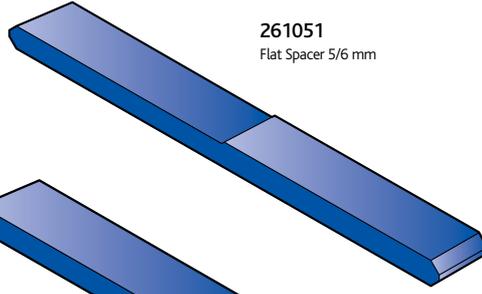


**261036**  
Tibial Corner Drill x2

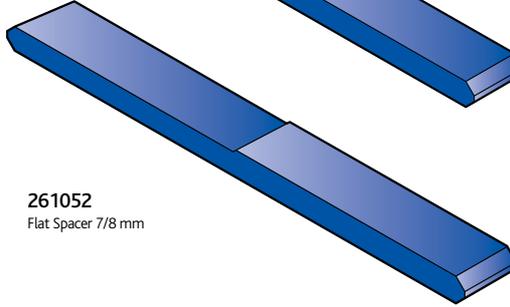
261037  
Tibial Corner Gouge



261051  
Flat Spacer 5/6 mm



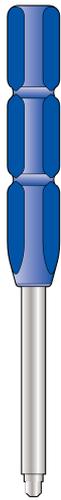
261052  
Flat Spacer 7/8 mm



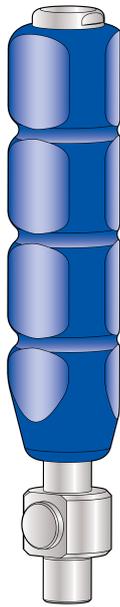
261040  
Tibial Length Gauge



261044  
Small Blue Handle



261108  
Large Blue Handle



261082  
3x 2.4 mm Pins  
(75 mm Long)



261083  
10x 2.4 mm Pins  
(100 mm Long)



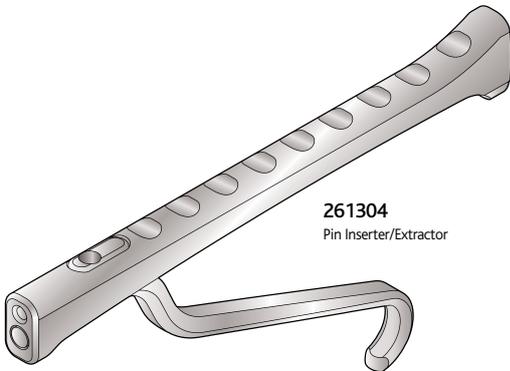
261080  
10x 2.4 mm Pins  
(130 mm Long)



261039  
Tibial Key Hole  
Cutter



261304  
Pin Inserter/Extractor



261041  
Talar Chamfer Guide (Small)

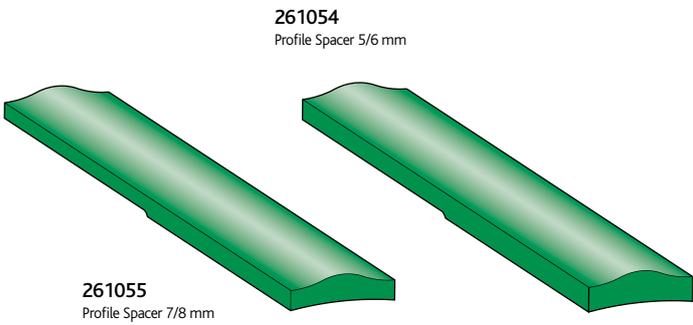
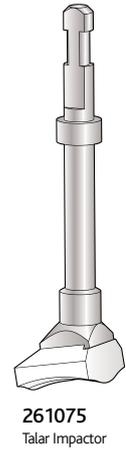
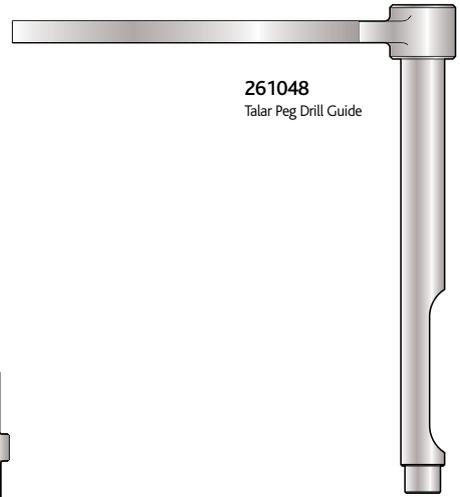
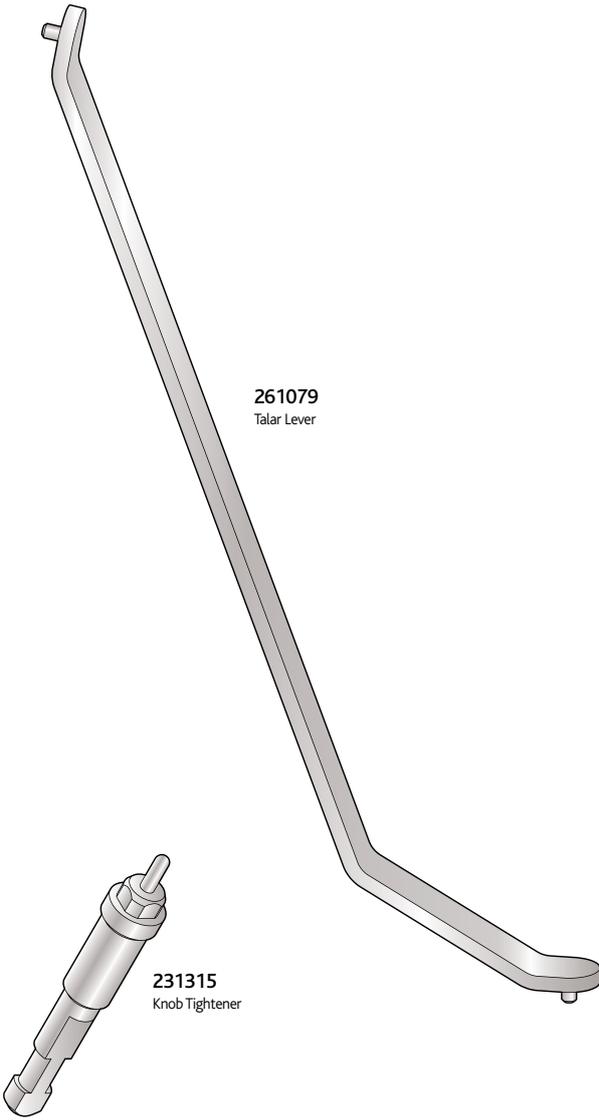


261042  
Talar Chamfer Guide (Medium)



261043  
Talar Chamfer Guide (Large)





Mensical Trial Set

Small	Medium	Large
 261115 5 mm	 261125 5 mm	 261135 5 mm
 261116 6 mm	 261126 6 mm	 261136 6 mm
 261117 7 mm	 261127 7 mm	 261137 7 mm
 261118 8 mm	 261128 8 mm	 261138 8 mm



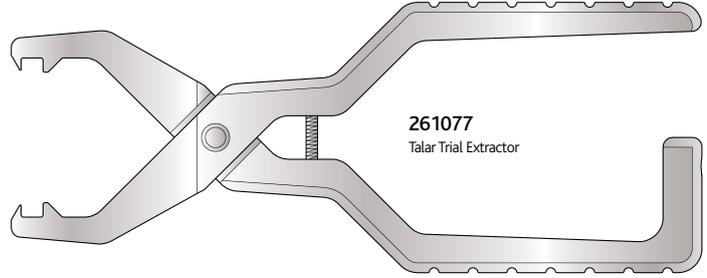
**261061**  
Tibial Trial (Small)



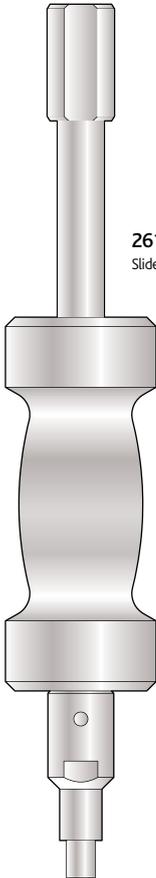
**261062**  
Tibial Trial (Medium)



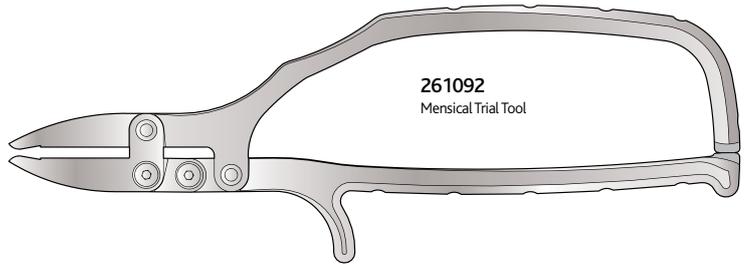
**261063**  
Tibial Trial (Large)



**261077**  
Talar Trial Extractor



**261078**  
Slide Hammer



**261092**  
Mensical Trial Tool



**261071**  
Talar Trial (Small)



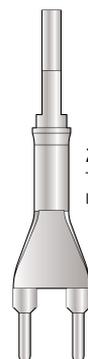
**261072**  
Talar Trial (Medium)



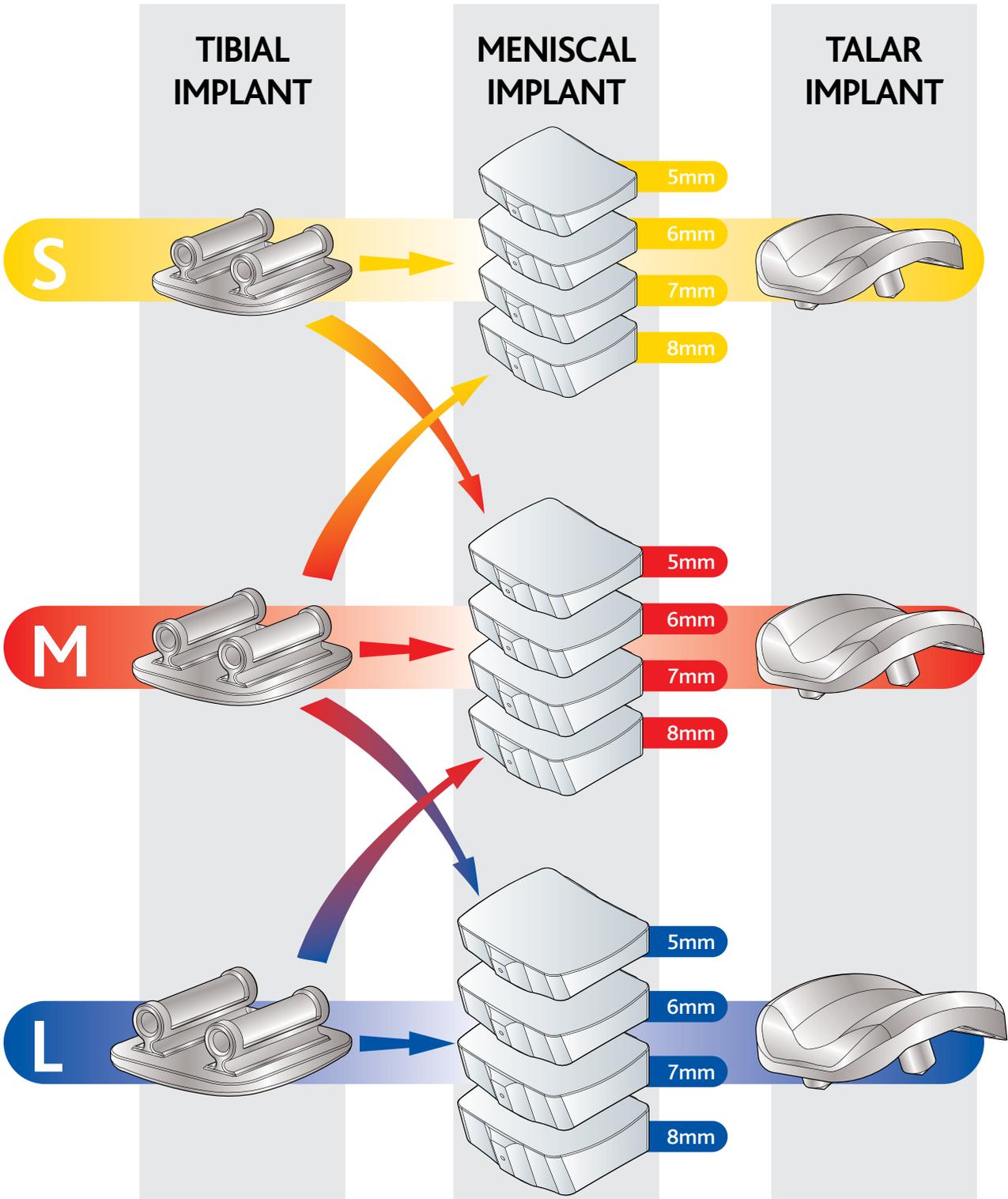
**261073**  
Talar Trial (Large)



**261064**  
Tibial Trial Extractor Hook



**261065**  
Tibial Trial Inserter





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