# **TomoFix Medial High Tibial Plate (MHT).** For Medial High Tibial Osteotomies.

Technique Guide



Instruments and implants approved by the AO Foundation

DePuy Synthes
TRAUMA
COMPANIES OF Johnson&Johnson

Image intensifier control

**Warning**
This description alone does not provide sufficient background for direct use of the product. Instruction by a surgeon experienced in handling this product is highly recommended.

**Reprocessing, Care and Maintenance of Synthes Instruments**
For general guidelines, function control and dismantling of multi-part instruments, please refer to: www.synthes.com/reprocessing

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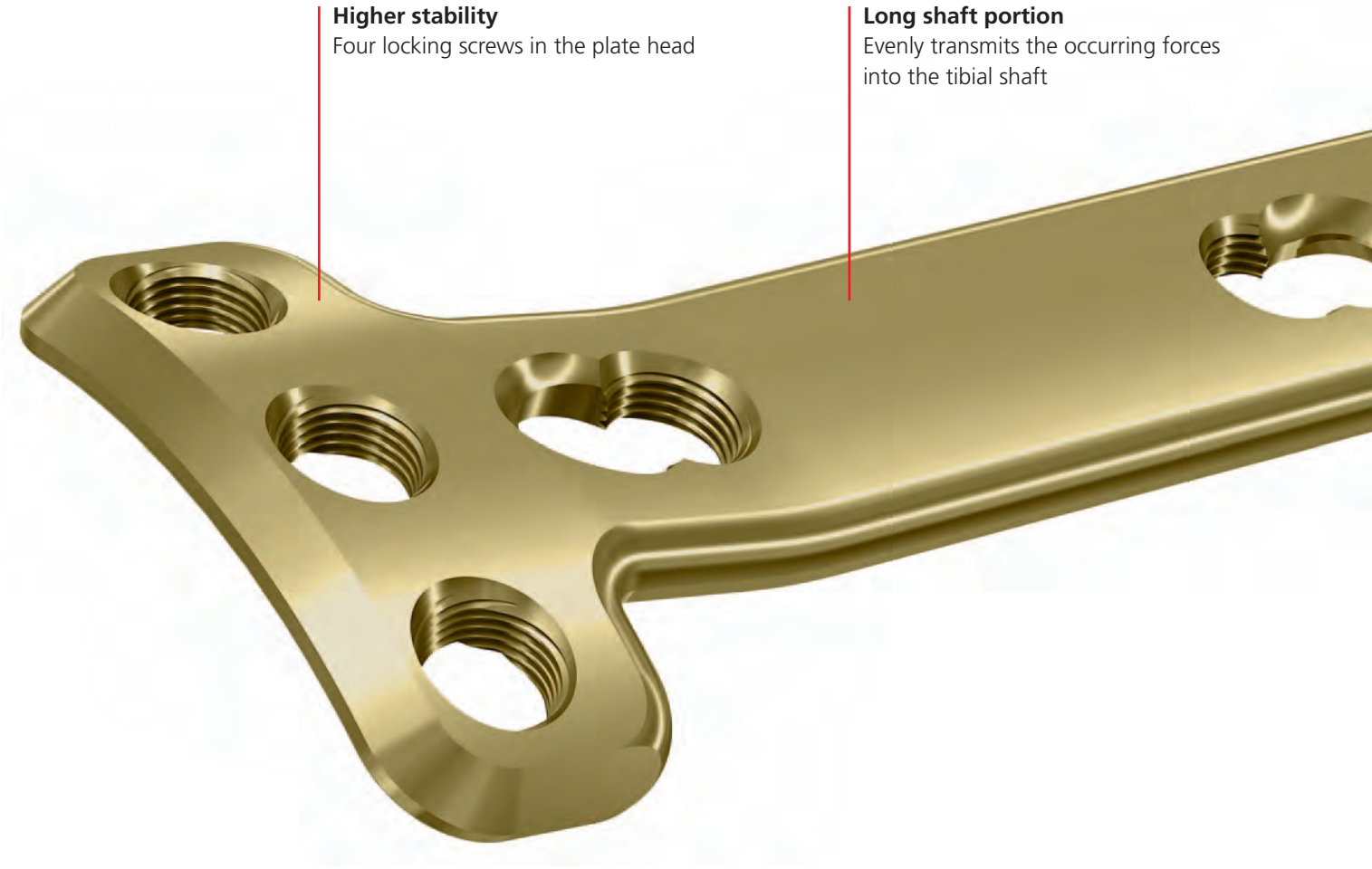
**TomoFix Medial High Tibial Plate (MHT).** For Medial High Tibial Osteotomies.

## Features and Benefits

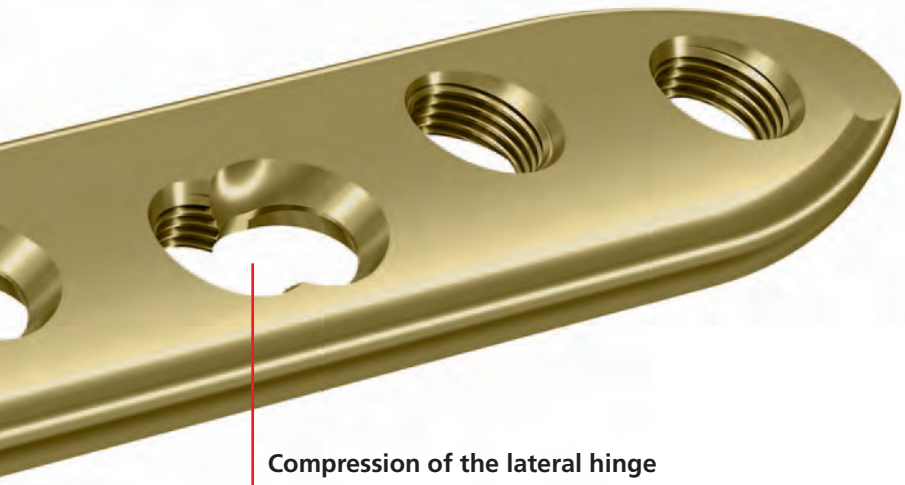



## Compression of the lateral hinge

A lag screw pulls the distal osteotomy segment towards the plate…

…and forces the plate into suspension, creating an elastic preload…

…which imposes pressure upon the lateral hinge.



**Easy plate insertion**
Tapered, rounded tip

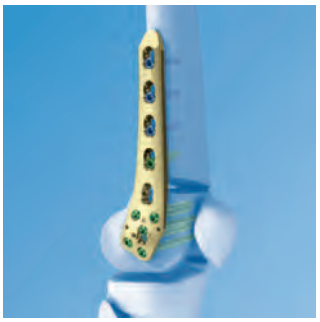
**Compression of the lateral hinge**
TomoFix technique allows pretensioning of the plate using cortex screw and spacers

## TomoFix Knee Osteotomy System

**TomoFix Tibial Head Plate medial, proximal**
- For open and closed-wedge high tibial osteotomies
- Increased plate strength allows application of the preload technique
- Optimum support for stable bridging
- Available in standard and small stature versions

**TomoFix Tibial Head Plate lateral, proximal**
- For open and closed-wedge osteotomies
- Fixed-angle construct for stable fixation
- Available in right and left versions

**TomoFix Femoral Plate medial, distal**
- For closed-wedge osteotomies
- Fixed-angle construct for stable fixation
- Available in right and left versions



**TomoFix Femoral Plate lateral, distal**
- For open and closed-wedge osteotomies
- Fixed-angle construct for stable fixation
- Available in right and left versions

# Indications and Contraindications

**Indications:**
- Open-wedge and closed-wedge osteotomies of the medial proximal tibia
- Unicompartmental medial or lateral gonarthrosis with malalignment of the proximal tibia
- Idiopathic or posttraumatic varus or valgus deformity of the proximal tibia

**Contraindication:**
- Inflammatory arthritis

# General Remarks

Open-wedge corrective tibia osteotomies are increasingly being used for joint-preserving surgery of the knee joint.

The TomoFix knee osteotomy system is based on the Locking Compression Plate system (LCP) and enables angular-stable connections between the screw and plate. This angular stability allows the stable fixation of an open-wedge osteotomy and hence its rapid osseous healing.

**Note:** Plan the type and position of the osteotomy.
The TomoFix medial high tibial plate is suitable for both open and closed-wedge osteotomies.

This technique guide will explain the procedure of an open-wedge osteotomy. For more detailed information on how to perform a closed-wedge osteotomy, please refer to the technique guide 036.001.026 (Osteotomy Guiding Device. For closed-wedge osteotomies at femur and tibia). For information on transverse and sagittal plane osteotomies please consult "Osteotomies around the knee" by Lobenhoffer P, RJ van Heerwaarden, AE Staubli, RP Jakob (see "Bibliography" on page 56).

## 1

### Preoperative Planning

A precise preoperative plan is crucial to the success of this procedure. The recommended method for planning is that of Miniaci. It must be done on the basis of the weight-bearing x-ray of the full leg in AP view, either on paper or at a digital workstation.

- Determine the mechanical axis of the leg: Draw a straight line from the center of the femoral head to the center of the ankle joint (a).
- Draw the new weight-bearing line from the center of the femoral head, passing the knee through the desired position (a').
- Determine a hinge point (H). Generally the hinge point should be chosen on the lateral cortex and at the upper border of the proximal tibiofibular joint.


**Important:** The optimal position of the hinge point may vary according to patient specific anatomy. However, it must always be at least 1.5 cm below the joint level!

- Connect the hinge point with the new (a') and with the old (a) center of the ankle joint. The opening angle corresponds to the angle between the two resulting lines.(α)

– Determine the entry point of the transverse osteotomy. It lies just above the pes anserinus. Make sure there is still enough space for the plate head, so that the screw in hole D can be inserted without protruding into the wedge. Depending on the determined opening angle and the length of the osteotomy cut (mediolateral diameter of the osteotomy) the corresponding opening height can be derived from Hernigou's trigonometric chart.

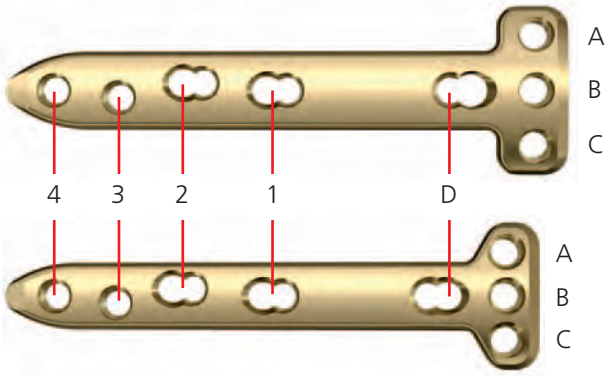
**Trigonometric chart**

| Mediolateral diameter of the osteotomy (mm) | Correction angle | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **4°** | **5°** | **6°** | **7°** | **8°** | **9°** | **10°** | **11°** | **12°** | **13°** | **14°** | **15°** | **16°** | **17°** | **18°** | **19°** |
| **50 mm** | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 16 |
| **55 mm** | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| **60 mm** | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| **65 mm** | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| **70 mm** | 5 | 6 | 7 | 8 | 10 | 11 | 12 | 13 | 15 | 16 | 17 | 18 | 20 | 21 | 22 | 23 |
| **75 mm** | 5 | 6 | 8 | 9 | 10 | 12 | 13 | 14 | 16 | 17 | 18 | 20 | 21 | 22 | 24 | 25 |
| **80 mm** | 6 | 7 | 8 | 10 | 11 | 13 | 14 | 15 | 17 | 18 | 19 | 21 | 22 | 24 | 25 | 26 |

**Note:** These instructions alone do not replace in-depth training in planning for osteotomies. It only serves as a general guideline.

## 2
### Prepare the implant

| Instruments | |
|---|---|
| 312.924 | Guiding Block for TomoFix Tibial Head Plate, small, medial, proximal |
| and | |
| 440.831 | TomoFix Tibial Head Plate, small, medial, proximal, shaft 4 holes, head 4 holes, length 112 mm, Pure Titanium |
| or | |
| 312.926 | TomoFix Guiding Block for TomoFix Tibial Head Plate, medial, proximal |
| and | |
| 440.834 | TomoFix Tibial Head Plate, medial, proximal, 4 holes, Pure Titanium |
| 323.042 | LCP Drill Sleeve 5.0, for Drill Bits ∅ 4.3 mm |
| 413.309 | LCP Spacer ∅ 5.0 mm, length 2 mm, Titanium Alloy (TAN) |




Choose the corresponding guiding block for either the standard sized or small TomoFix plate.

Place the guiding block on the plate. The guiding block serves as an aid for attaching the LCP drill guides at the correct angle. Screw in and tighten a LCP drill guide into holes A, B and C. Insert a LCP spacer ∅ 5.0 mm into hole D and hole 4.

**Note:** Using spacers allows for the pes anserinus to move freely underneath the plate as well as for bending of the plate. This creates a tension that will act on the lateral hinge, thus generating compression.

## 3
### Positioning of patient

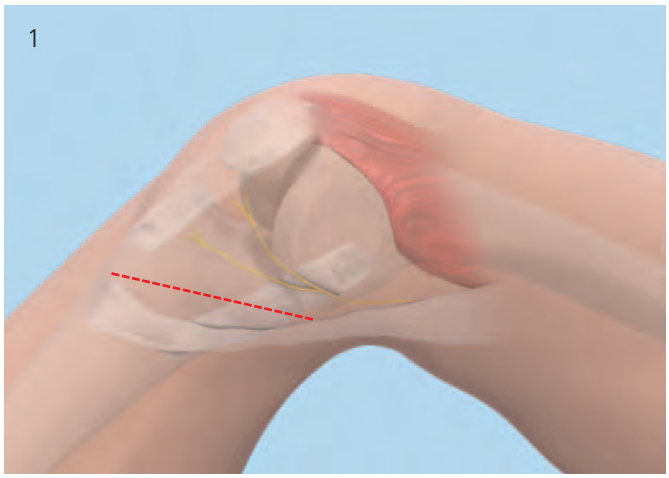
Perform the surgery with the patient in a supine position. Attach a lateral support and foot pad to the operating table so that the leg can be easily positioned in 90° flexion and in full extension. Position the patient so that the hip, knee and ankle joint can be visualized with the image intensifier. Lower the contralateral leg at the hip joint to facilitate access to the medial proximal tibia. The sterile draping also exposes the iliac crest so that the leg axis can be checked intraoperatively. A sterile tourniquet can be used, but is not mandatory.

**Note:** Allow enough space so that the leg can later be positioned in full extension as the intraoperative verification of the weight-bearing line has to be done with the leg in full extension.

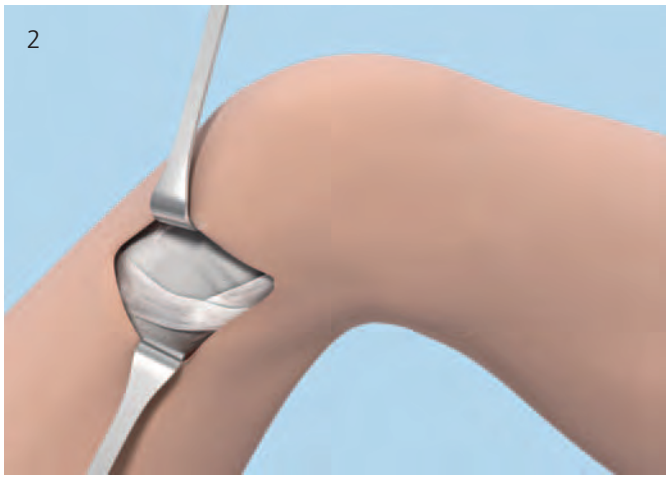
## 4
### Approach

Position the knee in 90° flexed position. Mark the anatomic landmarks (medial joint line, cranial border of pes anserinus, course of the medial collateral ligament, and tibial tuberosity) on the skin. Make a 6–8 cm long skin incision running from a point anterior to the insertion of the pes in a posterocranial direction. The incision ends over the posteromedial corner of the medial tibial plateau.(1)

**Note:** This incision runs essentially in line with the skin lines and the saphenous nerve.

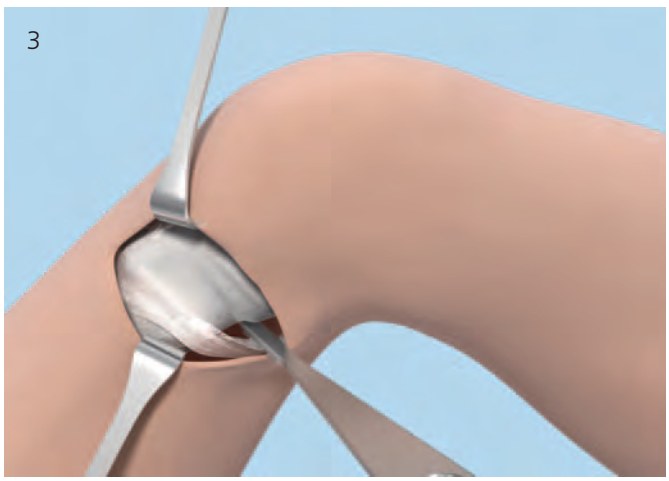



First, divide the subcutaneous tissues and the fascia at the cranial border of the pes anserinus. Retract the pes tendons distally. The anterior border of the superficial layer of the medial collateral ligament now comes into view (2). Pass a periosteal elevator under the ligament that is then lifted from the tibia. Detach the long fibers of the superficial part of this ligament from the tibia with a scalpel until the posterior ridge of the tibia is exposed. Insert a Hohmann retractor behind the tibia (3). Expose the insertion of the patellar tendon into the tibial tuberosity at the anterior edge of the incision and the medial border of the patellar ligament.




**Note:** The distal insertion of the patellar tendon must be clearly visualized to allow determination of the endpoint of the anteriorly ascending cut of the biplanar osteotomy later on.

**Note:** During the dissection, make sure that the dermal branches of the saphenous nerve are not damaged.



## 1
### Determine the position of the osteotomy

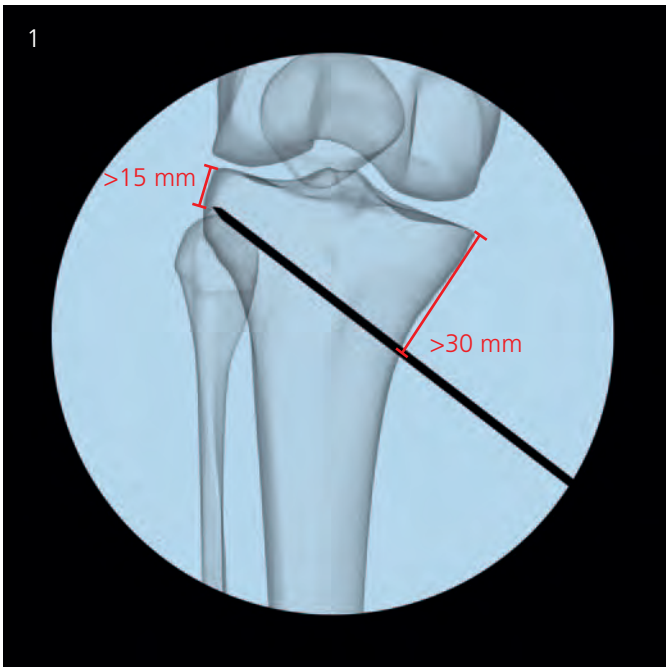
| Instrument | |
|---|---|
| 292.260 | Kirschner Wire ∅ 2.5 mm with trocar tip, length 280 mm, Stainless Steel |

| Alternative instrument | |
|---|---|
| 338.002 | Guide Wire ∅ 2.5 mm with drill tip, length 300 mm, Cobalt-Chrome Alloy |

Position the leg in full extension and adjust the knee joint exactly into AP view under fluoroscopy. Align the medial and lateral compartments in AP projection. Rotate the leg in a position which locates the patella exactly anteriorly (one third of the fibular head is then usually covered by the tibia).(1)

**Caution:** A correct view of the tibia is crucial to ensure the proper orientation of the osteotomy.

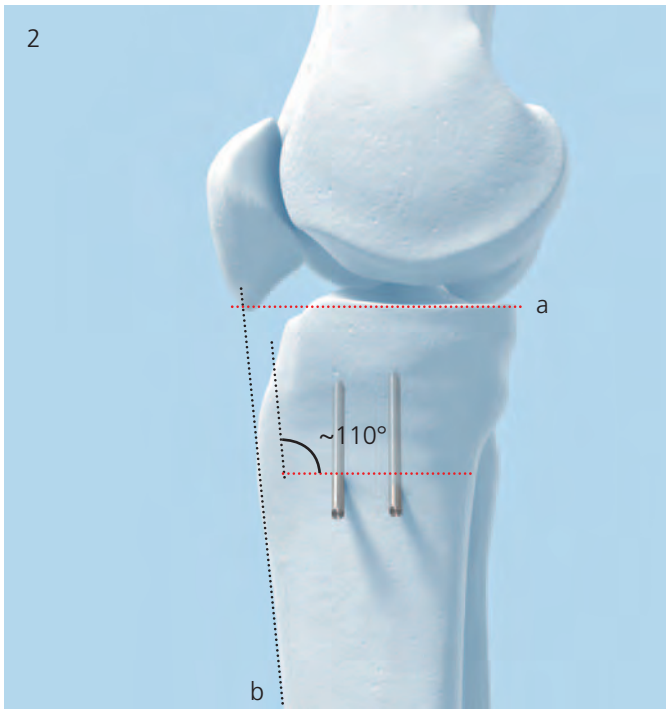
Place two 2.5 mm Kirschner wires into the tibial head under image intensification to mark the direction of the osteotomy. Both wires must run parallel and aim towards the hinge point which was previously defined as part of the preoperative plan.(1)

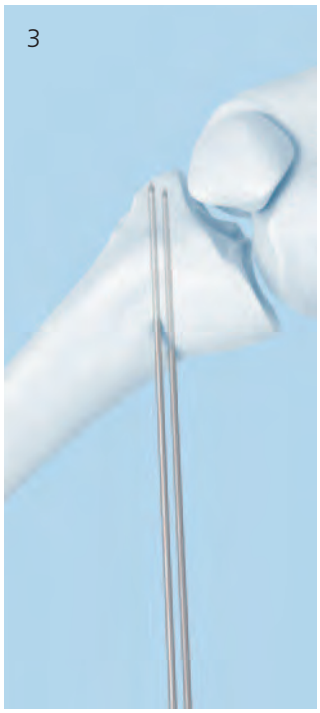


The wires must end exactly at the lateral tibial cortex. Place the first posterior wire at the cranial border of the pes anserinus just in front of the posterior tibial ridge. Place the second wire about 2 cm anterior and parallel to the first wire. When placing the two wires, it is important to ensure that there is sufficient space cranial to the saw cut for the four locking screws A, B, C and D in the TomoFix plate, leaving at least 30 mm of distance to the ridge of the medial tibial plateau.

**Caution:** To maintain the inclination of the tibial slope, the wires must run at the same angle to the tibial plateau (a). Performing the ascending osteotomy cut parallel to the anterior cortex of the tibial shaft (b; at a resulting angle of around 110° to the transverse osteotomy cut) is supposed to ensure good bony contact in the area of the ascending cut, after opening the osteotomy.(2)

**Technique tip:** To determine the cutting depth, hold a third wire of the same length against the cortex and measure the excess length compared to the inserted wires. Generally the tibial diameter is 5–10 mm smaller anteriorly than posteriorly. Note the measured values.(3,4)




**Technique tip:** For convenience the guide wires can be shortened to allow better access to the osteotomy.(5)

5

## 2
**Biplanar osteotomy**

| Instruments | |
|---|---|
| 519.105 | Saw Blade 70/49 × 20 × 0.6/0.4 mm, for Oscillating Saw with AO/ASIF Coupling |
| 519.108 | Saw Blade 116/95 × 25 × 0.9/0.8 mm, for Oscillating Saw with AO/ASIF Coupling |

Flex the knee in 90° flexion again and mark the course of the anterior ascending osteotomy, which runs at an angle of around 110° to the horizontal saw cut ending behind the patellar tendon. This tuberosity segment should be at least 15 mm wide.

Mark the cutting depth (determined in the previous step) on the saw blade.

Perform the transverse osteotomy with an oscillating saw below the two Kirschner wires that act as a guide. Pay attention to completing the osteotomy cut of the hard posteromedial tibial cortex. Protect the anatomical structures dorsal to the posterior tibial surface with a Hohmann retractor.(1)

Perform the entire sawing procedure slowly, with very little pressure and under constant cooling of the saw blade by irrigation. When the planned depth is achieved in the posterior two thirds of the tibia, perform the anterior ascending saw cut with the narrow saw blade. The ascending cut is a complete osteotomy including the medial and lateral aspects of the anterior cortex.(2)

1

2

**Caution:** Observe caution with the neurovascular structures. Saw slowly in full control since the blade could deviate into the back of the knee.

**Technique tip:** After performing the osteotomy cut, a ruler can be used to measure the osteotomy, making sure the saw cuts were completed as planned.(3)

3

## 3
### Open the osteotomy

| Instruments | |
|---|---|
| 397.992 | TomoFix Osteotomy Chisel, width 10 mm |
| 397.993 | TomoFix Osteotomy Chisel, width 15 mm |
| 397.994 | TomoFix Osteotomy Chisel, width 20 mm |
| 397.995 | TomoFix Osteotomy Chisel, width 25 mm |

Insert an osteotomy chisel into the transverse osteotomy up to the lateral bony hinge using light hammer blows. The insertion depth corresponds with the cutting depth. Mark it on the first osteotomy chisel. Then slowly insert a second osteotomy chisel between the first one and the guide wires. Insert it 10 mm less far than the first one.(1)

**Technique tip:** Leave the two guide wires in place while opening and spreading the osteotomy. This will stiffen the proximal segment and prevent fracturing of the articular surface of the tibia.(2)

1

2

## 4
### Spreading the osteotomy

**General aspects**
Open and spread the osteotomy slowly over a period of several minutes in order to prevent fracturing of the lateral cortex. Intra-articular secondary fractures can arise if the osteotomy is spread too quickly.

**Note:** Due to the medial collateral ligament complex, the osteotomy tends to open more anteriorly during spreading, thus increasing the caudal inclination of the tibial plateau. It is therefore important to ensure sufficient release of the long superficial fibers of the medial collateral ligament and symmetrical opening of the horizontal osteotomy. If needed, dissect the medial collateral ligament to provide subperiostal and caudal release.

Choose from the following options:

## 4a

### Spreading the osteotomy with the chisel technique

| Instruments | |
|---|---|
| 397.992 | TomoFix Osteotomy Chisel, width 10 mm |
| 397.993 | TomoFix Osteotomy Chisel, width 15 mm |
| 397.994 | TomoFix Osteotomy Chisel, width 20 mm |
| 397.995 | TomoFix Osteotomy Chisel, width 25 mm |

Additional chisels may be inserted between the first two for gradual spreading of the osteotomy. Continue inserting a third, fourth and fifth one, until the desired opening angle is reached. Insert each new chisel a little less far than its predecessor.(1,2)

1

2

## 4b

### Spreading the osteotomy with the TomoFix bone spreader

| Instrument | |
|---|---|
| 395.000 | TomoFix Bone Spreader |

As an alternative to spreading the osteotomy with chisels, the TomoFix bone spreader may be used. This device also serves to measure the opening angle of the osteotomy in degrees.

Use at least two chisels to gain an initial osteotomy gap as described in step 3. Remove the chisels and carefully hammer in the TomoFix bone spreader until it reaches the hinge.(1)

To avoid any inaccuracies, the spreader must be inserted absolutely perpendicular to the lateral bony hinge. The osteotomy depth can be read from the scale on the spreader blades (2). Slowly turn the screw clockwise with a screwdriver to spread the osteotomy until the desired opening angle is reached.(3)

**Note:** The readings on the bone spreader may not reflect the exact opening angle if the tip of the tool is not precisely at the hinge point.


## 4c

**Spreading the osteotomy with Bone Spreader forceps**

| Instrument | |
|---|---|
| 399.097 | Bone Spreader, soft lock, width 8 mm, length 220 mm |

As an alternative to spreading the osteotomy with chisels, the bone spreader forceps may be used.

Use at least two chisels to gain an initial osteotomy gap as described in step 3. Insert the bone spreader in the dorsomedial intercortical portion of the osteotomy gap. Slowly spread the osteotomy by opening the bone spreader forceps until the desired opening angle is reached.

## 5

**Check the correction**

| Instruments | |
|---|---|
| 03.108.030 | Alignment Rod |
| 03.108.031 | Stand, large, for Alignment Rod, with handles |
| 03.108.032 | Stand, small, for Alignment Rod |
| 399.097 | Bone Spreader, soft lock, width 8 mm, length 220 mm |
| 395.001 | TomoFix Osteotomy Gap Measuring Device, Stainless Steel |
| **Optional instrument** | |
| 324.060 | Calliper for Corpectomy, short, Stainless Steel |

While spreading the osteotomy using the techniques described above in step 4, it is necessary to adjust it according to the preoperative plan. Therefore constantly check the alignment of the leg and the height of the opening while spreading. For verification of the weight-bearing axis, put the leg in full extension. When the knee is extended, pay attention to the adaptation of the surfaces of the anterior ascending part of the osteotomy.

**Important:** The control and the fine adjustment of the osteotomy must always occur with the leg in full extension. Always monitor the osteotomy with the image intensifier in two planes. Check the tibial slope for possible changes. Avoid malrotation and medial and lateral destabilization.

To measure the height of the osteotomy, use the gap measuring device which measures the opening height in millimeters.

Hammer the gap measuring device into the opened osteotomy gap until it grips the bone. Slide the sledge towards the gap until it has reached the cortex. The opening value in millimeters can then be read from the scale.(1)

A second measuring device may be used to maintain the opening of the osteotomy after the instrument used for spreading has been removed. The implant can be placed between the two measuring devices.(2)

**Note:** Alternatively, the Calliper for Corpectomy (324.060) may be used to measure the osteotomy height.

1

2

The alignment rod is designed to confirm correction of the mechanical axis of the leg. The alignment rod is used with an image intensifier to ensure the accuracy of surgery. Attach handles to the large stand to hold the alignment rod in the correct position, without hand exposure to the x-ray beam. The handles may be connected to the stand either parallel or perpendicular to the rod.

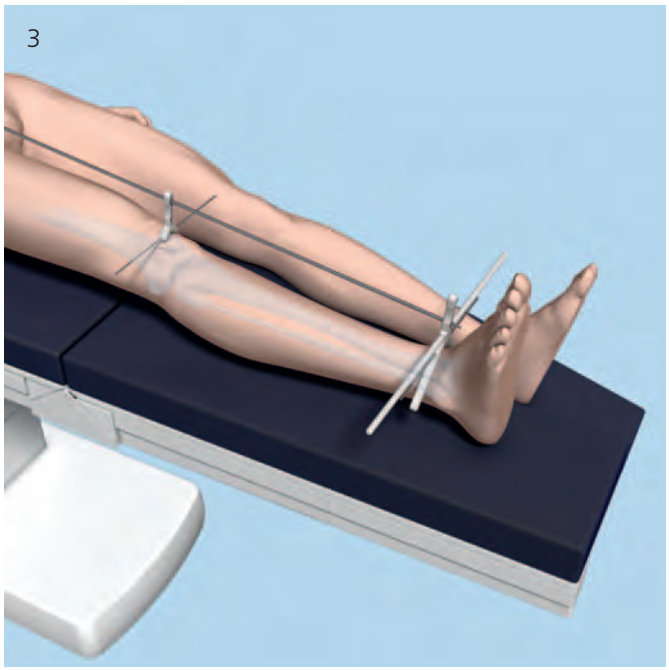
Place the alignment rod over the leg and align the metal rod at the center of the femoral head and at the center point of the ankle joint (3).

Check it with an image intensifier. The axis can be adjusted by opening or closing the osteotomy as required. Adjust the weight-bearing line according to the preoperative plan (4).

To check the knee joint line, a 2.0 mm Kirschner wire can be inserted into the stand at a right angle to the metal rod as reference during image intensification.

For further information on the alignment rod please refer to the handling technique 036.001.010.

**Note:** The alignment rod is for checking purposes. Only a standing full leg x-ray will provide absolute confirmation of the leg axis.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4

## 1
### Insert the plate subcutaneously

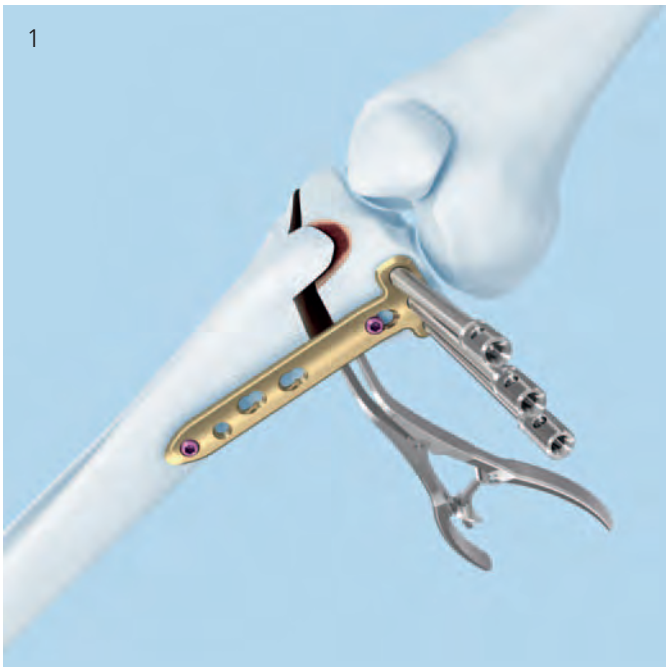
| Instruments | |
|---|---|
| 399.097 | Bone Spreader, soft lock, width 8 mm, length 220 mm |
| 323.042 | LCP Drill Sleeve 5.0, for Drill Bits ∅ 4.3 mm |
| 413.309 | LCP Spacer ∅ 5.0 mm, length 2 mm, Titanium Alloy (TAN) |
| 323.044 | Centering Sleeve for Kirschner Wire ∅ 2.0 mm, length 110 mm, for No. 323.042 |
| 292.210 | Kirschner Wire ∅ 2.0 mm with trocar tip, length 280 mm, Stainless Steel |
| 395.001 | TomoFix Osteotomy Gap Measuring Device, Stainless Steel |

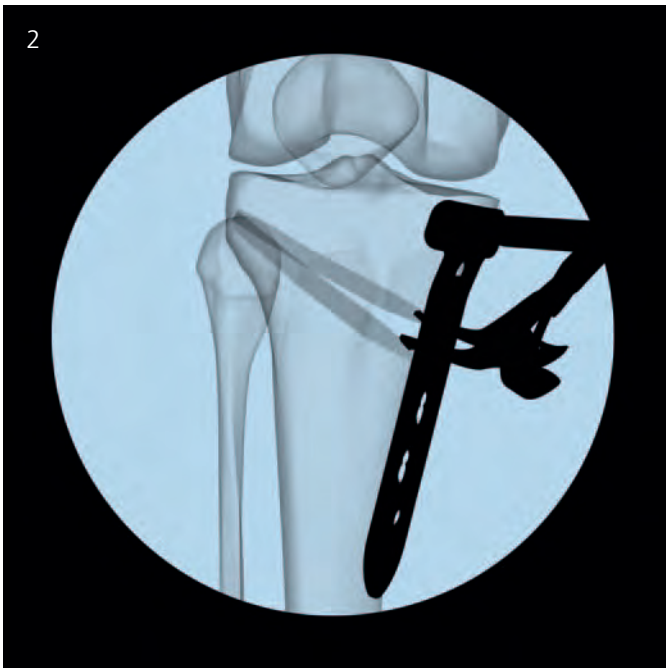
Use the bone spreader forceps or the gap measuring device to maintain the opening.(1)

Carefully remove the guide wires.

Insert the prepared plate subcutaneously. The shaft portion must be aligned with the ti-bial diaphysis avoiding anterior or posterior cortical overhang.

Position the plate under the image intensifier so that the solid plate segment is bridging the osteotomy, and that the proximal locking screws are placed 1 cm subchondral to the joint line.(2)



Temporarily secure the plate by insertion of a Kirschner wire into the central drill sleeve using a centering sleeve.(3)

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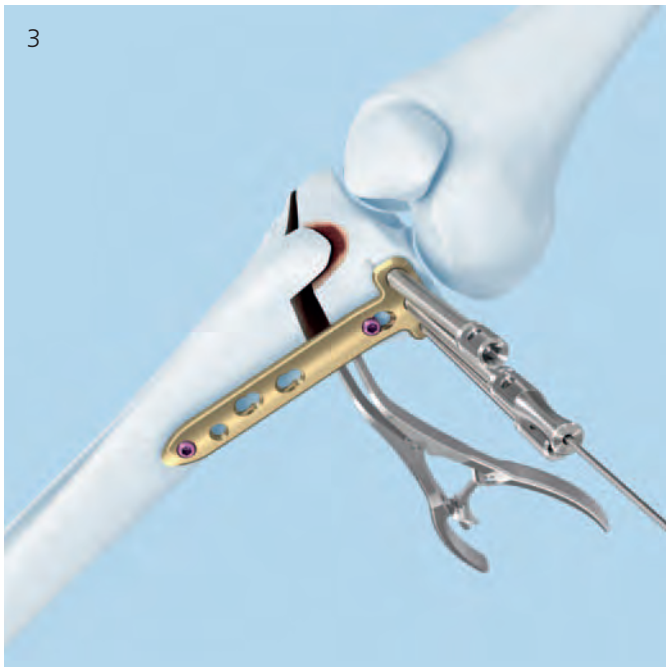
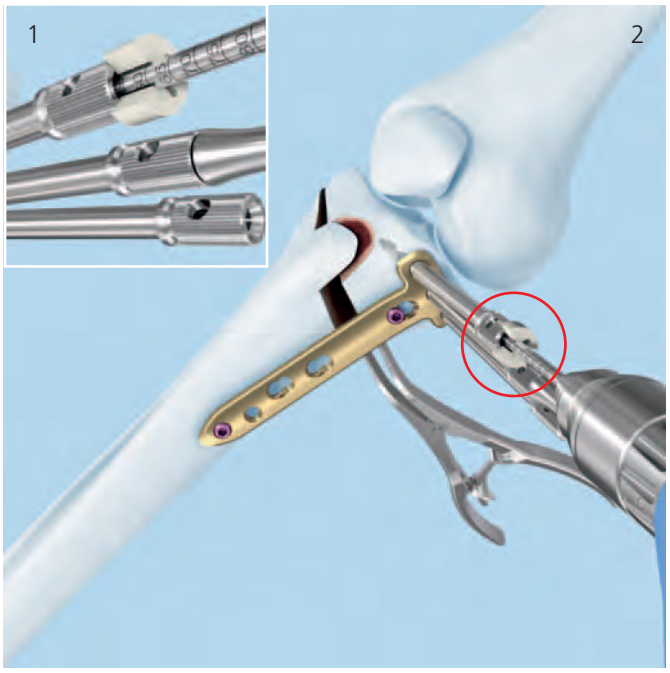


## 2

**Proximal fixation of the plate (holes A, B and C)**

| Instruments | |
|---|---|
| 310.430 | LCP Drill Bit ∅ 4.3 mm with Stop, length 221 mm, 2-flute, for Quick Coupling |
| 323.500 | LCP Universal Drill Guide 4.5/5.0 |
| 323.044 | Centering Sleeve for Kirschner Wire ∅ 2.0 mm, length 110 mm |
| 292.210 | Kirschner Wire ∅ 2.0 mm with trocar tip, length 280 mm, Stainless Steel |
| 397.705 | Handle for Torque Limiter Nos. 511.770 and 511.771 |
| 511.771 | Torque Limiter, 4 Nm, for Compact Air Drive and Power Drive |
| 314.150 | Screwdriver Shaft, hexagonal, large, ∅ 3.5 mm |




Drill screw holes with the LCP drill bit ∅ 4.3 mm and insert the three proximal self-tapping locking screws one after the other.(1)

Determine the screw lengths either by reading the drilled depth from the laser mark on the drill bit (2) or with the depth gauge after removing the drill sleeve. The chosen screws should be as long as possible without them protruding from the lateral cortical bone.

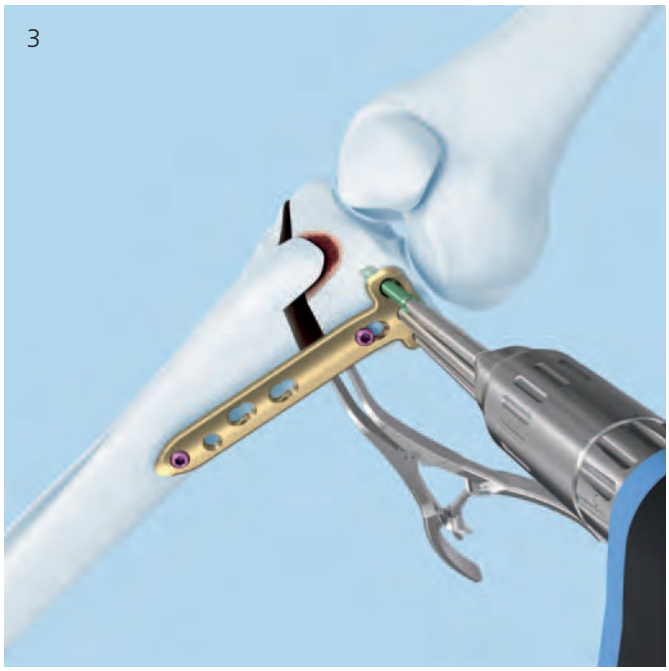
**Note:** Be careful not to rotate the plate when unscrewing the drill sleeves.

While pressing the TomoFix plate onto the tibia in its correct position, insert screws into holes A and C. Remove the Kirschner wire from hole B and replace it with a self-tapping locking screw. Insert the screws using a power tool, but do not fully tighten them.(3)

Finally, lock the screws manually with a screwdriver using the torque limiter (4). Optimum torque is reached after one click.

**Note:** To ensure sufficient tightening of locking head screws and to reduce the risk of cold welding of the screw head to the plate, locking head screws should always be tightened by hand using a torque limiter.

3



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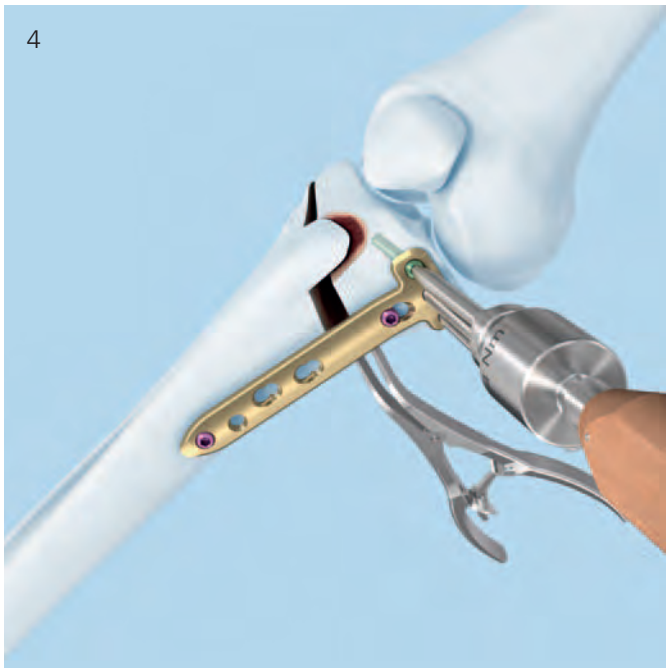
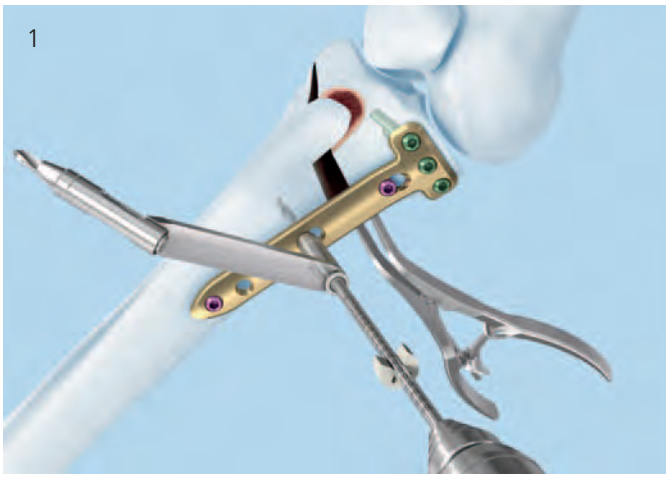
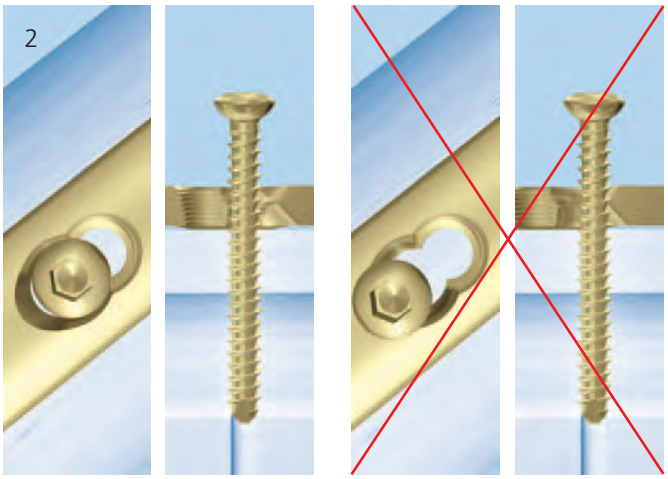


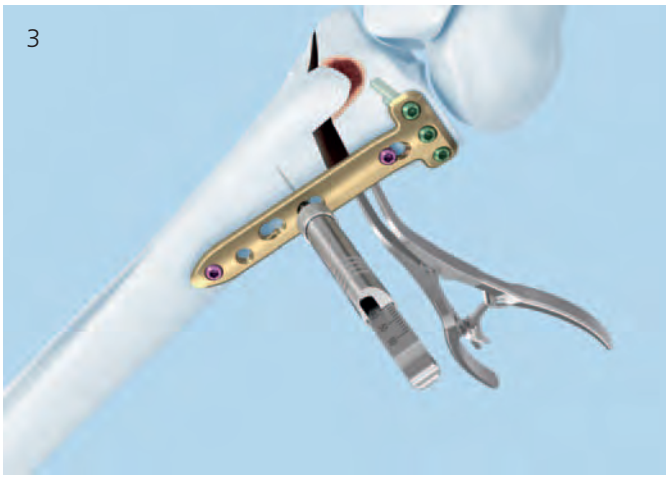
## 3
### Insert lag screw

| Instruments | |
|---|---|
| 310.290 | Drill Bit ∅ 3.2 mm, length 195/170 mm, 2-flute, for Quick Coupling |
| 323.500 | LCP Universal Drill Guide 4.5/5.0 |
| 319.100 | Depth Gauge for Screws ∅ 4.5 to 6.5 mm, measuring range up to 110 mm |

Insert a temporary lag screw in a neutral position of the dynamic part of the LCP hole 1 (1,2). Use the LCP universal drill guide to drill a hole angulated slightly towards distal so it will not interfere with a locking screw which will later be inserted into the locking position of this hole. Determine the required screw length with the depth gauge for screws.(3)



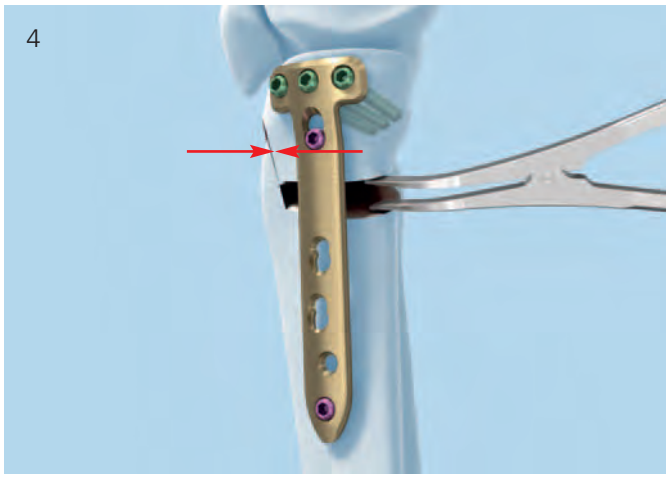



It is mandatory to place the leg in full extension at this stage of the operation. Use a hard bolster under the heel and manual stress to achieve full extension before the lag screw is tightened.

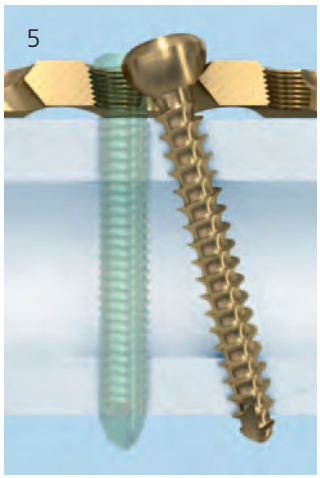
**Note:** Monitor potential correction loss and the ventral bone contact of the ascending osteotomy. Check the bone axis and, if necessary, make final corrections. Avoid compressing soft tissue.(4)

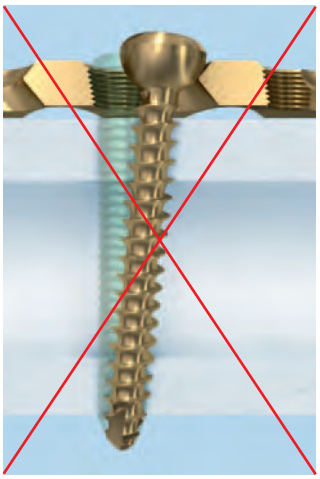
**Important:** The cortex screw must be angulated slightly towards distal, to avoid the trajectory of the bicortical locking screw in the same hole, which is required in the following steps.(5)

4



5





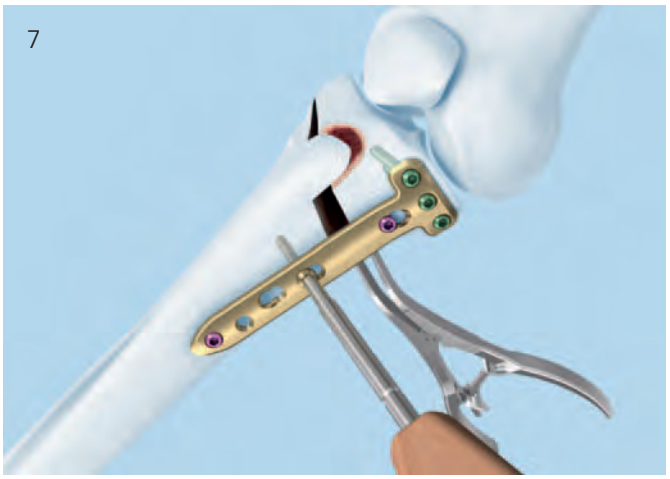
Insert a self-tapping cortex screw. Insert the screw using a power tool, but do not fully tighten it.(6)

Finally, tighten the screw manually with a screwdriver.(7,8)

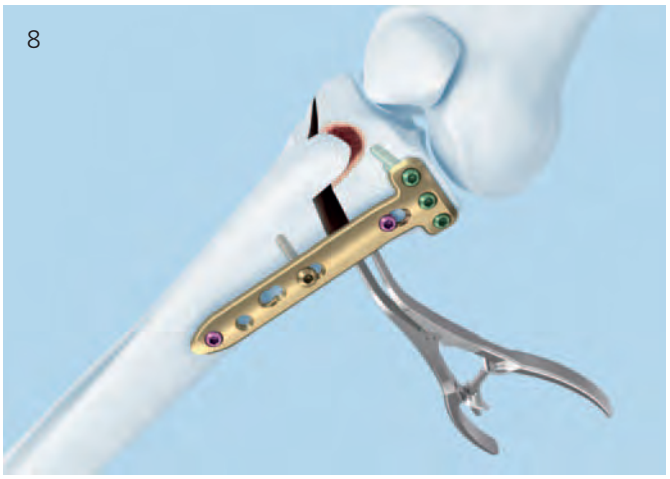
**Important:** Exert special care when tightening the cortex screw to avoid thread stripping and associated damage to the bone.

6

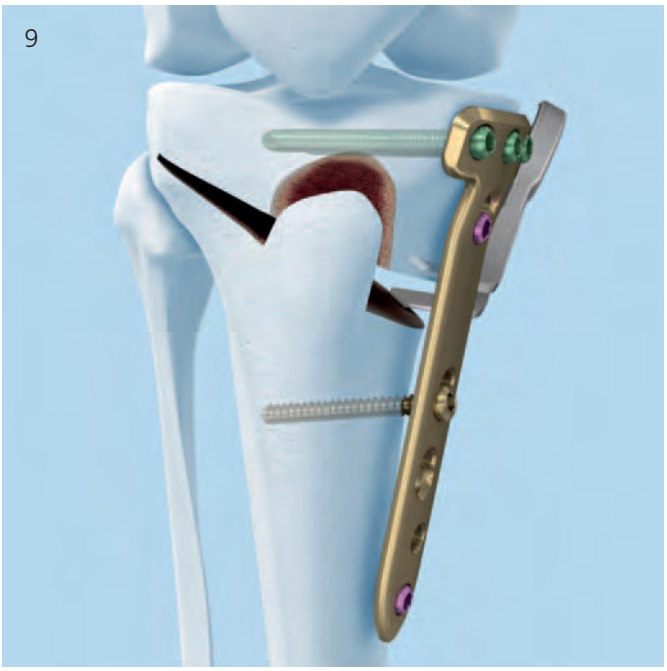
7



8



This lag screw compresses the lateral hinge by pulling the distal osteotomy segment towards the plate and also by forcing the plate into suspension which will impose pressure upon the lateral hinge. Potential fissures within the lateral bone hinge are brought under elastic preload and distraction on the lateral side is eliminated. Watch the osteotomy gap constantly while the lag screw is slowly tightened to avoid secondary loss of correction.(9)




## Compression of the lateral hinge

A lag screw pulls the distal osteotomy segment towards the plate…

…and forces the plate into suspension, creating an elastic preload…

…which imposes pressure upon the lateral hinge.

## 4
### Distal fixation of the plate

| Instruments | |
|---|---|
| 323.500 | LCP Universal Drill Guide 4.5/5.0 |
| 397.705 | Handle for Torque Limiter Nos. 511.770 and 511.771 |
| 511.771 | Torque Limiter, 4 Nm, for Compact Air Drive and Power Drive |
| 314.150 | Screwdriver Shaft, hexagonal, large, ∅ 3.5 mm |

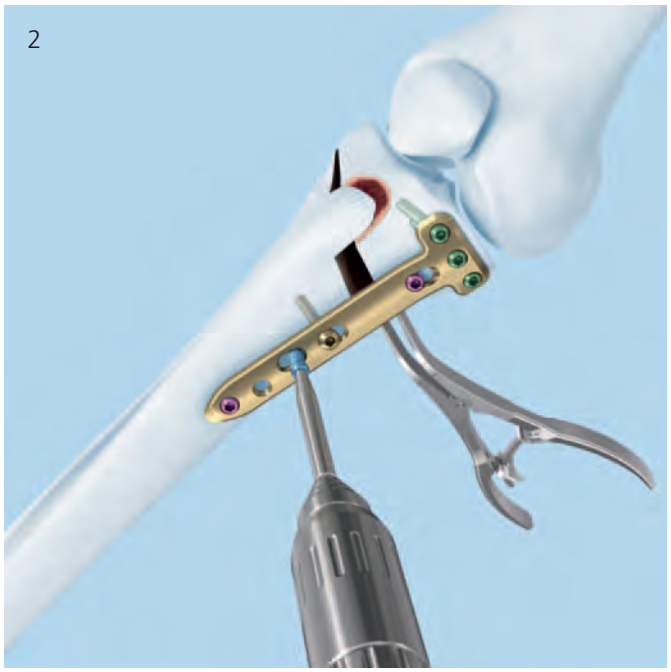
Make a stab incision over hole 3. The incision will be used to gain access to holes 2, 3, and 4.

Drill a monocortical hole with the LCP universal drill guide through the locking portion of hole 2.(1)

Insert a monocortical self-drilling locking screw. Insert the screw using a power tool, but do not fully tighten it.(2)

1

2



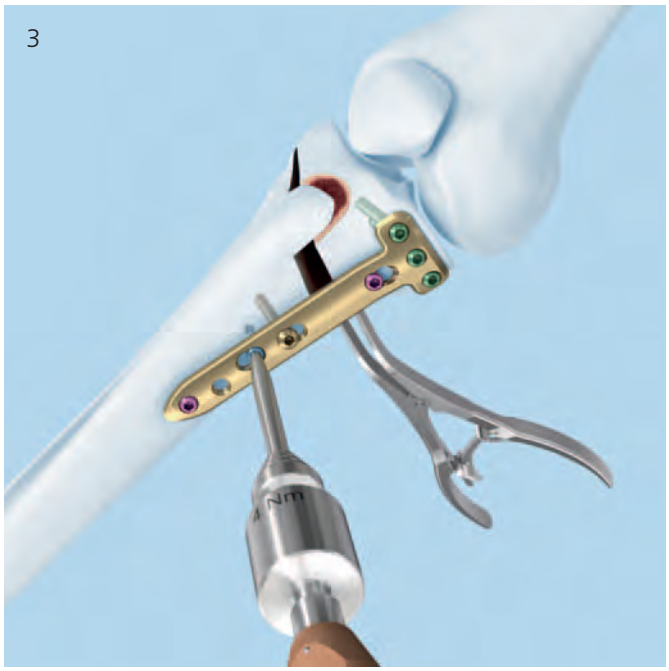
Finally, lock the screw manually with a screwdriver using the torque limiter (3). Optimum torque is reached after one click.

Repeat these actions for hole 3.

**Note:** To ensure sufficient tightening of locking head screws and to reduce the risk of cold welding of the screw head to the plate, locking head screws should always be tightened by hand using a torque limiter.

**Note:** In cases where increased stability is required, bicortical self-tapping screws may be used in the three distal holes, using the same technique as described in step 6.

**Note:** Alternatively, monocortical self-tapping screws can be inserted instead of the self-drilling screws, as described above in step 2.

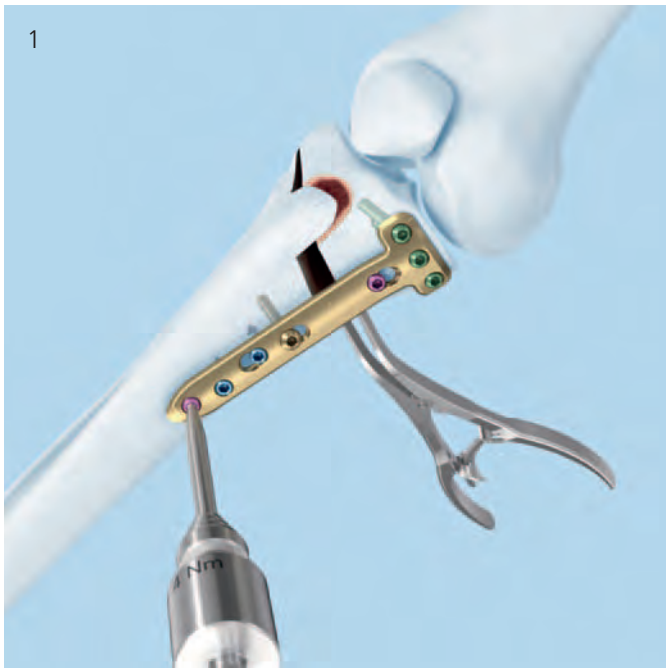



## 5

### Replace the distal LCP spacer with a locking head screw

| Instruments | |
|---|---|
| 323.500 | LCP Universal Drill Guide 4.5/5.0 |
| 397.705 | Handle for Torque Limiter Nos. 511.770 and 511.771 |
| 511.771 | Torque Limiter, 4 Nm, for Compact Air Drive and Power Drive |
| 314.150 | Screwdriver Shaft, hexagonal, large, ∅ 3.5 mm |

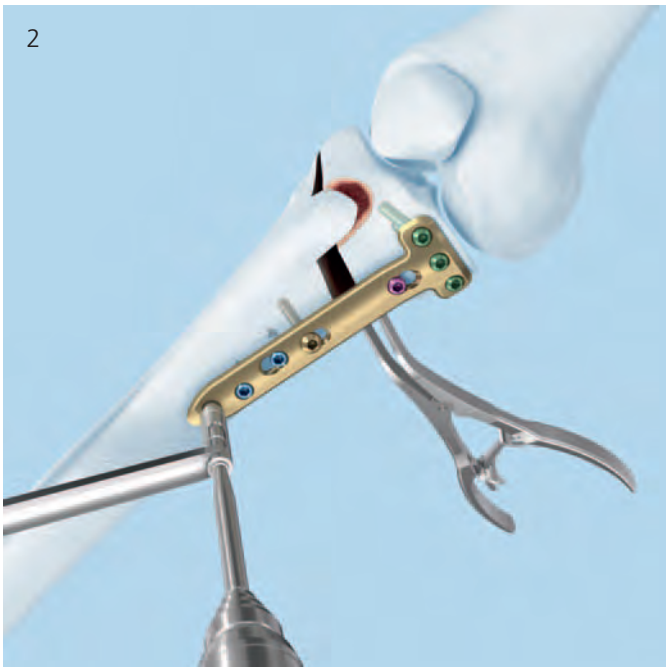
Remove LCP spacer ∅ 5.0 mm from hole 4.(1)



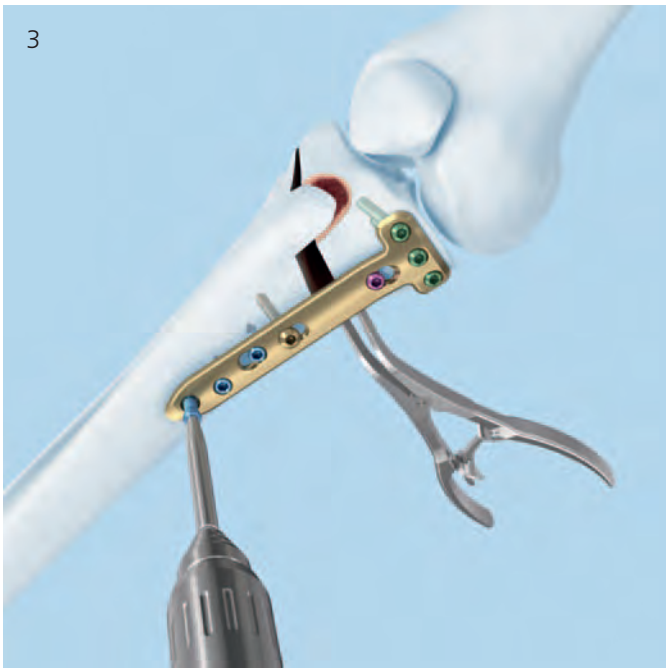
Drill a monocortical hole with the LCP universal drill guide through the locking portion of hole 4.(2)

Insert a monocortical self-drilling locking screw. Insert the screw using a power tool, but do not fully tighten it.(3)

2



3

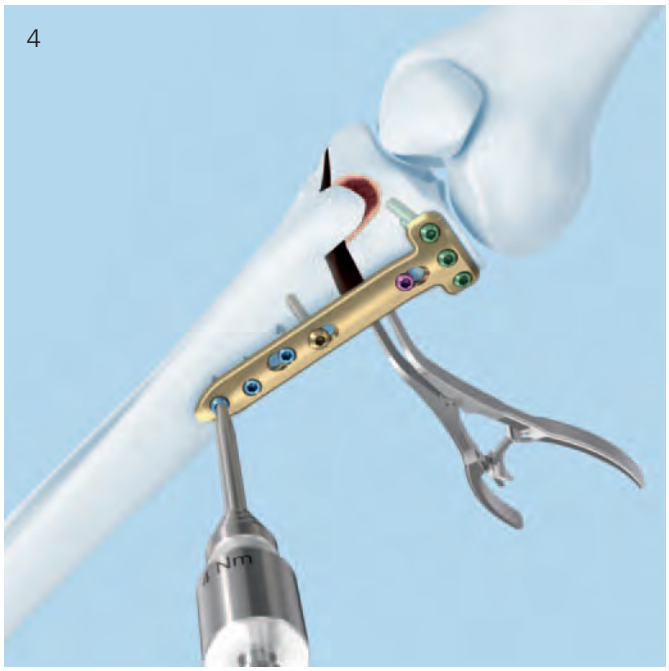


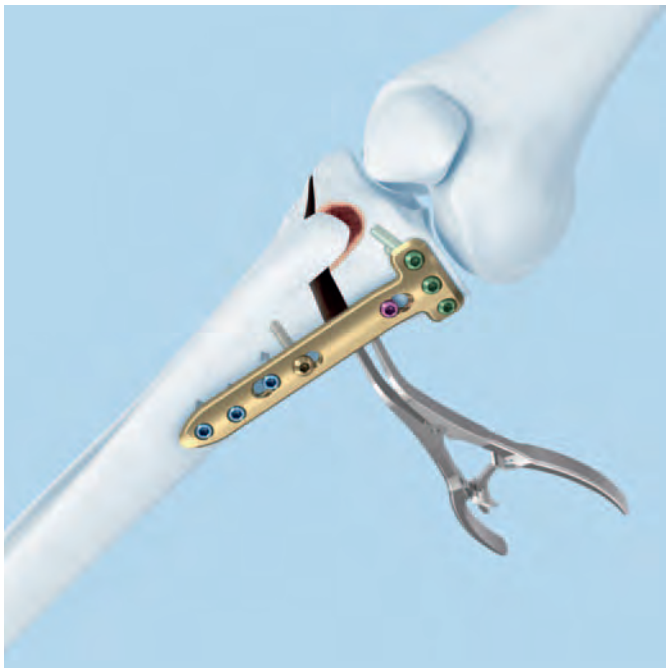
Finally, lock the screw manually with a screwdriver using the torque limiter.(4)

Optimum torque is reached after one click.

**Note:** To ensure sufficient tightening of locking head screws and to reduce the risk of cold welding of the screw head to the plate, locking head screws should always be tightened by hand using a torque limiter.

4



## 6
### Replace lag screw with a locking head screw

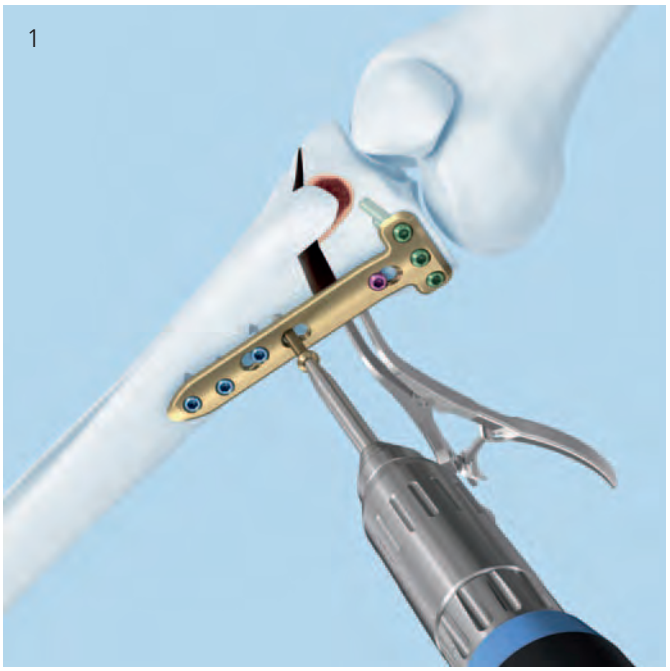
| Instruments | |
|---|---|
| 310.430 | LCP Drill Bit ∅ 4.3 mm with Stop, length 221 mm, 2-flute, for Quick Coupling |
| 323.042 | LCP Drill Sleeve 5.0, for Drill Bits ∅ 4.3 mm |
| 397.705 | Handle for Torque Limiter Nos. 511.770 and 511.771 |
| 511.771 | Torque Limiter, 4 Nm, for Compact Air Drive and Power Drive |
| 314.150 | Screwdriver Shaft, hexagonal, large, ∅ 3.5 mm |
| **Alternative Instrument** | |
| 319.100 | Depth Gauge for Screws ∅ 4.5 to 6.5 mm, measuring range up to 110 mm |

Remove the previously inserted lag screw from hole 1.(1)

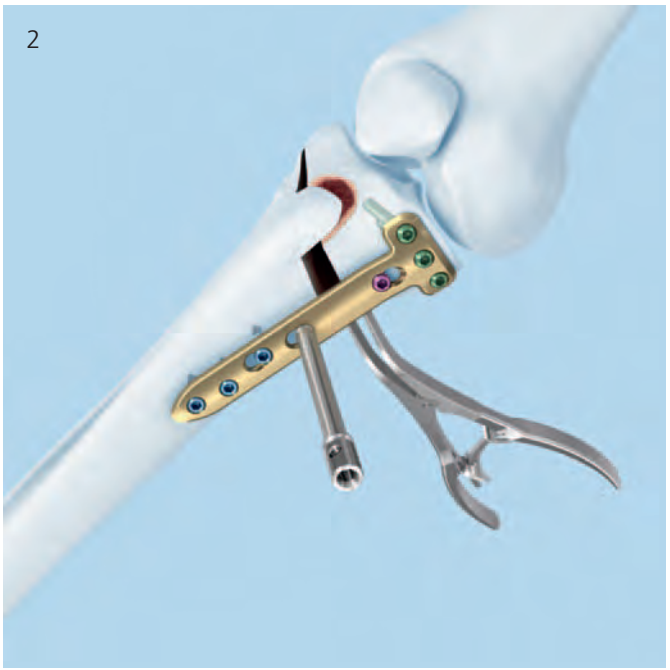
**Important:** The following screw is placed bicortically.

Screw the LCP drill sleeve into plate hole 1 and drill a bicortical hole with the LCP drill bit ∅ 4.3 mm.(2)

1



2

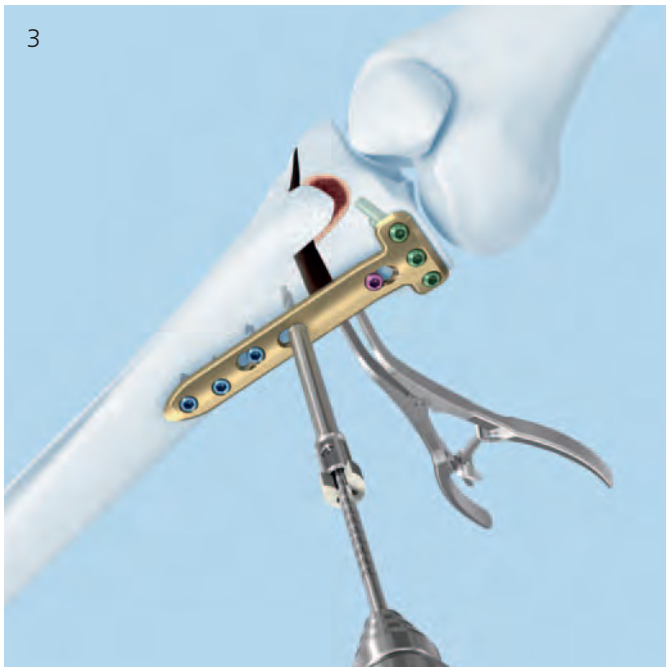


Read the length of the required screw on the drill scale.(3)

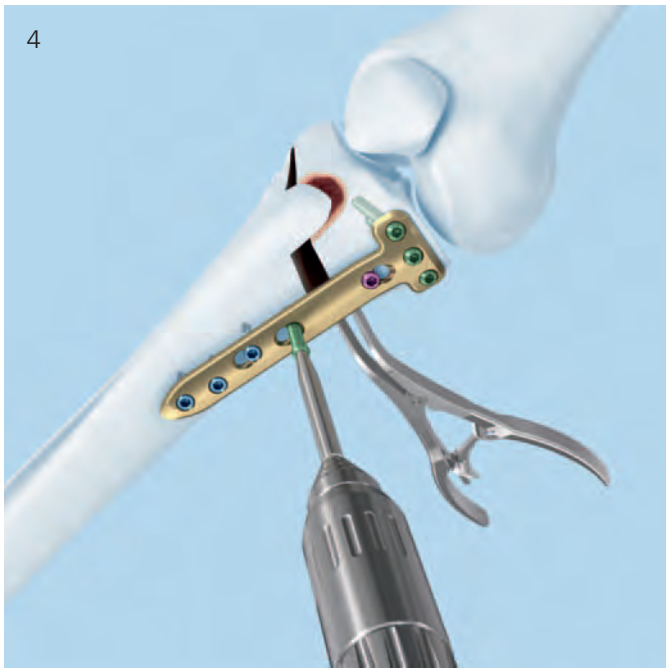
Alternatively, remove the drill guide and measure the length with the depth gauge.

Remove the drill sleeve from the plate and insert a self-tapping bicortical locking screw. Insert the screw using a power tool, but do not fully tighten it.(4)

3



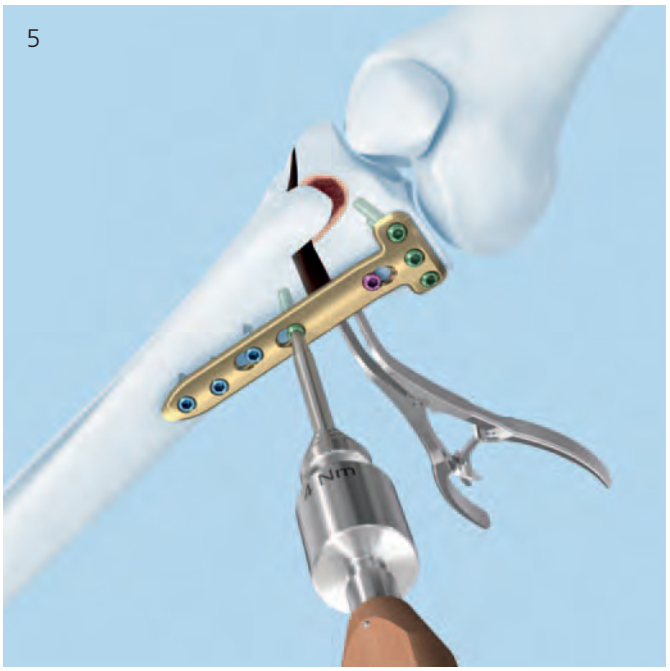
4

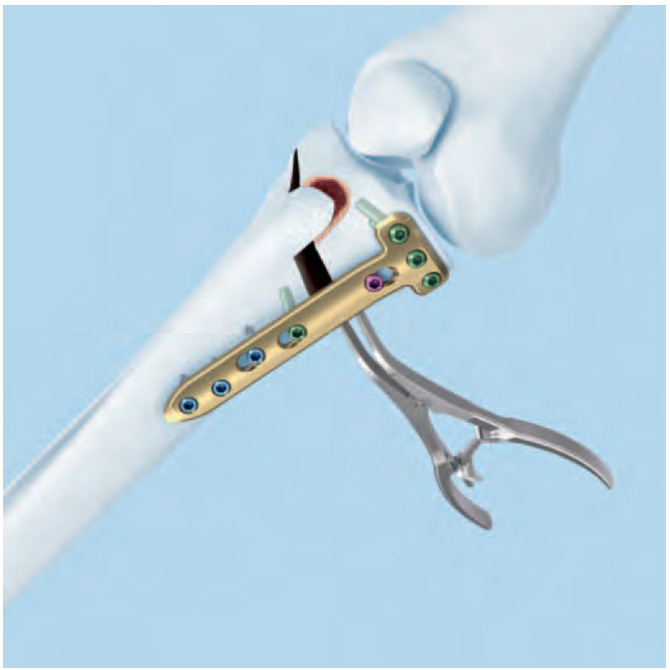


Finally, lock the screw manually with a screwdriver using the torque limiter (5). Optimum torque is reached after one click.

**Note:** To ensure sufficient tightening of locking head screws and to reduce the risk of cold welding of the screw head to the plate, locking head screws should always be tightened by hand using a torque limiter.

5





## 7

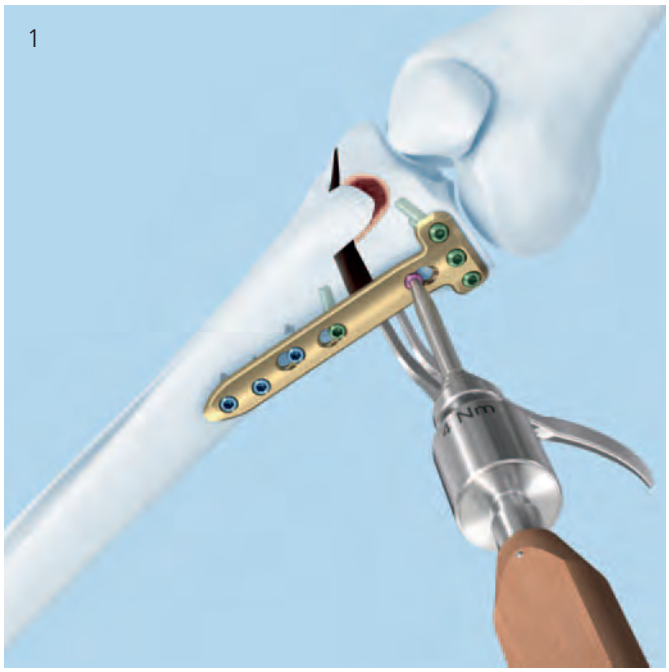
**Replace the proximal LCP spacer with a locking head screw**

| Instruments | |
|---|---|
| 310.430 | LCP Drill Bit ∅ 4.3 mm with Stop, length 221 mm, 2-flute, for Quick Coupling |
| 323.042 | LCP Drill Sleeve 5.0, for Drill Bits ∅ 4.3 mm |
| 397.705 | Handle for Torque Limiter Nos. 511.770 and 511.771 |
| 511.771 | Torque Limiter, 4 Nm, for Compact Air Drive and Power Drive |
| 314.150 | Screwdriver Shaft, hexagonal, large, ∅ 3.5 mm |

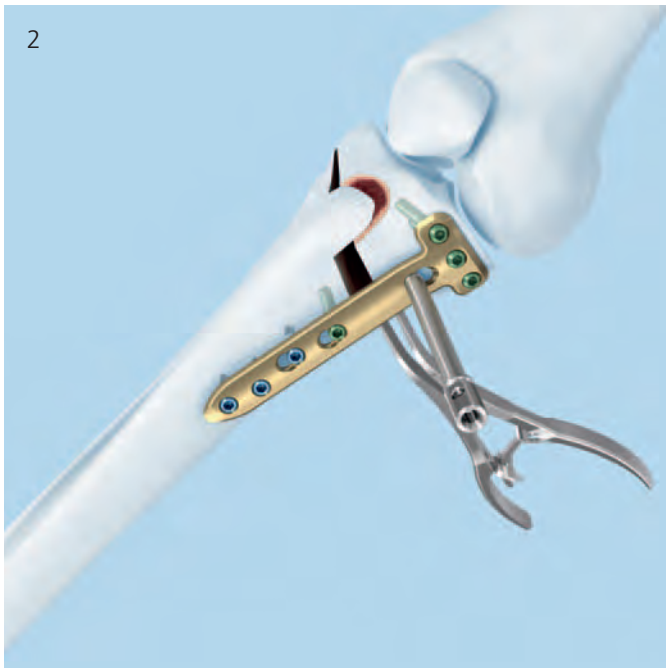
Remove LCP spacer ∅ 5.0 mm.(1)

Screw the LCP drill sleeve into plate hole D.(2)

1



2



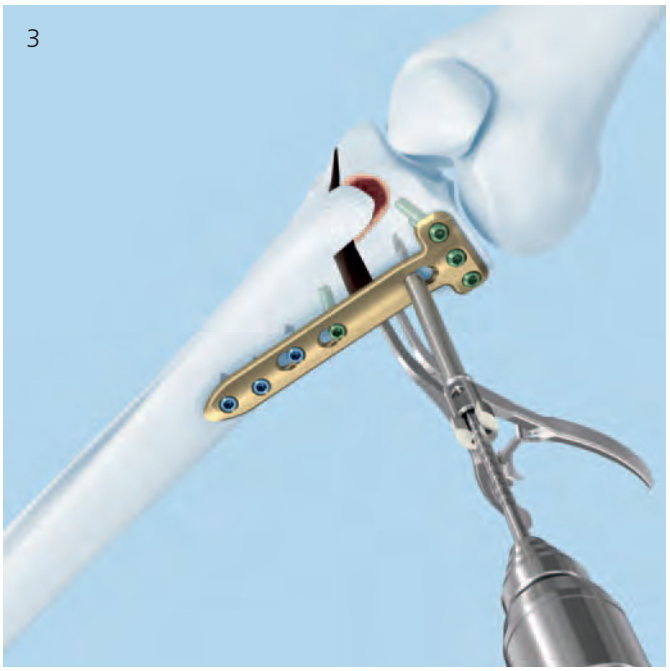
Drill a screw hole with the LCP drill bit ∅ 4.3 mm (3). Determine the screw length either by reading the drilled depth from the laser mark on the drill bit or with the depth gauge after removing the drill sleeve.

The chosen screws should be as long as possible without them protruding from the lateral cortical bone.

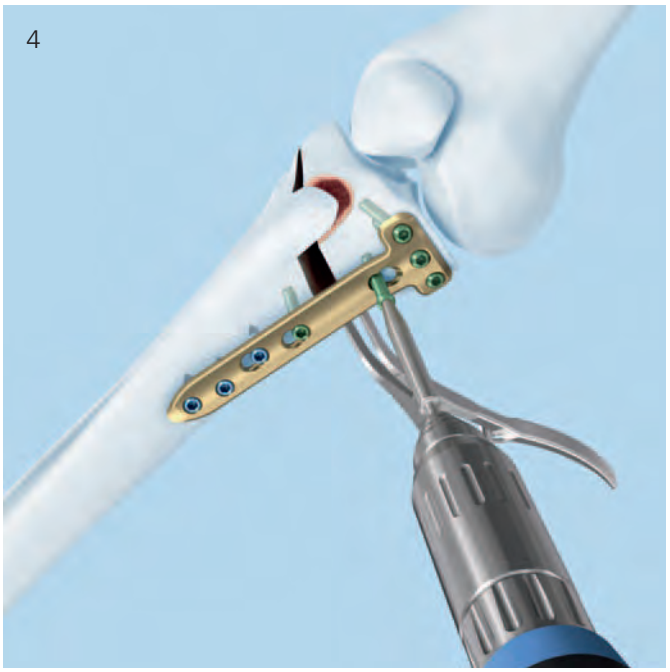
Remove the drill sleeve from the plate; insert a self-tapping locking screw.(4)

Insert the screw using a power tool, but do not fully tighten it.

3



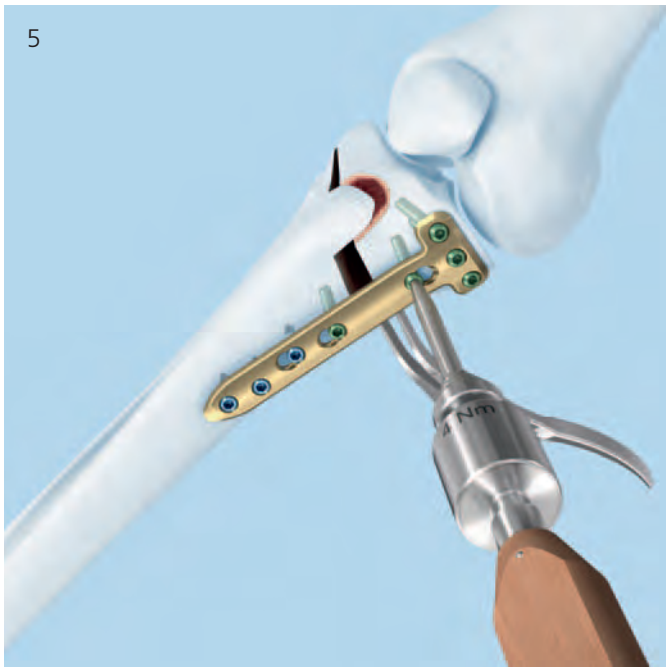
4



Finally, lock the screw manually with a screwdriver using the torque limiter (5). Optimum torque is reached after one click.

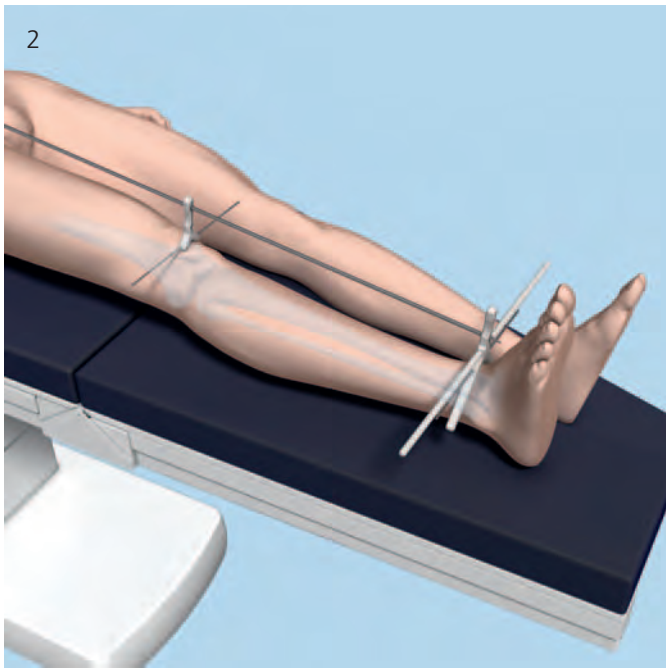
**Note:** To ensure sufficient tightening of locking head screws and to reduce the risk of cold welding of the screw head to the plate, locking head screws should always be tightened by hand using a torque limiter.

5




## 8
### Radiological control

Check the result of the correction and the position of the implant using the image intensifier in two planes.

## 9
### Wound closure

Fill the osteotomy site with blood clots. These clots must not be aspirated nor should the osteotomy be flushed empty. Close the subcutaneous layer with interrupted, thin resorbable sutures. Then close the skin with staples or interrupted sutures. Apply a padded elastic compression drape over the entire leg and place a cryo-compression unit over the knee.

**Note:** Close the wound following general surgical guidelines. The technique described above is one possible approach and may differ from other standards.

# Postoperative Treatment and Implant Removal

**Postoperative treatment**
Consider an early functional postoperative treatment with partial load bearing. Perform active and passive physiotherapy, manual lymph drainage, and electrical muscle stimulation if necessary. Preventive measures should be taken against thrombosis until full weight bearing is possible. Take follow-up x-rays in two planes.

**Note:** Define the postoperative treatment following general protocols. The technique described above is one possible approach and may differ from other standards.

**Implant removal**
The TomoFix Medial High Tibial Plate does not generally need to be removed. If desired, it should not be removed earlier than complete healing of the gap. To remove the plate, initially loosen all screws manually and then remove them using power tools.

# Plates

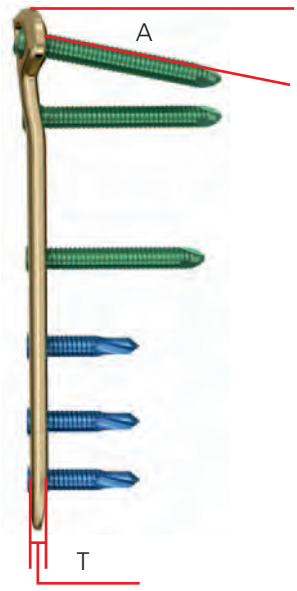
The TomoFix Medial High Tibial Plate is designed according to the principles of the Locking Compression Plate (LCP). In the proximal section there are 4 threaded holes, the directions of which are adapted to the anatomy of small adults. There are 2 combination and 2 locking holes in the distal section for secure anchoring of the screws in the tibial shaft. For a better positioning the plate is available in two sizes: standard and small. The plates are made of pure titanium.

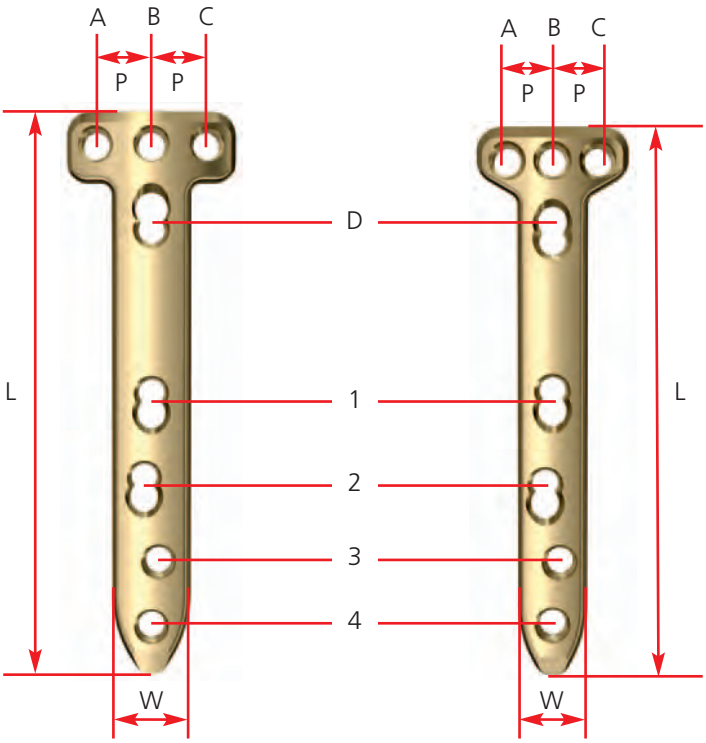
Choose either the standard or the small-sized plate based on the patient's anatomy, body weight, post-operative weight-bearing schedule, and compliance. Also take the size of the osteotomy as well as the final stability of the construct into consideration.

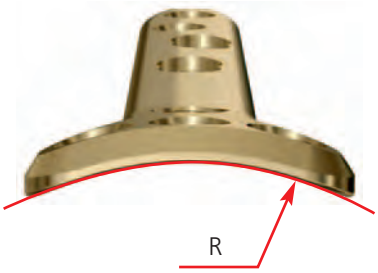
**Important:** Due to the adaption of the plate geometry to patients of small stature, the small version of the TomoFix Medial High Tibial Plate does not reach the same degree of stability as the standard plate.

| | |
|---|---|
| 440.831S | TomoFix Tibial Head Plate, small, medial, proximal, shaft 4 holes, head 4 holes, length 112 mm, Pure Titanium, sterile |
| 440.834S | TomoFix Tibial Head Plate, medial, proximal, 4 holes, Pure Titanium, sterile |

| Plate Dimensions | 440.834S TomoFix (Standard) | 440.831S TomoFix (Small) |
|---|---|---|
| Length (L) | 115 mm | 112 mm (3 mm shorter distance between hole D and hole 1) |
| Width (W) | 16 mm | 14 mm |
| Thickness (T) | 3 mm | 3.2 mm |
| Distance proximal holes A, B, C (P) | 11 mm | 9 mm |
| Radius proximal part (R) | 38 mm | 30 mm |
| Sagittal angle proximal holes A, B, C (A) | 10° caudally | 11° caudally |



# Screws

| | | |
|---|---|---|
| 413.309 | LCP Spacer ∅ 5.0 mm, length 2 mm, Titanium Alloy (TAN) |  |
| 413.324 – 413.385 | Locking Screws ∅ 5.0 mm, self-tapping, length 24 mm up to 85 mm, Titanium Alloy (TAN) |  |
| 414.824 – 414.852 | Cortex Screws ∅ 4.5 mm, self-tapping, length 24 mm up to 52 mm, Pure Titanium |  |
| 413.426 | Locking Screw ∅ 5.0 mm, self-drilling, length 26 mm, Titanium Alloy (TAN) |  |

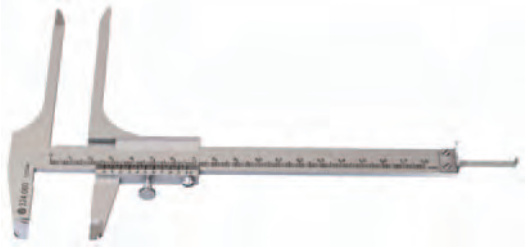
# Instruments

| | | |
|---|---|---|
| 292.210 | Kirschner Wire ∅ 2.0 mm with trocar tip, length 280 mm, Stainless Steel |  |
| 292.260 | Kirschner Wire ∅ 2.5 mm with trocar tip, length 280 mm, Stainless Steel |  |
| 310.430 | LCP Drill Bit ∅ 4.3 mm with Stop, length 221 mm, 2-flute, for Quick Coupling |  |
| 338.002 | Guide Wire ∅ 2.5 mm with drill tip, length 300 mm, Cobalt-Chrome Alloy |  |
| 310.290 | Drill Bit ∅ 3.2 mm, length 195/170 mm, 2-flute, for Quick Coupling |  |
| 314.150 | Screwdriver Shaft, hexagonal, large, ∅ 3.5 mm |  |
| 319.100 | Depth Gauge for Screws ∅ 4.5 to 6.5 mm, measuring range up to 110 mm |  |
| 323.042 | LCP Drill Sleeve 5.0, for Drill Bits ∅ 4.3 mm |   |
| 323.044 | Centering Sleeve for Kirschner Wire ∅ 2.0 mm, length 110 mm, for No. 323.042 |  |
| 323.500 | LCP Universal Drill Guide 4.5/5.0 |  |
| 397.705 | Handle for Torque Limiter Nos. 511.770 and 511.771 |  |

| | | |
|---|---|---|
| 511.771 | Torque Limiter, 4 Nm, for Compact Air Drive and Power Drive |   |
| 312.924 | Guiding Block for TomoFix Tibial Head Plate, small, medial, proximal |  |
| 312.926 | TomoFix Guiding Block for TomoFix Tibial Head Plate, medial, proximal |  |
| 519.105 | Saw Blade 70/49 × 20 × 0.6/0.4 mm, for Oscillating Saw with AO/ASIF Coupling |   |
| 519.108 | Saw Blade 116/95 × 25 × 0.9/0.8 mm, for Oscillating Saw with AO/ASIF Coupling |  |
| 395.000 | TomoFix Bone Spreader |   |
| 395.001 | TomoFix Osteotomy Gap Measuring Device, Stainless Steel |  |
| 397.992 | TomoFix Osteotomy Chisel, width 10 mm |  |

| | | |
|---|---|---|
| 397.993 | TomoFix Osteotomy Chisel, width 15 mm |  |
| 397.994 | TomoFix Osteotomy Chisel, width 20 mm |  |
| 397.995 | TomoFix Osteotomy Chisel, width 25 mm |  |
| 399.097 | Bone Spreader, soft lock, width 8 mm, length 220 mm |  |
| 03.108.030 | Alignment Rod |  |
| 03.108.031 | Stand, large, for Alignment Rod, with handles |  |
| 03.108.032 | Stand, small, for Alignment Rod |  |

# Optional Instrument

| | | |
|---|---|---|
| 324.060 | Calliper for Corpectomy, short, Stainless Steel |  |

# Cases

| | |
|---|---|
| 68.120.474 | Modular Tray for LCP Instruments 4.5/5.0, size 1/2, without Contents, Vario Case System |
| 684.060 | Lid for Modular Tray, size 1/2 |
| 68.120.070 | Modular Tray for TomoFix Instrument Set, size 1/1, without Contents, Vario Case System |
| 68.120.071 | Module for Screws, for TomoFix, for Frame, size 1/4 |
| 68.000.131 | Auxiliary Module, size 1/2, height 28 mm, for Screw Rack, size 1/2 |
| 68.000.111<br>or<br>68.000.113 | Screw Rack, size 1/2, height 77 mm<br><br>Screw Rack, size 1/2, with Drawer, length 100 mm, for Vario Case, height 88 mm |
| 68.000.121 | Lid, flat, size 1/2 |

# Optional Cases

| | |
|---|---|
| 68.108.015 | Insert for Osteotomy Guiding Device, for Vario Case |
| 68.000.101 | Lid for Modular Tray, size 1/1 |

# Also Available from Synthes: chronOS Wedges

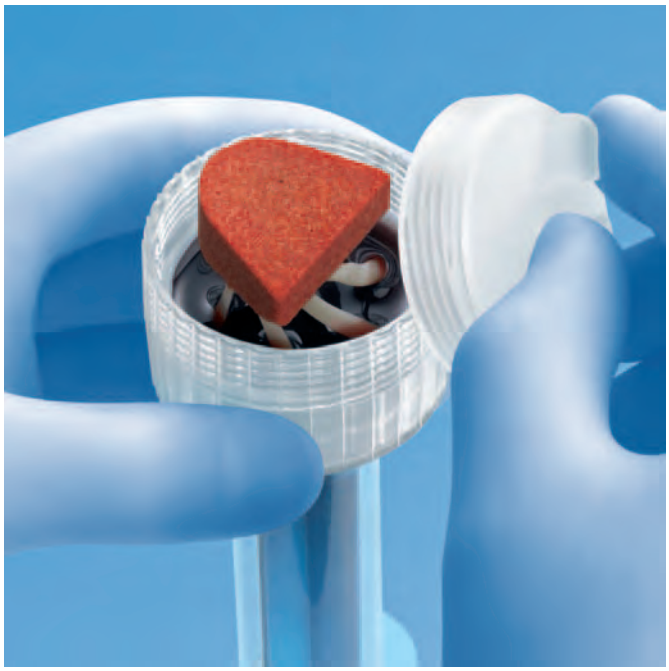
**Intended use***

Synthes offers a comprehensive solution for filling the gap created by an osteotomy. The material's excellent osteoconductive properties, combined with bone marrow aspirate, are optimal conditions for faster bone healing.

| Features | Benefits |
|---|---|
| chronOS is of synthetic origin | – Avoids problems with traditional grafting methods<br>– Consistent quality<br>– Sufficient quantity |
| chronOS is osteoconductive and resorbable | Fast remodeling (6–18 months) |
| chronOS can be trimmed to fit | Easy and safe to use |
| chronOS and bone marrow aspirate | Optimal conditions for faster bone healing |

* For indications, contraindications and instructions please consult the following technique guides: chronOS (036.000.305); Perfusion Concept (036.000.745); BMAS (036.001.020).
**Case report:** chronOS in high tibial osteotomy (036.000.308)

**Perfusion System and Bone Marrow Aspiration System**
Perfusion of the porous material with bone marrow introduces blood cells, growth factors and osteoprogenitor cells into the bone graft substitute. This accelerates and enhances osseointegration and is a valuable alternative to autologous or allogenic bone graft material (Stoll et al., 2004 and Becker et al., 2006).



**Perfusion System:**
- Provides osteogenic potential of autologous bone marrow.
- Efficient, intraoperative impregnation of chronOS products with the patient's own bone marrow or blood.

**Bone Marrow Aspiration System (BMAS):**
- Easy to use and minimally invasive.
- Compatible with the chronOS Perfusion System.
- Direct transfer of the bone marrow into the perfusion devices containing the chronOS implants.

**Note:** The use of chronOS is restricted to applications with load sharing.

**chronOS Wedge, semicircular**

| Art. no. | Angle | Dimensions |
|---|---|---|
| 710.057S | 7° | 25×35 mm |
| 710.060S | 10° | 25×35 mm |
| 710.063S | 13° | 25×35 mm |

**chronOS Wedge, semicircular, with Perfusion System**

| Art. no. | Angle | Dimensions |
|---|---|---|
| 07.710.057S | 7° | 25×35 mm |
| 07.710.060S | 10° | 25×35 mm |
| 07.710.063S | 13° | 25×35 mm |

# Bibliography


Agneskirchner JD, D Freiling, C Hurschler, P Lobenhoffer. "Primary stability of four different implants for opening wedge high tibial osteotomy." Knee Surg Sports Traumatol Arthrosc; 14 (2006): 291–300.

Agneskirchner JD, C Hurschler, CD Wrann, P Lobenhoffer. "The effects of valgus medial opening wedge high tibial osteotomy on articular cartilage pressure of the knee: a biomechanical study." Arthroscopy 23 (8) (2007): 52–61.

Becker et al. "Osteopromotion by a _-TCP/Bone Marrow Hybrid Implant for Use in Spine Surgery." Spine, Volume 31 (1) (2006): 11–17.

Brinkman JM, P Lobenhoffer, JD Agneskirchner, AE Staubli, AB Wymenga, RJ van Heerwaarden. "Osteotomies around the knee: patient selection, stability of fixation and bone healing in high tibial osteotomies." J Bone Joint Surg Br 90 (12) (2008):1548–57.

Insall JN, WN Scott. Surgery of the Knee. 3rd Edition. Philadelphia: Churchill Livingstone. 2001.

Jacobi M, RP Jakob. "Open wedge osteotomy in the treatment of medial osteoarthritis in the knee." Tech Knee Surg 4 (2) (2005): 70–78.

Lobenhoffer P, JD Agneskirchner. "Improvements in surgical technique of valgus high tibial osteotomy."
Knee Surg Sports Traumatol Arthrosc 11 (2003): 132–138.

Lobenhoffer P, C De Simoni, AE Staubli. "Open-wedge high-tibial osteotomy with rigid plate fixation." Techniques in Knee Surgery 1 (2) (2002): 93–105.

Lobenhoffer P, RJ van Heerwaarden, AE Staubli, RP Jakob. Osteotomies around the knee. New York: Thieme. 2008.

Miniaci A, FT Ballmer, PM Ballmer, RP Jakob. "Proximal tibial osteotomy: a new fixation device." Clin Orthop Relat Res (246) (1989): 250–9.

Müller W. "High Tibial Osteotomy, European Instructional Course Lectures." The British Editorial Society of Bone and Joint Surgery 5 (2001):194–200.

Paley D. Principles of Deformity Correction. Berlin, Heidelberg: Springer. 2002.

Ruedi T, R Buckley, C Moran. AO/ASIF Principles of Fracture Management. New York: Thieme. 2007.

Staubli AE, C De Simoni, R Bapst, P Lobenhoffer. "TomoFix: a new LCP-concept for open wedge osteotomy of the medial proximal tibia – early results in 92 cases". Injury 3 Suppl. 2S (2003): B55-S-B62.

Stoffel K, G Stachowiak, M Kuster. "Open wedge high tibial osteotomy: biomechanical investigation of the modified Arthrex Osteotomy Plate (Puddu Plate) and the TomoFix Plate." Clinical Biomechanics 19 (2003): 944–950.

Stoll et al. "New Aspects in Osteoinduction. Mat.-wiss. u. Werkstofftech." 35 (4) (2004): 198–202.

Van Heerwarden RJ, I Van Der Haven, MAP Kooijman, AB Wymenga. "Derotation osteotomy for correction of congenital rotational lower limb deformities in adolescents and adults." Surgical Techniques in Orthopaedics and Traumatology. 55-575-A-10 (2003): 1–10.

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