8th Advanced Course on Knee Surgery

Osteotomies around the knee

Choice of fixation

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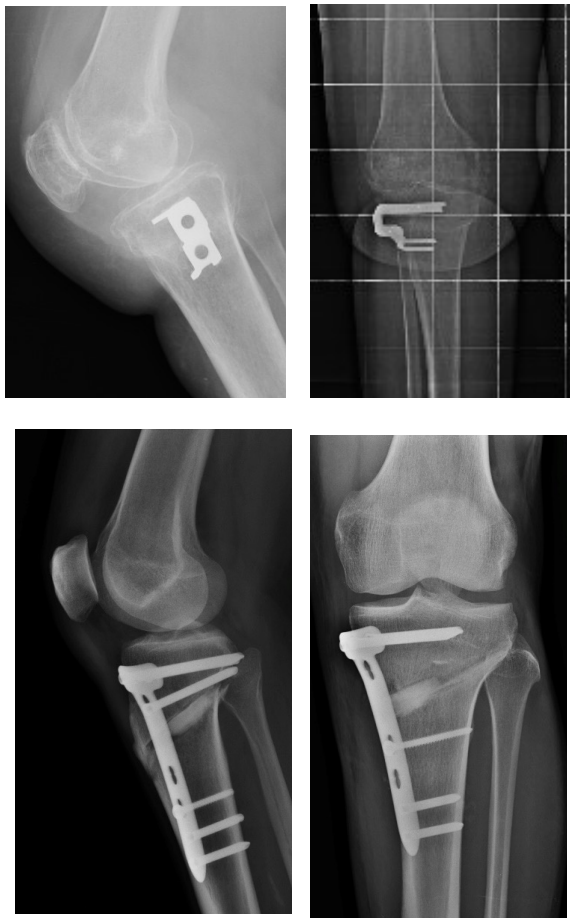
Type of fixation

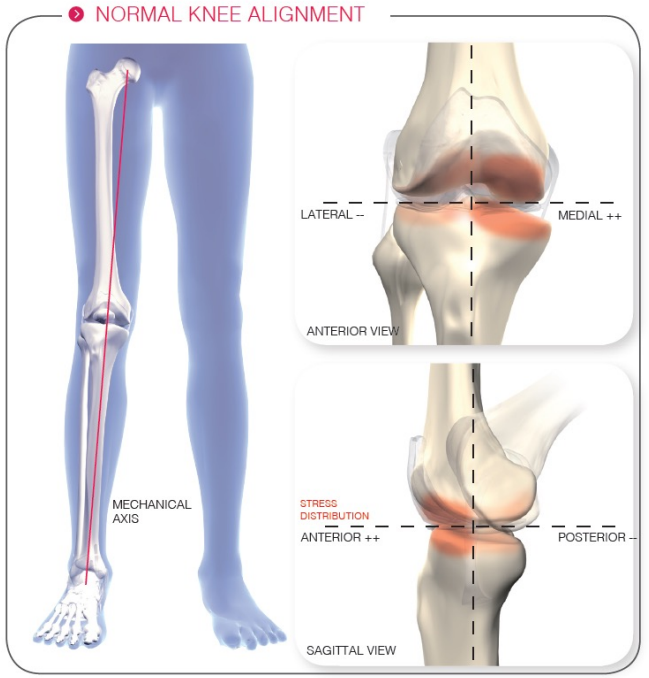
Surgical options

- **External fixators**
  - ✓ Axial
  - ✓ Circular
- **Staples**
- **Plates and screws**
  - ✓ Conventional
  - ✓ Locking screws
  - ✓ Long or short plate
  - ✓ With or without spacer



Osteotomies around the knee

Surgical options



Most common:

- **Closing wedge**
- **Opening wedge**

Other options

- Dome osteotomy: large correction, inverse U-shaped cut
- Chevron osteotomy: inverse V, invasive and challenging
- Progressive callus distraction: axial or ring EF, large correction

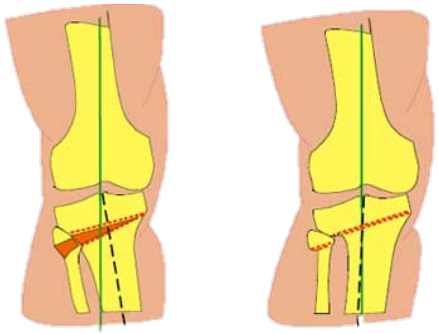
CLOSING WEDGE OSTEOTOMY

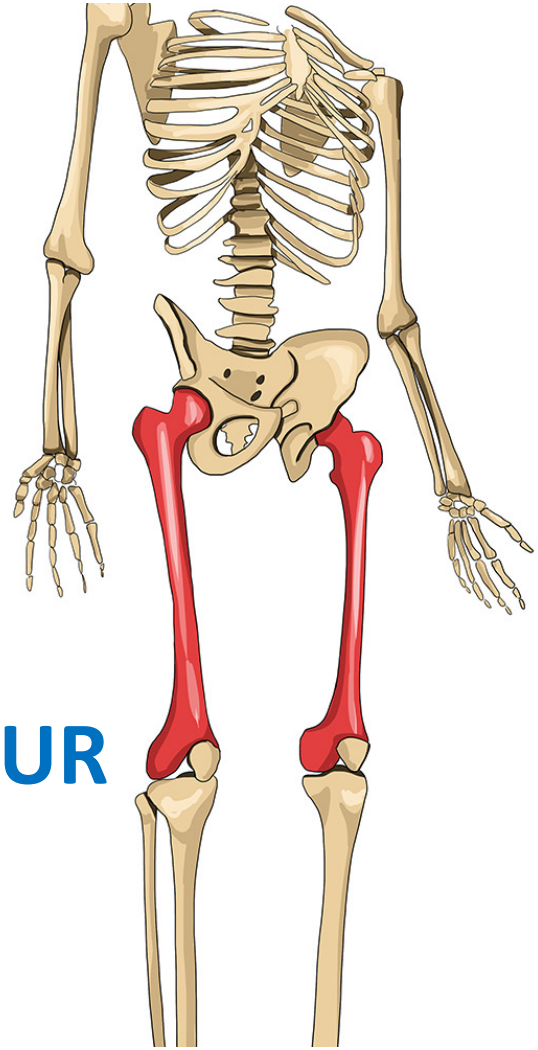
CLOSING WEDGE OSTEOTOMY

TIBIA

- More stable
- Early weight bearing
- Low risk of nonunion
- more accurate correction
- more challenging conversion to TKA

- Staples
- Plate and screws:
  - ✓ Four-hole medial plate (with two proximal cancellous and two distal cortical screws)
  - ✓ Blade-plate
  - ✓ LCP





FEMUR

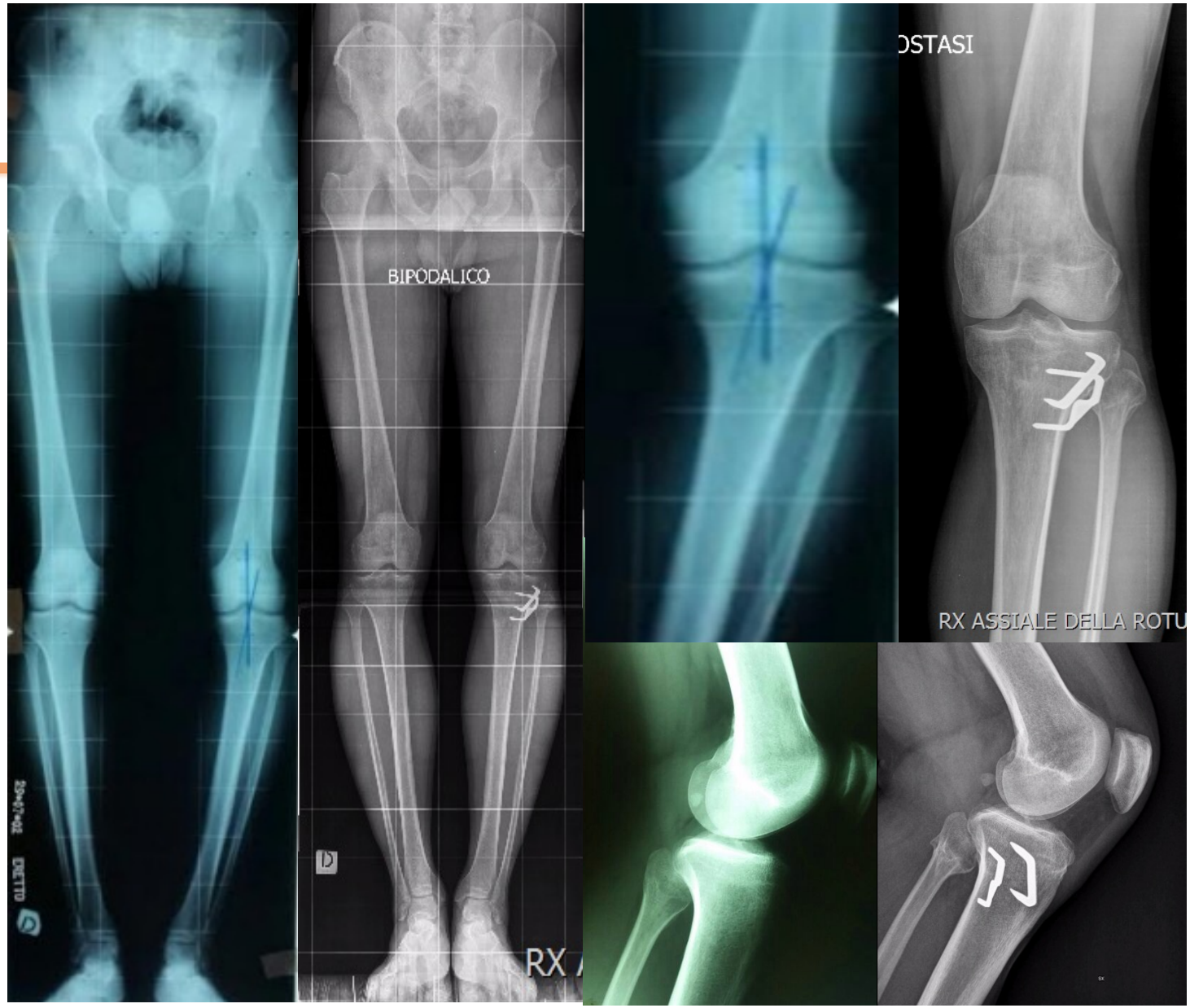
TIBIAL
CLOSING WEDGE
WITH DOUBLE STAPLE

Advantages

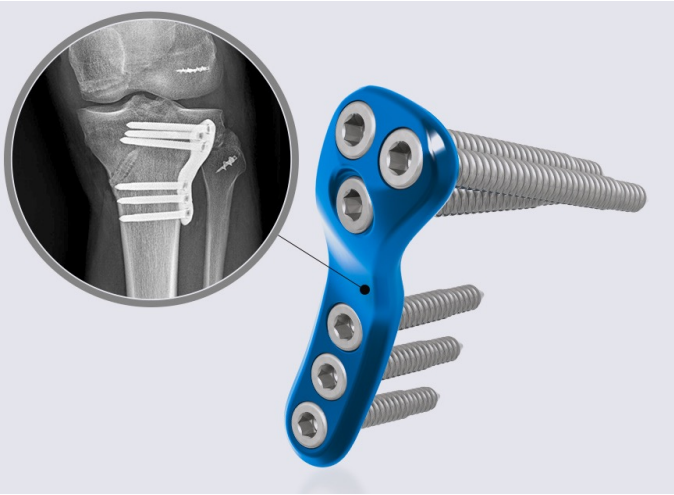
- Simpler and quicker than plate fixation
- Larger contact area after osteotomy closure

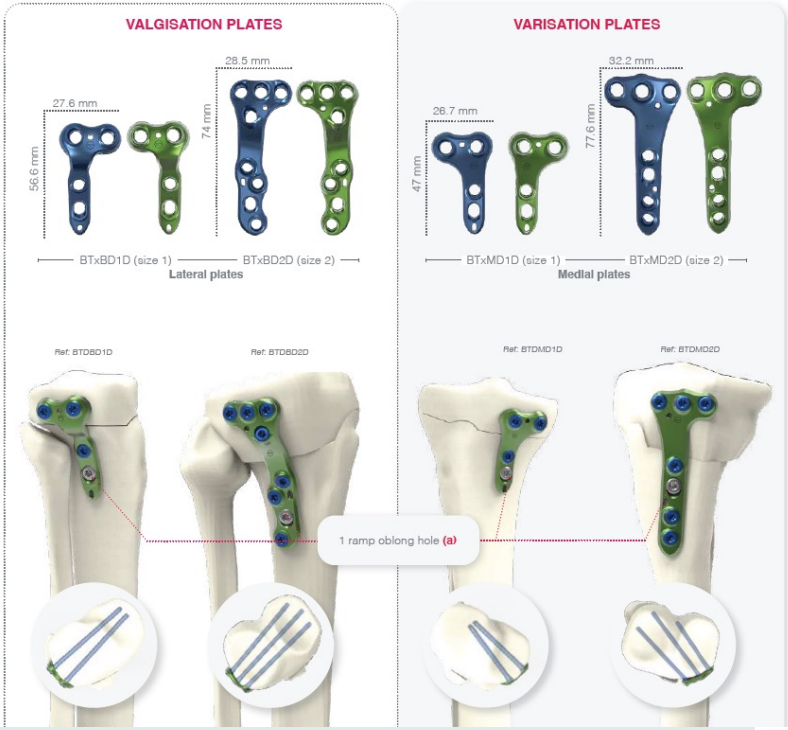
Disadvantages

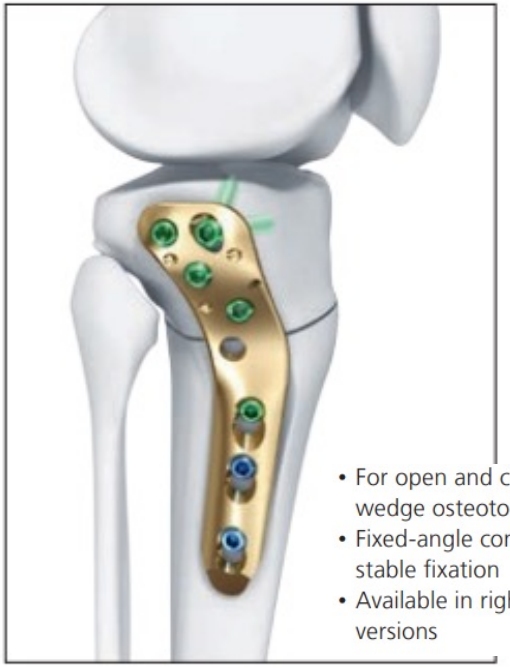
- Poor holding power of staples
- Loss of correction
- Complications of lateral approach
- Large offset created in lateral proximal tibia
- Removal can be difficult



TIBIAL CLOSING WEDGE WITH LCP PLATES







- For open and closed wedge osteotomies
- Fixed-angle construct for stable fixation
- Available in right and left versions

TECHNICAL FEATURES

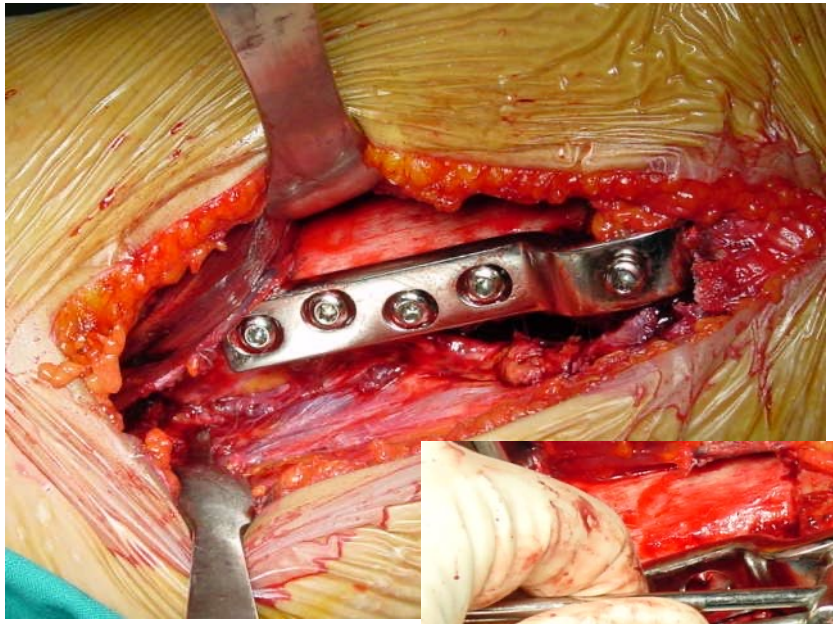
- **Lateral and medial closing plates**
- **Precontourned implants:** the maximum congruence between the plate and the bone.
- **Compression oblong ramp hole** to optimize the osteotomy compression.
- Compatible with **mini invasive approach**.
- **Titanium alloy TA6V** implants: optimized mechanical resistance.

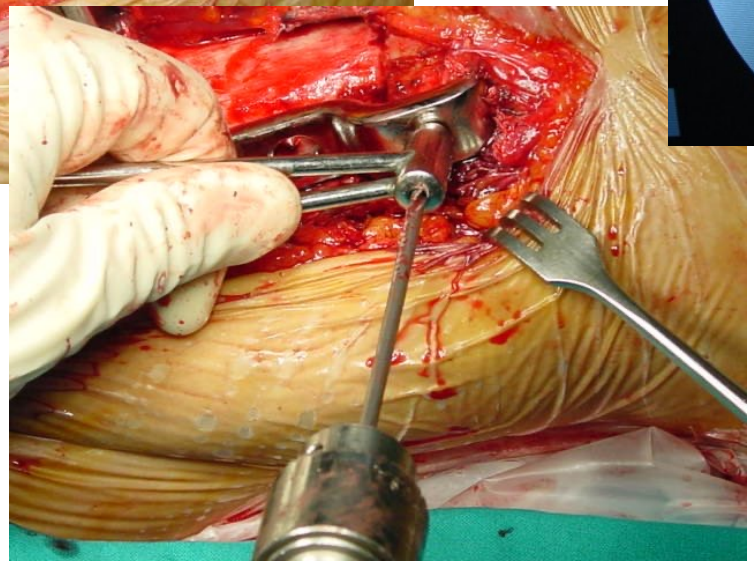
TomoFix Tibial Head Plate lateral, proximal

The TOMOFIX Lateral Proximal Tibia Plates are indicated for open- and closed-wedge osteotomies, fixation of fractures, and malalignment caused by injury or disease, such as osteoarthritis, of the lateral proximal tibia

FIXED ANGLE DEVICES

FEMORAL MEDIAL CLOSED WEDGE





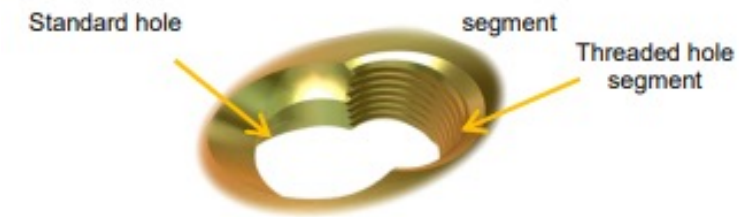
Blade-plate with a derotational screw

95˚ angled blade plate

LCP
FEMORAL MEDIAL CLOSED WEDGE

TomoFix Femoral Plate medial, distal

The TOMOFIX Medial Distal Femur Plates are indicated for closed-wedge osteotomies, fixation of fractures, and malalignment caused by injury or disease, such as osteoarthritis, of the medial distal femur



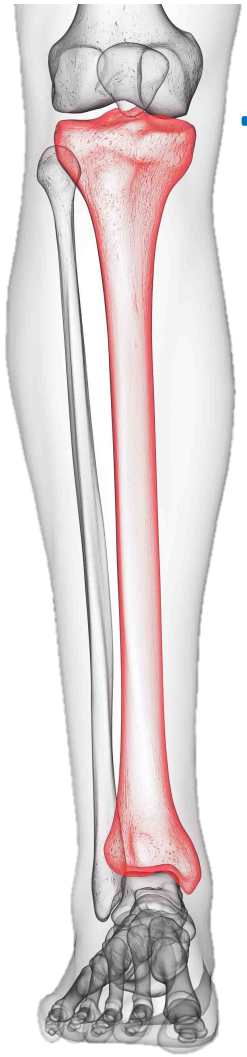
- More stable fixation
- Rapid weight bearing and recovery

NewClip ActivMotion

MEDIAL CLOSING WEDGE DISTAL FEMORAL OSTEOTOMY PLATE

OPENING WEDGE OSTEOTOMY

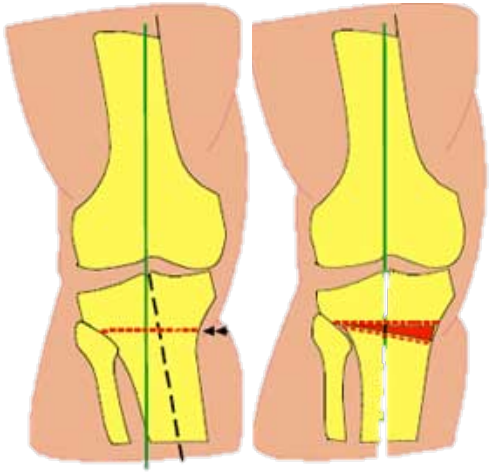
OPENING WEDGE OSTEOTOMY

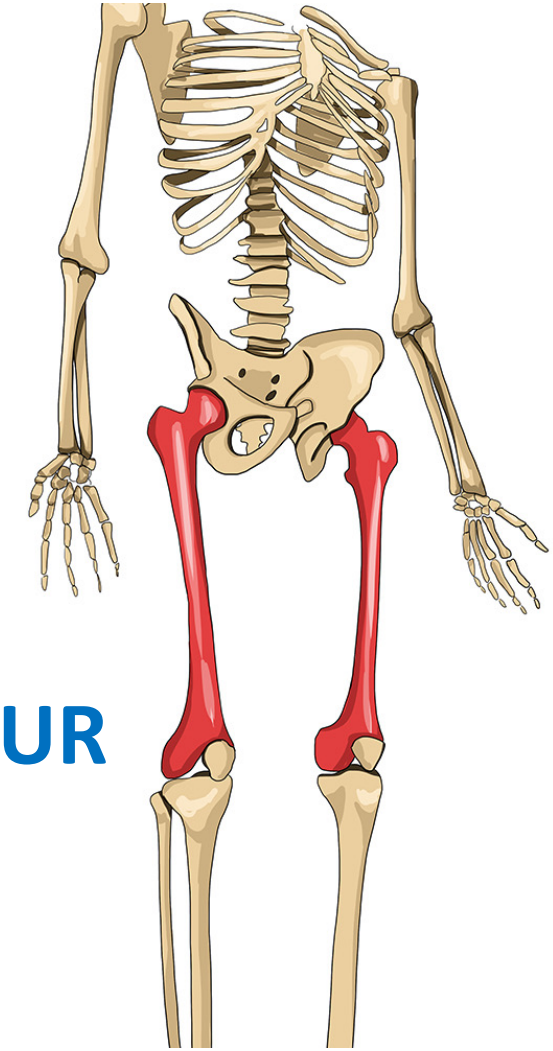


TIBIA

Higher risk of non-union,collapse and need of bone graft

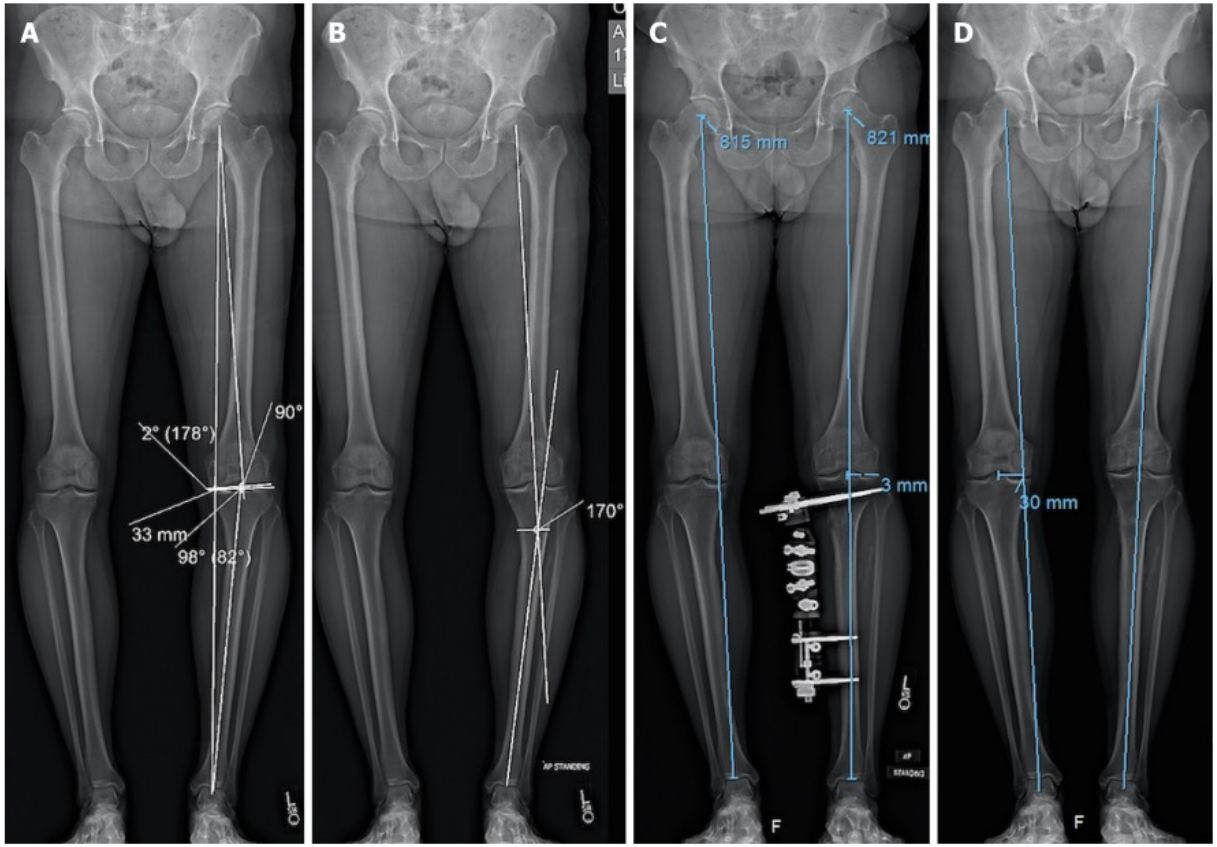
- Ex-Fix
- Plate and screws:
  - ✓ DCP
  - ✓ LCP

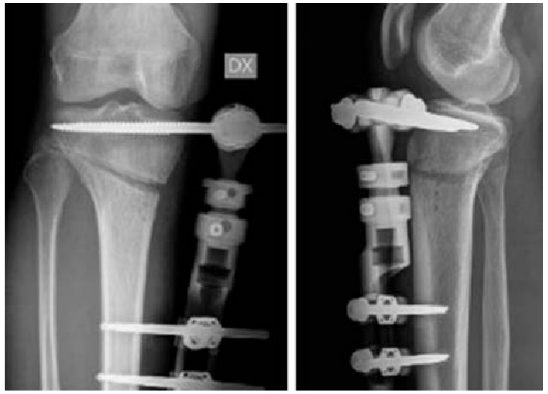


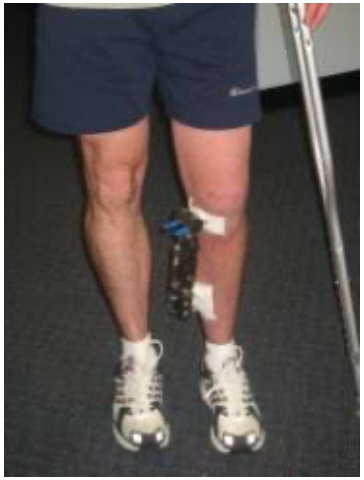


FEMUR

Ex-Fix







High tibial osteotomy with external fixator

Advantages

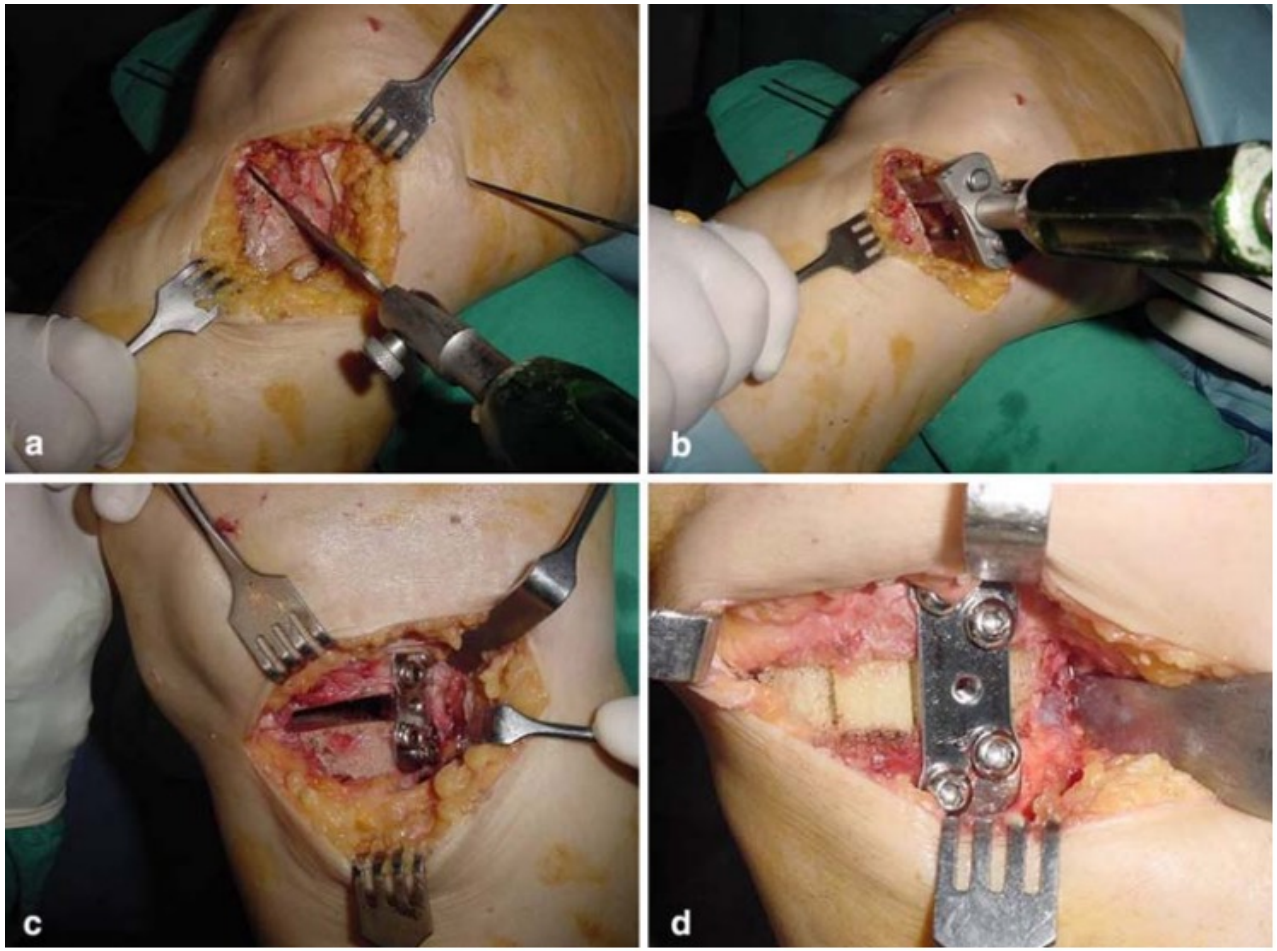
- Gradual correction of large deformities possible
- Angle of correction can be changed
- Easy removal

Disadvantages

- Bulky device
- Inconvenient for patients
- Pin-tracker complications

DCP systems

PUDDU PLATE



Dynamic compression plate (DCP) concept

LCP systems for OPENING WEDGE OSTEOTOMY

- All the plates in the Tomofix Osteotomy System are designed according to LCP System principles
- The fixed-angle locking holes provide multiple fixed-angle constructs throughout the plate, improving retention of screws in the plate and in the cortical bone.
- Plates are anatomically contoured, eliminating the need for intraoperative contouring and minimizing soft tissue irritation
- Long shaft to support and deflect forces in the diaphysis
- Plates have tapered ends allowing submuscular plat insertion
- Locking screws create a fixed-angle construct, providing angular stability
- Spacers reduce plate-to-bone contact. Reduced plate-to-bone contact may minimize disruption of the periosteal blood supply

TomoFix Tibial Head Plate medial, proximal

TomoFix Tibial Head Plate lateral, proximal

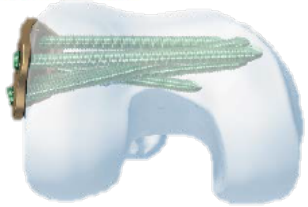
TomoFix Femoral Plate lateral, distal

The TOMO… …Plates are indicated for open- and closed-… …eotomies, fixation of fractures, and malalignment caused by injury or disease, such as osteoarthritis, of the medial proximal tibia

TOMOFIX Medial High Tibia Plate

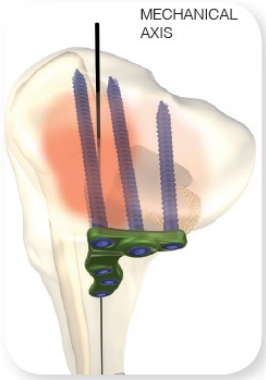
The TOMOFIX Lateral Proximal Tibia Plates are indicated for open- and closed-wedge osteotomies, fixation of fractures, and malalignment caused by injury or disease, such as osteoarthritis, of the lateral proximal tibia

TOMOFIX Lateral High Tibia Plate

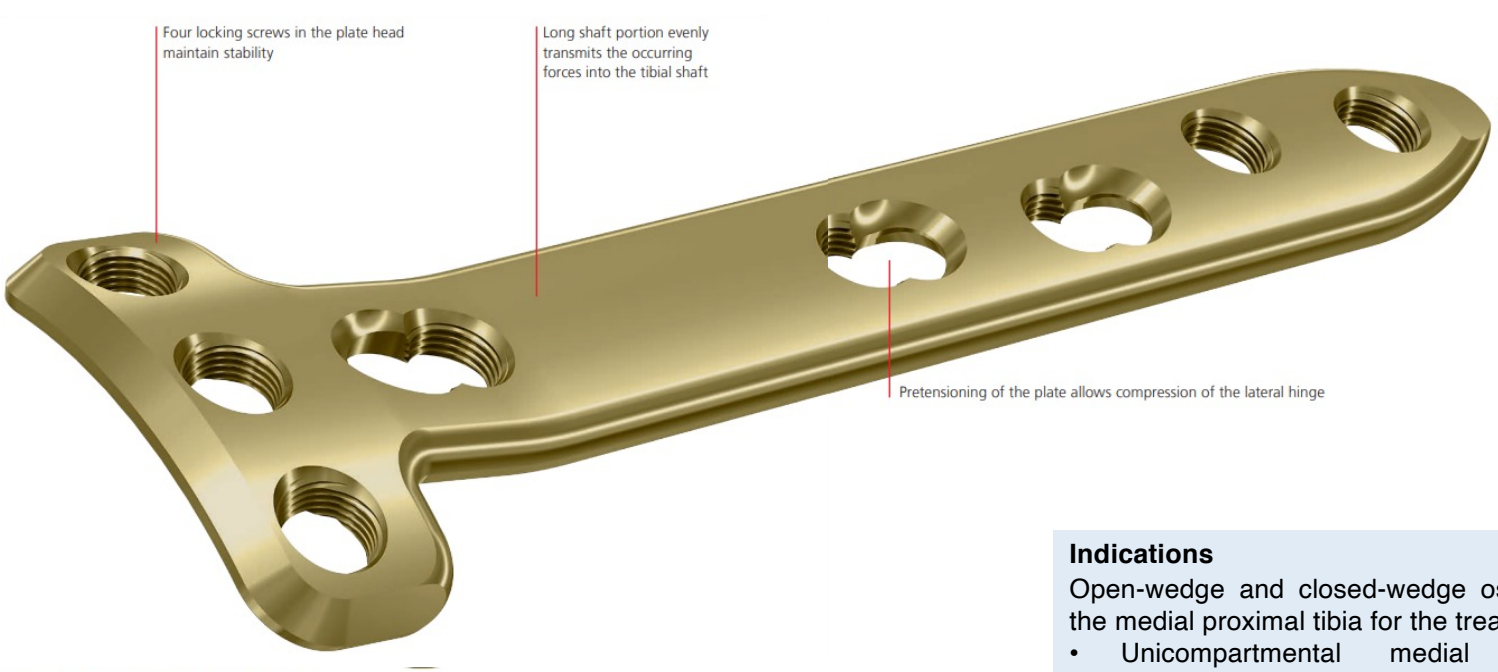


The TOMOFIX Lateral Distal Femur Plates are indicated for open- and closed-wedge osteotomies, fixation of fractures, and malalignment caused by injury or disease, such as osteoarthritis, of the lateral distal femur

TOMOFIX Lateral Distal Femur Plate



Medial High Tibial Plate for HTO



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.

Indications

Open-wedge and closed-wedge osteotomies of the medial proximal tibia for the treatment of:

- Unicompartmental medial or lateral gonarthrosis with malalignment of the proximal tibia
- Idiopathic or post-traumatic varus or valgus deformity of the proximal tibia

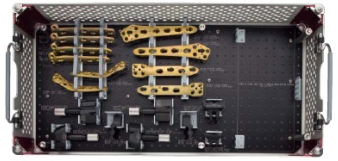
Contraindications

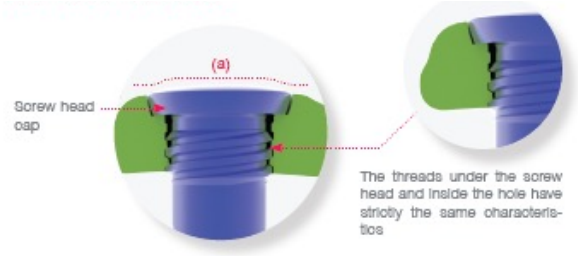
Inflammatory arthritis

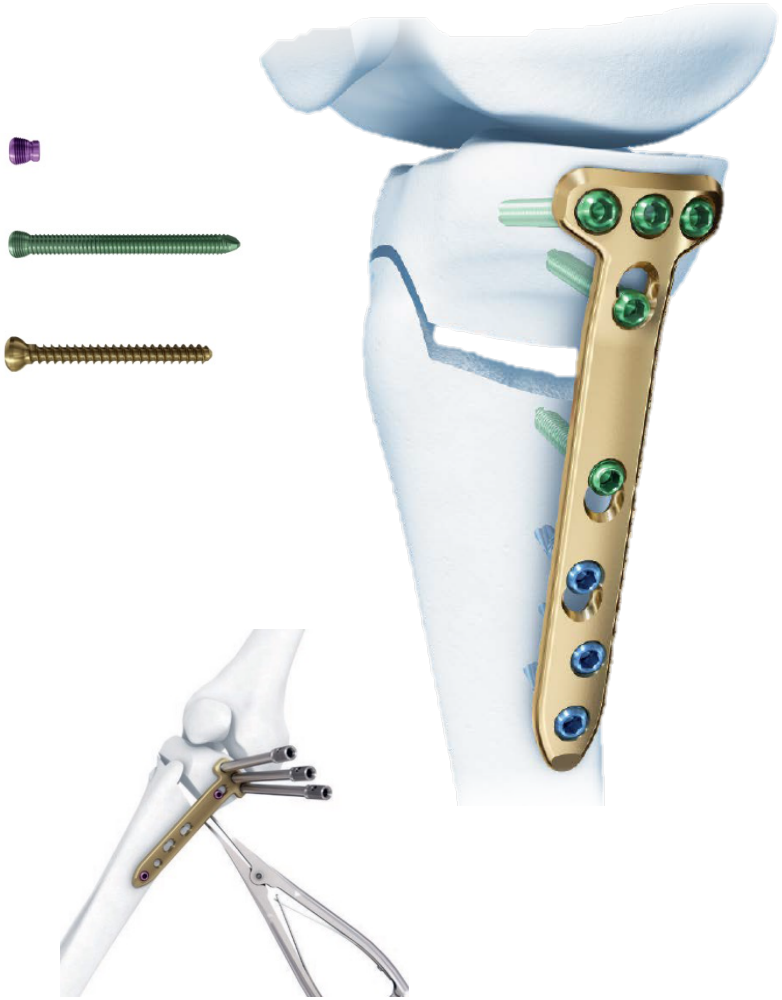
Medial High Tibial Plate for HTO

Postoperative treatment
Early functional postoperative treatment with full weight bearing after open wedge HTO with TomoFix Medial High Tibial Plate may lead to earlier improvement of clinical results (Schröter et al.)
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.

Implant removal
It does not generally need to be removed. If desired, it should not be removed earlier than complete bone healing of the osteotomy gap. To remove the plate, unlock all screws from the plate, then remove the screws completely from the bone. This prevents simultaneous rotation of the plate when unlocking the last locking screw.





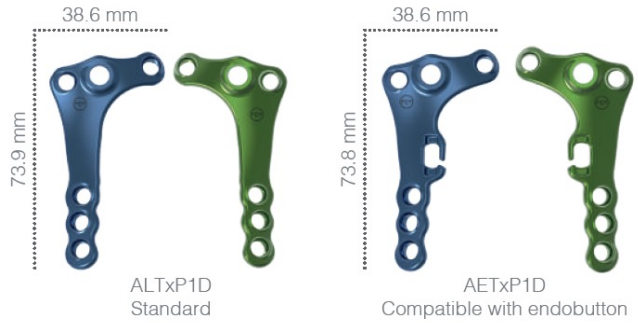


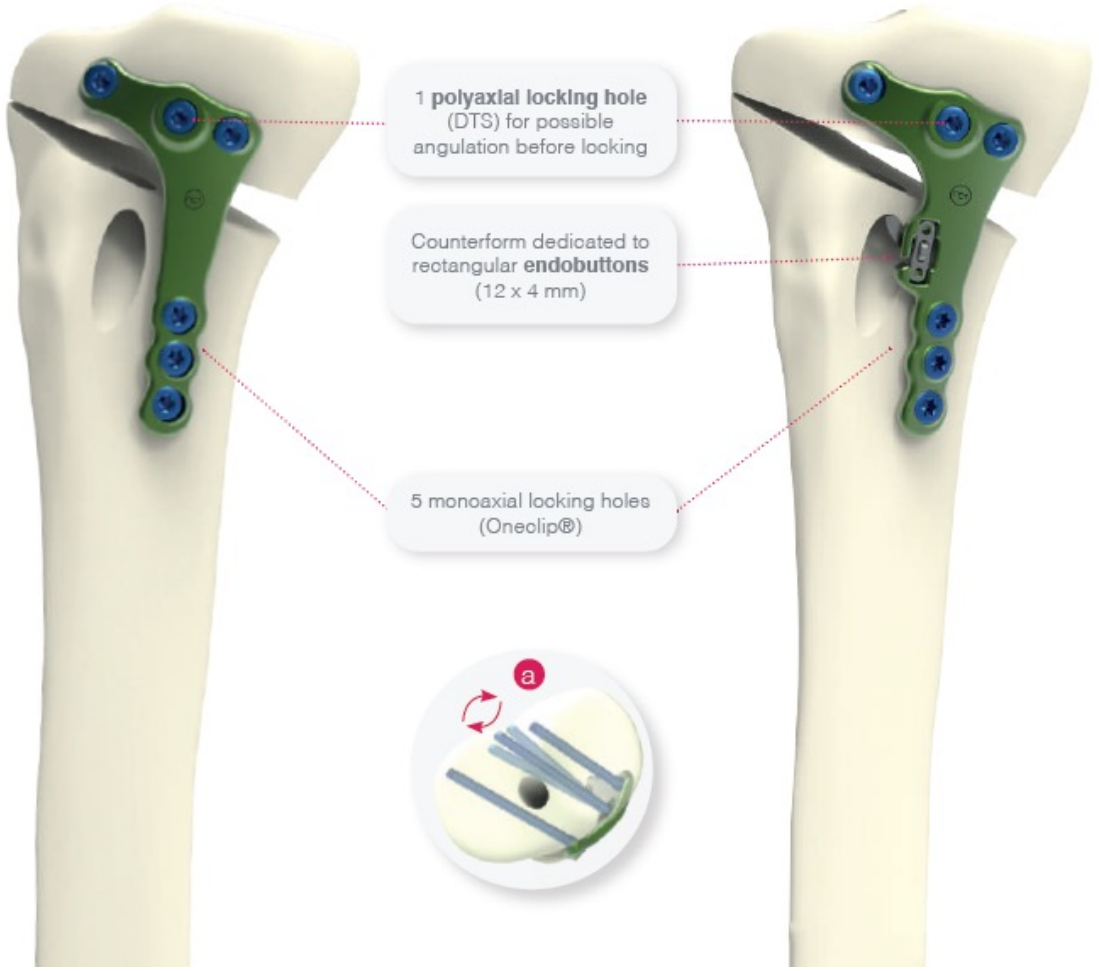
Construct limiting cold welding risks for improved removal properties. Optimized coaptation of both profiles during locking.

OPENING WEDGE HIGH TIBIAL OSTEOTOMY WITH ACL REPLACEMENT PLATES

TECHNICAL FEATURES

- **Anatomic asymmetrical implants**
- To prevent any risk of damaging the tunnel, the plate's upper part is **optimized for ACL reconstruction**.
- 1 polyaxial locking hole located in the proximal part of the ACL tunnel to avoid damaging the graft.
- One design compatible with the PEEK or titanium endobutton placement.





Type of augmentation

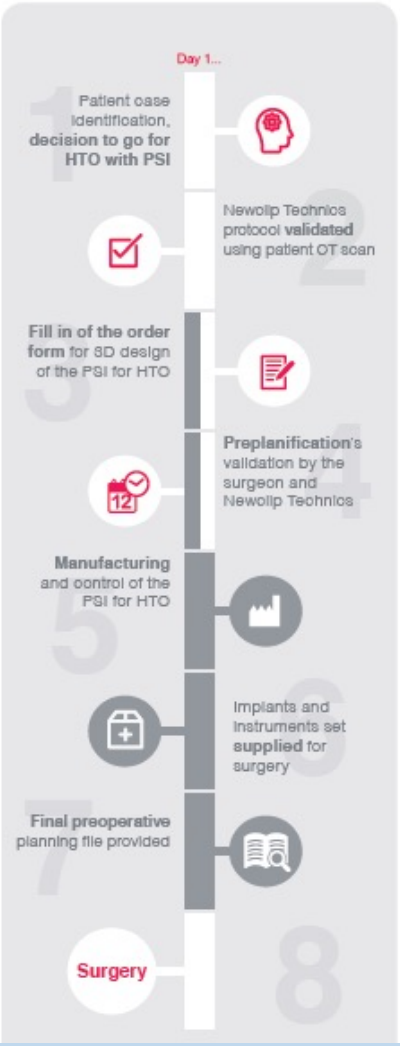
Bone graft vs synthetic bone substitues

- Bone graft (auto/allograft):
  - ✓ Osteoinductive, osteogenic and osteoconductive (less for allograft) properties
  - ✓ donors site morbidity (allograft)
- Synthetic bone substitutes (Hydroxyapatite, Beta-tricalcium phosphate, bone cement):
  - ✓ Concerns about resistence to compressive loads and biological degradability
  - ✓ Bone cement not recommended to achieve biological repair

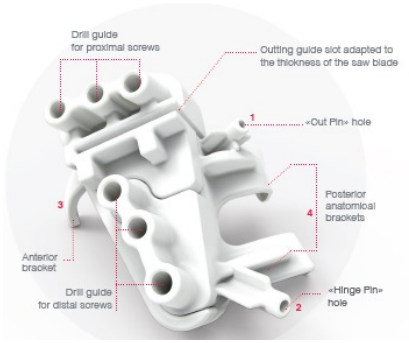
PSI SYSTEMS

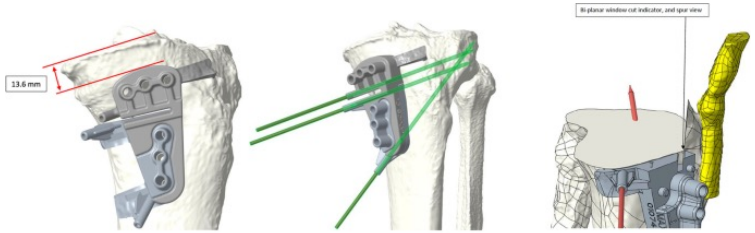
LATERAL OPENING WEDGE DISTAL FEMORAL OSTEOTOMY USING PATIENT SPECIFIC CUTTING GUIDE

- Internal hinge protection
- Femoral slope controlled
- Accuracy of correction



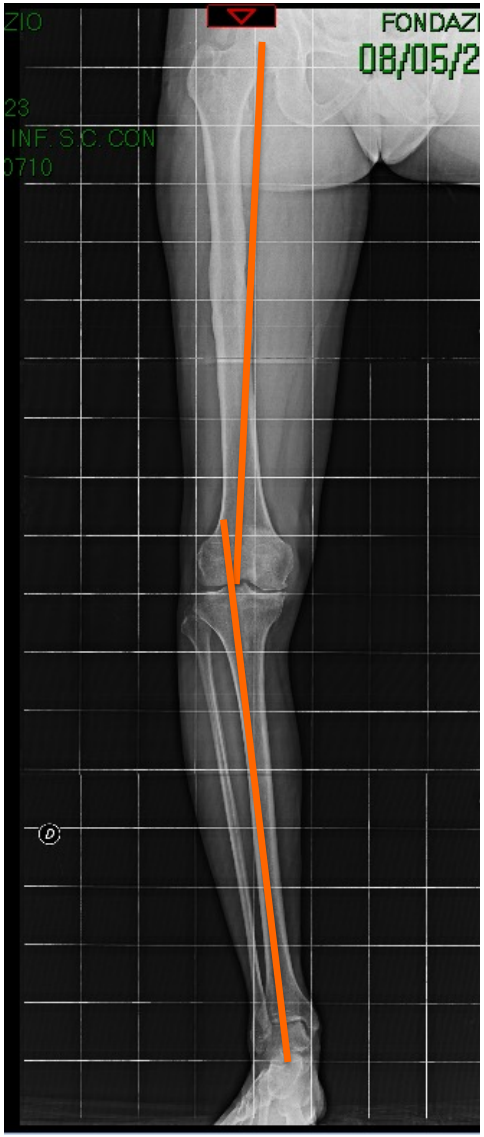
HTO USING PATIENT SPECIFIC CUTTING GUIDE

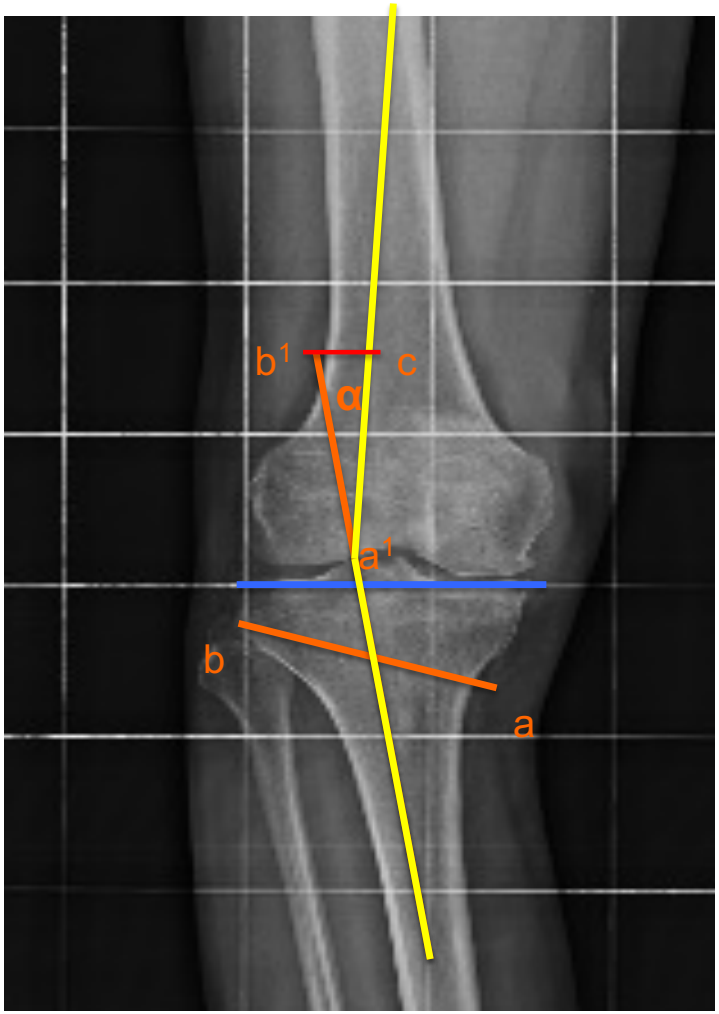




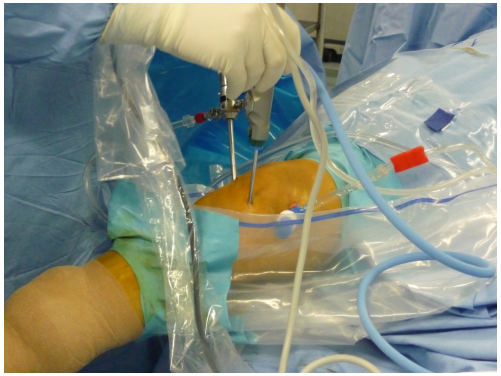
The patient specific guide based on patient's CT scan, offers a correction into the frontal and sagittal planes.

Clinical case





Surgery

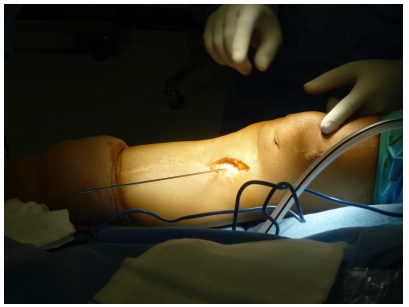


Arthroscopy:

- Evaluation of lateral compartment
- Other intra-articular lesions

Approach:

- Slightly oblique incision 5 to 8 cm long, 4 cm distal to the joint line and 1 cm above the pes anserinus



1 Kirschner wire mark the oblique osteotomy 5 cm distal to the joint line, starting proximal to the pes anserinus and extending to the level of the tip of the fibula at the lateral cortex

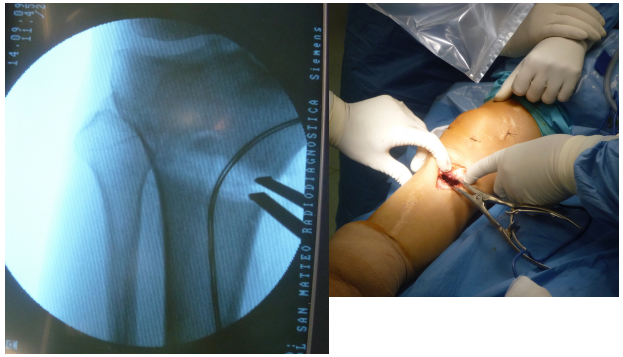
Osteotomy

Open the initial osteotomy in a stepwise fashion using stacked osteotomes to avoid creating an intra-articular fracture of the tibial plateau

➔Fine-tuning of the mechanical axis

- based on preoperative planning
- calibrated wedge spreader

➔overall alignment can checked with use of the cable method



Osteotomies:

<u>Oblique osteotomy</u>

➔ posterior 2/3 of medial aspect of tibia

➔ distal to K wire

➔ parallel to the tibial slope

➔ extending to the tip of the fibula, leaving a 10-mm lateral bone bridge intact

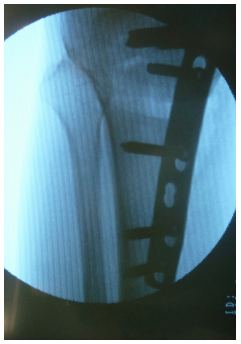
<u>Second osteotomy</u>

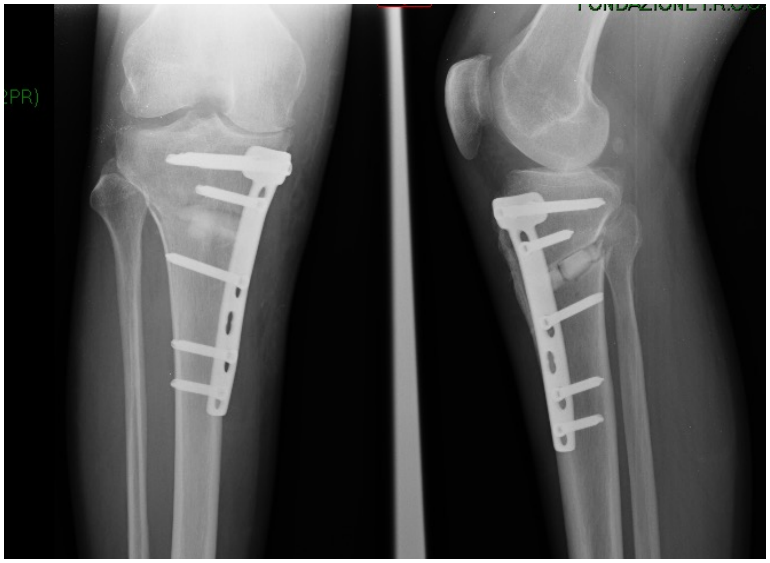
➔anterior one-third of the tibia at an angle of 135°, leaving the tibial tuberosity intact

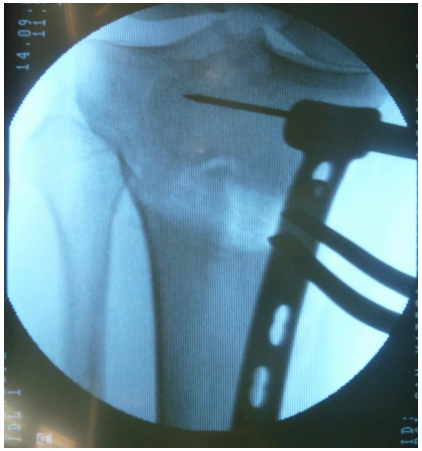
Result

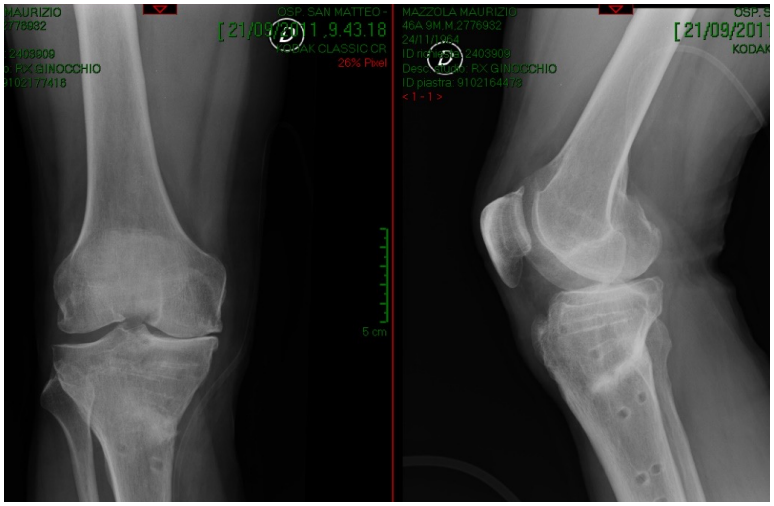
Plate positioning and fixation:

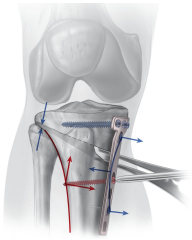
- spacer bolts to maintain distance between the fixator and the bone of >5 mm, avoiding compression of the medial collateral ligament and the pes anserinus.











TAKE HOME MESSAGE

- Many types of fixation
- Systems of fixation are constantly improving
- The system of fixation needs to consider the surgeon and patient preferences, the age of the patients and the anatomical site