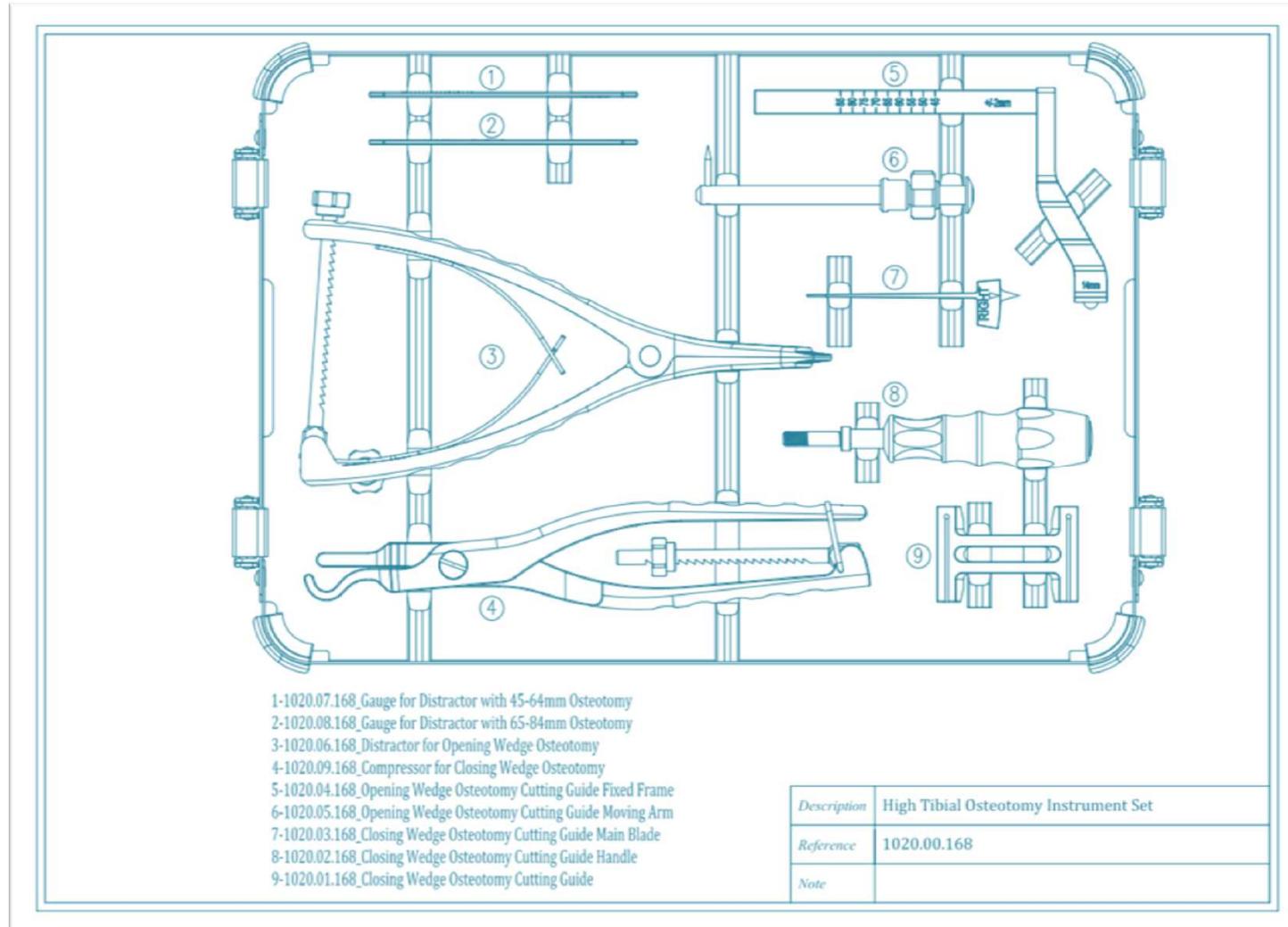
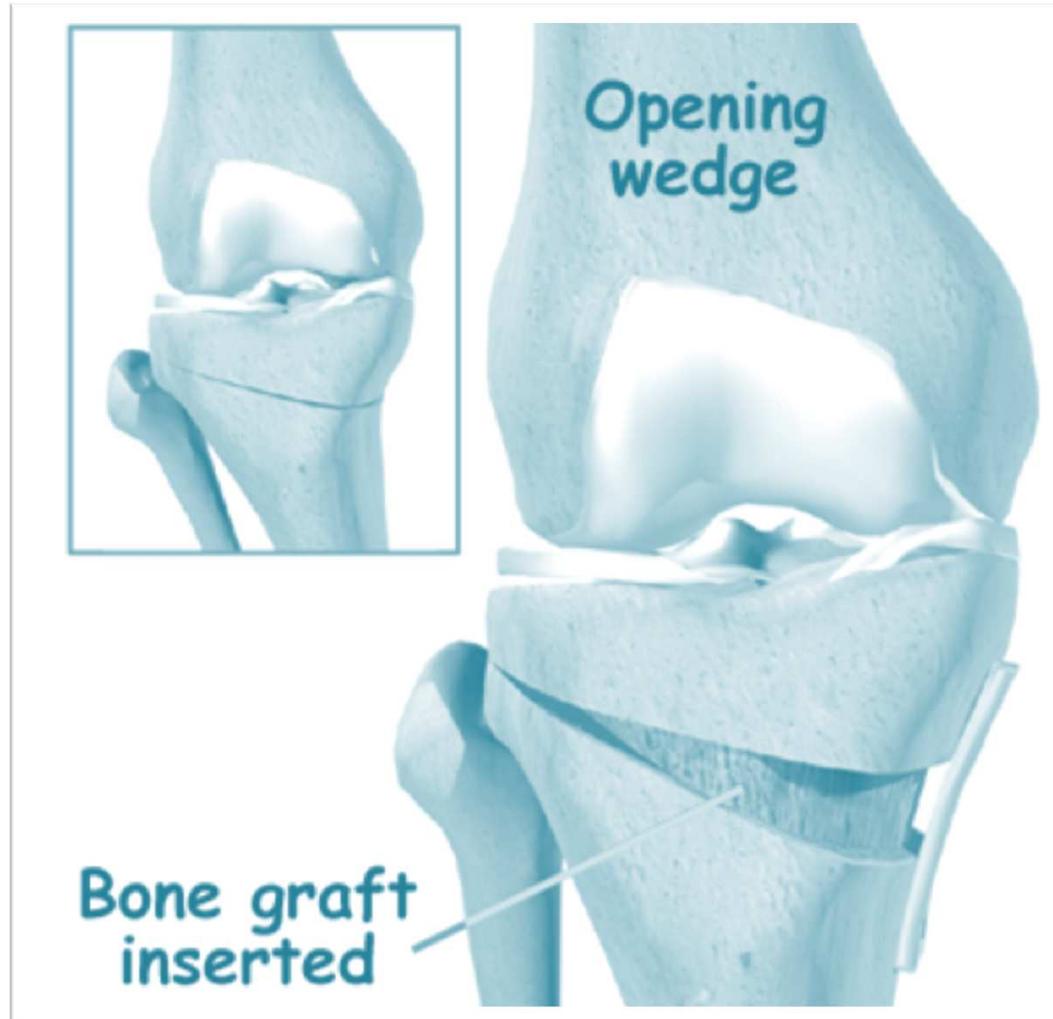


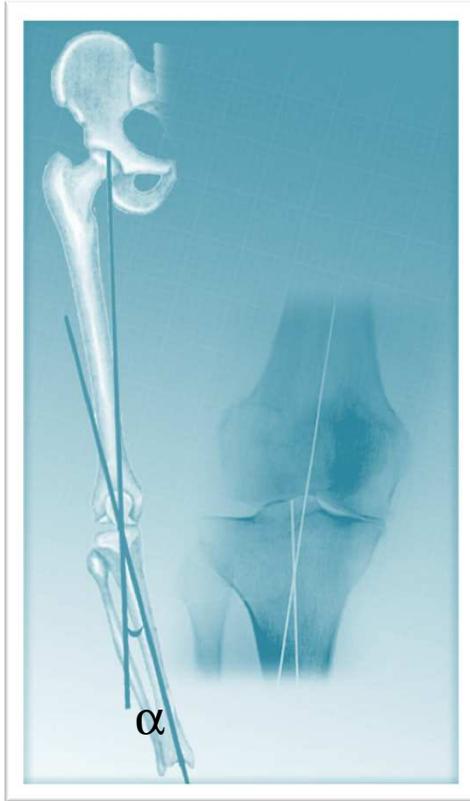
Instrument Set Layout



Opening Wedge Osteotomy



1- Preoperative planning



Preoperative planning is performed with long leg standing frontal plane X-rays. Measurement is done using the anatomic axis method, measuring the angle between the anatomical axis of the femur and the tibia (HKA angle) α .

The radiological technique used is to be as accurate and reproducible, according to a protocol described and controlled by the surgeon.

The aim of the surgery is to accomplish angular correction of 3° to 6° of valgus post operatively, so as to increase the chance for consolidation and for durable results.

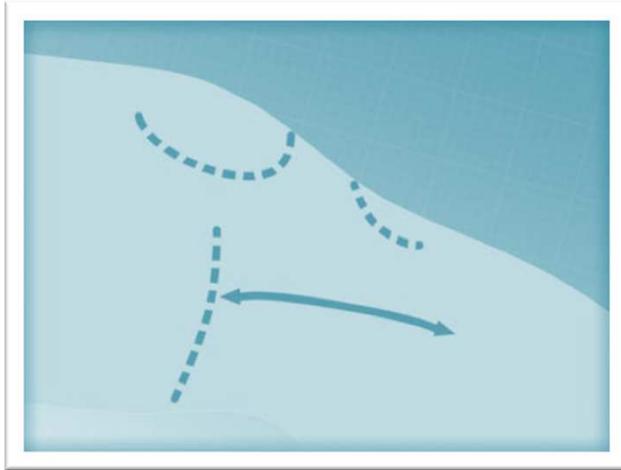
2- Patient Positioning



The patient is placed supine on the operation table. A sand bag is placed under the involved hip.

A leg holder is applied to the proximal thigh, maintaining the knee in a semi flexed position. The knee is thus positioned with the patella being oriented in a strict frontal plane. A tourniquet is applied to the proximal thigh. The C-arm image intensifier is placed in such way that the femoro-tibial joint is well seen in the frontal plane.

3- Approach and exposure in osteotomy area



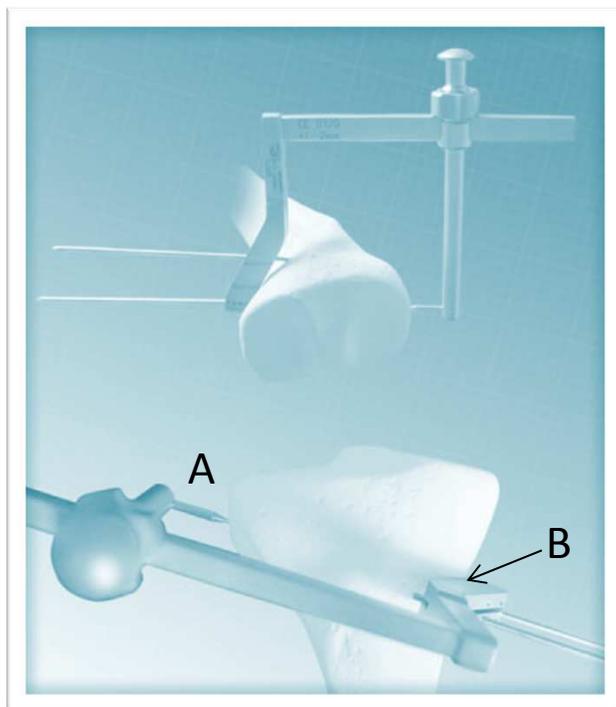
Vertical metaphyseal anterior-interior incision, slightly sinuous or arciform with posterior concavity, mid distance between the anterior and posterior borders of the medial tibia cortex, not extending beyond the level of the joint.

Section of the subjacent aponeurotic plane along the same path and detachment in one piece, using a scalpel or a sharp bone chisel, of the anterior-superior part of the insertions of the pes anserinus and the foot of the superficial medial collateral ligament, from front to back; thus medial tibial cortex of the tibial metaphysis is exposed over a height of 4-5 cm.

Release of the posterior face of the metaphysis with a blunt periosteal elevator which will be left in place, or replaced by a Hohmann or straight Merle D'Aubigné retractor.

Freeing of the patella tendon at its insertion, and the subtendinous bony area in the direction of the outer facet of the metaphysis.

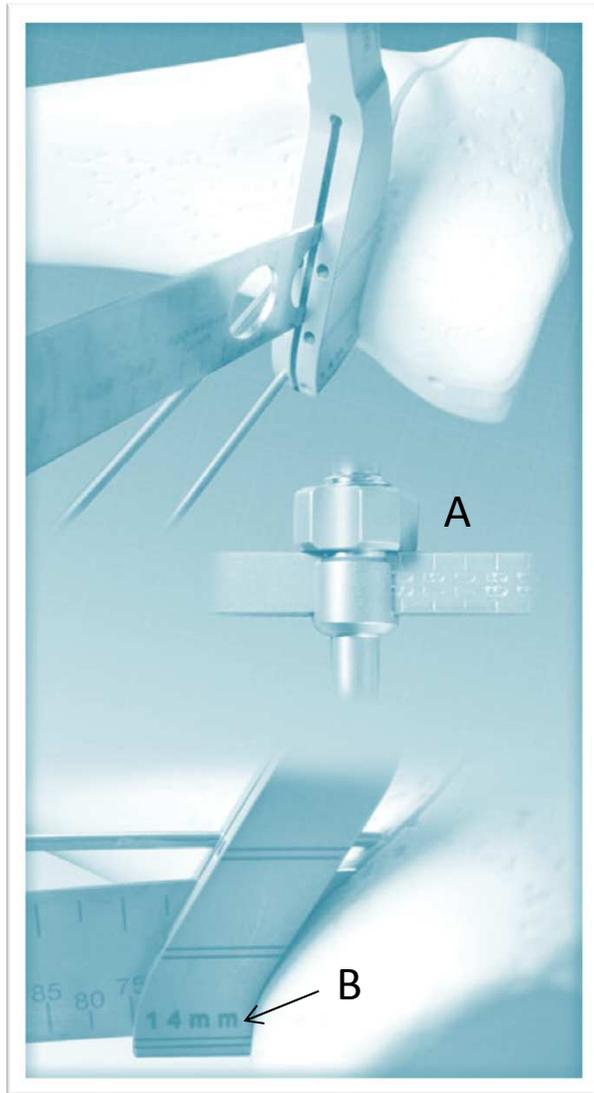
4- Definition of the osteotomy line



Using a motorised tool, placement of one or two K-wires (\varnothing 1.8 mm), from inside to outside, with the help of the cutting guide for opening wedge osteotomy positioned previously:

- external tip inserted as far as the bone, at approximately 15 mm under the joint «A» , marked by an IM needle inserted in the latter.
- stabilised blade guide in contact with the medial cortex «B» . The most posterior K-wire must be parallel to the plane of the posterior cortex of the metaphysis. The level and obliquity of the K-wires are checked by C-arm.

5- Making the osteotomy line



The 1.27mm saw blade must be wide and rigid, to avoid the risk of a change of plane. It is inserted in the slot of the cutting guide for opening wedge osteotomy and will cut nearly the whole of the tibial metaphysis, taking care at the front not to damage the foot of the patella tendon, and at the back not to cut the posterior cortex. To prevent the risk

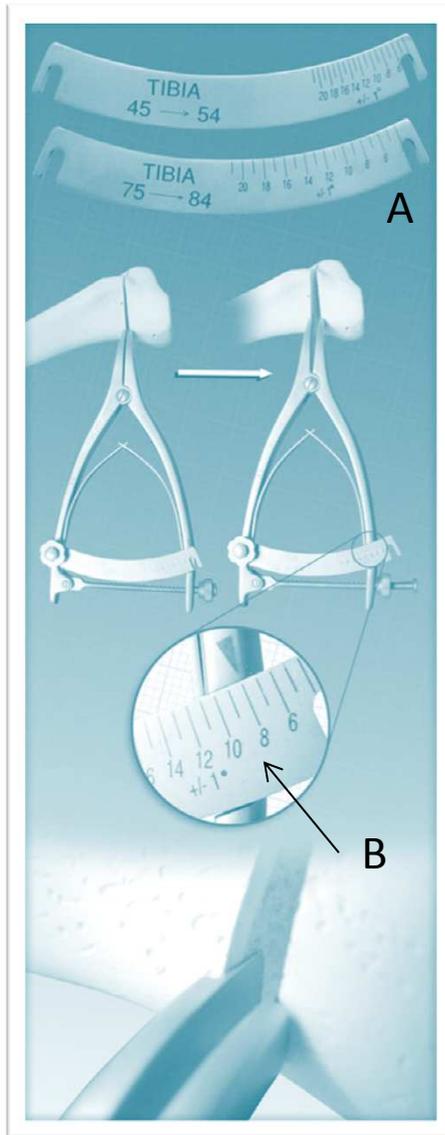
of posterior escape of the blade, a retractor is always in place to protect soft tissues, a lateral cortical hinge of 3-5 mm must be retained.

The width of the metaphysis can be read directly on the graduated section of the cutting guide for opening wedge osteotomy «A». The depth of the cut can be measured by reading the measurement on a graduated saw blade after deducting the thickness of the blade guide (14 mm) «B».

This allows to:

- assess the thickness of the osteotomy hinge,
- select the gauge for the distractor.

6- Opening the osteotomy



The depth of the osteotomy site may be measured either by using the cutting guide for opening wedge osteotomy, or by using a K-wire and rule.

The distractor forceps are fitted with one of the two small rulers whose face corresponds best to the depth of the osteotomy site «A».

The angle of the opening may be read directly from the small ruler.

Gradually move the leg segment into valgus, the lateral side of the thigh immobilized by a support positioned previously (or with the assistance of manual counter-support), to slightly open the osteotomy site.

Insert the tips of the distractor horizontally, on the corner between the medial and posterior cortex, then open gently the osteotomy site with the forceps until the desired correction angle is reached «B».

7- Packing & plating the osteotomy site



After opening the osteotomy site pack it by using either an iliac autograft or synthetic bone substitute.

After packing support the osteotomy site with appropriate HTO plate.

8- Closure

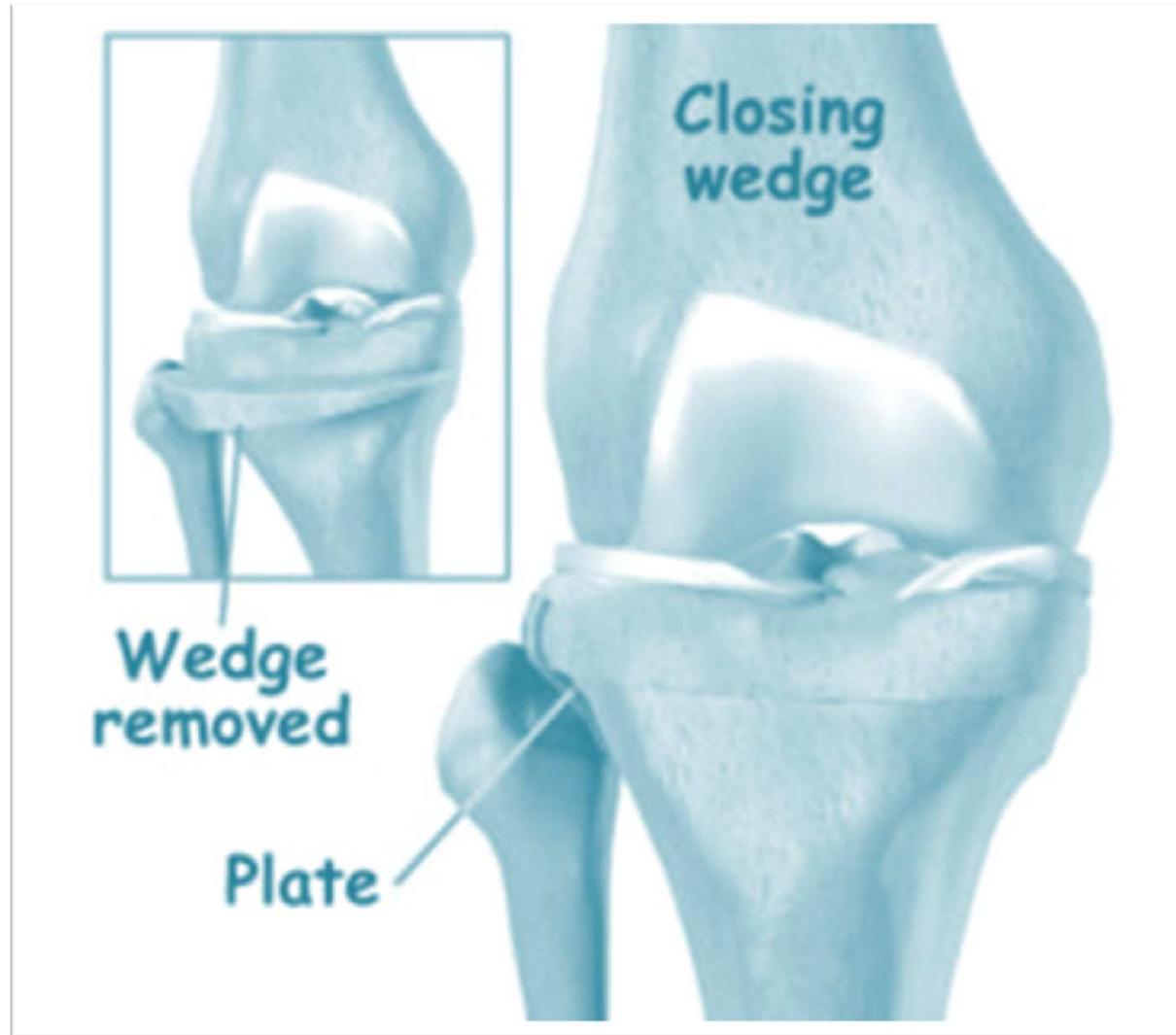
The tourniquet is released and hemostasis is controlled.

The wound is irrigated. A suction drain is left in place for two to three days.

The fascia of the anterior compartment and the muscles are sutured in their previous position by interrupted sutured.

Subcutaneous tissue and skin are equally closed by interrupted sutures, or by any other technique as per usual habits of the surgeon.

Closing Wedge Osteotomy



1- Preoperative planning



Preoperative planning is performed with long leg standing frontal plane X-rays. Measurement is done using the anatomic axis method, measuring the angle between the anatomical axis of the femur and the tibia (HKA angle) α .

The radiological technique used is to be as accurate and reproducible, according to a protocol described and controlled by the surgeon.

The aim of the surgery is to accomplish angular correction of 3° to 6° of valgus post operatively, so as to increase the chance for consolidation and for durable results.

One of the major draw backs of closing wedge HTO is the distortion of the proximal tibia, making it more difficult for total knee arthroplasty if required at a later stage.

This risk remains however insignificant if the correction is less than 10° . For angular correction of more than 10° , it seems that an opening wedge HTO would be better indicated as it induces less proximal distortion.

2- Patient Positioning



The patient is placed supine on the operation table. A sand bag is placed under the involved hip.

A leg holder is applied to the proximal thigh, maintaining the knee in a semi flexed position. The knee is thus positioned with the patella being oriented in a strict frontal plane. A tourniquet is applied to the proximal thigh. The C-arm image intensifier is placed in such way that the femoro-tibial joint is well seen in the frontal plane.

3- Approach and exposure in osteotomy area



An inverted L-shaped incision, of the 10 to 15 cm, is made using a lateral approach to the proximal tibia. Incision starts at the head of the fibula and extends anteriorly to the lateral tibial tubercle. At this point, the skin incision becomes vertical, along the tibial crest.

The incision is carried down the periosteum, exposing the lateral portion of the tibia.

The inter-osseous membrane is incised at the posterior border of the proximal tibia.

This allows for access to the posterior surface of the corresponding part of the tibia. The region of the patellar tendon is exposed till the medial surface of the proximal tibia.

4- Procedures on fibula



There are two possibilities regarding the procedures on fibula

1- Partial resection of the head and joint dislocation:

The proximal tibio-fibular joint is disrupted using a fine scalpel. Partial resection of the head of the fibula will facilitate disruption of this joint. The resection is done from below upwards and from outside inwards. If this step is done strictly anteriorly and from within the head of the fibula, the risk of injury to the lateral peroneal nerve is almost insignificant.

2- Diaphyseal osteotomy:

The middle third of the fibula may be exposed by a lateral approach through a separate skin incision and after subperiosteal circumferential release. Osteotomy of the fibula is done obliquely from above downwards and from outside inwards, using either a thin oscillating saw blade or bone chisels.

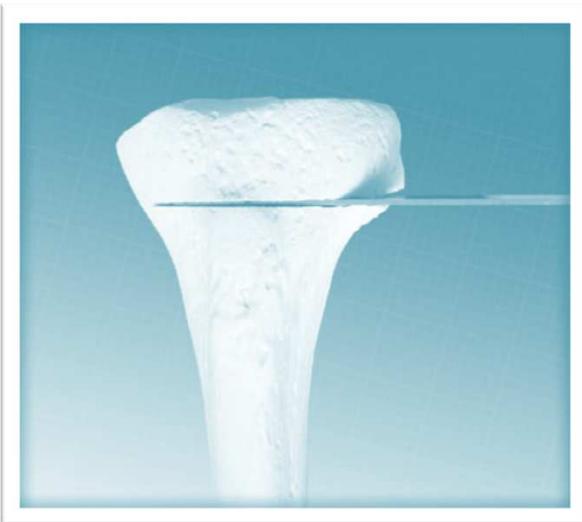
Whichever option is chosen, one must ensure that the fibular osteotomy does not hinder closure of the tibial osteotomy.

5- Preparing to the osteotomy



If the planned wedge to be removed is located besides the anterior tibial tuberosity, its removal might interfere with the extensor apparatus through weakening of the patellar tendon; this may however be avoided by a prior osteotomy of the proximal tibia in the frontal plane using a narrow and thin blade.

A guide pin may be inserted prior to the osteotomy, the position of which is controlled under C-Arm: This pin is placed 15 to 20 mm below the knee joint, parallel to the articular surface and perpendicular to the longitudinal axis of the tibia.



Careful positioning of a retractor posteriorly will avoid damage to the muscles and blood vessels. An oscillating saw with a thin but rigid blade is then used to realize the osteotomy, the pin being used as the guide. Use the C-Arm will check the direction of the osteotomy; it must be parallel to the joint surface. The antero-lateral and posterior surfaces of the tibia are cut. A bony bridge of 5 to 10 mm is maintained medially over the antero-medial cortex; this will ensure a hinge during closure.

6- Making the osteotomy



The osteotomy guide is adjusted to the desired angular correction. The guide is assembled and the reading is indicated by the marked code, which corresponds to the operating side:

- left side: visualization of the three red points.
- right side: visualization of the three green points.

The blade of the guide is inserted in the upper plane osteotomy. It is pushed further inside till it is in contact with the bony bridge.

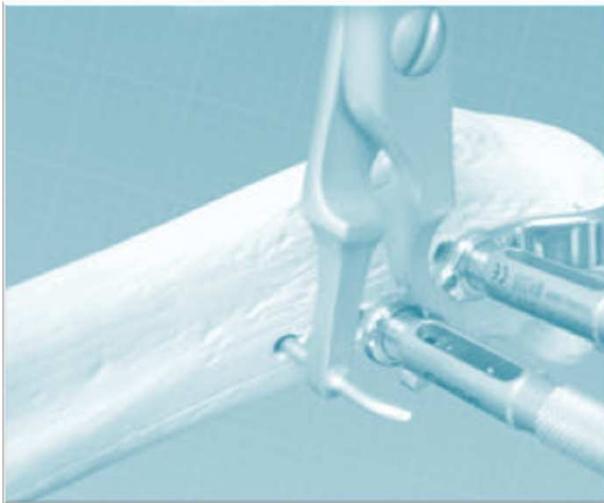
A 1.27 mm saw blade is introduced in the distal slot of the guide the corresponding color point.

The lower plane osteotomy is then carried out. As done previously, the anterolateral and posterior cortex of the proximal tibia are cut while the antero-medial cortex is not ruptured.

The osteotomy guide is removed. The wedge is excised. Some residual bony fragments may remain attached to the antero-medial cortex.

They should be removed either with a curette or with a forceps.

7- Closing the osteotomy site



The osteotomy site is closed by applying appropriate HTO plate and fixing it on the tibia.

While applying the plate, first proximal part of the plate is fixed on the proximal part of the osteotomy.

Then drill an oblique hole in the diaphysis using a drill \varnothing 3.5 mm. This hole is located 5 to 10 mm below the HTO plate, and is where the compressor tip will be inserted.

The hook is positioned around the drill guide of the plate which is attached into the most distal hole on the HTO plate.

Gently close the osteotomy to preserve the diaphysis and the internal hinge. The ratcheting mechanism is 1 mm for each tooth.

Once closure is complete drill the last hole on the plate and apply the screw.

8- Closure

The tourniquet is released and hemostasis is controlled.

The wound is irrigated. A suction drain is left in place for two to three days.

The fascia of the anterior compartment and the muscles are sutured in their previous position by interrupted sutured.

Subcutaneous tissue and skin are equally closed by interrupted sutures, or by any other technique as per usual habits of the surgeon.