KYN® total knee prosthesis

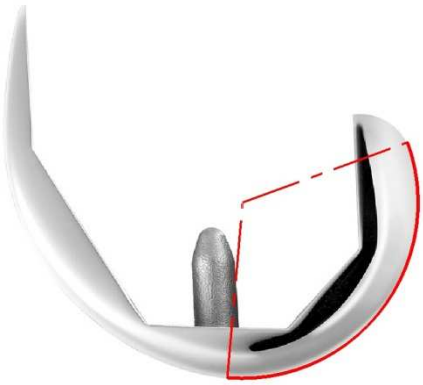
Surgical Technique

The concept

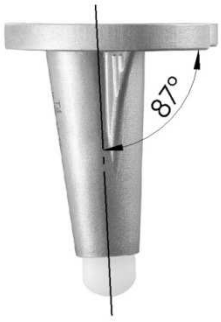
KYN® total hip prosthesis is a fixed bearing prosthesis, available in a posterior-stabilised version and a posterior-cruciate retaining version

The asymmetrical femoral implants and the tibial trays available in 8 sizes as well as the interchangeability to +/1 size allow adjusting to all morphologies.
The ML/AP ratio is defined for women on the small sizes and for men on the large sizes.

The sagittal bend radius is constant from 5° hypere xtension up to 110° flexion.
It guarantees the stability of the implant and reduces the patellar constraints while improving the implant kinematics and the flexion amplitude.



The single medio-lateral radius over the entire range of femoral components increases femorotibial congruence and thus allows an improved stability and more uniform distribution of constraints.
The single medio-lateral radius also tolerates a slight varus or valgus positioning and minimises the constraints on the polyethylene.



The tibial cut is oriented at 3° with respect to th e axis of the keel.
The tibial implant is modular and allows using extension keels available in two sizes (ø12x35mm and ø14x45mm)

On the Posterior-stabilised version, the posterior-stabilisation is ensured by the 3rd condyle which hooks up early in flexion over the tibial bearing and thus reproduces the natural roll-back of the femur on the tibia.
The absence of cage on the posterior-stabilised femoral component allows a minimum bone resection and reduces the weakening of the femur.

The similarity of the PS and CR femurs allows selecting which version to implant per-operative after performing the resections.

Summary of the operative period

N.B.: The order of the femoral distal and proximal tibial resections may be inverted as they are independent resections.

1. Distal femoral resection.
2. Proximal tibial resection.
    a. Intramedullary vision system
    b. Extramedullary vision system
    c. Control and tibial resection
3. Verification of ligament gaps – Spacer method
    a. Ligament balance in extension
    b. Ligament balance in flexion
4. Selection of the size of the femoral component and adjustment of rotation – Spacer method.
5. Size estimation and femoral rotation estimation device combined with the use of ligament tensor
6. Performance of femoral resections.

7. Tibial preparation
    a. CR/PS tibial preparation
    b. Full-poly tibial preparation
8. Patellar preparation
9. Preparation of the intercondylar zone and tests:
    a. Preparation of CR trochlea reinforcement
    b. Preparation of PS intercondylar zone
10. Definitive components.

Surgical Technique

1. Distal femoral resection

- After exposing the joint and resecting the osteophytes, prepare the entry point of the centromedullary vision system with the step drill **(ANC032441)**, positioned according to the pre-operative plan.

- Mount the centromedullary rod on the universal handle **(ANC072436).**

- Drill the femur using the ø8 or ø10mm centromedullary rod **(ANC052434 or ANC052435)**, depending on the femoral size of the patient and the pre-operative X-ray study. A marker situated on the centromedullary rod allows visualising the optimal depth level.

- Mount the paddle on the angle cursor **(ANC052114)**.
Two paddle sizes are available **(ANC052116 to ANC052120)** to optimise the load bearing on the condyles.

- Then mount the resection guide support **(ANC052113)** on the angle cursor with the load bearing paddle. The resection guide support is locked by an eccentric locking system.

- Introduce the angle cursor on the centromedullary rod after adjusting the planned valgus angle.

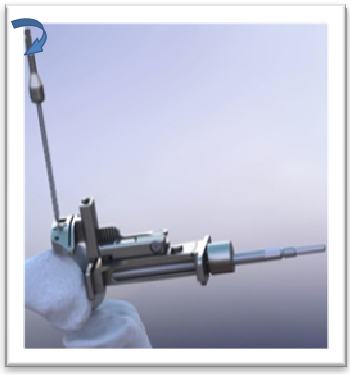
- Bring to bear load against the femur.

- Assemble the distal femoral resection guide on the angle cursor and adjust the femoral valgus angle if necessary.

- A preliminary visualisation of the resection level may be carried out using the curved bistoury **(ANC062238).**

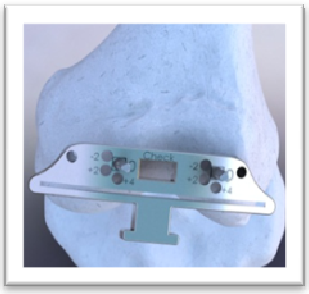
- Verify the right support of the cursor on the femur for the fixation of the resection guide.

- The resection guide can now be attached to the femur via the self-drilling pins **(ANC012077)** in the hole marked "0" corresponding to the distal thickness of the prosthetic femur. The magnetised adaptor **(ANC072078).** for assembling the pins is fitted with an AO tip.



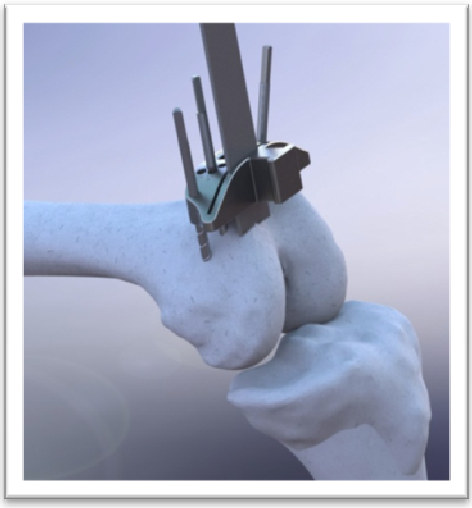
- Once the resection guide has been fixed on the femur, dissociate the resection guide support by opening the eccentric lock, slide the resection guide support, remove the angle cursor and then the centromedullary rod.

The resection level may be adjusted using the +2, +4 or -2mm positions, if necessary.



- At this stage, one or two additional lateral self-drilling pins must ensure the fixation of the guide on the femur.

- Proceed with the distal femoral resection using a 1.27mm blade.



2. Proximal tibial resection:

The proximal tibial resection may be carried out using the intra-medullary vision system or the extra-medullary vision system.

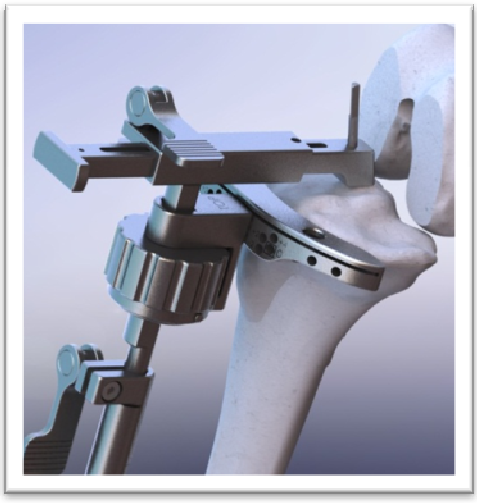
N.B.: The resection guide support integrates a posterior tibial slop of 4°.

a. Extramedullary vision system:

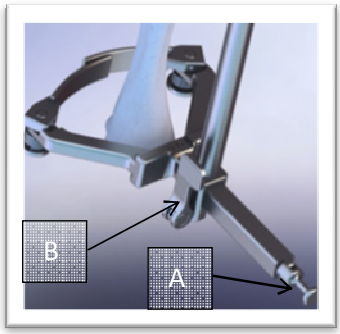
- Assemble the extra-medullary vision system composed of 5 pieces **(ANC051997, ANC051998, ANC052431, ANC05150, ANC051996).**

- Position the tibial resection guide **(ANC041994 et ANC041995)** on the resection guide support.

- Attach the extra-medullary vision system on the spinous process using a pin **(ANC012077)**.



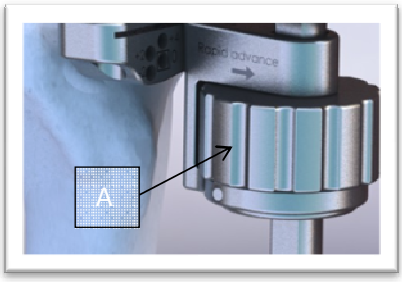
- The varus/valgus alignment of the bi-malleolar clip is performed using the the locking button A, and then moving the bimalleolar clip.
Remark: A translocation of one graduation corresponds to an angle of 1°for an average tibia



- The alignment on the sagittal plane is performed by translocating the distal alignment guide, making sure to unlock eccentric lock B.

The adjustment of the resection height can be performed in two stages:

- A traction on wheel A allows moving the support/resection guide assembly up/down rapidly.
- Once the position the position is close, the millimetre adjustment of the resection height is possibly by turning the wheel.

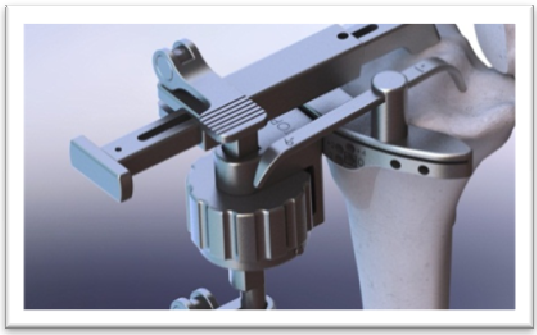


- The visualisation of the resection level is possible using the probe.

The probe presents in the two ends:

A resection level marked '-1' suitable for probing on the arthritic compartment, the level marked '-9' is suitable for probing on the healthy compartment.

The curved bistoury can also be used to visualise the resection level.



- Once the resection level is satisfactory, fix the resection guide on the tibia using the 2 pins positioned in the 2 holes marked "0". The resection guide may be moved to the holes marked "+2" and "+4" in order to perform an additional resection, if necessary.

Otherwise, if the resection level is considered to be too large, the guide may be placed on the "-2" hole.

- Remove the extra-medullary vision system unscrewing the pin on the spinous process, pull the assembly in the axis of the resection guide support making sure to unlock the eccentric lock B.

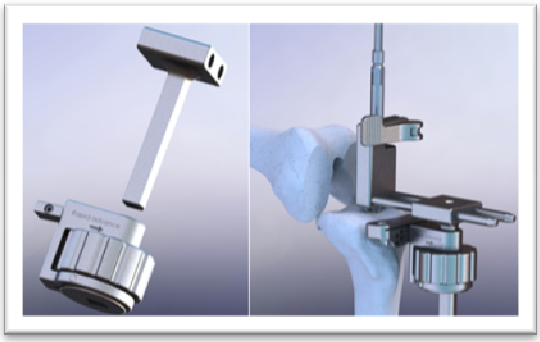
b. Extramedullary vision system:

- Drill the entry of the medullary cavity using a step drill **(ANC032441)** then introduce the ø8 or de ø10 **(ANC052434 and ANC052435)** centromedullary rod, previously mounted on a handle **(ANC072436),** along the axis of the tibia.

- Present the proximal alignment guide **(ANC052010)** on the centromedullary rod, then the distal alignment guide/millimetre screw assembly **(ANC052003 and ANC051996)** on the proximal alignment guide.

- The asymmetrical resection guide **(ANC041994 and ANC041995)** can then be positioned on the millimetre screw.

- An alignment rod **(ANC06190)** assembled on the distal alignment guide allows verifying the orientation of the resection.

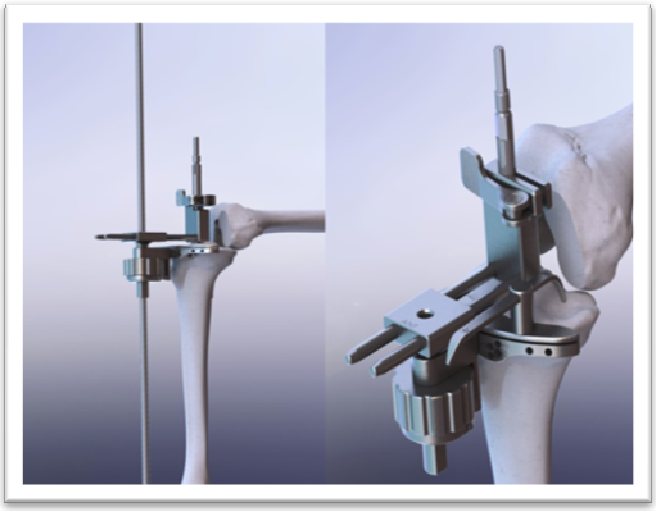


The adjustment of the resection height can be performed in two stages:

- A traction on wheel A allows moving the support/resection guide assembly up/down rapidly.

- Once the position the position is close, the millimetre adjustment of the resection height is possibly by turning the wheel.

- The visualisation of the resection level is possible using the probe.



The probe presents in the two ends:

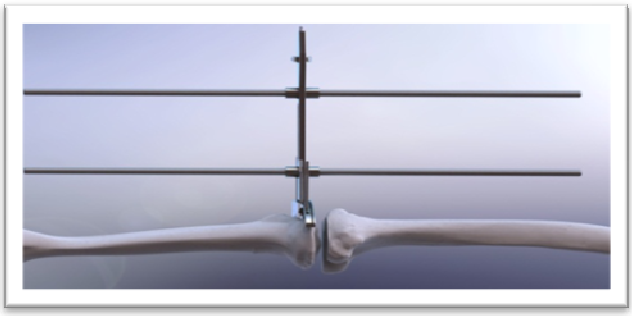
A resection level marked '-1' suitable for probing on the arthritic compartment, the level marked '-9' is suitable for probing on the healthy compartment.

The curved bistoury can also be used to visualise the resection level.

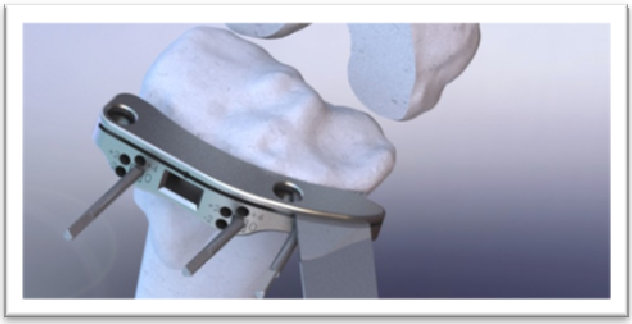
- Once the resection level is satisfactory, fix the resection guide on the tibia using the 2 pins positioned in the 2 holes marked "0". The resection guide may be moved to the holes marked "+2" and "+4" in order to perform an additional resection, if necessary.
Otherwise, if the resection level is considered to be too large, the guide may be placed on the "-2" hole.
Remove the intra-medullary vision system by performing a traction on the Wheel/Alignment guide wheel in the axis of the guide, then remove the centromedullary rod and the proximal alignment guide.

c. Control and proximal tibial resection:

At this stage, the resection alignment can be verified using the reversible 2 in 1 handle **(ANC072269)** fixed on the resection guide and the two ø6 extra-medullary control rods **(ANC06190)** to be aligned with the tibial axis.



- Once the alignment has been verified, tack the guide on the tibia and fix it using a pin positioned in the lateral hole in order to stabilise the resection.



- Carry out the tibial resection.

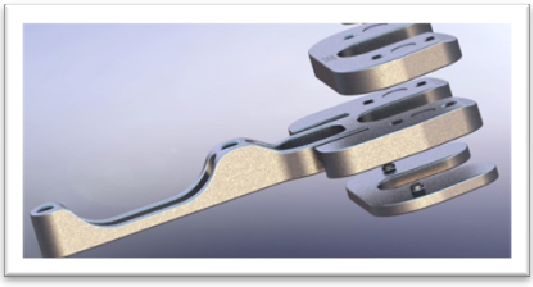
3. Verification of ligament gaps: Spacer method

NB: If a ligament tensor is used, refer to the instructions for use of the tensor and go directly to §4

a. Ligament balance in extension:

Place the knee in extension, and exert traction according to the axis.

Place the spacer **(ANC062335)** and the distal femoral compensation wedge **(ANC062342)**.
The compensation wedge must be assembled on the upper portion of the spacer.



This thickness corresponds to the sum of the thickness of the tibial tray, the polyethylene tray (9 mm) and the femoral prosthetic gap.

If the ligament gap is too large, spacer wedges **(ANC062336, ANC062337 and ANC062338)**, corresponding to the polyethylene tray thickness (11, 13 and 15mm) must be inserted on the spacer assembly on the tibial resection side.

Once the assembly is in place, it must be ensured that complete extension of the knee has been achieved and that the knee is aligned correctly.

b. Ligament balance in flexion:

Place the knee in flexion.

Introduce the spacer **(ANC062335)**, but without the distal compensation wedge.

To facilitate the introduction, place the knee at 120° flexion, then bring the knee to 90° flexion and test the laxity.

It it seems that the ligament gap is not identical between the medial and the lateral compartment, carry out a ligament release on the most constraint side in order to balance the ligament gap.

Remark: For the lateral condyle, in case of Genu valgum compensation half-wedges may be added on the upper face of the spacer.

- The alignment may be verified with the two control rods **(ANC06190)** positioned in the holes of the spacer handle.

The table below summarises the different actions to be implemented to verify the ligament gaps.
The actions mentioned below, in particular those highlighted in red must be implemented with great caution.

Management of		Flexion gap		
		Normal	Tight	Wide
Extension gap	Normal	OK	- Smaller femur - Pass from CR to PS sacrificing the PCL - Increase tibial slope (1 to 2°)	- Larger femur - Distal resection +2 and thicker PE.
	Tight	- Excision of posterior osteophytes and posterior release - Femoral distal resection	- Excision of posterior osteophytes and posterior release - Tibial resection	- Distal resection +2 and thicker PE. - Larger femur and distal resection +2 - Posteriorise the femoral component
	Wide	- Pass from CR to PS and thicker PE - Smaller femur and thicker PE.	- Excision of posterior osteophytes and posterior release	- Thicker PE

4. Selection of the size of the femoral component and adjustment of rotation – Spacer method.

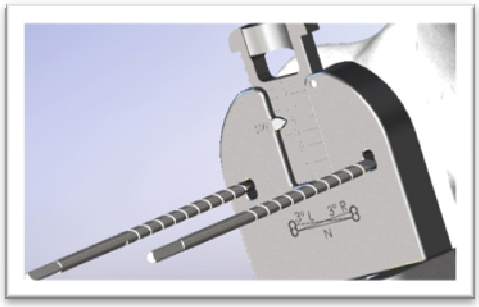
Insert the femoral size estimation device on the spacer **(ANC052368)**, then bring it into contact with the distal resection. The knee flexion must be at 90° so that this block is fully supported on the distal resection.

The stylus **(ANC052237)** previously assembled on the estimation device must come to probe the anterior cortical.

The size of the femoral implant read on the estimation device and on the stylus must correspond in order to ensure that the probing point is actually the exit point of the trochlea of the implant size measured. The theoretical probing point of the anterior cortical is defined opposite.

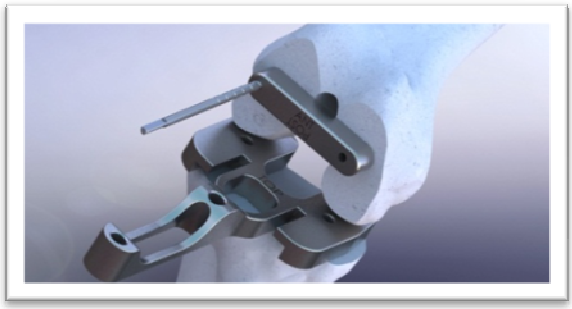
Once the size of the femoral component read on the estimation device, the two positioning holes of the 4 in 1 resection guides must be made:

- The insertion of the two pins **(ANC012077)** in the bottom holes of the estimation device allows positioning the femoral component without external rotation



- The external rotation positioning of the femoral piece is possible by inserting the ø3.3 pins according to the diagram on the estimation device. The external rotation thus obtained is of 3°.

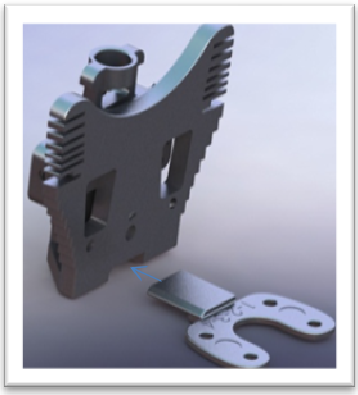
- The positioning of the 4 in 1 resection guide may be anterior or posterior shifted by 1.5mm using an adjustment wedge **(ANC052361)**, while preserving the rotation of the femoral component,



- For this, mount the adjustment wedge on the two pin holes prepared before, then prepare new holes that will be used as the reference for the positioning of the 4 in 1 resection guide.

5. Size and femoral rotation estimation device combined with the use of ligament tensor

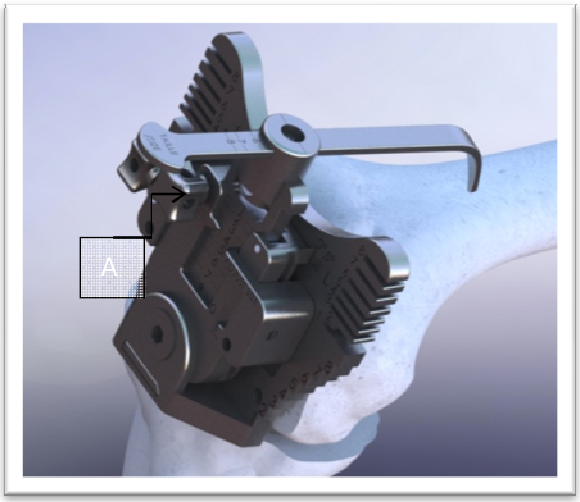
N.B.: The use of this femoral size estimation device is subject to the previous use of a ligament tensor in flexion and extension in order to be able to reproduce the rotation measured using this tensor.



Two paddle sizes are available **(ANC052116 to ANC052120)** to optimise the load bearing on the condyles.

- Mount a paddle and the femoral probe **(ANC052237)** on the estimation device **(ANC052234).**

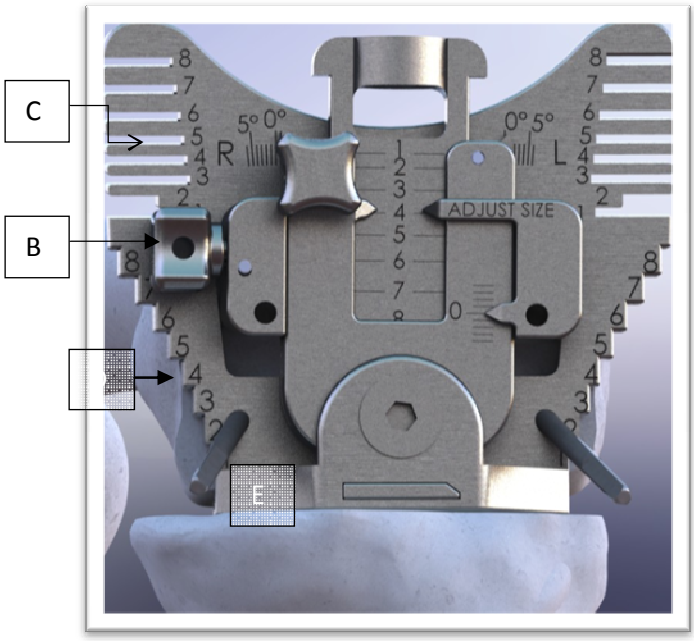
- Apply the femoral size estimation device on the distal resection. Two pins may be used to fix the femoral size estimation device, in the bottom of the device.



- Adjust the rotation given by the use of the tensor in flexion and extension unlocking wheel A.
- Adjust the stylus so that the anterior cortical is probed, the size read on the estimation device and on the stylus must correspond in order to ensure that the probing point is actually the exit point of the trochlea of the implant size measured.

This estimation device allows visualising the level of the anterior resection to verify the absence of anterior nick in the lateral slits. Mark C.

The medio-lateral space is also materialised on the piece supported over the distal resection. Mark D.

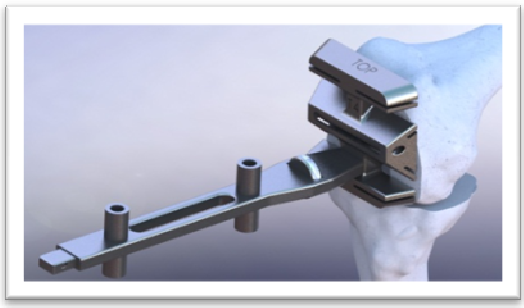


If the probing indicates an intermediate size, it is possible anteriorise or posteriorise the positioning of the femoral component. To do this, unlock wheel B, adjust the position by acting on the "Adjust Size" block, then lock wheel B.

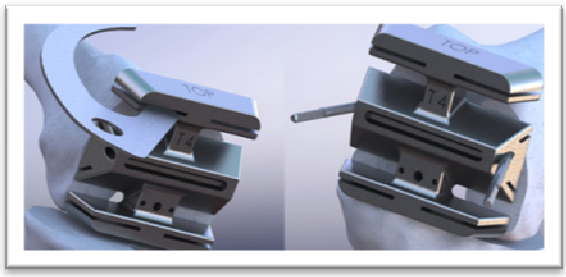
At this stage, the two holes of the 4 in 1 resection guide may be prepared via the insertion of two pins **(ANC012077)** in the two holes marked E.

6. Performance of anterior and posterior femoral resections and chamfers:

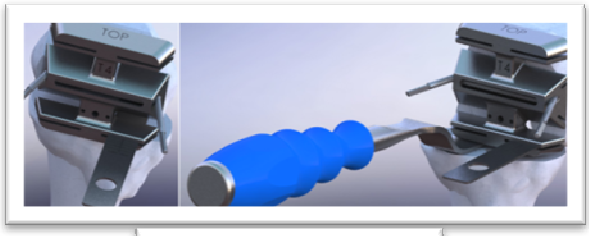
- Remove the pins and the estimation device, then position the 4 in 1 resection guide **(ANC042226 à ANC042233)** over the pin holes prepared previously. The resection guide must be flat against the distal resection. The visualisation of the height of the resection may be carried out using the curved bistoury.
The medio-lateral space of the 4 in 1 resection guide corresponds to the medio-lateral space of the implant.
The use of the handle is optional.



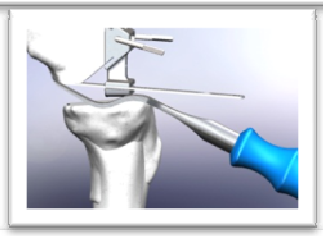
- Place two pins **(ANC012077)** on either side of the resection guide to stabilise and carry out the anterior resection, the posterior resection and then the two chamfer resections.



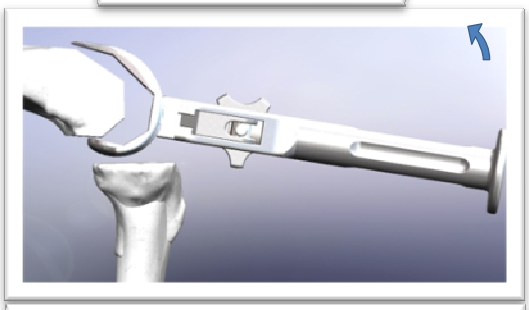
- An osteophyte resection ruler **(ANC072358)** allows marking the femoral component space, at the level of the posterior resection in order to give the surgeon an indication of the depth to which the osteophytes should be resected. Place the ruler in the posterior slit of the resection guide, superposing the value of the size of the femoral component with the face of the resection guide.



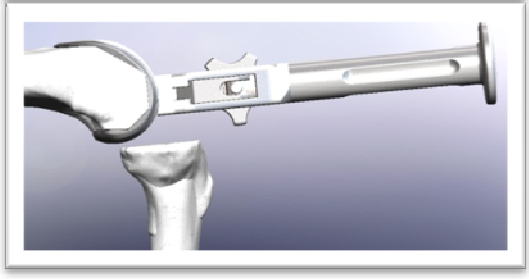
- Perform the ablation of the osteophytes with osteophyte chisel **(ANC022423)**, to the depth indicated by the ruler in order to optimise flexion.



- Using the femoral grip device **(ANC072249)**, grab the test component corresponding to the size determined and impact it.



- The test femoral component must be flat against the previously performed resections.



7. Tibial preparation:

a. CR/PS tibial preparation Tray and bearing version:

N.B. : A tibial tray bigger or smaller in size than the femur may be implanted. The size of the polyethylene must correspond to that of the tibial tray.
Thus, a Size 3 femur could be associated with a size 2 or size 4 tray-bearing assembly.

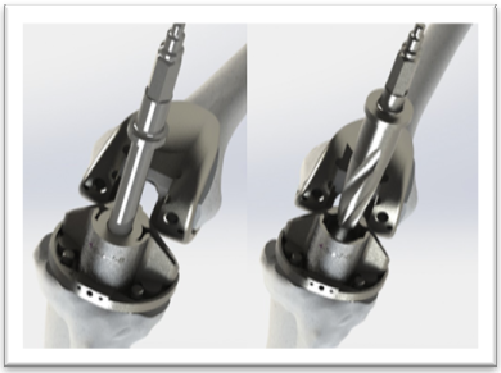
N.B. : Special attention must be given to the rotation positioning of the tibial tray which must be aligned on the middle third of the anterior tibial tuberosity.

- Choose the tray size that will cover the tibial resection surface best, assemble the grip handle **(ANC072269)** on the test tibial tray **(ANC061911 to ANC061918).**

- Position the ø6 extra-medullary control rods **(ANC06190)** on the handle in order to adjust the rotation of the test tray.

- Fix the tray using 4 shouldered nails **(ANC012279)** using the nail impactor **(ANC072345).**

- Assemble the desired sized jib bushing (1 preparation jib bushing for sizes 1-2 and 3 **(ANC042281)** and one jib bushing for sizes 4-5-6-7 and 8 **(ANC042282)**)



- In case of an implantation of Genou KYN® without extension rod, go directly to the following step, otherwise assemble the guide bush of the diameter of the rod chosen, ø12 **(ANC042326)** or ø14 **(ANC042327)**) on the jib bushing, then go down the corresponding drill **(ANC032276 à ANC032277)**, until it stops on the preparation jib bushing.

- Remove the guide bush, then carry out the preparation of the keel using the spongy compactor **(ANC032272).**

- After mounting the appropriate sized winged router **(ANC032273, ANC032274 or ANC032275)** on the handle **(ANC032280)**, introduce it in the jib bushing and prepare the wings bringing the router to stop on the test tibial tray.

- In order to verify the tibial preparation, the test rods **(ANC062265 or ANC062266)** must be assembled on the winged router if an extension rod will be implanted.

b. Tibial preparation Full poly tray version

N.B. : Full poly trays only exist in PS version.

- The tibial preparation of the full poly is performed using a template **(ANC072465 to ANC072472)** and a rasp **(ANC022464)** mounted on the handle **(ANC072280).**

- Choose the template that covers best the surface of the tibia resection and fix it with shouldered nails **(ANC012279).**

- It is possible to return the tip of the rasp to use it as guide bush for a Ø8 centromedullary rod, in order to make a pre-hole to facilitate the use of the rasp.

- Mount the rasp on the handle and carry out the preparation.

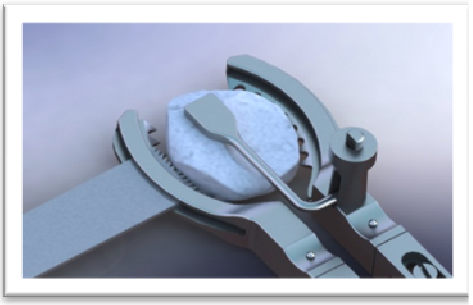
- Mount the test Full-poly tray in order to verify the preparation and the tests with the femoral component.

8. Patellar preparation:

- You will find below the Patella/Femoral component size compatibility table:

		Femoral components								Thickness Patella
		T1	T2	T3	T4	T5	T6	T7	T8	
Patel	T1	✓	✓	-	-	-	-	-	-	**8**
	T2	-	-	✓	✓	✓	✓	-	-	**9**
	T3	-	-	✓	✓	✓	✓	-	-	**9**
	T4	-	-	-	-	-	-	✓	✓	**10**

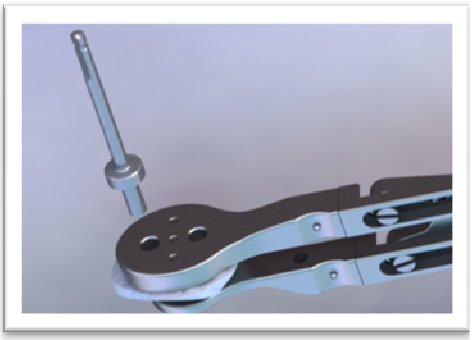
- Mount the two clamps **(ANC07626 and ANC07625)** on the modular patella resection forceps **(ANC07627)**



- Using the probe and the preliminary measurement of the thickness of the initial patella, adjust the thickness of the patella resection.

- Carry out the patellar resection.

- Assemble on the forceps, the clamp **(ANC07623)** that will rest on the anterior face, then the clamp that allows preparing the holes of the two rivets **(ANC0724451, ANC0724452, ANC0724453, ANC0724454).**
The coverage of the patellar button may be assessed either with the test patellar button, or with the preparation clamps that correspond to the exact space of the corresponding patellar button.

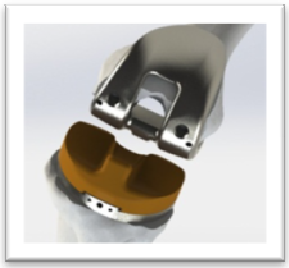


- There are 4 patellar buttons, the centre distance of their rivet is constant over the entire line which allows changing the size of the patella after preparation.

- Once the patellar button size has been chosen, position the corresponding test patella **(ANC0620891, ANC0620892, ANC0620893 and ANC0620894)** on the preparation performed.

9. Preparation of the intercondylar zone and tests:

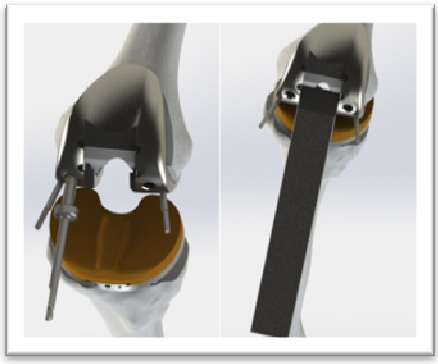
- Assemble the test tray of the thickness chosen during the ligament balance on the test tibial tray and carry out the first tests.



a. Preparation of CR trochlea reinforcement:

- Once the position of the femoral component has been defined, the rivet holes of the femoral component must be prepared with the rivet preparation drill **(ANC032278)**, guided in the two holes of the test femoral component.

- The intercondylar zone, corresponding to the trochlea reinforcement will be prepared using a chisel **(ANC022421)** rested against the notches of the test femoral component.

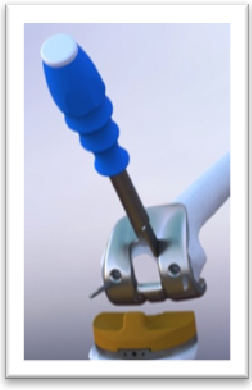


- The detachable trochlear portion of the CR test component allows verifying this preparation: This detachable portion corresponding to the size of the femoral component chosen must be adequately flat against the test femur.

- Flexion/extension tests may be performed to verify the suitable movement of the patella in flexion.

b. PS femoral inter-condylar preparation:

- The intercondylar zone must be prepared to detach the space of the posterior-stabilisation rivet. This preparation is carried out using an L chisel **(ANC022428)** resting against the test femoral component, following the direction opposite.

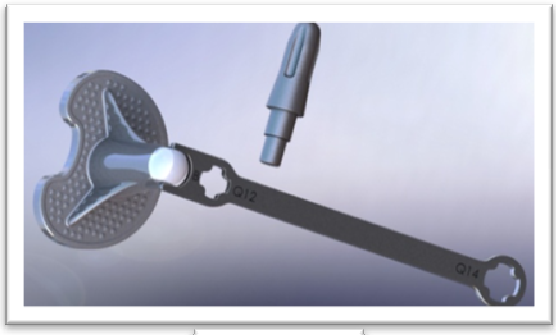


- Once the position of the femoral component has been defined, the rivet holes of the femoral component must be prepared with the rivet preparation drill, guided in the two holes of the test femoral component.

10. Placement of final components:

Proceed as follows:

a- Tibial tray:

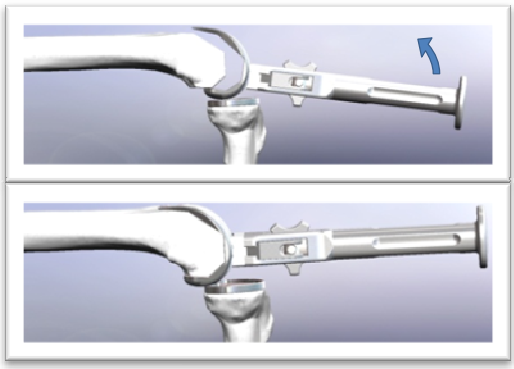


- If an extension keel is implanted, remove the UHMWPE cap of the tray using the flat key **(ANC072268)** unscrewing the button, then bring up the keel holding it tightly with the same key using the imprint corresponding to the diameter of the keel.
- The keels (ø12x35 and ø14x45) are compatible with all the tibial trays.

Use the tibial impactor **(ANC072372)** for the final impaction.

- IF a full-PE tray is implanted, impact the Full-PE tray using the specific impactor **(ANC072510)**

b- Femoral component:



- Position the femoral component over the grip device. Imprint on the implant/grip device an extension movement in order to facilitate the insertion.

- The final impaction must be carried out with the femoral impactor **(ANC072425)**. The femoral component must be perfectly flat against the previously performed resections.

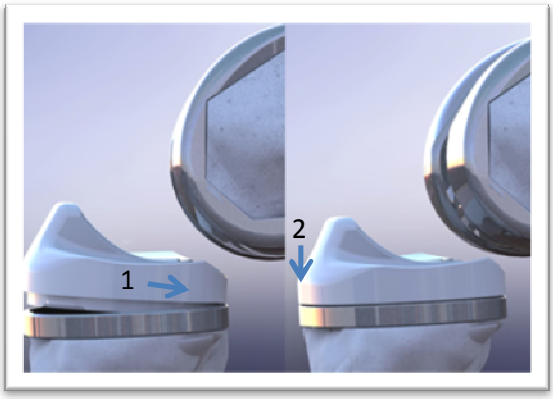
- If the contact is not perfect, recommence the inter-condylar preparation (See §8.a and §8.b)

c- Insertion and locking of bearing:

- When the tibia is in hyper flexion and anterior draw position, insert the fixed bearing by sliding the posterior portion of the bearing into the posterior portion of the tray. Bring the bearing to posterior stop in the tray.

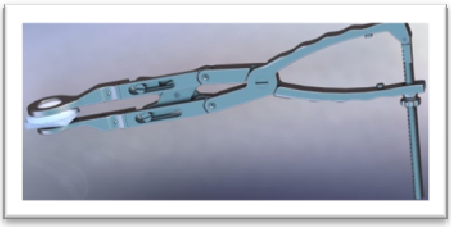
- Clip the anterior portion of the bearing in the tibial tray by pressing firmly on it.

- Verify that the bearing has been adequately clipped.



d- Sealing of definitive head:

- Mount the patella tightening clamp **(ANC07623)** and the tightening tip **(ANC07621).** This tightening tip is fitted with a silicone joint to prevent modifying the patellar button during the pressing of the cement.



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