Parameters to be taken into account:

- Failure causes: don’t reproduce the same mistakes.
- Bone capital: internal and external ligaments apparatus state, extensor apparatus performances and bone quality.

Incision:

The skin is to be incised vertically at the center of the patella, from above it down to below it.

If there have been previous procedures on the knee, the old incision lines should be used as much as possible, and any scar tissue should be removed.

Approach:

A para-patellar approach should be made, passing along the internal edge of the patellar tendon from the tibial tuberosity, and re-ascending between the quadriceps tendon and the vastus medialis.

Since the replacement is a pivoting model which, by definition, provides stability immediately, the lateral ligaments should then be released, essentially into the concavity, by desinsertion at the femur. The patella is then easily displaced towards the outside and the knee can be bent to an angle of 90° to completely expose all the surfaces of the joint.

If there is major valgus (over 10°), the approach should be an external latero-patellar one, passing along the external edge of the patellar tendon from the external edge of the patella, and terminating at the top between the quadriceps tendon and the vastus lateralis. The external lateral ligament is then released, again at the femur, to be able to dislocate the patella towards the inside.
STEP 1: Pre-sectioning of the tibia

Pre-sectioning of the tibia:

- The procedure begins with resection of the tibial articular surface. Extra-medullar or intra-medullar guide are available.

- Intra-medullar guide:
  - Drilling the centromedullary hole using the 8mm diameter drill bit (6).
  - Introduction of the intra-medullar stem (34) using the handle (31).
  - Remove the handle and position the tibial viewfinder spindle (39) without fully impacting it so that the rotation can be adjusted subsequently.
  - Slide the hanger (38) on the tibial viewfinder spindle (39).
  - Assemble the selected tibial cutting guide (37) (choice between the slopes: 0°, 3° or 5°) with the tibial viewfinder stem (45). Assemble that with the hanger (38).
  - Approach the system closer from the tibia. A spanner (36) could be used in order to adjust the level of resection. In position 0, the lower part of the spanner feels at 0 and the other at 4mm. A thrust ball bearing allows adjusting different palpations (0, 2, 4, 6, 8, 10mm).
  - It is also possible to check the valgus angle thanks to alignment handle (35) and with two extra-medullar stems tibial (43) and femoral (44) which have to correspond to the femoral head and to malleolus.
  - Impact two headless nails in the holes identify 0 (middle holes). Holes on both sides enable re-cuts at ± 2mm. It is also possible to add angled pins in the two inferior holes for stabilization.
  - Disassemble the tibial cutting guide from the short stem of tibial viewfinder (45) and desimpact it from the viewfinder.
  - Osteotomy can be performed with the oscillating saw.
  - Remove tibial cutting guide and let temporarily the two headless nails (in case of secondary recut).
STEP 1: Pre-sectioning of the tibia.

- Extra-medullar guide: The aim of the guide is to position the extra-medullary rod (42+1) parallel to the medullary axis of the tibia.
  - Assemble the selected tibial cutting guide (37) (choice between the slopes: 0°, 3° or 5°) with the tibial viewfinder stem (42).
  - Assemble that on the alignment guide - extra stem support (1). Slide it on the malleolar clamp (3).
  - Fix the malleolar clamp on the ankle and approach the system closer from the tibia. A spanner (36) could be used in order to adjust the level of resection. In position 0, the lower part of the spanner feels at 0 and the other at 4mm. A thrust ball bearing allows adjusting different palpations (0, 2, 4, 6, 8, 10mm).
  - Impact two headless nails in the holes identify 0 (middle holes). Holes on both sides enable re-cuts at ± 2mm. It is also possible to add angled pins in the two inferior holes for stabilization.
  - Disassemble the tibial cutting guide (37) from the long stem of tibial viewfinder (42).
  - Osteotomy can be performed with the oscillating saw.

- NOTE: This bone section should be no thicker than 1 to 1.5 cm and it should be made perpendicular to the axis of the tibial diaphysis (to be checked later).
STEP 2: Preparation of the femur

Preparation of the femoral canal:

- Bearing in mind the size as determined with the preoperative templates, the femoral section guide (4) is installed by positioning the hook (5) on the external anterior cortical.
- Fix the femoral cutting guide thanks to 4 pins.
- Then, using an 8 millimetre bit (6) an entry point is drilled for the femoral diaphysis.
- Then the sight axis is inserted (7).

Implementation of the rotation:

- Remove the 4 pins of fixation.
- The condylar stirrup (8) is then installed, the stirrup’s two plates applied to the posterior surface of the condyles in order to ensure that the guide is in the right rotational position. Make sure that the hook (5) is well placed on the external anterior cortical.
- Once the positioning has been checked, the femoral section guide is fixed in place with four pins.
- Then the sight axis (7), the hook (5) and the condylar stirrup (8) can be removed.

Femoral cuts:

- The various sections are then made, beginning with the anterior trochlear section, followed, still using the oscillating saw, by posterior sectioning of the two condyles.
- Then a saw is used to cut out the inter-condylar bone fragment by inserting the blade in the special grooves.
- Once these various sections have been made, the four pins are removed using the pin extractor (9) on the femoral section guide (4).
**STEP 2: Preparation of the femur**

- To ensure good finishing of the inter-condylar fragment, it is important to carry out with hand raised an oblique osteotomy of the posterior femoral cortical by releasing the notch with a backwards withdrawal movement and then, using a claw tool in a steady, gentle fashion, removing the inter-condylar bone fragment.

- This sectioning is an essential part of the procedure and ends with smoothing off of the posterior cortical using the gouge-forceps.

**Femoral resurfacing:**

- After opening and rounding off the canal of the diaphysis using the round femoral rasp (33), the femoral casing (11) and the implant-carrier (12) mounted on a brace (13) with a brace-tip (14) are installed.

- The casing should be pushed down until it is level with the upper condyle.

- The condyle is then smoothed off with the oscillating saw and/or with rasp and/or with gouge resting on the bottom of the casing.

- The casing is then removed.

- The trial femoral implant (15) fitted with the brace (13) and brace-tip (14) is then installed. It should perfectly match the surface of the bone.

- It will be necessary to use the flat rasp (32) to ensure this, mainly to round off the anterior parts of the condyles.

- It is important to know that, because of the implant's anatomical nature; it is the internal condyle which merits most care.

- When, after a series of trials, the implant seems to be perfectly adjusted, it is removed to allow for the next step.
STEP 3: Preparation of the tibia

Preparation of the tibia:

- Once the center of the upper end of the tibia has been registered (the trial tibial implant has a notch in its center), the axis of the tibial diaphysis is opened using the round rasp (33) and then the triangular tibial rasp (17) this traces out the bottom of the tibial implant. The triangular raps (17) will be handled thanks to the tibial raps holder (19).

- The trial tibial implant (18) with its handle (19) and brace (13) is then installed. It is possible to make a trial with a brace-tip (14) (imitating the presence of the centering obturator).

- It should perfectly match the tibial section in both the frontal and sagittal dimensions.

- If such is not the case, repeat the tibial sectioning. For this, the trial implant is removed and the triangular tibial rasp (17) is put in place in such a way that the metal part is in contact with the upper end of the tibia. The handle (19) is then unscrewed in order to make resection possible; the oscillating saw is rested on the flat edge of the released rasp.

- NOTE: If there is a tibial bone mass destruction notably in a follow-up procedure, it will be necessary to use a compensatory wedge (with a thickness of 5, 10 or 15 mm) (20) or semi-wedge (with a thickness of 5, 10 or 15 mm) corresponding to the size of the tibial implant.
**STEP 4: IMPLANT TESTING**

**Implant testing:**

- Reduction of the two implant components and testing of knee mobility in extension and rotation.

- It may be necessary to reposition the tibial component (18) in rotation using the tibial impactor (21). Note the chosen position in rotation.

- It is also important to obtain complete extension. If this is not the case, work can be carried out on the soft tissues to ensure more effective desinsertion of the lateral capsules and ligaments; otherwise, further bone sectioning will be necessary.

- NOTE: to make the trial implants easier to use (reduction, dislocation), the pivot has been foreshortened of 5mm. So it is important to know that the stability of the definitive implant will be better.
**STEP 5: Patellar implant**

*Patellar implant:*

Given the special design of the femoral trochlea, it is strongly recommended that a patellar button be installed.

- For this, frontal patellar osteotomy is performed using an oscillating saw thanks to the resection forceps (24).
- The size of the patella is measured using the patellar template (22).
- Next, using of the patellar drill (23) at the height of the pin, through the patellar template.
- Then installation of a trial patellar button thanks to the patellar forceps (25). This phase is usually carried out after the trial implant phases.
- Definitive fixing of the patellar button is carried out at the same time as the femoral implant is fixed in place.
**STEP 6: Preparation and cementation of the definitive implants**

**Preparation of the definitive implants:**

- The braces and their guides (options between lengths 90, 105, 160mm) are directed onto the femoral implant and the tibial implant, and then tightened on using the three-sided key (27) and the 10/11 Facom key (10).

- If a compensatory tibial wedge (20) or semi-wedge (5 or 10mm) has to be used, it should be screwed on using a 3.5 mm hexagonal screwdriver (28) butted up against the tibial implant. The heads of the screws should not project beyond the visible surface of the wedge or semi-wedge.

**Cementation of the femoral implant:**

- Start with the femoral implant after a diaphysis obturator has been implanted.

- NOTE: Regarding the diaphysis obturators, the choice between a D15 or a D12 is making in function of the place in the diaphysis canal. These are centring obturators but they must not conflict with the cortical bone (pain risks). This effect is amplified when the diaphysis canal is deformed and when we use the longest stems. Therefore, in the tibial side it is not advice to put a D15 diaphysis obturator. In the femoral side, it is necessary to insure that there is not conflict with the cortical bone and that it is possible to place intimately the femoral prosthesis.

- To prevent any cement migrating into the articulating part of the femoral implant, its polyethylene protective tongue should be kept during all the cementation procedure.

- Before the cement is added, check that the femoral implant’s articulating part is working properly.

- The cement is injected into the medullary canal using a syringe. Then, a thin layer of cement is spread over the parts of the condyles that come into contact with the bone.

- The femoral implant is then installed using the definitive implant carrier (30) and the femoral impactor (29). Pressure should be maintained on it for as long as it takes for the cement to harden.

- At the same time, any excess cement on the internal and then the external parts of the condyles should be removed. Then, it should be checked that no cement particles are caught up in the articulation of the femoral joint. For this, the articulating part of the implant is pushed to the top and then, using the impactor (29) the femur is detached as far as possible from the tibia to afford the broadest possible visual field.

- Once this has been checked, do not remove the tongue until the cement has completely hardened.
STEP 6: Preparation and cementation of the definitive implants

Cementation of the tibial implant:

- Then comes fixation of the tibial implant. The cement is injected into the canal of the tibial diaphysis using a syringe then a thin layer of cement is spread over the tibial implant.
- The tibial implant is then installed using the impactor (21) in line with the rotation determined in the prior trials.
- Pressure should be maintained on it for as long as it takes for the cement to set.
- At the same time, any excess cement around the tibial plate should be removed.
- Once both components of the implant have been fixed in place, reduction of the implant and checking of knee mobility in flexion, extension and rotation.

Closure:

- Closure is routine: three or four sutures with non-resorbable thread should stabilise the patella for movements of flexion and extension.
- Then closure with non-resorbable thread, firstly of the entire latero-patellar arthrotomy with aspiration drainage, then of the subcutaneous layer with skin sutures.

*Operating technique suggested for reference purposes: compiled on the basis of techniques used by the surgeons who designed the replacement.*
1: Extra-medullary alignment guide ST00540 or A34204
2: Drill A0 Ø3 L=150 A50214
3: Malleolar clamp A40329
6: Femoral Drill Ø 8 BRA21
14: Brace-tip BRA15 and BRA16
16: Box of pins A40301
31: T-handle A40232
34: Intramedullar stem A40224
35: Alignment handle A35752
36: Spanner A35551
37: Tibial cutting guide A35548 to A35550
38: Hanger A35542
39: Tibial viewfinder spindle A35541
40: Impaction tube A34248
41: Wing screw M5 A34213
42: Long tibial viewfinder stem ST00540-03
43: Extra-medullary stem 35750
44: Intra-medullar stem 35749
45: Short tibial viewfinder stem A150605

9: Nail extraction pliers A33668
12: Trial Implant Holder BRA54
17: Tibial Rasp BRA61
19: Tibial Rasp Holder BRA67
21: Tibial Impactor BRA31
27: Three-Sided Key BRA11
28: Hexagonal Screwdriver BRA64
30: Definitive Implant Carrier BRA74
INSTRUMENTATION

1: Femoral tray A41099
4: Femoral Section Guide BRA24 à BRA27
5: Femoral Section Guide Hook BRA13
7: Sight axis BRA01-1/BRA01-2
8: Femoral Section Guide Stirrup BRA19
10: 10/11 FACOM key BRA65
11: Femoral casing BRA02 à BRA05
13: L90 Brace, 105 (x2) and 160mm BRA55, BRA56 et BRA79
15: Trial Femoral Implant BRA32 à BRA35
18: Trial Tibial Implant A41093 à A41096
20: Wedge BRA08-X et BRA09-X
29: Round Femoral Impactor BRA30
32: Flat rasp BRA59
33: Round Femoral Rasp BRA58

22: Patellar Template BRA68-1 et BRA68-2
23: Patellar Drill Bit Ø10 BRA20
24: Patellar Resection Forceps BRA78
25: Patellar Forceps BRA77
26: Patella BRA63-1 à BRA63-4

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