Revision Unicompartmental Knee Arthroplasty

28

G. Demey and Robert A. Magnussen

Plan

Introduction

Unicompartmental knee prosthesis (UKA) has excellent results for unicompartmental tibiofemoral osteoarthritis. However, poor results and failures may occur.

UKA revision to total knee arthroplasty (TKA) is common. Some surgeons think that this procedure is as easy as a primary TKA. We do not agree, even if it may be easier than a TKA revision.

Surgical history of the knee must be known to plan the revision surgery: the type of UKA (bone resection, versus resurfacing) and cause of failure (metallosis, loosening, wear, tibial plateau fracture, etc.).

UKA revision is not limited to revision to TKA. Sometimes, only one of the two components needs to be changed. Arthroscopy after UKA may be indicated in cases of chronic and unexplained pain, but this indication is very rare.

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Revision of a UKA to a TKA

Surgical planning and techniques are described here, but details of surgical technique to implant TKA are not. We focus on specifics of a UKA revision.

Indications

The cause of failure must be known. Usual causes of UKA revision are:

- Aseptic loosening.
- Implant malpositioning.
- Polyethylene wear or fracture (Fig. 28.1).
- Osteoarthritis of one of the two other compartments (opposite tibiofemoral or rarely patellofemoral).
- Sepsis is rare (<0.5 %), but if present we prefer two-stage revision.
- Sometimes, causes of failure are multiple.

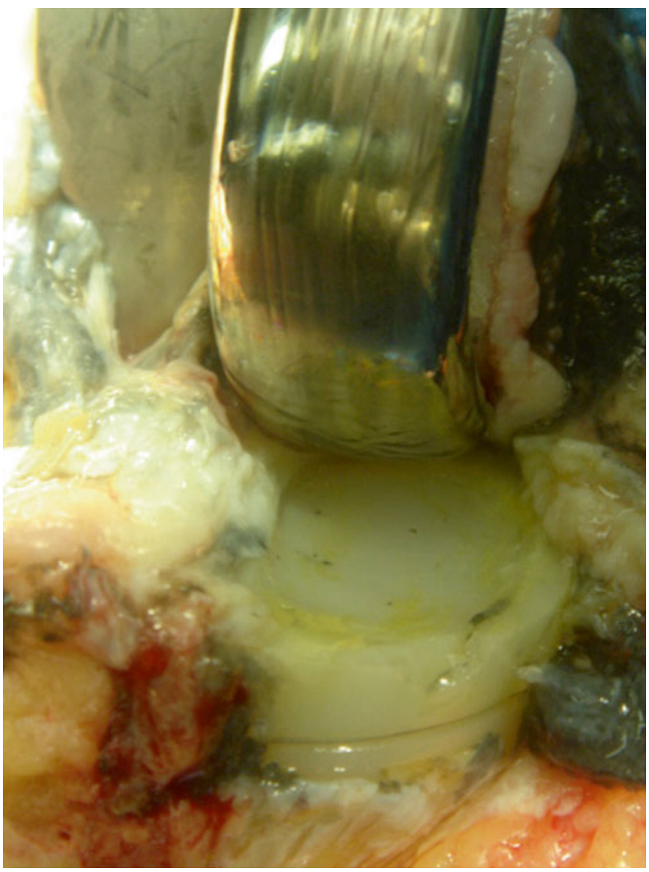


Fig. 28.1 Metallosis and polyethylene wear

Preoperative Planning

Clinical examination along with biological and radiological screening is essential to plan surgery. Infection must be ruled out with history, clinical exam, inflammatory markers, radiographs, and bone scintigraphy.

Standard radiographs needed are:

- AP single leg stance view (loosening, quality of contralateral tibiofemoral compartment)
- Lateral single leg stance view with 30° of knee flexion
- Schuss view with 45° of knee flexion (Fig. 28.2)
- Stress valgus/varus radiographs
- Standing long-axis view to measure both lower limbs' axes and angles, as in the planning of primary TKA
- Contralateral knee radiographs

  Computed tomography is very useful to diagnose failure of a UKA (osteolysis, prosthesis oversizing, loosening, etc.) and to plan surgery. Measure of biepicondylar posterior angle will let you know if the femoral component is well positioned and if the cutting guide can be used without removing the femoral component.

  Technetium (Tc-99m) scintigraphy and marked leukocyte scintigraphy (LeucoScan) may confirm if loosening is septic or aseptic.

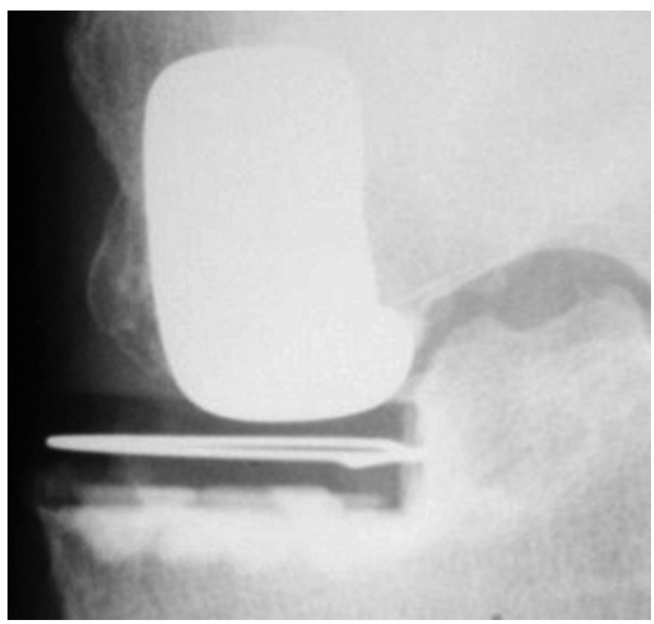


Fig. 28.2 Schuss view showing polyethylene wear

Technical Difficulties: Planning

Technical difficulties are mainly bone loss and ligament laxity.

- Bone loss is more frequent. It can be evaluated on preoperative radiographs (Fig. 28.3) and CT scans. But the true extent of bone loss can only be known during the surgery, after removal of the components.
- Frontal laxity is evaluated on valgus and varus stress radiographs. In case of lateral laxity with failure of a medial UKA, ligament balancing must be done and can be difficult. In our experience, the need for revision to a hinged TKA is rare. In addition, laxity on the concave side of the limb, which can be easily compensated by a TKA, is different from laxity on the convex side of the limb (due to ligamentous lengthening) which is more difficult to handle.
- We use posterior-stabilized UKA, so sagittal laxity is rarely a technical problem. In cases of undiagnosed anterior laxity, metallosis occurs when the polyethylene wears down to the metal backing. In this situation, precise evaluation of bone lesions is more difficult and a CT scan should be obtained.
- Implants: They can be left in place if they are perfectly placed in flexion and extension (preoperative radiographs are very important to evaluate it). Axis in flexion is evaluated on the side-view radiograph and on the scanner. Axis in extension is evaluated on the front radiograph and the long-axis one. However, the femoral component usually prevents adequate positioning of cutting guides, and it is better to remove it prior to making the bone cuts.

Fig. 28.3 Preoperative X-ray showing a bony defect of the medial plateau in case of a 9 mm cut (*dotted line*)

Surgical Technique

Medial UKA Revision

Surgical Approach

Skin incision for a medial UKA revision to a TKA is done extending the previous scar proximally and distally if needed. A medial parapatellar arthrotomy is done (Fig. 28.4). Tibial tubercle osteotomy is usually not necessary.

The cause of UKA failure is confirmed, and wear and fixation of implants are evaluated. Synovial and bone biopsies are done to look for wear debris or infection.

Tibial Cut

The tibia is easily anteriorly dislocated (Fig. 28.5). The tibial component and cement are carefully removed to prevent increasing bone loss. The femoral implant can often be left in place. An osteotome is used to prepare the introduction point of the intramedullary guide. The landmark is the ACL footprint.

The tibial cut is done the same way as in a primary TKA. The bony reference for the tibial cut is the native lateral compartment and the resected bone should be 9 mm thick on the lateral side (Fig. 28.6a, b). An oscillating saw is used. The goal is to prevent worsening bone defect by cutting too much and to reproduce tibiofemoral joint line.

This cut may be proximal to the medial compartment after removal of the tibial component. A medial compartment tibial cut of 4 mm, 8 mm, or 12 mm can be done parallel to the lateral compartment tibial cut (Fig. 28.7). This space will be filled with a metal augment (Fig. 28.8).

When the tibial cut is done, the trial tibial implant with augments is positioned (Fig. 28.8) and temporarily fixed. The posterior border of the tibia and the tibial tubercle are accessory landmarks. The tibial keel is prepared. When augments are necessary, the tibial keel must be lengthened (30 or 70 mm long keels are available). We do not hesitate to use long (75 mm) and thin keels (10–12 mm thick), so that implant positioning is easier (Fig. 28.9).

A tuliped tibial keel is another option (Fig. 28.10a). The tibial hemi-epiphysis is filled and the prosthesis lies on the medial cortical bone, similar to the femoral stem of a total hip prosthesis (Fig. 28.10b).

Femoral Cuts

The knee is positioned at 90° of flexion. The femoral guide for the posterior cut must be applied on the distal and posterior condyles, as described in the TKA chapter.

This can be done without removing the femoral component if it is well positioned, as determined before surgery with radiographs or a CT scan. Rotational malposition and over-/undersizing of implant must be absent. In case of malpositioning of the femoral component, it is removed and the posterior defect is filled with augments placed on the femoral cutting guide (Fig. 28.11a, b). Distal augments are not needed as the guide usually rests on the native condyle.

The femoral entry point is prepared with an osteotome above the medial side of the notch (just anterior to the PCL origin). The femoral medullary canal is prepared with a drill bit and is generally placed in 7° valgus. The stem of the femoral cutting guide is then inserted in the femoral medullary canal and the femoral cutting guide rests against the distal femoral condyle(s). The guide must also be applied on the posterior femoral condyles (or on the lateral condyle and the posteromedial augment if the femoral implant had to be removed).

The anteroposterior size of the implant is measured with the guide on the anterior femoral cortex. Rotation is determined by ensuring that the guide is flush against both condyles posteriorly. If the femoral component of the medial UKA was oversized, an excessive internal rotation of the femoral TKA component can occur. However, if the femoral component of the UKA has been removed, excessive external rotation must be prevented with the posterior augment. Thus, control of the femoral component rotation based on the posterior condyles is more unpredictable than in a primary TKA. When in doubt, the epicondylar axis and Whiteside's line can be used as landmarks.

After the cutting guide is appropriately positioned, it must be taken off to remove the femoral component and then replaced to do the distal and posterior femoral cuts (Fig. 28.12).

Distal Femoral Cuts

The femoral guide is pressed on the native condyle. The distal femoral cut and the chamfers are done as described before (Fig. 28.13a, b).

Filling Bone Defects

If bone loss is moderate (sparing most of the periphery), filling is done with autograft from the bone cuts or with cement (Fig. 28.14). A long keel must be used if the bony support is not strong enough. If bone loss is large or segmental, a metallic augment in association with a long keel should be used (see Chap. 29 on TKA revision). Augments can be posterior, distal, or both:

- Positioning of the trial implants: tibial, femoral, and 9 mm thick insert (Fig. 28.15a–c)
- Ligament balancing

In our experience, PCL resection and use of a posterior-stabilized TKA make the ligament balancing easier. However, increased lateral laxity associated with medial UKA failure can make ligament balancing difficult.

The first release is done during the surgical approach, by sectioning the deep MCL. As described before, medial release can be increased by "pie crusting" the MCL. If needed, a complete release of the distal superficial MCL can be performed. In cases of flexion contracture, release of the semimembranosus tibial insertion is done.

Final Implants

Any impingement between the tibial augment and the MCL must be prevented. Different size and thickness of augments must be available (Fig. 28.16).

The tibial plateau is cemented first. The tibial keel is also cemented. If the tibial keel is long (>75 mm), a polyethylene cement restrictor is inserted in the tibial medullary canal in order to prevent cement extrusion distal in the canal. Excess of cement is removed from around the implant.

The polyethylene is positioned and the knee is hyperflexed to insert the femoral component. It is impacted with the knee in 90° of flexion (Fig. 28.17). A polyethylene cement restrictor is also inserted in the femoral canal if a long femoral keel is used (>75 mm). The knee is extended to compress the cement and the patellar button is cemented (Fig. 28.18).

Lateral UKA Revision

The surgical technique is the same except for the surgical approach and the level of the tibial cut.

Surgical Approach

For lateral UKA revision to a TKA, the skin incision is created by extending the previous scar proximally and distally (Fig. 28.19). In case of multiples scars, the most lateral one is reused. We prefer a lateral approach over a medial one because soft tissue release is easier and some complications may be avoided including skin necrosis, patellar necrosis, and exposure difficultly. A tibial tubercle osteotomy is rarely necessary – only if exposure is difficult (Fig. 28.20).

Preparation of the Tibia

The reference for the bone cut is the native compartment. The cut should be 6 mm below the medial tibial plateau (native). As it is concave, the cut is less than in cases of medial UKA revision (Fig. 28.21). As with medial UKA revision, this cut may be above the lateral compartment after removal of the lateral tibial component. A minimal cut of the lateral compartment can be done parallel to the medial compartment cut. A 4 mm, 8 mm, or 12 mm difference between the lateral and medial tibial plateau will be compensated by the corresponding metallic augment (Figs. 28.22, 28.23, and 28.24). Minimal bone resection is preferred.

Preparation of the Femur

As the posterior femoral condyle is absent (after removal of the implant), one must avoid positioning the femoral cutting guide in internal rotation. The guide is placed on the distal medial femoral condyle and external rotation is assured by placing an augment of the posterior aspect of the lateral femoral condyle. Alternatively, external rotation can be achieved by placing one or more osteotomes between the posterior lateral condyle and the guide (Fig. 28.25). Posterior cuts are done first (Fig. 28.26) and then distal cuts and chamfers (Fig. 28.27).

Ligament Balancing with Trial Implants

Medial laxity associated with lateral UKA failure can lead to difficult ligament balancing. The first release is done during the anterolateral surgical approach where the lateral capsule is released and iliotibial band is released from Gerdy's tubercle (but left in continuity with tibialis anterior muscle fascia). Laxity in flexion and in extension is checked after positioning the trial implants. If medial laxity in extension persists, "pie crusting" of the IT band is done with an 11 blade. To do so, multiple transverse incisions are done.

Final Implants

Cemented implants are positioned and the knee is extended to compress the cement (Fig. 28.28).

Postoperative Care

Postoperative rehabilitation is the same as after primary TKA (see chapter TKA). In case of tibial tubercle osteotomy, flexion is limited at 95° for 45 days. Two knee braces are worn during the first 45 days: one in extension for walking and one at 20° of flexion for rest. A radiograph is done at day 45 to ensure adequate healing of the osteotomy before removing the braces and increasing knee flexion.

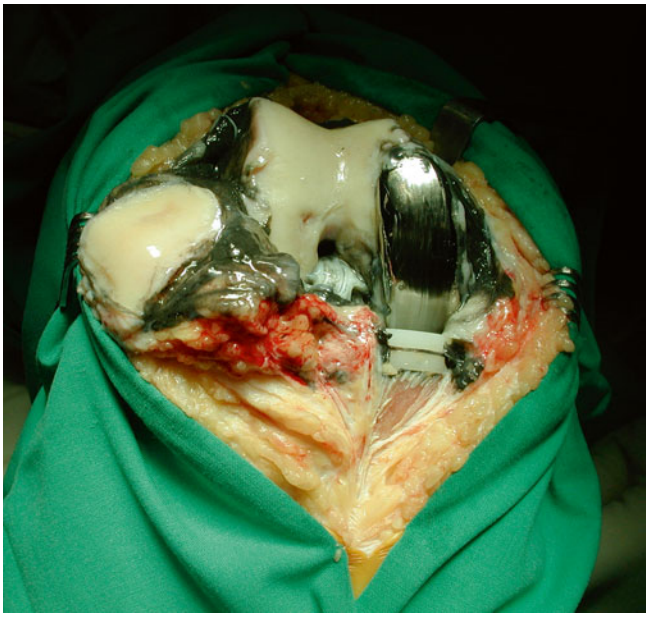


Fig. 28.4 Medial parapatellar approach

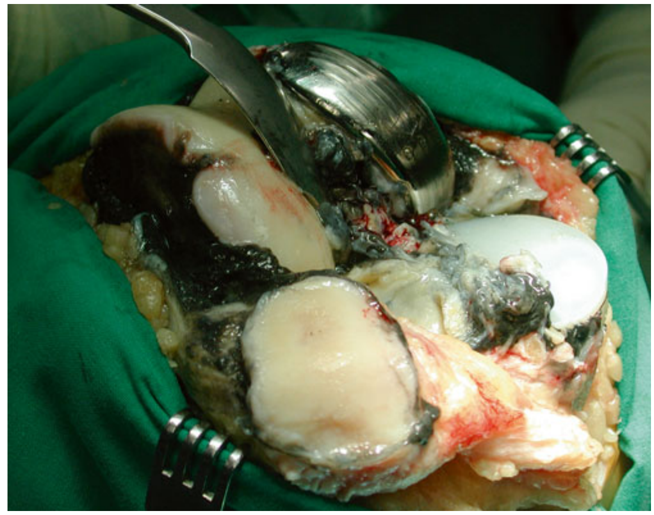


Fig. 28.5 Tibial exposure

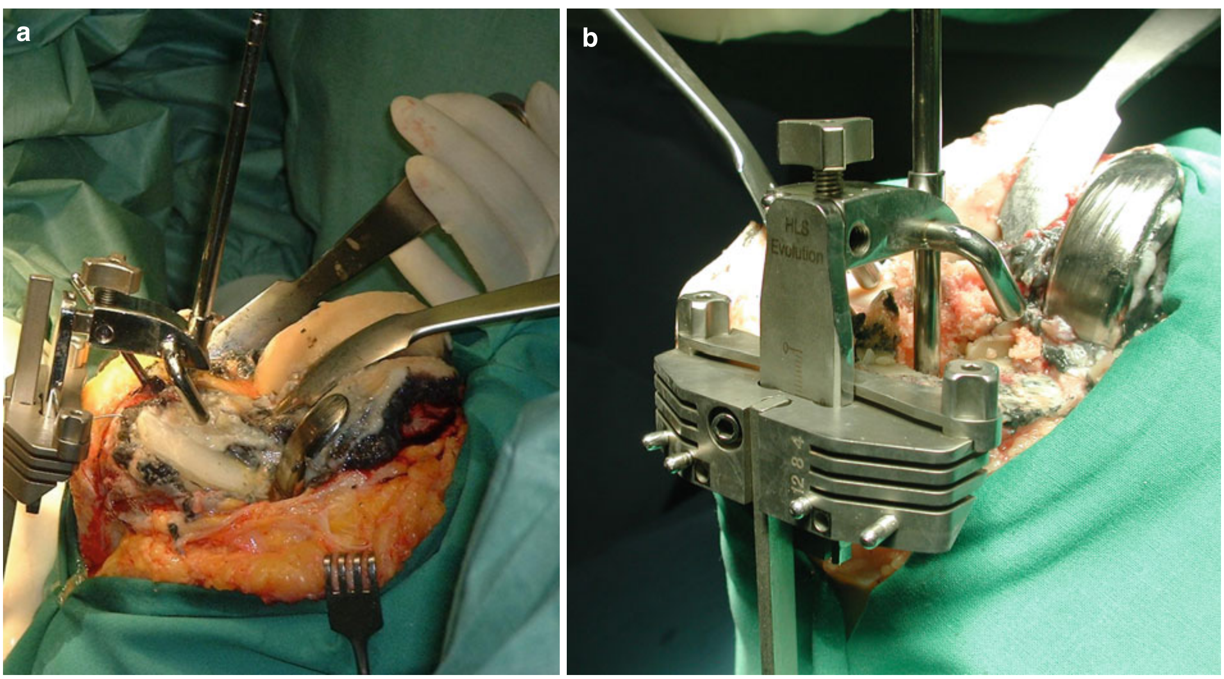


Fig. 28.6 Intramedullary guide introduction (**a**) and fixation of the tibial cutting guide (**b**)

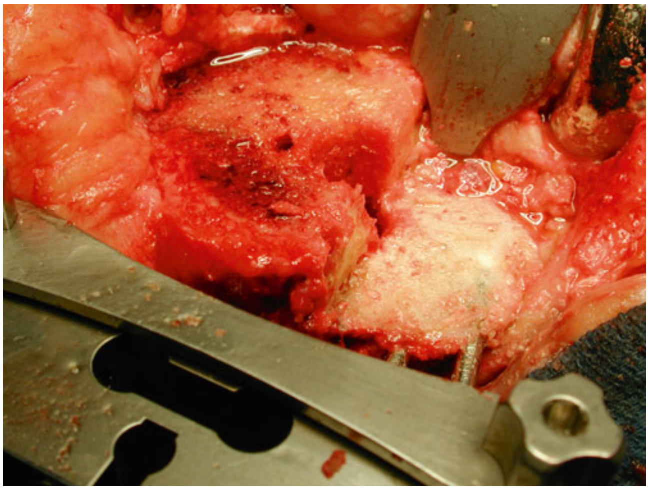


Fig. 28.7 Medial compartment tibial recut (4, 8, or 12 mm)

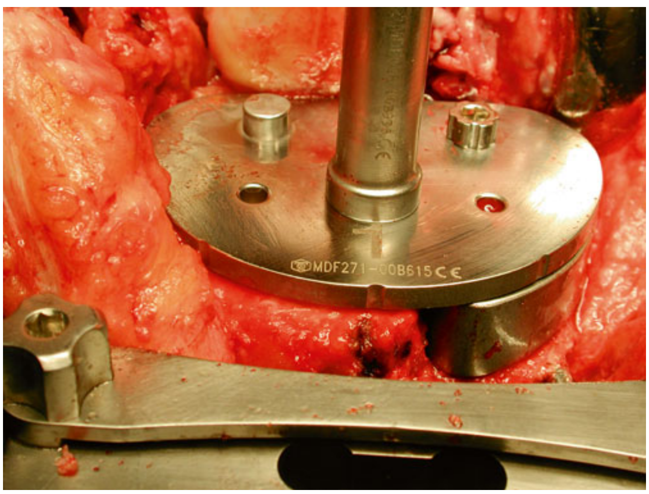


Fig. 28.8 Metal augment filling the medial space

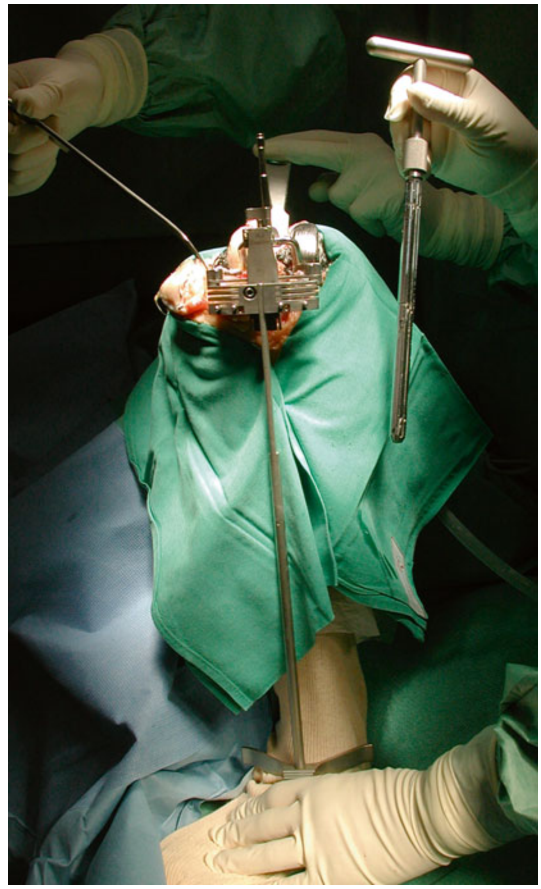


Fig. 28.9 A long tibial keel is used in case of metal augment

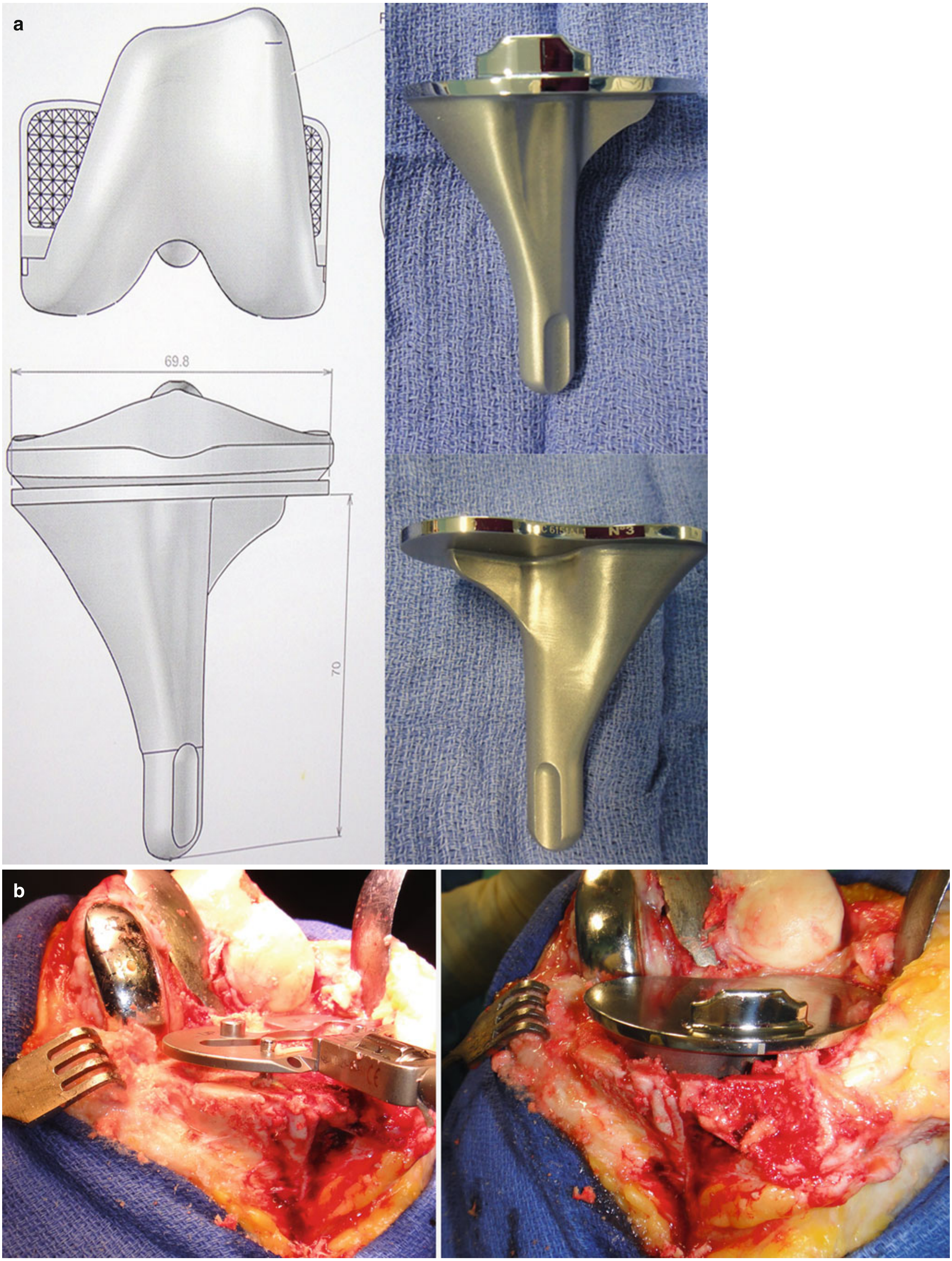


Fig. 28.10 (**a**, **b**) Tuliped tibial keel lies on medial cortical bone

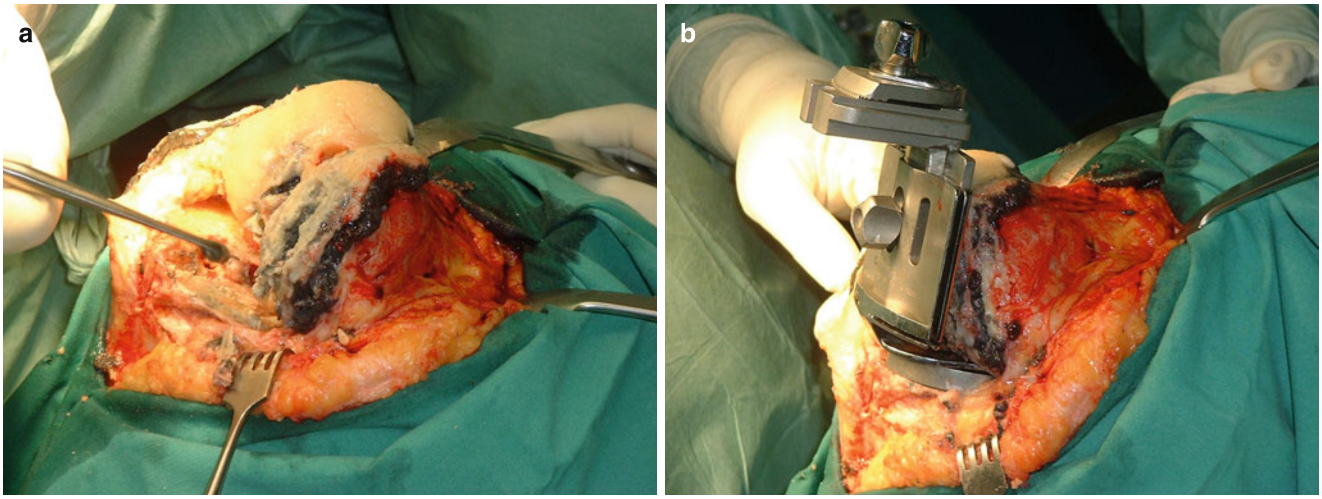


Fig. 28.11 The femoral component is removed (**a**) and the femoral cutting guide is positioned (**b**)

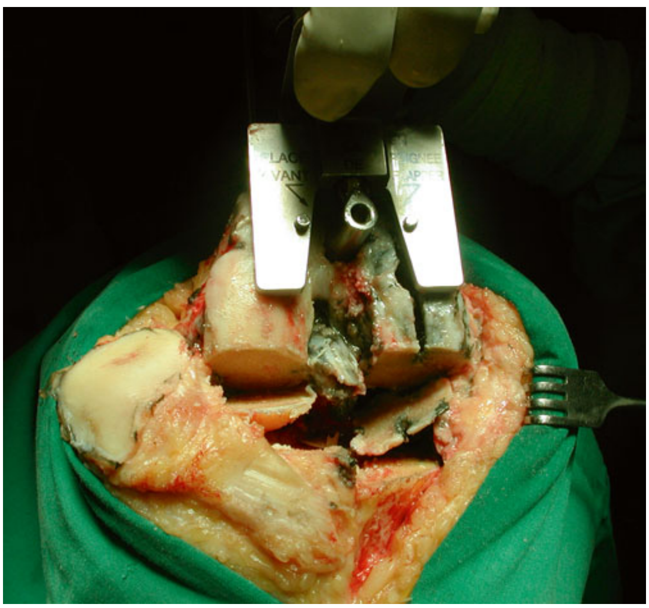


Fig. 28.12 Posterior femoral cut

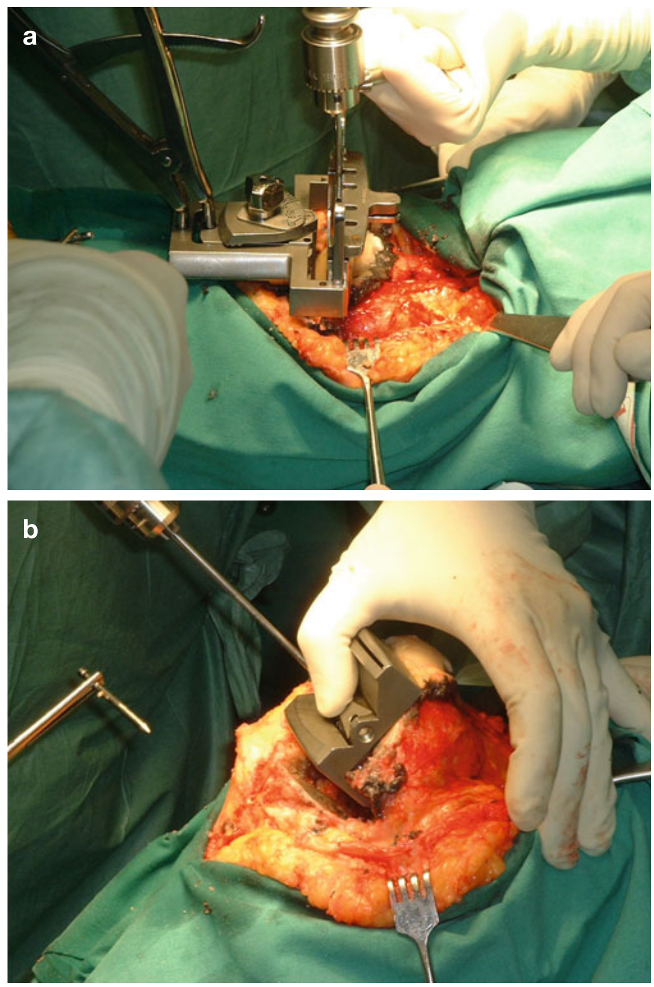


Fig. 28.13 Distal femoral cut (**a**) and then anterior and chamfers (**b**)

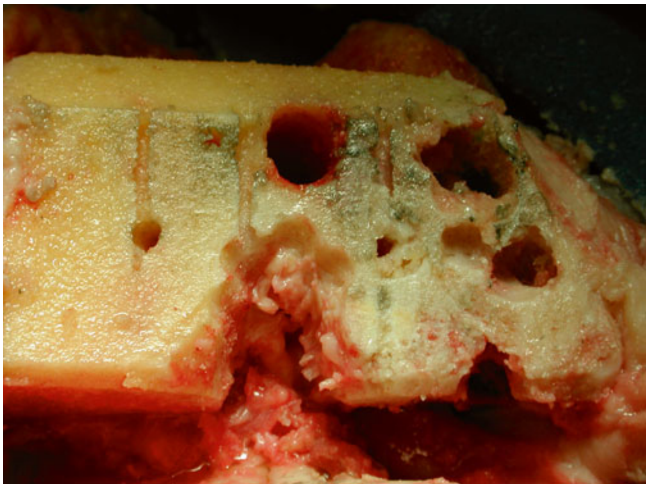


Fig. 28.14 Moderate bone loss

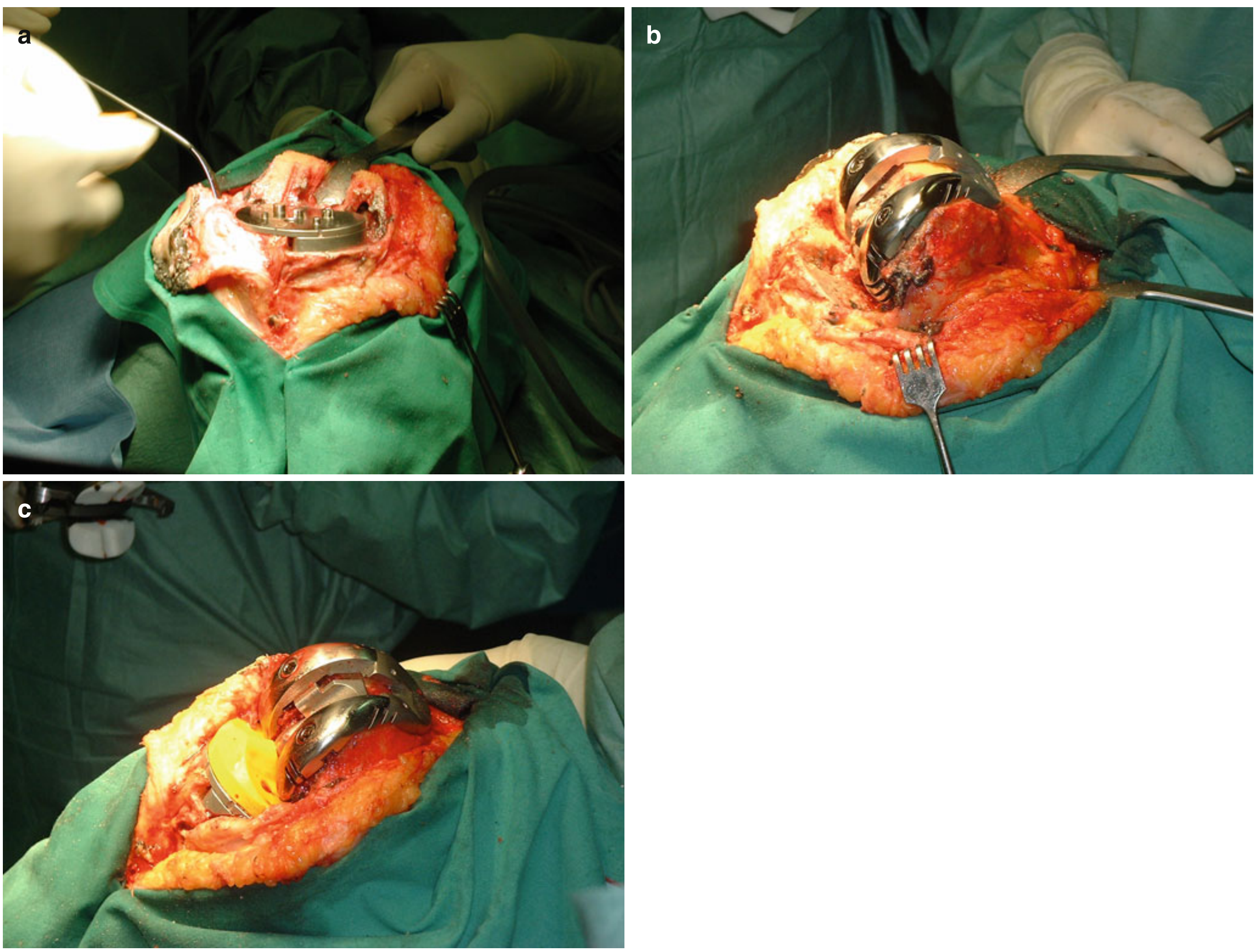


Fig. 28.15 Positioning of the trial implants (**a**) tibial, (**b**) femoral, and (**c**) insert

Fig. 28.16 Medial augments attached to the medial component

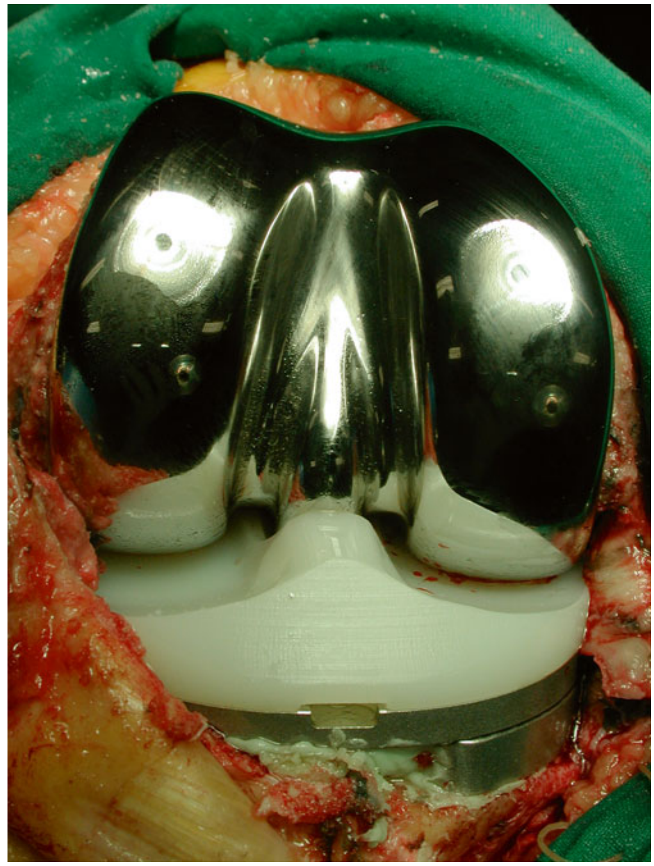


Fig. 28.17 Cemented components

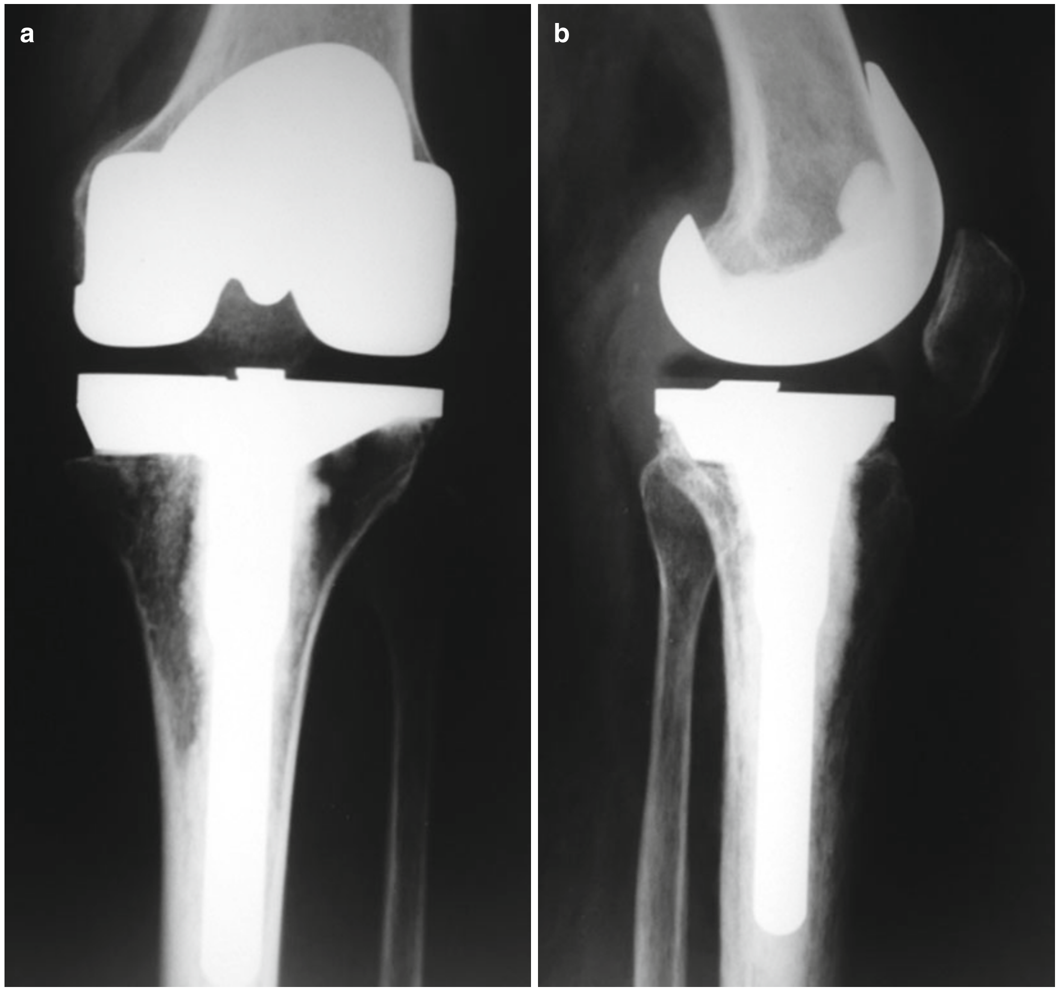


Fig. 28.18 Postoperative X-rays (**a**) AP and (**b**) lateral views

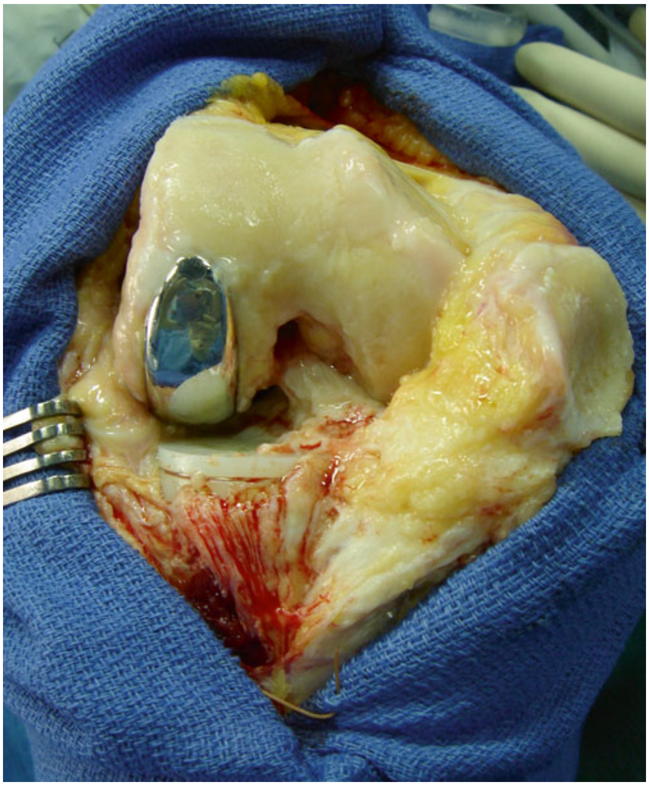


Fig. 28.19 Lateral parapatellar approach

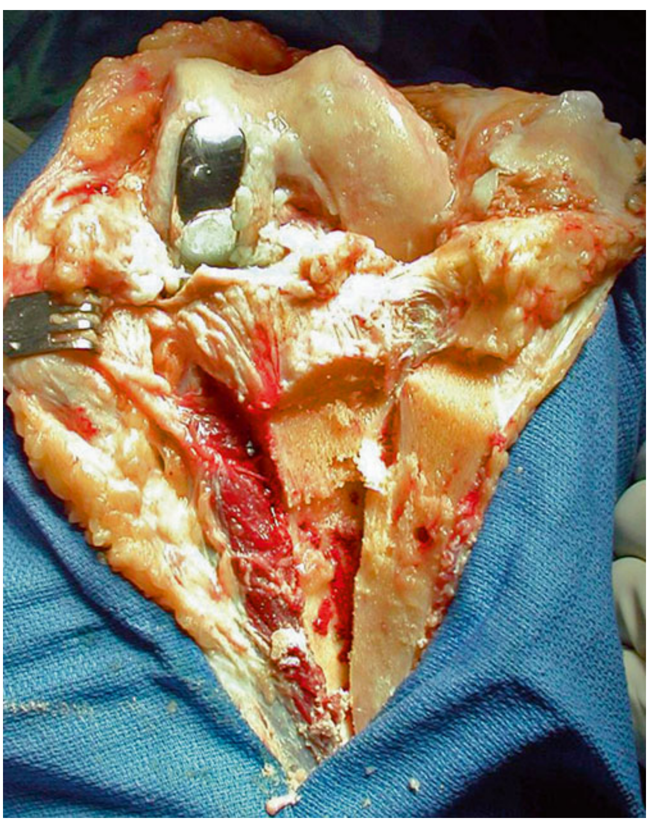


Fig. 28.20 Tibial tubercle osteotomy in case of difficult exposure

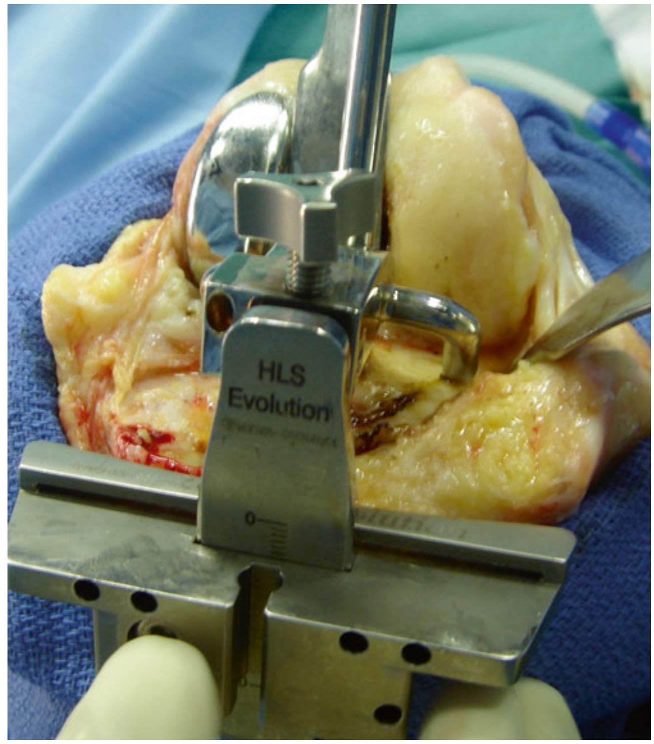


Fig. 28.21 Cutting guide positioning. The cut is 6 mm below the medial tibial plateau

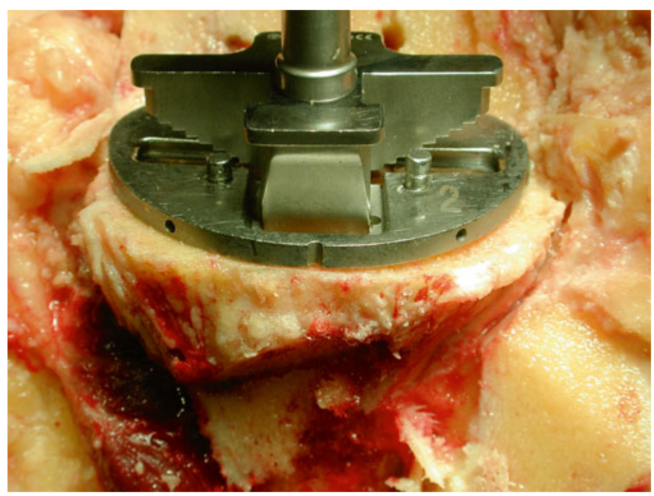
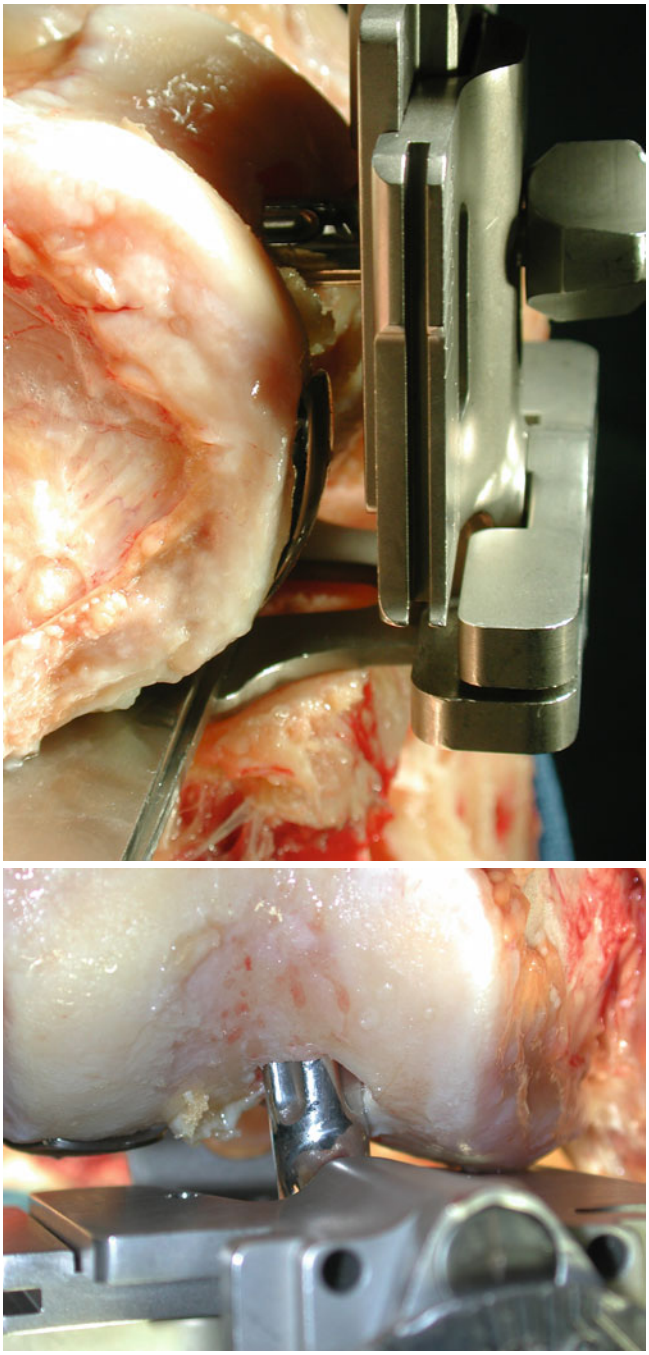


Fig. 28.22 Case of 8 mm cut below the medial tibial plateau. The tibial surface is now flat and augments are not required



Figs. 28.23 and 28.24 Femoral guide positioning: the contact is obtained between the guide and medial condyle

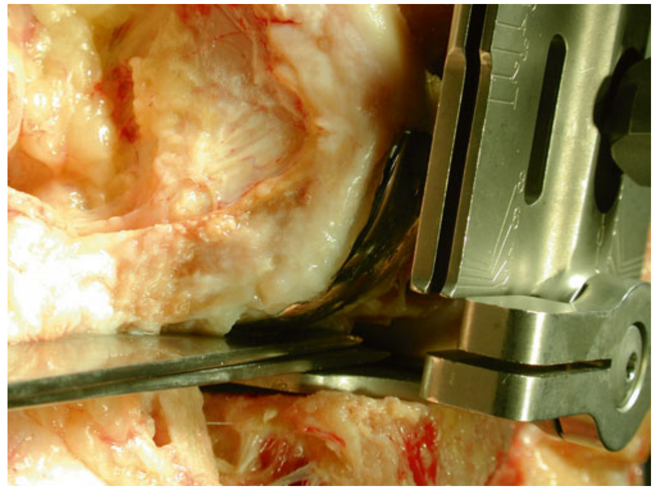


Fig. 28.25 External rotation achieved by placing one or more osteotomes between the posterior lateral condyle and the guide

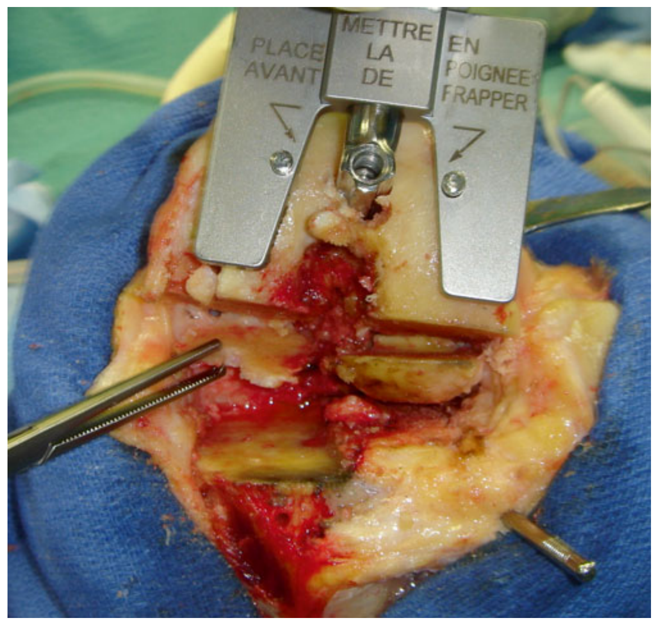


Fig. 28.26 Posterior cuts

Fig. 28.27 Distal femoral cut

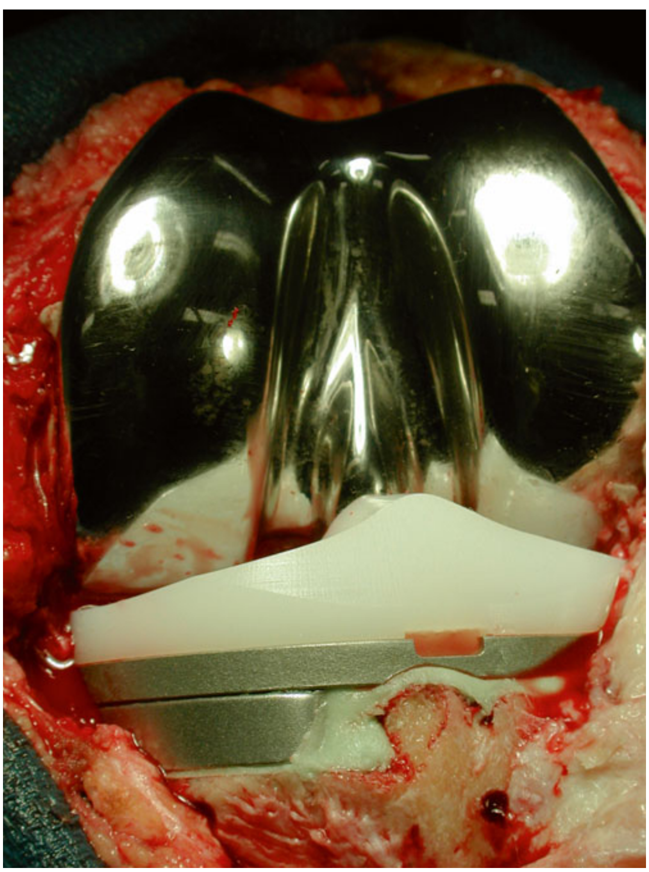


Fig. 28.28 Cemented implants

Arthroscopy and Unicompartmental Knee Arthroplasty

In case of unexplained pain after UKA, arthroscopy is a useful diagnostic and therapeutic tool. It helps diagnosis of:

- Meniscal lesions of the opposite compartment
- Impingement between the femoral implant and anterior tibial spine or patella
- Arthritis of native patellofemoral or tibiofemoral compartments (Fig. 28.29)
- Pain due to neo-meniscal formation
- Metallosis
- Integrity of the polyethylene

It also allows removal of extruded cement, fibrous scars, meniscal tissue (residual or neo-meniscus) (Figs. 28.30 and 28.31), or hypertrophic synovitis. Flexion and extension kinematics are also checked.

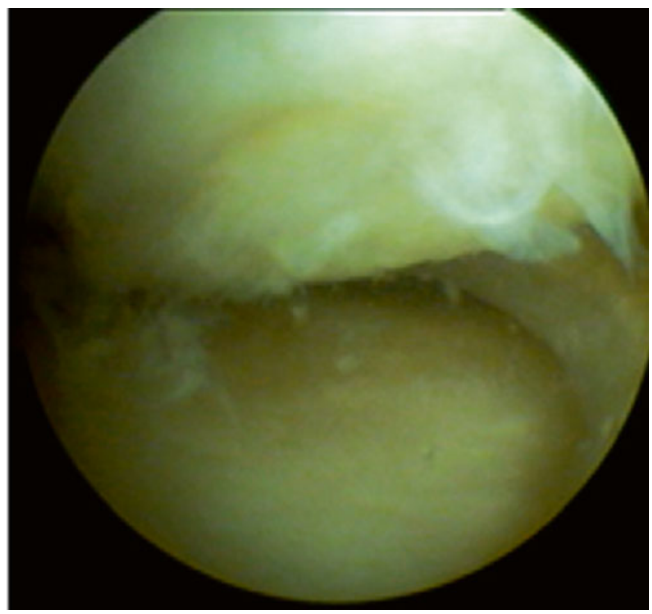


Fig. 28.29 Degenerative lesions of the contralateral compartment (arthroscopic view)

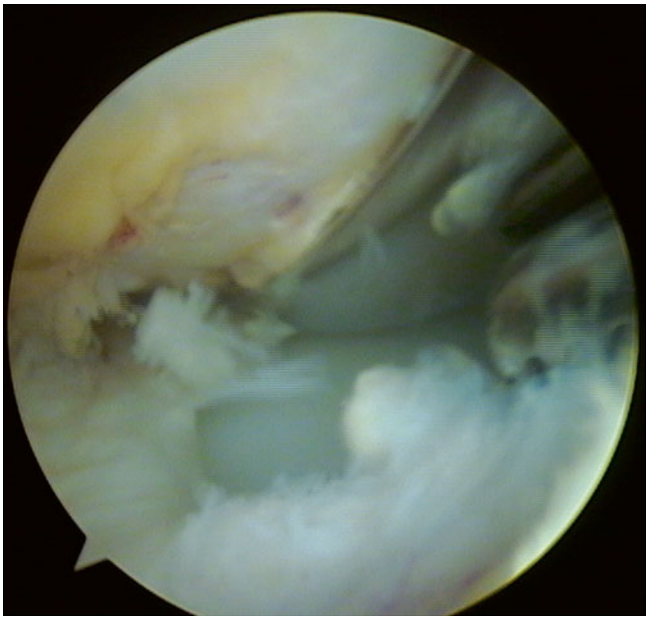


Fig. 28.30 Neo-meniscus (arthroscopic view)

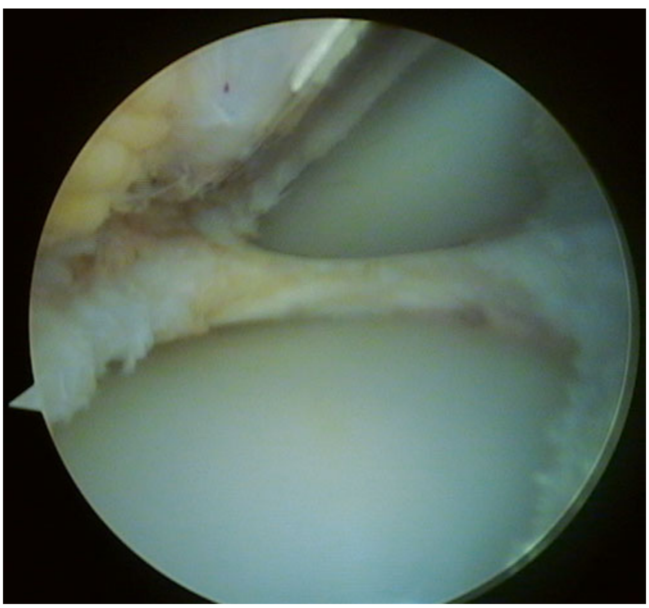


Fig. 28.31 Resection of the neo-meniscus (arthroscopic view)

Technique

The technique has been described in the chapter on Arthroscopy. Portal should be created carefully to prevent damaging the femoral component. Patellofemoral compartment exploration is done first to look for cartilaginous lesions, synovial hyperplasia, or impingement between the femoral component and patella. Care must be taken not to damage the tibiofemoral components with the arthroscope or the instruments.

The second step is exploration of the notch, with 90° of knee flexion. The ACL is palpated, and if Hoffa's fat pad is hypertrophied, it can be partially excised. The medial and lateral tibiofemoral compartments are explored by positioning the knee in valgus and then in the "figure of four" position.

Wear or metallosis may be present. Metallosis is very difficult to diagnose: indirect signs are synovial hypertrophy and polyethylene wear. It is very rare to see black synovium or synovial fluid. Component fixation and excess cement are checked. Loosening is sometimes obvious. However, it is difficult to know by palpation what moves: the implant alone (loosening) or the implant plus whole bone segment to which it is fixed. Anterior fibrosis is excised in order to check for any micromotion at the bone-implant tibial junction.

A contralateral meniscal lesion or meniscal proliferation (neo-meniscus previously described after total meniscectomy) can be excised. Care must be taken not to damage the polyethylene with the shaver. Postoperative care includes full weight bearing and early mobilization.

Revision of Unicompartmental Knee Arthroplasty to a Second Unicompartmental Knee Arthroplasty

Replacement of one of the two components only can be done in case of obvious malpositioning (Fig. 28.32) or oversized components creating joint pain (Fig. 28.33). However, the literature suggests a high rate or poor outcomes from such procedures and the patient should be informed of the risk of persistent pain.

Fig. 28.32 Malpositioning of the femoral component in varus

Fig. 28.33 Tibial component overhang

Technique

The initial surgical approach is reused. Biopsies are done to rule out infection. Look for wear or metallosis signs. The malpositioned implant is removed with an osteotome (Fig. 28.34), minimizing bone loss. Correction of malpositioning may require technical tricks such as the use of screw or augments (Figs. 28.35, 28.36, and 28.37). A TKA (with an augment and long keel) must be available in the operating room and the patient must be informed that revision may require a TKA.

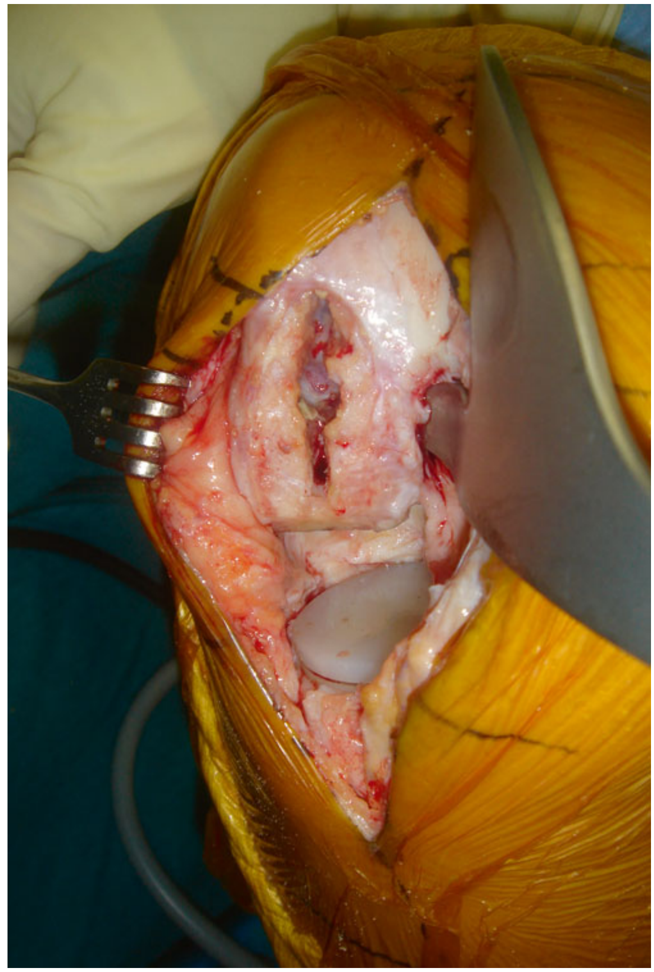
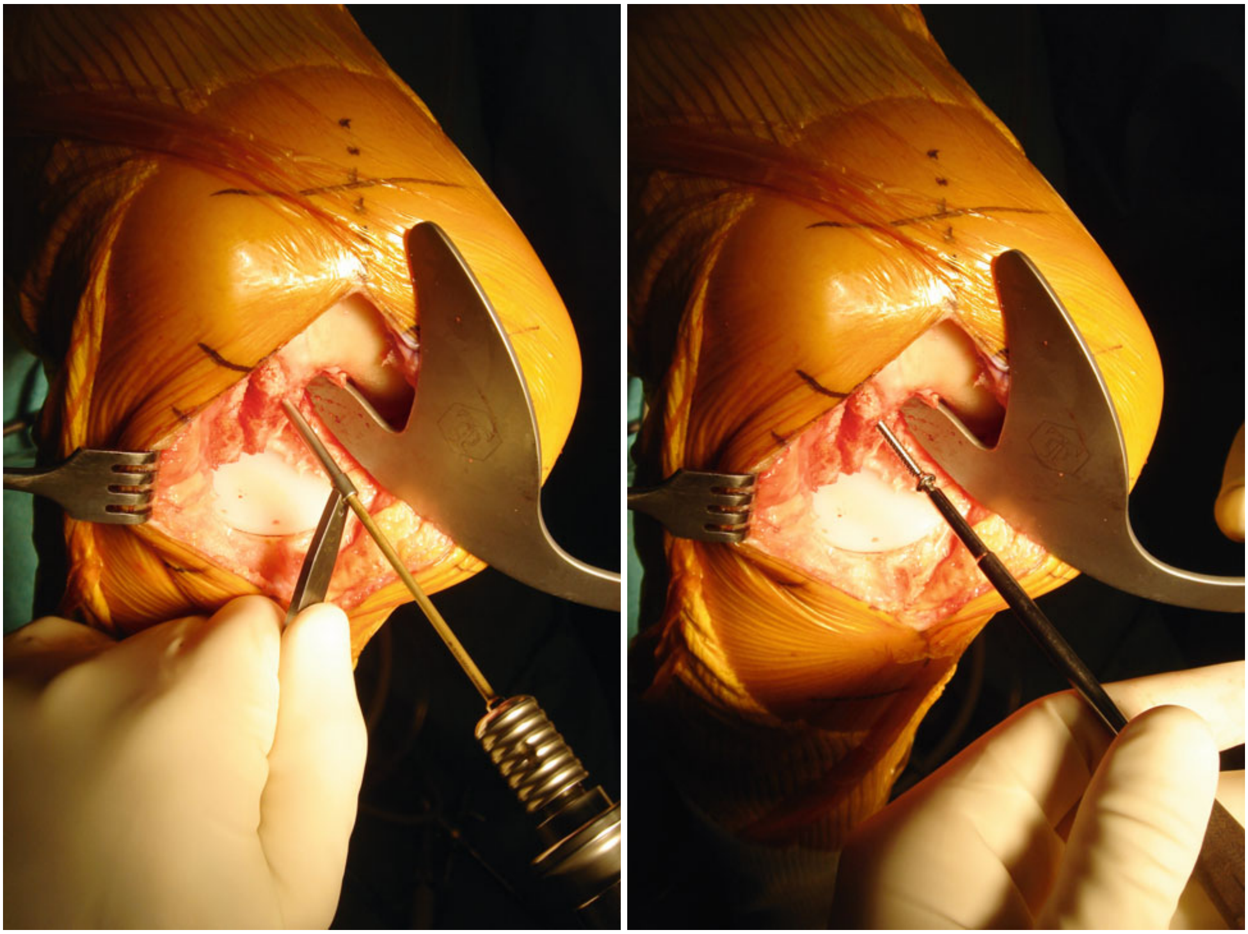


Fig. 28.34 Removal of the malpositioned implant with minimal bone loss



Figs. 28.35 and 28.36 Use of screw to correct the malpositioning (technical tricks)

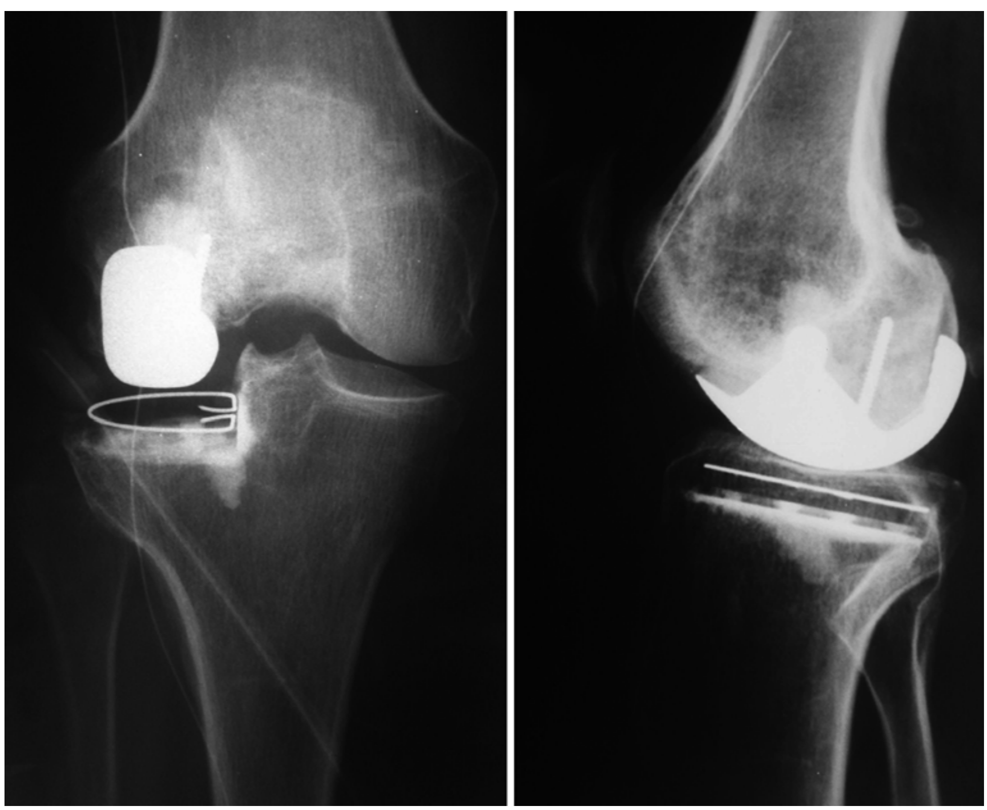


Fig. 28.37 Postoperative X-rays (see case Fig. 28.32)