Introduction

Unicondylar knee arthroplasty (UKA) was introduced in the early 1970s by Marmor [1]. There were many subsequent designs for the prostheses and many clinical studies were published in the late 1980s and the early 1990s [2–5]. Unfortunately, the results were not satisfactory, especially when they were compared to the results of total knee arthroplasty (TKA) [6–8]. In the early 1990s, Repicci developed the UKA as a minimally invasive surgery (MIS) [9]. Through his efforts, interest in the UKA increased, and the MIS technique became the common mode of surgery. The surgical approach was changed so that the UKA was no longer performed as a modified TKA. UKA does not include ligament releases, over-correction of the knee, or excessive flexion and extension gap tightness. With these modifications, UKA is now a well-accepted procedure for the properly chosen patient.

Preoperative Evaluation

The patient should be evaluated through a good history along with a thorough physical examination and proper X-ray studies. The patient’s pain should be localized to the medial or lateral tibiofemoral compartment. The symptoms should be reproducible and there should be no patellofemoral pain. It is often helpful to compare the pain with walking on level surfaces and on stairs or inclines. If the patient notices a difference in the intensity of the pain or the location with stair climbing, the patellofemoral joint is probably involved and the UKA is contra-indicated.

The physical examination should confirm the same location of the pain with tenderness on the joint line and no tenderness elsewhere. The ligaments of the knee should be intact; however, anterior cruciate ligament insufficiency is not an absolute contra-indication to UKA as long as a fixed bearing implant is chosen. The knee should have no deformity greater than 10° of varus, 15° of valgus, or a 10° flexion contracture. Ideally, the varus or valgus deformity should correct to neutral for greater ease of performing the surgery and obtaining proper laxity in flexion and extension with the UKA implant. The range of motion should be at least 110°.

The X-ray evaluation should include a standing anteroposterior view (Fig. 9.24) along with a lateral and patellofemoral view, such as a Merchant X-ray. It is ideal to have a full-length view of the limb from the hip to the ankle, but it is not mandatory. The standing X-ray is important for evaluation of the degree of medial or lateral narrowing along with any possible translocation of the tibial beneath the femur. Translocation indicates that there is some arthritic involvement of the opposite compartment and correlates with a thrust of the femur on the tibia through the stance phase of gait on the physical examination (Fig. 9.25). Translocation is a relative contra-indication to UKA. The standing X-ray should be used to measure the anatomic alignment of the limb. If the varus exceeds 10° or the valgus exceeds 15°, the UKA is contra-indicated. Argenson emphasizes that the deformity should be correctable to neutral and performs stress X-rays pre-operatively [10]. Almost all X-rays of the knee will show some involvement of the opposite compartment and of the patellofemoral joint. Insall stated that only 6% of knees would satisfy the requirements for UKA and that may indeed be true [11]. The author will accept some moderate involvement (Ahlback 1 or 2) [12] of the two other compartments of the knee, especially in the older population (age >80 years). However,
in the younger age group, it is best to adhere to strict criteria for the best results. The remaining compartments should have minimal arthritic changes.

**Operative Technique**

The author performs all of the UKA surgeries with an MIS technique. The medial approach uses an incision from the top of the patella to the tibial joint line (Fig. 9.26). If there is any need to extend this incision, it is best to do so proximally. The capsule is opened in a parallel technique to the skin incision, avoiding the vastus medialis and the quadriceps tendon. The deep medial collateral ligament is released from the tibial joint line for the purposes of exposure only and not for correction of the existing varus. The medial joint is debrided and the intramedullary hole is made on the femoral side just above the roof of the intercondylar notch. The intramedullary guide is inserted and the distal cutting guide is attached (Fig. 9.27). The standard cut removes 6 mm of bone which matches the thickness of the femoral implant. The angle of this cut is determined by the difference between the anatomic and biomechanical axis of the limb. For most clinical purposes, the varus knee requires a 4° angle and the valgus knee uses a 6° angle. The tibial cutting guide is extramedullary and aligns with the tibial tubercle and the prominence of the tibial shaft (Fig. 9.28). The horizontal cut is made 2–3 mm below the lowest surface, perpendicular to the tibial shaft, and sloped from anterior to posterior to...
match the pre-existing slope of the tibia that has been measured on the pre-operative lateral X-ray of the knee. Once the proximal tibial cut has been completed, the distal femur is easier to approach and the surface is sized for the correct cutting block. If the bone surface is between two sizes, it is always best to use the smaller size to avoid impingement on the patellofemoral surface. The femoral component should be set perpendicular to the tibial cut surface in full extension and in 90° of flexion. If the femoral condyles have an increased divergence angle, the component should not be placed anatomically on the cut surface because this will lead to edge loading of the femoral runner on the polyethylene. The runner should still be placed perpendicular to the tibial surface even if this leads to slight overhang into the femoral notch (Fig. 9.29). The final femoral cuts and peg holes are completed and, then, the tibial surface can be sized. External rotation of the knee at 90° of flexion brings the tibia forward and makes the exposure much easier. The tibial tray should cover the entire surface to rest on the remaining cortical rim for good support but should not overhang, especially medially, where it can cause irritation of the medial collateral ligament and pain. Once all of the cuts are completed, a trial reduction should be performed. The knee should come to full extension and full flexion with 2 mm of laxity at full extension and 90° of flexion (Fig. 9.30). The pre-operative varus or valgus should be partially corrected but not fully. That is, if the pre-operative knee has 6° of varus it will commonly have about 2° of varus after the surgery. A 15° valgus knee should have about 10–12° of valgus after the operation.

During the course of the surgery, the extension and flexion gaps are compared similarly to TKA. The laxity in the two positions should be 2 mm. After all of the cuts have been completed in the UKA, it is easiest to correct on the tibial side. If the extension gap is too tight, the tibial cut can be deepened anteriorly and left the same pos-
Fig. 9.30a, b. The UKA should have 2 mm of laxity, measured with this type of tongue depressor, in full extension (a) and in 90° of flexion (b).

Fig. 9.31. Line A is the standard slope cut and line B is the cut slightly deeper at the anterior aspect with the same depth posteriorly. Line B will increase the extension space, correcting a flexion contracture, without affecting the flexion gap.

Fig. 9.32. The anatomic valgus of this distal femur is 10°. If the knee had a flexion contracture, an additional 2 mm of bone could be resected from the femur correcting the contracture and decreasing some of the excess distal femoral valgus.

Flexion contractures of up to 10° can be corrected in the varus knee. The author measures the anatomic valgus of the distal femur on the pre-operative standing X-ray (Fig. 9.32). If the valgus is 6° or more, an additional 2 mm of bone can be resected from the distal femur. This corrects the flexion contract even though the cut is only made on one condyle and it reduces some of the excess femoral valgus. If the femoral valgus is 5° or less, the flexion contracture is corrected by making the tibial cut slightly deeper anteriorly with less slope posteriorly. In the valgus knee, modification of the cuts is not applicable, and the standard operative approach should be applied with a vertical, lateral MIS incision.
The capsule is closed with a drain in the knee joint. Proper tracking of the patella is confirmed after the closure.

Physical therapy is instituted a few hours after the surgery and the patients are discharged home the next day. Fondaparinux (Arixtra) \cite{13, 14} is used for anticoagulation starting at 8 a.m. the day after surgery. The pentasaccharide is continued for 10 days and bilateral Doppler ultrasounds are performed before discontinuing the agent. Outpatient physical therapy is continued for about 6 weeks after the surgery.

## Results

The author has performed more than 300 UKAs over the past 4 years. The first 63 knees are now 3 years after surgery. The average age of the entire group is 67 with 25% below the age of 60 and 25% above the age of 75. The medical complications for the entire group include one fatal pulmonary embolism (prompting us to move from aspirin to fondaparinux for anticoagulation) and one proximal femoral DVT (also on aspirin at the time). The orthopedic complications include: two tibial fractures that occurred after the surgery and did not displace or require re-operation, one femoral loosening secondary to sizing, one patellar subluxation leading to revision TKA, and two knees with persistent patellofemoral pain leading to revision TKA. There have been no manipulations or knees with decreased range of motion.

Approximately 2 years ago, the author switched anticoagulation from aspirin to fondaparinux. The TKAs are usually anticoagulated with a low-dose coumadin technique. It was difficult to anticoagulate the UKAs with coumadin because of the early discharge protocol with the MIS surgery. Initially, aspirin was the chosen agent. However, the early fatal pulmonary embolism caused us to re-evaluate our routine for DVT protection. 55 consecutive patients have been anticoagulated with fondaparinux over the past 20 months and all of the bilateral Doppler ultrasound studies performed at 10 days after the surgery have been negative for any clot at all. The TKAs anticoagulated with low-dose coumadin have a positive DVT incidence of 18% below the knee and 7% in the thigh.

The incidence of re-operation, thus far, is 1.3% (4 knees in 300). It is interesting that all four of the knees that required revision had symptoms within the first 12 months of the initial surgery. No knee has developed new symptoms of pain after the first year. It appears that a successful UKA that is 18 months to 2 years after surgery will last for many years to come.

**References**