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Minimally Invasive Surgery for Unicondylar Knee Arthroplasty: The Bone-Sparing Technique

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When considering treatment options for osteoarthritis of the knee, the pathology and progression of the disease must be considered. Past studies examining osteoarthritis of the knee have demonstrated that the disease is slow, progressive, and typically limited to the medial tibiofemoral compartment.[1–4] Moreover, the erosion of cartilage in the medial compartment is almost always limited to the anterior half of the medial tibial plateau and the corresponding contact area on the distal portion of the medial femoral condylar.[4] Anteromedial osteoarthritis was coined by White et al. to describe this distinct clinicopathological condition.[4] The ensuing anatomic defect, namely, loss of articular cartilage in the extension gap with no corresponding loss of articular cartilage in the flexion gap, results in a 6-mm to 8-mm disparity between the extension and flexion gaps. For this reason, medial osteoarthritis also may be considered an extension gap disease (Figure 12.1). The joint surface asymmetry also accounts for the varus alignment and lateral tibial thrust commonly associated with medial unicompartmental osteoarthritis. At this stage in the disease process, the medial meniscus is either partially torn or completely compromised and tension is compromised in the anterior cruciate (ACL) and medial collateral (MCL) ligaments.[5] To compensate for the varus deformity, a sclerotic layer of bone, or medial tibial buttress is formed. As varus angulation increases, the medial tibial buttress hypertrophies to resist the increasing varus stresses. Although this may appear to be a rather inefficient solution, this layer of sclerotic bone allows the medial compartment to withstand joint loading and to support weight, permitting continued ambulation for 10 to 19 years after initiation of the disease.[3] Eventually, however, patients experience weight-bearing pain as a result of the plastic deformation of bone at the articular surface, instability because of ligamentous laxity, and mechanical symptoms due to meniscal damage.[5]

The clinical presentation of this early, unicompartmental form of osteoarthritis must be differentiated from that of patients with more advanced forms of the disease. The pain associated with the tricompartmental form of the disease often is so debilitating that activities of daily living are severely restricted, independence is lost, and ambula-

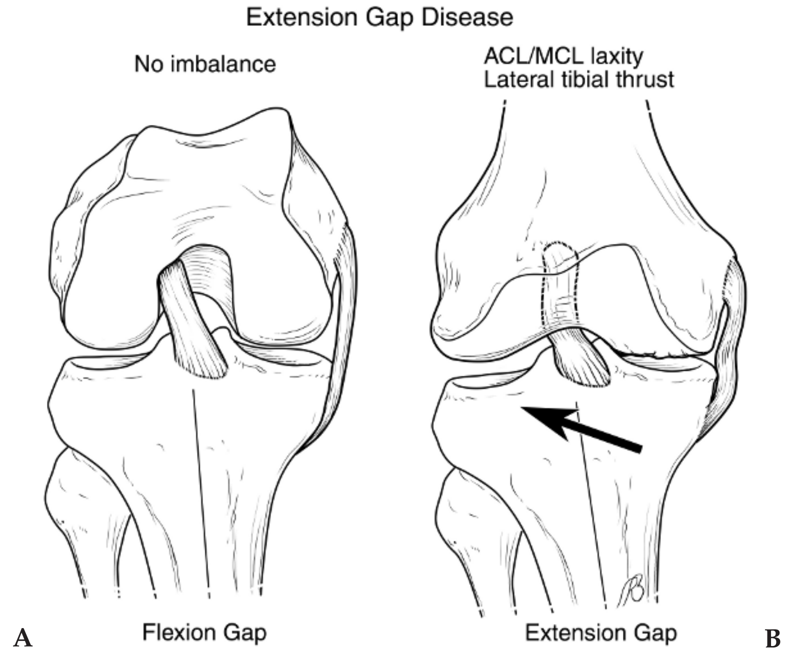


Figure 12.1. Medial unicompartmental osteoarthritis is an extension gap disease. (A) There is no articular surface loss in the flexion gap. (B) In contrast, a loss of approximately 5 mm is present in the extension gap. This narrowing of the medial compartment joint space is evident on radiographic evaluation and is responsible for ACL and MCL laxity, the lateral tibial thrust, or varus deformity, present in the extension gap, and the absence of deformity in the flexion gap, which are all clinical observations characteristic of medial unicompartmental osteoarthritis.

tory aids, such as crutches, a walker, or wheelchair, are required. For these patients, total knee arthroplasty (TKA) is the most appropriate surgical option to relieve pain and to restore some degree of independence. Fortunately, however, unicompartmental osteoarthritis is far more prevalent than the tricompartmental form of the disease[1,3] and the associated pain usually is not as disabling. In general, patients exhibiting unicompartmental osteoarthritis are more active than those with the tricompartmental variant and, therefore, are not satisfied with simple pain relief. These patients typically are inconvenienced by their pain and are seeking restoration of function and a return to activities of daily living. Unicompartmental knee arthroplasty (UKA) is a viable surgical option for many of these patients, as it addresses articular surface pathology, restores anatomic alignment, and reinstates appropriate tension to the ACL and MCL. Utilization of a resurfacing UKA design preserves the medial tibial buttress, which provides peripheral support for the inlay tibial component. Combining a minimally invasive surgical technique with UKA avoids soft tissue trauma, which greatly reduces rehabilitation time and the need for formal postoperative physical therapy,[6–8] making the procedure an even more appealing option to many patients.

Patient Selection

One of the most significant factors contributing to UKA success, whether minimally invasive or traditional techniques are employed, is proper patient selection. According to the senior author's selection criteria, all patients between 50 and 90 years of age who are diagnosed with osteoarthritis and have failed nonoperative treatment are candidates for UKA if presenting with weight-bearing pain that significantly impairs quality of life. Radiographic assessment identifies pathological changes and establishes the extent of osteoarthritis, whereas the preoperative physical examination determines the degree of pain, function, and deformity. In addition, patient discussion identifies restrictions in the activities of daily living, as well as occupational and recreational demands, which are of particular significance in electing UKA.[9,10] Although this preoperative evaluation assists in selecting potential UKA candidates, the decision to perform UKA may only be finalized at the time of surgery, at which point the status of the contralateral compartment and meniscus may be evaluated.

Weight-bearing anteroposterior, lateral, and patellofemoral radiographs, in addition to Ahlback classification to grade the progression of medial compartment disease,[1,11] are critical components of the patient selection process. The anatomic tibiofemoral alignment averages 6 degrees varus for medial disease.[5] Osteoarthritis must be confined to a single tibiofemoral compartment on weight-bearing radiograph. Studies have suggested that some degenerative changes in the contralateral compartment are permissible and do not adversely affect the results of UKA, provided that the articular cartilage on weight-bearing surface of the contralateral compartment appears adequate.[12–16] Large osteophytes on the femoral condyle of the uninvolved compartment, however, may be indicative of bi- or tricompartmental disease, so, if present, the surgeon should be prepared to perform a TKA.[15,17,18] During the course of medial osteoarthritis, the joint line becomes elevated by several millimeters in the weight-bearing position, which consequently affects the patellofemoral compartment. As a result, most patients with medial osteoarthritis also exhibit an altered patellofemoral compartment, which is not a contraindication for UKA.[12,15,16] If, however, the Merchant's view demonstrates sclerosis with loss of lateral patellofemoral joint space, UKA should not be considered.[5] Most patients selected for UKA demonstrate Ahlback stage 2 (absence of joint line) or stage 3 (minor bone attrition), but the procedure may be considered in select cases with Ahlback stage 4 (moderate bone attrition).[5] Patients with Ahlback stage 1 disease are too early in the disease process to be considered for UKA; patients with Ahlback stage 5 have advanced osteoarthritis with gross bone attrition and, therefore, are better treated with TKA.[5]

All patients with Ahlback stage 2, 3, or 4 osteoarthritis are candidates if range of motion is at least 10 to 90 degrees.[19] Instability, including a compromised anterior cruciate ligament (ACL), is a relative contraindication to medial UKA,[14,18–23] but an absolute contraindication to lateral UKA.[19] Absolute contraindications include rheumatoid arthritis, extensive avascular necrosis, and active or recent infection.[19] As long as absolute indications are met, certain relative contraindications, including obesity and high activity, do not appear critical in determining UKA survivorship.[23–25] According to Sisto et al. the key to UKA success is to be absolutely certain that the osteoarthritic process is confined only to the involved compartment that is to be replaced.[26] In this context, a surgeon may elect to perform UKA in spite of relative contraindication(s), as long as the surgeon and patient are aware that the survivorship of the prosthesis may be affected.

Although other surgeons may recommend adherence to strict selection criteria,[27–30] concentrating on absolute indications and contraindications, the senior author follows a broad approach,[8,19] focusing on patient choice rather than on definitive criteria. According to this serial prosthetic replacement concept, UKA is used to treat patients with unicompartmental osteoarthritis who wish to avoid or postpone UKA. The objective is to delay the need for TKA, either indefinitely or for as long as possible, so that if TKA use is required, the UKA may be converted to a primary TKA, which may survive the duration of the patient's life. The use of UKA in this context is minimally invasive in that it is less aggressive than TKA. After other conservative treatment modalities have failed, UKA is inserted in a segmental fashion into the middle of a disease process and, consequently, is considered as the last reconstructive procedure. TKA, on the other hand, is a salvage procedure, signifying the end of the disease process and marking the beginning of a new predictable construct.

In the senior author's twenty years of implementing UKA, patients readily accept the concept of a temporizing arthritic bypass to delay or prevent TKA. When patients exhibiting unicompartmental osteoarthritis are given a choice between UKA and TKA, they tend to choose the less invasive procedure.[8,19] In addition, based on the preoperative discussion, most patients understand that, when used under broad indications, UKA may require conversion to TKA. Because most patients with unicompartmental osteoarthritis are inconvenienced by pain, but remain involved in leisure or professional pursuits, many are interested in UKA as a means of reducing their symptoms, while avoiding or postponing UKA.

Surgical Technique

The surgical technique for performing minimally invasive UKA with medial inlay preparation has been described previously[31] and is summarized, focusing on medial implantation, the most common indication for UKA. The goal of the procedure is to replace one tibiofemoral compartment and to subsequently balance the forces so that the opposite compartment and replaced compartment equally share the weight. General, spinal, or regional anesthesia may be implemented. The anesthesia team must, however, be cognizant of the goal for out-patient or short-stay rehabilitation, which requires the patient to begin physical therapy and walking within 2 to 4 hours postsurgery. Patient preparation and closure are performed per standard protocols. The patient is placed in a supine position and a thigh holder with an arterial tourniquet set at 300 mm Hg is used to secure the leg. A standard operating table is used, with the foot end of the table in a flexed position. In order to accomplish the minimally invasive surgical approach, continuous repositioning of the knee will be required throughout the surgical procedure to optimize visualization, as certain structures are better visualized at low or high degrees of flexion. Because the knee must be positioned from 0 degrees to 120 degrees of flexion, the lower leg and knee are drape free.

Diagnostic Arthroscopy

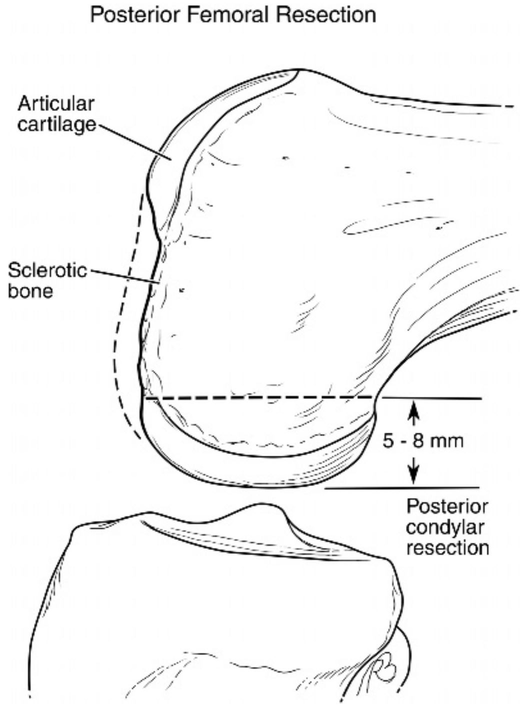
Before beginning the UKA procedure, arthroscopy is used to corroborate the preoperative diagnosis of unicompartmental osteoarthritis by verifying that the contralateral compartment is unaffected. The status of the contralateral meniscus also must be assessed at this time, because it cannot be visualized through the flexion gap during the open procedure. In addition, the extent of medial compartment damage and the status of the ACL should be observed. The arthroscope is introduced through a medial portal. The UKA procedure should proceed only if the osteoarthritis is limited to one tibiofemoral compartment and the contralateral meniscus is functional. If the disease is more progressive, the surgeon must be prepared to perform a TKA, the potential of which should be preoperatively discussed and consented to by the patient.

Exposure with Posterior Femoral Condyle Resection

To proceed with the UKA, a limited 7-cm to 10-cm skin incision is made from the superomedial edge of the patella to the proximal tibial region, incorporating the arthroscopic portal (Figure 12.2). A subcutaneous dissection, producing a 2-cm to 5-cm skip flap surrounding the entire incision improves skin mobility and visualization. A medial parapatellar capsular arthrotomy, from the superior pole of the patella to the tibia, is produced. A 2-cm transverse release of the vastus medialis further enhances visualization. If additional exposure of the femoral condyle is required, 2-cm to 3-cm of medial patellar osteophyte may be resected with a sagittal saw.

The medial parapatellar capsular arthrotomy does not violate the extensor mechanism and does not dislocate the patella, which is fundamental to the minimally invasive surgical technique. By avoiding patellar dislocation, the suprapatellar pouch remains intact and able to unfold the required four times in length when the knee is flexed 90 degrees.[5,32] The patellar eversion that occurs during traditional open TKA and UKA procedures damages the suprapatellar pouch, thereby necessitating extensive physical therapy to reverse the iatrogenic damage.

Because medial compartmental osteoarthritis is an extension gap disease (see Figure 12.1), there is no defect in the flexion gap, which necessitates the creation of approximately 10 mm of space in the flexion gap to accommodate the prosthesis. A 5-mm to 8-mm resection of the posterior femoral condyle is the first step in generating space for insertion of the prosthesis. The articular defect is located at the distal femur



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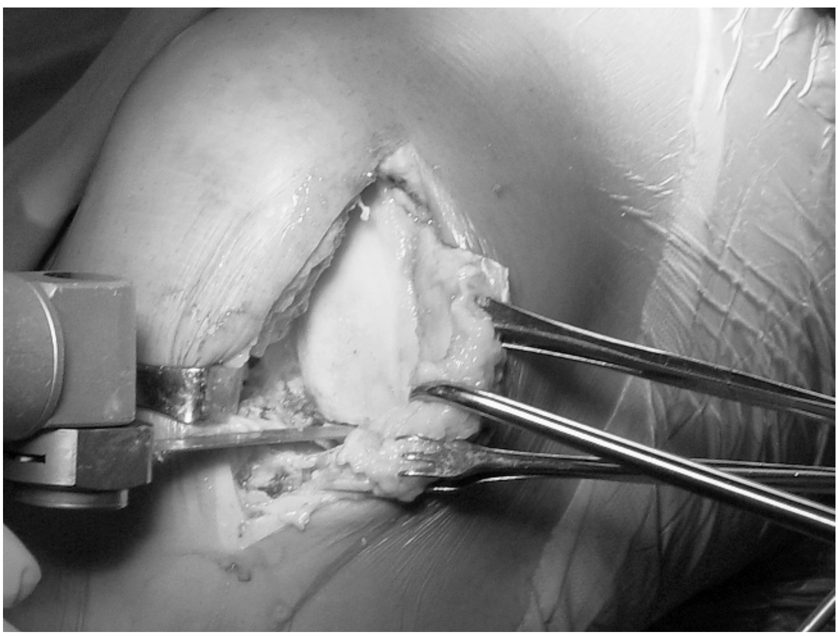

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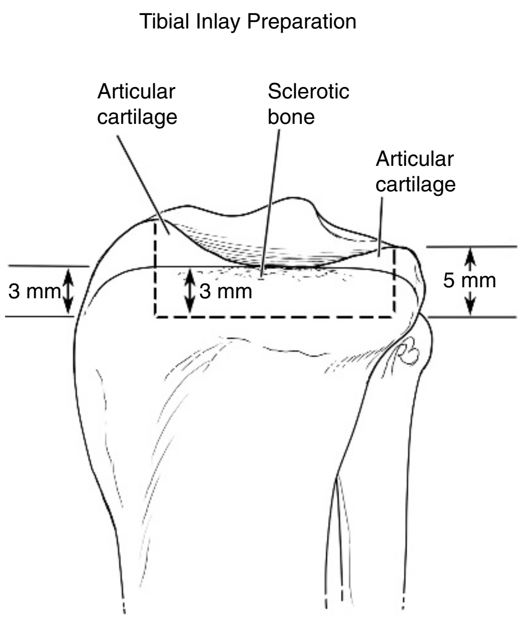
Figure 12.2. (A and B) Exposure with posterior femoral condyle resection.

and the anterior tibia. When the knee is flexed 90 degrees, the femur rolls back onto the tibia, exposing an area of preserved articular cartilage. This area of retained cartilage is an excellent reference point for reconstruction.

Distraction with Tibial Inlay Preparation and Resection

To improve visualization of the tibial plateau, curved distractor pins are placed at the femoral and tibial levels to allow placement of a joint distractor (Figure 12.3). Tibial bone adjacent to the posterior tibial rim is resected with a high-speed burr to create the additional 4-mm to



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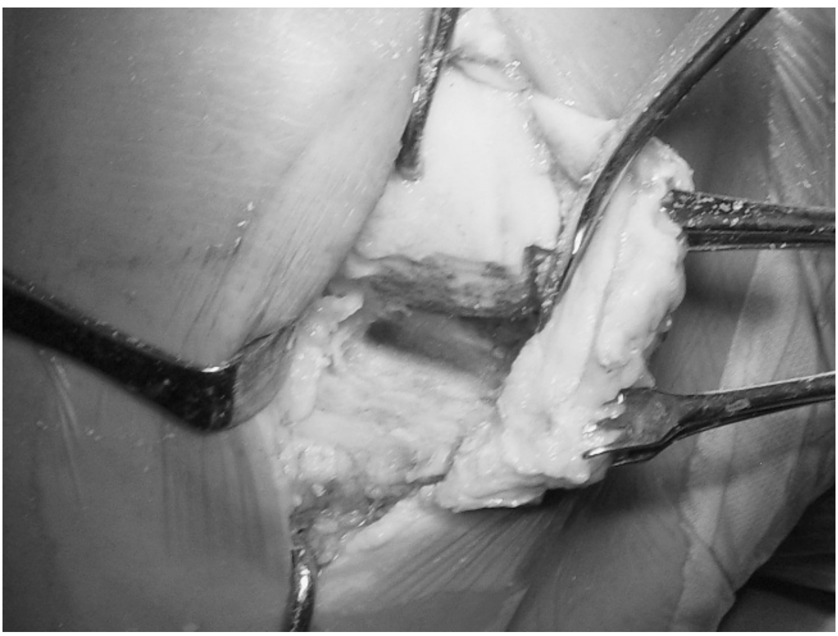

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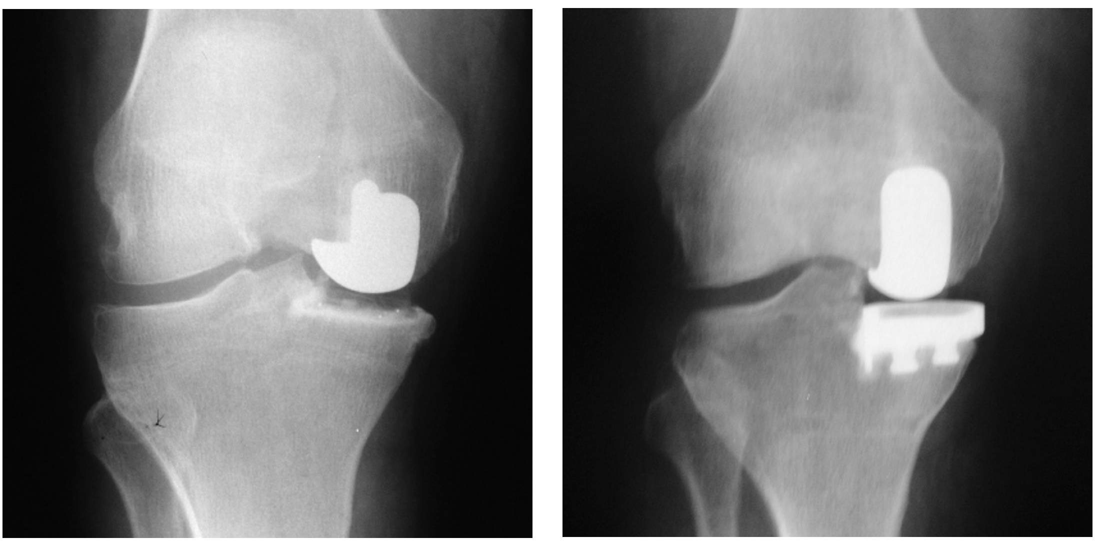
Figure 12.3. (A and B) Distraction with tibial inlay preparation and resection.

5-mm of space in the flexion gap necessary for prosthetic insertion. To preserve the medial tibial buttress, the burr only is buried at a half-depth (3 mm) at the anterior tibial region, which corresponds to the area of articular cartilage loss and sclerotic bone formation. In addition, a 2-mm to 3-mm circumferential rim of tibial bone is preserved to aid in stabilizing the component. This careful resection process creates a bed for the all-polyethylene tibial inlay component. A crosshatch is created at the anterior tibial level, which is the natural location of femoral-weight transfer. The tibial inlay component may be fitted and adjusted as necessary.

By preserving the layer of sclerotic bone, a stable platform for the tibial component is created and medial tibial bone loss is minimized, which is a major cause of UKA revision.[33,34] The importance of protecting this medial tibial buttress may be likened to the preservation of the posterior acetabular rim in total hip arthroplasty in that, if lost, future reconstruction is severely compromised. Therefore, the use of a resurfacing UKA design that implements a tibial inlay component and preserves the medial tibial buttress is advantageous compared to the use of a UKA design that requires saw-cut resections and sacrifices the valuable layer of sclerotic bone (Figure 12.4).

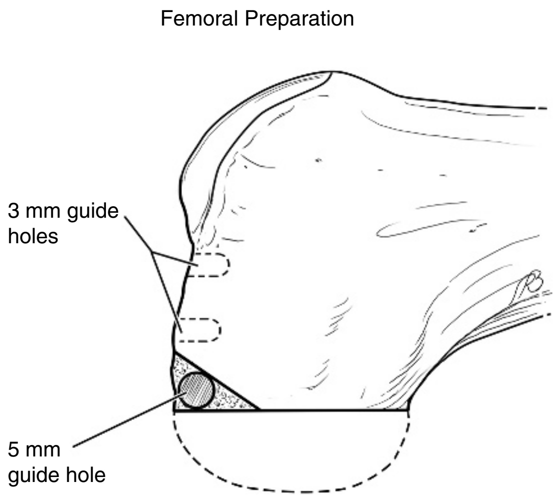


A B

Figure 12.4. Inlay all-polyethylene versus saw-cut tibial component. AP weight-bearing postoperative radiographs of knee joints exhibiting Ahlback 3 osteoarthritis with complete loss of medial joint space. (A) Limited bone resection and preservation of the medial tibial buttress associated with the use of the inlay all-polyethylene tibial component. (B) More aggressive bone resection and corresponding medial tibial buttress sacrifice required with the use of saw-cut polyethylene designs.

Femoral Preparation and Resection

To prepare for femoral component insertion, the 5.5-mm round burr is used to drill to a half-depth of 3 mm into the femoral extension gap surface, which will serve as a depth gauge (Figure 12.5). Next, an additional full-depth of 5 mm is created at the junction with the previous saw cut and the distal femoral surface, which will allow the curved portion of the femoral component to set midway between the



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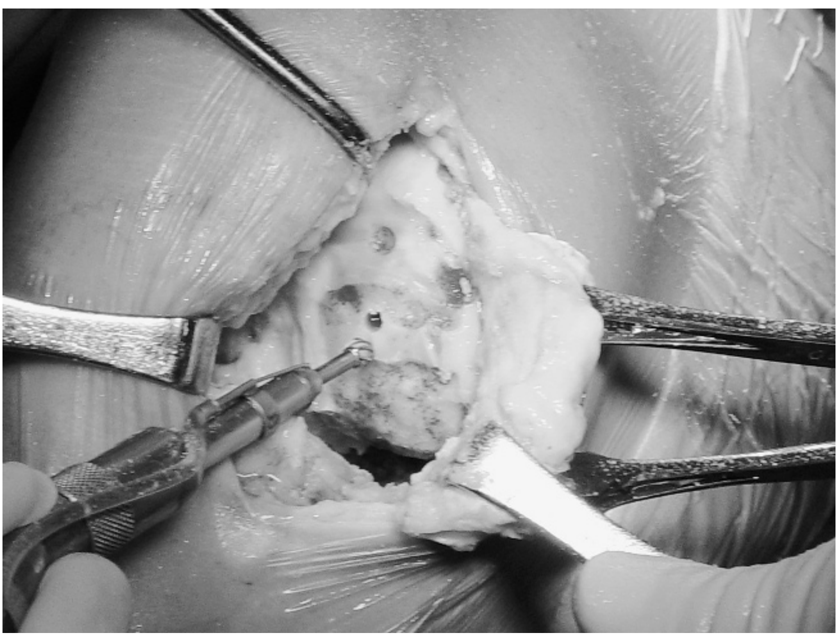

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Figure 12.5. (A and B) Femoral preparation and resection.

flexion and extension gaps (45-degree flexion position). Bulk bone is removed with the burr. By performing the femoral resection in this manner, adequate space for the component is created, while preventing settling.

Femoral-Tibial Alignment

Methylene blue marks on the sclerotic tibial bone and on the corresponding area of the femoral condyle are created with the knee in full extension and flexion to indicate the desired center of rotation, or contact point, of the femoral component in relation to the tibial component and to indicate the desired center point of the femoral component (Figure 12.6). A femoral drill guide, manufactured with a large central slot to visualize component alignment, is inserted to assist in this alignment process. A sagittal saw or side-cutting burr may be used to create a keel-slot for the fin of the femoral component referencing the methylene blue markings. The trial femoral component is placed using the femoral inserter.

Trial Reduction and Local Anesthetic Injection

Trial reduction is performed to evaluate range of motion through 115 degrees of flexion and to assess soft-tissue balance (Figure 12.7). Lack of complete extension or flexion indicates inadequate tibial or femoral preparations. Insertion and proper alignment of appropriately sized implants should result in ligament balancing. If, however, the ligaments are tight only in the extension gap, tension may be adjusted by further bone removal at the distal femoral level. Tension in both the flexion and extension gaps requires additional tibial bone resection, as previously described, in 1 mm increments until proper tension is achieved.

When satisfactory range of motion and proper soft tissue balancing is achieved, the trial components are removed, the joint is irrigated thoroughly, and a dry field is established. At this stage, the femoral and tibial preparations will be visible. Prior to component insertion, all incised tissues are infiltrated with anesthesia (0.25% bupivacaine and 0.5% epinephrine solution) for postoperative pain relief and hemostasis.

Component Insertion and Final Preparation

Methylmethacrylate cement is used to insert all components into gauze-dried bone after irrigation with pulse lavage and antibiotic solution (Figure 12.8). Sponge packs are placed in the suprapatellar pouch, posterior to the femoral condyle, and on the femoral and tibial surfaces to dry the field and to aid in cement removal. Excess cement should be removed from the posterior recess and perimeter of the tibial component after insertion, but before femoral component placement, using a narrow nerve hook. Following femoral component insertion, excess cement should be removed from the perimeter using a dental pick. Following final prosthetic implantation, range of motion should be performed to evaluate the flexion-extension gaps. The cement is cured with the knee in full extension. Once the cement mantle has hardened,

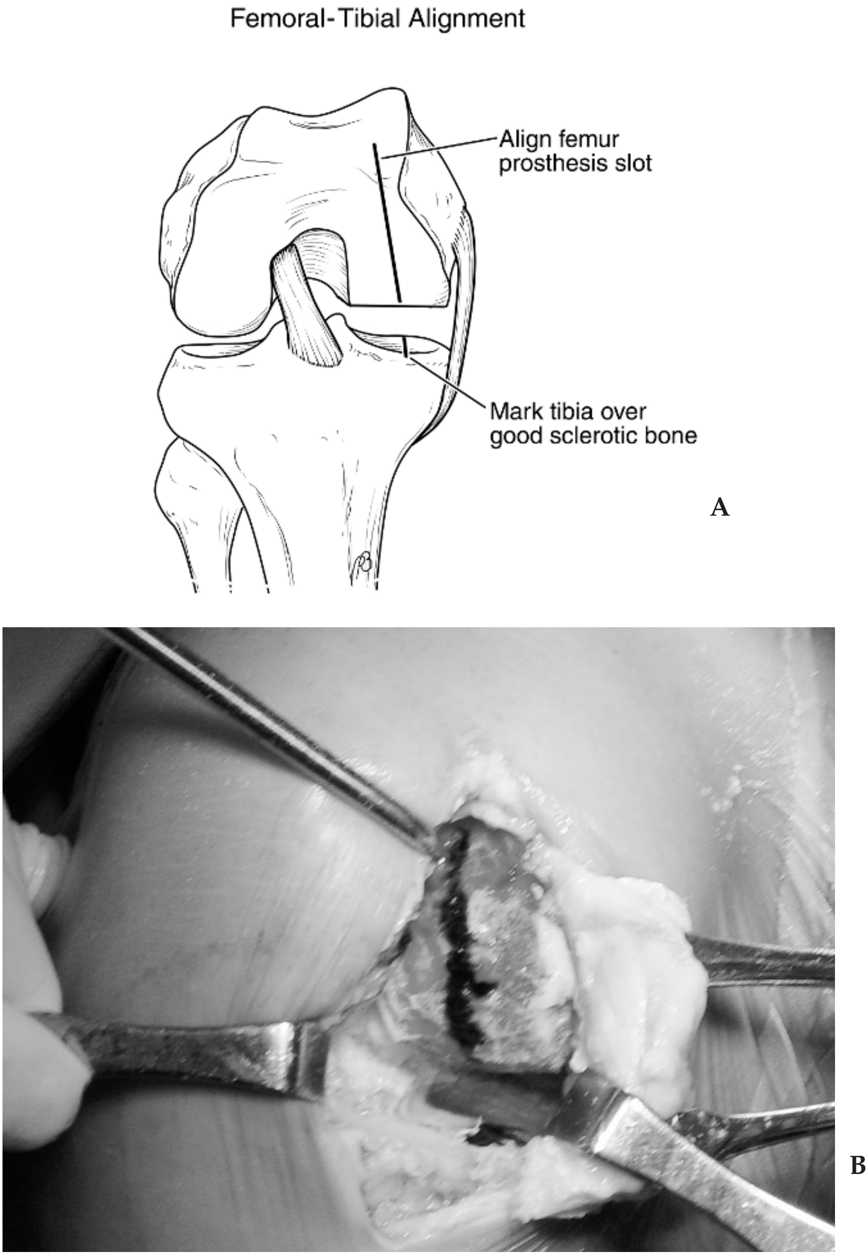

Figure 12.6. (A and B) Femoral-tibial alignment.

Figure 12.7. Local anesthetic injection.

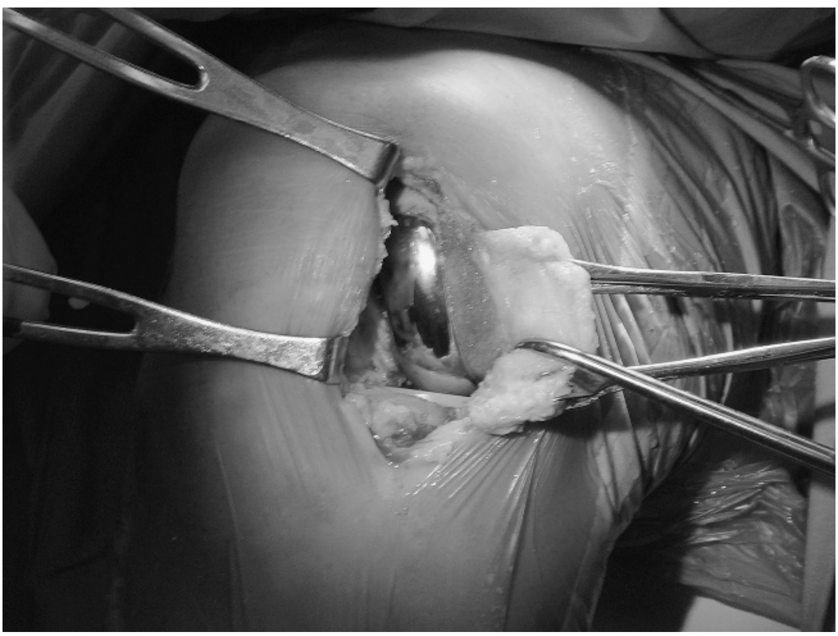

Figure 12.8. Implantation of UKA resurfacing prosthesis.

any remaining osteophytes should be removed. If necessary, patella contouring or notchplasty may be performed. As a final step, the joint should be thoroughly irrigated with sterile saline. The tourniquet then is deflated and hemostasis is achieved with electrocautery. A tube drain is inserted into the contralateral compartment via a stab wound. Capsular closure is performed with 0-Vicryl suture (Ethicon Company; Somerville, NJ). The skin is closed with subcuticular 0-prolene suture and sterile dressing. Before exiting the operating room, final knee preparation involves applying a circumferential ice cuff, a pneumatic compression device, and an immobilizer.

Avoiding Complications

The minimally invasive surgical technique described previously provides adequate visualization to effectively perform UKA. If, however, visualization or technique is compromised at any point, the technique should be converted from the minimally invasive approach to an open procedure, with full dislocation of the patella.

Many of the surgical errors associated with early UKA failures are avoidable. The most common error associated with resurfacing UKA is overly aggressive resection of the tibial surface.[5] Maintaining the medial tibial buttress is crucial, which may require slight varus positioning of the tibial component. If the sclerotic layer of bone is broached, the all-polyethylene tibial inlay component will subside into the proximal tibia. Another frequent error in resurfacing UKA is using an undersized tibial component, which will cause the femoral component to roll off the posterior margin of the tibial component in flexion, resulting in early failure.[5] A careful medial meniscectomy and a well-defined posterior edge of the tibia prior to bone preparation will ensure that adequate tibial coverage is achieved, while maintaining the posterior rim of the tibia. The 2-mm to 3-mm circumferential rim of tibial bone is necessary to counteract sheer forces and increase the surface area for interdigitation of the cement mantle.

Aggressive initial resection of the posterior femoral condyle, which results in a loose flexion gap and predisposes the femoral component to patellar impingement, is another common error that should be avoided.[5] Instead, erring towards underresection is recommended initially, as modification of the transition from extension surface to flexion surface with the round burr during selection of the femoral jig size allows a more precise fit of the femoral component and better flexion-extension gap balance.

Perhaps the largest obstacle in performing UKA, regardless of using a traditional open or minimally invasive approach, is overcoming the learning curve, which is a well-established phenomenon associated with UKA.[10,16,17,35–39] While the main causes of UKA failures, including improper patient selection and technical errors, are not unique to UKA, but to any arthroplasty procedure, UKA is particularly affected by these failure modes because the device is implanted in the middle of a progressing disease process. Patient selection decisions alone greatly influence survivorship. In addition, overcorrection may lead to aseptic loosening, subsidence, and secondary degeneration of the contralateral compartment. Furthermore, a minimally invasive surgical technique adds a significant variable to the procedure. These challenges stress the importance of obtaining UKA-specific training, the significance of strong surgical technique, and the advantage of surgeon experience, all of which enhance UKA survivorship. Robertsson et al. emphasized that surgeon skill, judgment regarding patient selection, and operative routine are assumed to be influenced by the volume of procedures performed.[40] Christensen acknowledged the need for UKA-specific training by contending that TKA systems with good instrumentation may be implanted referring to written instructions, but stressing that UKA technique is best learned in the operating room.[21] Centers performing UKA on a regular basis do, indeed, demonstrate better results compared to those centers where the procedure is performed on an occasional basis.[38,41]

Results

Author's Experience

A retrospective study conducted by the senior author of 136 patients (Ahlback stages 2, 3, and 4) involving minimally invasive UKA with medial inlay preparation and using broad selection criteria demonstrated an overall 7% revision rate requiring TKA at 8 years.[8] The revision rate at 8 years among the 20 Ahlback 4 cases was 25%.[8] The Repicci II unicondylar knee system (Biomet, Inc., Warsaw, IN) was used in all cases. All patients ambulated with a walker within 4 hours after surgery and most (98%) were discharged from the hospital within 23 hours.[8] Hospitalization for 48 hours was required for refractory nausea in one case and for telemetry observation for new onset atrial fibrillation in another case.[8] Primary TKA designs were utilized in the 8 cases requiring revision, with good (25%) or excellent (75%) Knee Society clinical ratings at follow-up.[8] The results from this study support the safety and efficacy of the minimally invasive surgical technique, highlight the decreased recovery and rehabilitation time associated with the technique, and substantiate the relative ease of conversion to TKA, if required, of this particular resurfacing UKA design.

Minimum 10-Year Results of Other Resurfacing UKA Designs

Nondesigning surgeons have reported survivorship of 90% or greater at a minimum follow-up of 10 years for other resurfacing UKA designs.[20,24] Squire et al. reported a 22-year survivorship of 93%, defined by revision due to aseptic loosening, at a minimum follow-up of 15 years.[24]

Minimally Invasive UKA Program

A successful minimally invasive program, regardless of its application, must meet the following goals:

- Minimal physiologic disruption;
- Minimal interference in patient lifestyle; and
- Minimal obtrusion to future treatment options.

In 1992, the senior author implemented a minimally invasive UKA program[31] that is significantly different from simply the use of a small incision or implementation of only a minimally invasive surgical approach. The following concepts, which are all minimally invasive in nature, were combined into a single program to meet the previously mentioned goals:

- Minimally invasive surgical approach avoiding patellar dislocation;
- Adjunct use of arthroscopy;
- Resurfacing UKA design with an inlay tibial component; and
- Pain management with local anesthetic and without the use of narcotics.

The purpose of arthroscopic evaluation prior to arthroplasty allows assessment of articular cartilage in the contralateral compartment and permits the evaluation of the contralateral meniscus, which cannot be visualized through traditional surgical exposure alone. If advanced osteoarthritic involvement of the contralateral compartment is observed or if the contralateral meniscus is not intact, the pre-planned UKA procedure may be abandoned in favor of TKA, the preferred procedure for more advanced cases of osteoarthritis. Verification of a fully functioning, intact contralateral meniscus is critical before proceeding with UKA, as the surface area of load bearing and the stability of the knee joint are enhanced by intact menisci.[42–48] The average tibiofemoral surface contact area when the menisci are intact is 765 mm to 1150 mm^2, but is reduced to approximately 520 mm^2 if the menisci are removed.[49–51] Based on these findings, Kuster et al. concluded that a contact area of approximately 400 mm^2 is necessary to avoid polyethylene stress and to prevent cold flow in knee prostheses.[51] Although a certain degree of cold flow is acceptable in UKA designs, due to the lower tibiofemoral contact area compared to TKA designs, an absent contralateral meniscus will result in an inadequate amount of tibiofemoral contact. This lack of tibiofemoral contact, combined with continued osteoarthritic progression, may hasten the rate of degeneration of the untreated contralateral side and may lead to early failure of the UKA device.[52] Therefore, although eliminating overcorrection has reduced the incidence of UKA failures in recent years,[10,13,15,16,18,22,24,25,30,35,43,52–56] contralateral compartment degeneration and early UKA failure remain a concern if the status of the contralateral meniscus is not assessed.

A minimally invasive surgical approach is considerably different from a "mini incision," which is merely a small hole and may result in significant distortion of soft tissue. A minimally invasive surgical approach preserves soft tissue, while maintaining the function of the suprapatellar synovial pouch, the quadriceps tendon, and the patella. The advantages of a minimally invasive surgical approach in combination with UKA include a reduction in postoperative morbidity; a reduction in postoperative pain; decreased rehabilitation time without the need for formal physical therapy; and the ability to perform the procedure on a same-day or short-day basis.[7,8,31,57–60] Several studies have demonstrated a faster rate of recovery and earlier discharge in minimally invasive UKA compared with traditional open UKA or TKA.[6,7,60] UKA also may be performed as reliably with a minimally invasive approach as through a wide incision, without compromising proper component placement or long-term results.[7,57,60] The preservation of the quadriceps tendon, opposed to the short skin incision itself, is most likely responsible for the diminished postoperative pain and decreased rehabilitation time associated with the minimally invasive surgical technique.[7]

A major problem in converting UKA to TKA is medial tibial bone loss.[33,34] The use of an inlay all-polyethylene component, which requires minimal bone resection and preserves the medial tibial buttress, therefore, is advantageous compared with use of their modular, saw-cut tibial counterparts, which are thicker and require significantly more bone resection (Figure 12.9). The full exposure that often is required for jig instrumentation requires additional bone resection. Because such saw-cut tibial designs frequently use peg or fin fixation, tibial bone will be compromised on implant removal and may necessitate the use of bone grafts, special custom devices, or metal wedge tibial trays to sta-

Figure 12.9. Intraoperative photograph depicting the conversion of a bone sparing, resurfacing medial UKA to TKA. After 10 years, revision to a primary TKA was required due to advanced disease of the lateral compartment. With the use of an inlay tibial component, the medial tibial buttress is preserved and the amount of tibial bone loss at revision is minimal, allowing a relatively easy conversion to TKA.

bilize the tibia if conversion to TKA is required, further complicating the revision surgery.[33,34,61–63]

Outpatient status requires a structured pain management program. Spinal or general anesthesia is used in all cases. Patient education, avoidance of cerebral-depressing injectable narcotics, infiltration of all incised tissues with long-acting local anesthetics, and the preemptive use of scheduled oral 400 mg ibuprofen every 4 hours and oral 500 mg acetaminophen/5 mg hydrocodone bitartrate every 4 hours for the first 3 days postoperatively, all aid in controlling pain. In addition, 30 mg ketoroloc tromethamine (15 mg for patients over 65 years of age) is administered either intramuscularly or intravenously during surgery and is repeated after 5 hours in patients with normal renal function. This pain management program results in fully alert patients in the recovery room with no local knee pain. When pain is absent, patients are able to perform straight leg raises and to actively participate in their postoperative rehabilitation process. In addition to the minimally invasive surgical approach, the use of the local anesthetic and avoidance of narcotics are credited for shortening the recovery and rehabilitation time, permitting the procedure to be performed on an outpatient basis.

Conclusion

The senior author's multipronged minimally invasive UKA program is a highly desirable treatment option for patients suffering from unicompartmental osteoarthritis of the knee, as it results in minimal interference in physiology, lifestyle, and future treatment options. In summary, by thorough preoperative clinical and radiographic evaluation, corroborated by diagnostic arthroscopy, patients with more advanced stages of osteoarthritis are excluded from UKA and, instead, may receive the more appropriate TKA, reducing morbidity and increasing survivorship. By avoiding patellar dislocation and nonessential tissue dissection, interference in physiology is avoided, resulting in lower morbidity and rapid rehabilitation. The minimally invasive surgical approach, combined with the specific pain management program, allows UKA to be performed on an outpatient basis, with full independence achieved by 4 hours postoperatively. This rapid rehabilitation and return to activities of daily living addresses patient satisfaction regarding minimizing lifestyle interference. The use of a resurfacing UKA design diminishes bone resection compared to other UKA designs. Consequently, future treatment options are not interfered with and UKA use is permitted in a broader range of patients, including younger, heavier or active patients.

Because UKA is an extension of conservative management, osteoarthritis will continue to progress following prosthetic implantation. Therefore, long-term survivorship of UKA is variable and is affected by many factors, including the stage of osteoarthritis at insertion, limited tibial bone support, and material constraints, such as polyethylene deformity and wear. Although the surgeon does not directly control these aforementioned variables, the single factor affecting UKA survivorship, regardless of design or use of a minimally invasive approach, is proper surgical technique. Therefore, for those surgeons choosing to perform UKA, receiving proper instructional training is critical to ensure the surgical expertise required to successfully perform UKA. Combining a minimally invasive surgical approach with UKA is appealing due to lower morbidity and decreased rehabilitation; however, it adds a significant variable to an already demanding surgical procedure. Proper component positioning and accurate cement removal in spite of decreased visualization must be achieved. In this context, UKA is feasible as a minimally invasive, bone-sparing outpatient procedure with low morbidity.

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