Symptomatic Valgus Knee: The Surgical Options

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Abstract

Valgus knee deformities requiring surgery are difficult to manage due to the relative rarity and abnormal biomechanics of the condition and the unique soft-tissue and osseous pathologic features. Surgical options include arthroscopic debridement, abrasion arthroplasty, proximal tibial varus osteotomy, distal femoral varus osteotomy, combined femoral-tibial varus osteotomy, unicompartmental knee arthroplasty, and total knee arthroplasty. Each procedure has its own indications, contraindications, and limitations.

J Am Acad Orthop Surg 1993;1:1-9

Severe valgus deformity can result from many different causes, including metabolic conditions, inflammatory arthritis, posttraumatic and primary osteoarthritis, and an excessively overcorrected proximal tibial valgus osteotomy. Fortunately, severe valgus deformity is uncommon. Since prevalence studies of gonarthrosis have not differentiated between medial and lateral disease, the actual incidence of valgus deformity is unknown. However, many reports have shown that valgus knee is much less common than varus knee. Valgus deformities are more common in women than in men and are more prevalent in certain conditions such as rheumatoid arthritis, rickets, renal osteodystrophy, and infantile poliomyelitis.

The pathologic features in the valgus knee are distinctive. The soft-tissue structures on the lateral and posterolateral concave side of the joint are contracted. The involved structures may include the iliotibial band, the popliteus tendon, the lateral collateral ligament, the posterolateral capsule, the lateral head of the gastrocnemius, the lateral intermuscular septum, and the long head of the biceps femoris. At the same time, the medial collateral ligament and the medial capsular structures may be attenuated. Unlike varus knee deformity, most of the osseous abnormality in the valgus knee occurs on the femoral side, particularly in patients with osteoarthritis. The lateral tibial plateau is often well preserved. The lateral femoral condyle may appear hypoplastic. It is unclear whether the hypoplasia is a contributing etiologic factor or a result of the valgus knee deformity.

Biomechanics of the Knee

An understanding of the biomechanics of the normal knee and the application of these principles to the abnormal valgus knee is essential before any surgical procedure is considered. Hsu et al[1] studied the normal axial alignment of the lower extremity using static analysis of full-weight-bearing radiographs in 120 normal subjects. They found the normal mechanical axis angle to equal 1.2 degrees varus and the normal distal femoral anatomic valgus relative to the mechanical axis to equal 4.2 degrees (4.9 degrees when the full-length femoral anatomic valgus was used). In male subjects, joint-line obliquity equaled –1.0 ± 1.5 degrees varus; in female subjects, it equaled +0.1 ± 1.7 degrees valgus. Age had little effect on the normal axial alignment of the lower extremity. In the normally aligned knee, 75% of the load passed through the medial compartment when one-legged weight-bearing stance was simulated.

When assessing knee-joint biomechanics, it is also important to determine dynamic loading patterns and their relationship with static load patterns across the knee. However, the relationship between static and dynamic loading patterns is not simplistic or predictable. Under static conditions, there is a high degree of correlation between the tibiofemoral angle and the load distribution across the knee. As the tibiofemoral angle becomes more valgus, the mechanical axis and load are shifted laterally. When dynamic gait analysis is used, the load distribution is greater medially than the static analysis would predict.

Harrington[2] assessed the static and dynamic joint loads across the knee in patients with a normally aligned knee or a varus, valgus, or flexion deformity. No direct correlation was found between the tibiofemoral angle, the magnitude of load, and the location of load across the knee joint. For valgus deformity,

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the maximum joint-bearing force was greater on dynamic assessment than on static assessment. With the static method, the center of pressure was located in the lateral compartment; with the dynamic method, it was located in the medial compartment. The force profiles generally illustrated blunting and absence of force peaks compared with the normally aligned knee. Harrington concluded that patients with knee deformities can dynamically modify force transmission and blunt force profiles by compensatory mechanisms, such as alteration in gait pattern and walking speed in response to pain. He further concluded that static analyses are unreliable in accurately determining loading patterns across the knee.

Operative Considerations

Before a surgical procedure is considered, the patient should have received adequate conservative treatment. The usual methods include a variety of nonsteroidal anti-inflammatory drugs and exercise designed to strengthen muscles and maintain or increase knee mobility. Other basic strategies include avoidance of activities that incite symptoms, the use of a cane, and sometimes a knee brace.

The surgical options in treating valgus deformity are arthroscopic debridement with or without abrasion arthroplasty, proximal tibial varus osteotomy, distal femoral varus osteotomy, combined femoral-tibial varus osteotomy, unicompartmental knee arthroplasty, and total knee arthroplasty. In determining the operative approach, major considerations are the patient's age, the desired level of physical activity, the magnitude of the deformity and its underlying causation, and associated nonmusculoskeletal medical conditions.

Arthroscopic Debridement

Debridement for the treatment of early unicompartmental gonarthrosis is well described in the literature. The rationale for this procedure is to debride fibrillated cartilage and degenerative meniscal tears, to remove loose bodies, and to lavage proteolytic enzymes. With this procedure, one hopes to decrease the patient's synovitis and discomfort. In addition, abrasion arthroplasty is sometimes used as a treatment option in patients with early unicompartmental osteoarthritis. The abrasion of subchondral bone exposes its vascular bed, with the goal of creating an environment for clot organization and subsequent fibrocartilage formation.

Bert and Maschka[3] evaluated 67 knees after arthroscopic debridement for early unicompartmental knee arthritis. They reported good to excellent results in 66% of the knees 5 years after that procedure. These results were significantly better than those obtained in 59 knees that underwent debridement plus arthroscopic abrasion arthroplasty.

Rand[4] evaluated 131 knees with early unicompartmental gonarthrosis where arthroscopic debridement was performed. Eighty percent were improved at 1 year, and 67% remained improved at 5 years. The results in the 103 knees that underwent debridement were significantly better than those in the 28 knees that underwent debridement plus arthroscopic abrasion arthroplasty.

In the studies by Rand[4] and Bert and Maschka,[3] the differences in the results might be explained by a further advanced state of osteoarthritis in those patients who underwent the abrasion procedure.

Arthroscopic debridement is useful for early unicompartmental knee arthritis, especially if symptoms of internal derangement are present. Arthroscopic debridement alone is more predictable than arthroscopic abrasion arthroplasty. However, the success of this procedure is usually of limited duration, and progression of the arthritis should be anticipated.

Osteotomy

There are three osteotomies about the knee that can be considered for a patient with valgus deformity: upper tibial varus osteotomy, distal femoral varus osteotomy, and combined femoral-tibial varus osteotomy. Each osteotomy has a specific role in the treatment of symptomatic valgus knee deformity. The rationale of osteotomy is to correct the excessive tibiofemoral valgus by shifting the mechanical axis line of load from the lateral compartment to a more medial position. Excessive medial joint-line obliquity must be prevented; it may predispose to medial subluxation of the femur on the tibia, with resultant clinical failure.

Appropriate radiographs are essential in evaluating the osteotomy candidate. Full-length standing anteroposterior radiographs of the lower extremity must be obtained to assess the tibiofemoral angle and the mechanical axis of the limb. Single-leg standing views have not proved more useful than double-leg standing views. Stress radiographs are useful in evaluating joint degeneration in the medial compartment. Although arthroscopy has been used to assess the status of the medial compartment and the patellofemoral joint prior to osteotomy, it has little predictive value for determining the results of osteotomy.

The candidate for osteotomy should have unicompartmental lateral tibiofemoral gonarthrosis. Patients less than 65 years of age rehabilitate faster than older patients after osteotomy and in general are better candidates for the procedure. The individual with high physical demands is a better candidate for osteotomy than arthroplasty. Pain and tenderness should be localized to the lateral compartment of the knee. Knee motion should be greater than 90 degrees of flexion, and a flexion contracture should be less than 15 degrees. The knee should possess anterior and posterior stability with no more than mild medial lateral laxity. Vascular competence in the lower extremity is essential.

Inflammatory arthritides, such as rheumatoid arthritis, are a contraindication to osteotomy about the knee. Patients with excessive lateral bone loss tend to present with an unstable valgus knee, which is a relative contraindication to surgery. An adduction contracture of the ipsilateral hip is a specific contraindication to the procedure because the contracture produces valgus stress about the knee, which will lead to recurrence of the deformity. Severe patellofemoral symptoms (pain on going up and down stairs and on arising from a chair) may represent a relative contraindication to redirective osteotomy.

Proximal Tibial Varus Osteotomy

Results with the proximal tibial varus osteotomy for lateral compartment involvement have not been as predictable as those with the proximal tibial valgus osteotomy for medial compartment disease. Due to the anatomic valgus of the femur, the ability to transfer load medially is limited. If the medially based closing wedge is excessive, the osteotomy may result in excessive medial joint-line obliquity and may potentiate medial subluxation of the femur on the tibia.

Coventry[5] evaluated 31 proximal tibial varus osteotomies after an average follow-up period of 9.4 years. Each procedure consisted of a medially based closing wedge osteotomy proximal to the tibial tubercle with reefing of the medial collateral ligament. The average tibiofemoral angle postoperatively was 0.03 degrees valgus. Twenty-four of 31 procedures (77%) resulted in major relief of the preoperative symptoms. Only two knees demonstrated marked instability postoperatively. Ten knees (32%) underwent a subsequent procedure: a medial meniscectomy in two, a lateral MacIntosh prosthesis in one, staple removal in one, and total knee arthroplasty an average of 9.8 years postoperatively in six. There was one common peroneal palsy. The average medial joint-line obliquity for all patients was 10 degrees, and a satisfactory result correlated with a medial joint-line obliquity of 10 degrees or less. Coventry concluded that proximal tibial varus osteotomy is indicated for a valgus knee deformity of 12 degrees or less if the medial joint-line obliquity is projected to be 10 degrees or less after the operation.

Preoperative planning for the proximal tibial varus osteotomy is essential. Two radiographic methods may be used. One method employs operative tracings based on the full-length standing radiographs, from which can be calculated the size of the wedge 2 cm below the joint that will shift the mechanical axis medially to the desired location. We prefer to base this calculation on shifting the mechanical axis of the limb to the medial side of the medial tibial spine (Fig. 1). The other method to determine proper wedge size involves computer static analysis of the full-length standing weight-bearing radiograph. Existing software can calculate joint pressure magnitude and distribution across the knee joint.

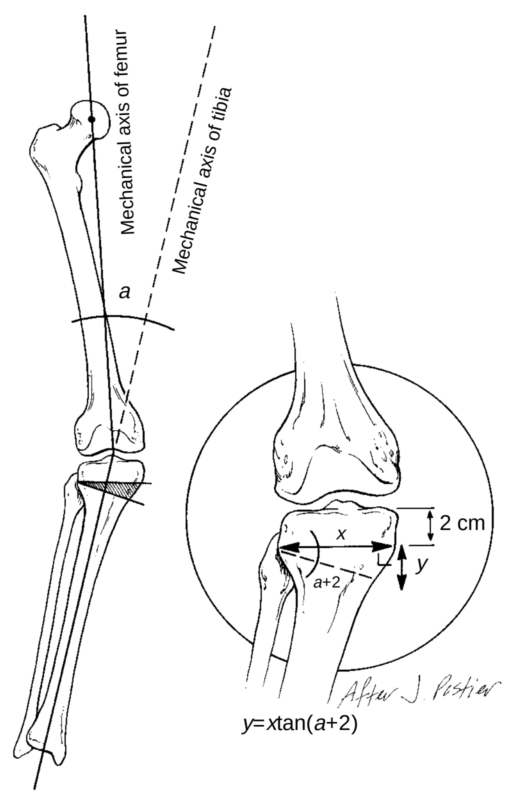

Fig. 1 Operative tracings based on full-length standing radiographs can be utilized to calculate the size of the wedge 2 cm below the joint that will shift the mechanical axis medially to the desired location.

There are several surgical techniques for proximal tibial varus osteotomy. Medially based closing osteotomies above and below the tibial tubercle and dome osteotomies above and below the tubercle have been described. Osteotomies below the tubercle have a higher risk of nonunion and neurologic complications. Dome osteotomies are technically more difficult and in our opinion offer no advantage over the medially based closing wedge osteotomy. We prefer the medially based closing wedge osteotomy as described by Coventry[5] (Fig. 2).

Complications associated with proximal tibial varus osteotomy include nonunion, delayed union, overcorrection, undercorrection, peroneal nerve injury, fractures into the joint, compartment syndrome, thrombophlebitis, pulmonary embolus, arterial injury, and infection.

The proximal tibial varus osteotomy is a satisfactory surgical alternative with good long-term results in the properly selected patient with a symptomatic valgus knee deformity. Patients with a preoperative tibiofemoral angle greater than 12 degrees or a predicted medial joint-line obliquity greater than 10 degrees following osteotomy are not good candidates for this procedure.

Distal Femoral Varus Osteotomy

The distal femoral varus osteotomy is the preferred alternative to the proximal tibial varus osteotomy in the patient with a preoperative tibiofemoral angle greater than 12 degrees and a projected medial joint-line obliquity greater than 10 degrees.

McDermott et al[6] evaluated 24 distal femoral varus osteotomies performed for primary osteoarthritis after an average follow-up period of 4 years. They performed a medially based closing wedge osteotomy with blade-plate fixation. The goal of the procedure was to produce a tibiofemoral angle of 0 degrees and a horizontal joint line. Twenty-two of 24 knees had a satisfactory result. Knee manipulation was subsequently performed on one of those 22 knees. In the other two patients, there was one failure of fixation, and one patient underwent total knee arthroplasty 3 years postoperatively.

Healy et al[7] evaluated 23 distal femoral varus osteotomies after an average follow-up period of 4 years. A medially based closing wedge osteotomy with blade-plate fixation was performed in all cases. The Hospital for Special Surgery knee score improved from a preoperative value of 65 to a postoperative value of 86. Overall, 86% of the patients were satisfied with the results. Of 15 patients with osteoarthritis, 14 (93%) had good or excellent results. Of the remaining eight patients, three had posttraumatic arthritis or deformity, two had renal osteodystrophy, and three had rheumatoid arthritis. Of the four knees assessed as having a fair or poor outcome, three were in two patients with rheumatoid disease. Of the eight procedures subsequently performed in seven knees, two were total knee replacements in patients with rheumatoid arthritis. The remaining six procedures were one manipulation under anesthesia, two arthroscopies, and three operations for removal of the blade-plate fixation device. Two nonunions and one fracture occurred. The authors concluded that distal femoral varus osteotomy is an effective and reliable procedure for patients with osteoarthritis and posttraumatic deformity, but is not recommended for patients with rheumatoid arthritis or poor preoperative motion.

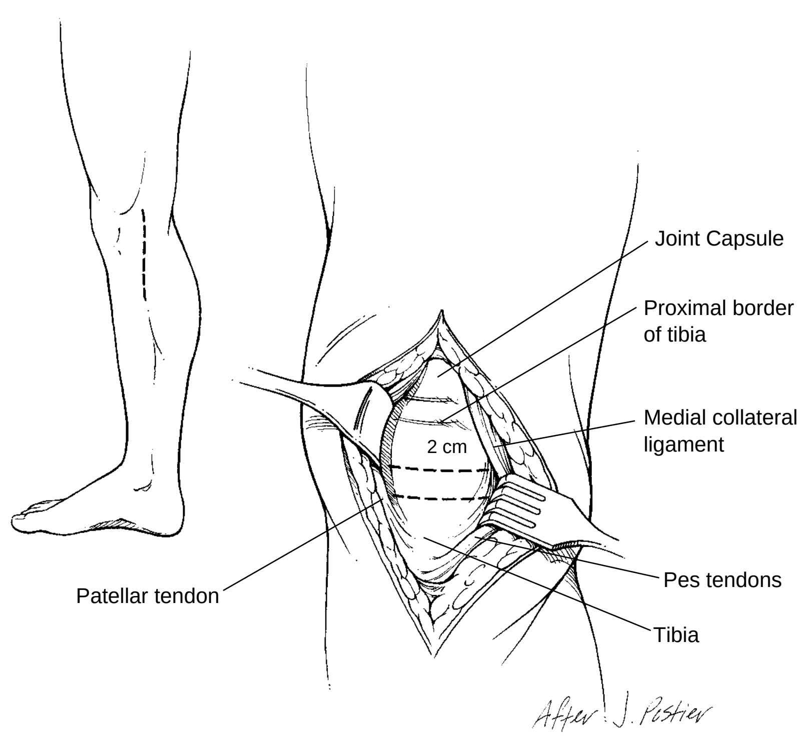

Fig. 2 Exposure for the proximal tibial varus osteotomy as described by Coventry.[5]

Careful preoperative planning for the distal femoral varus osteotomy is essential. As with any osteotomy about the knee, the wedge size and location are planned on the basis of preoperative templating using full-length standing radiographs of the lower extremity. Regardless of the technique used, it is essential to shift the mechanical axis medially while minimizing joint-line obliquity. The adductor canal and vessels in this region should be protected during the most proximal portion of the dissection for plate placement.

Several techniques exist for the distal femoral varus osteotomy. Laterally based opening-wedge osteotomies and V-shaped osteotomies have been described. The laterally based opening wedge is indicated in patients with significant leg-length shortening. The V osteotomy has been advocated because of its inherent stability even without fixation and the ability to adjust position postoperatively if needed. We prefer a medially based closing-wedge technique. A variety of methods of fixation for the distal femoral varus osteotomy can be used, including staples, Steinmann pins, lateral blade plates, medial blade plate, external fixator, and cast.

Our preferred technique utilizes a medial longitudinal incision from the tibial tubercle to a point 15 cm proximal to the patella. The vastus medialis obliquus is retracted anteriorly to expose the femur (Fig. 3). A longitudinal mark is made on the distal femur for rotational alignment. Guide wires are placed across the femur immediately proximal to the femoral condyles to outline the desired wedge size. An osteotomy is made across the femur, and the wedge of bone is removed (Fig. 4). A medial blade plate is applied for fixation of the osteotomy (Fig. 5).

The complications associated with the distal femoral varus osteotomy are the same as those described earlier for proximal tibial osteotomy.

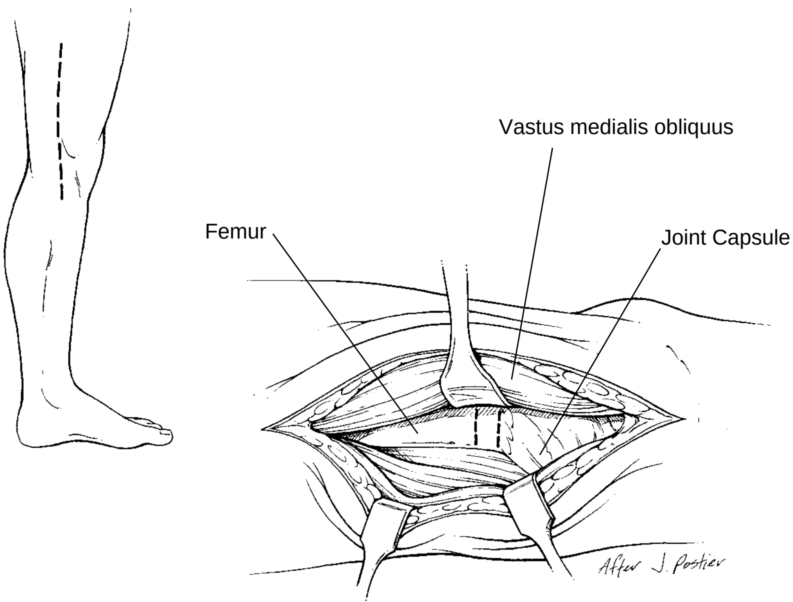

Fig. 3 After placement of a medial longitudinal incision from the tibial tubercle to a point 15 cm proximal to the patella, the vastus medialis obliquus is retracted anteriorly to expose the femur.

Combined Femoral-Tibial Varus Osteotomy

The ideal candidate for a combined osteotomy has a severe valgus deformity in which a single osteotomy above or below the joint would result in excessive medial joint-line obliquity or excessive resection of bone. The preoperative considerations and techniques already mentioned for single osteotomies are also applicable in performing the combined procedure. The first step is to perform and fix the distal femoral osteotomy. The mechanical axis of the limb is assessed intraoperatively,

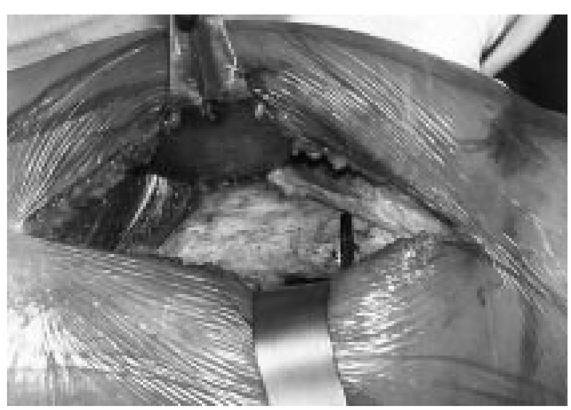

Fig. 4 After placement of guide wires across the femur immediately proximal to the femoral condyle to outline the desired wedge size, an osteotomy is made across the femur, and the wedge of bone is removed.

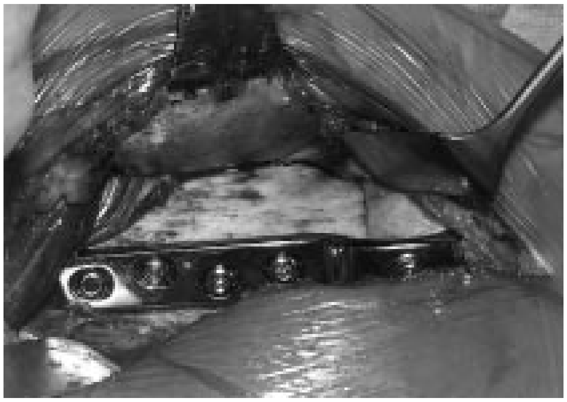

Fig. 5 Medial blade plate is applied for fixation of the osteotomy.

and, if needed, additional correction is achieved through the tibial osteotomy. The extensive nature of the procedure and the more difficult rehabilitation (relative to that after single osteotomy) must be considered (Fig. 6).

Rehabilitation

Careful attention to postoperative management and rehabilitation is essential for a satisfactory result. Although we have utilized removable prefabricated braces, the use of a hinged cast brace provides the most secure support of the osteotomy and the greatest degree of patient comfort. The cast brace is used for 6 to 8 weeks until early union of the osteotomy is present. Touch weight-bearing is used until the cast is removed. A program of progressive weight-bearing combined with quadriceps strengthening is followed for an additional 8 to 12 weeks. Observation for at least 6 months from the time of osteotomy is necessary to assess the early clinical success.

Unicompartmental Knee Arthroplasty

Unicompartmental knee arthroplasty has several potential advantages compared with tricompartmental replacement, including increased range of motion, more normal gait patterns, a low complication rate, rapid rehabilitation, and preservation of bone stock, as well as preservation of the cruciate ligaments, the patellar articular surface, and the articular surface of the opposite tibiofemoral compartment. The disadvantages include progressive arthritis of the unresurfaced compartments and the possibility of increased polyethylene wear.

The selection criteria for unicondylar knee replacement in the patient with symptomatic valgus knee deformity are different from those for the osteotomy patient in that the patient must demonstrate radiographic evidence of lateral compartment disease with minimal changes in the medial compartment and patellofemoral joint. The typical patient should be older than 65 years of age, with a lean physique and sedentary lifestyle. The patient must demonstrate medial and lateral collateral stability and preferably anterior cruciate ligament stability as well. Most important, the valgus deformity should be passively correctable, since extensive soft-tissue releases should not be performed in unicompartmental knee arthroplasty.

Unicompartmental posttraumatic arthritis and osteoarthritis are the primary indications for unicompartmental knee replacement, while inflammatory arthritides are contraindications. Other contraindications include arthritis secondary to hemophilia, hemochromatosis, and chondrocalcinosis. Patients with osteonecrosis often are not amenable to unicondylar knee replacement. Frequently, patients with osteonecrosis have excessive posterior femoral condylar bone loss, and there is a high incidence of bicondylar involvement.

Lateral unicondylar knee replacements appear to have more satisfactory results than medial replacements. Insall and Walker[8] evaluated 24 unicompartmental knee replacements at 2 to 4 years. Nineteen replacements were medial, and five were lateral. The result was poor or fair in 42% (8/19) of the medial replacements, while none of the five lateral replacements had fair or poor results. The authors concluded that the prime indication for unicompartmental knee arthroplasty may be lateral compartment osteoarthritis.

Marmor[9] evaluated 60 unicompartmental knee replacements after a minimum follow-up of 10 years. Of 21 failures, 20 occurred in medial compartment replacements. There was one lateral replacement failure. Marmor[10] also reported on 14 lateral unicompartmental knee replacements after an average follow-up interval of 89 months. Eleven of 14 (78%) had excellent results, and one failed due to progressive osteoarthritis at 9 years. There were no complications.

Scott and Santore[11] evaluated 100 consecutive unicompartmental knee replacements. Eighty-eight of the implants were medial, and 12 were lateral. Only one of the medial replacements and two of the lateral replacements failed, at an average of 3.5 years.

Fig. 6 **A,** Preoperative radiograph of a patient with a severe valgus deformity. On static analysis, the mechanical axis passes lateral to the lateral compartment of the knee joint. **B,** Postoperative radiograph obtained after double osteotomy. The mechanical axis has been shifted to the medial side of the medial tibial spine, the desired location.

Surgical exposure for the lateral unicondylar knee replacement should be through an anteromedial approach, as this exposure will facilitate total knee arthroplasty if necessary. Removal of all peripheral and intercondylar osteophytes is essential when correcting the deformity, and soft-tissue releases should be avoided. Mild to moderate chondromalacia of the medial or patellofemoral compartments is not a contraindication to replacement. However, exposed subchondral bone necessitates a total knee arthroplasty. Exposed cartilage of the unresurfaced compartments should be protected during the procedure.

It is essential that the entire weight-bearing surface of the femoral condyle be covered and that the anteroposterior dimension of the condyle be reproduced with the femoral implant. The anterior flange of the femoral component should be countersunk flush with the cartilage surface to prevent patellar impingement. The tibial component must lie parallel to the femoral component while in full extension and must sit on the peripheral cortical bone to help prevent subsidence. The surgeon should aim to correct the mechanical axis to neutral, but overcorrection to a varus angulation should be avoided.

Complications associated with lateral unicompartmental arthroplasty include patellar impingement, overcorrection, undercorrection, progressive osteoarthritis of the unresurfaced compartments, implant loosening, tibiofemoral subluxation, implant breakage, polyethylene wear, peroneal nerve palsy, thrombophlebitis, pulmonary embolism, and infection.

Lateral unicondylar knee arthroplasty is a successful treatment option in the older patient with a symptomatic valgus knee, particularly the older patient with a low level of physical demand and passive correctability of the deformity. The literature suggests that lateral replacements fare better than medial replacements. While some investigators believe that the lateral replacement should take the place of the unpredictable proximal tibial varus osteotomy, we believe that there are separate and well-defined indications for both procedures.

Total Knee Arthroplasty

Total knee replacement in the severely symptomatic valgus knee presents a difficult challenge. This challenge results from the necessity of obtaining adequate soft-tissue balance as well as the relative rarity of the valgus deformity. Indications for knee arthroplasty include severely symptomatic tricompartmental arthrosis in older patients who lead relatively sedentary lives.

Soft-tissue balancing in the valgus knee consists of sequential lateral soft-tissue releases in stages, after osteophytes have been removed from the femur and tibia. The first stage is release of the iliotibial band at or proximal to the joint. The second stage is release of the popliteus tendon and lateral collateral ligament from the lateral femoral condyle. The third stage is release of the posterolateral capsule and the lateral head of the gastrocnemius muscle from the femur. The fourth stage is step-cut lengthening of the biceps femoris. A lateral retinacular release is frequently required in the valgus knee. It is essential to evaluate the soft-tissue balance after each stage before performing additional releases (Fig. 7).

Krackow et al[12] have discussed medial collateral ligament advancement during total knee arthroplasty in the valgus knee as a means of avoiding excessive lateral soft-tissue releases and the need for more constrained implants. We have found it difficult to find the exact epicenter of rotation when advancing the medial collateral ligament, and fixation to bone is often poor due to the presence of osteoporotic bone. For these reasons, we prefer to avoid soft-tissue advances whenever possible.

Stern et al[13] evaluated 134 total knee arthroplasties performed for valgus knee deformities greater than 10 degrees. The average follow-up was 4.5 years. Seventy-six percent of the knee replacements required a lateral retinacular release. The results were excellent in 95 knees (71%), good in 27 (20%), fair in 8 (6%), and

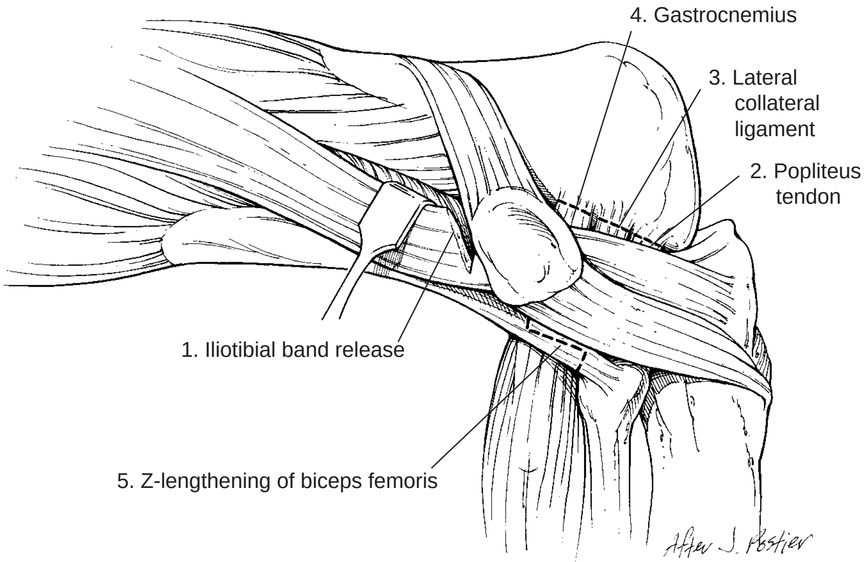

Fig. 7 Soft-tissue balancing in the valgus knee consists of sequential lateral soft-tissue releases in stages, with assessment of soft-tissue balance between each stage.

poor in 4 (3%). The four poor results occurred in three knees in which aseptic loosening developed and one knee that was revised for chronic pain of unknown etiology. There were five peroneal nerve palsies.

Krackow et al[12] evaluated 99 knees with a fixed valgus deformity treated by total knee replacement. The average follow-up was 54 months. They divided the knee deformities into two separate types: type I deformities, characterized by a stable medial collateral ligament, and type II deformities, characterized by an attenuated medial collateral ligament. Type I deformities underwent standard lateral soft-tissue releases without medial collateral ligament advancement. Type II deformities underwent medial collateral ligament advancement in addition to the standard lateral soft-tissue releases. In all knee replacements, an unconstrained implant was used. Overall, there were 90% good to excellent results, with 94% in type I knees and 85% in type II knees. Only 6% of the surgically treated knees had significant varus or valgus instability. Medial collateral ligament advancement prolonged the operative time by an average of 40 minutes.

Total knee arthroplasty presents a difficult challenge in the patient with a previous severely overcorrected proximal tibial valgus osteotomy. The replacement must address the excessive valgus deformity, lateral tibial bone loss, and patella infera present in such cases. There are several surgical treatment options. A staged recorrective osteotomy followed by a total knee replacement can be performed. This option may result in excessive shortening of the tibia and accentuated medial instability. Another option is simultaneous recorrective osteotomy and total knee arthroplasty. This procedure is difficult and may also excessively shorten the tibia and accentuate medial instability.

Krackow and Holtgrewe[14] have described a new technique for managing the severely overcorrected proximal tibial valgus osteotomy when total knee arthroplasty is performed. Their technique involves a complex ligamentous advancement of the posteromedial structures and medial collateral ligament while implanting an unconstrained device. In five knees there were excellent results and no instability after an average follow-up period of 37 months. The operative time was 50% to 100% longer than that required for a routine knee replacement. Krackow and Holtgrewe conclude that this new technique, although difficult and time consuming, can provide excellent results while diminishing the need for a more constrained device.

We believe that the ideal treatment for the patient with a severely overcorrected proximal tibial valgus osteotomy is an adequate lateral soft-tissue release with minimal tibial bone resection. The selection of the degree of prosthetic constraint is based intraoperatively on the soft-tissue balance. The lateral tibial plateau deficiency can be treated with a bone graft or wedges; alternatively, a tibial component can be custom-fitted to make up for the extent of bone loss. These cases are difficult and require proper preoperative planning and precise surgical technique for a satisfactory result.

Most authors prefer a medial parapatellar approach when performing a total knee replacement in patients with a valgus knee deformity. However, a lateral parapatellar approach has been recommended by some surgeons. The proposed advantages of the latter incision include the directness of the approach, preservation of the neurovascular supply to the extensor mechanism, spontaneous correction of the external rotation deformity of the tibia, and enhancement of postoperative rehabilitation by avoiding the medial structures.

Buechel[15] described in detail the lateral parapatellar retinacular approach and his three-step lateral soft-tissue release. The approach includes a midline curved incision over the lateral aspect of the tibial tubercle followed by a deep lateral parapatellar incision. The lateral parapatellar incision is extended into the anterior compartment fascia 3 cm distal to the tubercle. Reflection of the lateral portion of the tibial tubercle medially is then carried out. The fat pad is maintained on the patellar tendon and used later in closing the lateral retinaculum. A three-step lateral soft-tissue release is then performed. The release entails subperiosteal elevation of the anterior compartment muscles and iliotibial band to the level of the fibular head. The lateral collateral ligament and popliteus are then elevated subperiosteally as a proximally based flap on the lateral femoral shaft. Finally, the fibular head is resected after identification and protection of the peroneal nerve. We prefer to perform a total knee arthroplasty through the conventional medial parapatellar approach.

Complications following total knee arthroplasty in the valgus knee are no different than those in the varus knee with the exception of an increased risk of peroneal nerve palsy. Stretching of the peroneal nerve is more apt to occur after correction of a severe valgus and flexion knee deformity. It is essential in these cases to apply a nonconstricting dressing, to keep the knee slightly flexed during the early postoperative period, and to monitor neurologic function closely.

In summary, total knee arthroplasty in the severe valgus knee can be difficult. It is essential to adequately balance the soft-tissue structures about the knee. To achieve soft-tissue balance, extensive lateral soft-tissue releases may be required. The type of prosthesis used depends on the soft-tissue balance after the appropriate releases. If the soft-tissue balance is tenuous, a more constrained implant is indicated. We rarely perform advancement of the medial collateral ligament. If done well, one can expect excellent results in the severe valgus knee deformity after total knee arthroplasty.

Summary

A valgus knee deformity in a patient who requires surgery presents significant challenges to the operating surgeon. The difficulty arises from several factors, including the relative rarity and abnormal biomechanics of the condition and the unique soft-tissue and osseous pathologic features. Surgical options include arthroscopic debridement with or without abrasion arthroplasty, proximal tibial varus osteotomy, distal femoral varus osteotomy, combined femoral-tibial osteotomy, unicompartmental knee arthroplasty, and total knee arthroplasty. Each of these surgical procedures has its own indications, limitations, and complications. With preoperative planning, correct patient selection, and good surgical technique, one can usually obtain excellent clinical results.

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