Summary

Inability to obtain full extension following knee arthroplasty is due to a combination of many factors. Some factors are not under the control of the surgeon, and are related to patient morphology and disease. Others are related to prosthesis design. Many, however, are directly related to the surgical technique and are therefore controllable by the surgeon. By attention to detail, the surgeon can have a direct effect on these factors and can maximize extension.

Introduction

The major goal of total knee arthroplasty is relief of pain. Almost as important, however, is the restoration of function, and that function depends primarily on an adequate arc of motion in the knee. Extension and flexion following a knee arthroplasty are dependent upon a multitude of factors related to surgical technique, the implant used, the physical therapy program, and the patient him- or herself. This chapter will discuss these factors and describe methods that the authors have used to maximize motion in extension. A subsequent chapter will deal with the subject of obtaining full flexion.

Why Do We Need Full Extension?

During normal gait, the knee is at full extension at the time of heel strike and then gradually flexes during stance phase and swing phase [1]. A patient whose knee cannot come into full extension must contract his quadriceps to prevent the knee from buckling during early stance, and this increases the work of walking. Whereas most patients after knee replacement have sufficient quadriceps strength to compensate in this manner when they first begin walking, with continued walking quadriceps fatigue can result in a limp and anterior thigh pain [2]. When the knee does not come to full extension, the limb is functionally short. This can cause a limp as well as pain in the back and in the ipsilateral hip and ankle. For all these reasons, therefore, the goal for the total knee surgeon is to obtain full extension in the reconstructed knee.

How Do We Determine if the Knee Is Fully Extended?

At the onset, the authors would like to distinguish between two terms. Extensor lag refers to an inability to actively extend the knee to the point where it can be passively extended (it is the difference between passive and active extension). A flexion contracture, on the other hand, is an inability to bring the leg to full extension passively. Although regaining muscle power is important after knee replacement, very few patients have an extensor lag following primary surgery. It is a flexion contracture that we are most concerned with during knee replacement.

To examine for full extension, the patient should be recumbent with both legs exposed and the heel on the table. If the knee is fully extended, the examiner should not be able to pass any of his hand behind the knee in the popliteal space. The greater the flexion contracture, the more fingers the examiner should be able to pass under the knee.

Full passive extension of the knee can appear limited if there is hamstring spasm or tightness (for instance, in the patient with discogenic disease), especially if the knee is tested with the hip flexed. It is for this reason that assessing extension while the patient is sitting with his leg hanging off the side of the examining couch often results in a false increase in the appearance of a flexion contracture. If an exact measurement of extension is required, a lateral cross-table radiograph can be taken with the ankle supported on a small box.

The standard method of recording knee range of motion assigns zero degrees to the fully extended knee. A knee that has a 5° flexion contracture and can, for example, flex to 125° of flexion should be listed as having a range of motion of 5°-125°. The use of minus numbers should be reserved for degrees of recurvatum at the knee.

During surgery, these tests are difficult to perform because the leg is encased in sterile drapes. A test has been used by the senior author that eliminates this problem: The leg is lifted from the ankle and the ankle joint itself is
passively dorsiflexed. Axial pressure is then applied to the sole of the foot. If there is a flexion contracture, the knee will suddenly flex. If the knee is at full extension, however, there will be motion.

Although the presence of pain can lead to a false evaluation of joint motion, this relates predominantly to flexion. In a study performed at the senior author’s institution, patients who were to undergo knee arthroplasty had an evaluation made of knee motion prior to and after the administration of their epidural anesthetic. Although an average of 15° more motion was obtained in flexion once the patient’s pain sensation had been eliminated, there was no significant change in extension.

What Factors in the Arthritic Patient’s Knee Can Cause a Block to Full Extension?

Lack of full extension is commonly seen in patients with advanced arthritis who are candidates for knee arthroplasty. In the author’s database of over 1500 patients undergoing TKA, the average block to full extension in patients with osteoarthritis was 5°. In patients with rheumatoid arthritis the mean flexion contracture was 10.5°, while in patients with post-traumatic arthritis it was 14°. It is fairly intuitive that this pre-operative contracture must be corrected at surgery if a postoperative contracture is to be avoided.

For patients with a flexion contracture less than 10°-15°, the culprit is usually anterior or posterior osteophytes (Fig. 30-1). Anterior tibial osteophytes are normally removed when the proximal tibia is resected; however, posterior femoral osteophytes, which can tent the posterior capsule, are not easily visible during the surgical exposure [3].

Posterior femoral osteophytes can be most easily removed once the proximal tibia and posterior femur are resected. A laminar spreader is placed medially, and the knee, in 90° of flexion, is distracted. A curved osteotome and angled curettes will remove the posterior osteophytes from the medial femoral condyle (Fig. 30-2). The position of the laminar spread is then changed to the medial side and a similar procedure is performed to remove any lateral femoral condylar osteophytes. Finally, a check should be made for any remaining osteophytes behind the posterior cruciate ligament.

For patients with a flexion contracture >15°, further releases are normally necessary. The next step should be elevation of the posterior capsule from the femur. The knee should be flexed maximally and laminar spreaders again placed between the femur and tibia. The posterior capsule of the knee can then be elevated for 1-2 cm from the proximal femur using a periosteal elevator [3]. For flexion contractures greater than 45° this same approach can be used to elevate the tendinous origins of the gastrocnemius muscle medial and laterally.

In 1991, the senior author reported his results using a technique of transverse sectioning of the posterior capsule [4], a technique that had initially been described by Insall [5]. The safety of this procedure was based on the assumption that, in flexion, the posterior neurovascular structures displaced posteriorly away from the posterior capsule. In actuality, the reverse is true, as described by Zaidi [6] in 1995. With knee flexion, the neurovascular bundle is displaced anteriorly and can lie tethered against the posterior capsule. For this reason, posterior capsule sectioning should not be routinely used, lest inadvertent popliteal artery and vein damage occur.

An apparently simple surgical solution to correct a block to full extension would be to remove extra bone from the distal femur, i.e., a segment of bone greater than the distal thickness of the femoral component that will be inserted. Whereas an extra resection of 3-4 mm can at