Articular Constraint: Use Only What You Need
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Instability is the most common reason patients are referred after a failed total knee replacement (TKR). Correcting such instability at revision requires eliminating any residual fixed deformities, flexion and extension space balancing, and choosing an implant with proper constraint. Some surgeons may skimp on the first two steps and rely completely on the intrinsic stability in the implant. This flawed strategy usually leads to early implant wear and failure.

**SURGICAL TECHNIQUE**

**Deformity Correction**

Fixed deformities at revision knee surgery usually represent inadequate release of a contracture that existed prior to the primary arthroplasty. The releases required for a fixed varus deformity of the medial capsule, posterior cruciate ligament (PCL), and possibly the pes tendons and superficial medial collateral ligament are analogous to those used during primary TKR. For a fixed valgus deformity, release of the iliotibial band, the posterolateral capsule and the structures inserting onto the lateral epicondyle are similar to those released in the primary situation.

**Flexion/Extension Space Balancing**

After the fixed deformities are released, the knee is placed in full extension, the soft tissues are distracted using laminar spreaders medially and laterally between the femur and tibia, and the resultant extension space is measured. The knee is then placed in 90° of flexion, the soft tissues are distracted using laminar spreaders between the posterior femoral condyle and the cut tibial surface, and the resultant flexion space is measured. If the spaces are within 1-2 mm of one another, the implant can be chosen. If not, a strategy to equilibrate the spaces is planned.

Commonly, the flexion space becomes larger than the extension space. One way of addressing this is to remove bone from the distal femur to enlarge the extension space. This technique is optimal if little, if any, bone loss occurred with primary femoral component removal. If some bone loss from the distal femur exists, the surgeon might be reluctant to remove more bone. The strategy is to use a femoral component with a large anteroposterior diameter, and use posterior augments to accommodate it to the bone. Using this method, the flexion space can be decreased 5-10 mm.

A second, less common, scenario is that the flexion space is smaller than the extension space. In this case, removing more posterior femoral bone and using a smaller implant is improper. This decreases the posterior offset and leads to a diminution of potential flexion. An optimal technique is to “distalize” the femoral component using distal femoral augments behind the femoral component.

**Implant Options**

Once the soft-tissue deformities are corrected and the flexion and extension spaces are balanced, the implant is chosen. Choices include an implant that substitutes for the PCL (a posterior-stabilized, deep-dished, ultracongruent implant), a superstabilized implant (one with a varus-valgus constraint built-in), or an articulated implant. In the revision patient the PCL rarely is present or functional therefore, the PCL preserving implant usually is not an option.

To make this determination, a trial femoral component is inserted with a central box that accepts either a posterior or stabilized or a superstabilized tibial insert. The tibial base plate and progressively larger PCL substituting components are inserted to obtain stability in both flexion and extension. If stability is not obtained, a superstabilized tibial insert is used. If this is not sufficient, an articulated implant must be considered.

**RESULTS**

In a review of 61 revision cases, the flexion and extension space were equal in 29 patients and the flexion space was larger than the extension space in 27 patients. The flexion space was smaller than the extension space in 5 patients.

A posterior-stabilized or deep-dish ultracongruent component was appropriate in 53 knees, a superstabilized component in 5 knees, and an articulated implant in 3 knees. In all 5 patients in whom a superstabilized component was required, osteolysis of the femoral epicondyles was present. An articulated

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Implant was required in 2 patients with a flexion space >2 cm larger than the extension space (unbalanced flexion space), and in 1 patient who had a prior disruption of the medial collateral ligament.

At 3-year follow-up, excellent varus-valgus stability (as measured by the Knee Society rating system) was noted in all patients. Six patients had mild AP instability of approximately 5 mm, which did not cause functional limitation or pain. No patient had radiographic evidence of implant loosening; however, in two knees (one with a posterior stabilized implant and one with a super-stabilized implant) a 1-mm radiolucency was noted in zone I.³

**DISCUSSION**

Whereas in the older patient with limited functional demands, one might opt to use more constraint and rely less on the patient’s soft tissues, for the younger active and heavy patient, such an algorithm is important: the majority of the stresses should be borne by the patient’s soft tissues using the implant primarily for articular surface replacement.

**REFERENCES**