Sacrifice of the posterior cruciate ligament (PCL) in revision total knee replacement (TKR) is common, aiding in exposure, restoration of the flexion space, obtaining postoperative stability, and improving the clinical outcomes. Several PCL substituting implants are available including deep-dished, post-and-cam, varus/valgus constrained, and hinge implants. Use of the least constrained implant possible has been advised in the literature.1,5 This article attempts to answer the question when a constrained (varus/valgus constrained or hinge TKR) revision implant should be used.

**IMPLANT TYPES**

Deep-dished or post-and-cam PCL substituting implants provide resistance to posterior subluxation, but provide no varus/valgus stability to a knee with a deficient medial collateral ligament (MCL). These implants also allow internal and external rotation of the tibiofemoral articulation. Varus/valgus constrained implants prevent posterior subluxation, but due to the conforming tibial post, also provide varus/valgus constraint at the expense of internal and external rotation of the tibiofemoral articulation (Figure 1). Linked hinge arthroplasties provide coronal and sagittal stability and do not allow rotation unless they are of a rotating hinge design.

The surgeon’s goal in revision TKR is to use the revision prosthesis with the minimum degree of constraint necessary to solve instability. The integrity of the MCL is a key determinant in choosing the degree of implant constraint necessary. (Figure 2).

If the MCL is present and functional, a PCL-substituting (post-and-cam or deep-dished) implant will suffice in most patients. If the MCL is present but significantly lax or incompetent, yet amenable to repair/reconstruction, a varus/valgus constrained implant usually is chosen. If the MCL is absent or non-reconstructible, particularly in an elderly, low-demand patient, a hinge revision knee arthroplasty may be indicated. Between

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**Figure 1:** A post-and-cam PCL-sacrificing implant allows 7°-9° of internal and external rotation (A) whereas a varus/valgus constrained device allows virtually no internal and external rotation (B).

**Figure 2:** An algorithm for guiding the selection of revision TKR constraint based on the status of the MCL.
1990 and 2000, we performed 949 consecutive knee revision arthroplasties in our hospital. Posterior cruciate ligament substituting implants were used in 86% of patients (53% post-and-cam, and 33% varus/valgus constrained).

If a varus/valgus constrained implant is needed, Barrack\(^2,3\) has outlined four requirements necessary to improve outcomes when using a constrained knee replacement (Table). Failure to observe these requirements will result in a high likelihood of early failure.

Use of a varus/valgus constrained TKR should be used with caution (Figure 3). The polyethylene post used in such devices is highly congruent with the housing of the femoral component. This places considerable stress on the polyethylene post and can lead to considerable wear, fracture, or both. The use of a varus/valgus constrained insert does not allow rotation, therefore proper implant orientation and altered knee kinematics should be considered.

If the MCL is absent or non-reconstructible, a linked hinge implant may be necessary. For practical purposes, a hinge revision knee arthroplasty is indicated when we are revising another hinge implant. If Barrack’s\(^2,3\) requirements for use of a varus/valgus constrained implant cannot be met, a hinge arthroplasty should be considered. Hinge arthroplasties also play a role in patients with poorly functioning extensor mechanisms in whom a fusion might be contraindicated.

Whenever using a revision knee arthroplasty with increased constraint (ie, varus/valgus constrained or hinge-type arthroplasty), it is recommended that implant fixation be supplemented with intramedullary femoral and tibial stems. Considerable debate exists as to whether these stems should be cemented or press-fit.\(^6,10\) This is an important, but as of yet, unanswered question. We routinely do not cement the intramedullary stem in these patients because if further revision is necessary in the future, better bone stock will be preserved for this procedure (Figure 4).

The surgeon’s goal in revision TKR is to use the revision prosthesis with the minimum degree of constraint necessary to solve instability.

### TABLE

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<td>Flexion/extension gap difference of &lt;10 mm</td>
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<td>Joint line restoration to within 10 mm</td>
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**REFERENCES**


**Figure 3:** A failed varus/valgus constrained revision TKR due to poor flexion/extension gap balancing and marked elevation of the joint line.

**Figure 4:** When a varus/valgus constrained revision TKR is used, the augmented constraint increases the forces at the bone-implant interface. This patient seems at risk of implant loosening due to global sclerosis surrounding the revision stem.