Session 24: Primary TKA: The Impact of Technique

Learning Objectives
Upon completion of this activity, participants should be able to:
1. Discuss the differing effects of selective soft tissue releases on the flexion and extension spaces in total knee replacement.
2. Understand how proximity to the joint affects management of angular deformities in total knee replacement.

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The Difference in Balancing CR & PS TKA

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Background: The principle effect of posterior cruciate ligament (PCL) release is a tendency for the flexion gap to open up more than the extension space.\textsuperscript{1,2} This requires subtle differences in bone cuts and soft tissue balancing in cruciate-retaining (CR) versus posterior stabilized (PS) total knee arthroplasty (TKA).

This review will be particularly helpful to surgeons who use different prostheses in different demographic groups, and to those who occasionally convert intra-operatively from a CR to a PS prosthesis.

The problems encountered in CR and PS knees reflect the effect of PCL release.

Problems in CR knees include:
- Limited flexion when the PCL is too tight
- Paradoxical roll forward/flexion instability if the PCL is too loose

Problems in PS knees include:
- Posterior dislocation of the femur on the tibia (rare)
- Flexion contracture
Differences in bone cuts in CR & PS TKA may help to avoid these scenarios:

**CR Knees:** A thinner distal femoral resection helps avoid use of a thicker polyethylene that may make the PCL too tight.
Posterior slope of the tibia helps flexion by opening up the flexion space.

**PS Knees:** Additional distal femoral resection may be required to allow use of the polyethylene insert that adequately fills the flexion gap without a residual flexion contracture.
Avoid significant tibial posterior slope (no more than 5 degrees) due to potential anterior post impingement.

Differences in soft tissue releases may also be considered in CR & PS knees:

**CR Knee:** If the knee is tight in flexion, PCL “balancing” or partial release may be considered. However, in these cases there is a concern of late failure of the PCL.
An alternative is the use of minus or half-size components that incorporate a reduction in the posterior condyle thickness, for any given ML dimension, which relaxes the PCL.

**PS knees:** In the valgus knee, avoid release of both the LCL & popliteus tendon or risk dislocation in the flexed, figure 4 position.
When faced with a small residual intra-operative flexion contracture (< 10 degrees) with a PS knee, the surgeon may incorporate a posterior capsular release rather than additional distal femoral resection.

Prosthetic solutions:
In a PS knee, avoid routine down-sizing.
In a CR knee, consider the use of minus sizes.

**Conclusions:** Release of the PCL is likely to increase the size of the flexion gap more than the extension gap. In PS knees, flexion contracture is the most common result and can be eliminated by additional distal femoral resection or posterior capsular release. In a CR knee, tightness in flexion may require PCL balancing or use of a minus sized femoral component.

**Clinical Relevance:** Knowledge of the effect of PCL release is particularly important for CR surgeons who occasionally use a PS knee.

References:

Session 24
Management of Extra-articular Deformities

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Extra-articular deformities of the femur or tibia can occur as a result of many conditions, including metabolic bone diseases, fracture malunions, prior osteotomies, tumors, or Paget’s disease. These deformities may increase the difficulty of total knee arthroplasties and may lead to excessive varus or valgus deformity, which has been associated with component loosening, poor patellofemoral tracking, and poor clinical outcomes.

Multiple authors have examined the outcomes of total knee arthroplasties with simultaneous corrective osteotomies to treat patients who have extra-articular deformities. At follow-up times of 2 to 7 years, the clinical results are good to excellent, with significantly improved mechanical axis angles. However, this procedure is technically demanding, and there is a risk of nonunion of the osteotomy site.

Some surgeons have utilized intra-articular bone cuts with ligament balancing to restore alignment during total knee arthroplasties. Intra-articular bone guides can be used when the guide can pass through the deformity; otherwise, extra-articular bone guides are used. Various success rates of this procedure have been reported, ranging from poor to excellent.

More recently, computer-assisted navigation has been utilized to assist with performing intra-articular bone cuts. Reports show excellent mechanical axis alignment as well as clinical scores at short-term follow-up.

In summary, corrective osteotomies may improve the mechanical axis, and have been associated with satisfactory to excellent outcomes at short- to mid-term follow-up, but these procedures are difficult and include the risk of nonunions. The use of intra-articular bone cuts to correct joint alignment, using extramedullary guides, might be successful, but there are limitations for this procedure. Computer navigation may be useful for helping to guide the bone cuts, and has been associated with good mechanical axis alignment. Further experience and studies are necessary to gain a greater understanding of the outcomes of these techniques.
Does the Patella Always Have to Be Resurfaced?

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Initial total knee arthroplasty designs did not allow for patellar resurfacing, and residual anterior knee pain was a significant problem. Design changes in total knee arthroplasty allowed for resurfacing the patellofemoral compartment, and clinical results improved. Patellofemoral complications became a significant problem in total knee arthroplasty, accounting for a majority of total knee arthroplasty revisions in the late 1980s and early 1990s.

Improvements in surgical technique—particularly a better understanding of component rotation as well as more anatomic “patellar friendly” femoral trochlea designs—led to a marked decrease in patellar complications. Additionally, clinical studies began to emerge comparing routine desurfacing versus unresurfaced patellae in total knee arthroplasty. While additional surgery was often more common in the unresurfaced patients, the overall clinical results were often similar.

This controversy remains today. While both sides of this debate have their champions, a number of surgeons selectively do not resurface some total knee arthroplasty patients. The criteria for selective resurfacing are not clear, including the state of the articular cartilage. My own indications have been to not resurface younger, active patients with minimal articular changes on the patella, morbidly obese patients, and patients with patellae too thin to resurface safely.

References:


**High-Flexion TKA Is More Than Hype**

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High-flexion total knee arthroplasty (TKA) designs aim to safely accommodate deep flexion. It is unknown how often TKA patients use deep flexion during a routine day. Using a validated smart-activity monitor, we documented the prevalence of knee flexion > 90° in 20 consecutive high-flexion TKA patients with osteoarthritis at a minimum of 2 years after their operation. Patients wore the device continuously for a mean of 35.7 ± 0.5 hours. Activities performed with flexion > 90° were, on average, 70% in single limb stance, 12% going from sitting to standing, 8% walking, 7% going from standing to reclining, 2% stepping, 0.9% going from lying to standing, and 0.1% running. Nine TKAs flexed > 120° for an average of 2.2 minutes (range, 0.2-15 minutes). Activities performed with flexion > 120° were, on average, 90% in single limb stance, 6% going from sitting to standing, 3% walking, 0.6% going from standing to reclining, 0.3% stepping, and 0.1% going from lying to standing. Peak flexion used at any time during testing for the 21 high-flexion TKAs was, on average, 84% ± 11% of their maximum postoperative flexion (125° ± 12°). These patients rarely flexed their TKAs beyond 90°. Single limb stance was the most common posture employed during deep flexion.

References:


**What Is The Evidence for Mobile Bearing Knees?**

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*Background & Premise:* Mobile-bearing total knee arthroplasty (MB TKA) was introduced with several theoretical advantages, including reduced polyethylene wear, fixation stresses, and ultimately, the rate of revision TKA. Clinical comparisons of fixed versus MB TKA have not demonstrated significant differences although they are limited in number and follow-up duration. Available clinical evaluations were reviewed to evaluate these claims and compare outcomes between different types of mobile-bearing TKA.

*Materials & Methods:* An extensive database search was completed to perform a meta-analysis of studies reporting outcomes of MB TKA. Inclusion requirements for manuscript analysis were a minimum 5-year follow-up duration and those reporting knee scores, motion, loosening rates, complications, and survivorship. Both retrospective and prospective trials were included. A total of 1855 reports were initially identified and 18 manuscripts met criteria for analysis with an average follow-up duration of 8.6 years. Data was subdivided based on MB design and included rotating platform (RP), meniscal bearing (MeB), and rotation-AP translation (R-AP) subgroups.

*Clinical Results:* Fifteen-year survivorship of RP designs (96.4%) was greater than MeB implants (86.5%; *P* < .003). Mean component loosening across all mobile-bearing implant subgroups was 0.33%. Bearing instability was uncommon (≤ 1%). Implants
placed prior to 1995 exhibited higher rates of bearing instability (1.3% vs 0.12%; \( P < .002 \)). Prospectively randomized trials comparing fixed and mobile-bearing TKA were very limited and demonstrated similar results, although follow-up duration was short.

**Conclusion:** Excellent clinical results with low revision rates have been obtained with use of mobile-bearing TKA over 2 decades.\(^{1,4-27}\) Loosening and polyethylene wear rates have been very low. Bearing instability was an uncommon mode of failure and has been lessened as experience with MB TKA has been gained.

**Clinical Relevance:** Clinical results of fixed and MB TKA after one decade of follow-up duration have been similar.\(^{1,4-30}\) The initial fears of substantial backside wear and bearing instability with use of MB TKA have not been recognized.\(^{1,4-27}\) Prospectively randomized controlled studies with longer follow-up duration are required to determine superior survivorship over fixed-bearing TKA.

**References:**


Session 24
graduated components posterior cruciate retaining total knee replacement. Clin
30. Sextro GS, Berry DJ, Rand JA. Total knee arthroplasty using the cruciate-

Case Presentation & Discussion Panel
Henry D. Clarke, MD; Michael A. Mont, MD; Michael Kelly, MD; Harry E. Rubash,
MD; Douglas A. Dennis, MD; Richard D. Komistek, PhD