Factors Determining Flexion After Total Knee Replacement
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I. General: Factors determining range of motion:
   a. Preoperative range of motion, body habitus
   b. Prior surgery or trauma
   c. Surgical technique
   d. Prosthetic design
   e. Postoperative pain and scarring problems

II. Patient Factors:
   a. Obesity: (Shogi, et.al.: flexion >120°, 7% obese; flexion < 100°, 78% obese)
   b. Preoperative motion: may diminish if high, but will usually better than a patient that starts with poor motion
   c. Post operative pain issues, motivation, and pain tolerance are critical determinants.

III. Active vs Passive Range of Motion in TKA (Kinematic Assessment)
   a. Weight bearing flexion < Passive flexion in Normal, PCR, PS (P<.045)
   b. Active Flexion: Normal-135°; PCR-103°;PS-113°
   c. PS > PCR Active Weight Bearing (P<.025)
   d. Dennis, et.al., Jl Arthroplasty, 1998

IV. Kinematic “Conflict”, circa 2004
   a. Absent ACL Causes Loss of “Rollback”
   b. True for Unicondylar, Bicruciate, Cruciate Retaining, and “Total Condylar” Rotating Platform
   c. Anterior Translation exaggerated by Flexion Laxity
   d. ? Effect of Joint Line Elevation, but may tend to tighten extensor mechanism
   e. Dennis, et.al., Knee Society, 2003

V. Prosthetic Design Issues:
   a. Favor Posterior stabilized designs: Callahan, Hirsh, Dennis, Becker
   b. LCS: International Outcome Study (4036 patients): All- 110.2°; bicruciate retaining- 110.2°; posterior cruciate retaining- 111.9°; rotating platform- 108.7°
   c. LCS: Design issues favor “roll-forward” in deep flexion limiting ROM, this relates specifically to absence of the ACL.
   d. LPS High-Flex Mobile Bearing (Zimmer): Removed 2 mm from the posterior condyle with the addition of metal of condylar geometry to offer
increase flexion, increased spine height limits possibility of “jump”, tibial insert cutout favors high flexion by eliminating patellar tendon impingement.

VI. Surgical Technique (Mobile Bearings)

**Tibial Cut First**
- a. Anterior Femoral Cortical Reference
- b. Flexion Space: Tension Adjustment
- c. Distal Femoral Cut Last
- d. Standard Revision Arthroplasty Method
- e. Accurate extension/flexion balancing
- f. Maintain anatomical preoperative patellar thickness
- g. Avoid joint line elevation
- h. Clearance of posterior condylar remnants, soft tissue
- i. ? closure of knee in flexion; ? avoid thigh tourniquet
- j. Primary Ligament Balancing in Extension
- k. Flexion Gap symmetrical and < 3 mm
- l. Extension Gap symmetrical and < 2 mm
- m. Flexion=Extension Balance
- n. Patella Resection- anatomical
- o. Careful Osteophyte, soft tissue removal
- p. Correct Final Tibial Implant Rotation

VII. Clinical Results LPS High Flex Mobile

- a. 102 TKA; Age 66 ave.(43 to 80); Wt- 72 Kg (36 to 110)
- b. Varus Deformity: Ave 9° (Range 4° to 20°)
- c. Valgus Deformity: Ave 6°(Range 1° to 11°)
- d. Postop Femorotibial Angle: 2° Valgus (Range 1° to 5°)
- e. Preoperative Flexion: 120° (90° to 140°)
- f. Postoperative Flexion: 131° (90° to 150°)
- g. Argenson, et.al., ISK Fall Meeting, 2003

VIII. What Do I Tell My Patients?

- a. Preoperative Range of Motion of 90° probably improves 15-25°
- b. Stair function, sitting, and exercycle requires > 120° Flexion
- c. Certain patients have painful knees and will not improve (about 1 of 20)
- d. LPS High Flex, properly done, may flex 130° to 140° in many cases!!
Bibliography

4. Hirsch HS, Lotke PA, Morisson LD: The posterior cruciate ligament in total knee surgery. Save, sacrifice, or substitute? CORR 309: 64-68