QUANTITATIVE EVALUATION OF KNEE STRENGTH FOLLOWING TOTAL KNEE REPLACEMENT

*Jackson, W; *Pratt, J A.; *Shepherd, E F.; *McClung, C D.; ++Schmalzried, T P. (A-Piedmont Fund of the Los Angeles Orthopaedic Foundation)  
*The Joint Replacement Institute, Orthopaedic Hospital, Los Angeles, CA. ++The Joint Replacement Institute, Harbor-UCLA Medical Center, Los Angeles, CA,

Torrance, CA. 2400 S. Flower Street, Los Angeles, CA, (213) 742-1075, Fax: (213) 744-1175, schmalzried@earthlink.net

Introduction: In an otherwise satisfactory total knee replacement (TKR), the extensor mechanism function, including mild anterior knee pain, is now the prevalent issue following TKR. Extensor mechanism moment arms do not return to normal following TKR, with the greatest reduction occurring in the last thirty degrees of extension. There is a paucity of data on knee flexion and extension strength and their relationship to patient characteristics and outcome measures of TKR.

Methods: 49 control knees (no TKR) and 30 TKR knees were evaluated using a standardized protocol with a LIDO Active Dynamometer to measure isometric peak torques from 0° to 90° of flexion. Results are reported as the ratio of flexion torque (hamstrings) to extension torque (quadriceps): the HQ ratio. HQ ratios standardize strength measurement for each patient. TKR patients were also evaluated with the Knee Society Scoring System (KSS). Analysis of differences was done using multivariate linear regression.

Results: For both groups, the HQ ratio was highest in terminal extension and progressively decreased with flexion (Figure 1). The average Knee Society Score for subjects with a total knee replacement was 92 both clinically (range 76-100) and functionally (range 35-100). Following TKR, a lower HQ ratio (better quadriceps strength) was associated with a higher KSS function score (p<0.0001) and walking score (p<0.05). HQ ratios were similar in mid-flexion for the control and TKR groups. Relative quadriceps strength following TKR was comparable to control at higher degrees of flexion but could be substantially reduced with more extension (<45°) (Figure 2). The greatest difference in mean HQ (TKR vs. control) and the greatest variability in HQ ratio was in terminal extension.

HQ ratios increased (relative loss of quadriceps strength) with age in TKR patients (p<0.01). TKR patients over 70 years old demonstrated greater variability in the HQ ratio near terminal extension. Greater isometric flexion strength was seen in males (p<0.0001), younger patients (p<0.0001), heavier patients (p<0.001), and was associated with a higher KSS clinical score (p<0.05).

Discussion and Conclusion: Relative extension strength can be restored to normal following TKR, but there is great variability. Older patients are significantly less likely to demonstrate normal extension strength, which is associated with decreased walking ability and lower KSS functional scores. These results indicate a need for more aggressive quadriceps rehabilitation following total knee replacement, especially in older patients. Furthermore, quantitative evaluation of knee strength can improve rehabilitation and assist the evolution of TKR design and surgical technique.