PATELLOFEMORAL JOINT LOAD AFTER TKA

Introduction:
Patellofemoral joint (PFJ) complications are frequently encountered after TKA, and remain among the leading causes of pain and revision surgery. Laboratory studies have shown that medial placement of the patellar button significantly decreases medial patellar tilt and subluxation compared to central placement of the implant [1]. Clinical studies have also shown improved intraoperative patellar tracking and a significantly decreased need for lateral retinacular release with medial patellar placement [2,3]. The purpose of this study was to determine the effects of patellar component placement on PFJ load transfer and kinematics in both PCL retaining and posterior stabilized knee designs. This research proceeded from the hypothesis that patellar placement would have a significant and equal influence on PFJ mechanics in both knee designs.

Methods:
Eleven radiographically normal cadaver knees were selected for routine PCL retaining (CR) total knee arthroplasty using a conforming condylar knee system (NexGen; Zimmer, Inc.). Each patella was resurfaced with a conforming patellar dome button, restoring native patellar height. The patellar button was placed at the geometric center of the bony patella. A custom fabricated 6-DOF load cell was attached to the patella to record the patellofemoral reaction forces and moments. A pair of instrumented spatial linkages was used to record 3D tibiofemoral and patellofemoral kinematics. Each knee was manipulated through a flexion range of approximately 10° to 100° in an Oxford-style knee simulator using 48 N to simulate half-body weight. The unique design of the patellar load cell allowed the patellar button to be medialized by 3.75 mm at the sagittal ridge and the testing sequence was repeated. Lastly, the femoral component and tibial insert were replaced by posterior stabilized (PS) devices and the same variations in patellar placement were tested. The mounting of the PS components used the same bony fixation as the CR components so that identical component orientation was assured.

Results:
Implant medialized caused a decrease in the medial-lateral force on the patella in all cases (Fig. 1) and had no effect on PFJ normal force. The patella tilted laterally with medial placement of the patellar component at all flexion angles in the CR knee and at flexion angles of less than 65° in the PS knee (Fig. 2). In both designs, button medialization increased tibial external rotation and tibial valgus. The results illustrated in Fig. 1 and Fig. 2 are averages computed over eleven specimens.

Discussion:
Medial placement of the patellar component improves patellofemoral mechanics by decreasing medial-lateral force. At small flexion angles, the change in loading helps reduce the tendency for lateral subluxation. At larger flexion angles, the reduction in load shows a better balance of PF forces. Because the normal force did not change with button medialization, a better balance of PF forces should produce a more symmetric wear pattern in both CR and PS knees. Note that a medially directed load on the patella indicates constraint of the patella by the lateral side of the condylar groove.

The decrease in medial-lateral force is independent of the choice of CR or PS arthroplasty. Use of the CR design reduces medial-lateral load magnitude at higher flexion angles when the patellar button is centered, but use of the PS design reduces medial-lateral force values at all flexion angles when the button is medialized. Proceeding from the indicated benefit of button medialization, use of the PS design offers an advantage. As indicated by the kinematic differences based on the use of CR and PS components, however, the effect of button medialization has multiple implications. Many factors affect the choice of TKA components and would need consideration. More analysis may discover the importance of the altered kinematics.

Acknowledgments:
This research was supported in part by an RRD grant from the Veteran’s Administration and components were donated by Zimmer, Inc.

References:

Additional Affiliations:
**Rush Presbyterian St. Luke’s Medical Center, Chicago, IL
***Massachusetts General Hospital, Boston, MA

Presenting Author: Anthony Petrella
Corresponding Author: Mark Miller

PC 8  ABSTRACT NO. 0439

I prefer a Poster Presentation

First Name  Last Name

First Name  Last Name

Additional Affiliations