AN IN VIVO DETERMINATION OF KINEMATICS FOR SUBJECTS HAVING A PATELLOFEMORAL IMPLANT

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INTRODUCTION: Previous in vivo fluoroscopic studies have determined that subjects having a total knee arthroplasty experience more superior contact patterns, abnormal patellofemoral tilting and the incidence of patellofemoral separation [1,2]. The objective of this present study was to determine the in vivo kinematic patterns for subjects implanted with a patellofemoral arthroplasty (PFA).

METHODS: Twenty subjects, all having a PFA, were studied after a minimum of two years postoperatively under fluoroscopic surveillance while performing a weight-bearing deep knee bend to maximum flexion. The videos were analyzed on a workstation computer and analyzed in two-dimension (2D) using digitization. (Sigma Scan, SPSS Science, Chicago, IL) Patellofemoral contact positions, relative to the superior/inferior midline of the patella in the sagittal plane were initially determined for each subject. Then the sagittal plane angle (patellotibial tilt) of the patella, relative to the tibia was measured each knee was assessed for patellofemoral separation at full extension. Finally, subjects were analyzed from a skyline view to assess medial/lateral translation. The kinematic patterns for subjects in this present study were then compared to our previous study of the normal knee and TKA subjects.

RESULTS: Although the average pattern was similar to the normal knee, the patellofemoral contact patterns for each subject having a PFA was highly variable. Subjects having a normal knee experienced, on average, 13.4 mm of inferior-to-superior translation, while subjects having a PFA experienced 11.9 mm. Subjects having a PFA did experience very different patellofemoral tilting angles. At full extension, the PFA subjects experienced 1.0° of patella extension, while the normal subjects experienced -7.0° of patella flexion. The PFA subjects were the only group we ever analyzed that experienced patella extension at full extension. The average amount of patella tilting during the full flexion cycle was 26.3°, much greater than the 16.0° determined for the normal knee in our previous study. One PFA subject experienced 48.6°. No subjects in this present study experienced patellofemoral separation. We were only able to analyze the medial/lateral translation kinematics for 18 subjects, who experienced an average of 3.8 mm of motion. Five subjects experienced greater than 5.0 mm of motion.

DISCUSSION: This was a unique study for two reasons: (1) It was the first study to ever determine the in vivo kinematics for subjects having a PFA and (2) It was the first study to determine the in vivo medial/lateral translation patterns of the patellofemoral joint. Subjects in this study with PFA experienced an average patellofemoral kinematic pattern similar to the normal knee but with high variability among subjects and some abnormal rotational patterns. Most of the subjects who underwent PFA in this study had a previous history of subluxed or dislocated patella which affects the normal patella tracking, especially regarding tilting and translation. This tracking may also be directly affected by patellofemoral conformity, a consequence of femoral implant design. Finally, after PFA the patellotibial tilt angle is influenced by the anteroposterior positioning of the femoral component. The results of this very first in vivo kinematic study may play an important role, not only for design consideration of patellofemoral replacement but also for surgical technique in order to obtain optimal implant positioning.