INTRODUCTION: In previous studies, TKA kinematics has been compared to knee motion of younger, healthy subjects, rather than attempting to understand the older, more comparative, non-implanted knee. Therefore this study analyzed the in vivo kinematics of both implanted and non-implanted knees of the same patient.

METHODS: Fifteen patients (average age 71.8 ± 7.4 years) having one implanted leg (mobile bearing Hi-Flex PS) and one non-implanted knee, performed a deep knee bend to maximum under fluoroscopic surveillance. The study was approved by the Institutional Review Board and the informed consent form was obtained from all subjects. The 3D femorotibial kinematics was determined for both knees using previously published 3D-to-2D registration technique (Fig. 1) [1,2]. The CAD bone models were created using segmentation technique from CT images. Tibiofemoral rotations were described using the Grood and Suntay convention [3], recommended by the International Society of Biomechanics [4]. Anterior-posterior translations of the femorotibial contact points were determined. A statistical analysis was conducted using the non-parametric Kruskal Wallis test at a 95% confidence level.

RESULTS: On average the subjects achieved greater flexion with their TKA (103.4° ±15.9°) than with their contralateral knee (96.3° ±18.3°) and consequently experienced significantly (p=0.038) higher ROM for their implanted knee. However, the TKAs demonstrated significantly (p=0.0005) lower range of axial rotation (8.9° ±3.7°) than the contralateral knee (18.0° ±7.1°) and lower (p=0.0618) range of abduction/adduction (1.2° ±0.5°) than the non-implanted knee (4.3° ±1.5°). The significant differences in tibiofemoral rotations between TKA and contralateral knees were seen only at full extension and early flexion (Fig. 3). Significant differences were seen in the AP position of the femorotibial contact point. The contact point of the medial condyle for the TKA was significantly more posterior at 0° (p<0.001) and 30° (p=0.001) and remained more posterior than the same condyle of the contralateral knee throughout flexion. Also the lateral condyle remained significantly more posterior (p=0.05) for all flexion increments for the TKA than for the contralateral knee.

DISCUSSION: Even though the contralateral knee revealed more external rotation than the TKA, the subjects were able to achieve more flexion with their implanted compared to their non-implanted knee. Possible explanation of this phenomenon may be in the AP location of the femorotibial contact point. This point for both medial and lateral condyles was located much more posterior for the TKA than contralateral knee, which might lead to more flexion and ROM. Also, osteoarthritis may be present in the contralateral knees, leading to degeneration and loss of flexion. The medial condyle of the non-implanted knees in this study revealed AP translation patterns similar to healthy knees in previous studies, but the lateral condyle contacted the tibia much less posteriorly than observed for younger subjects. The kinematics of the TKA in this study was similar to those previously reported for other TKA. However, the motion of the same subjects' non-implanted knees was different from healthy, younger subjects. The contralateral knee experienced less adduction and less posterior femoral rollback of the lateral condyle which may explain the lack of expected pivoting motion and consequently limited flexion of this knee.

REFERENCES:

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