Title: Does an Anatomically Designed Total Knee Replacement Improve Knee Joint Kinematics?

Trainee Name: Jordan Broberg

Supervisor(s): Dr. Matthew Teeter

Structured Abstract:

Introduction: Currently, total joint replacement (TKR) is the only treatment for end stage arthritis, a serious health issue affecting one in six Canadians. Even though TKR has improved over the years, with implants having greater longevity, patient satisfaction following TKR has not improved, with approximately 20% of patients recording dissatisfaction with their new knee joint. It is unclear why many patients feel this way, but it may relate in part to implant designs that do not provide a “natural” feeling knee. Implant manufacturers continue to introduce new concepts for implant design which are essential for reaching the goal of a “normal” knee after TKR surgery. The Journey II TKR (Smith & Nephew) was developed with this goal in mind. Its anatomical design attempts to mimic the normal knee joint structure to return more natural kinematics to the joint. Our objective is to examine patients receiving the Journey II to measure the knee joint contact kinematics of the Journey II compared to other implants by the same manufacturer. We hypothesize that the Journey II TKR will have contact kinematics that differ from non-anatomically designed implants.

Methods: A total of 56 individuals will be recruited to receive a Journey II TKR, matching an existing prior cohort with a non-anatomically designed TKR (Legion TKR, Smith & Nephew). For the Journey II TKR group, a series of RSA images were acquired at 3-months post-operatively at different knee flexion angles, ranging in 20° increments from 0° to 120°. Model-based RSA software (RSACore, Leiden, Netherlands) was used to obtain the 3D positions and orientations of the femoral and tibial implant components. Results from the model-based RSA software were used to attain kinematic measures for each condyle of magnitude of excursion and contact location. Results from the Journey II TKR group were compared to the 2-year post-operative measurements from the Legion TKR group. Statistical analyses (t-test, Mann-Whitney test, and Fisher exact test) were performed for comparisons between the Journey II TKR and the Legion TKR.

Results: Preliminary results from 65 patients (21 Journey II, 44 Legion) suggest that there is no significant difference between Journey II and Legion groups with respect to magnitude of excursion on both medial (mean difference=0.62 mm, p=0.50) and lateral (mean difference=2.25 mm, p=0.08) condyles. For contact locations on the medial condyle, there were significant differences at 0°, 60°, 80°, 100°, and 120° of flexion (p<0.05). For contact locations on the lateral condyle, there were significant differences for all angles of flexion (p<0.01).

Discussion: Early results suggest that Journey II TKR provides significantly different knee kinematics from the Legion TKR. The greater femoral rollback and absence of unnatural anterior motion in the Journey II TKR suggest that it provides more natural knee joint kinematics.