Aims The Oxford Knee Score (OKS) is a 12-item questionnaire used to track knee alignment options were analyzed. Femoral alignment was significantly different between groups. 13.1% of KA compared to 3.3% of FA plans were outside safe coronal boundaries. Majority of these occurred by placement of femoral component in more than 6° of valgus. For femoral rotation using the TEA as reference, KA placed 3.3% outside of a safe zone limit of 3° ER to 6° IR, with 25% being placed in more than 3° IR compared to FA which had 1.6% outside the safe-zone and 4.1% being placed in more than 3° IR. The trochlear groove was translated most using a mechanical alignment (MA) technique. In full extension, a MA femoral component was a mean 7.84 +/- 1.99mm lateral to the native groove compared to KA 6.40 +/- 2.43mm and functional alignment (FA) 6.88 +/- 1.74mm (p < 0.001). This difference was less in mid-flexion (p = 0.003) and not significant in deep flexion. In full extension, KA overstuffed by a mean of 1.36 +/- 1.16mm compared to MA 1.28 +/- 1.21mm and FA 0.83 +/- 1.18mm (p < 0.001). In mid-flexion and deep flexion, all alignments resulted in a mean under-stuffing of the groove, most with KA, followed by MA and FA (p < 0.001). FA most closely restored the trochlear groove depth. Choice of alignment philosophy led to significant variations in trochlear groove restoration. MA resulted in the greatest translation shift and KA created the most understuffing overall. FA and KA were equally consistent in reproducing the trochlear groove in terms of translation, however KA resulted in femoral coronal component positioning that is considered unsafe in 13.2% of cases, compared to FA in 3.7% of cases. A KA philosophy also resulted in a femoral component that was IR beyond 3° relative to the TEA in more than 25% of cases compared to 3.3% with a FA philosophy. These findings confirm our hypothesis that a KA placed femoral component better restores the constitutional trochlea groove alignment but frequently results in unsafe coronal or axial implant positioning. These findings may explain why patellofemoral complications are the most common reason for revision in KA TKA.

Summary: The three questions on overall knee pain, limping when walking, and knee ‘giving way’ were the strongest predictors of subsequent revision within two years. Data: Aims The Oxford Knee Score (OKS) is a 12-item questionnaire used to track knee arthroplasty outcomes. Validation of such patient reported outcome measures is typically anchored to a single question based on patient satisfaction, however risk of subsequent revision surgery is also an important outcome measure. The OKS can predict subsequent revision risk within two years, however it is not known which item(s) are the strongest predictors. Our aim was to identify which questions were most relevant in the prediction of subsequent knee arthroplasty revision risk. Patients and Methods All primary TKAs (n=27,708) and UKAs (n=8,415) captured by the New Zealand Joint Registry between 1999 and 2019 with at least one OKS response at six months, five years or ten years post-surgery were included. Logistic regression and receiver operating characteristics (ROC) curves were used to assess prediction models at six months, five years and ten years. Results Q1 ‘overall pain’ was the strongest predictor of revision within two years (TKA: 6 months, odds ratio (OR) 1.37; 5 years, OR 1.80; 10 years, OR 1.43; UKA: 6 months, OR 1.32; 5 years, OR 2.88; 10 years, OR 1.85; all p<0.05). A reduced model with just three questions (Q1, Q6 ‘limping when walking’, Q10 ‘knee giving way’) showed comparable or better diagnostic ability with the full OKS (area under the curve (AUC); TKA: 6 months, 0.77 vs. 0.76; 5 years, 0.78 vs. 0.75; 10 years, 0.76 vs. 0.73; UKA: 6 months, 0.80 vs. 0.78; 5 years: 0.81 vs. 0.77; 10 years, 0.80 vs. 0.77). Conclusions The three questions on overall knee pain, limping when walking, and knee ‘giving way’ were the strongest predictors of subsequent revision within two years. Attention to the responses for these three key questions during follow-up may allow for prompt identification of patients most at risk of revision.

Category: Knee - Arthroplasty

Reproducibility and Reliability of a New and Non-invasive Technique to Evaluate Aseptic TKA Loosening: A Cadaveric Study

Abstract ID# 21519

All Authors: George Samuel Buiks MD NETHERLANDS Arthur Kievit MD NETHERLANDS Matthias U. Schafroth MD NETHERLANDS Leendert Blankevoort PhD NETHERLANDS

Summary: Non-invasive measurement of knee implant loosening using knee loading, CT scans and 3D-image analysis.

Data: INTRODUCTION: Despite its success up to 13% of the patients will require revision surgery within 10 years after Total Knee Arthroplasty (TKA). In the majority, the reason for revision is aseptic loosening of the tibial component. The main tests used to diagnose aseptic TKA loosening currently have a sensitivity or specificity higher than 70-80% and merely demonstrate secondary and a-specific effects. This leads to 20-30% of patients undergoing unnecessary, risky and expensive revision surgery. Detecting actual displacement of the implant with respect to the bone may be a more reliable and direct approach to evaluate TKA loosening. Therefore, a new non-invasive technique was developed to evaluate implant loosening. This study presents this new technique and evaluates its reproducibility and reliability in a laboratory cadaveric study. METHODS: For the purpose of this study a prototype loading device was developed to apply consecutive varus- and valgus loads to the knee (20 Nm). The advanced 3D-image analysis software was developed by the Biomedical Engineering and Physics department. It consists of a three-step approach to visualize and quantify prosthesis loosening using CT-images, i.e. (1) segmentation of the tibia and tibial TKA component in the varus scan, (2) registration of the tibia and tibial segmentations to the valgus scan and (3) calculation of varus-to-valgus displacements and rotations of the tibial component relative to the tibial bone. These displacements and rotations are quantified using the mean Target Registration Error (mTRE), helical axis rotation and Maximum Total Point Motion (MTPM). In this experimental study, first the reproducibility errors of this technique were quantified using a single frozen solid specimen in which implant displacement and rotation were assumed to be absent. This specimen was implanted with a TKA and scanned in ten slightly different orientations without load. Any observed implant displacement was designated as reproducibility errors caused by the noise content of the CT images, the segmentation and/or registration procedure. Secondly, to evaluate reliability, ten thawed cadaveric specimens were first implanted with loosely fitted TKA’s and scanned under varus load first followed by a valgus load scan. Thereafter, the implants were fixed to the bone using bone cement and scanned in the same manner to investigate possible differences between the loose and the fixed tibial component. Differences were tested using a paired sample t-test. RESULTS: Reproducibility errors, expressed in terms of mTRE, helical-axis rotation and MTPM were 0.073 mm (SD 0.035), 0.129 degrees (SD 0.039 degrees) and 0.116 mm (SD 0.031), respectively. Comparing the mTRE, helical axis rotation and MTPM of the loose situation relative to the fixed situation resulted in mean differences of 0.463 mm (SD 0.279 mm; p<0.001), 1.769 degrees (SD 0.868 degrees; p<0.001) and 1.339 mm (SD 0.712 mm; p<0.001), respectively. All displacements and rotation changes in the loose situation were larger than the reported reproducibility errors. CONCLUSION: The results of this cadaveric study suggest that this new and non-invasive method is both reproducible and reliable for detection of TKA loosening. Yet, a patient study is needed, and underway, to investigate future clinical utilization.