Gait Affects Tibial Component Migration in Unicondylar Knee Arthroplasty

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INTRODUCTION

The processes behind tibial component migration in Unicondylar knee arthroplasty (UKA) have been relatively unstudied. The force applied to the prostheses during walking increases the shear stress at the bone cement interface, which may lead to aseptic loosening[1]. Knee compressive forces in gait may also cause prosthesis migration[1]. By participating in a large amount of walking, the UKA prosthesis may be highly exposed to these knee loads, exacerbating the migration thus loosening. Roentgen stereophotogrammetric analysis (RSA) can accurately measure component migration[2]. In addition, by using three-dimensional (3D) gait analysis and wearing daily activity monitors, respectively we examined if knee joint loading during gait and exposure to this loading is related to UKA tibial component migration.

METHODS

11 patients who received a Millar Glante (Zimmer) UKA for medial compartment Osteoarthritis with suitable RSA films for analysis at 2 years post surgery were studied with 3D gait analysis. The sample is part of a larger sample still to be collected and analyzed. The Vicon 370 (Oxford Metrics, Oxford UK) motion analysis system with 7 infra red camera at 50 hertz and two ATMI force plates were utilised to measure the lower limb joint kinematics and kinetic with the cluster marker model and optimized joint axes and centres[3]. Kinematic variables were normalized to bodyweight x height and expressed as external joint moments. Patients were instructed to walk at their self-selected, normal walking speed for analysis. Prior to the gait analysis session, each subject also wore an activity monitor. Nine age matched control subjects were also tested using the same procedures for comparison.

RESULTS AND DISCUSSION

The UKA group walking with higher peak knee adduction and flexion moments during the stance phase compared to the control group. There was no correlation between peak knee adduction moment and tibial component migration. However peak knee flexion moments showed moderate correlations with distal subsidence (r=0.48) and posterior tilt (r=0.43) of the tibial component. Higher correlations were found between average number of steps per day and lateral (r=0.57) and posterior subsidence (r=0.52) and varus tilt (r=0.62).

High peak knee flexion moments in total knee arthroplasty patients have also been associated with increased tibial component migration, leading to the potential early onset of aseptic loosening[1]. High peak flexion moments also predict the presence and severity of anterior knee pain following total knee arthroplasty[4].

The preliminary results are also the first to show an association with physical activity and component migration in knee replacement, supporting a long held belief by orthopaedic surgeons. When the peak knee flexion moments were multiplied by the average number of steps taken per day the correlations with components migration were strengthened (r=0.68 for distal subsidence and r=0.61 for varus tilt of the tibial component). These stronger correlations suggest the amount and frequency of knee joint loading has the greatest affect on potential tibial component loosening.

CONCLUSIONS

The results from this small sample of a larger study group to be tested suggests that high flexion moments have a negative effect on the tibial component in UKA, similar to that seen in total knee replacement[1]. This sample is the first reported evidence of the frequency of joint loading having larger affect on migration, which is further strengthening when combined with high joint moments.

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