INTRODUCTION:

Patello-Femoral Angle (PFA) has been measured in several different techniques to assess patello-femoral joint function as a possible indicator of tibio-femoral antero-posterior translation and anterior knee pain [3,2,4] in patients operated on Total Knee Arthroplasty. The inclination of the patellar tendon in the tibial sagittal plane during knee flexion is important because it can reflect the femur rollback on the tibial plateau. Femur rollback determines reduction at the patello-femoral joint force and optimizes the extensor and flexor muscular lever arm. Aim of this paper was to find whether there is a correlation between PTA and tibio-femoral contact point location measured by fluoroscopy to verify if it is possible to use the PTA alone as an indicator of sagittal knee kinematics.

METHODS:

Twelve patients (mean age 69.1 years, mean weight 68.7 kg, and mean height 156.9 cm) underwent TKA using a cemented Posterior Stabilized prosthesis (OPTETRAK, Exactech, Gainesville, Florida, USA). Fluoroscopic analysis was performed at least 12 months after surgery. Patients performed step up-down motor task, while maintaining the replaced knee within the fluoroscopic field of view. Three dimensional prosthesis component positions and orientations were obtained from each fluoroscopic image by a standard iterative procedure using a CAD-model-based shape matching technique [5]. Previous validation work [1] showed that position and orientation in the sagittal plane of the prosthesis components can be estimated with an accuracy better than 0.5 mm and 1 degree, respectively. Medial and lateral tibio-femoral contacts were assumed as the points on the articulating surfaces of the prosthetic condyles closest to the tibial component.

For the characterization of the antero-posterior (AP) motion of the femoral with respect of the tibial component, the position of the midpoint between the medial and lateral contact points was calculated and normalized with respect to the AP dimension of the tibial component. The most posterior (MAX), most anterior (MIN), and mean (MED) positions, together with the AP translation of the midpoint (RANGE) were calculated for each subject.

The cine-fluoroscopic 2D images were then analyzed with a semi-automated software developed for the purpose in Matlab (The Mathworks, Inc.) for the measure of the patellar tendon angle (PTA). The same result was obtained for MED, which showed the most significant correlation (p = 0.016, R = 0.677) for the single regression model with M (cost = 61.929, Bm = -0.01).

No significant correlation was found for the RANGE parameter neither with the multiple nor with the simple regression model. The parameter RANGE showed changes of only a few millimetres over different subjects.

DISCUSSION:

No significant correlation was found between neither of the parameters M and Q, characterising the PTA versus knee flexion relationship, and the AP range of motion of the femoral over the tibial component represented by the parameter RANGE. This parameter is almost constant over the subjects, while the two PTA parameters correlate significantly with MAX, MIN and MED. The latter can be interpreted as the actual AP motion of the femoral component, not changing much among subjects. The almost constant range of AP motion is only centred more or less posteriorly on the tibial plateau, and this is revealed by the PTA parameters. This result can be accounted not only for the congruency between the femur and the polyethylene insert but also for the spine-cam mechanism featured by this prosthesis design. On the other hand, PFA parameters do not seem to reveal the range of actual AP motion of the femoral component.

REFERENCES: