THE EFFECT OF POSTERIOR TIBIAL SLOPE ON THE KINEMATICS OF PCL-RETAINING TKA. A PILOT STUDY

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INTRODUCTION

Total knee arthroplasty (TKA) is an effective technique to treat end-stage osteoarthritis of the knee. One important goal of the procedure is to restore a physiological knee kinematics. However, fluoroscopy studies have shown abnormal knee kinematics after TKA [1] which may lead to suboptimal clinical outcomes [2]. Posterior slope of the tibial component may significantly impact the knee kinematics [3]. There is currently no consensus about the most appropriate slope. The goal of the present study was to analyze the impact of different prosthetic slopes on the kinematics of a PCL-preserving TKA. The tested hypothesis was that the knee kinematics will be different for all tested tibial slopes.

MATERIAL

A PCL-retaining TKA (Optetrak CR, Exactech, Gainesville, FL) was performed by a board-certified orthopedic surgeon on one fresh frozen cadaver that had a non arthritic knee with an intact PCL. Native intact knee kinematic was assessed using a computer-assisted orthopedic surgery (CAOS) system (ExactechGPS®, Blue-Ortho, Grenoble, FR) Then, the TKA was implanted using the guidance of the CAOS system. The implanted tibial baseplate was specially designed (Fig. 1) to allow modifying the posterior slope without repeatedly removing/assembling the tibial insert with varying posterior slopes, avoiding potential damages to the soft-tissue envelope. Knee kinematic was evaluated by performing a passive range of motion 3 separate times at each of the 4 posterior slopes selected: 10°, 7°, 4° and 1°. Respective 3D positioning of femur and tibia implants was recorded by the navigation system. Femorotibial rotation, antero-posterior (AP) translation and hip-knee-ankle (HKA) angle were plotted with regard to the knee flexion angle.

RESULTS

Tested knee kinematics are presented in Fig. 2. Tibial slopes of 1° and 4° significantly altered the normal rotational kinematics. Tibial slopes of 7° and 10° led to a kinematics close to the original native knee. All tibial slopes significantly altered the changes in HKA before 90° of knee flexion, without significant difference between the different slopes tested. The magnitude of change was small. There was no significant change in the AP kinematics between native knee and all tested tibial slopes.

DISCUSSION

Navigation systems are able to accurately assess the knee kinematics after TKA [4]. Changing the tibial slope significantly impacted the TKA kinematics. However, in the implant studied, only the rotational kinematics were significantly impacted by the change in tibial slope. Tibial slopes of 7° and 10° led rotational kinematics that were closest to that of a normal knee. Alterations in knee kinematics related to changing tibial slope may be related to a change in the PCL strain [5]. However, these results must be confirmed by other tests involving more specimens.

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DISCLOSURE

JYJ receives royalties from the Company Aesculap and is a paid consultant of Exactech Inc.
MC is a paid consultant of Exactech Inc.
CH and AJ are employees of Blue Ortho.
LA, YD are employees of Exactech Inc.

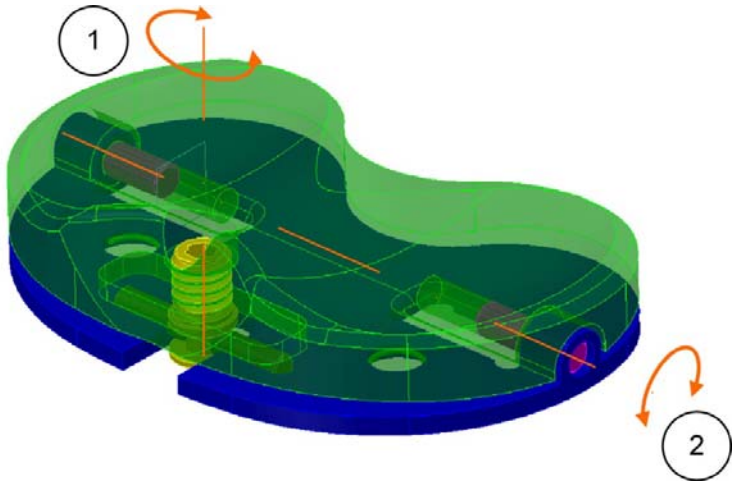

Figure 1: A custom designed tibial baseplate for the test. Turning the anterior screw (1) results in modification of the tibial component posterior slope (2).

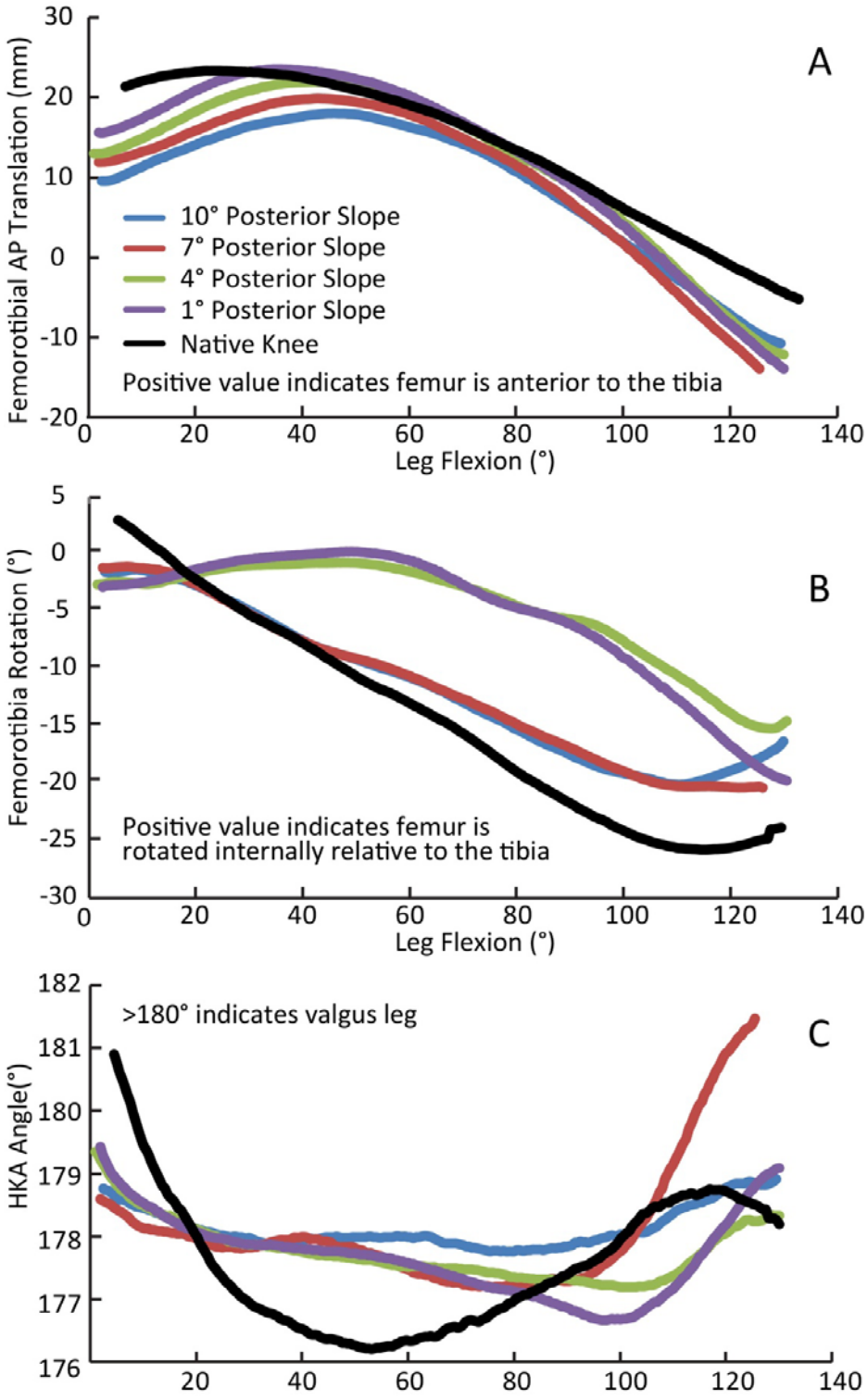

Figure 2: Femorotibial AP translation (A), femorotibial rotation (B), hip-knee-ankle angle (C) as a function of the knee flexion, compared across different tibial posterior slopes and the native knee.