INTRODUCTION

• Anterior Cruciate Ligament (ACL) injury is one of the most common ligamentous injuries of the knee.
• Although many patients have good outcomes after ACL reconstruction, a number of patients experience instability or graft failure.
• The posterior tibial slope (PTS) of the tibial plateau may play a role in ACL injury mechanisms [1].

A paired t-test was used to analyze statistical significance between normal and osteotomized knees every 5° of flexion.

- Significance level was set at p < 0.05.

MATERIALS AND METHODS

• Eleven fresh-frozen cadaveric knees were tested.
  - Mean age of 27 years (range: 18 to 41 years)
• The femoral attachment of the ACL was mechanically isolated and attached to a load cell for direct measurement of resultant ACL force (Figure 2).

PTF was calculated using a 3D digitizer (FARO Gage; Figure 3).
  - A reference axis was defined between midpoints along the long axis of the tibia.
  - Markers were placed on the anterior and posterior margins of the medial and lateral tibial plateau.
  - Medial PTS was calculated as the angle between the medial tibial plateau and the perpendicular to the reference axis (long axis of tibia).
  - Lateral PTS was calculated as the angle between the lateral tibial plateau and the perpendicular to the reference axis.
• The tibia and femur were potted in PMMA and attached to a 6-DOF robot (Figure 4; Kuka KR210).
  - The robot flexed the knee from 0° to 50° under 200 N TFC combined with the following loads:
    - 45 N anterior tibial force (AF)
    - 5 Nm valgus moment (VM)
    - 2 Nm internal tibial torque (IT)
    - 45 N AF + 5 Nm VM + 2 Nm IT
  - Knee kinematics and resultant ACL force were recorded.
• After testing the normal knee, a 10° PTF-reducing osteotomy was performed (Figure 4), and the knee was re-tested.
  - A paired t-test was used to analyze statistical significance between normal and osteotomized knees every 5° of flexion.
  - Significance level was set at p < 0.05.

DISCUSSION AND CONCLUSIONS

• PTF-reducing osteotomy significantly reduced ACL force under TFC combined with AF or VM.
  - Likely due to the corresponding anterior, internal, and valgus kinematic changes.
• There were no significant differences in ACL force for all conditions with an applied IT.
  - ACL force during internal tibial rotation is produced by cruciate impingement from internal winding and not a reduction of anterior tibial translation.
• The osteotomy is effective at protecting the ACL in the absence of IT, but the protective effect is lost when IT is applied.

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REFERENCES