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The risk of sacrificing the PCL in cruciate retaining total knee arthroplasty and the relationship to the sagittal inclination of the tibial plateau

Pasquale Sessa *, Giulio Fioravanti, Giuseppe Giannicola, Gianluca Cinotti

Department of Anatomical, Histological, Forensic Medicine and Orthopaedics Sciences, University "La Sapienza" Rome, Italy

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ABSTRACT

Background: In cruciate retaining total knee arthroplasty (TKA), a partial avulsion of PCL may occur when en-bloc tibial osteotomy is performed. We evaluated the effects of a tibial cut performed with different degrees of posterior slope on PCL insertion and whether the results are affected by the sagittal inclination of the patient's tibial plateau.
Methods: We selected 83 MRIs of knees showing mild or no degenerative changes. The effects of a simulated tibial cut performed with a posterior slope of 0°, 3°, 5° and parallel to the patient's tibial plateau inclination on PCL insertion in the proximal tibia were investigated. The results were correlated with the degree of posterior inclination of the tibial plateau.
Results: Every angle we used for the tibial cut caused a PCL avulsion greater than 50%. The percentage of PCL avulsion significantly increased with increasing the posterior slope of the tibial cut. Patients with sagittal tibial plateau inclination <5° showed greater PCL avulsion than those with sagittal inclination >8°.
Conclusions: Most of the PCL insertion is likely to be sacrificed when resection of the proximal tibia is performed en-block. The risk of PCL avulsion is reduced in patients showing a marked posterior inclination of the tibial plateau, but even in this group of patients a surgical technique aimed at sparing most of the PCL insertion is necessary.

1. Introduction

Preserving the posterior cruciate ligament (PCL) in total knee arthroplasty (TKA) may theoretically be useful for joint stability by limiting posterior tibial translation and varus-valgus laxity and for joint kinematics by preserving femoral roll-back and knee motion in flexion [1]. However, in vivo fluoroscopic investigations have questioned the potential advantages of posterior cruciate-retaining (CR) implants, since a reduced femoral roll-back was more often associated with CR than posterior stabilized (PS) implants [2,3]. These findings have been explained considering the degenerative changes of the PCL which may occur in arthritic knees causing excessive laxity or tightness of the ligament [4–6]. Moreover, recent investigations have shown that, during the tibial cut, the PCL insertion may be partially divided, thus questioning the biomechanical function of the residual PCL after tibial osteotomy [7–10]. This issue may have a substantial clinical relevance because if PCL fibres are mostly detached during the tibial cut, the reported clinical outcomes of CR TKA, actually refer to patients in whom a TKA designed to work with an intact PCL is implanted with a potentially incompetent PCL.

The tibial cut in TKA is usually performed with 0 to 7° of posterior inclination in accordance with the manufacturer suggestions or parallel to the natural slope of the operated knee as measured on preoperative images [7,11]. Although the degree of posterior inclination of the tibial cut are likely to influence the amount of PCL fibres excised at surgery, only one study analysed the relationship between the two [9]. In addition, the sagittal inclination of the tibial plateau may theoretically affect the amount of PCL fibres detached during the tibial cut, since PCL fibres may insert more cranially or distally depending on the degree of sagittal inclination of the tibial plateau. However, no study has investigated whether the sagittal inclination of the tibial plateau may affect the risk of PCL damage during the tibial cut.

The aim of the present investigation was to analyse the extent of PCL fibres sacrificed when a tibial cut with varying posterior inclination is performed. A second aim was to analyse whether a correlation exists between the extension of PCL avulsion occurring with the tibial cut and the degree of posterior inclination of the tibial plateau. Our hypothesis was that the risk of sacrificing the PCL during the tibial cut is higher in patients showing a reduced sagittal inclination of the tibial plateau compared to those with a greater sagittal inclination.

2. Methods

Magnetic resonance (MR) images of the knee of skeletally mature Caucasian subjects attending the Department of Radiology were analysed. Exclusion criteria were a clinical history of previous knee surgery or trauma to the PCL, the presence of degenerative changes of cartilage and subchondral bone, severe varus-valgus deformity and

* Corresponding author at: Piazzale A. Moro, 5 Roma, 00100, Italy. Tel.: +39 3341791178 (mobile).
E-mail address: p.sessa@hotmail.it (P. Sessa).

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