Correlation between posterior offset of femoral condyles and sagittal slope of the tibial plateau

G. Cinotti,¹ P. Sessa,¹ F. R. Ripani,¹ R. Postacchini,² R. Masciangelo³ and G. Giannicola¹

¹Department of Anatomy, Histology, Medico Legal and Orthopaedic Sciences, University La Sapienza, Rome, Italy ²Israelitic Hospital, Rome, Italy

³Department of Public Health and Infectious Diseases, University La Sapienza, Rome, Italy

Abstract

The aim of this study was to address, in normal knees, the variability of posterior offset of femoral condyles and tibial slope, and the presence of any correlation between the two that might be needed to achieve an adequate joint motion in flexion. Magnetic resonance images of normal knees of 80 subjects, 45 males and 35 females, with a mean age of 38.9 years, were analysed. Measurements were performed by two independent observers using an imaging visualization software. The tibial slope averaged 8 and 7.7 °, on the medial and lateral sides, respectively (P = 0.2); the mean posterior offset of femoral condyles was 27.4 and 25.2 mm on the two sides, respectively (P = 0.0001). The variation coefficient of the condylar offset and tibial slope was 11.5 and 38%, respectively. In the medial compartment, a significant correlation was found between the femoral condylar offset and the tibial slope, while the same was not observed in the lateral compartment of the knee. Magnetic resonance imaging allows the assessment of tibial slope and femoral condylar offset in the medial and lateral side separately, taking into account any difference between the two compartments. The sagittal tibial slope exhibits a greater variability compared with the posterior offset of femoral condylar offset suggests that the reconstitution of the proper morphology of the posterior part of the knee joint may be necessary to obtain a full range of motion in flexion after total knee replacement.

Key words: femoral condylar offset; knee flexion; knee ligamentous balancing; tibial slope; total knee arthroplasty.

Introduction

A limited range of motion after total knee arthroplasty (TKA) may be responsible for unsatisfactory clinical outcomes, particularly in patients who need a high range of flexion due to cultural habits. However, an even worse condition is when knee flexion is below 110°, which has been reported to be the necessary mobility for most activities of daily living (Kettelkamp et al. 1970; Laubenthal et al. 1972). When limited motion is due to excessive joint tightness in flexion, abnormal tensile and compressive stresses may occur, respectively, on the anterior and posterior portion of the implant, leading to early wear, micromotion and eventually loosening of the prosthesis (Laskin & Rieger, 1989; Bai et al. 2000).

Correspondence

Gianluca Cinotti, Piazza Acilia,4, 00199 Rome, Italy. T: 0039 3478419319; E: md3581@mclink.it

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The sagittal tibial slope is the inclination of the tibial plateaus in the sagittal plane. In healthy individuals, the anterior portion of tibial plateaus is usually higher than the posterior one, and the resulting sagittal inclination of tibial plateau is postero-caudally directed. The posterior femoral condyles are the portion of the femoral joint that articulate with tibial plateaus during the flexion of the knee. The distance between the most posterior portion of the condyles and the posterior diaphyseal cortex of femur is defined posterior condylar offset. Some authors suggested that, in TKA, the sagittal tibial slope and the posterior condylar offset may affect the range of motion in flexion in different ways (Bellemans et al. 2002; Massin & Gournay, 2006; Arabori et al. 2008; Malviya et al. 2009). An appropriate sagittal inclination of the tibial component may enhance the flexion space of the joint and prevent the knee from becoming too tight in flexion (Bellemans et al. 2002; Massin & Gournay, 2006; Arabori et al. 2008; Malviya et al. 2009). A proper restoration of preoperative offset of femoral condyles may increase the space between the posterior femoral cortex and the posterior border of the tibial plateau during