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Improving tibial component alignment in total knee arthroplasty

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Abstract
Purpose Tibia torsion may influence the accuracy of extramedullary instrumentations in total knee arthroplasty (TKA). This study assessed whether the effect of tibial torsion may be overcome using a surgical technique in which the extramedullary rod is aligned to reference points at the proximal tibia only.
Methods A consecutive series of 94 knees that underwent TKA were analyzed. In the first 47 knees (group 1), a standard procedure for tibial component alignment was performed while in the second group of 47 knees, a modified surgical technique was used including the alignment of the extramedullary rod to the reference points at the proximal tibia only (group 2). Lower limb, femoral, and tibial component alignment were measured on postoperative long-leg radiographs.
Results Femorotibial mechanical axes angles were similar in the two groups. Femoral component alignment also did not differ between the groups. A neutral alignment of the tibial component was achieved in 17 and 34 % of the knees in group 1 and group 2, respectively ($p = 0.04$). A malalignment of the tibial component >3° was found in 34 % of knees in group 1 compared with 4 % of those in group 2 ($p = 0.0001$).
Conclusions Coronal alignment of the tibial component may improve by setting the extramedullary rod in line with anatomical references in the proximal tibia only. This technique appears to bypass the influence of tibial torsion on the alignment of the extramedullary guide at the distal tibia. The clinical relevance of the study is that using this technique, the rate of malalignment of the tibial component may be reduced compared to a standard technique in which a fixed reference is used at the ankle joint.

Keywords Total knee arthroplasty · Tibial cut · Tibial component alignment · Total knee alignment · Extramedullary instrumentations

Introduction

Several investigations have shown that a proper TKA alignment influences knee biomechanics and long-term survival of the implants [12, 13, 16, 32]. However, current instrumentations are not entirely satisfactory in this respect since a varus–valgus malalignment of tibial component >3° has been reported in 2–40 % of cases [5, 14, 24, 33, 39]. A major issue in achieving a correct coronal alignment of tibial component is tibial torsion, i.e., the axial rotation of the tibia along its longitudinal axis, which causes a rotational mismatch between proximal and distal epiphysis [3, 10, 19, 25, 38]. It has been reported that, due to tibial torsion, the distal epiphysis is externally rotated compared to the proximal one by an average of 19°–28° [6, 10, 38]. This leads to a lateral shift of the anterior projection of the mechanical axis at the ankle joint compared to AP axes at the proximal tibia, a lateral shift which may be even greater when distal alignment is set at the intermalleolar point since the lateral malleolus exhibits a greater thickness compared to the medial one [6]. As a result, if the extramedullary rod is not shifted medially at the ankle joint to compensate for tibial torsion and the different thickness of medial and lateral malleolus, and the extramedullary guide is aligned

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