

Mechanical and Anatomical Axis in Total Ankle Arthroplasty

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Category: Ankle Arthritis

Keywords: alignment, arthritis, deformity

Introduction/Purpose: Inadequate correction of alignment in the coronal, sagittal or axial planes will inevitably lead to failure of the Total Ankle Arthroplasty (TAA). The mechanical axis of the lower limb (MAL), the mechanical axis of the tibia (MAT) and the anatomical axis of the tibia (AAT) are three recognized coronal plane measurements using plain radiography. The relationship between anatomical and mechanical axes depends on the presence of femoral or tibial deformities from trauma or inherited conditions, or previous corrective or replacement surgery. Ankle arthroplasty relies heavily on preoperative radiographs or CT scans and the purpose of this study was to assess whether MAL, MAT and AAT are the same in a cohort of patients upon which placement of TAA is considered.

Methods: We analysed 75 patients operated on between 2015 and 2016 at a specialist tertiary centre for elective orthopaedic surgery. All patients had a pre-operative long leg radiograph. They were split into 2 groups. The first group had known deformity proximal to the ankle (such as previous tibial or femoral fracture, severe arthritis, or previous reconstructive surgery) and the second group had no clinically detectable deformity. The MAL, MAT and AAT were assessed and the difference between these values was calculated.

Results: There were 54 patients in the normal group, and 21 patients in the deformity group. Overall, 25 patients(33%) had a difference between all three axes of less than 1 degree. In 33 patients(44%), there was a difference in one of the axes of ≥ 2 degrees.

There was no significant difference between MAT and AAT in patients in the normal group($p=0.6$). 95% of patients had a difference of <1 degree. There was a significant difference between the MAT and AAT in patients in the deformity group($p<0.01$). In the normal group, 39 patients(73%) had a difference of <2 degrees between the AAT and MAL. In the deformity group, only 10 patients (48%) had a difference of <2 degrees. In fact, 24% of patients had a difference ≥ 3 degrees.

Conclusion: Malalignment in the coronal plane in TAA may be an issue that we have not properly addressed. Up to 66% of patients without known deformity may have a TAA that is placed at least 1 degree incorrectly relative to the MAL. We recommend the use of full-length lower limb radiographs when planning a TAA in order to plan the placement of implants. The decision to perform extramedullary referencing, intramedullary referencing, or patient specific Instrumentation must be part of the pre-operative planning process.

Foot & Ankle Orthopaedics, 3(3)
DOI: 10.1177/2473011418S00089
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