Malalignment Correction of the Lower Limb Before, During, and After Total Ankle Arthroplasty

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KEYWORDS

• Deformity • Total ankle arthroplasty • Osteotomy • Alignment procedures • Soft tissue balancing • Fusion • Tendon transfer

KEY POINTS

- Approximately one-third or more cases of end-stage ankle arthritis present with some degree of deformity.
- These deformities are often multidimensional and present challenges to surgeons to reestablish alignment and provide durable results of arthroplasty procedures.
- Arthroplasty combined with deformity correction is intimidating, but, using basic skills and principles, many of these problems can be met and overcome with good results and longevity of implants.

INTRODUCTION

It is well documented in the literature that the success and survivorship of a total ankle arthroplasty (TAA) is linked to creating a balanced, neutrally aligned, and stable ankle.[1] Clinical and radiographic angular deformity of the ankle from the mechanical axis of the leg that is less than 5° is generally accepted as being within reasonable limits. There is some debate as to the level of deformity that is acceptable, with some investigators advocating that 15° of coronal plane angulation be considered a relative contraindication and some who accept up to 30°.[2] Although coronal plane angulation is a more commonly discussed topic, sagittal plane deformity can exist as well, either independently or as part of a multiplanar misalignment, and must be addressed for

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successful TAA. This article discusses various types of deformity and the potential interventions for correction.

Coronal plane deformity can exist in either varus or valgus at the level of the ankle joint and can be either congruent or incongruent. Myerson (personal communication, 2011) has attempted to simplify the thought process by identifying these deformities as either intra-articular or extra-articular.[3] Intra-articular deformities are considered incongruent and the talus and tibial plafond are seen in a nonanatomic alignment. Examples of incongruent ankles are given in **Figs. 6**A and **9**A, showing the alteration in normal ankle alignment. For example, tibial plafond erosion is commonly seen at the medial aspect with varus congruent deformities. This deformity can arise because of lateral joint stabilizers that are deficient or medial structures outside the joint space that have become contracted or altered. The lateral joint line in this case often presents with significant laxity and there can be contracture and derangement of the medial structures. Deformity driven at the extra-articular level is considered congruent. Congruent deformity is usually noted with the talus and tibia remaining in relative anatomic alignment, with surrounding bony deformity, most often within the tibia, along with fairly symmetric existing degenerative changes. A stepwise assessment and correction of all alterations in soft tissues and bony structures must be completed. As with any deformity, the cause driving the deformity must be identified and corrected or there are realistic risks of failure and recurrence. Incongruency has been shown to have a much higher incidence of recurrence.[4] In a study by Reddy and colleagues,[5] preoperatively identified varus incongruent deformity had a 14% recurrence rate. In contrast, no congruent deformity showed recurrence. There are cases of varus and valgus congruent and incongruent deformities that are either intra-articular or extra-articular, respectively. No matter the cause of the deformity, in order to prevent edge loading, instability, subluxation events, and even complete failure of the TAA, the malalignment must be corrected.

A reported 33% to 44% of patients who present for TAA have greater than 10° of coronal plane deformity.[5] Implant survivorship at 8 years decreases from 90% to 48% when deformity is left greater than 10° in the coronal plane.[6] However, if the deformity can be corrected, the success of the TAA approaches the level of TAA performed in anatomically neutral ankles.[7] Implant survivorship has improved vastly based on a collective study of 2240 total ankles arthroplasties and is now reported to range from 70% to 98% at 3 to 6 years and from 80% to 95% at 8 to 12 years.[8]

There exist multiple surgical interventions available to surgeons to assist in the correction of deformity of the ankle. They include soft tissue and bone procedures that can be used preoperatively and intraoperatively. This article discusses some of these current procedures, philosophies, and proposed algorithms in an effort to aid clinicians to develop rational thought processes and approaches in addressing deformity in TAA surgery. The goal is not to present an exhaustive list of procedures or rigid thinking but to provide a thoughtful overview and suggestions for itemizing the problems inherent in deformity management and prioritizing steps to effect correction while minimizing potential complications and pitfalls in this underaddressed area of ankle replacement surgical decision making. Also, consideration is given to whether a deformity correction should be staged or attempted concomitant with the TAA. The hope is that by surveying this article, readers will be able to implement a treatment plan and ultimately perform a successful TAA creating a well-balanced and mechanically aligned ankle joint that provides appropriate functionality and longevity to the patient.