Statement of Purpose & Literature Review

It is common knowledge that an ankle valgus deformity is associated with deltoid ligament insufficiency. However, we present 13 cases of ankle valgus deformity with a functionally intact deltoid and insufficient lateral ligaments. This appears to be an unrecognized pattern of end stage ankle arthritis. Accurate ligamentous balancing is critical during total ankle arthroplasty. Furthermore, the long-term effects and pathomechanical importance of a pure anterior talofibular ligament lesion needs to be reevaluated.

Methodology & Study Design

We performed a retrospective observational analysis of 13 ankle valgus ankle patients who underwent total ankle arthroplasty with lateral ligament plication. Preoperatively it was observed that each ankle had end stage degenerative joint disease with a mild to moderate valgus wear pattern. Radiographic intrinsic ankle valgus was measured by an independent foot and ankle surgeon. These measurements were performed on an AP radiograph with the bisection of the tibia compared to a tangential line of the tibial plafond in relation to a tangential line over the talar dome. In each case after the prosthesis had been placed, the deltoid ligament was taut and the lateral ankle ligaments were insufficient. Therefore a lateral ankle stabilization procedure (Brostrom) was performed on each of the ankles in our study.

Results

There were twelve men and one female included in the study. The average age was 58.3 years. All patients had prior history of ankle sprains. 12/13 patients were replaced with the STAR prosthesis and one was replaced with the Inbone prosthesis. The average talar tilt was 9.2 degrees valgus (3.25-19.25). Average follow up was 1.69 years. Two patients required revision with a modified Christman-Snook using peroneus longus allograft. One patient had 1st tarsometatarsal fusion at same time as replacement.

Literature Review

It has long been understood the different restrictive motions that each ankle ligament controls. (1) The anterior talofibular (ATF) ligament restricts anterior subluxation of the talus from the ankle mortise. (2) In a cadaveric study by McCullough et al demonstrated that after sectioning the ATF there was increased anterior subluxation of the talus from the ankle mortise. There was also noted an increase in internal rotation of the talus of 5.9 ± 1.9 degrees. Further sectioning of the CFL and PFTL led to an additional 5.4 ± 1.9 degrees of internal rotation of the talus in the ankle mortise. (2) In Ringleb and his colleagues’ cadaveric study, they again showed that sectioning of the ATF resulted in an average of 8.8 degrees of anterior translation and internal rotation. (4)

Bonnet et al in a biomechanical study noted that the natural contour of the ankle joint incentivizes some anterior translation and internal rotation. This natural motion occurs due to an elevated lateral talus relative to the medial. The anterior sloped tibial plafond then results in a “sliding” or rotation of the talus. They observed that the peroneal ligaments act primarily to restrict anterior sliding and internal rotation of the talus. (5) Tochigi et al confirmed this phenomenon in another cadaveric study in measuring tensile strain in the peroneal ligaments in a loaded ankle joint. (3) Leardini et al noted in his comprehensive review that the ATF is the most important stabilizer of the ankle joint and subsequently the primary restraint to supination and anterior translation of the ankle. (6)

Analysis & Discussion

To the authors’ knowledge, there has never been a description of ankle valgus deformity as a sequela of lateral ankle instability. All patients relate a history of lateral ankle sprain as the original ankle injury. These patients had long-term ankle instability symptoms and presented as a candidate for ankle replacement with a mild to moderate incongruent valgus ankle deformity. At the time of total ankle replacement, a fully intact deltoid ligament was identified, coupled with excessive wear of the lateral ankle compartment. In all 13 cases, there was clear evidence of lateral ligament deficiency which required Brostrom stabilization after placement of the total ankle prosthesis.

We theorize that a chronic anterior drawer mechanism without an inversion moment will cause excessive wear of the lateral ankle compartment and eventual migration into a valgus alignment as the ankle approaches end stage arthritis. We suggest that this occurs in the setting of an intact deltoid which then acts as a rotation fulcrum. This rotatory moment occurs in the setting of an absent or attenuated ATF which would normally restrict this internal rotation movement. Understanding and managing ligament pathology during total ankle arthroplasty is critical for surgical planning and for reproducible long-term outcomes.

References