

Tibiototalcaneal Fusion Rate with a Novel Pseudoelastic Intramedullary Nail with NiTiNOL

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Category: Ankle Arthritis

Keywords: dynamic compression, ankle arthritis, subtalar fusion, ankle fusion, TTC, tibiototalcaneal, NiTiNOL

Introduction/Purpose: Tibiototalcaneal (TTC) fusion is a salvage operation for patients with significant arthritis and deformity of ankle and subtalar joints. Despite overall clinic success, fusion across both joints continues to be a major challenge with nonunion rates reported up to 48% [Franceschi]. Aside from certain patient comorbidities, nonunion may result when compression across the joint is lost in the setting of bone resorption. The use of a pseudoelastic intramedullary nail has been shown to maintain compression across fusion site in response to bone resorption. The purpose of this study was to evaluate the fusion rate in a high-risk population at a tertiary care center using a pseudoelastic intramedullary nail with an internal nitinol element.

Methods: After obtaining IRB approval, a retrospective review of consecutive patients that underwent procedures with TTC fusion with novel intramedullary nail system with super elastic internal nickel titanium (NiTiNOL, DynaNail, Medshape Inc, Atlanta, GA) was performed at a single academic institution. From 2014 to 2016, 58 patients were identified, 55 of which had minimum one year follow up or clinical and radiographic fusion (20 months average, range 6-41 months). The primary outcome was radiographic fusion analysis which was reviewed by three authors. Fusion was determined by consensus with criteria of 3 of 4 cortices with osseous bridging in asymptomatic patients[1, 2] or CT fusion based on Glazebrook et. al. criteria for hindfoot fusion[3, 4]. Average age of this cohort was 59 (SD= 16.3) years with BMI average 33.1 (SD= 8.87). Exclusion criteria include: follow-up less than 12 months in non-fused patients, and incomplete clinical or radiologic data.

Results: The fusion rate in this high-risk population was 80.0% with the use of the NiTiNOL tibiototalcaneal nailing system. Univariate analysis demonstrated no significant difference ($p>0.05$) in fusion rates with patient comorbidities that portend to non-union: current or former history of tobacco use, diabetes mellitus, rheumatoid arthritis, nor patients with chronic kidney disease. The average BMI in the fusion group was 31.97 compared to 27.4 in the non-union group ($p=0.016$). There were 5 deep infections requiring reoperation with a single patient requiring a below the knee amputation. Seven patients required a second operation for removal of prominent interlocking screws.

Conclusion: This preliminary data demonstrates fusion rates with this novel intramedullary device are consistent with historical data. These findings are encouraging in that this nailing system shows equal rates of fusion in patients with high risk comorbidities for non-union compared to historical controls demonstrating increased non-union rates in diabetics, patients with chronic renal failure and those with a history of smoking. This Tibiototalcaneal nailing system is safe and offers theoretical sustained compression with up to 6mm of resorption or settling.

Foot & Ankle Orthopaedics, 3(3)
DOI: 10.1177/2473011418S00042
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