

Statement of Purpose

Talar collapse following total ankle arthroplasty (TAA) is a devastating complication with limited treatment options. Previous reports recommend revisional tibiototalcalcaneal arthrodesis due to extensive bone loss but, these procedures are extensive and still result in low success rates with decreased shock absorption, limb shortening and decreased propulsion.¹ Revisional custom total talus replacement has been proposed in order to restore ankle joint ROM, decrease adjacent joint arthritis, and maintain limb length. This prospective case study successfully illustrates the use of a custom total talus implant following a failed TAA with talar collapse.

Literature Review

Aseptic loosening remains one cause of failure following TAA.² Loosening presents in the talus and/or tibia. Due to the talus being covered with 60% articular cartilage, there is an increased risk for osseous necrosis.^{3,4}

As necrosis worsens, prevalence of talar body collapse increases which leads to devastating consequences requiring revisional operations. Revisional options include tibiototalcalcaneal arthrodesis with bone grafting, amputation, or metal-reinforced cemented or trabecular metal augmentation.^{3,4} These procedures often present with more debilitating consequences. One recent study found a 50% nonunion rate for TTC fusions following a TAA² in addition to limb shortening and adjacent joint degeneration.¹ Therefore, alternative procedures were sought to maintain length, regain function, and decrease pain.

Harnroongroj and Vanadurongwan described the first talar prosthesis in 1997.⁵ This first generation prosthesis composed a talar body with anterior peg attaching into the patient's talar neck.⁶ They showed promising long term results although talar neck osseous breakdown was a major complication. Taniguchi et al. then reported on 12 patients treated satisfactorily with the second generation implant without the anterior peg.⁷ Subsequently, third generation implants were created encompassing the entire talus.

Tsukamoto et al. reported a 56 yo woman with RA receiving a total talus implant after talar collapse following TAA. At two years, she experienced 0/10 pain with no limitations to normal activities.¹ Wagener et al. documented 12 patients undergoing a custom talus replacement following talar collapse after TAA. Although, these were not total implants but instead custom tali, after 6.9 years, 75% reported satisfied/very satisfied results with 11/12 revealing no radiographic loosening.²

Case Study

A 61 yo healthy female presented with hindfoot and ankle pain following a fixed bearing TAA 18 months prior. She underwent primary TAA four months after receiving a flatfoot reconstruction. After a year of significant pain relief and overall satisfaction, a new onset of right ankle pain began. 18 months following her initial TAA, this pain progressed to 8/10. Her activities of daily living significantly diminished. She was unable to bear weight without her boot and use of knee scooter. Advanced imaging was obtained of her right ankle (Figures 1 & 2). These images portrayed a stable tibial component with talar component subsidence and significant talar body collapse. The subtalar joint posterior facet remained intact. Inflammatory markers and ankle joint aspiration were evaluated returning negative results for infection or joint sepsis.

Because of the significant talar collapse and aseptic loosening of the talus, salvage procedures were offered including tibiototalcalcaneal fusion or revision TAA with a total talus. The patient ultimately elected to undergo a total talus replacement as a salvage procedure.

Procedure

A revision TAA with a total talus replacement using a custom 3D printed cobalt-chromium implant was performed. This required a contralateral ankle CT in order to obtain the 3D anatomic replica for the opposite side. The implant talar dome was made custom to match the polyethylene surface of the total ankle implant. A standard anterior ankle approach was utilized (Figure 3), the old polyethylene and talar component were explanted. The necrosed talus was excised. A total talus trial was inserted and appropriately sized before the final custom total talus and new polyethylene were implanted (Figures 4-6).

Results

At 6 months, total ROM improved from 32° preoperatively (2 dorsiflexion and 30 plantarflexion) to 50° (10 dorsiflexion and 40 plantarflexion). AOFAS scores also improved from 28 to 87. At 6 months, her VAS pain level drastically decreased from 8/10 to 2/10.

At 12 months, the patient was full weight bearing in regular shoes without any restrictions. Patient also returned to full duties at work.



Figure 1



Figure 2

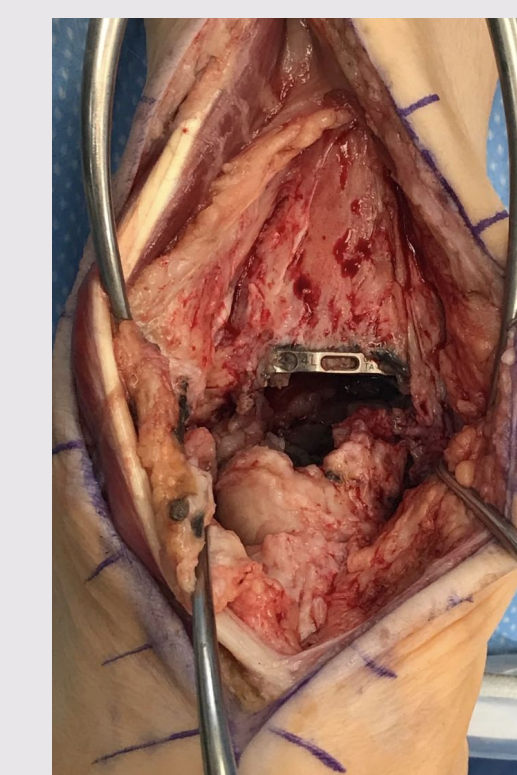


Figure 3

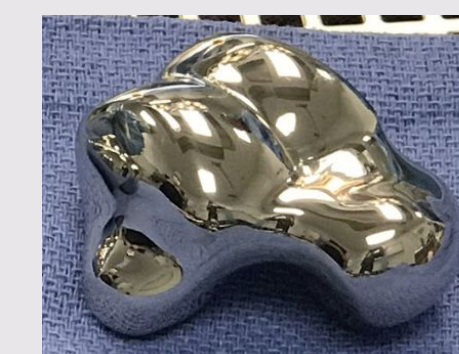


Figure 4

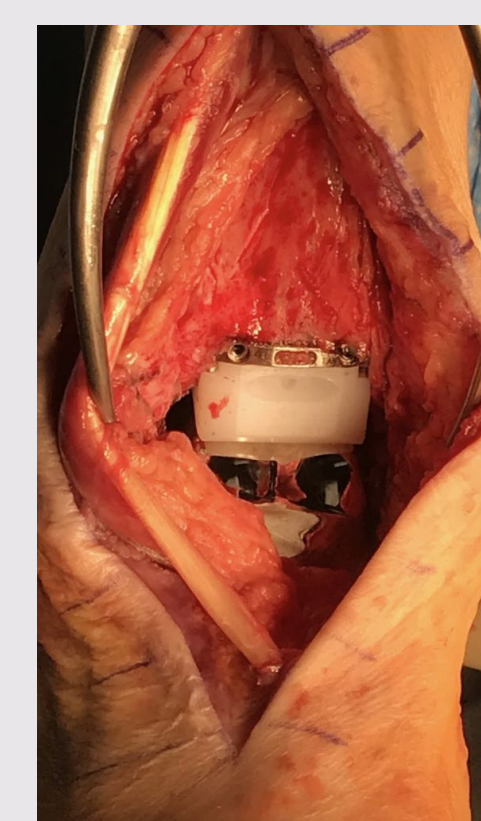


Figure 5



Figure 6



Figure 7

Figure 1: Weight bearing xray showing talar body collapse after primary total ankle replacement
 Figure 2: CT scan confirming talar collapse with plantar migration of the talus component
 Figure 3: Intraoperative photo showing chronic cystic aseptic changes to the talus
 Figure 4: CT guided 3D printed cobalt-chromium total talus implant
 Figure 5: Intraoperative photo with talus implant and polyethylene spacer
 Figure 6: Intraoperative fluoroscopy showing excellent positioning of the implant
 Figure 7: Xray 6 months post op showing maintenance of hardware positioning and stability

Results

SF-36 scores were reported:

	Physical Functioning	Role Limit due to physical health	Energy/fatigue	Emotional Well-being	Social functioning	Pain	General Health
Pre Op	10%	0%	30%	40%	25%	23%	40%
6 months	40%	75%	35%	72%	87.5%	77.5%	40%

Analysis and Discussion

Traditional revisional options for talar collapse following a TAA have proven unsuccessful and are often more harmful to the patient.² Recently, the total talus replacement was implemented in order to maintain limb length, reduce pain, and regain function without sacrificing biomechanical stability. Prior case studies report these satisfactory results for total talus replacements following a failed TAA.^{1,2}

Our prospective case study demonstrates a 61 year old female receiving a custom 3D printed cobalt-chromium implant following total talar collapse after failed TAA. Subjectively, her pain decreased with range of motion and weight bearing status. Within a year follow up, she was able to return to full weight bearing without any restrictions. Objectively, she regained intrinsic function throughout her ankle joint while increasing her preoperative dorsiflexion and plantarflexion range of motion as well as gaining strength to her lower extremity.

This study shows consistently favorable results for total talus replacement compared with prior studies. Therefore, for patients with failed TAA with talar collapse, total custom talus implants are a promising and viable salvage option.

Conflicts of Interest

Jason Nowak, DPM, FACFAS consults for Additive Orthopaedics.

References

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