

## Early Efficacy of Combined Total Ankle Total Talus Replacement in the Revision Setting

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**INTRODUCTION:** Revision of failed total ankle replacement (TAR), such as in the setting of implant subsidence, aseptic loosening, or avascular necrosis (AVN) of the talus can be challenging and associated with increased morbidity. As TAR becomes a more commonly performed procedure in the treatment of end-stage ankle arthritis (ESAA), naturally there arises the need for revision options. In this case series, we describe the short-term clinical and radiographic outcomes of using a patient-specific custom 3D-printed total ankle total talus (TATR) prosthesis in the treatment of this unique subset of patients.

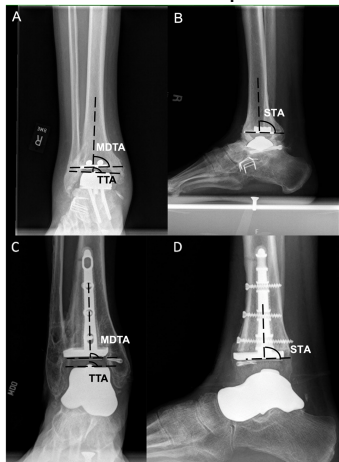
**METHODS:** Twenty-nine patients with ESAA who underwent total ankle total talus replacement (TATR) by a single surgeon at our institution from 2019 to 2022 were retrospectively identified. The average age was 61.3 (range, 39-77) years, with an average follow-up of 22.5 (range, 12 to 57) months. All patients were indicated for revision of primary implant for failed TAR in the setting of aseptic loosening/subsidence and/or talar AVN. All patients underwent replacement with 3D-printed titanium implants based on preoperative CT analysis. Custom components included a combined total talus and stemmed tibial component through an anterior approach (Figure). Pre- and postoperative patient-reported outcomes were assessed using Patient Reported Outcomes Measurement Information System (PROMIS). Pre- and postoperative implant alignment was assessed using medial distal tibial angle (MDTA) and tibiotalar angle (TTA) on anteroposterior, and sagittal tibial angle (STA) on lateral weight-bearing plain films. Incidences of revision and reoperations were recorded.

### RESULTS:

At the final follow up, all custom implants were intact without evidence of hardware failure or implant subsidence. There was a statistically significant improvement in all six PROMIS domains. Two patients (6.9%) had postoperative complications; one patient underwent open reduction internal fixation of the tibia for a tibial periprosthetic fracture 1 month postoperatively, and another patient underwent medial gutter debridement and tarsal tunnel release for recurrent pain 14 months postoperatively. There were no significant differences in pre- to postoperative radiographic coronal or sagittal alignment in terms of MDTA (88.4 vs. 88.8), TTA (87.3 vs. 88.0), or STA (85.1 vs. 85.9).

### DISCUSSION AND CONCLUSION:

As ankle replacement becomes a more popular surgical treatment for ESAA, there is a growing need to identify durable revision solutions. This study demonstrates the promising utility of custom 3D-printed TATR in the setting of revision TAR. At short-term follow up, there was a significant improvement in pain and physical function, with an acceptable postoperative complication rate. While preliminary, custom 3D-printed TATR offers an alternative solution for a unique subset of patients where there are limited options available for revision following failed primary TAR. Further longer-term follow up with a larger cohort is underway.



**Figure:** Anteroposterior (AP) and lateral weightbearing films demonstrating medial distal tibial angle (MDTA), tibiotalar angle (TTA), and sagittal tibial angle (STA) prior to revision (A and B). Postoperative measurements with custom implant (C and D).

PROMIS Domain	Pre-op	STD	Post-op	STD	Δ pre to post	P-value
Physical Function	38.4	9.1	48.1	8.3	9.7	p<0.01
Pain Interference	57.9	10.8	49.7	7.7	-8.2	p<0.01
Pain Intensity	50.2	11.1	44.5	9.8	-5.7	p<0.01
Global Physical Health	45.1	8.7	50.2	8.7	5.1	p<0.01
Global Mental	56.7	7.8	59.1	6.8	2.4	p<0.05
Depression	47	9.2	42.3	7.5	-4.7	p<0.01

**Table:** Pre- and postoperative Patient Reported Outcomes Measurement Information System (PROMIS) scores demonstrating significant improvements across all six domains (p<0.05).