Total Ankle Arthroplasty With Severe Preoperative Varus Deformity

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abstract

Advancements in total ankle arthroplasty (TAA) over the past several decades have led to improved patient outcomes and implant survivorship. Despite these innovations, many implant manufacturers still consider a preoperative coronal plane deformity greater than 10° a relative contraindication to TAA. Without proper intraoperative alignment, these implants may experience abnormal wear and hardware failure. Correcting these deformities, often through the use of soft tissue procedures and/or osteotomies, not only increases the difficulty of a case, but also the intraoperative time and radiation exposure. The authors report a case in which a 54-year-old man with a severe right ankle varus deformity of 29° underwent successful TAA using the INBONE II Prophecy total ankle system (Wright Medical Technology, Inc, Memphis, Tennessee) and additional soft tissue reconstruction. Intraoperatively, the patient’s coronal deformity was corrected to 1.8°. At 8 months postoperatively, the patient ambulated without restriction and had substantial improvement in validated patient outcome scores, specifically the Academy of Orthopaedic Surgeons Foot and Ankle Module and the Short Form Health Survey-12. This unique report documents the first time that this particular implant, with an exclusive preoperative computed tomography–derived patient-specific guide, has been used effectively for a severe preoperative varus deformity greater than 20° without the need for an osteotomy. Future studies should be directed toward the prospective evaluation of different total ankle implant systems and their outcomes with severe coronal plane deformity, specifically computed tomography–derived patient-specific guided implants. [Orthopedics. 2015; 38(4):e343-e346.]
Advancements in total ankle arthroplasty (TAA) over the past several decades have led to improved patient outcomes and implant survivorship. Despite these innovations, many implant manufacturers and surgeons still consider severe coronal plane deformity a relative contraindication to TAA.\(^1\)-\(^4\) As a result, several recent studies have investigated intraoperative correction of these deformities during the TAA procedure and have shown promising results; however, deformities greater than 20° often require osteotomies.\(^5\)-\(^8\)

The authors’ report describes the unique placement of an INBONE II Prophecy total ankle system (Wright Medical Technology, Inc, Memphis, Tennessee) in a patient with a severe varus coronal plane deformity of greater than 20° that resulted in favorable outcomes. Unlike previous studies that evaluated other TAA systems, the patient required only an additional soft tissue procedure as opposed to a more aggressive osteotomy. To the authors’ knowledge, this is the first time that this implant has been reported in the literature for the treatment of a severe coronal plane deformity.

**Case Report**

A 54-year-old man presented to the authors’ clinic with right ankle pain and deformity for several years. He denied prior ankle trauma or injury. Plain radiographs demonstrated end-stage arthritis with varus hindfoot deformity of 29° (Figure 1), at which time the patient refused the option of tibiotalocalcaneal fusion. At follow-up 3 months later, the patient reported worsening pain and the inability to ambulate. At that time, the authors believed that the patient’s best option was tibiotalocalcaneal fusion secondary to the degenerative changes seen in both the tibiotalar and subtalar joints. However, the patient again refused a tibiotalocalcaneal fusion in favor of preserving as much ankle motion as possible. The decision was then made to attempt a right ankle TAA despite the severe coronal deformity. The risks and benefits were then discussed and the patient consented.

Preoperative computed tomography (CT) imaging navigation was used to develop a patient-specific guide, and the corrected coronal plane deformity was predicted to be 2.1°. The specific implant used in this case was an INBONE II Prophecy, which consists of a talar dome with modular talar stem, a tibial tray with a multicomponent stem that can be adjusted, and an ultra-high-molecular-weight polyethylene insert. The patient underwent right TAA with the implant, along with subsequent Brostrom Evans ligament reconstruction for lateral ankle instability. The patient-specific guides were used intraoperatively, and neutral ankle alignment was achieved without the need for osteotomy. No complications were encountered. Postoperatively, he was placed into a short-leg splint with non-weight-bearing restrictions and discharged home on postoperative day 2.

Three weeks postoperatively, the wounds were healing well, the sutures were removed, and the patient was placed into a walker boot with allowance of full weight bearing. At 3 months postoperatively, the patient continued to improve and right ankle radiographs showed neutral alignment with no evidence of component loosening or failure. Coronal plane angle was 1.8° (Figure 2). At 8 months postoperatively, he was ambulating without assistance and participating in full activity. Full ankle flexion-extension range of motion at that time was 40°. Scores for the Academy of Orthopaedic Surgeons Foot and Ankle Module (AAOS-FAM, Global Foot Health) had improved to 52 from a preoperative score of 2; the AAOS-FAM (Shoe Com-

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**Figure 1:** Preoperative weight-bearing anteroposterior (A), mortise (B), and lateral (C) radiographs of the right ankle.

**Figure 2:** Weight-bearing anteroposterior (A), mortise (B), and lateral (C) radiographs of the right ankle obtained 3 months postoperatively.
Case Report

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In the current case report, a CT-derived patient-specific guide was used for intraoperative implant placement. Although no published, large clinical trials currently support their use, the authors believe that these guides provide several benefits that require future research. First, CT-derived patient-specific guides can reduce the complexity of difficult cases. As seen in the current case, a severe deformity was corrected with the addition of only soft tissue releases. No osteotomy was required. A recent cadaveric study by Berlet et al. showed adequate deformity correction that was also reproducible using similar guides. Their CT-derived patient-specific guides were able to achieve tibial component alignment within 2° of their intended target. Second, these guides have the potential to reduce intraoperative radiation exposure. A study by Angthong et al. showed that the use of extramedullary guides reduced radiation exposure during placement of TAAs. The current authors believe that similar data could be obtained with the use of CT-derived patient-specific guides; however, further research is required. Finally, the use of CT-derived patient-specific guides may also improve operating room efficiency. Currently, this opinion is based on the senior author’s (R.D.S.) own experience and has yet to be established in the literature.

CONCLUSION

Studies are starting to show satisfactory outcomes for TAA in patients with preoperative coronal plane deformity greater than 10°; however, many implant manufacturers and surgeons still consider this a relative contraindication. As a result, it is important for surgeons to obtain acceptable coronal plane alignment intraoperatively, often through the use of soft tissue reconstruction or osteotomy. The case documented in this report is unique for 2 reasons. First, it is the first time that the INBONE II Prophecy total ankle system, with its exclusive preoperative CT-derived patient-specific guides, has been documented in the orthopedic literature for successful treatment of a varus deformity of greater than 20°. Second, the deformity only required additional intraoperative soft tissue reconstruction as opposed to a more aggressive osteotomy. Future studies should be directed toward prospective evaluation of different TAA implant types with regard to severe coronal plane deformity to provide surgeons with the best possible treatment options.

REFERENCES

6. Hobson SA, Karantana A, Dhar S. Total ankle replacement in patients with significant pre-operative deformity of the hindfoot.


