



## Implant Placement Accuracy and Patient-Specific Surgical Guide Reproducibility Using Pre-Operative Navigation in Total-Ankle Arthroplasty

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### Abstract:

**Introduction:** Pre-operative navigation has provided many potential benefits for total-knee arthroplasty, including patient-specific alignment, repeatable implant placement, and decreased surgical time. For the first time, this advantageous technology was applied to TAA and pre-operative capabilities at the ankle were explored. The current study determines intra-operator repeatability of tibia and talus patient-specific guide placement and the deviation between the pre-operative plan and actual implant placement.

**Methods:** Routine ankle CT scans were acquired of three lower extremity limbs, converted into 3D solid models, and imported into a CAD assembly where anatomic landmarks defining tibia/talus alignment were established. The landmarks were used to perform a virtual TAA, where commercially-available implant components were placed to mimic traditional cases. A surgical guide, referencing the cadaver-specific anatomy, was reverse engineered to accurately define the resection planes necessary to recreate the virtual placement of traditional tibia and talus implants in the post-operative position.

Throughout the surgical procedure, the tibia and talus were tracked by a motion capture system. After a standard incision, board-certified, experienced TAA orthopaedic surgeons with no prior pre-operative navigation experience placed the surgical guides onto the bones in the best-fit location, based on tactile and visual feedback. Guide placement was repeated 4 times to determine variability.

**Results:** Average variation between implant pre-operative and post-operative placement was less than 2° and 1.4 mm in all specimens tested (Figure 1). Intra-observer tibia and talus guide variation between all trials was  $0.25^{\circ} \pm 0.13^{\circ}$  and  $0.47^{\circ} \pm 0.51^{\circ}$  in flexion/extension,  $0.50^{\circ} \pm 0.39^{\circ}$  and  $0.45^{\circ} \pm 0.34^{\circ}$  in varus/valgus, and  $0.92^{\circ} \pm 0.74^{\circ}$  and



$0.98^{\circ} \pm 0.54^{\circ}$  in internal/external rotation.

### Biography:

Dr. Gregory C. Berlet has completed extensive post-graduate fellowship training, specializing in foot and ankle surgery, arthroscopy and sports medicine. As a consulting physician with the Columbus Blue Jackets and The Ohio State University Department of Athletics, Dr. Berlet provides medical guidance for highly competitive athletes. He's a devoted patient advocate who strongly believes that the quality of education and training make a difference in treatment outcomes. Dr. Berlet is Chairman of Education for the American Orthopedic Foot & Ankle Society as well as member on the Education Committee for American Academy of Orthopedic Surgeons. These positions put foot and ankle education for all orthopedic surgeons in the United States under his direction.

### Publication of speakers:

1. Accuracy and Reproducibility Using Patient-Specific Instrumentation in Total Ankle Arthroplasty. Daigre J, Berlet G, Van Dyke B, Peterson KS, Santrock R.
2. Tendon arthroplasty for basal fourth and fifth metatarsal arthritis. Berlet GC, Hodges Davis W, Anderson RB.

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