

## Alignment Accuracy and Cost-Savings Threshold of Patient-Specific Instrumentation In Total Ankle Replacements

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**Introduction/Purpose:** Traditional intraoperative referencing for total ankle replacements (TAR) involves multiple steps and fluoroscopic guidance to determine mechanical alignment. Recent adoption of patient-specific instrumentation (PSI) allows for referencing to be determined preoperatively, resulting in less steps and potentially decreased operative time. We hypothesize that usage of PSI will result in decreased operating room time that offsets the additional cost of PSI as compared to standard referencing (SR). Additionally, we aim to demonstrate similar postoperative radiographic alignment between PSI and SR.

**Methods:** Between 2014 and 2015, 87 patients undergoing TAR were enrolled in a prospectively collected TAR database. Patients were divided into cohorts based on PSI versus SR and operative times were reviewed. Radiographic alignment parameters were retrospectively measured at 6 weeks postoperatively. Time-driven activity-based costing (TDABC) was utilized to derive direct costs. Cost versus operative time-savings were examined via two-way sensitivity analysis to determine cost-saving thresholds for PSI applicable to a range of institution types. Cost-saving thresholds defined the price of PSI below which PSI is cost-saving.

**Results:** A total of 35 PSI and 52 SR cases were evaluated with no significant differences identified in patient characteristics. Operative time from incision to completion of casting in cases without adjunct procedures was 127 minutes with PSI and 161 minutes with SR ( $p < 0.05$ ). PSI demonstrated similar postoperative accuracy to SR in coronal tibial-plafond alignment ( $1.1^\circ$  vs.  $0.3^\circ$  varus,  $p=0.06$ ) and tibial component sagittal alignment ( $0.7^\circ$  vs.  $0.9^\circ$  plantarflexion,  $p=0.14$ ). TDABC methodology estimated a PSI cost-savings threshold range at our institution of \$863 - \$1,026 below which PSI pricing will provide net cost-savings. Two-way sensitivity analysis generated a globally applicable cost-savings threshold model based on institution-specific costs and surgeon-specific time-savings.

**Conclusion:** This study demonstrates equivalent post-operative TAR alignment with PSI and SR referencing systems but with a significant decrease in operative time with PSI. Based on TDABC and associated sensitivity analysis, a cost-savings threshold of \$863 - \$1,026 is identified for PSI pricing at our institution below which PSI is less costly than SR. Similar internal cost accounting may benefit healthcare systems for identifying cost drivers and obtaining leverage during price negotiations.

