Effects of Variations in Dwyer Osteotomy Determined by 3D-Printed Patient-Specific Modeling

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Disclaimer

- The authors have no conflicts to disclose
Introduction

• A Dwyer osteotomy is commonly used in surgical correction of heel varus deformity, but few studies have reported on the size of wedge removed, and none have reported on location of the osteotomy or angle at which the osteotomy should be made.

• The purpose of this study is to determine these optimal parameters for surgical correction in patients undergoing Dwyer osteotomy using pre-operative imaging analysis with 3D-printed modeling.
Methods

• Patients with hindfoot varus deformity who had undergone Dwyer calcaneal osteotomy in a single institution were evaluated.

• Pre-operative CT scans were used to create a 3D-printed model of the ankle and foot sparing the calcaneus; multiple identical calcaneus models were 3-D printed to perform different variations of the osteotomy.

• Osteotomies were performed at 10, 15 and 20mm distal to the posterior calcaneal tuberosity at 3 different angles of 30, 45, and 60 degrees of obliquity taking out 5 or 10mm of bony wedge giving us 18 osteotomies for each patient.

• After fixation, each model was mounted to a fixed platform and posterior, and Harris heel views were obtained.

• The angle between the tibia-talus axis and calcaneal-tuber axis was measured digitally and compared to pre-osteotomy state. We used paired t-test to compare corrections.
3D-Printed Foot Model and Sample Calcaneal Measurements with Cuts
Posterior and Harris Heel Simulated 3D views
Results

- 90 osteotomies were performed on 5 patient specific models.
- We focused on angles 30 and 45 degrees cuts. 60-degree cuts were excluded from the study, because most of them were impossible to do due to anatomical landmarks.
- The average degree correction of deformity per mm of bone resected was found to be 1.67 degrees in the posterior view and 2.82 degrees in the Harris Heel view.
- This correction was not statistically different between 30 and 45-degree cuts or between the location of the osteotomy at 10 or 20mm from the posterior calcaneal tuberosity.
Conclusion

- This is the first study in which a 3D-printed model was used in the analysis of pre-operative imaging prior to Dwyer osteotomy to help determine optimal realignment of the hindfoot.

- The average degree of correction per mm bone resected was 1.67 degrees in the posterior view and 2.82 degrees in the Harris heel view.

- A 60-degree cut is not advised because it is not possible for many of the iterations due to limitations of the calcaneal or peroneal tuberosity.

- This study provides insight into the amount of bone needed to resect to correct the deformity, but the optimal position varies between the patients.
References


