DREXEL UNIVERSITY
School of
Biomedical Engineering,
Science and Health Systems

DREXEL UNIVERSITY
College of
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Supplemental Zimmer Total Ankle Replacement (TAR) Cutting Guide

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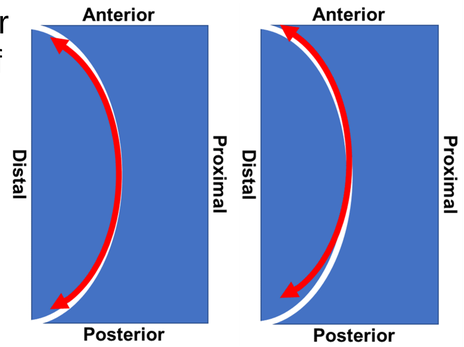
Background and Need

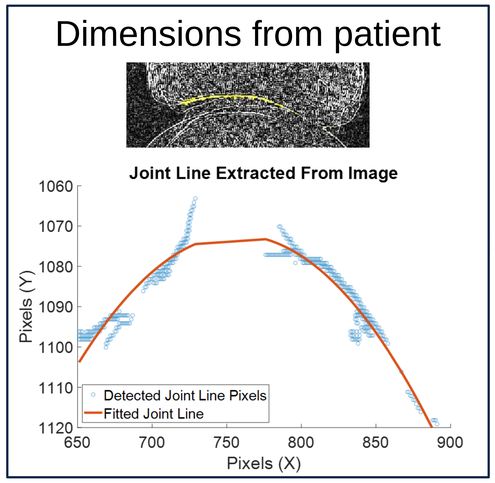
- TAR: Treatment for arthritis, in place of fusion
- Zimmer TAR:
  - Longer surgery → increased infection risk
  - Small misalignment → accelerated wear
- Revision surgery: 44% after 10 years



☑ Accurately traced joint line

☒ Sample misalignment (too anterior)

Design Overview



Objective

- **Patient-specific** supplemental cutting guide
- Modeled from preoperative research
- **Quickly** help surgeons usher the Cutting Guide into the **correct position**

Constraints

C.1. Time: 7 months
C.2. Budget: $800
C.3. Resources: CAD, 3D printers
C.4. Policies: Cadaveric tissue, Biocompatibility
C.5. Project Specific: Joint line size, compatibility with Zimmer System

Requirements

R.1. Accommodate talus widths 16.99 to 32.21 mm
R.2. Midpoint Alignment with joint line
R.3. Minimize product movement with hand force
R.4. Fits in the lateral incision site
R.5. Decrease procedure time (<10 min)

Verification

- Standards
  - FDA Class III → **21 CFR 814 and 812**
  - Calipers and stopwatch calibration → **ISO 9001: Quality Mgmt. Systems**

R	Methods	Passing Criteria
1	Find model joint line in ImageJ	Joint line can be replicated in CAD
2	Mark midpoint on model and on product	Measure the distance between midpoints
3	Attach motion sensors to guide and subject to hand force	Minimal displacement detected
4	Measure product	Measurements < incision size
5	Perform mock procedure	Procedure time < 10 min.

Conclusion

- Supplemental cutting guides can be printed from tibiotalar joint line data extracted from ankle models

Societal Impact

- Improve alignment to decrease surgery time → decrease cost of surgery
- Decrease need for revision surgery → decrease costs up to $6 million annually

Acknowledgments

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