

Overhang, Underhang, and Everything In Between:

A Retrospective Analysis of 400 CT-Based Patient-Specific TAR Plans

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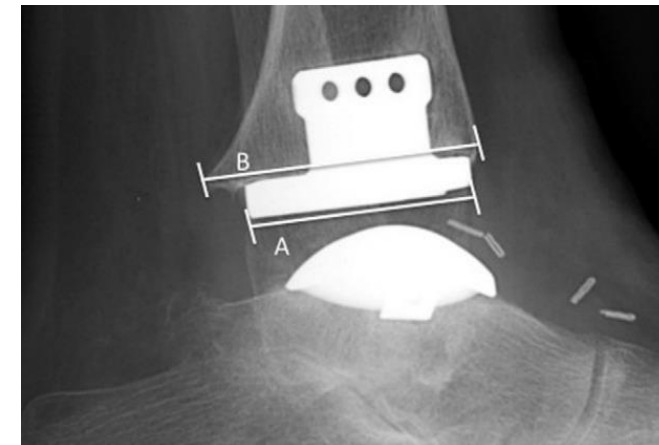
Disclosures

- **Paul Cammack**
 - Consultant –Paragon 28 Inc, Arthrex
- **Jeffrey Christensen**
 - Consultant, Royalties, Speaker- Paragon 28, Inc
 - Stock- Gramercy Extremity Orthopedics
- **Mathew Anderle**
 - Employee, Stock, Stock Options- Paragon 28, Inc.
- **Laura Brinker**
 - Employee, Stock, Stock Options- Paragon 28, Inc.
- **Donald Hume**
 - Employee, Stock- Paragon 28, Inc.

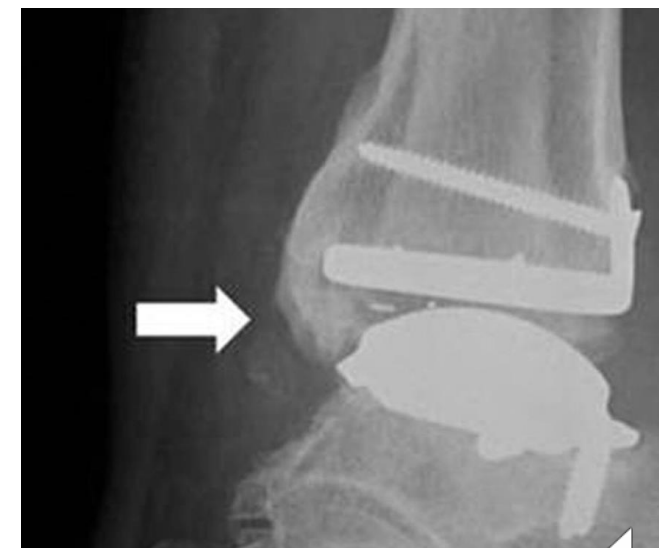


Background

- Fit and alignment of TAR tibial components has been shown to affect outcomes and survivorship.¹
- Arthritic ankles:
 - Anatomically distorted
 - In some cases, implant fit/size can be difficult, depending on the design of the implant system.
 - Healthy Anatomy vs Arthritic Anatomy
- Component overhang:²
 - Impingement
 - Localized soft tissue irritation
 - Heterotopic ossification
- Underhang:³
 - Subsidence → aseptic loosening
 - Hypertrophic bone formation



King et al.



Lee et al.



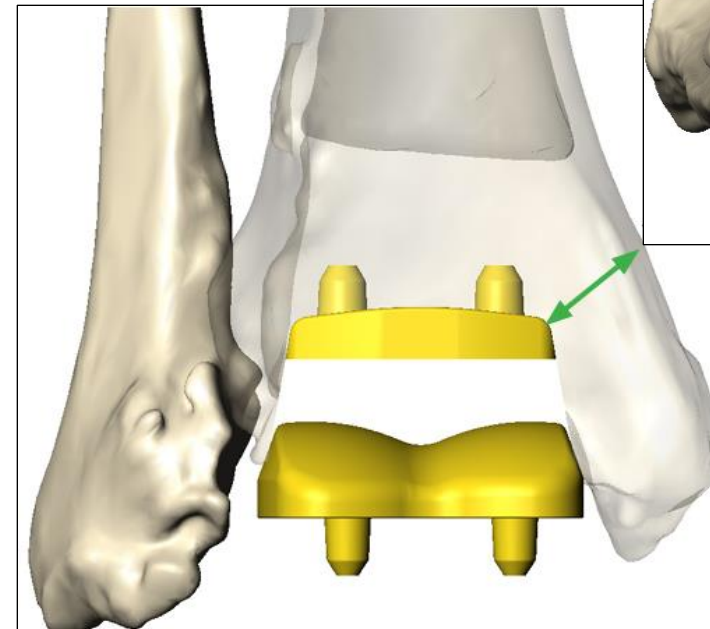
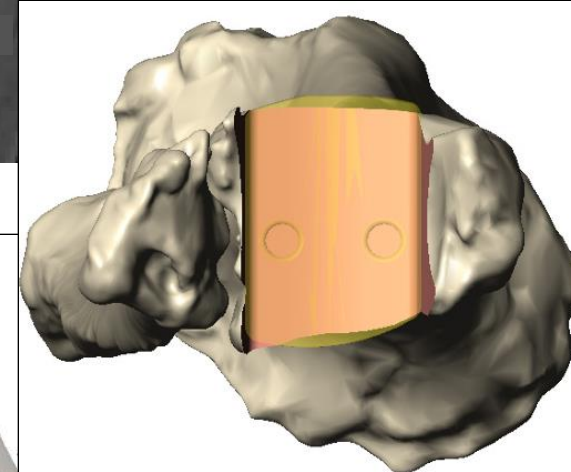
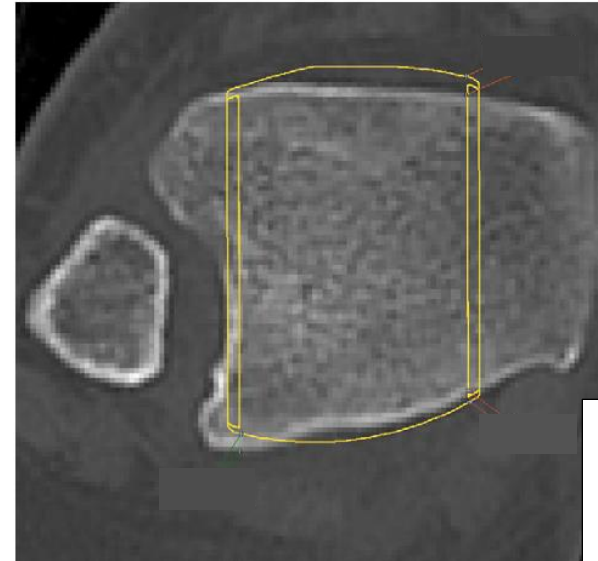
Study Aim

The aim of this study is to quantify the “fit” of an anatomic (arthritic-based) TAR tibial baseplate as planned by a CT-based patient specific alignment strategy.



Methods

- 400 consecutive de-identified CT-based patient-specific TAR plans were retrospectively reviewed.
- 389 patients included for analysis
 - 11 excluded due to existing hardware
- Tibial baseplate sizes ranged from 1 to 6
 - Standard and Long (+3mm length).
 - Right and left specific

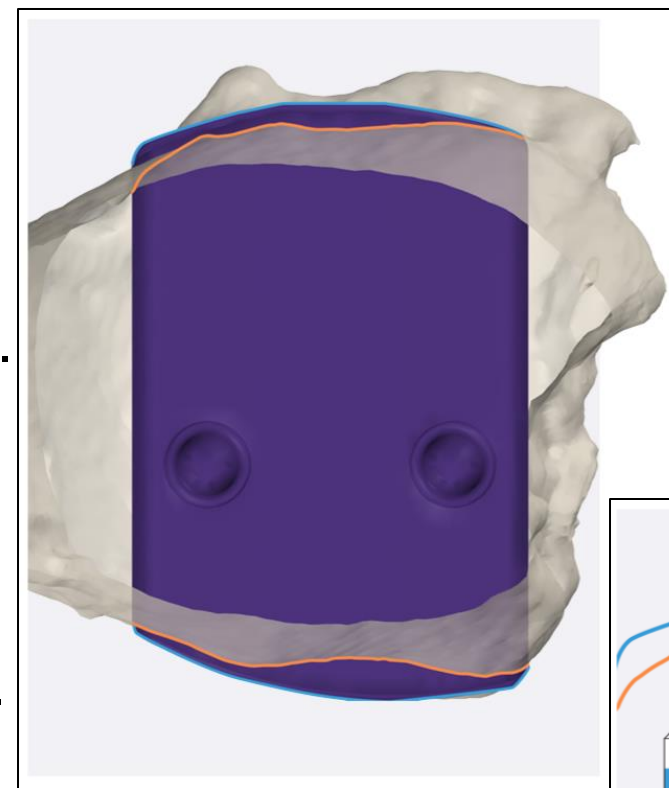


Example of patient-specific TAR plan.



Methods

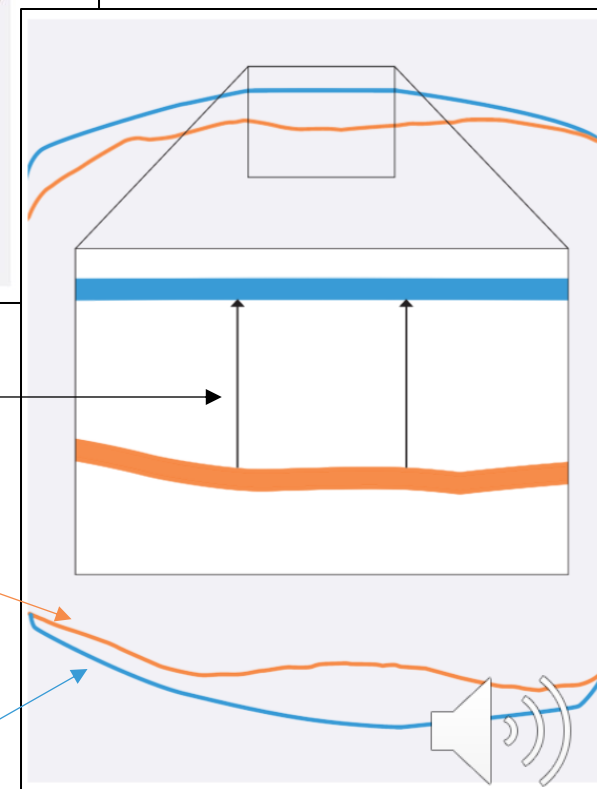
- Using MATLAB, the anterior and posterior edge of the bone at the planned resection height was found.
- 101 measurements were taken along the anterior and posterior face of the implant to the corresponding location on the bone.
- Average underhang and overhang was calculated across the full anterior and posterior span.
- Maximum underhang and overhang was found for each patient and averaged across all patients.



Difference between
implant contour and
bone contour.

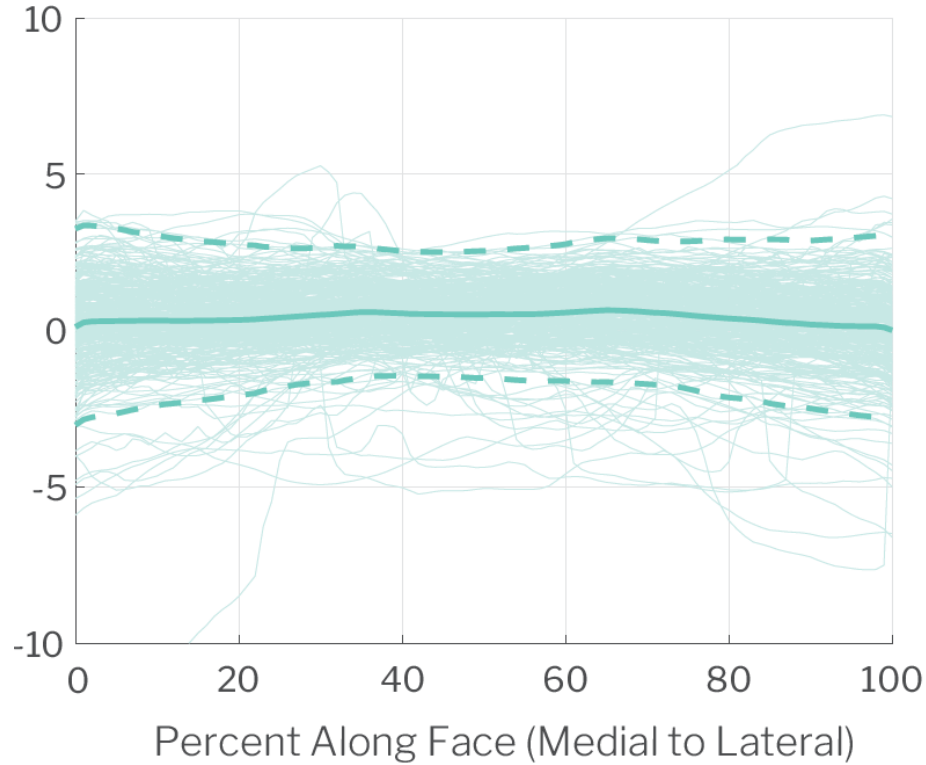
Bone face

Implant face



Results

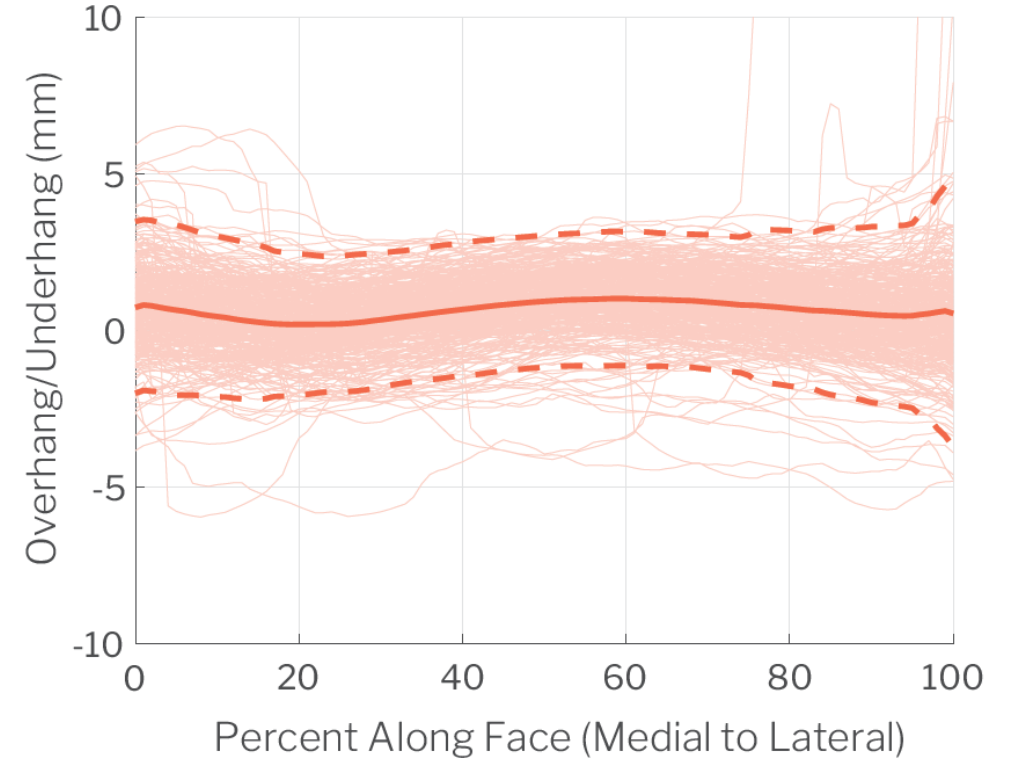
Anterior Overhang(+)/Underhang(-)



Anterior Fit

0.42 ± 0.93 mm of overhang

Posterior Overhang(+)/Underhang(-)



Posterior Fit

0.63 ± 0.87 mm of overhang

Average underhang/overhang across the full anterior & posterior implant face.



Results

	Size 1 (N=14)	Size 2 (N=82)	Size 3 (N=144)	Size 4 (N=113)	Size 5 (N=32)	Size 6 (N=4)	All (N=389)
Anterior	0.44	0.46	0.59	0.33	0.14	-1.31	0.42
Posterior	0.64	0.50	0.74	0.61	0.58	-0.25	0.63

Average fit for patients stratified by planned implant size in mm.

(+) denote overhang, and (-) denote underhang.

Average fit was less than 1 mm for 5/6 sizes on the anterior face & 6/6 sizes on the posterior face.



Results

	Max Overhang	Max Underhang
Anterior	1.56 ± 0.89	-1.28 ± 1.38
Posterior	2.16 ± 1.71	-1.18 ± 1.02

Average of maximum overhang and underhang for all patients in mm.

On average, the maximum underhang and overhang is between ~1mm to 2.25mm.



Limitations & Strengths

- Analysis was conducted on the planned position of the implant.
 - Actual implanted position not available in the data set.
- The analysis did not account for surgical removal of osteophytes, which would alter the amount of underhang/overhang.
- Size 1 and Size 6 had limited quantities, thus firm conclusions can't be drawn for these sizes.
 - We hope to have increased quantities of these sizes in future analyses.
- 389 consecutive cases were analyzed
 - Only cases with metal hardware were excluded.
- An automated process was used to take the measurements.
 - Eliminates user error and bias.



Conclusion

Improper implant fit and alignment are both risk factors associated with survivorship in total ankle replacement.

Minimizing underhang and overhang is critical to improving patient outcomes.

The present analysis demonstrated average overhang and underhang is below 1mm for both anterior and posterior cortex, indicating current baseplate sizing is a good match for arthritic periarticular morphology of the tibia.

An anatomically derived tibial baseplate coupled with a broad sizing portfolio may help to better accommodate the wide range of patient anatomy and pathology.



Thank you!

