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Novel Technique for Fixation of Medial Malleolus Fractures: A Biomechanical Study

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Disclosures

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*Dr. Prayson is a consultant for Bioventus.

*The remaining authors have no disclosures.

Our disclosures are in the final AOFAS mobile application.



Introduction

- Traditional repair of medial malleolus fractures has been with open reduction internal fixation (ORIF) with 2 partially threaded (PT) 4.0 mm cancellous screws.¹
- Screws pass the fracture plane and extend beyond the physeal scar without reaching the far cortex (unicortical).
- Recently, several authors advocated for bicortical fixation.²⁻⁴
 - Advantages: greater strength in osteoporotic bone, improved stiffness under tension, and less screw loosening versus PT unicortical lag screws and tension band techniques.
 - Disadvantages: iatrogenic injury to structures lateral to the far cortex, drill bit breakage and risk of overcompression.



- Example of drill bit breakage with bicortical fixation *in vivo*.





Purpose

- We applied a novel fully threaded (FT) far endosteal fixation technique to medial malleolus fractures with the goal of improved biomechanical strength versus a partially threaded unicortical screw, while obviating the downsides seen with bicortical fixation.

AOFAS 2017



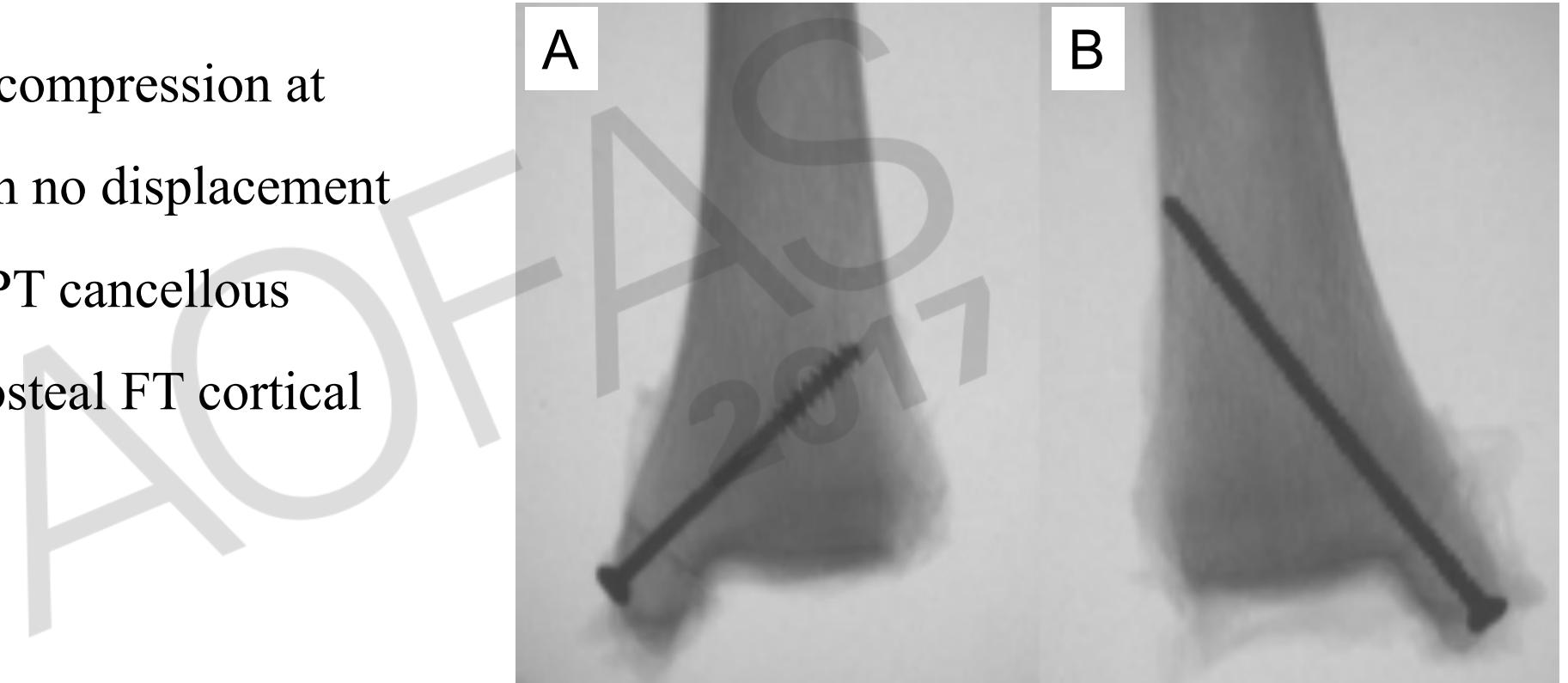
Methods

- Medial malleolus fractures simulated in 12 matched cadaver pairs.
- Oblique osteotomy at a 45 degree angle to the axilla and 2 Kirschner wires placed to temporarily reduce fracture and provide rotational control.
- 1 PT 4.0 mm screw of 45 mm length OR 1 FT 3.5 mm screw placed in one ankle.
- Contralateral ankle received 1 screw of opposite configuration.
- FT screw length determined by a depth gauge extended to far cortex and 5 mm was added to achieve far endosteal purchase.
- Screws placed with a torque-measuring screwdriver and final torque (in-lbs) was recorded when screw stripping occurred.



Results

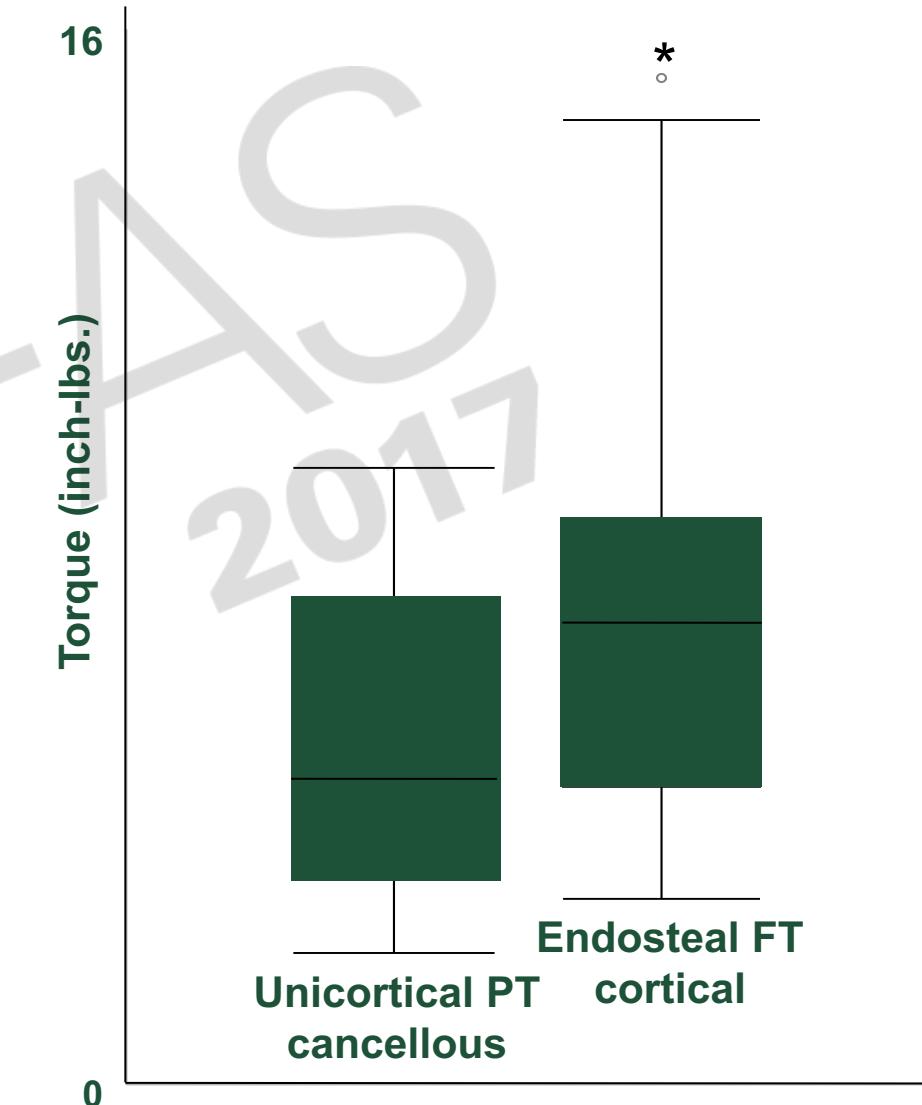
- Radiographs show compression at the fracture site with no displacement seen in unicortical PT cancellous fixation (A) or endosteal FT cortical fixation (B).





Results

- Mean torque of 5.02 inch-lbs (range 2.00-9.36 inch-lbs) in the PT unicortical screw versus 7.63 inch-lbs (range 2.8-15.26 inch-lbs) in the FT far endosteal screw.
- Paired t-test, * $p<0.01$.





Conclusions

- Far endosteal FT screw fixation increases biomechanical torque versus the traditional unicortical PT method.
- This novel technique may provide added strength compared to PT cancellous screws while decreasing the risks associated with bicortical screw placement.
- Far endosteal fixation is another treatment option for medial malleolus fractures in patients with osteoporotic bone.



Future Directions

- Assessment of clinical outcomes with far endosteal fixation *in vivo*.

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References

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