Piecing It Together: *A Paradigm Shift in 3D Printing Foot Ankle Surgery*

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SANFORD HEALTH

Disclosure:

- Consultant Fusion Inc.
- Consultant Flower Conventus
- Design & Ownership Yanstrument
- Membership Committee AOFAS
- Foot Ankle Content Committee AAOS

My 3D Planning Case 1. Muscular Dystrophy (EDMD) Rigid Equines Foot Auto-Strut Frame

Muscular Dystrophy Rigid Equines Foot

19 Y.O. Male

Color Snapshot
Not for diagnostic use

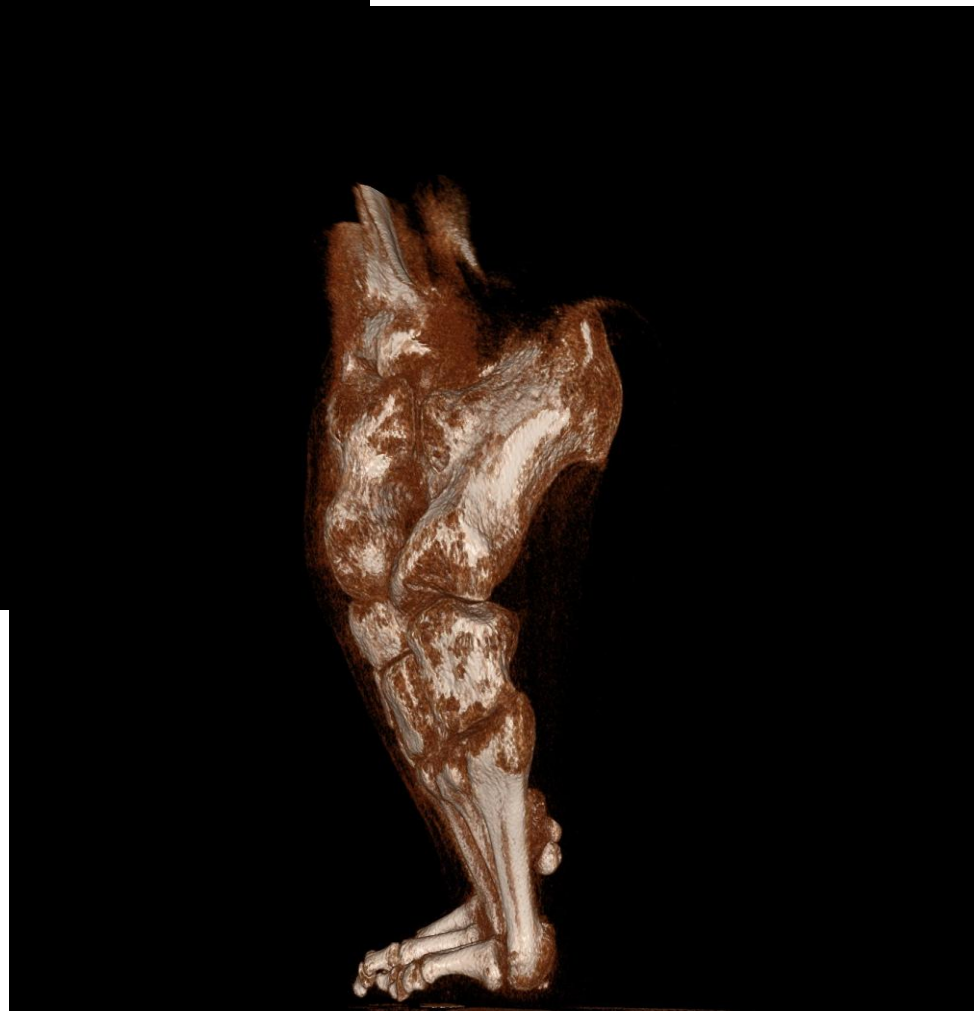
User: Hayes,Matthew
7/17/2024 1:08:39 PM

Image not calibrated

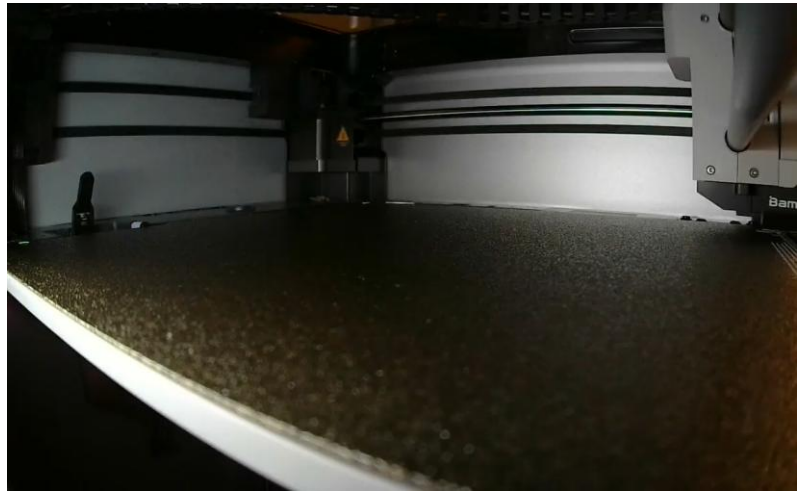
Measurements based on original DICOM data.

AP Foot
Hallux valgus angle (HVA): 16°
I-II Intermetatarsal angle (I-II IMA): 14°
Distal metatarsal articular angle (DMAA): 6°
Talonavicular coverage angle (TNCA): 19°
Talo-first metatarsal angle (T1MA): -24°
Talo-second metatarsal angle (T2MA): -10°
Talo-calcaneal angle (TCA): 39°
Metatarsus adductus angle (MAA): 86°

Regular 2D Plain X-Ray



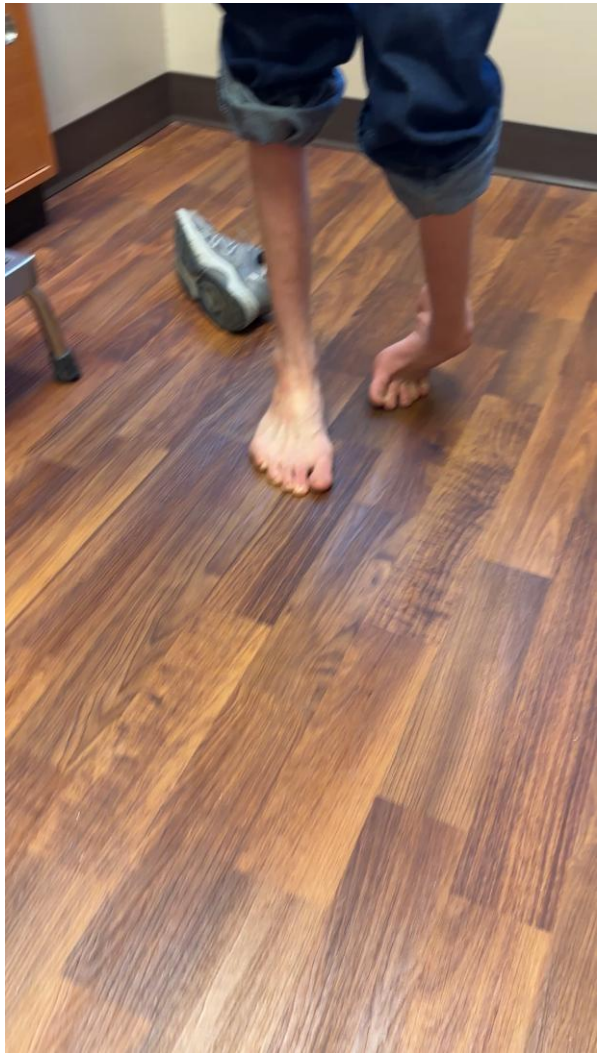
WBCT standing
3D imaging



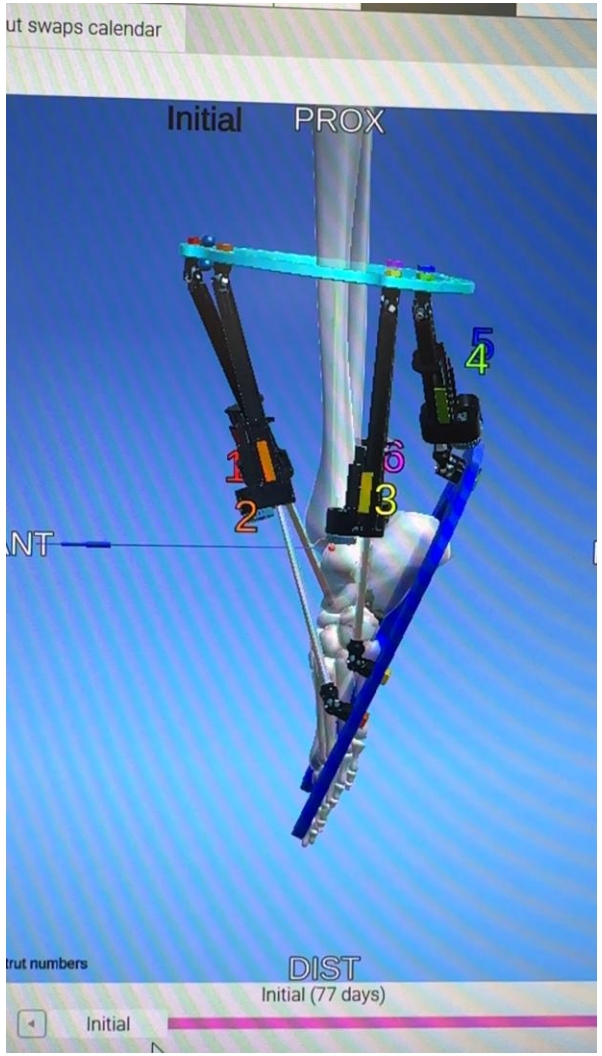
In Office 3D Printed Model: UNDER 24 HRS & 5 DOLLARS IN COST DESK TOP FROM Yan's Lab:

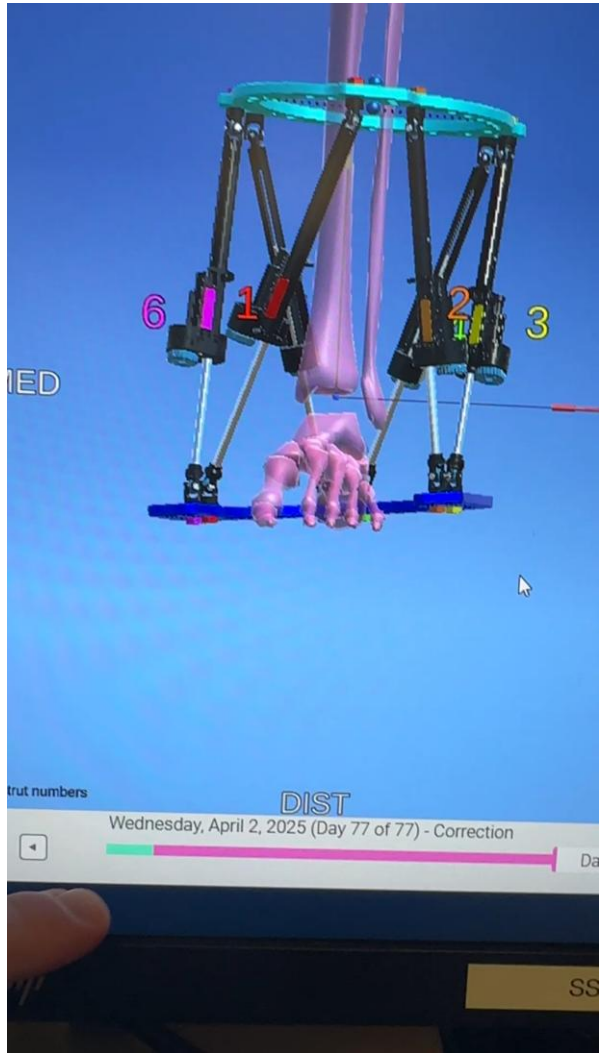
Business Opportunities in Italy

500 Euro???



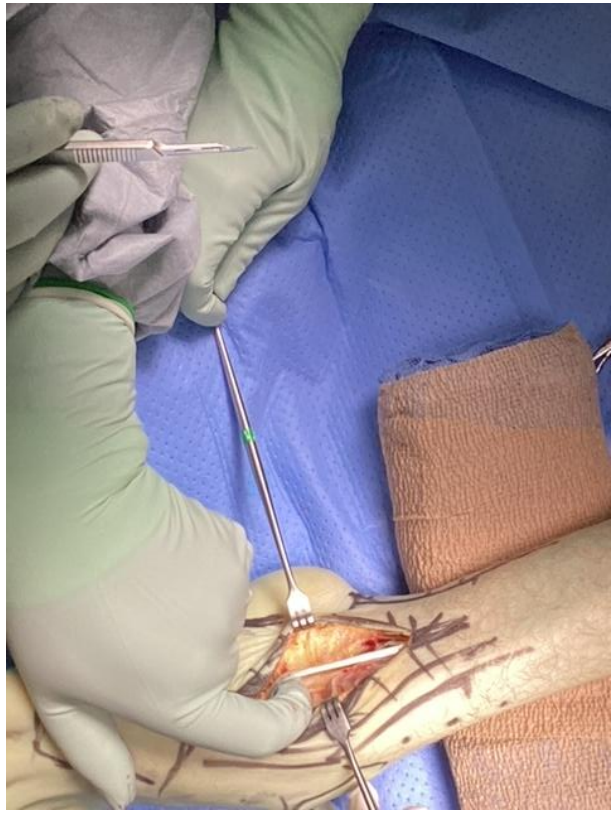
Clinical Exam in Dynamics

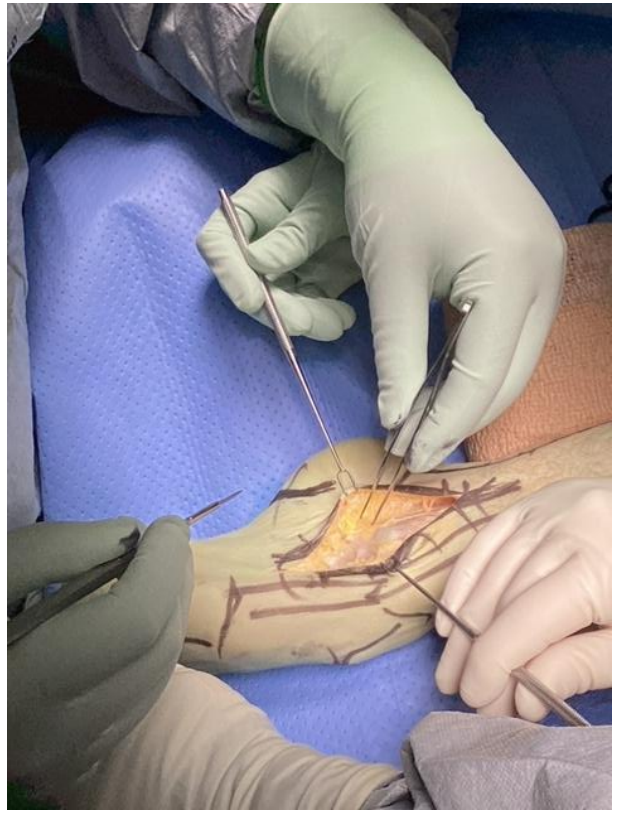




PreOp 3D Planning with autostruts:

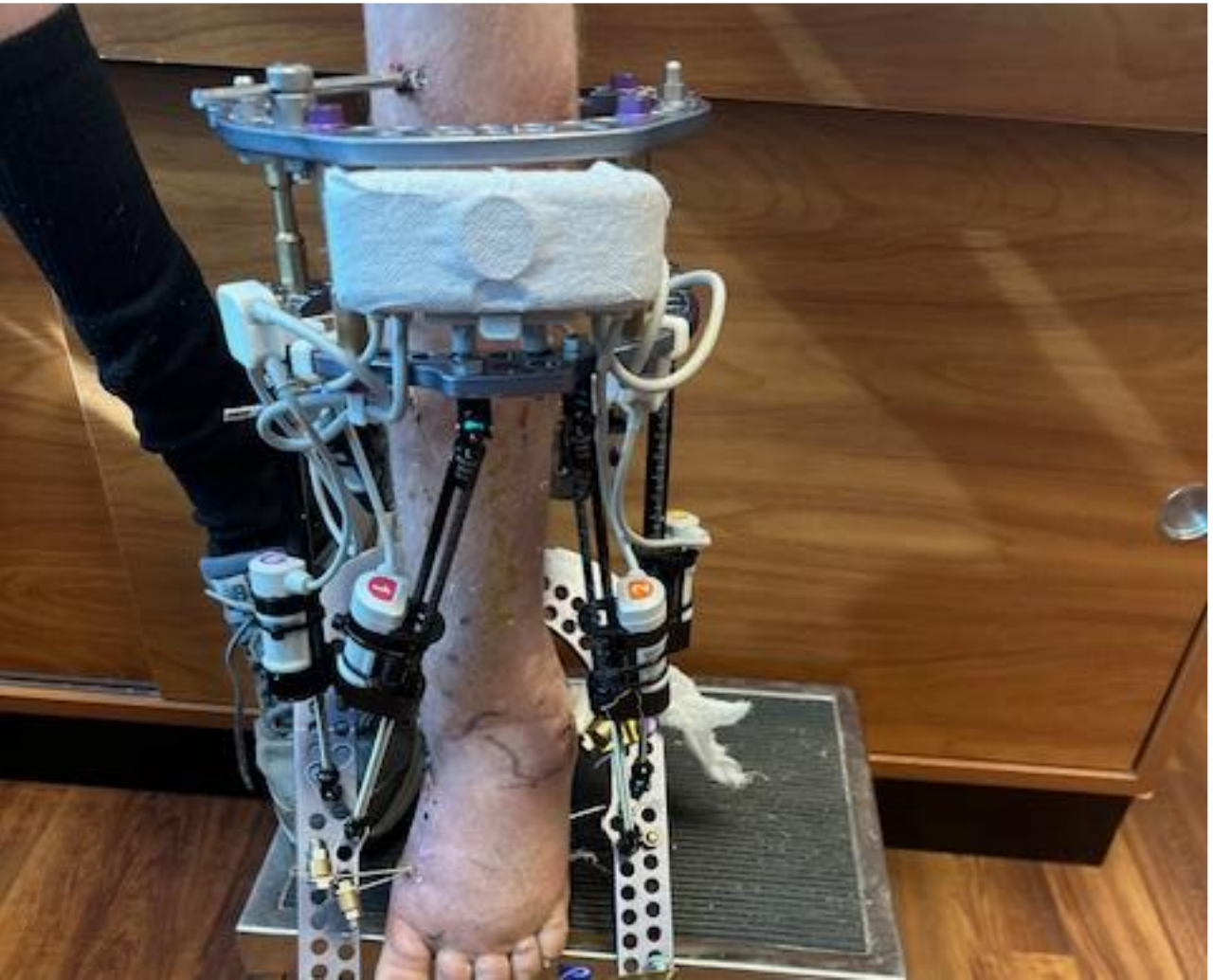
Intra-Op: Soft tissue release

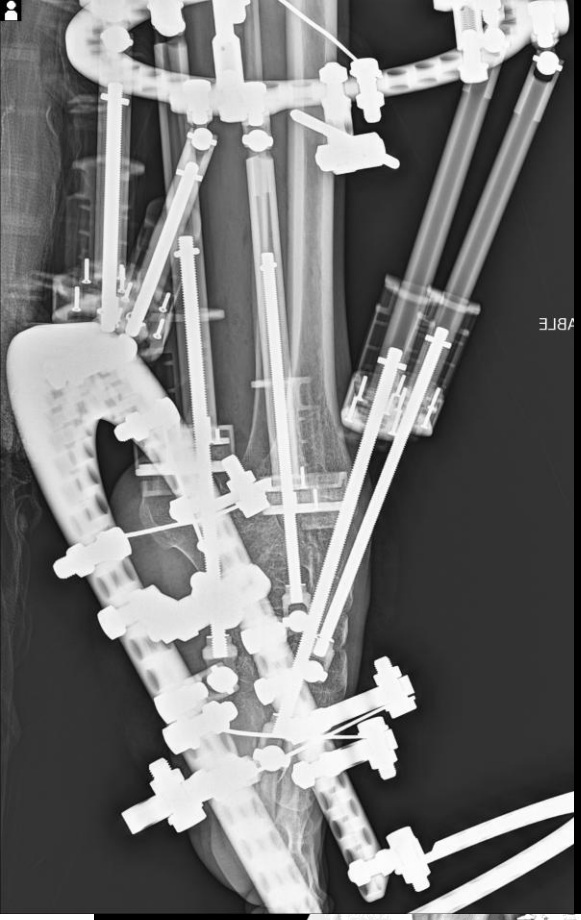


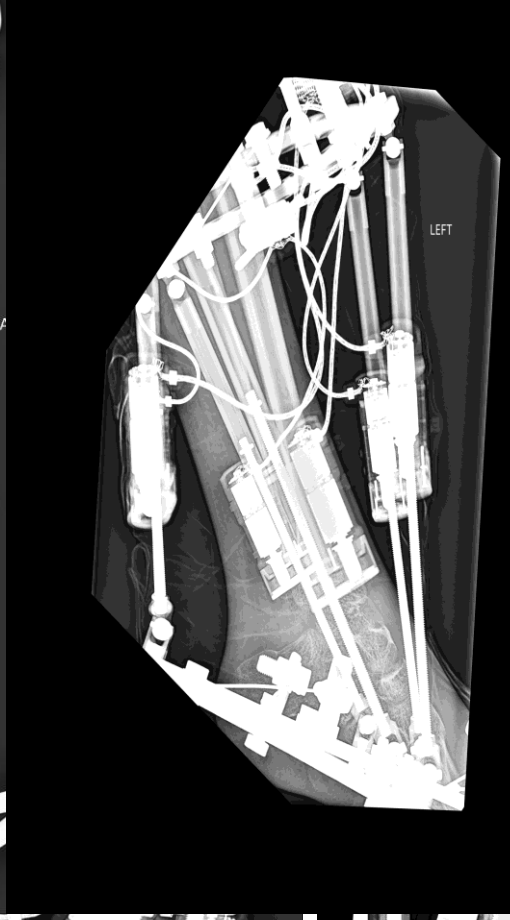


IntraOp Execution of Plan:
Hexapod Autostruts

Post Op Follow ups:



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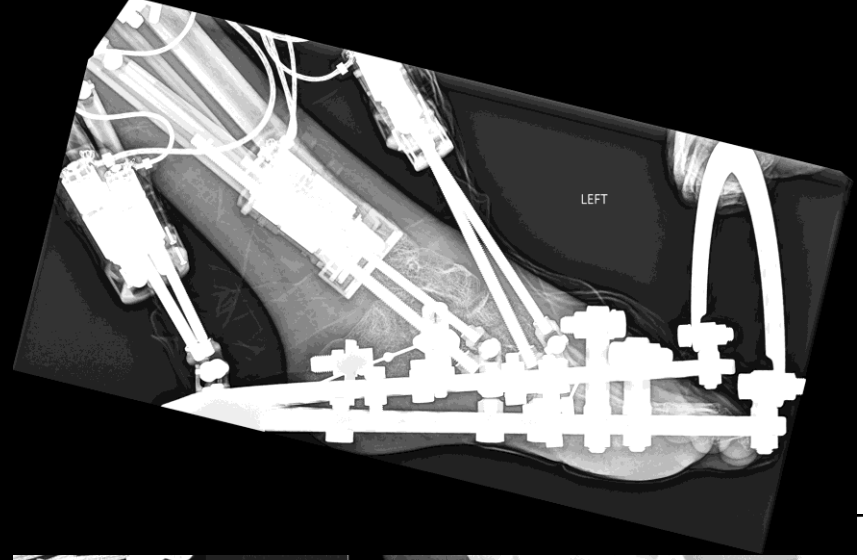
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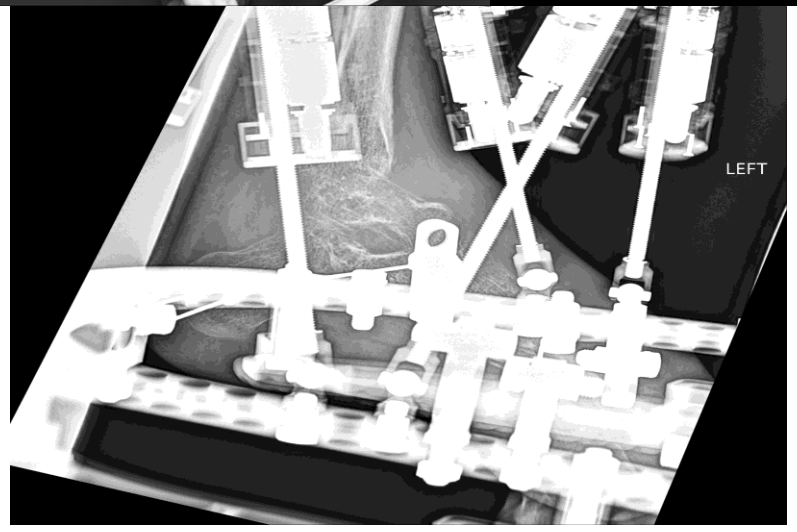
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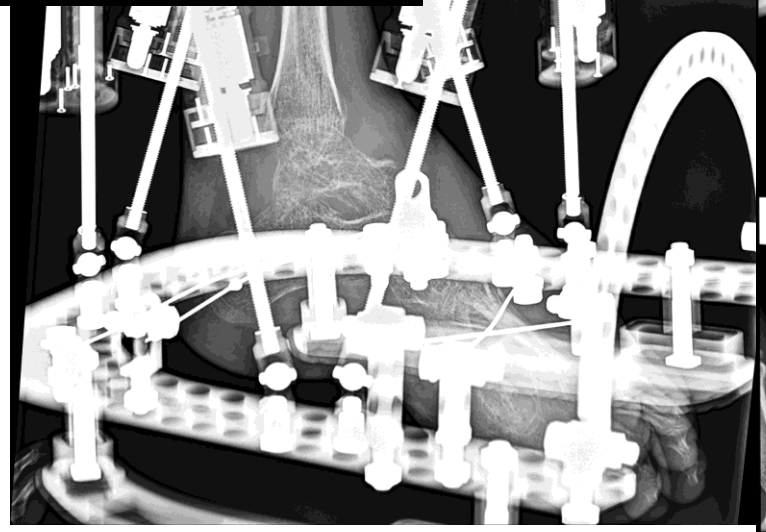

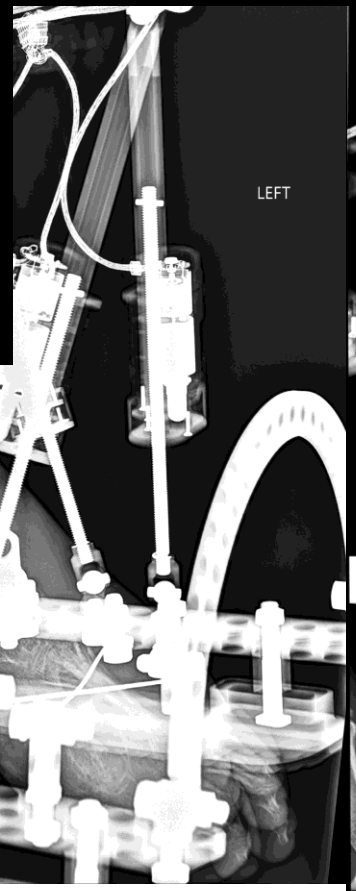
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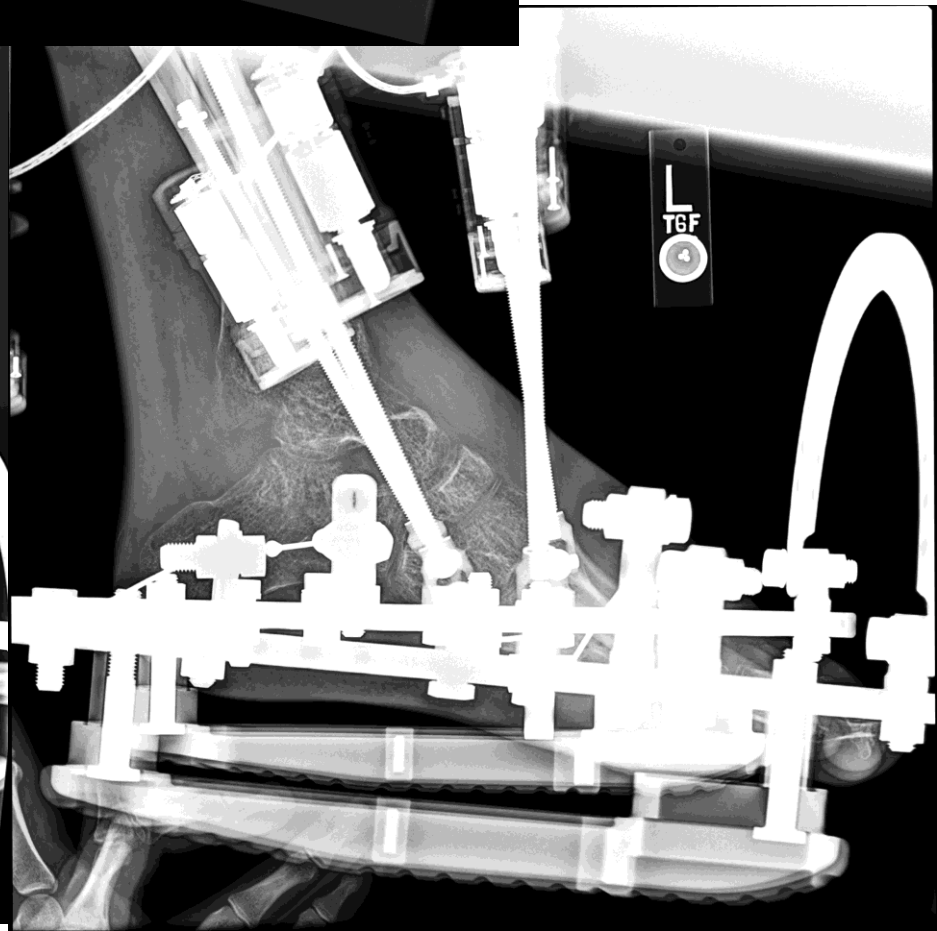
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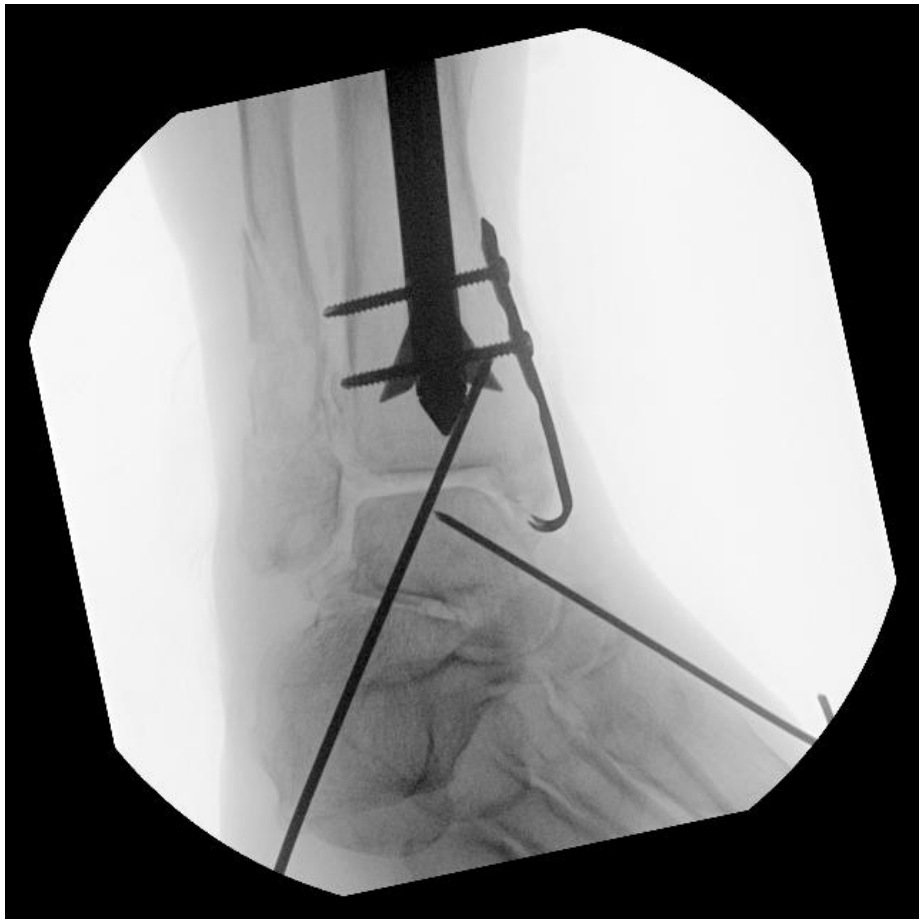
TGF

My 3D Planning Case
2. Complex Deformity TTC Fusion with 3D Printing Cage

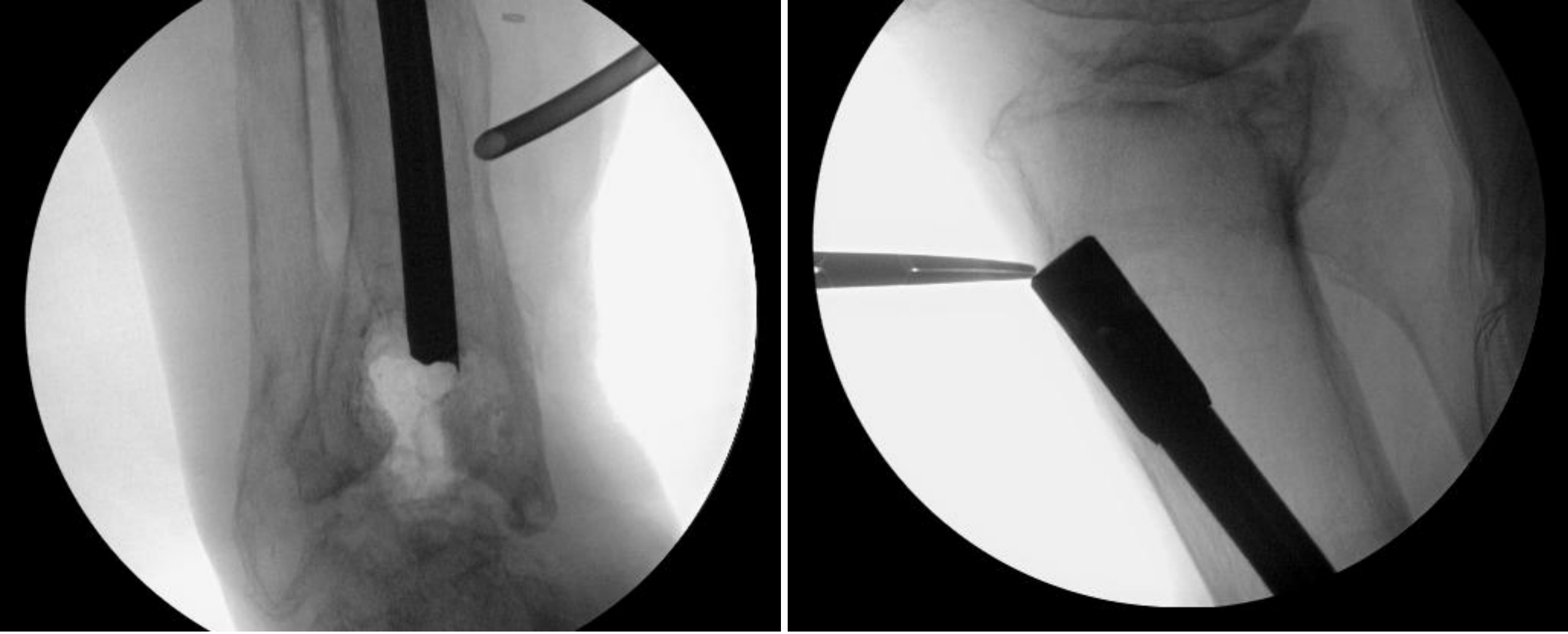
Multiple Trauma Hx from MVA: 1990
Antiquated Tib Nail

Second MVA with Poly-trauma: 2 Years Prior

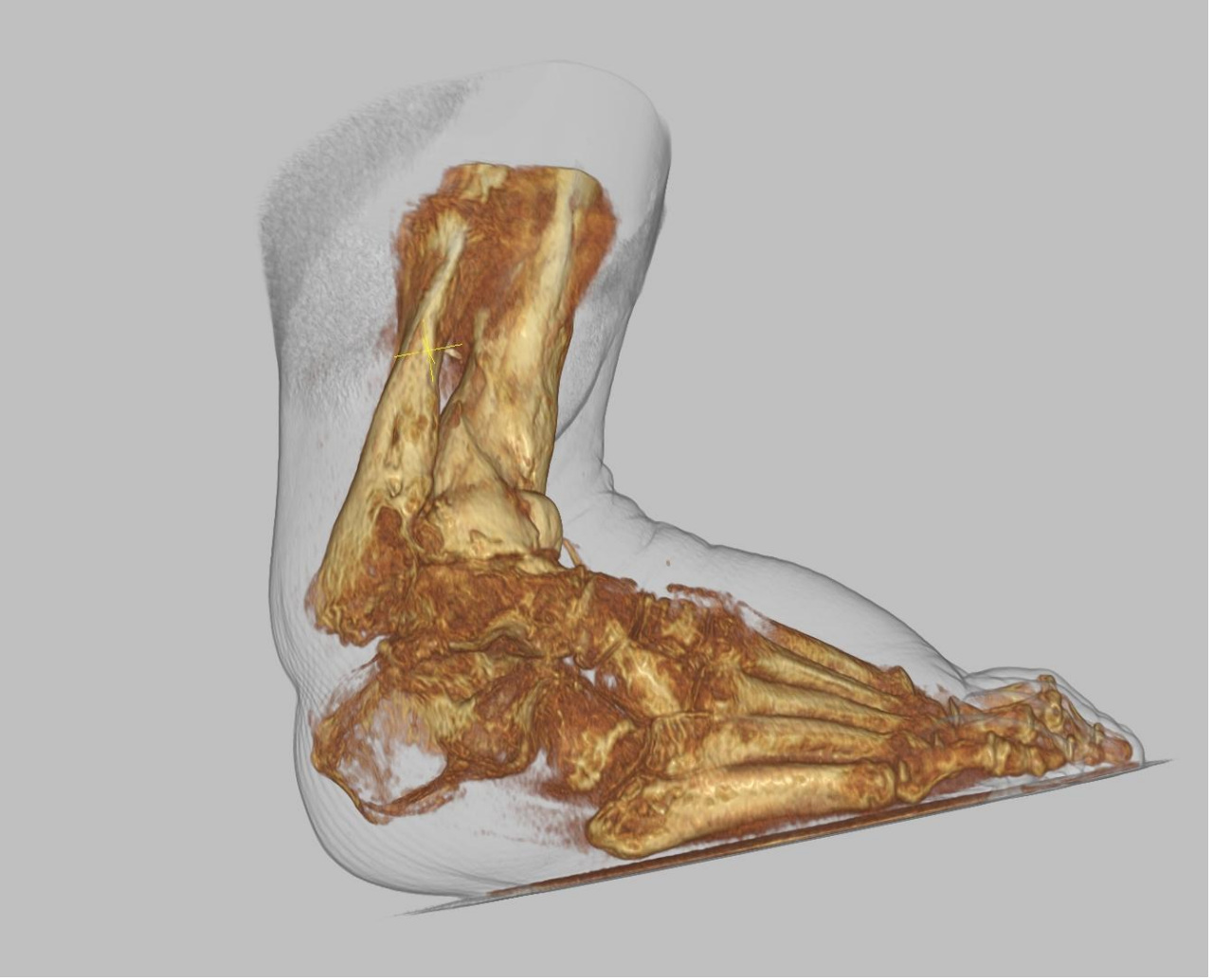


Smoker & Open Wound Plastic Flap:

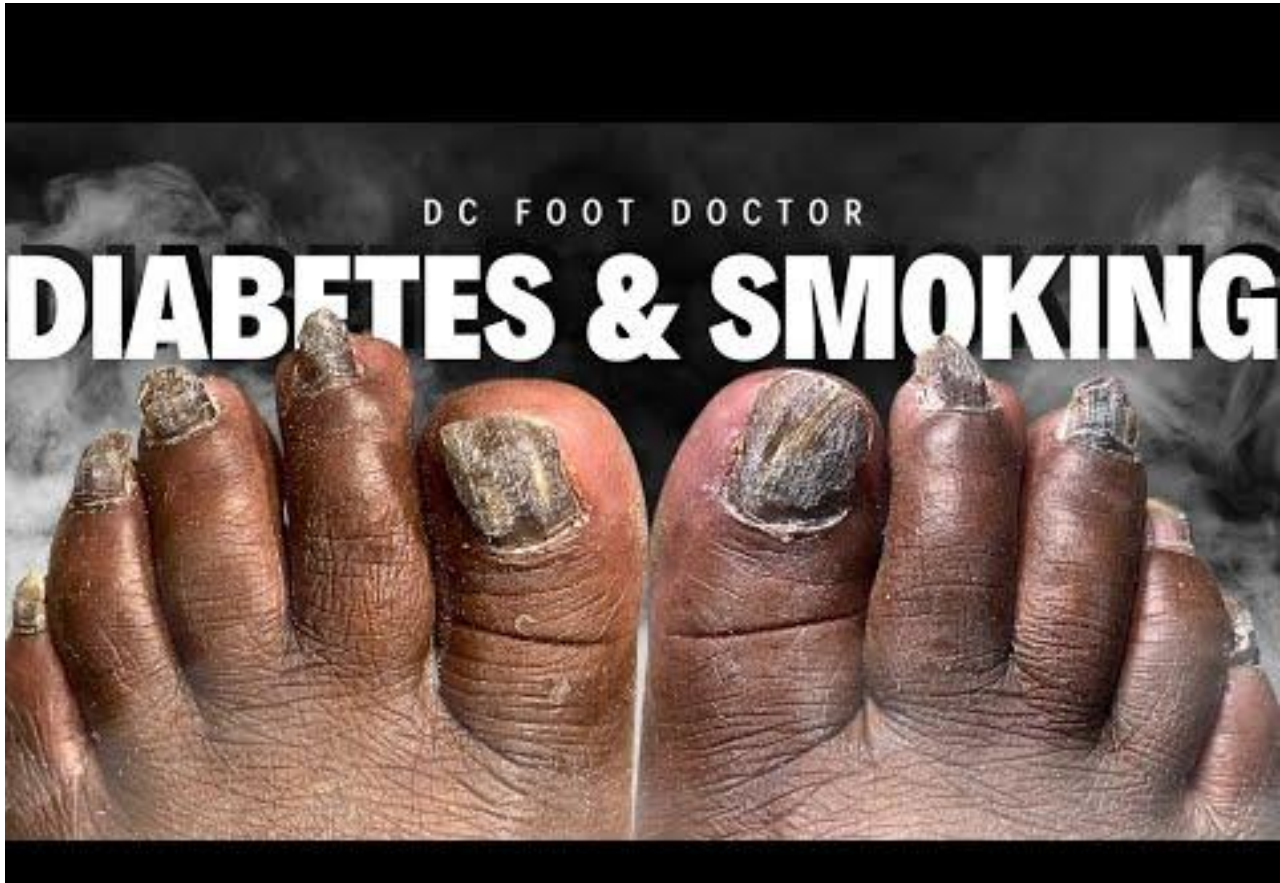
Refused Amputation & My Limb Salvage Clinic:

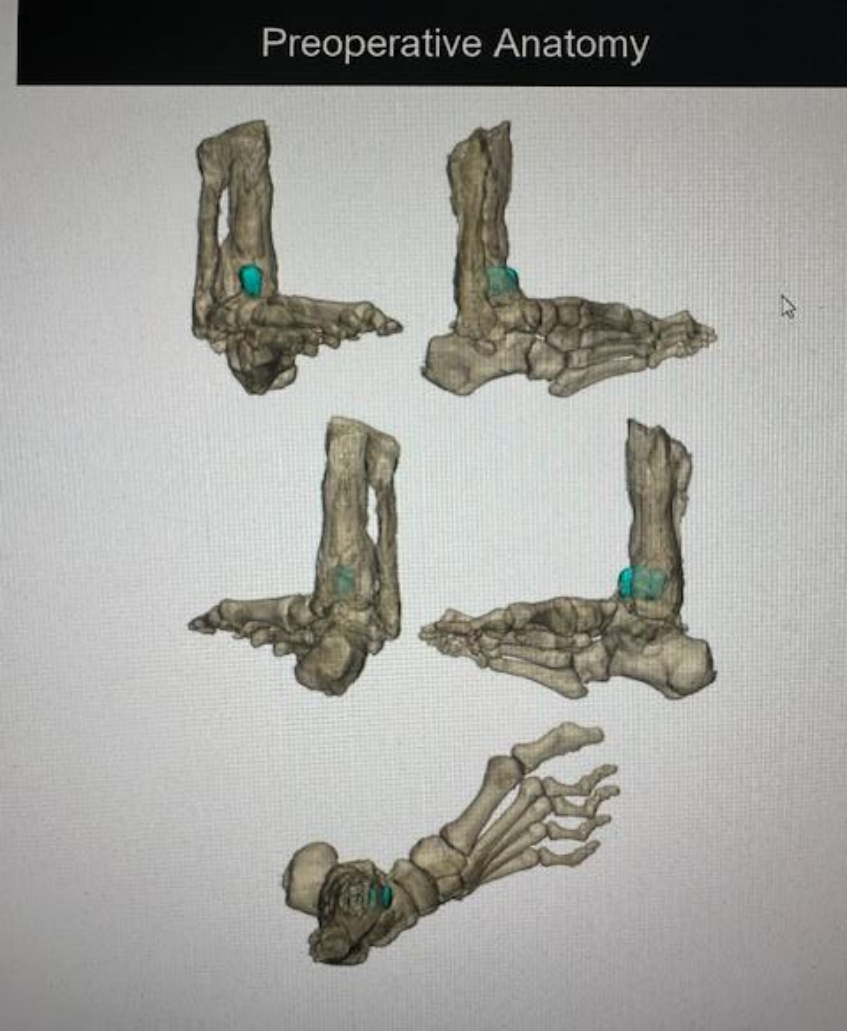


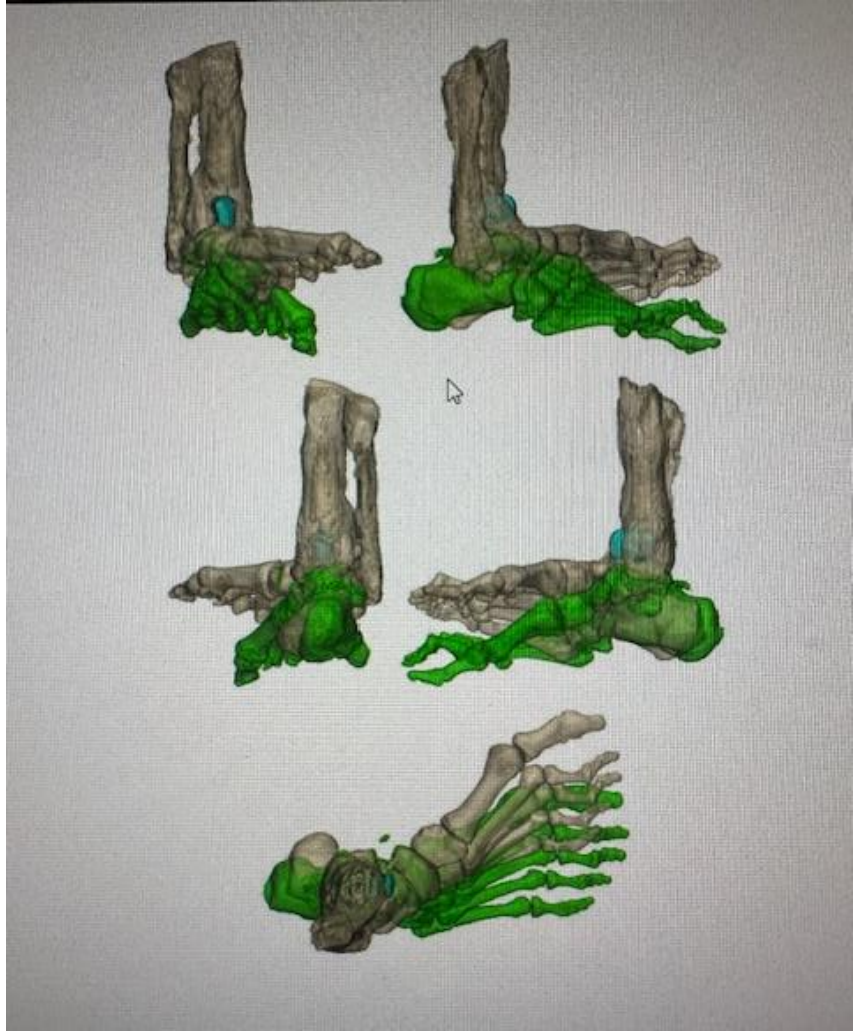
Staged Nail Removal & Abx Spacer

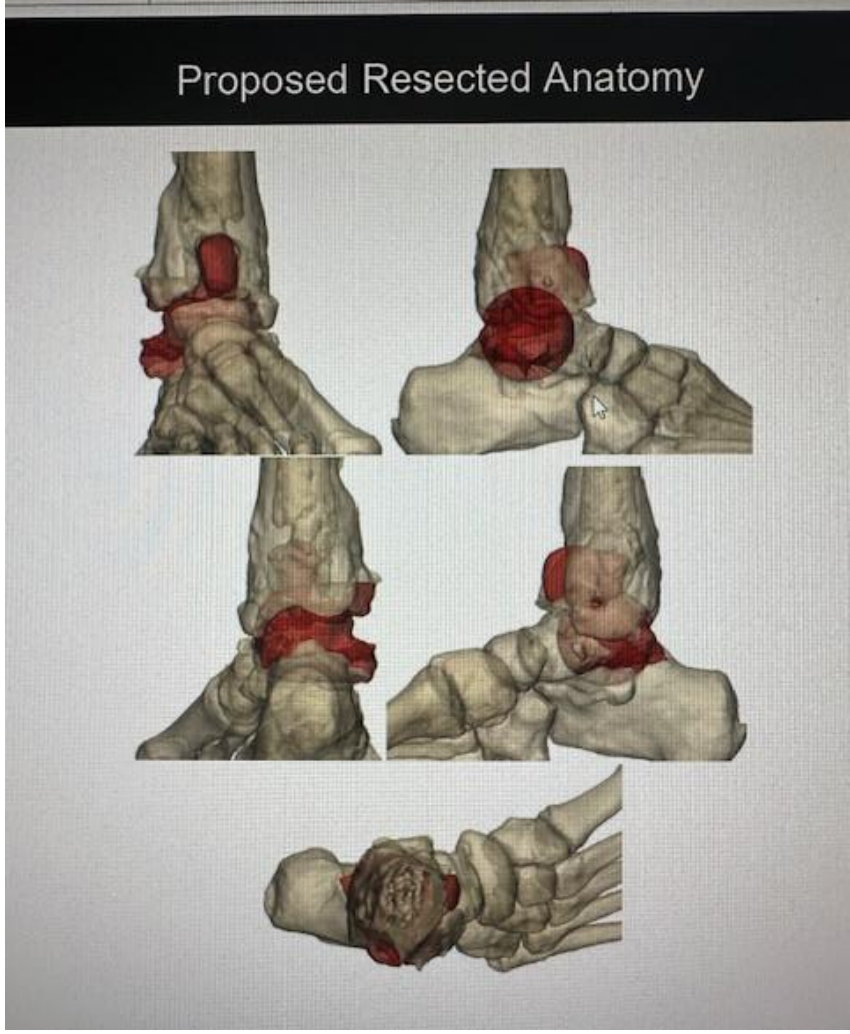


Stop Smoking 6 to 8 Weeks: Urine Nicotine Test Verification 1 Week prior to Reconstruction Surgery

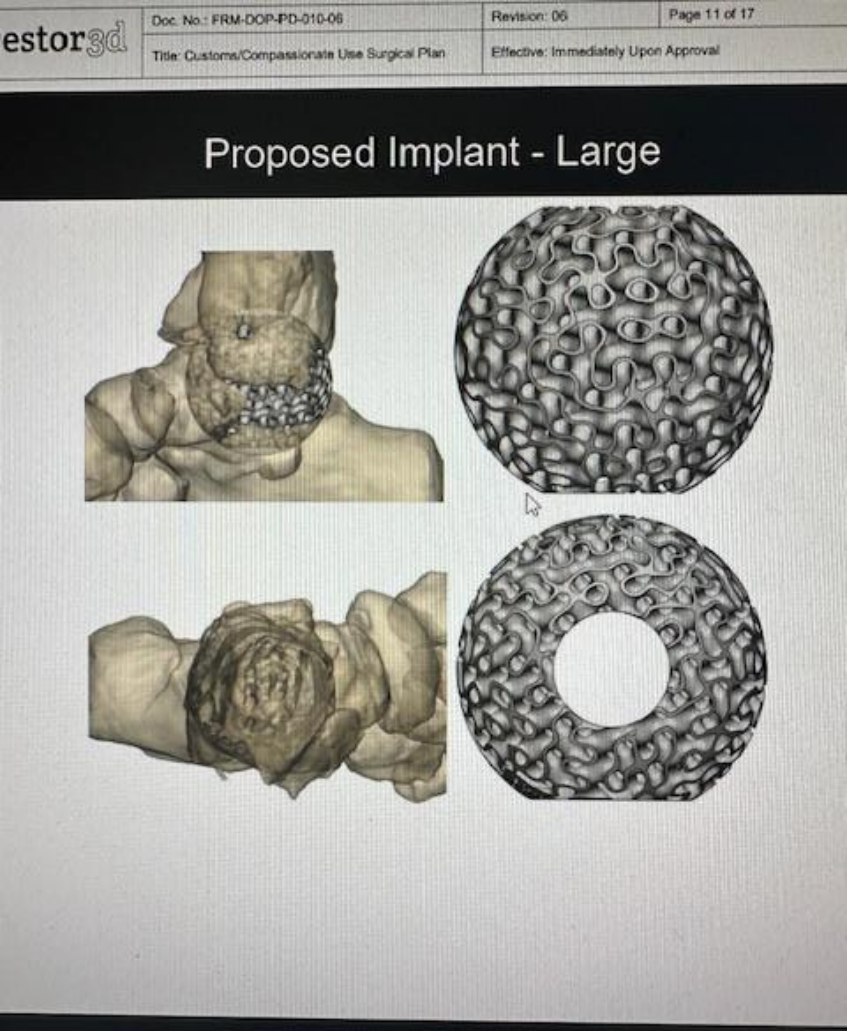


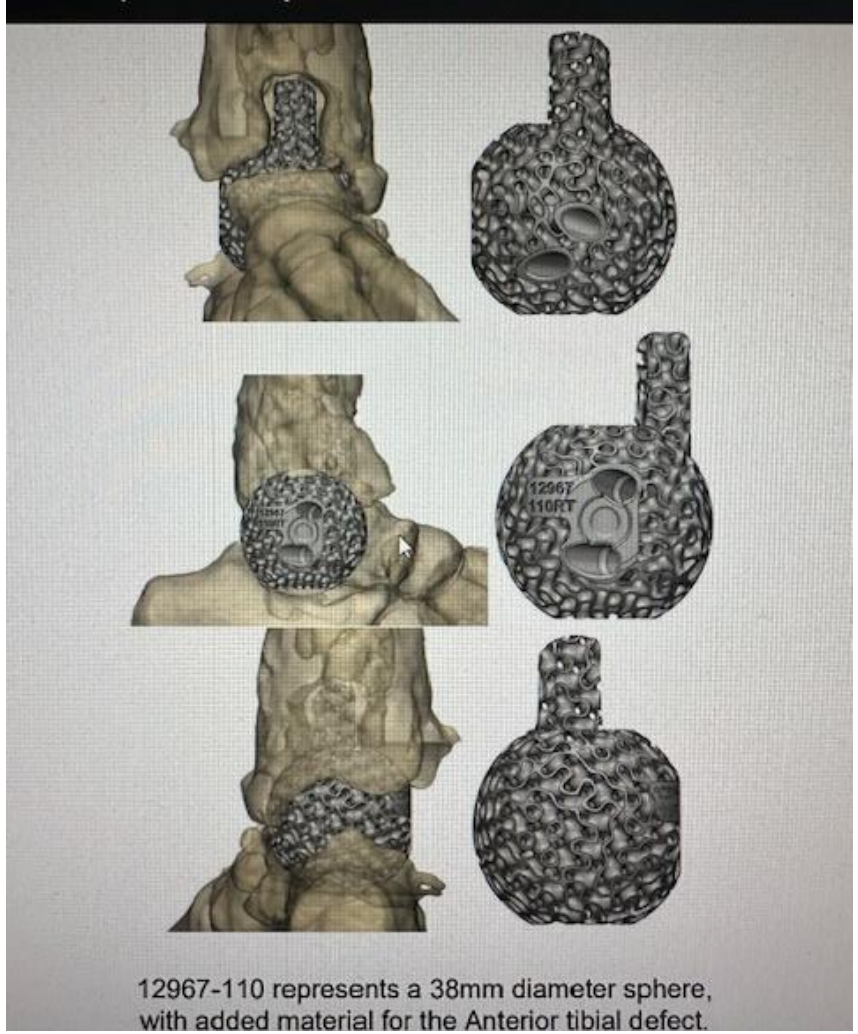


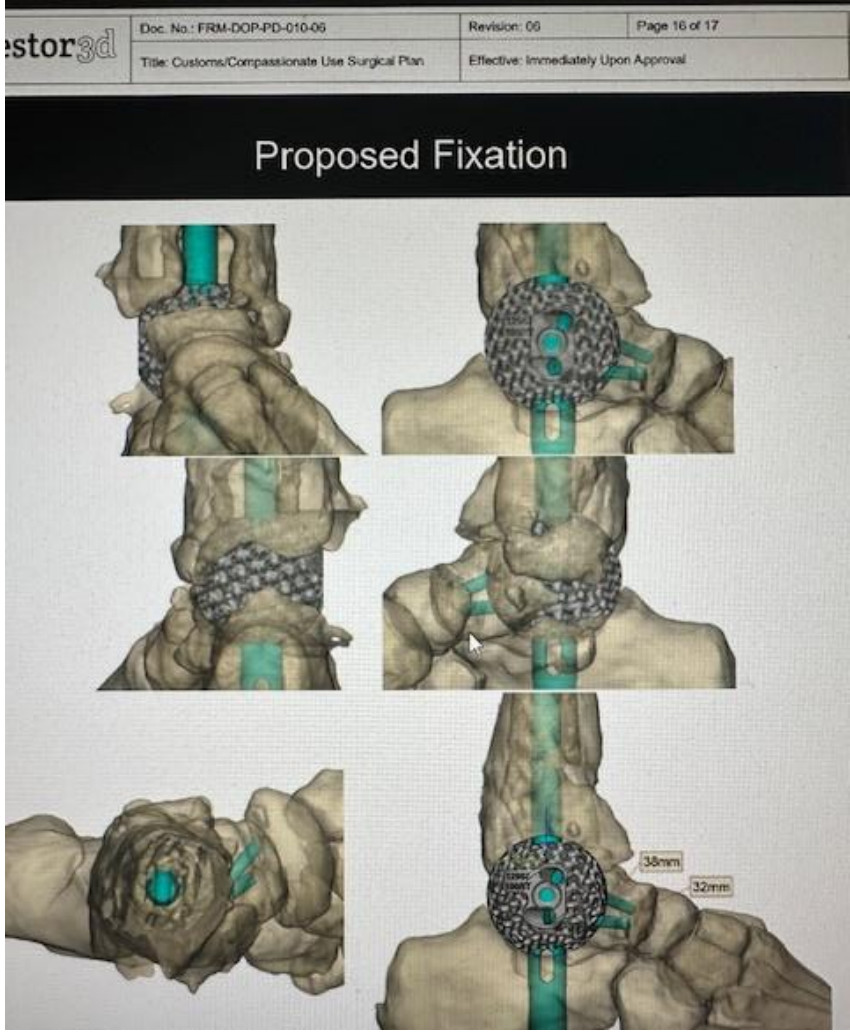




Surgical Planning & 3D Printed Implant for Large Bone Defects:

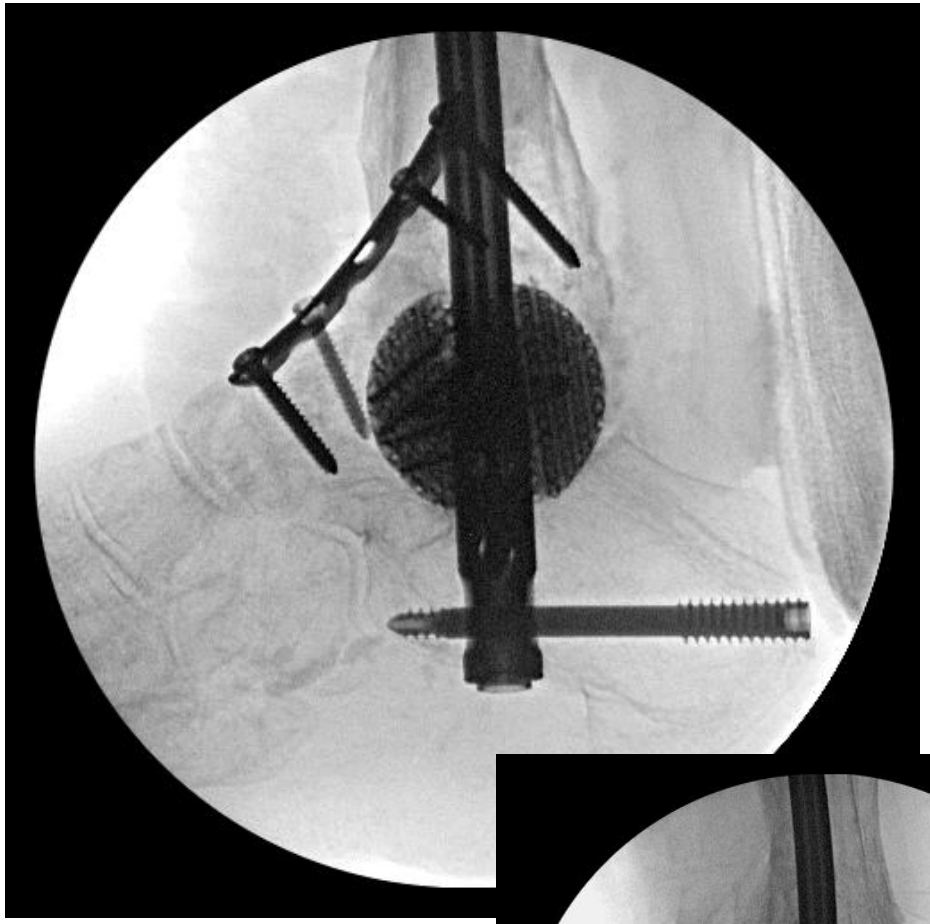






TTC through the Cage

IntraOp 3D Cage Implant Bone Grafting: Italian Meatball Technique

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ATM


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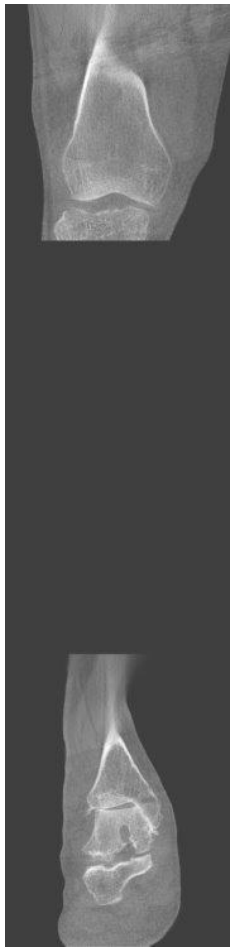
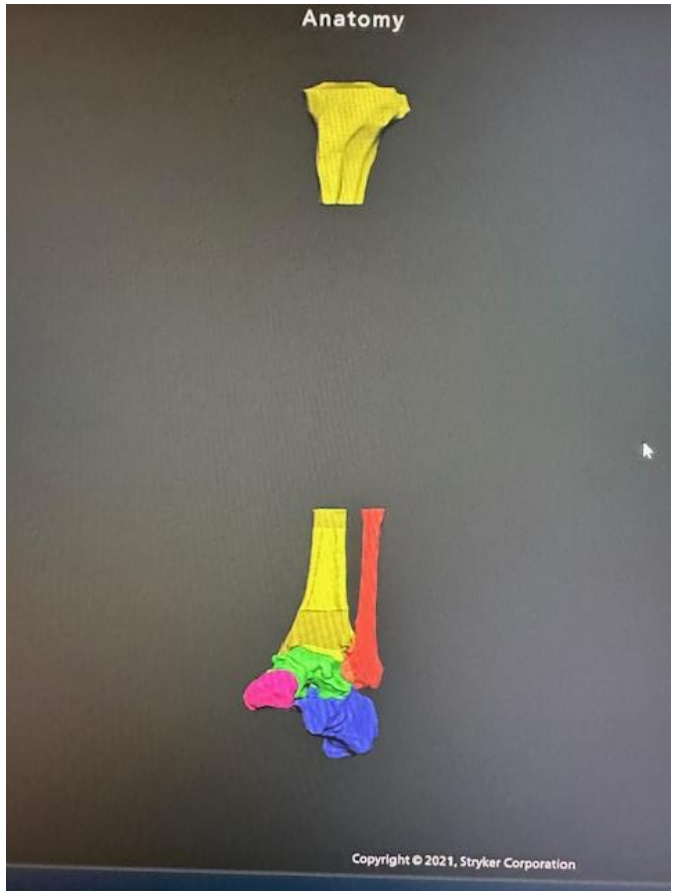
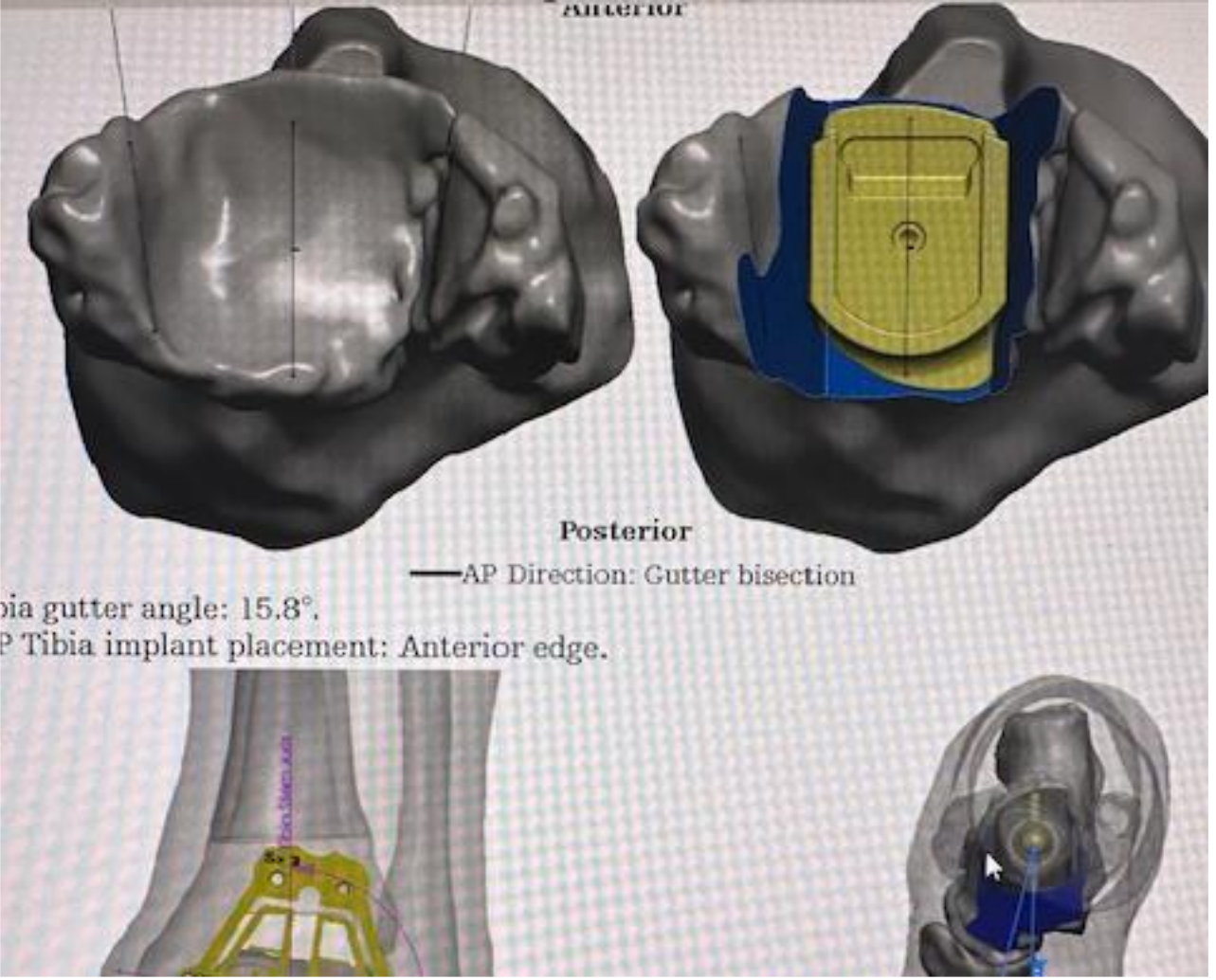
Immediate Post Op Correction

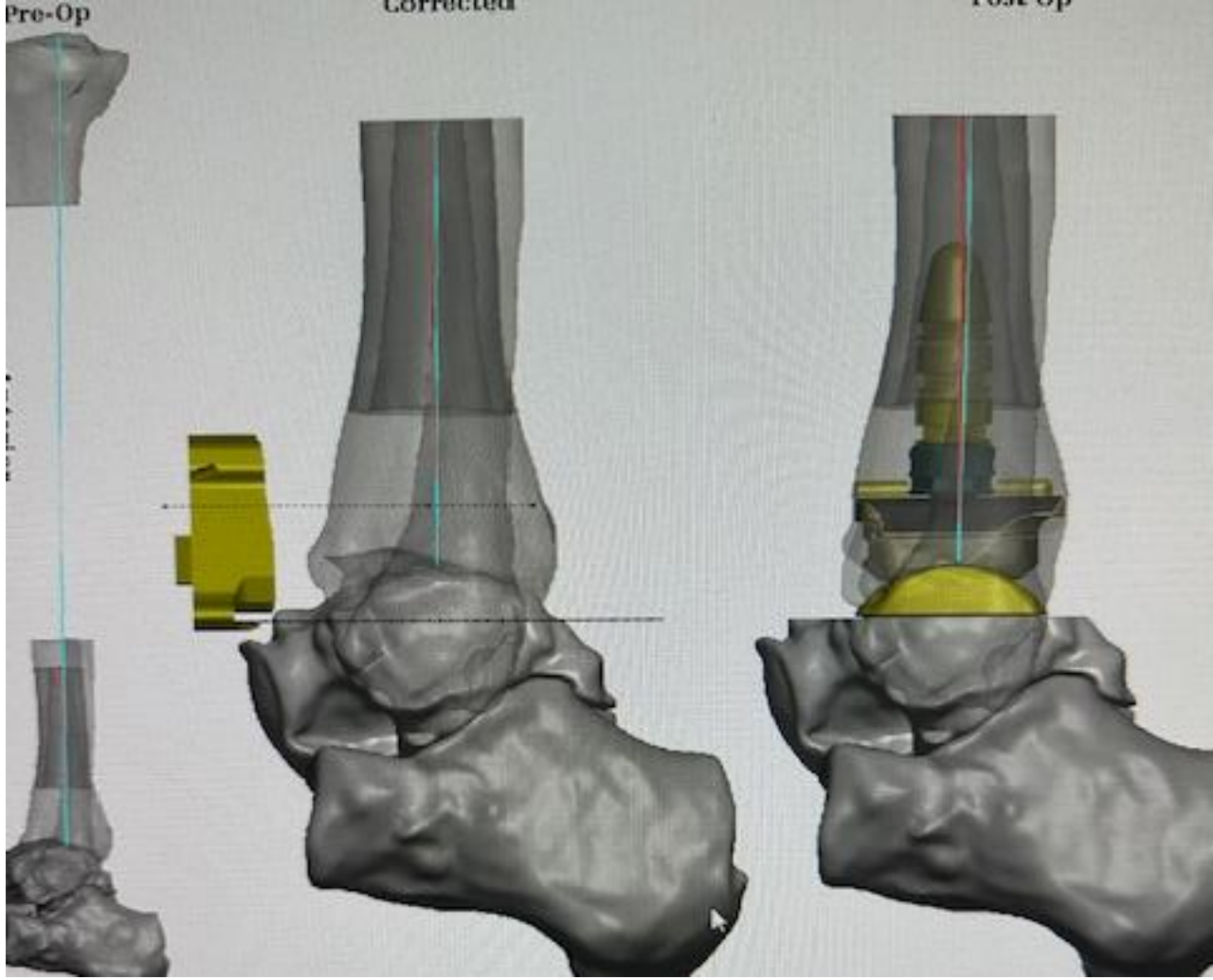
My 3D Printing Case 3. 52 M
Revision Total Ankle Cage vs. Total Talus

WBCT w Specific Protocol:

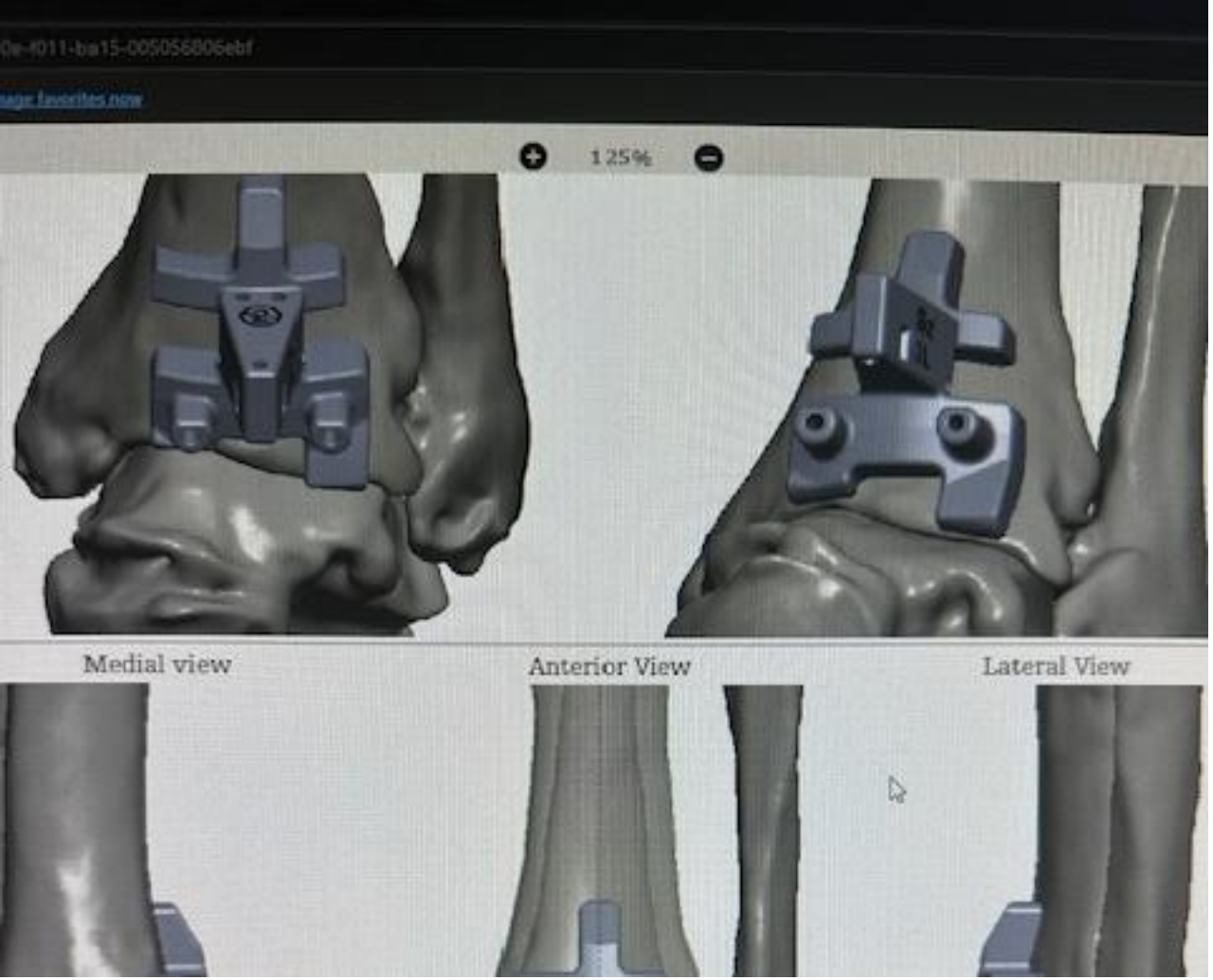


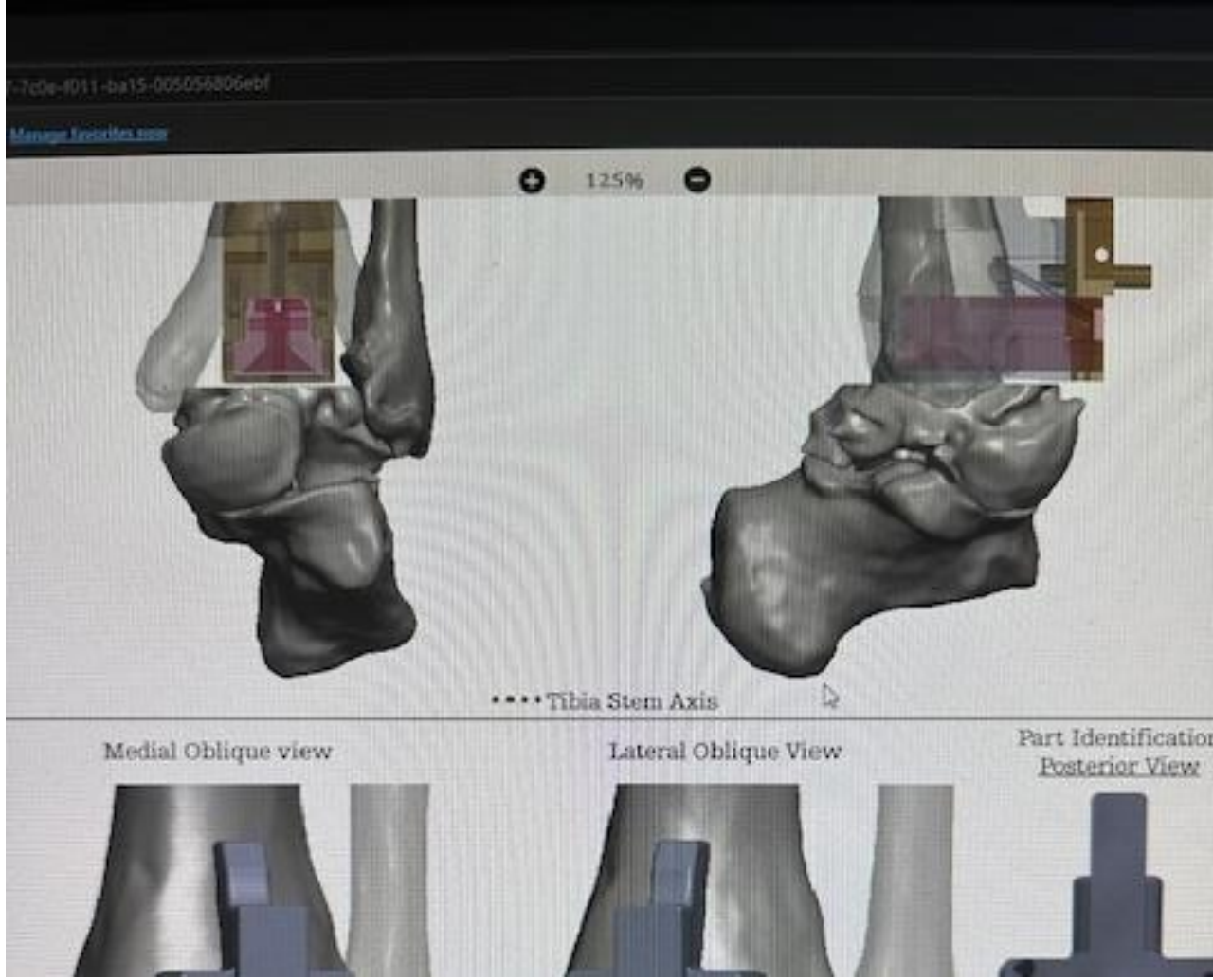






Design Discussion w Engineer



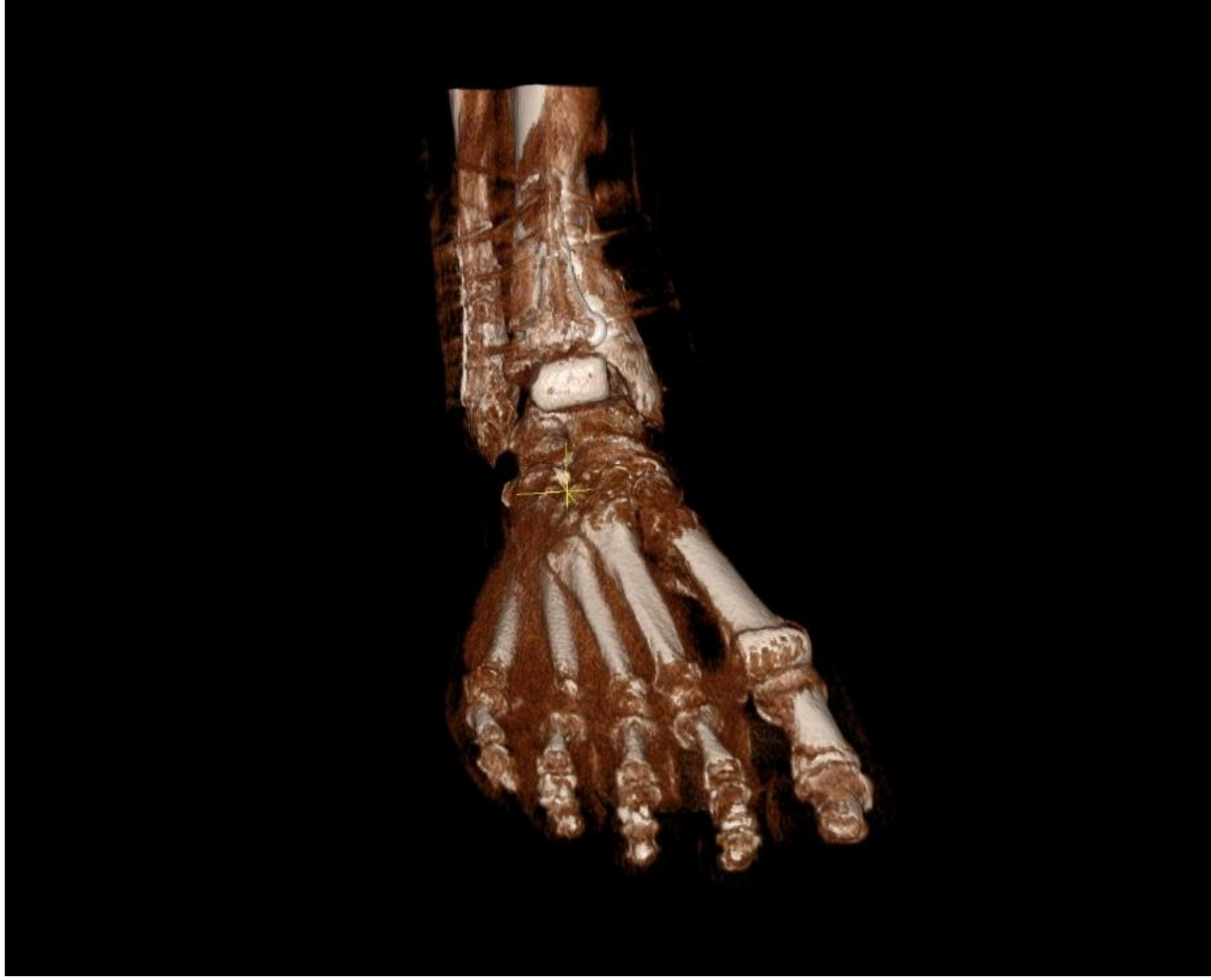


3D Printed Cutting Block PSI

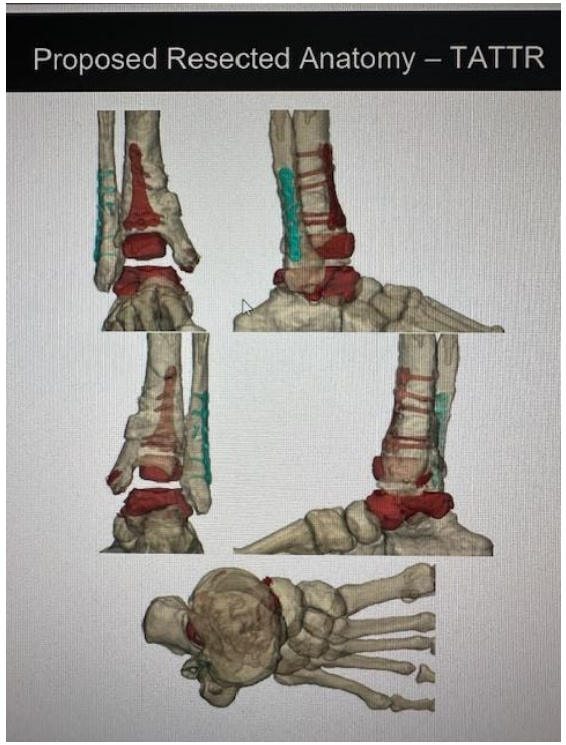
Hi Five.

Fracture of the Talus


Staging Surgery for Revision TAA vs Fusion Vs. TATTER

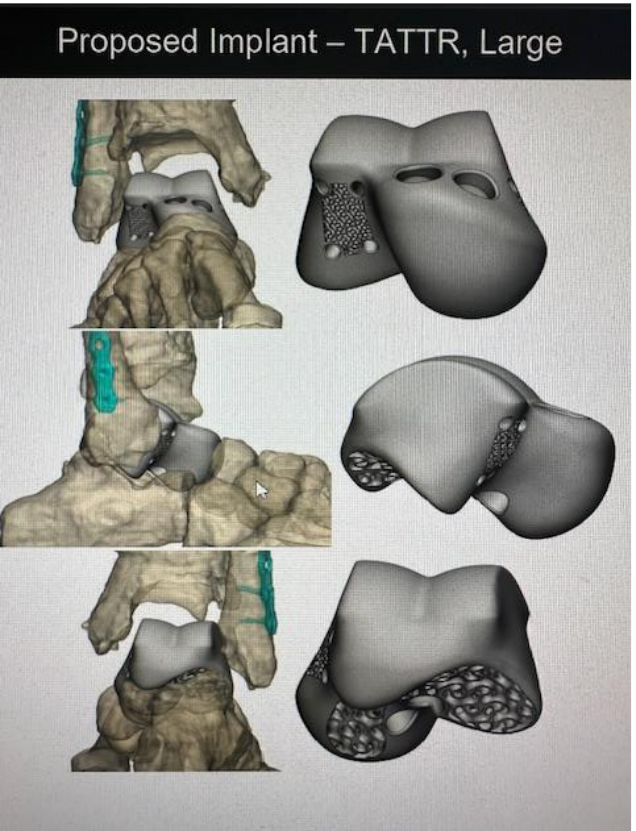


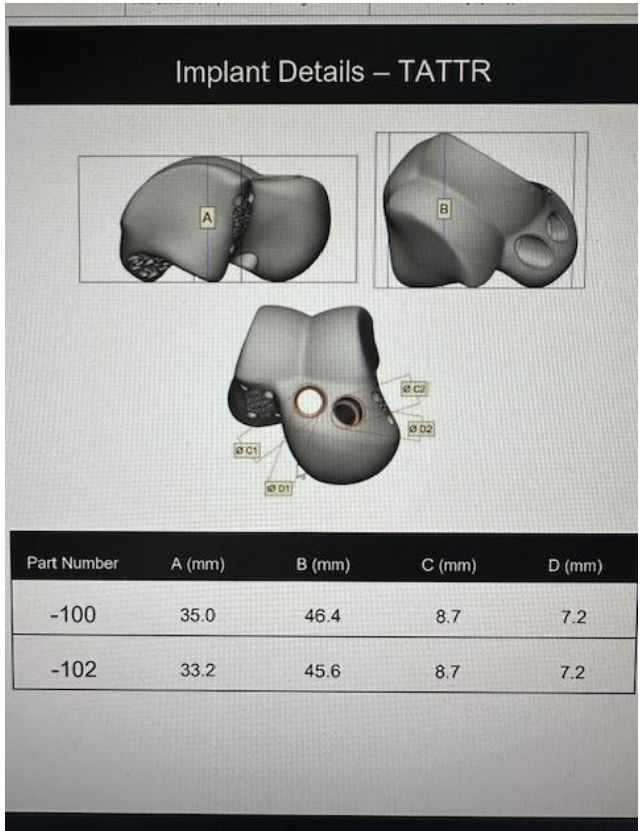
WBCT for Details in Standing

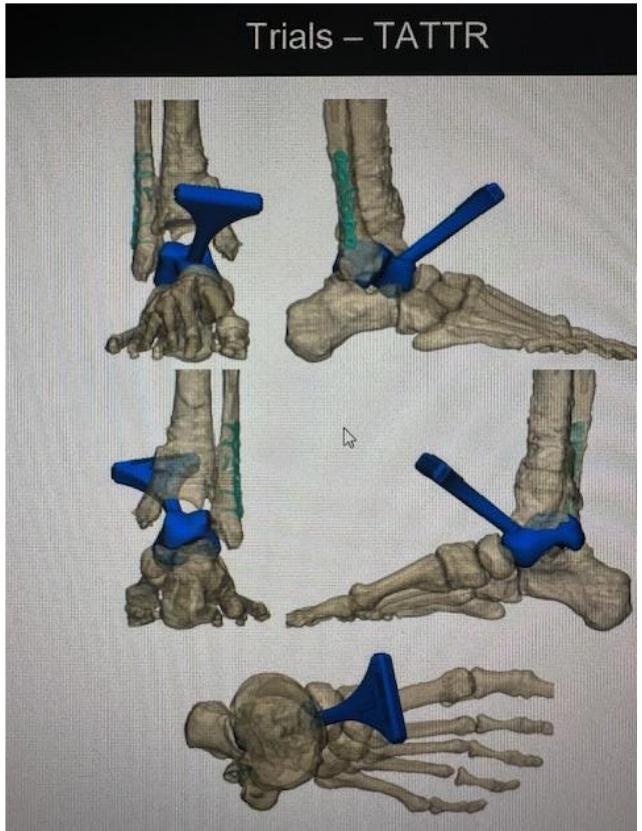


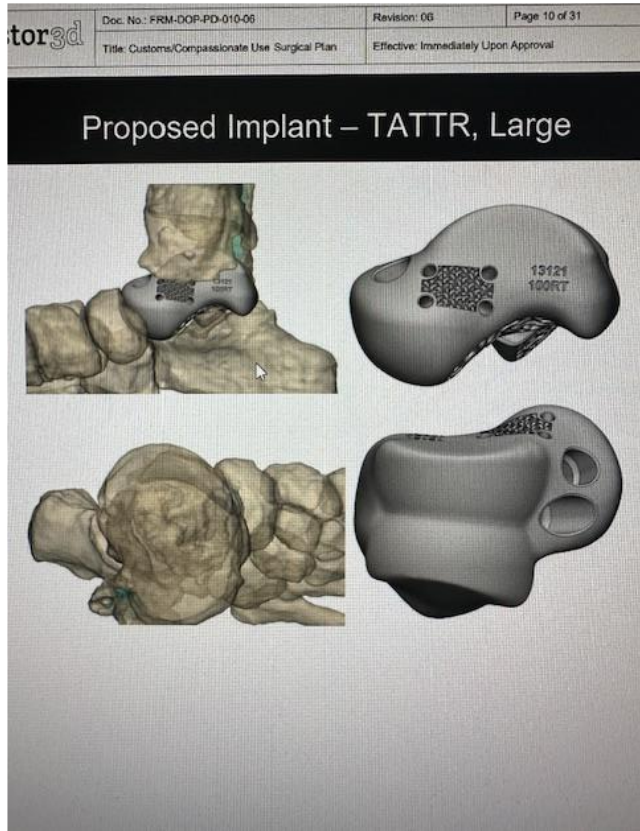
3D Design Predicted Correction

Total Talus TATTER

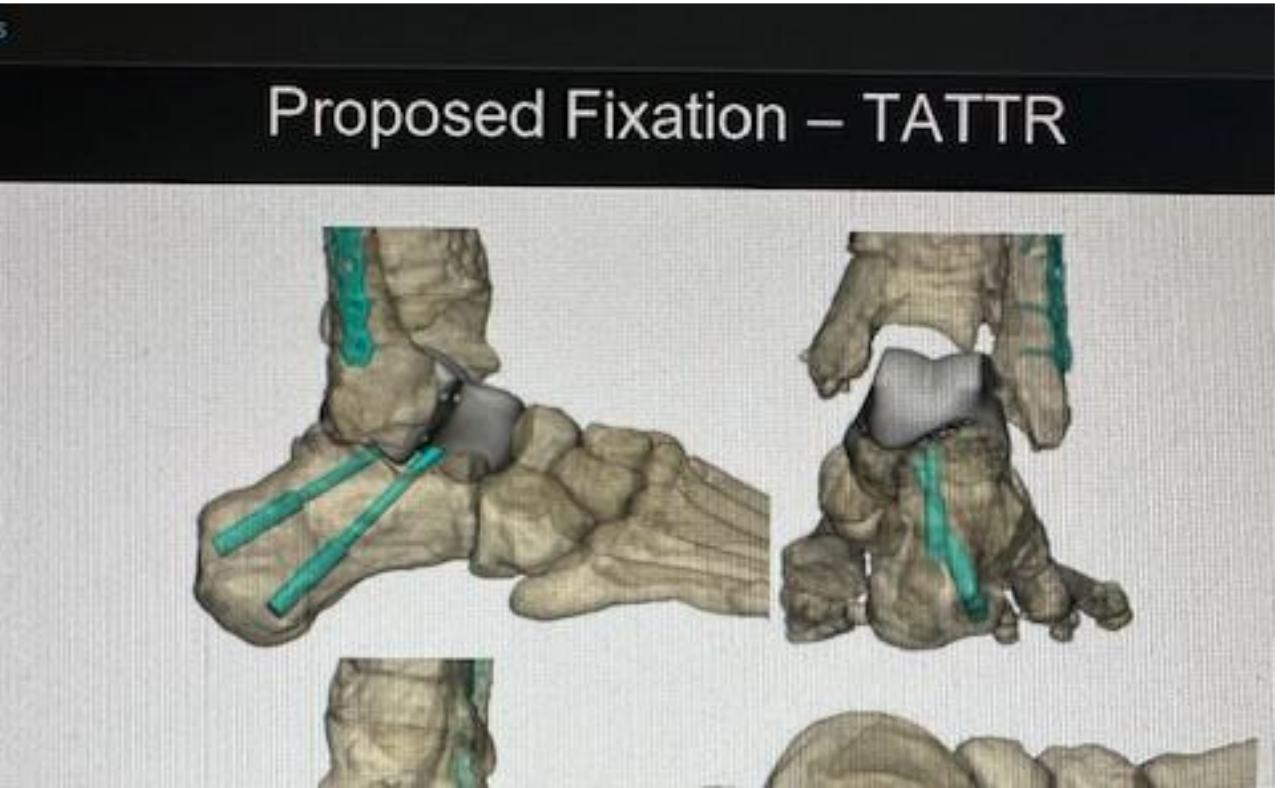




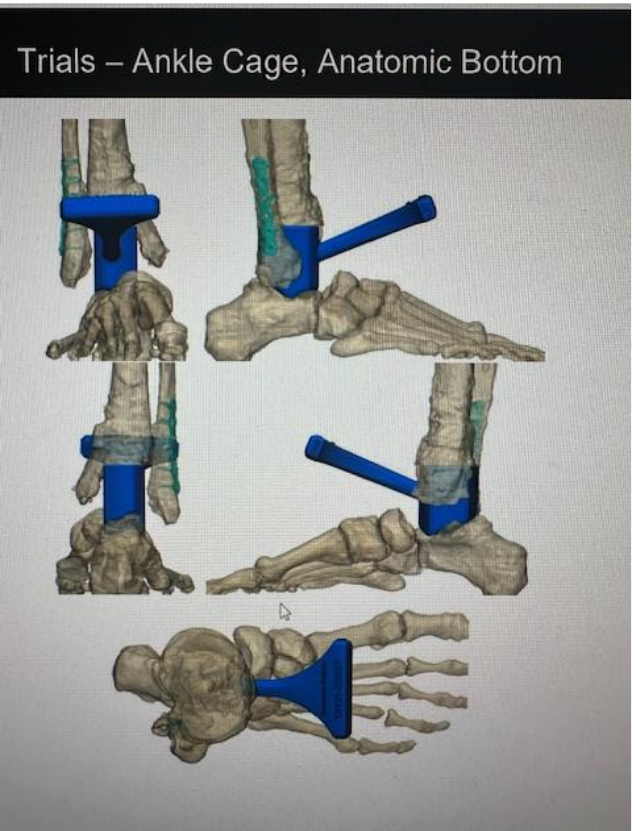


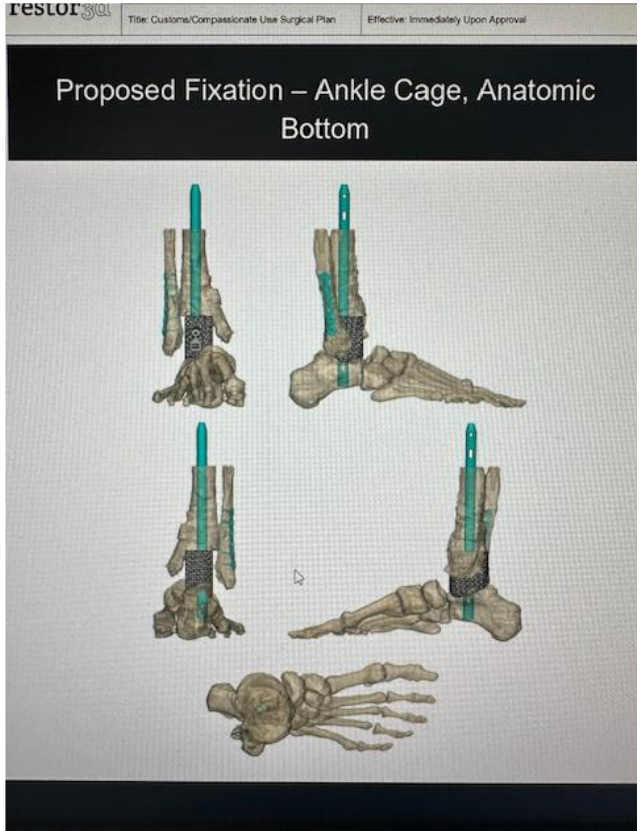


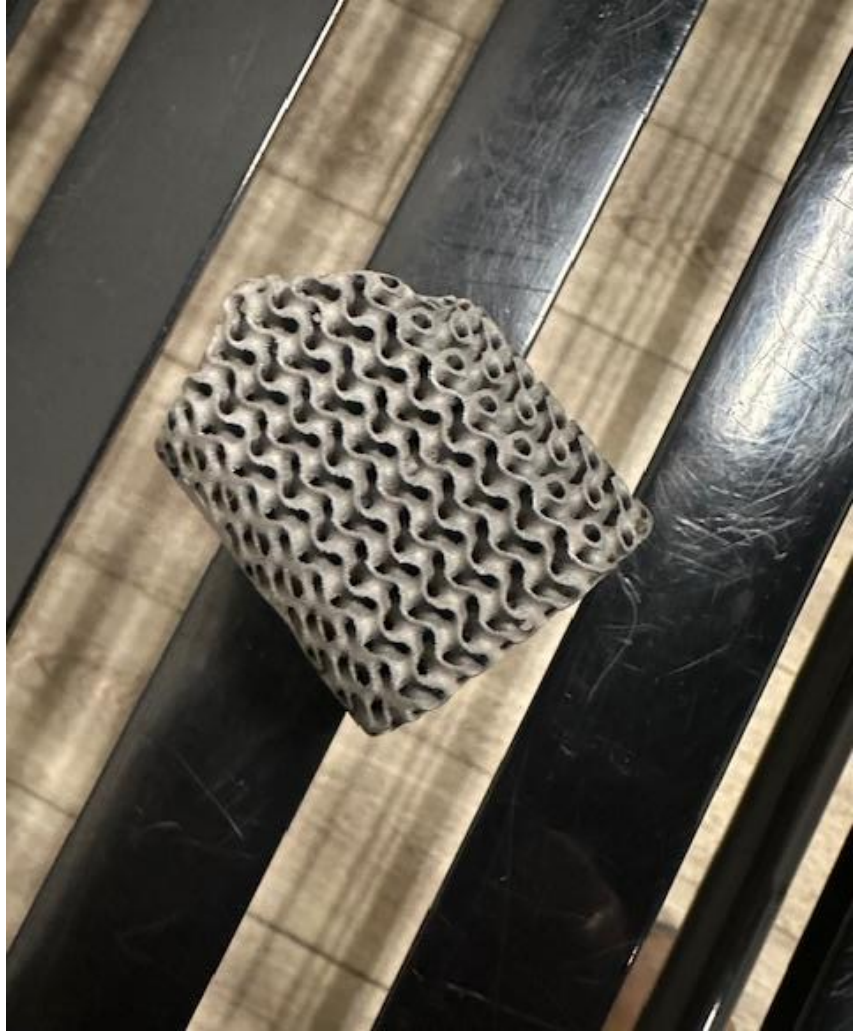
Approval, Manufacture & Delivery in Sterile Package



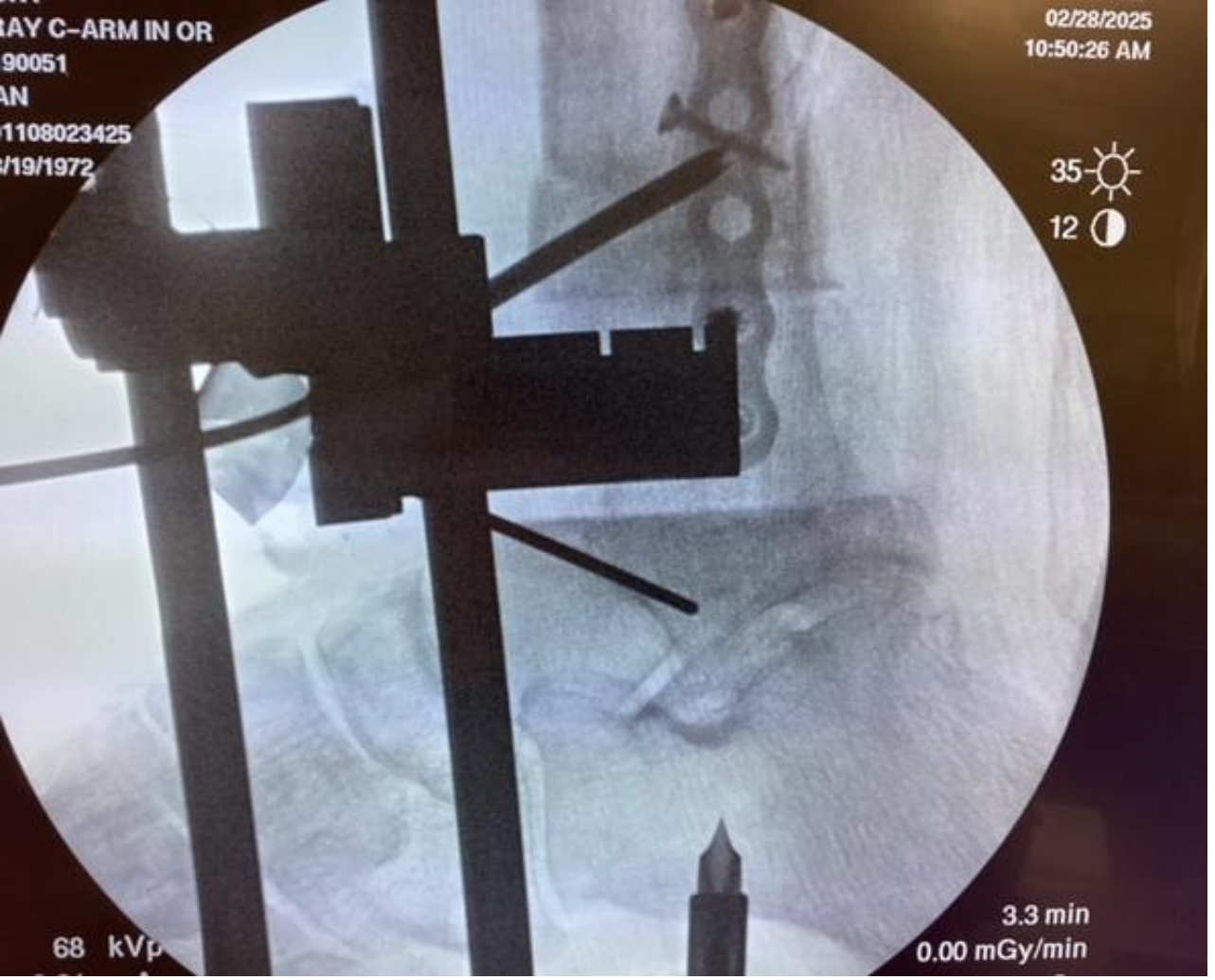
3D Printed Cage for Large Bone Defect







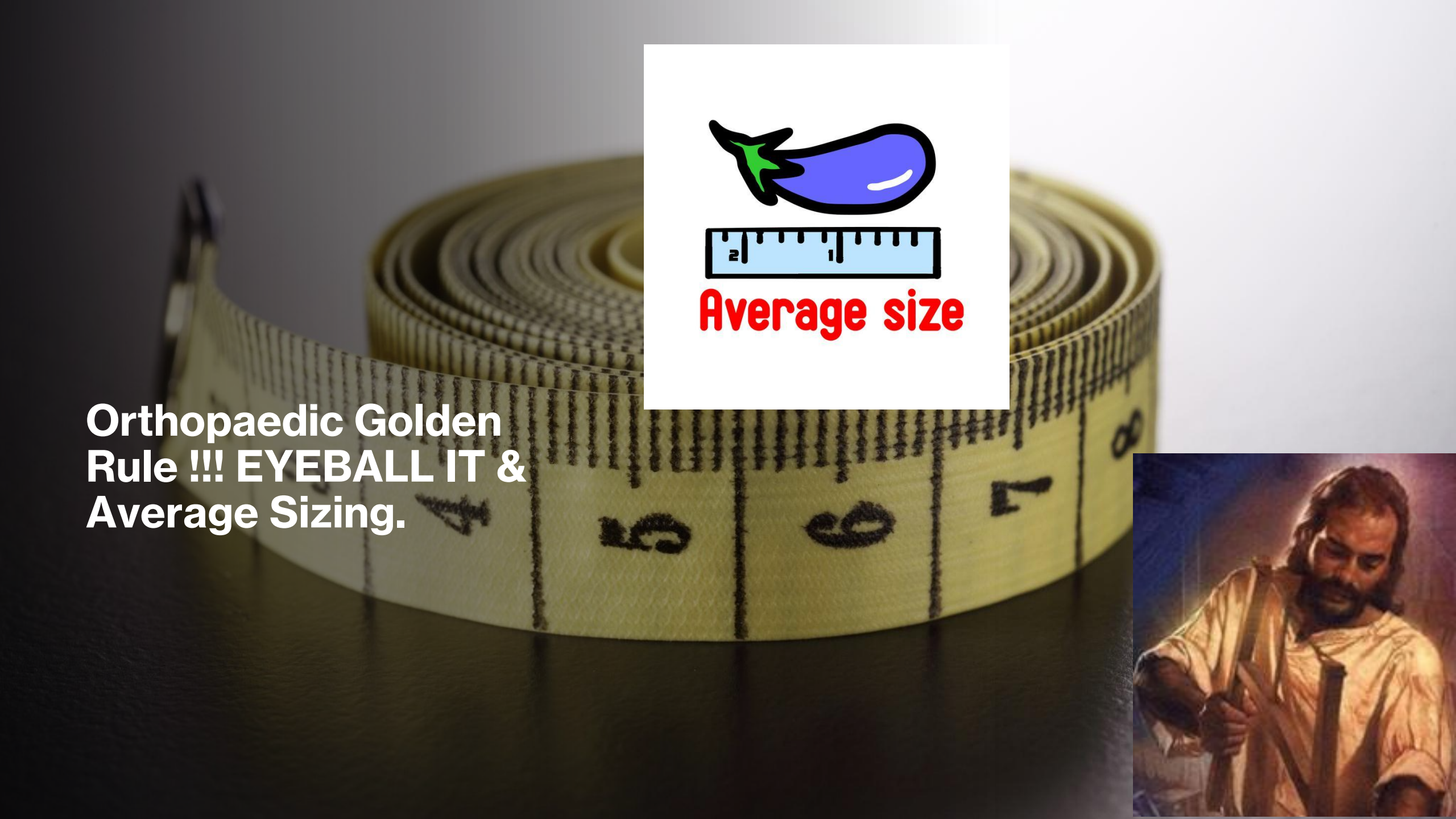
Planning for Bone Defect Cages: Engineer Communication



Attempt Plan A:

Eliminating Plan B due to Tibial Failure:

Execution of Plan C: Here we go.



Orthopaedic Golden Rule !!! EYEBALL IT & Average Sizing.


Historical Lessons:
One View is NO View.
Appropriately Used from Some Genius Twitter Pix

Stefan Rammelt, MD, PhD

Andrzej Boszczyk, MD, PhD

Investigation performed at University Hospital Carl Gustav Carus, Dresden, Germany

Computed Tomography in the Diagnosis and Treatment of Ankle Fractures

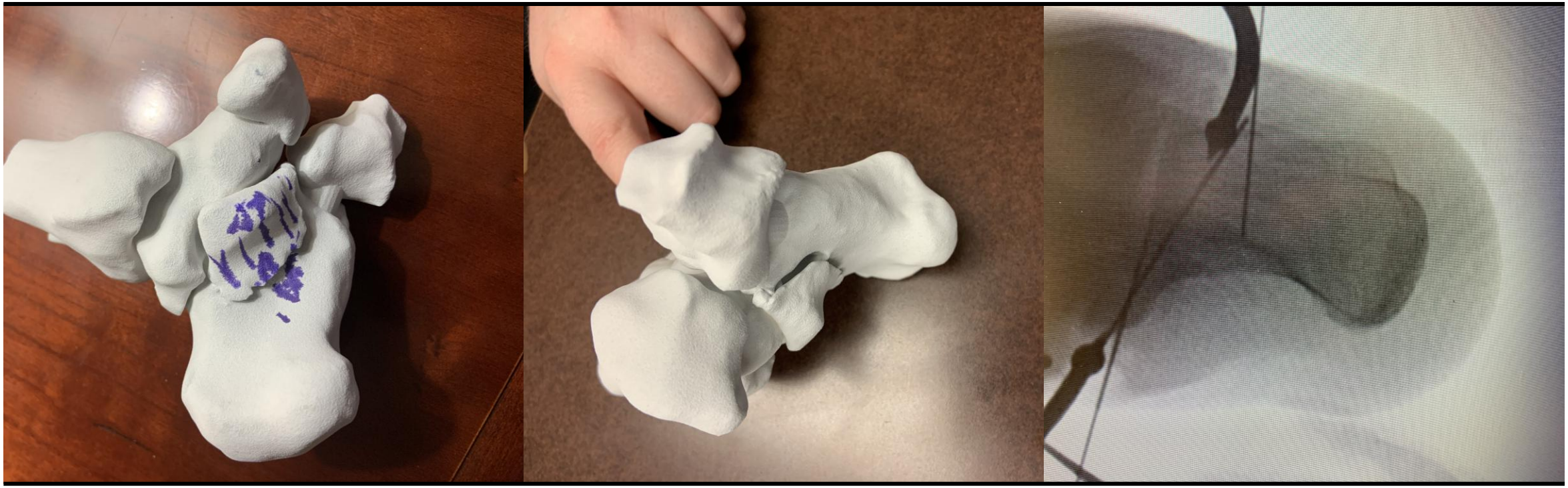
A Critical Analysis Review

Historical Lessons for Orthopaedic Visualization:

of formulating a treatment plan. In 24% of cases, the original operative strategy was changed after the preoperative CT scans were reviewed. The most common

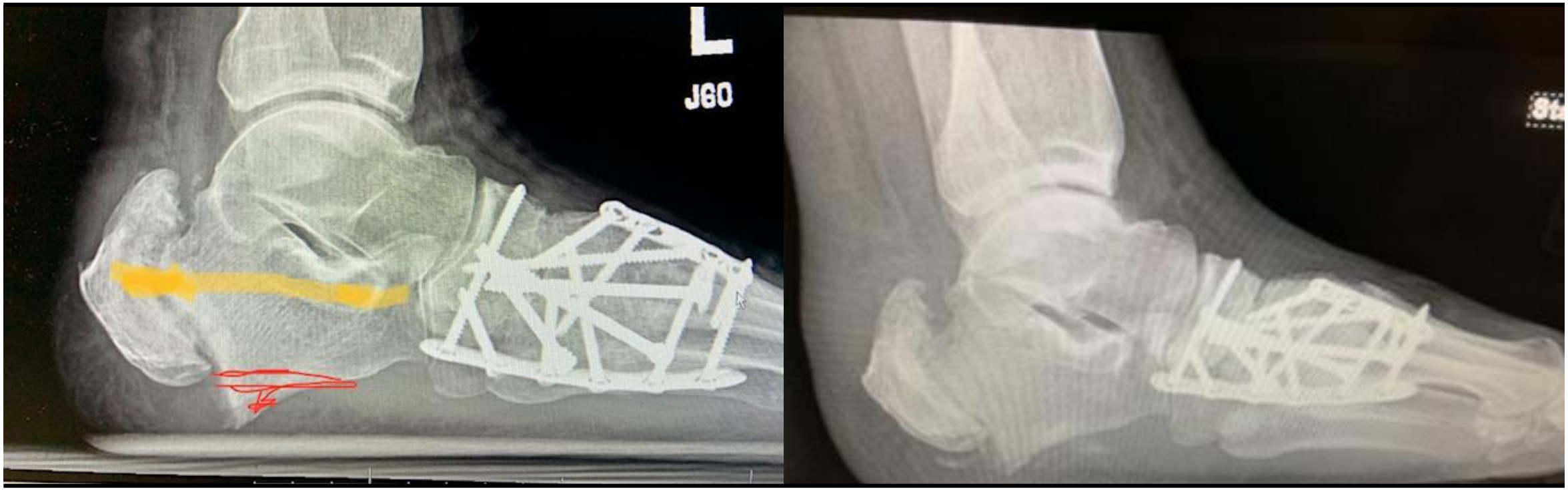
A Pix Worth A Thousand Words: ??? Escape from Average

A 3D Print Start-Up:

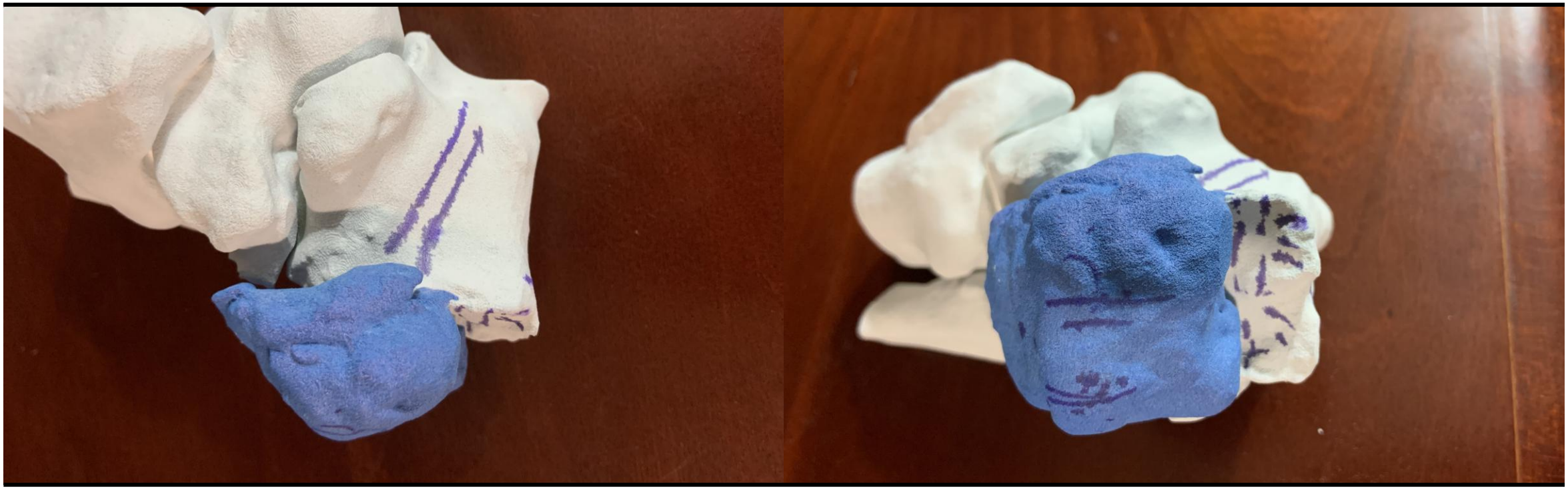


Precision: Time Efficient & Cost Saving

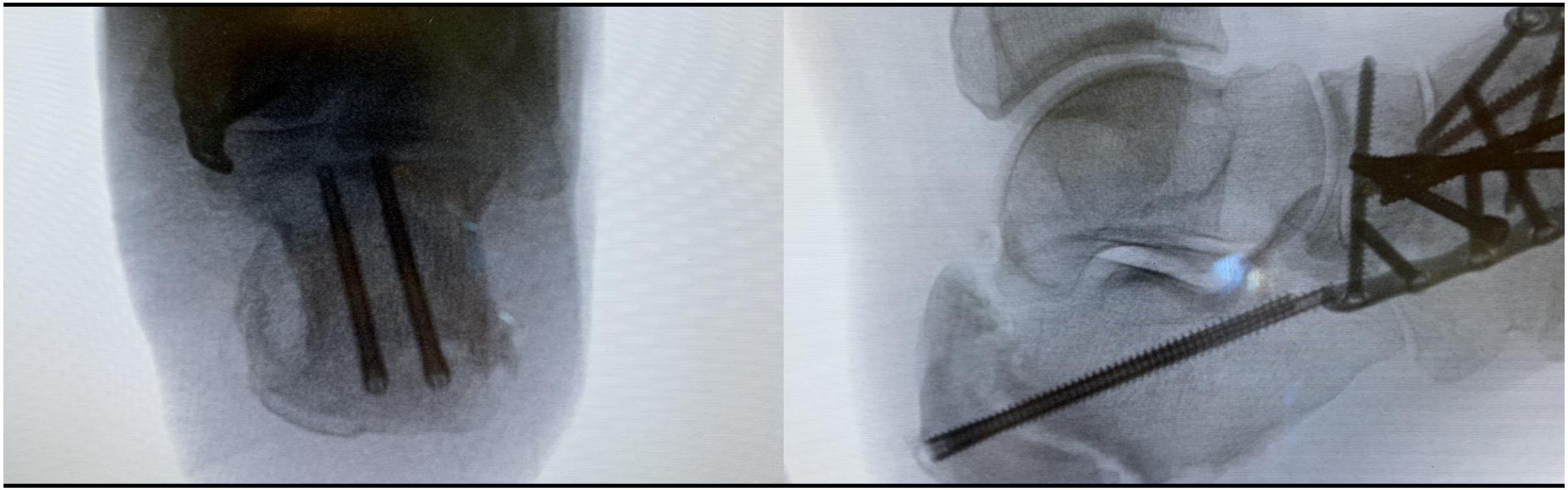
- PreOp Planning:
- Incision & Safety Zones
- Reduction
- Accurate Placement of Screw Trajectory



Love It: Keep Going & Experimenting in a Safe Margin



Truly Appreciation of What is Going ON.

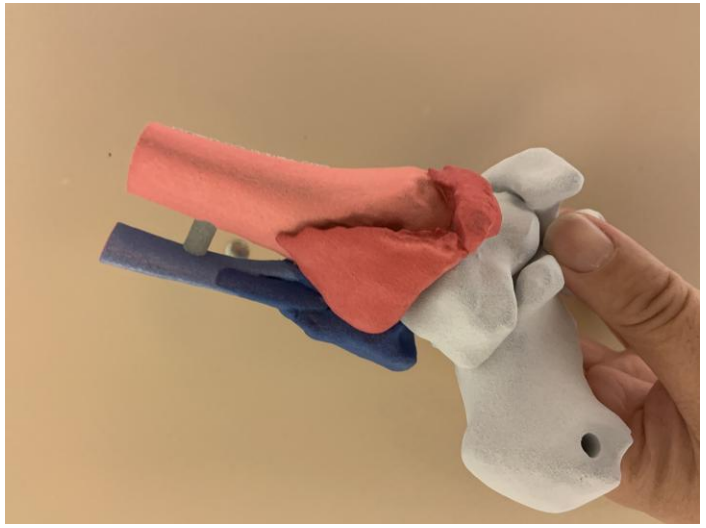


Easy Smooth Execution Intra-Op

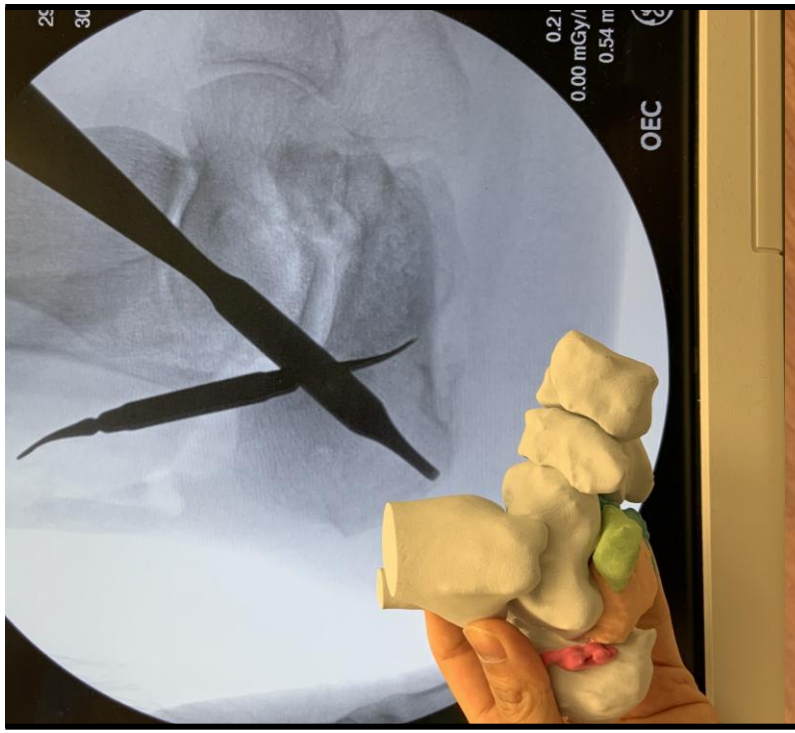
Time is Money: Reducing Radiation

- Exactly Where to Put Your
- MIS Burr

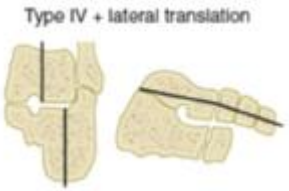
Understand All Pieces:



My Cases: Complicated Malunion Need More Understanding



Romash Osteotomy:



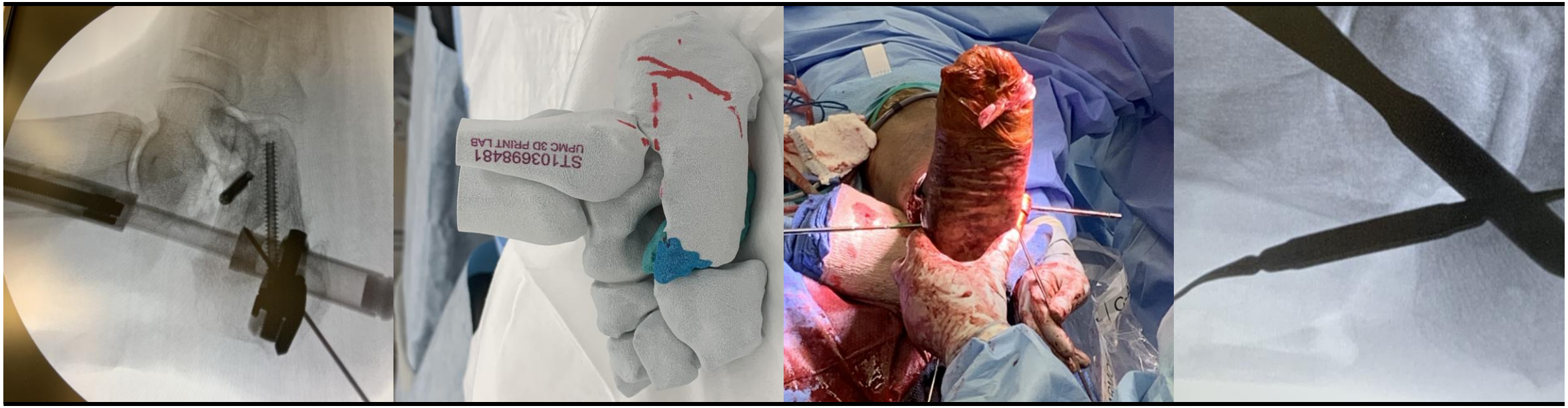
Lateral and upward translation of the tuberosity (malunited fracture-dislocation)

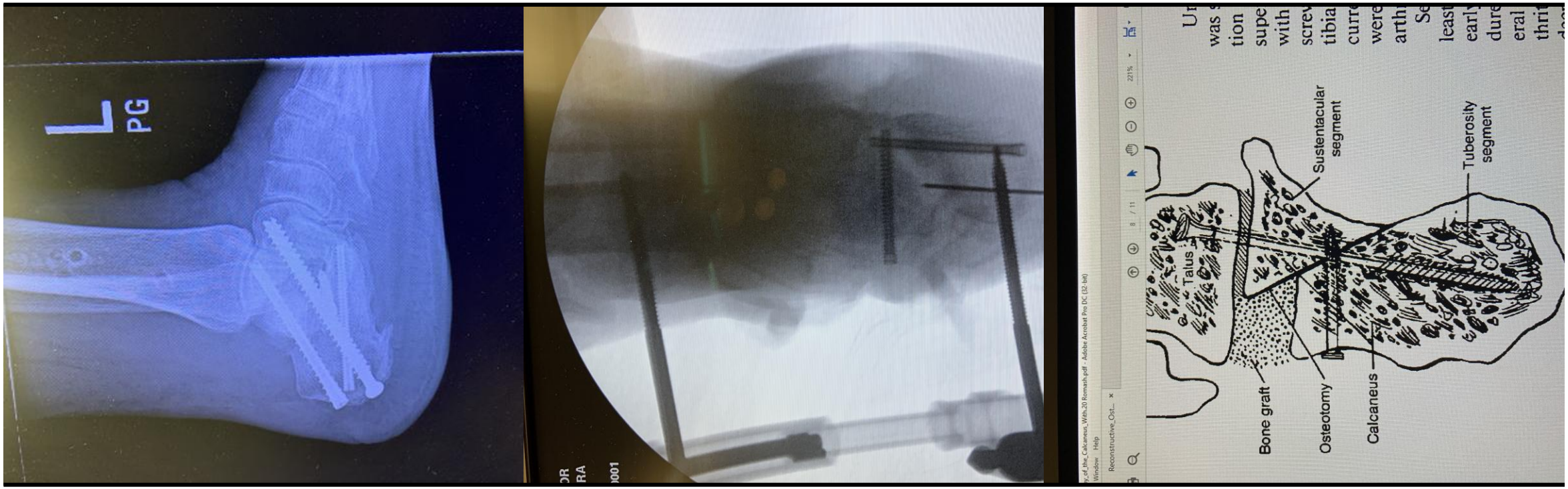
Corrective osteotomy along the former fracture with subtalar fusion and bone grafting

Managing Severely Malunited Calcaneal Fractures and Fracture-Dislocations

Stefan Rammelt, MD, PhD*, Christine Marx, MD

Easy & Make Sense
Intra-Op References



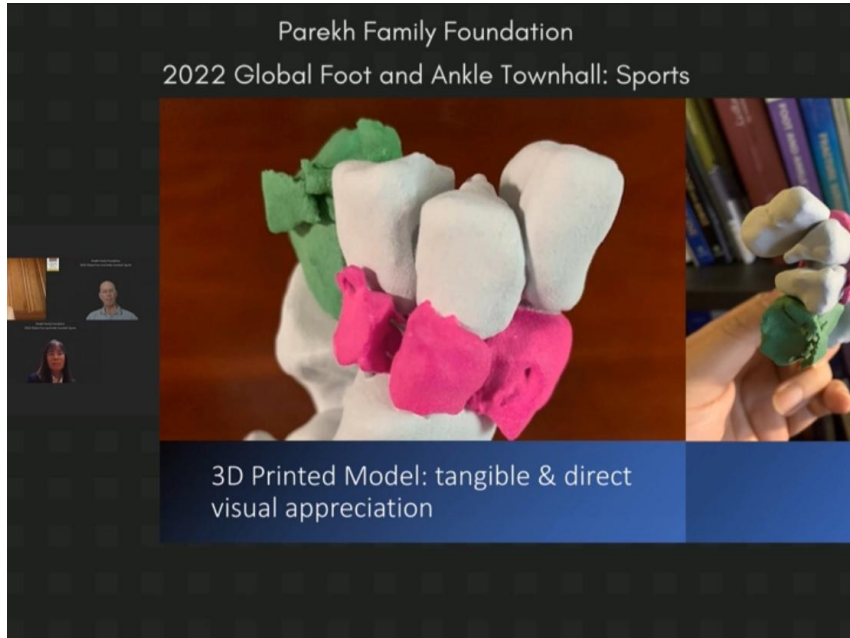


As Planned: More Reliable & Predictable

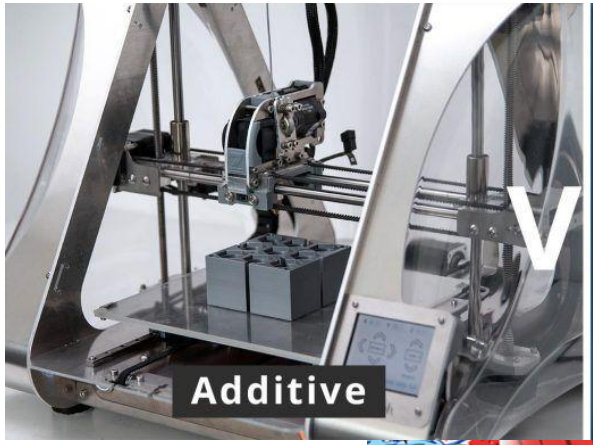
Sterilizable Option IntraOp:

Screw vs Plate & Incision & Hardware Planning: Pre-Op Simulation

Target Colorization:



A Bit of Amazing History of New Toy: Additive vs Subtractive



Accurate, Accessible & Affordable

- Basic models to biocompatible implants or cutting tools
- DESKTOP 3D Printer (FDM/SLA) vs High End Machine
- CT/MRI → STL file →3D print
- 3D Slicer Free Open Software 2018 (3Dslicer.org)

Hideo Kodama is widely credited with being the first to develop a layer-by-layer manufacturing system using a photosensitive resin cured by UV light, which is considered a precursor to modern Stereolithography (SLA) 3D printers.

Major Event in a glance:

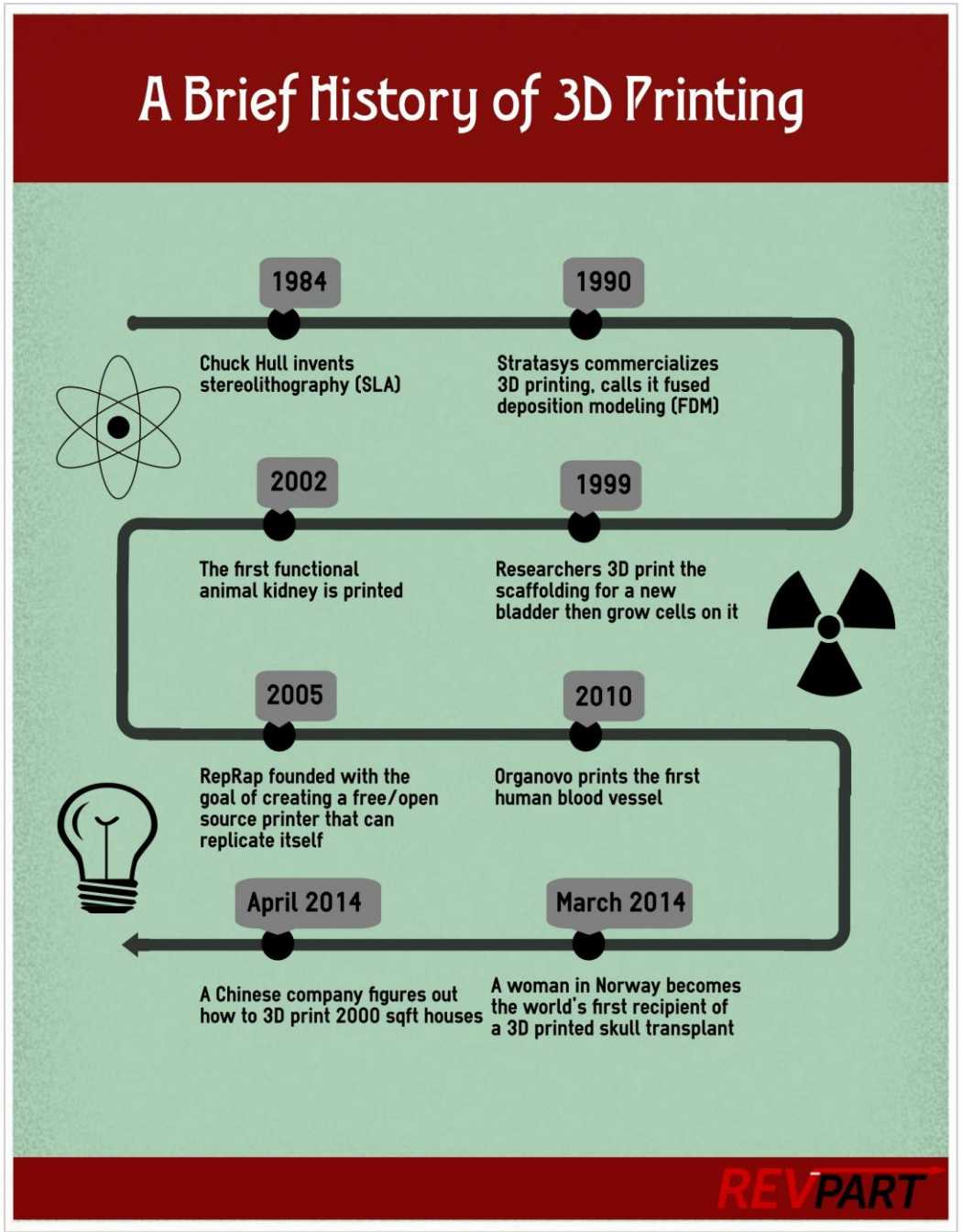
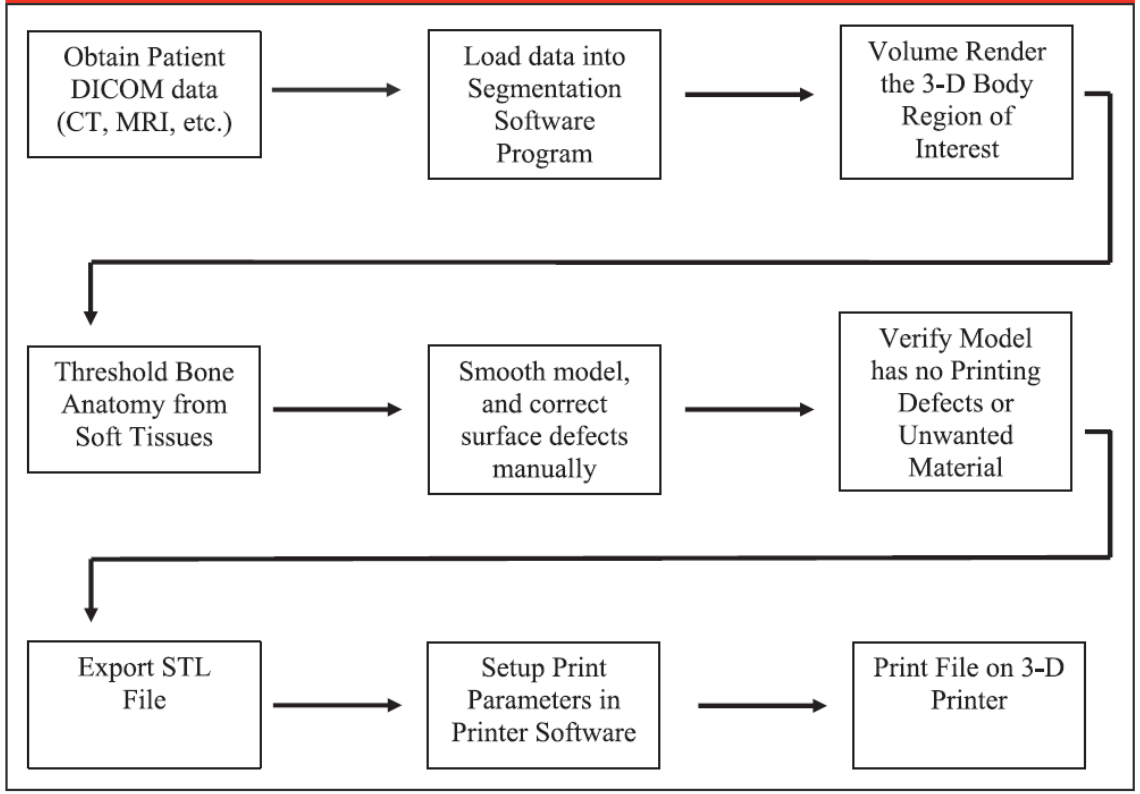


Figure 3



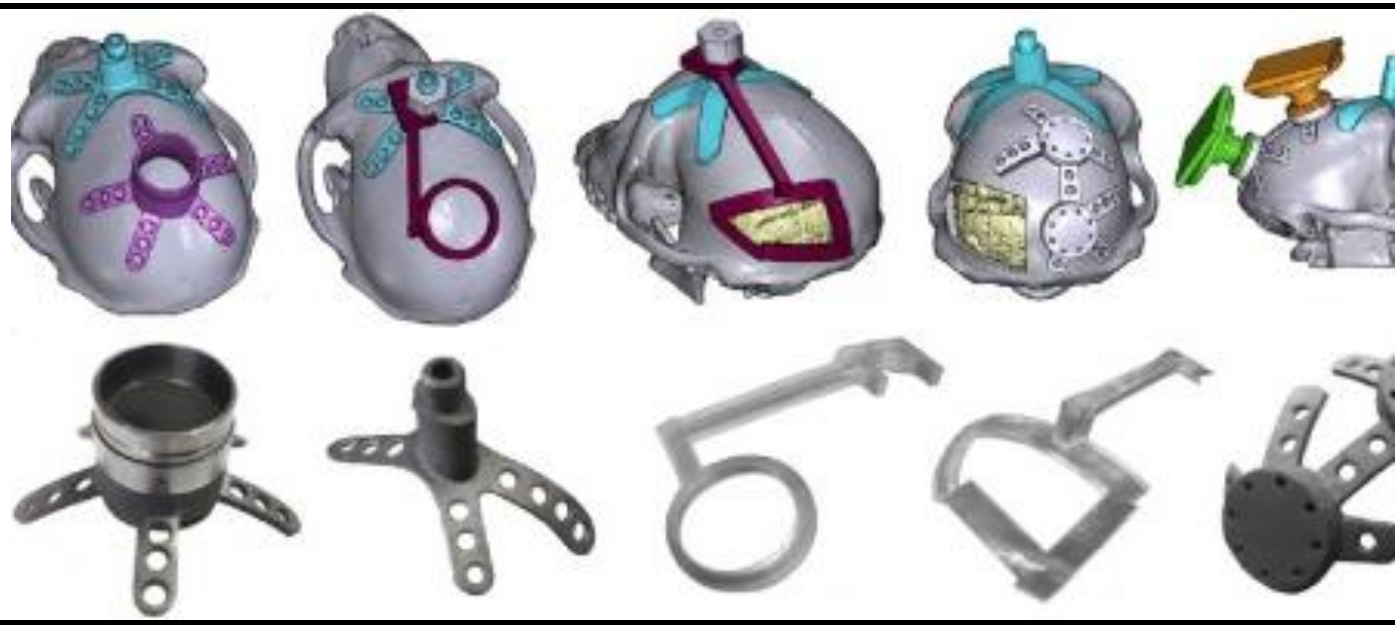
This flowchart demonstrates the process of creating a 3-D printed structure from a patient's advanced imaging study. For more information and an example, please see Video, Supplemental Digital Content 1, http://links.lww.com/JAAOS/A356. 3-D = three-dimensional, DICOM = digital imaging and communications in medicine

Figure 4

A B

Journal of the AAOS®

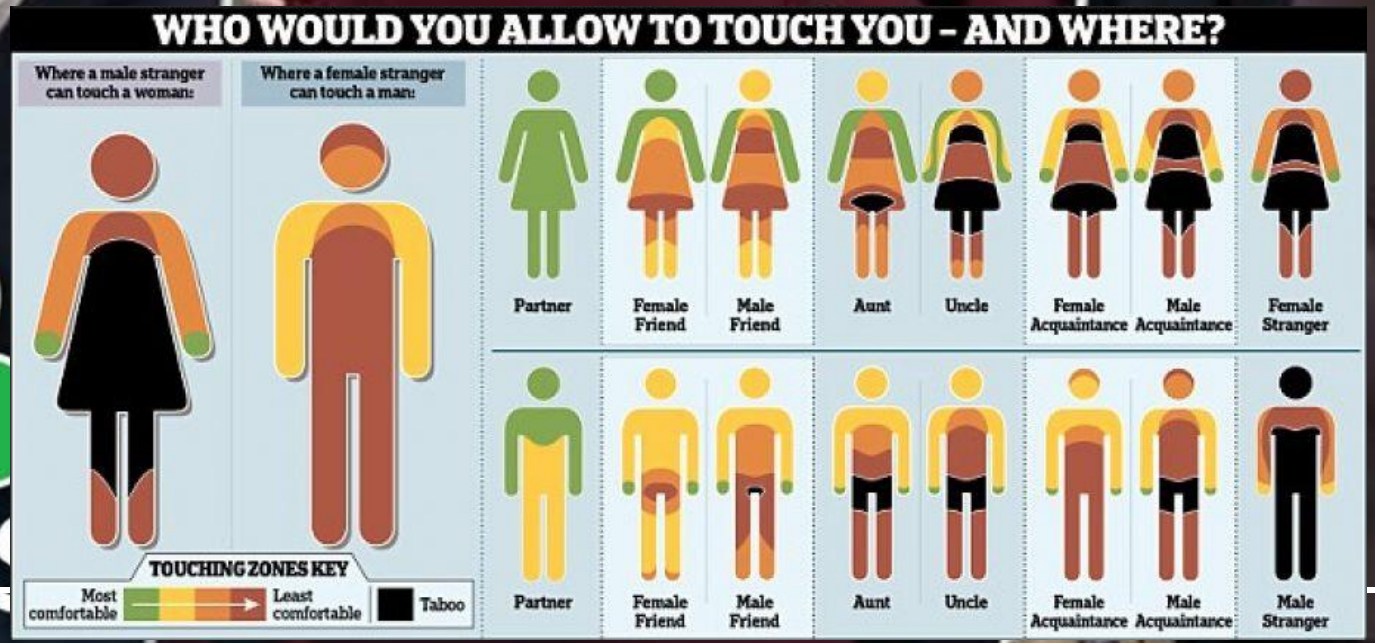
What’s More?



- 3D Guide
- 3D Implant
- 3D Planning Imgaing Software
- Many More of Your Imagination


We Are Only
Scratched the
Surface.

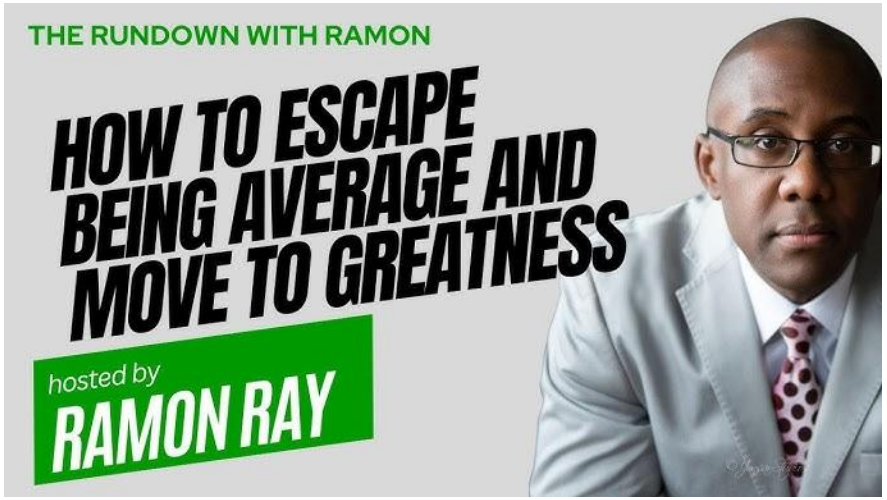
New Orthopaedic Golden Rules: Touchy and Feely!

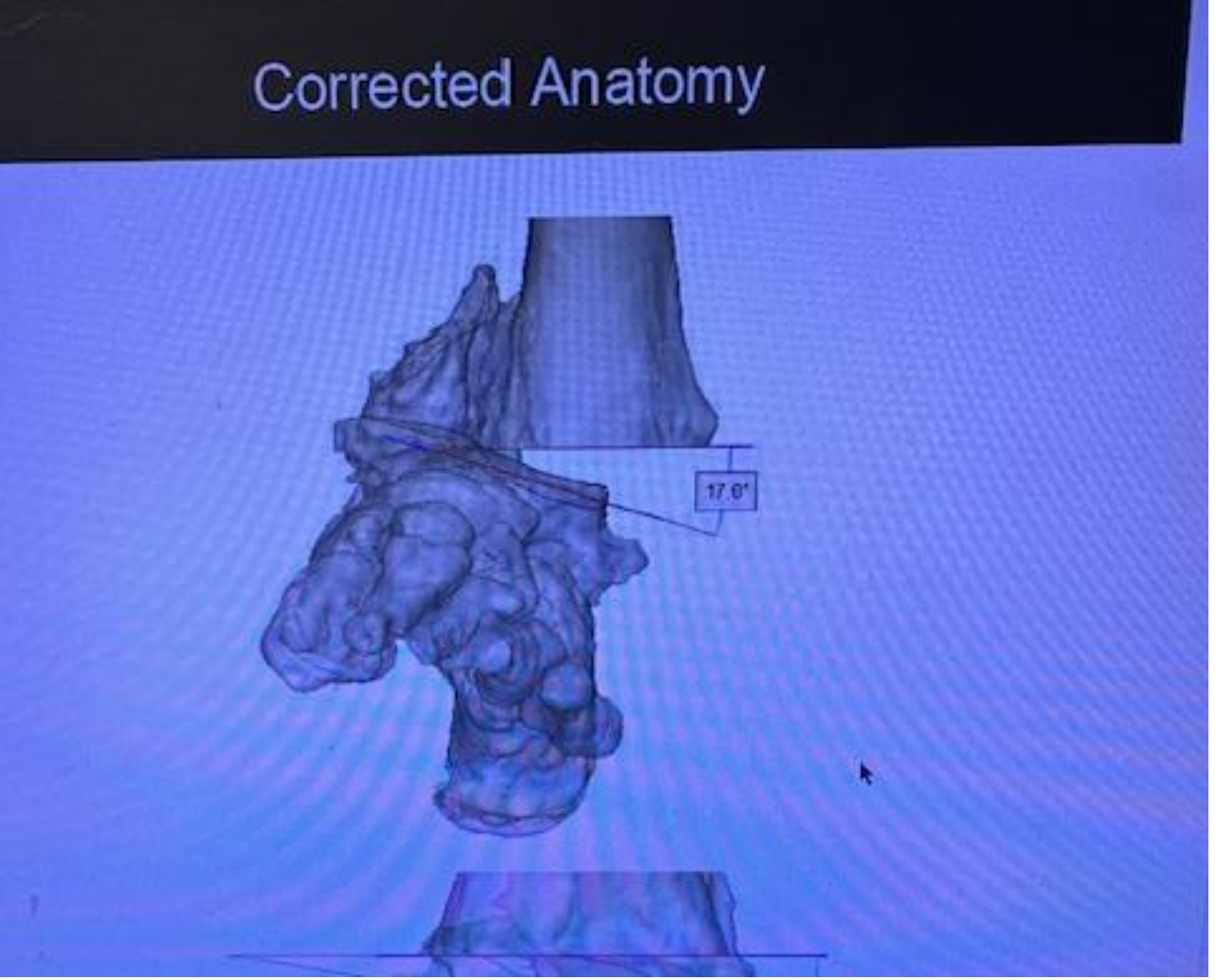



Touch Feely in Advance

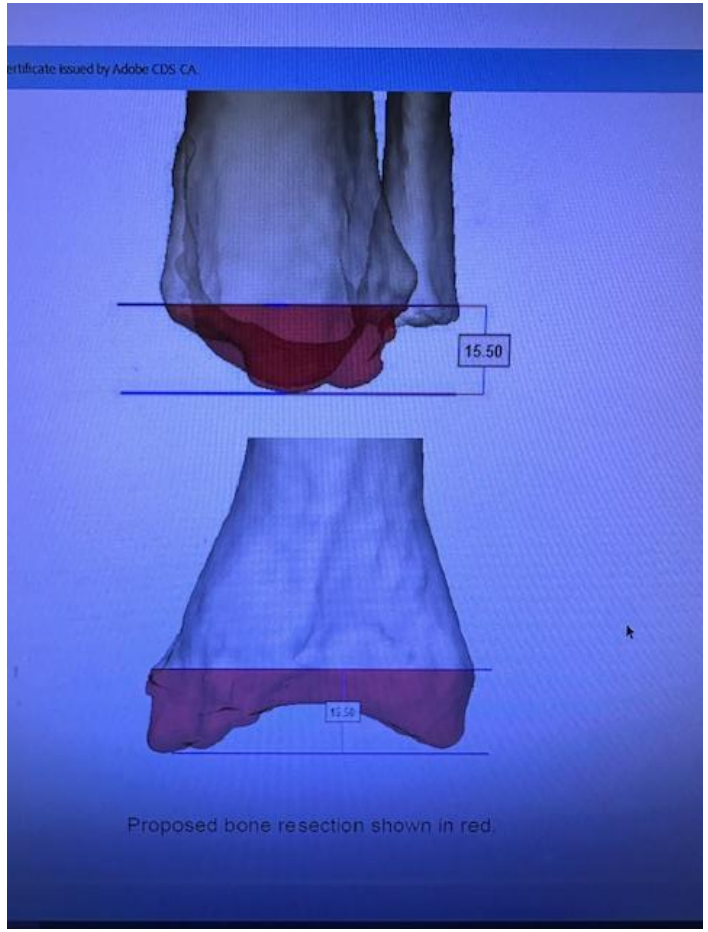
Use it and Do it and you will ❤️ it.
Turn Your Gut Wrenching to Enjoyable Event for you and your patient.
(Can't Tell You How Much Happier Since...)

Precision
Personalized
Predictable Outcome



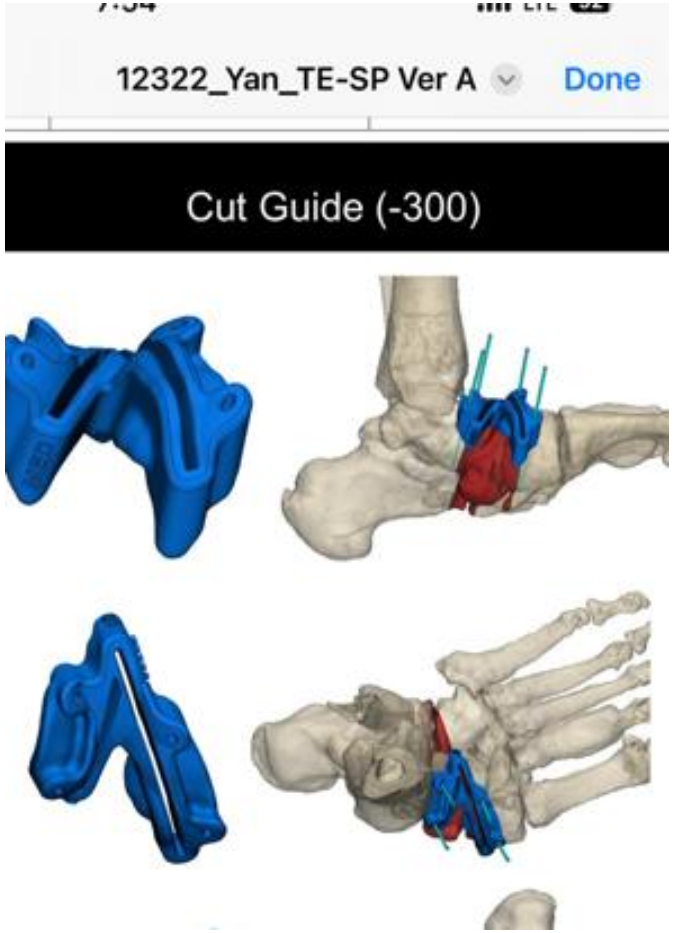


Use in F & A Deformity Correction

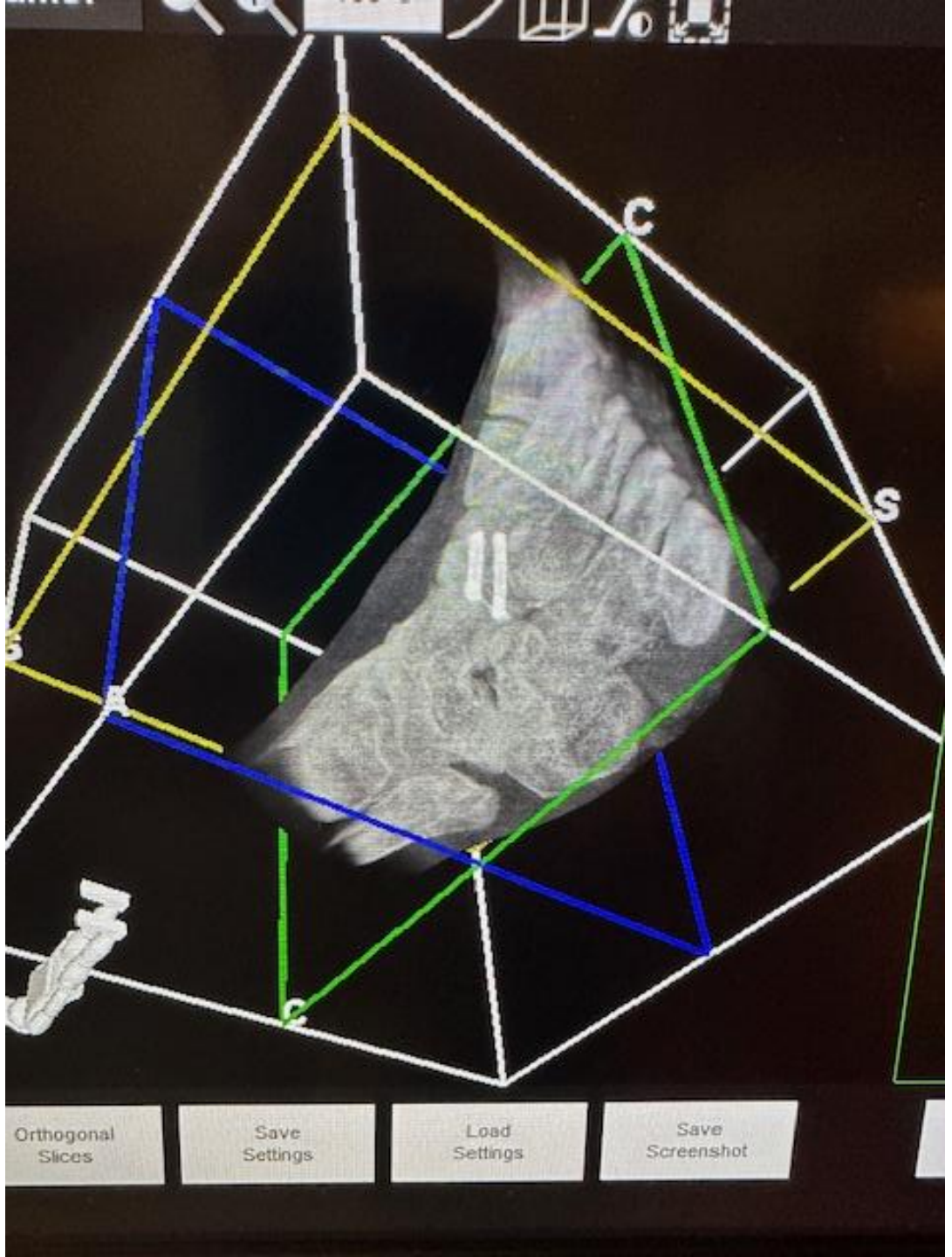


Simulated Cutting Planes:

3D Printed Cutting Guides:

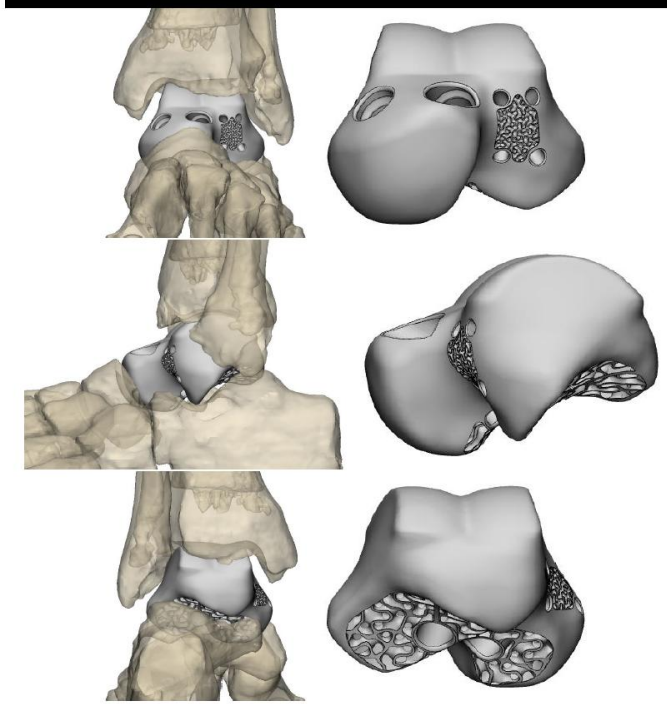


Efficient Intra-Op 3D Guidance:

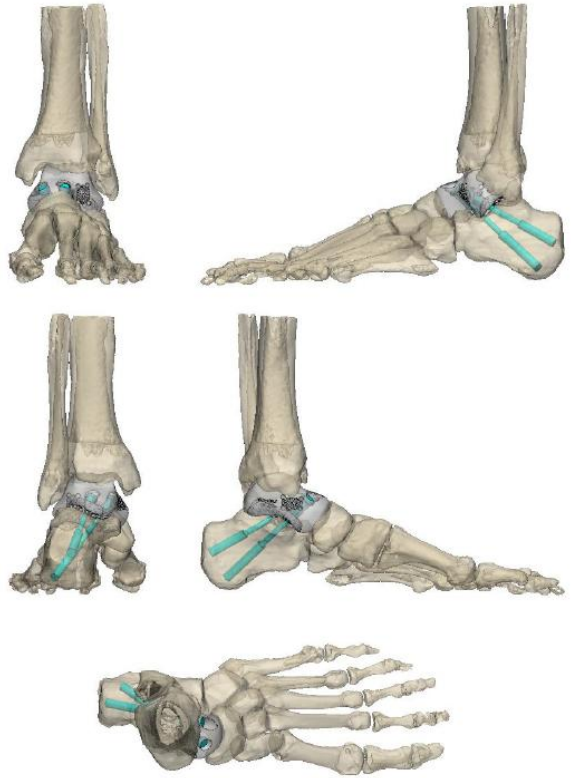


Total Talus & TATTER

Proposed Implant - Small (95% Volume STJ Fusion)

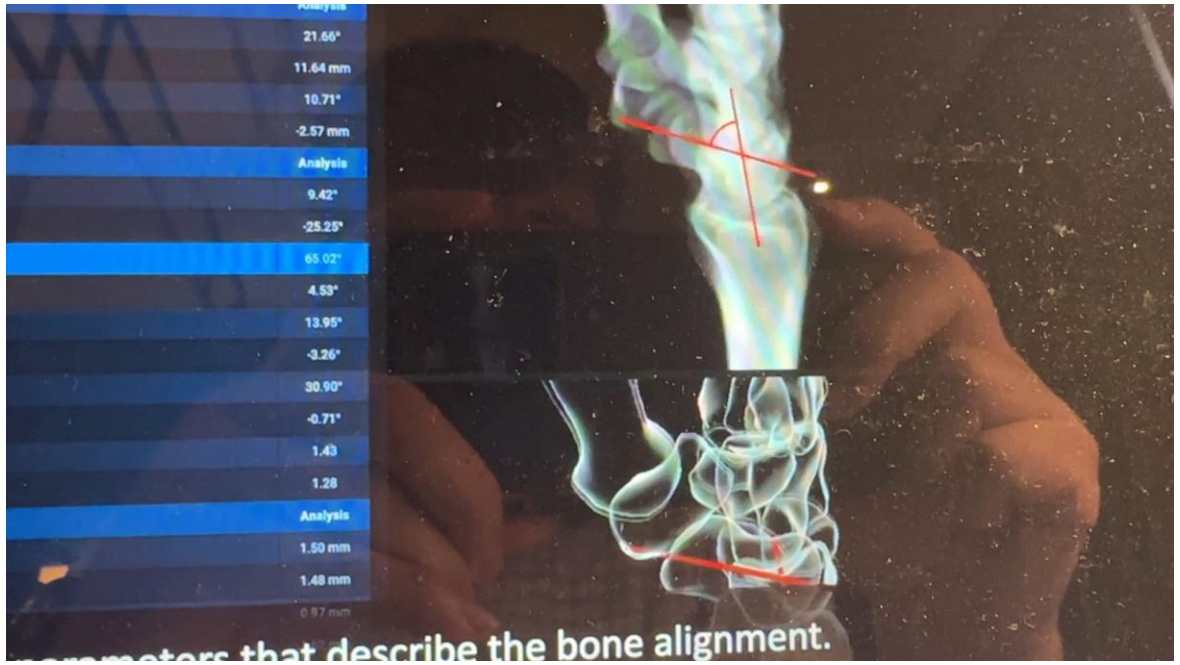


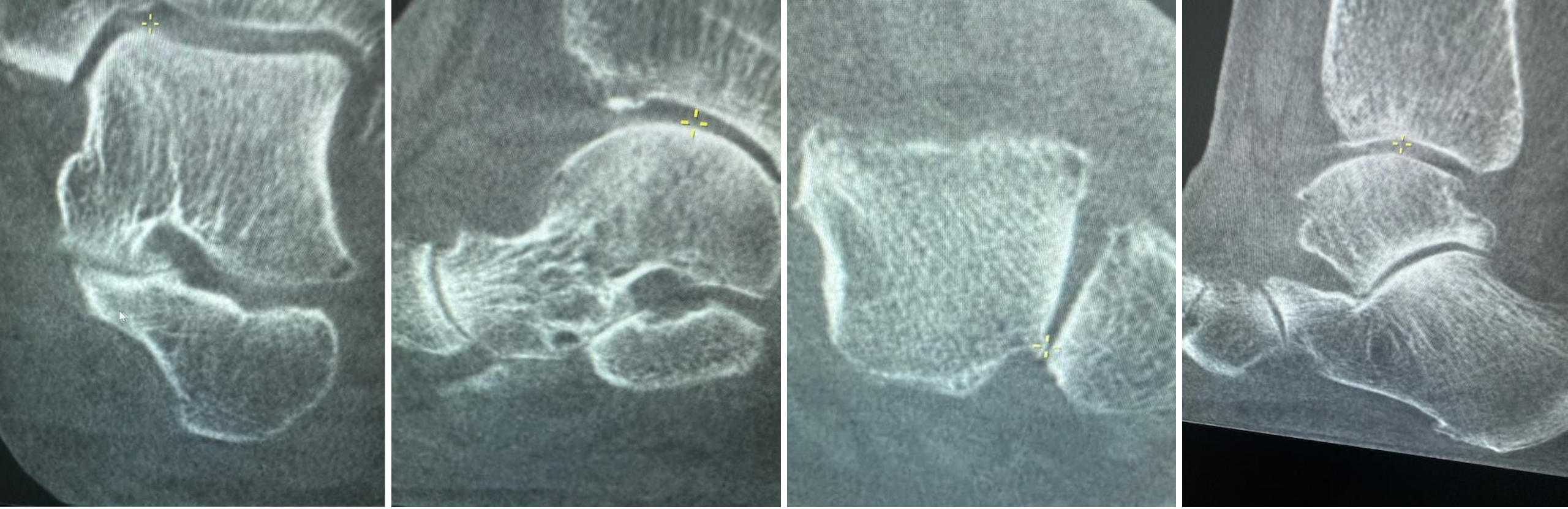
Proposed Fixation Detail (112 and 110 Only)



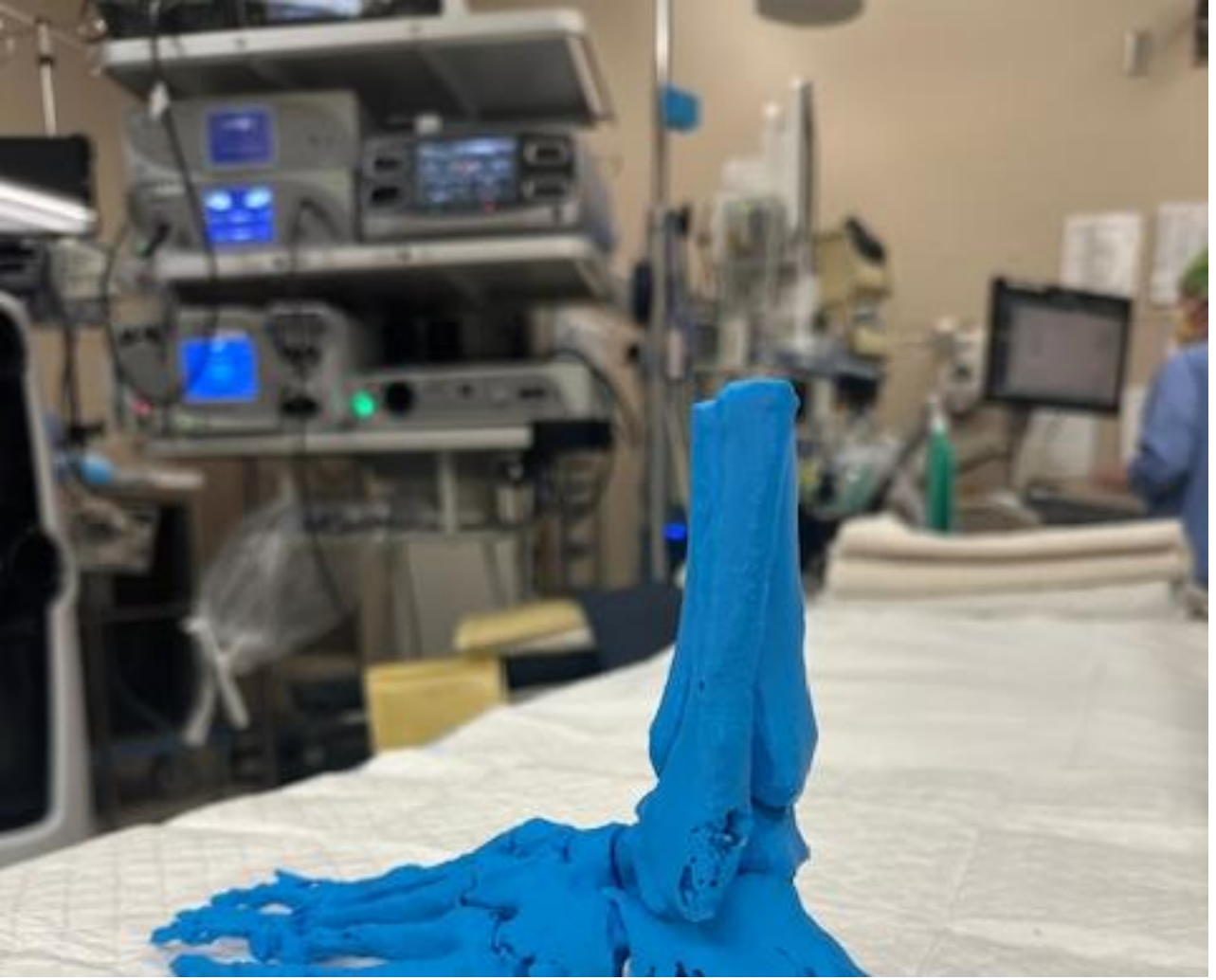
Implants facilitate Subtalar-Joint Fusion using Vilex 6.5mm Cannulated Screws Screws.
Medial Entrance: 90mm Representative Screw Shown
Lateral Entrance: 80mm Representative Screw Shown

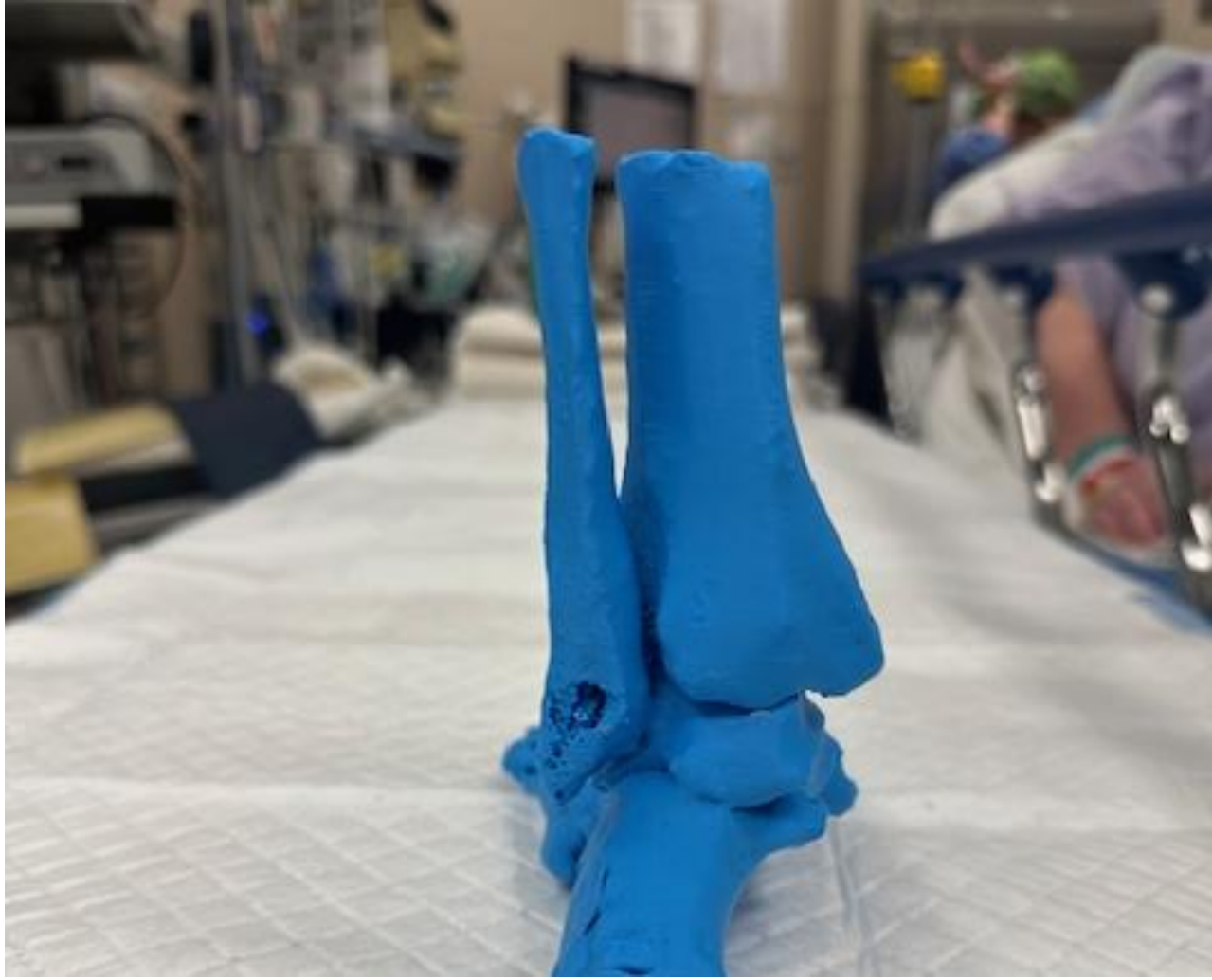
3D Imaging Viewers:



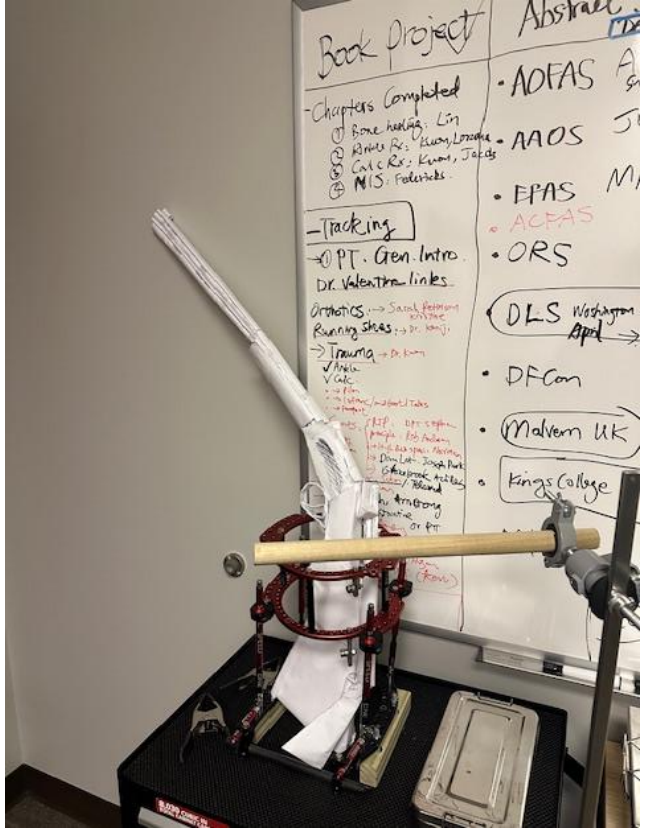


Details in Standing Position

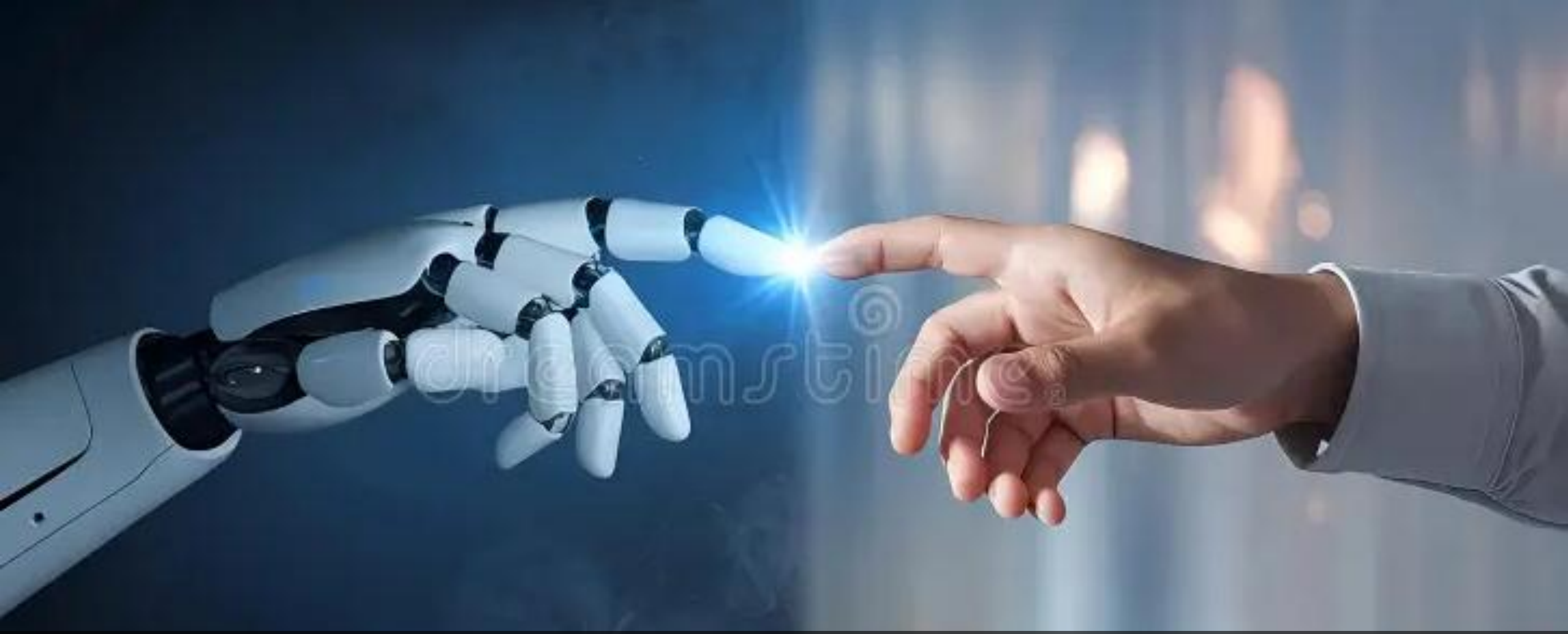




Execution of Plans Intra-Op



My Humble Office Lab:



Time of Transition: The Future is Now.
My Sistine Chapel Moment

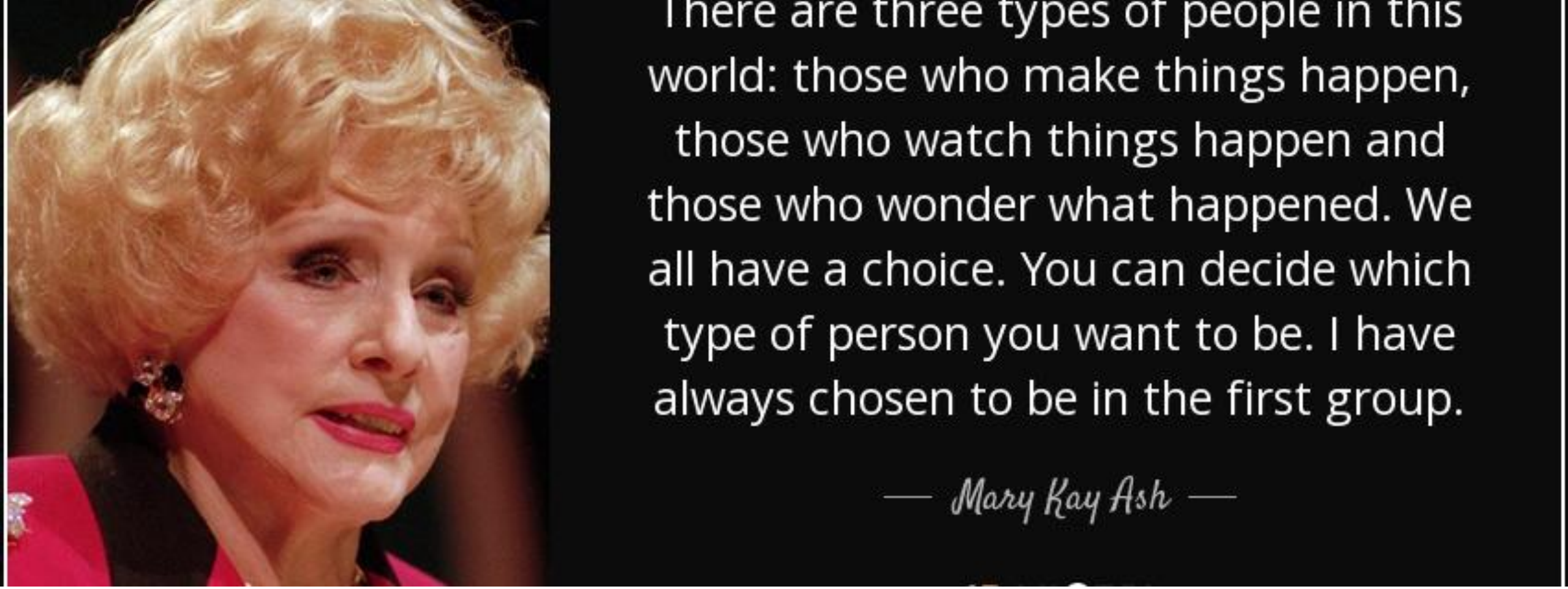
INCR3DIBLE®
ADDITIVE MANUFACTURING
Redesigning Life...

PRECISION AND PERSONALIZATION:
WHY 3D INCREDIBLE STANDS OUT FOR
CUSTOMIZED 3D PRINTED IMPLANTS

Precise, Personalized Planning for a Predicative Outcome

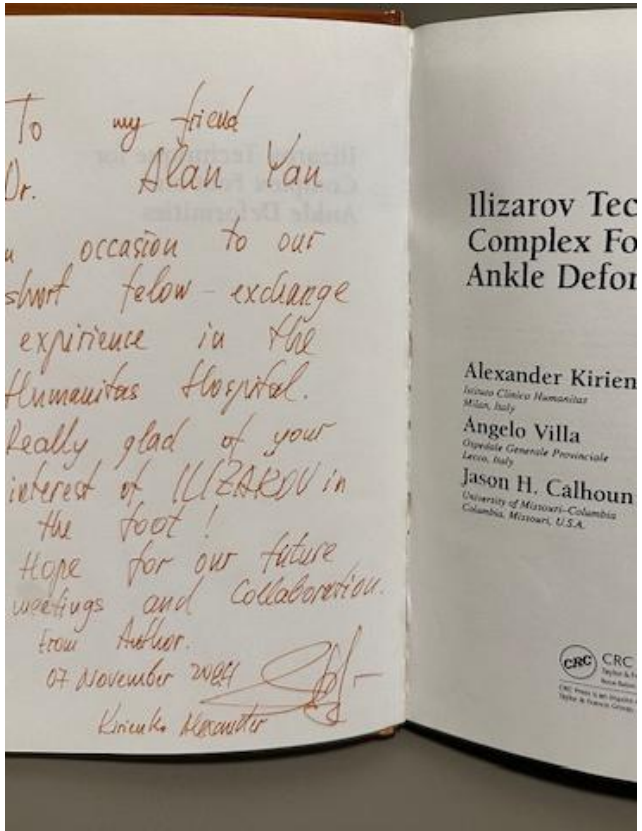
READ MORE

3D Printing, Bio-3D Printing, Wearable, VR, AI, Robotic Surgery: Frontier of Orthopedic Surgery



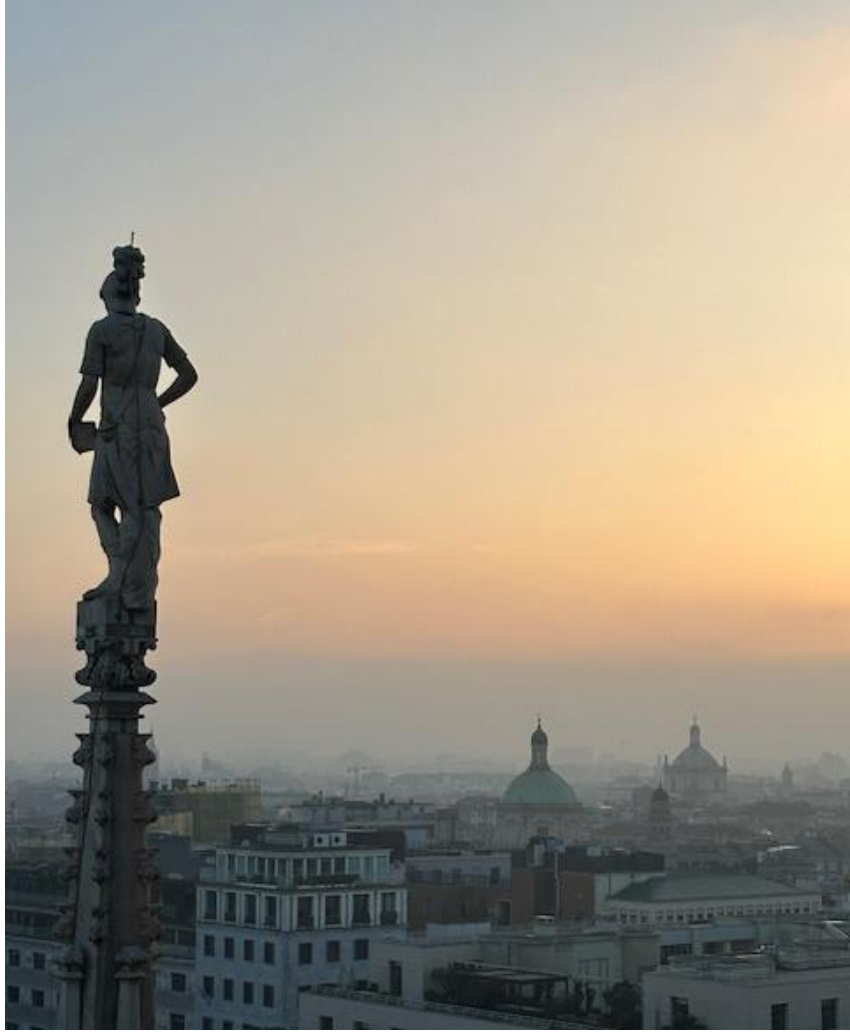
There are 3 Types of Person in the World: Don’t Missing Out.

Glazie.

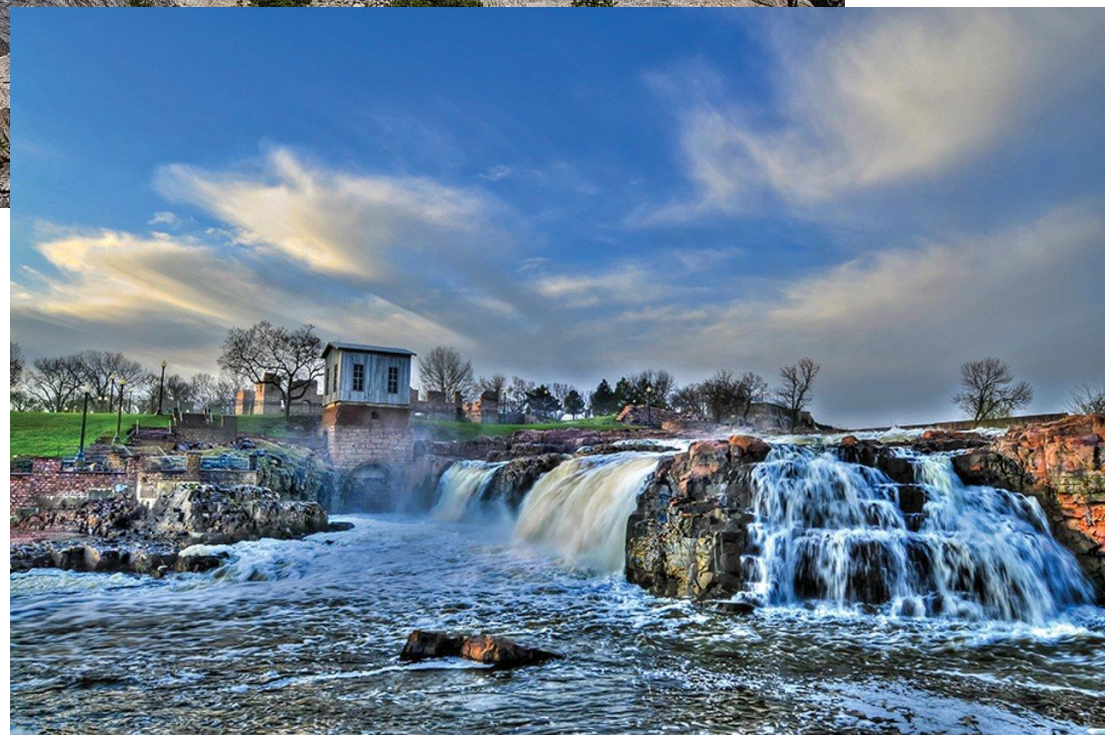

To my friend
Dr. Alan Yau
occasion to our
short fellow-exchange
experience in the
Humanitas Hospital.
really glad of your
interest of ILIZAROV in
the foot!
Hope for our future
meetings and collaboration.
from Author.
07 November 2021
Ilizarov Tec
Complex Fo
Ankle Defor
Alexander Kirien
Angelo Villa
Jason H. Calhoun
CRC


DENTRO LA VITA





Piacere Di Conoscerla.



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MT. RUSHMORE

DIABETIC FOOT RECONSTRUCTUON FORUM