ROADMAP POLYMERS IN ADDITIVE MANUFACTURING FOR MEDICINE/DENTISTRY

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(AKA CAPT Grant)

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DISCLAIMER

- NOT and ENGINEER

(but I have stayed at a Holiday Inn Express)

CURRENT DIGITAL DESIGNED/AM MANUFACTURED DEVICES/ACTIVITIES

Neurosurgery
Cranioplasty
Aneurysms
Tumor

Pediatrics
Airway stents
Cranial deformaties

Orthopedics
Complex Fractures
Heterotopic Ossification
Custom Fixation
Joint Replacement

Maxillofacial
Facial Reconstruction
Custom Fixation
Surgical Guides
Facial Prosthesis

DIGITAL MANUFACTURING TECHNOLOGIES

Pharmaceutical
Drug Fabrication

Dentistry
Implant guides
Prostheses
Orthodontics
Virtual Planning

Bio fabrication
Bio printing
Bio Plotting
Bio Assembly

Rehabilitation
Prosthetic fabrication
Custom Attachments
Assist Devices

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CURRENT TRENDS

- Medical Models
  - Pre-surgical models
  - Patient Education
  - Record – Pre/Post models
- Virtual Surgical Manipulation/design
  - Registration of multiple images
  - Reconstruction of missing anatomy
  - Movement of present structures
- Medical Devise design
  - Surgical Guides and positioners
  - Custom implants and other medical devices
  - Bending guides
- Bio plotting/printing
  - Assays
  - Smooth organs?
  - Complex organs?

Radiology Sees it as a part of their Service

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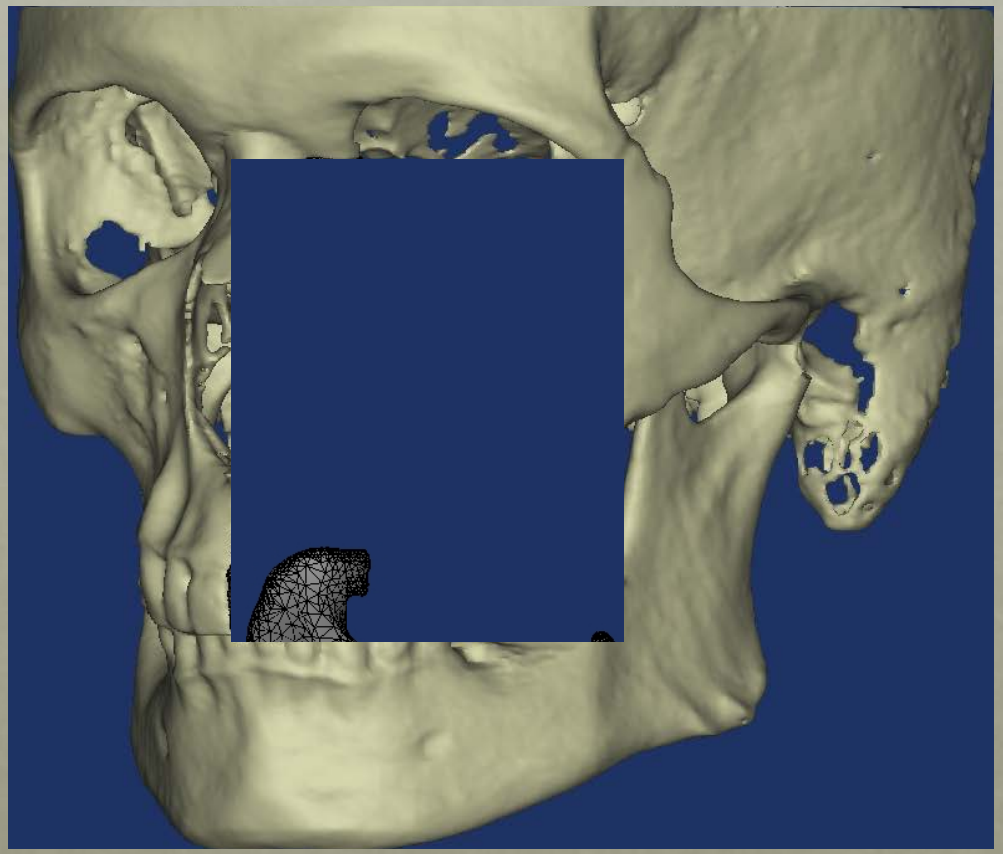
RECONSTRUCTION



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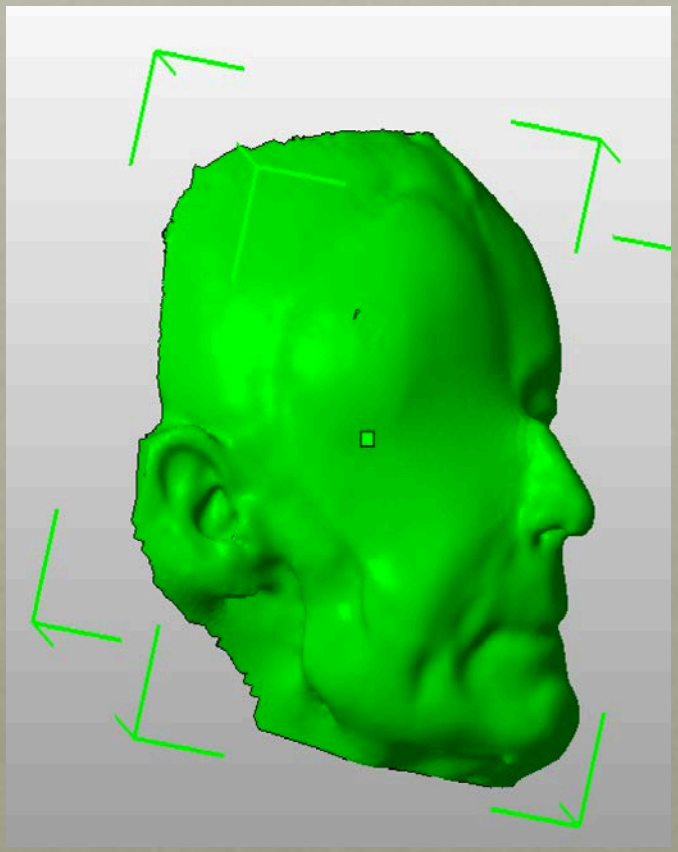
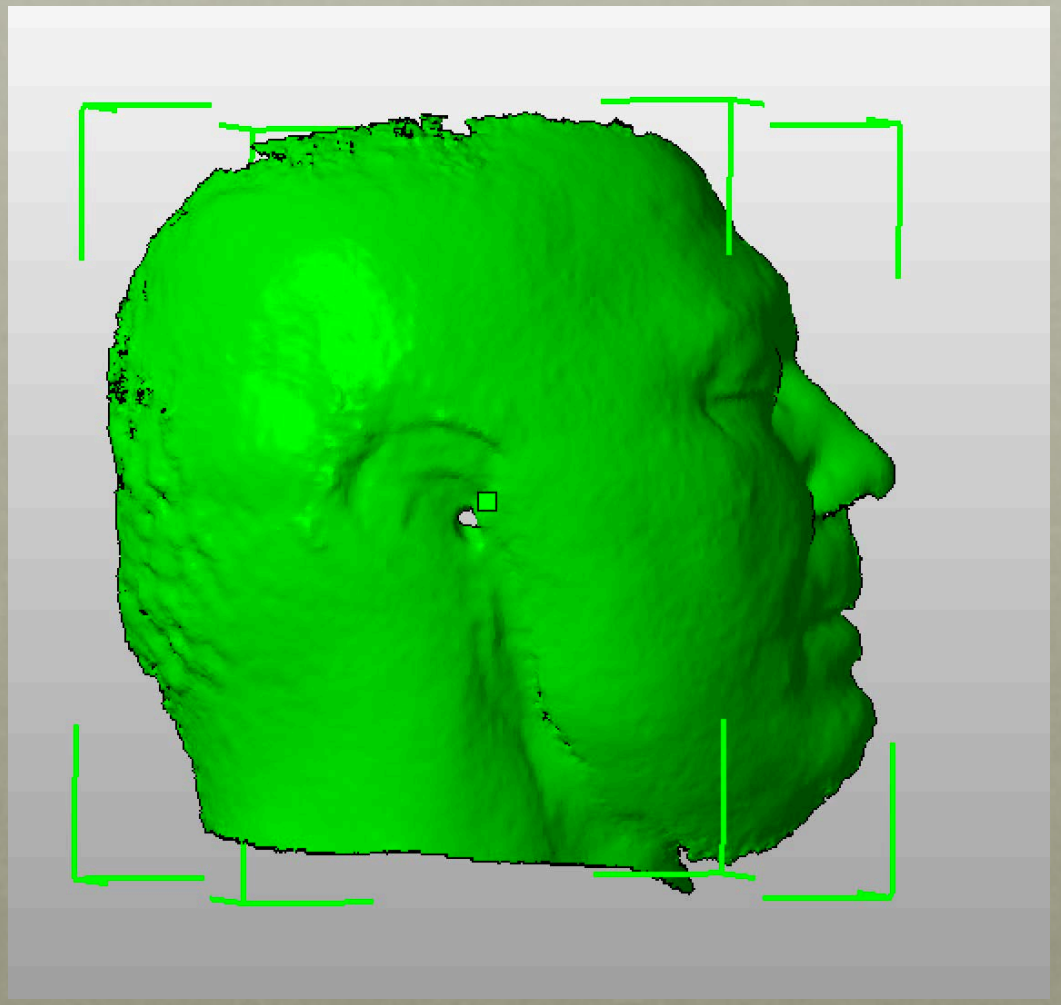
MEDICAL IMAGING

SCAN

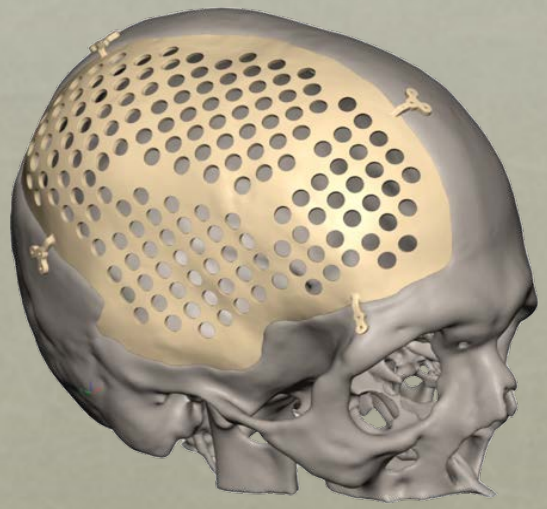


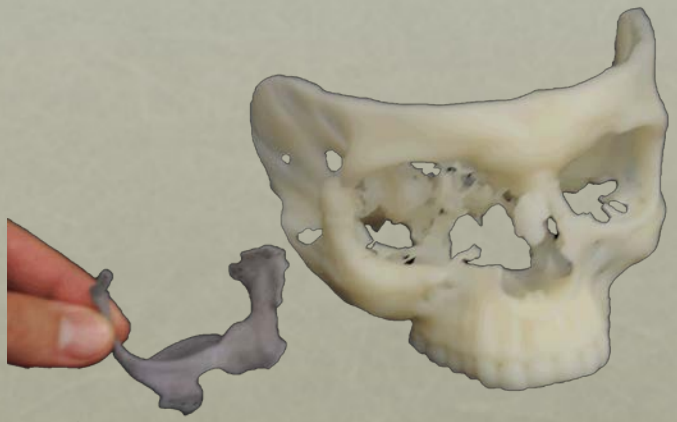


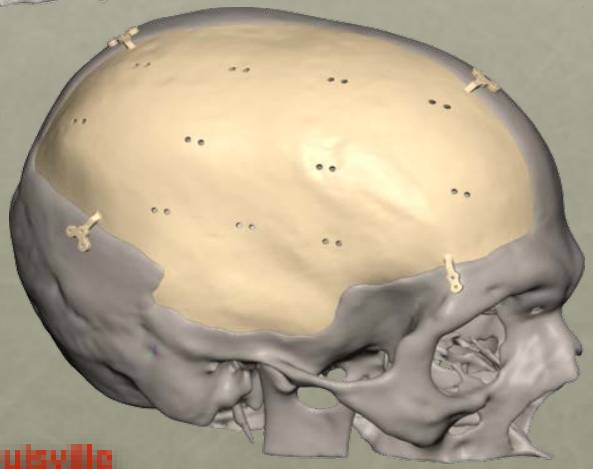
IMAGING CHALLENGES FOR AM FABRICATION

- Capture Protocols
  - General Protocol do not support adequate parameters for accurate model fabrication
- Artifact
  - Image artifact from metals and low radiation (CBCT)
- Picture Archiving Systems (PACS)
  - Do not generally maintain other file forms but DICOM

DEVICES







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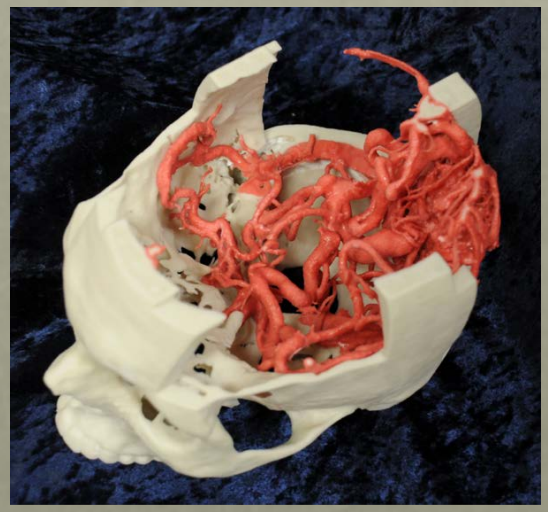
MEDICAL MODELS



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DENTAL

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PROSTHETICS

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FACIAL PROSTHESIS

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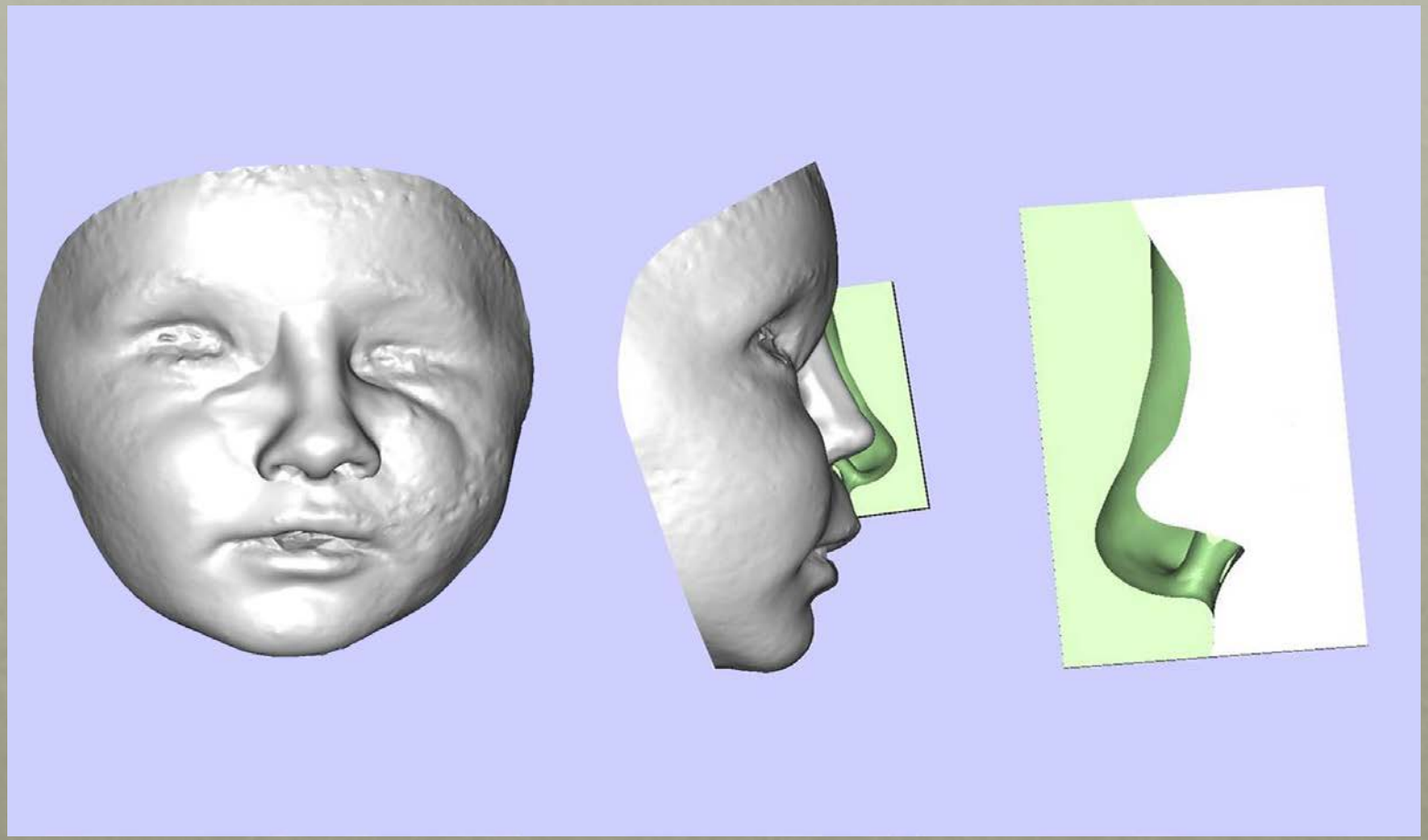
Grant et al, J Prosthet Dent. 2015

MOLD DESIGN



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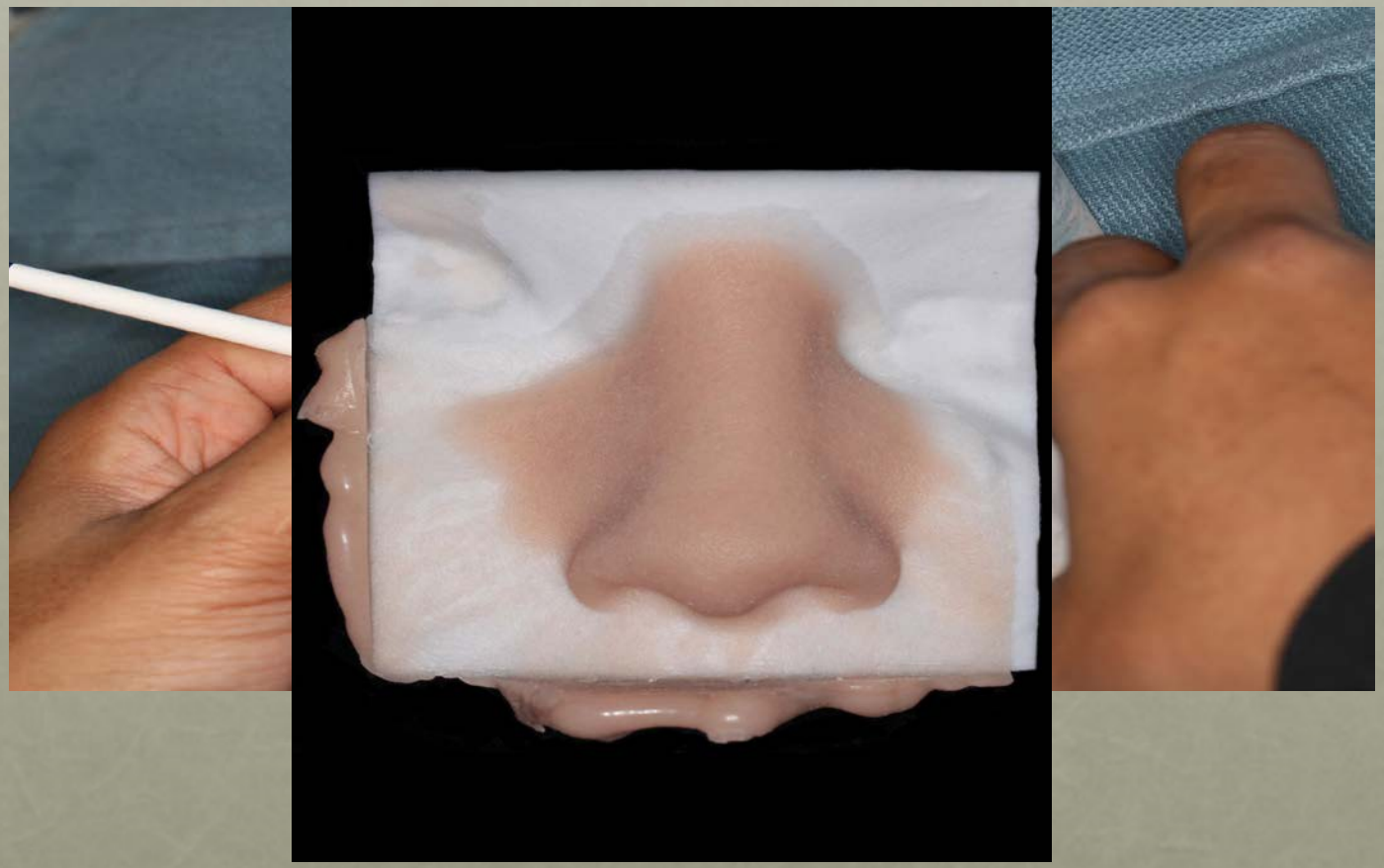
SILICONE MOLDS



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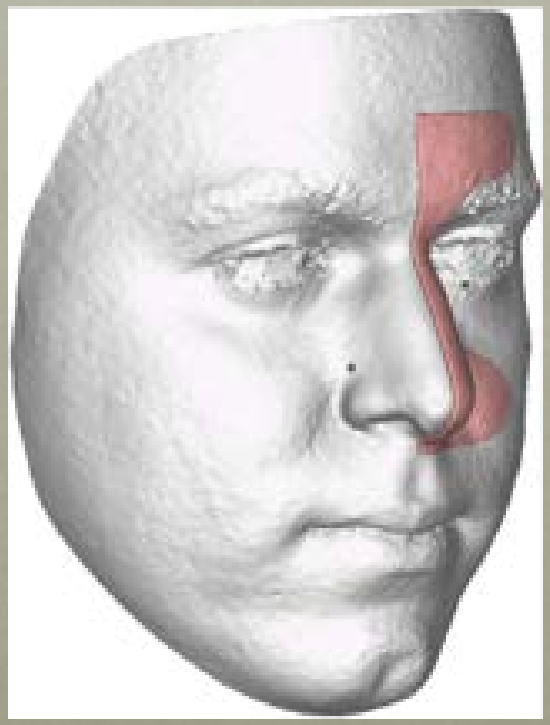

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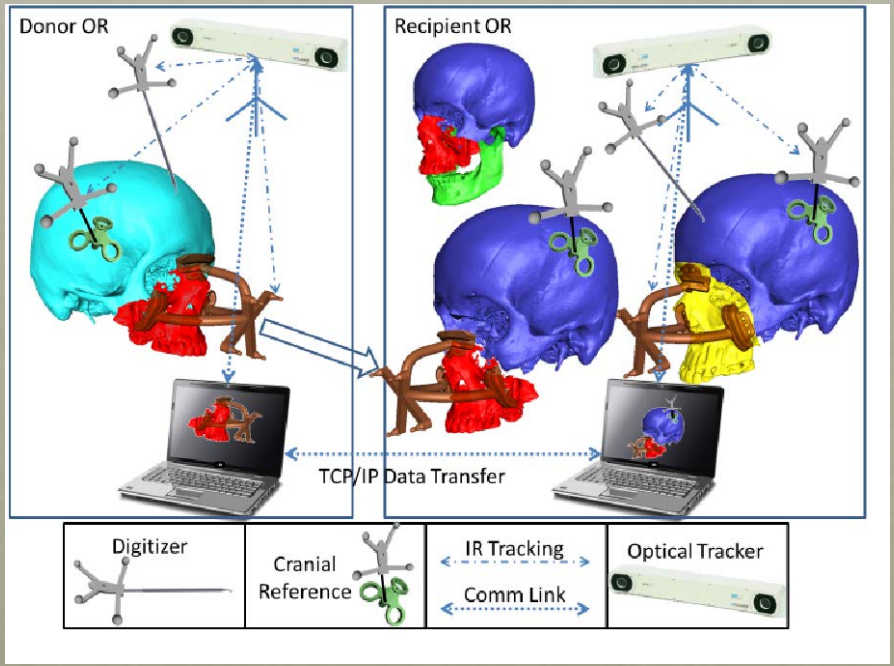
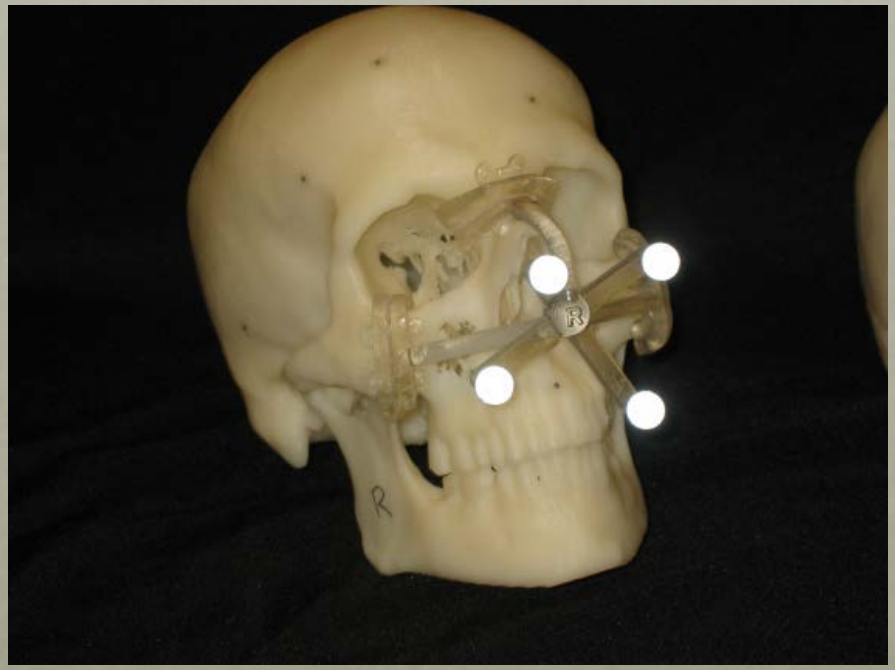
FACE TRANSPLANT





Murphy et al, Plast Reconstr Surg. 2015 Aug;136(2):350-62

TRANSPLANT MASK

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OCCUPATIONAL HEALTH

Challenges for AM Polymers

- Fabrication Speed
  - Trauma – reconstruction
  - Orthopedic splints
- Materials library
  - Biocompatible/ Bioactive/ Bioresorpable
  - Withstand Sterilization Processes
  - Variable durometer,
  - layered color addition
- Application
  - Inadequate research to support flexible design/manufacturing capabilities

THANK YOU