

# Strategies for Head and Neck Reconstruction: Value Based Utilization of Technology

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Director, Head and Neck Surgical Oncology and Reconstruction

Disease Team Co-Leader, Head and Neck Oncology

Ear, Nose and Throat Institute

University Hospitals Cleveland Medical Center/Seidman Cancer Center

Professor Otolaryngology-Head and Neck Surgery

Case Western Reserve University School of Medicine



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**CASE**  
SCHOOL OF MEDICINE





# SPECIALTY OVERVIEW

## Providers

- Rod Rezaee, MD
- Pierre Lavertu, MD
- Nicole Fowler, MD, FACS
- Shawn Li, MD
- Ted Teknos, MD
- Kate Clancy, MD
- Jason Thuener, MD
- Akina Tamaki, MD
- Jacob Brady, MD  
(Head and Neck Fellow)

### New additions:

- Madelyn Stevens, MD



## Extenders

### Nursing Team

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- Cindy Knapp, BSN, RN-C
- Lauren Sahagian, RN
- Megan Potts, RN
- Jamie Minch, RN
- Emily Hammermeister, RN
- Cheryl Brandt, MSN, ACNSBC, CORLN

### Nurse Practitioner

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- Kerry-Ann Walker, CNP

### Nursing Leads

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- Katie Galik(OR)
- Alex Metrisin (Seidman)
- Allison Ward (Seidman)

## Partners

### Key Practitioners

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SEIDMAN CANCER CENTER

- Jennifer Dorth, MD (Rad Onc)

- Matthew Mirsky MD

ENDOCRINOLOGY

- Baha Arafah, MD
- Steve Burgun, MD

RADIOLOGY

- Ari Blitz, MD (NeuroRad)
- Norbert Avril, MD (Nuc Med)
- Nami Azar (IR)

SPEECH THERAPY

PATHOLOGY

JAY WASMAN

# University Hospitals Cleveland Medical Center HN Team

- Head & Neck Surgeons
- Head & Neck Nurses
- Radiation Oncology
- Medical Oncology
- Speech/Language Therapy
- Nutrition
- Radiology
- Pathology
- Anesthesiology
- Dental/OMFS
- Cancer Care Coordinators
- Case workers/  
social workers
- Schedulers/Administrators



# Outline

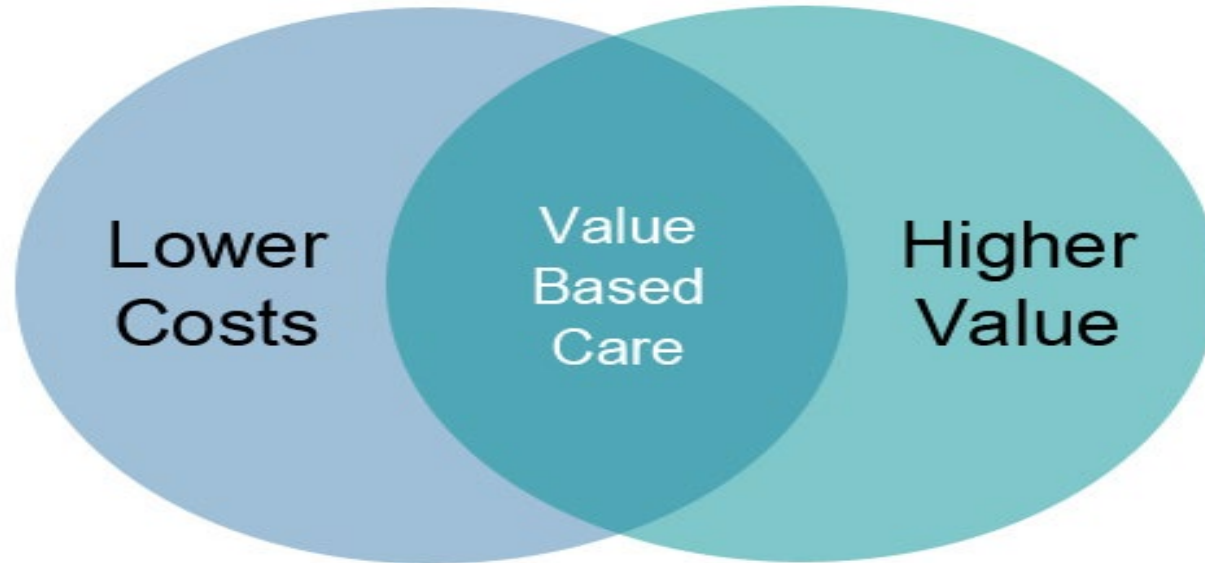
Value Based Care-Technology-Outcomes concepts

Literature review

Available Technologies/Application Considerations

Case examples for potential 'added value' (virtual surgical planning)

# Value Based Care : The Future (The present?)



Health care designed to focus on the quality of care provided, provider performance and patient experience

# Value Based Medicine: Is it possible with the cost of new technology and therapeutics?



## Divergent pathways?





# Available Technologies for HN surgeons

## Technologies

- Preoperative
  - **Virtual planning**
  - Medical modeling
  - Patient specific plates
  - 3D printing
- Intraoperative
  - Plates-custom vs stock
  - Surgical localization (Stealth, PT-EYE)
  - Imaging-CT/SPY/Infrared cameras
  - Equipment-robots, couplers, microscopes (standard vs exoscopes), loupes, VR, energy devices
- Postoperative
  - Graft monitoring systems (implantable Doppler, tissue oxygenation systems)
  - ICU's vs surgical specialty units

Provide overview of concepts/discussion points

\*\*will not be discussing chemotherapeutic agents/Immunotherapy

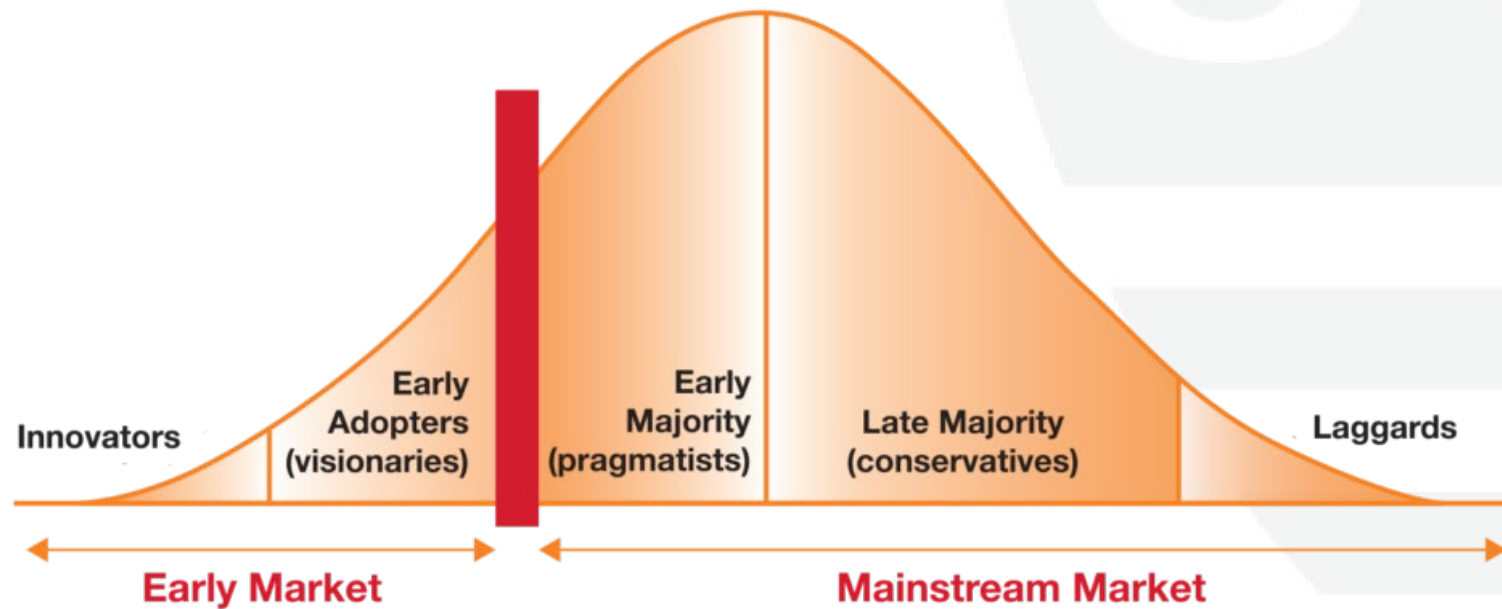


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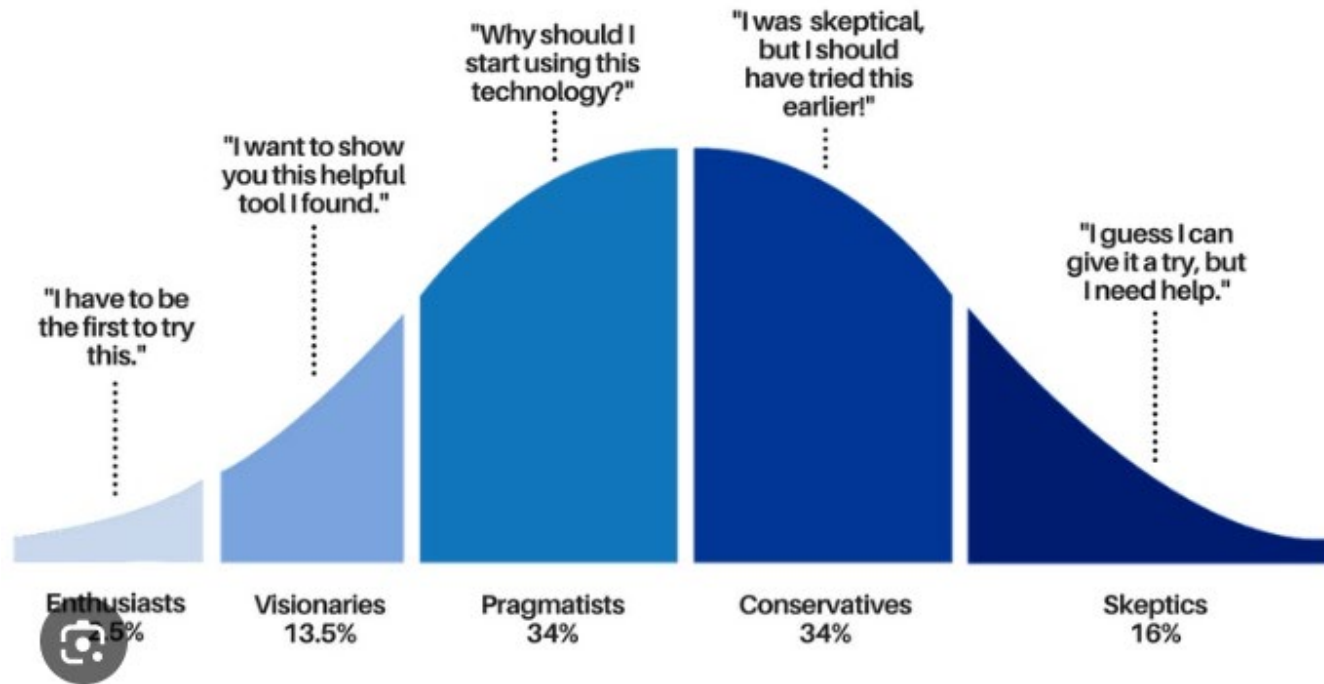
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# Integration/adoption/acceptance of Technology

## Innovation Adoption Curve



# Integration/Adoption/Acceptance of Technology and/or Therapeutic Advancements



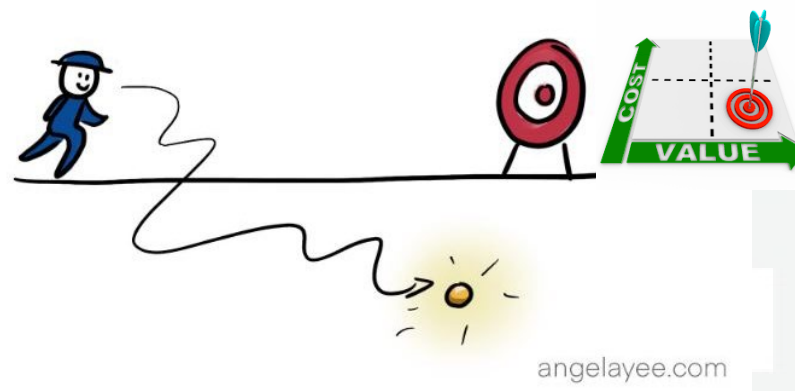
# Impact on training and outcomes? How can this be measured?

Resident and fellow training?

Decreased patient operative time?

Improved outcomes?

- Decreased return to OR, reduced complications?
- Improved survival?
- Reduced (increased?) morbidity?





# Outline

Value

Literature review

Available Technologies/Application Considerations

Case examples for 'added value'

## Literature Support (and caution)

1. Hanasono M, Skoracki R: Computer-assisted design and rapid prototype modeling in microvascular mandible reconstruction. Laryngoscope 000:000-000, 2012
2. Broer P, Tanna N, Franco P, Thanik V, Levine S, Garfein E, Saadeh P, Ceradini D, Hirsch D, Levine J: Ten-year evolution utilizing computer-assisted reconstruction for giant ameloblastoma. J Reconstr Microsurg 29: 173-180, 2013
3. Doscher M, Garfein E, Bent J, Tepper O: Neonatal mandibular distraction osteogenesis: converting virtual surgical planning into an operative reality. International Journal of Pediatric Otorhinolaryngology 78: 381-384, 2014
4. Saad A, Winters R, Wise MW, Dupin C, St. Hilaire H: Virtual surgical planning in complex composite maxillofacial reconstruction. Plast Reconstr Surg 132 (3): 626-633, 2013
5. [Piezoelectric Bone Scalpel osteotomies in osteocutaneous free flaps.](#) Wick CC, Rezaee RP, Zender CA. Laryngoscope. 2013 Mar;123(3):618-21. doi: 10.1002/lary.23740. Epub 2012 Sep 24. PMID: 23007609
6. Foley B, Thayer Q, Honeybrook A, McKenna S, Press S: Mandibular reconstruction using computer-aided design and computer-aided manufacturing” an analysis of surgical results. J Oral Maxillofac Surg 71: e111-e119, 2013



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## Literature Support (and caution)

[Starting a medical 3D printing lab for otolaryngology-head and neck surgery collaboration.](#)

Witsberger C, Overshiner B, Nisi T, Zopf D, Green G, Mantravadi A.

Am J Otolaryngol. 2022 Mar-Apr;43(2):103322. doi: 10.1016/j.amjoto.2021.103322. Epub 2021 Dec 15.

PMID: 34923279

[Editorial: Virtual surgical planning and 3d printing in head and neck tumor resection and reconstruction.](#)

Su YX, Thieringer FM, Fernandes R, Parmar S.

Front Oncol. 2022 Aug 8;12:960545. doi: 10.3389/fonc.2022.960545. eCollection 2022.

PMID: 36003774

[Optimizing value in head and neck cancer free flap surgery.](#)

Cash H, Abouyared M, Houlton JJ.

Curr Opin Otolaryngol Head Neck Surg. 2019 Oct;27(5):413-419. doi: 10.1097/MOO.0000000000000570.

PMID: 31415262



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## Literature Support (and caution)

[Practice patterns of virtual surgical planning: Survey of the reconstructive section of the American Head and Neck Society.](#)

Miles BA, McMullen CP, Sweeny L, Zenga J, Li R, Divi V, Jackson R, Patel UA, Richmon JD.  
Am J Otolaryngol. 2022 Jan-Feb;43(1):103225. doi: 10.1016/j.amjoto.2021.103225. Epub 2021 Sep 14.  
PMID: 34571439

[Computer-assisted versus traditional technique in fibular free-flap mandibular reconstruction: A CT symmetry study.](#)

Bartier S, Mazzaschi O, Benichou L, Sauvaget E.

Eur Ann Otorhinolaryngol Head Neck Dis. 2021 Jan;138(1):23-27. doi: 10.1016/j.anorl.2020.06.011. Epub 2020 Jun 30.

PMID: 32620425

[Does implant drill design influence the accuracy of dental implant placement using static computer-assisted implant surgery? An in vitro study.](#)

Takács A, Marada G, Turzó K, Nagy Á, Németh O, Mijiritsky E, Kivovics M, Mühl A.

BMC Oral Health. 2023 Aug 18;23(1):575. doi: 10.1186/s12903-023-03297-0.

PMID: 37596610



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# Outline

Value

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Case examples for 'added value' using virtual planning

# Technologic Considerations

## Visualization

Microscopes

Microscope Alternatives

- Loupes, Exoscope, VR

## Mandibular Reconstruction

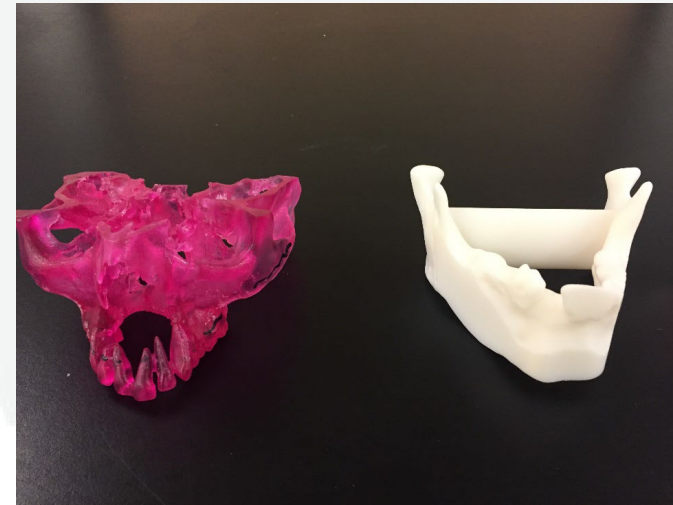
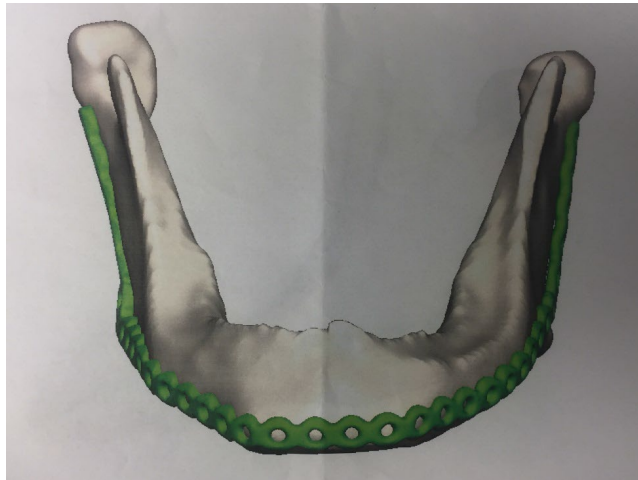
- Oncologic
  - Problem prevents intraoperative accurate contouring
    - Reoperative/Revision cases
    - Buccal cortex deformity
    - Anterior segment erosion
    - Lateral defect with prior surgery
    - Condylar reconstruction
- Traumatic
  - Bone loss

## Maxillary Reconstruction

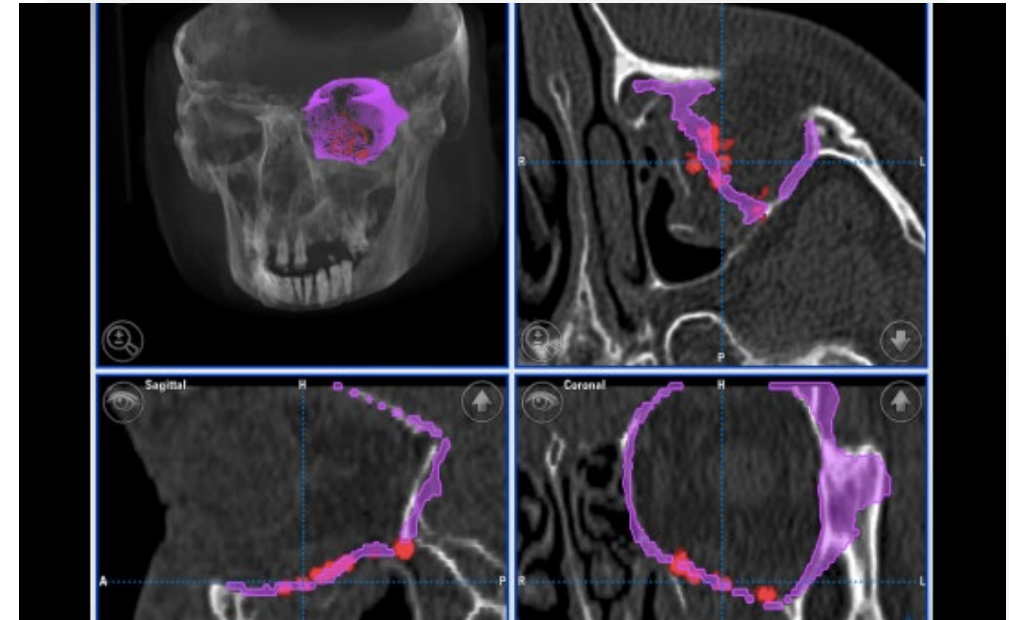
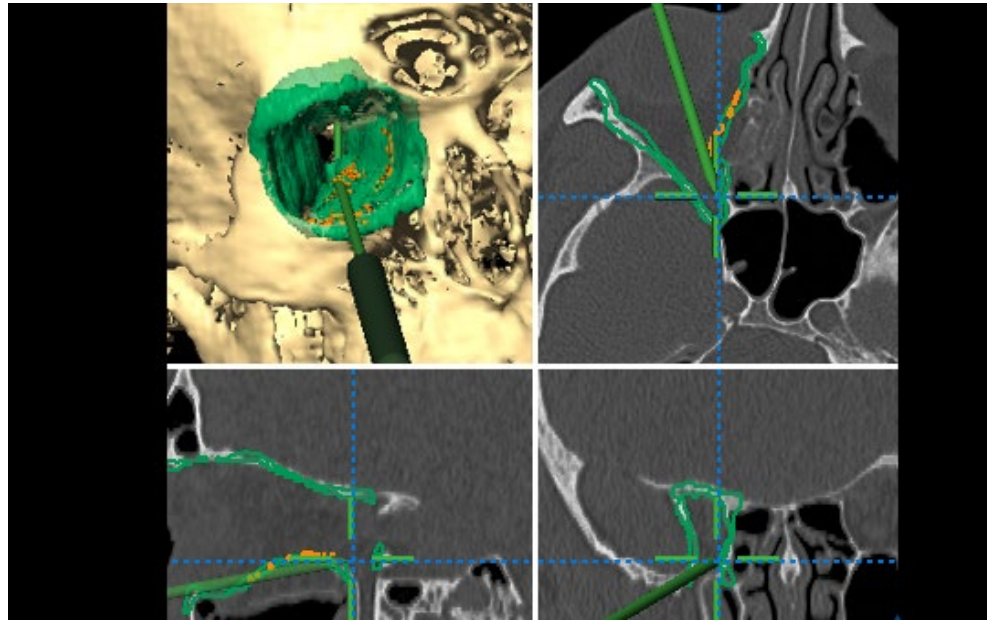
## Orthognathic/Craniofacial



# Pre-bent Plates/Medical Models/3 D printing

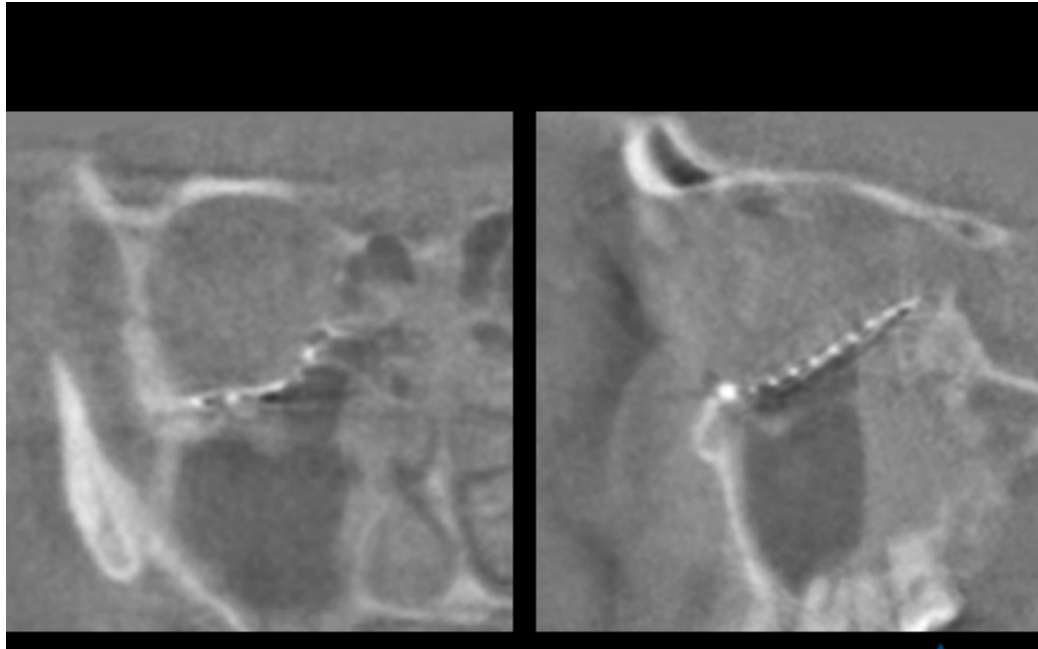


# Intraoperative Localization/Navigation





# Intraoperative Imaging



# Outline

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# Technologic Considerations

## Visualization

Microscopes

Microscope Alternatives

- Loupes
- Exoscope
- VR

## Mandibular Reconstruction

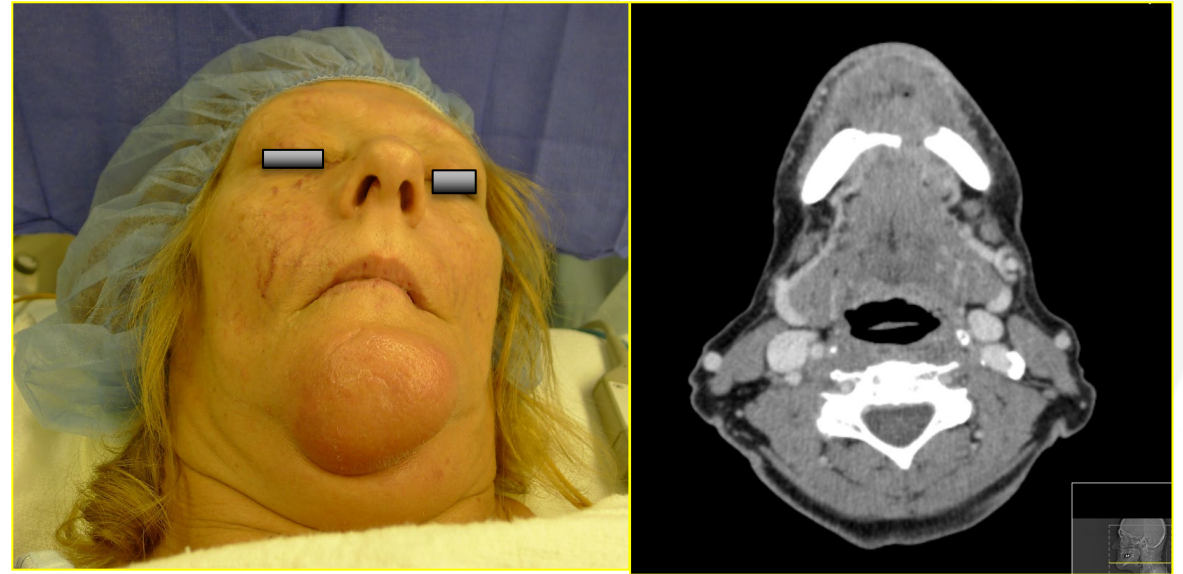
- **Oncologic**
  - **Problem prevents intraoperative accurate contouring**
    - **Reoperative/Revision surgeries**
    - **Buccal cortex deformity**
    - **Anterior segment erosion**
    - **Lateral defect with prior surgery**
    - **Condylar reconstruction**
- Traumatic
  - Bone loss

## Maxillary Reconstruction

Orthognathic/Craniofacial  
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# Special Considerations

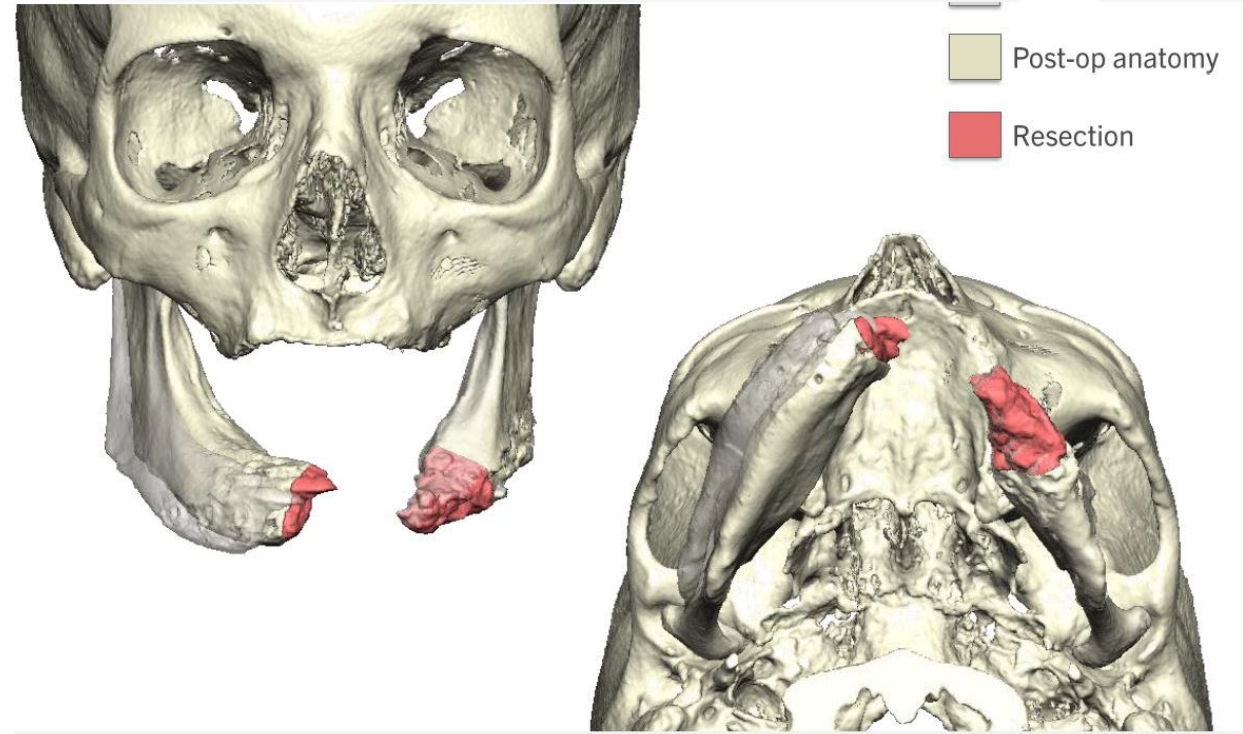
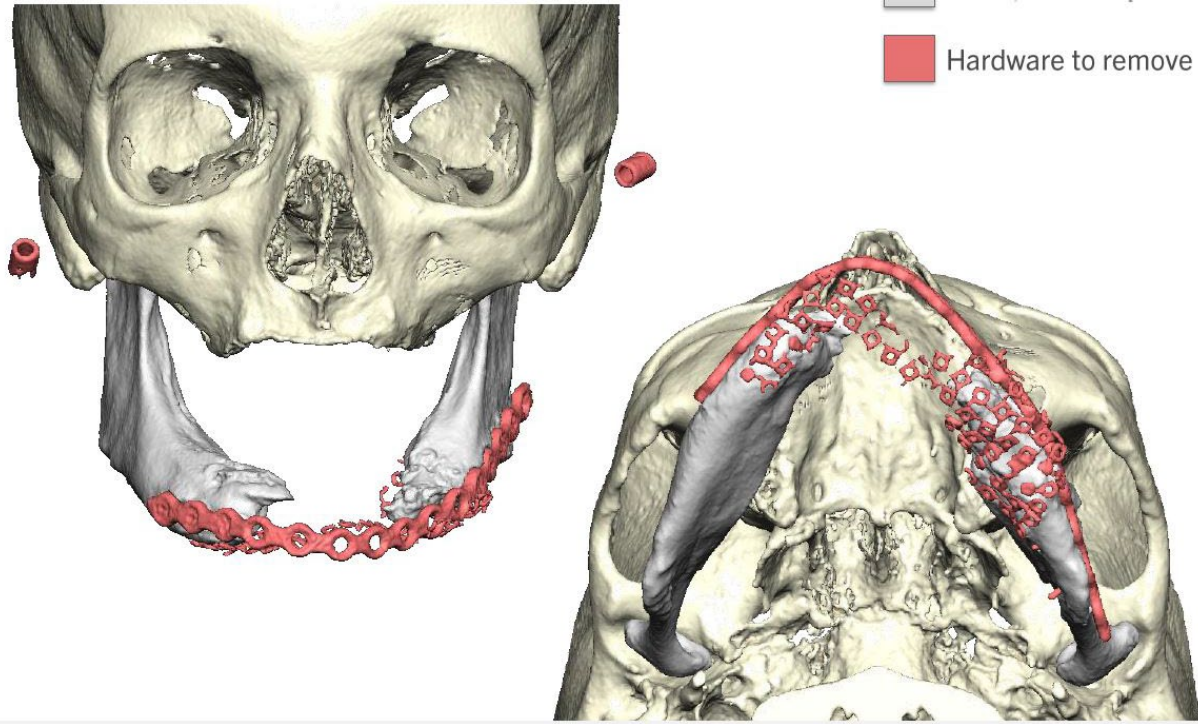


- Buccal or anterior plate application not possible due to tumor invasion of outer cortex



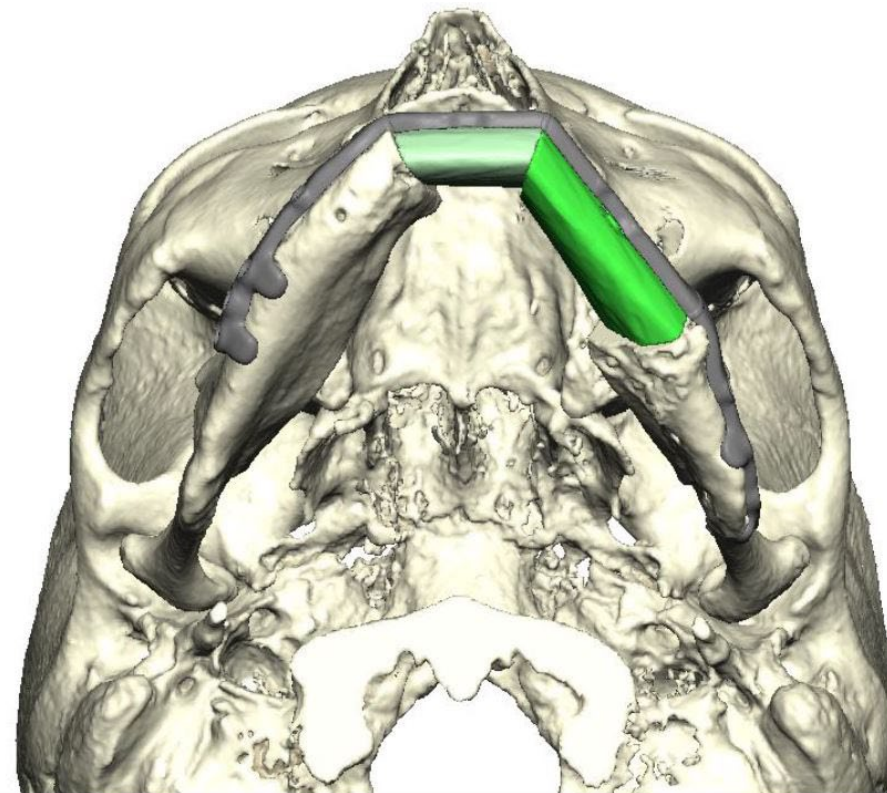
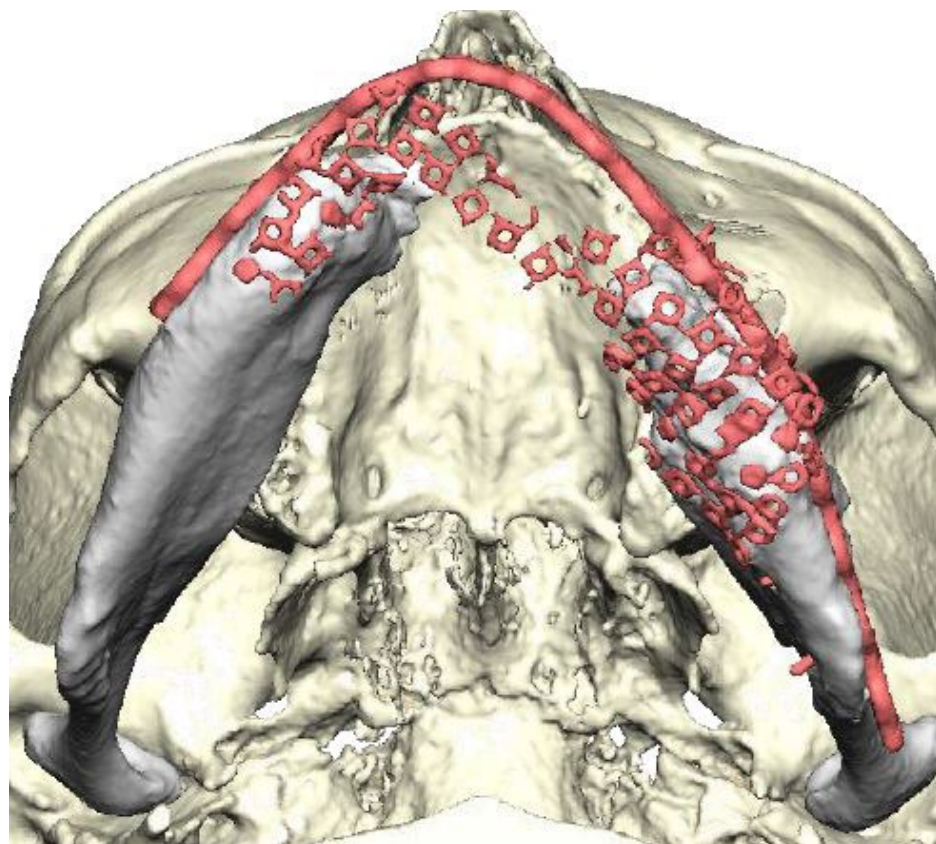


# Anterior Segment/Revision Surgeries





# Resection Template



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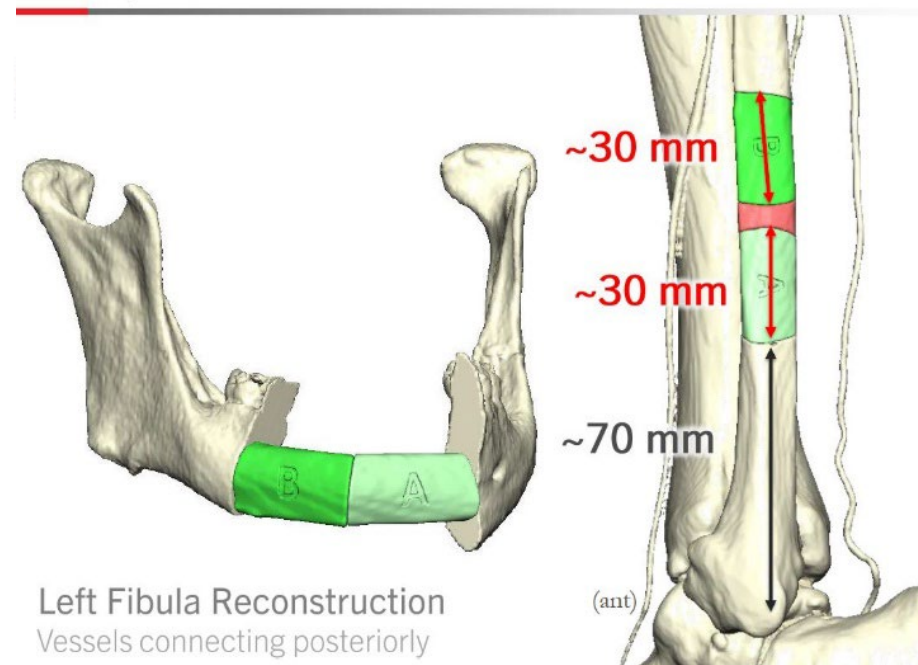
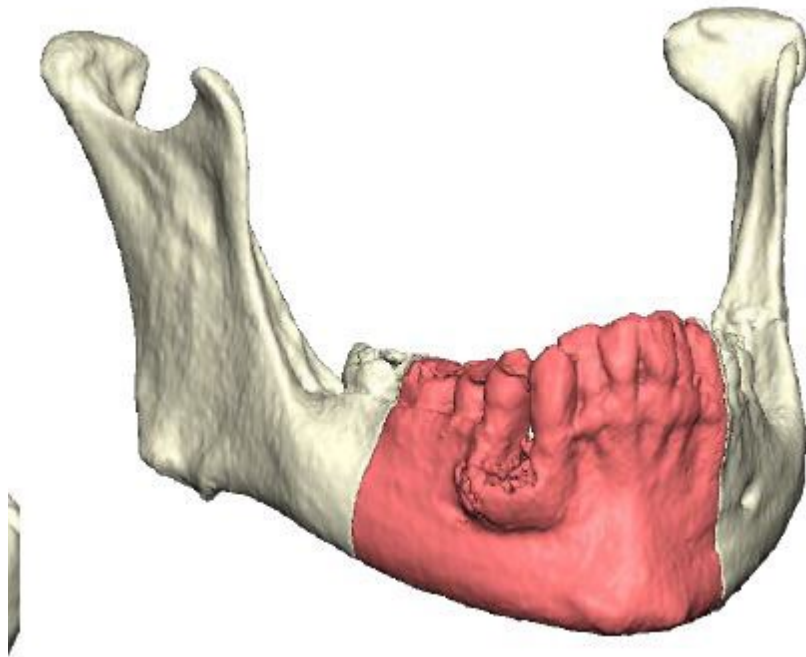
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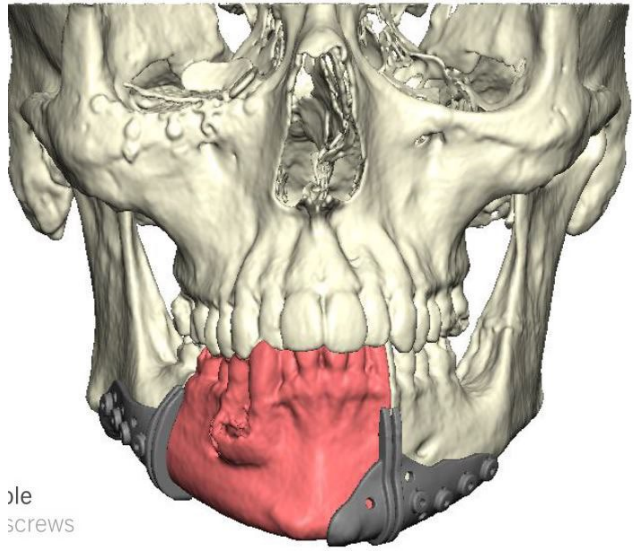
# 3 years post op revision surgery-15 years from original procedure



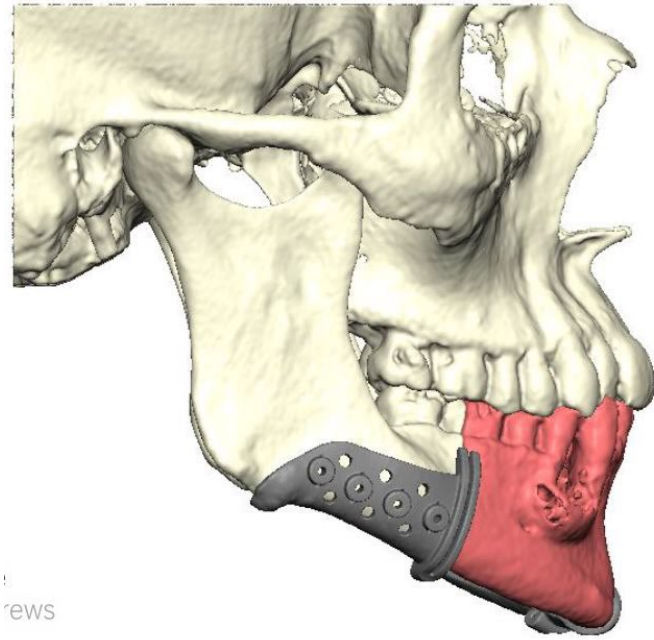


# Medical Modeling/Virtual Surgical Planning- 48 y/o male with recurrent ameloblastoma s/p 2 prior curettages

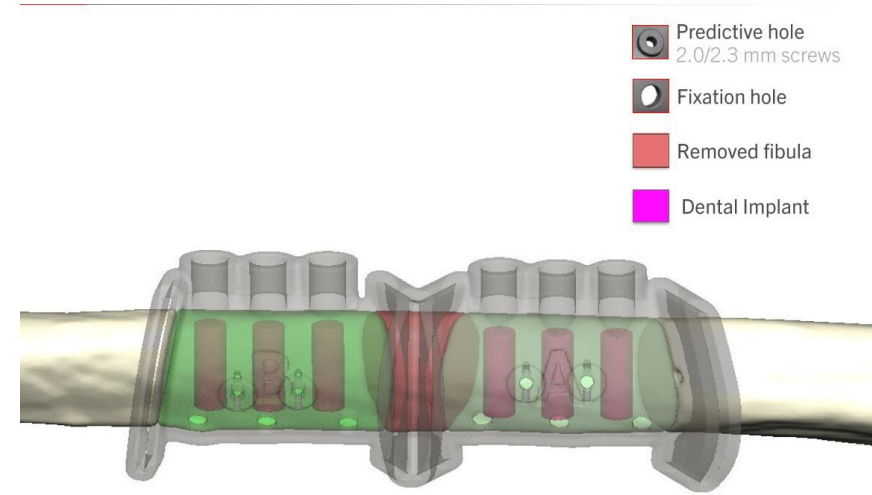
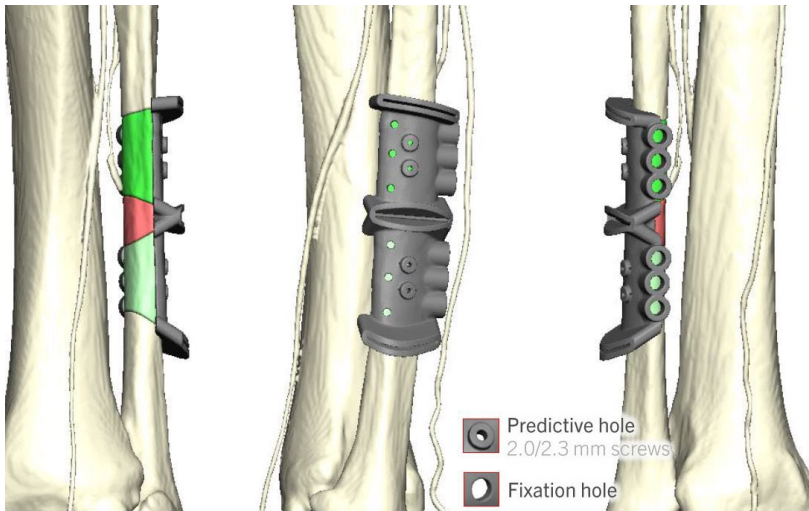


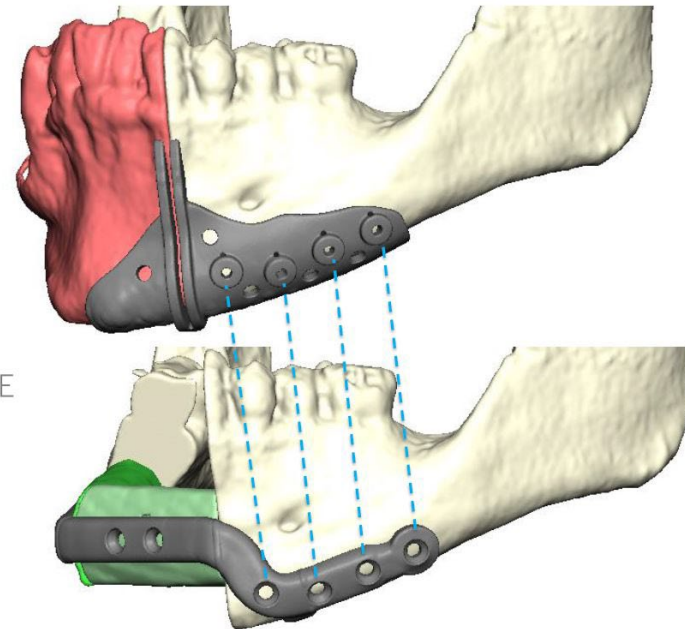
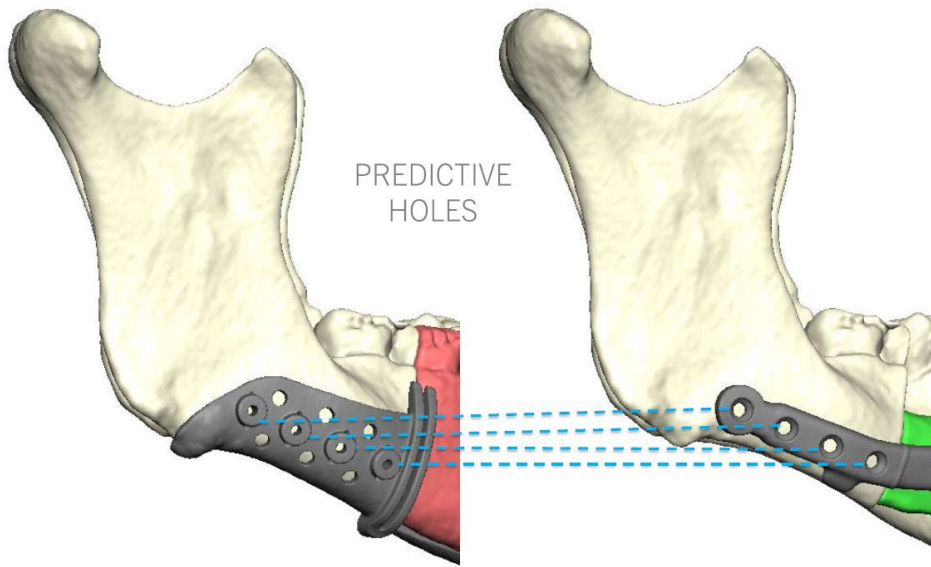


ble  
screws

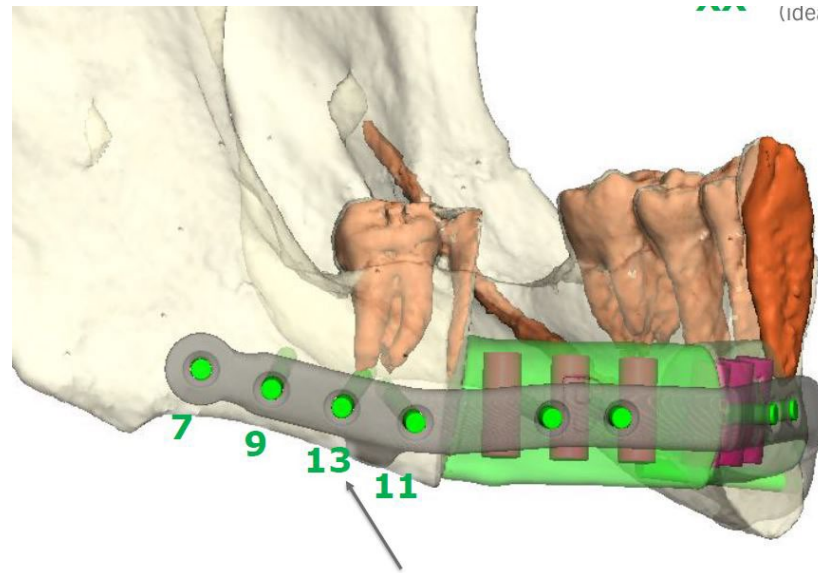


rews

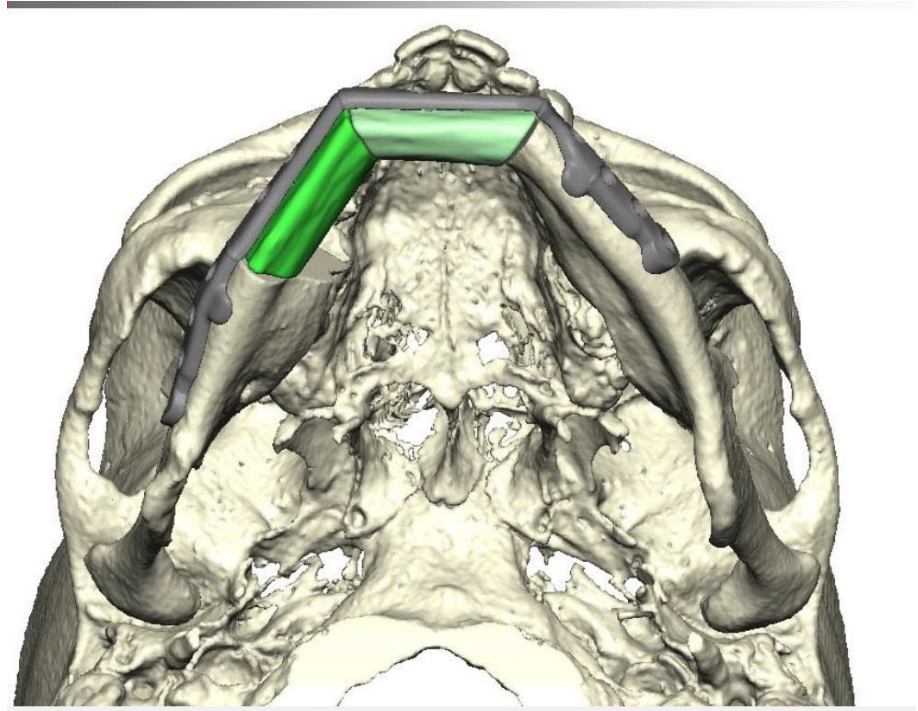
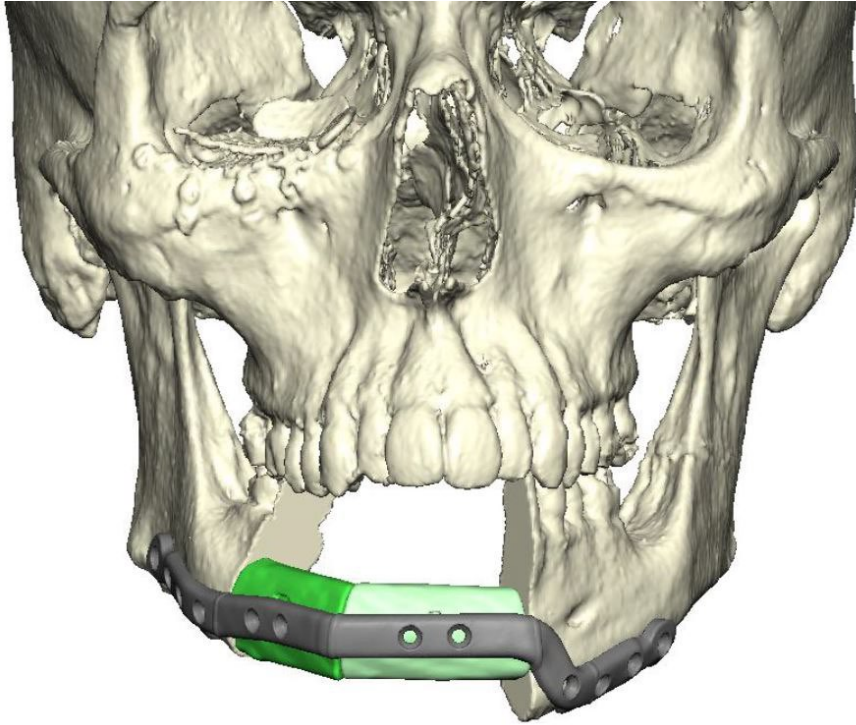




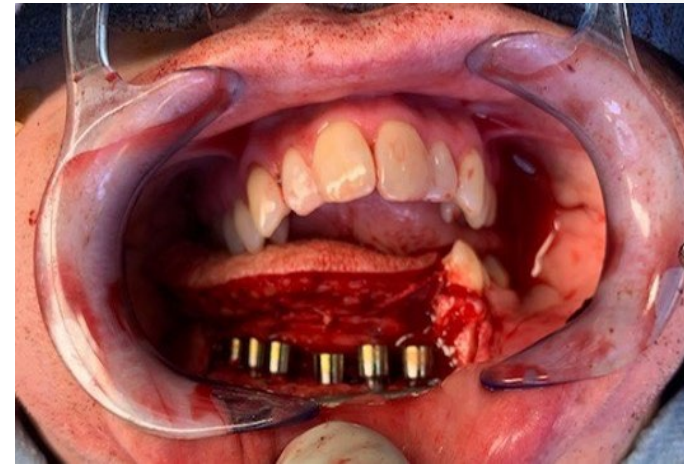
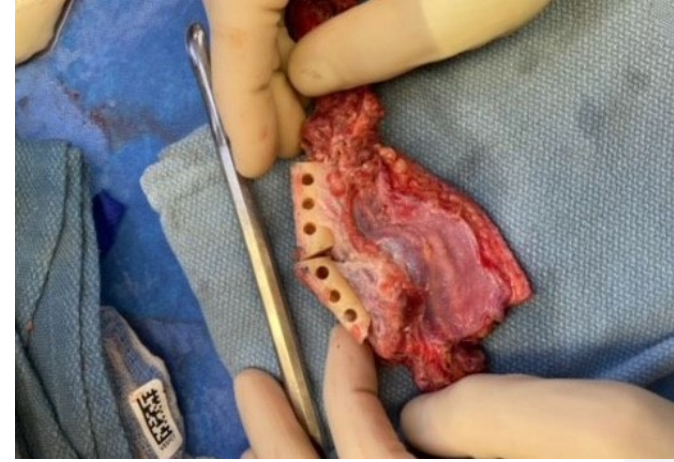
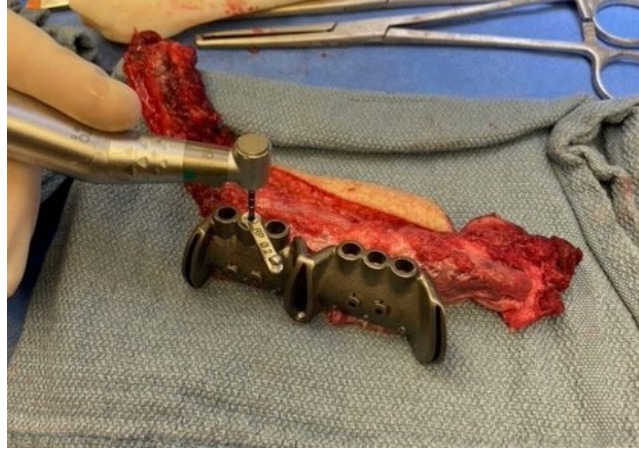
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## Intraoperative Steps



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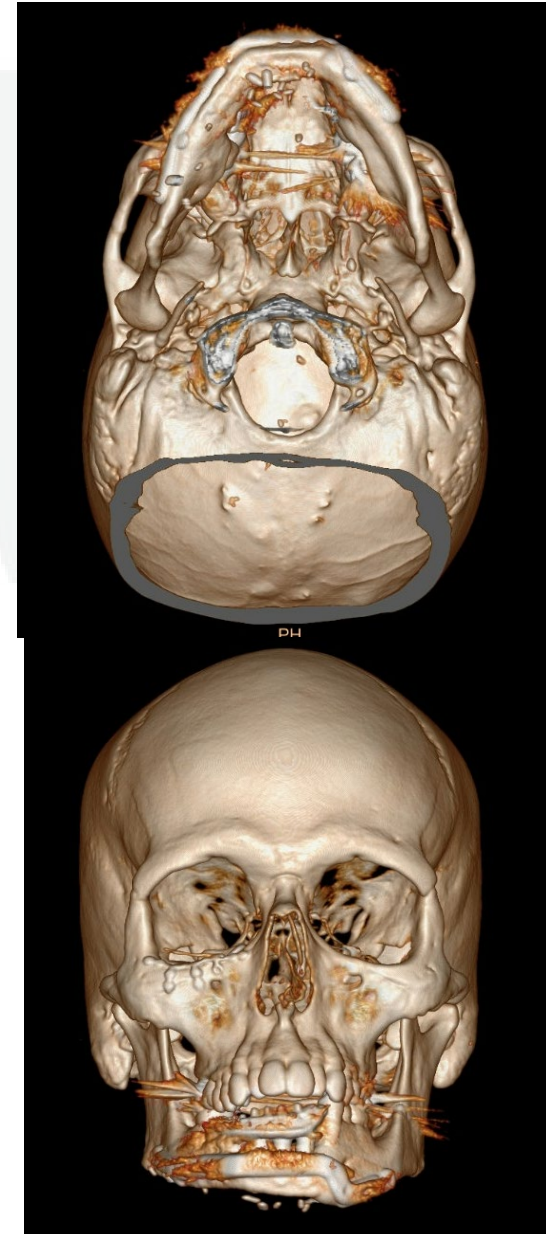
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# Flap revision prior to implant activation



12 months



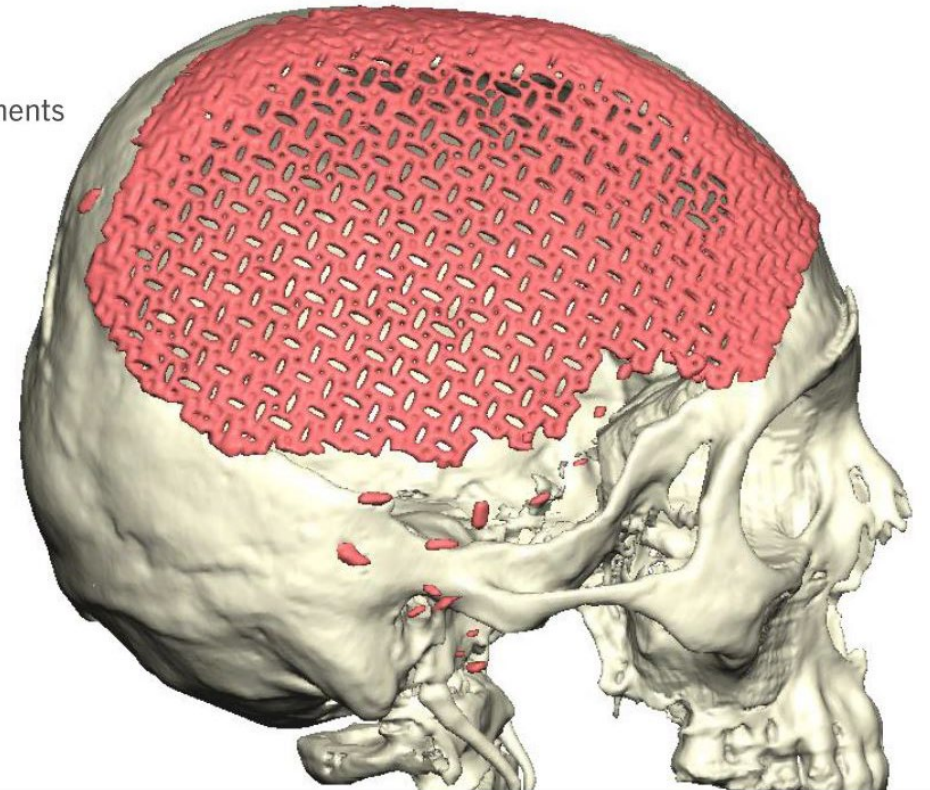


# Scalp Reconstruction/Cranioplasty



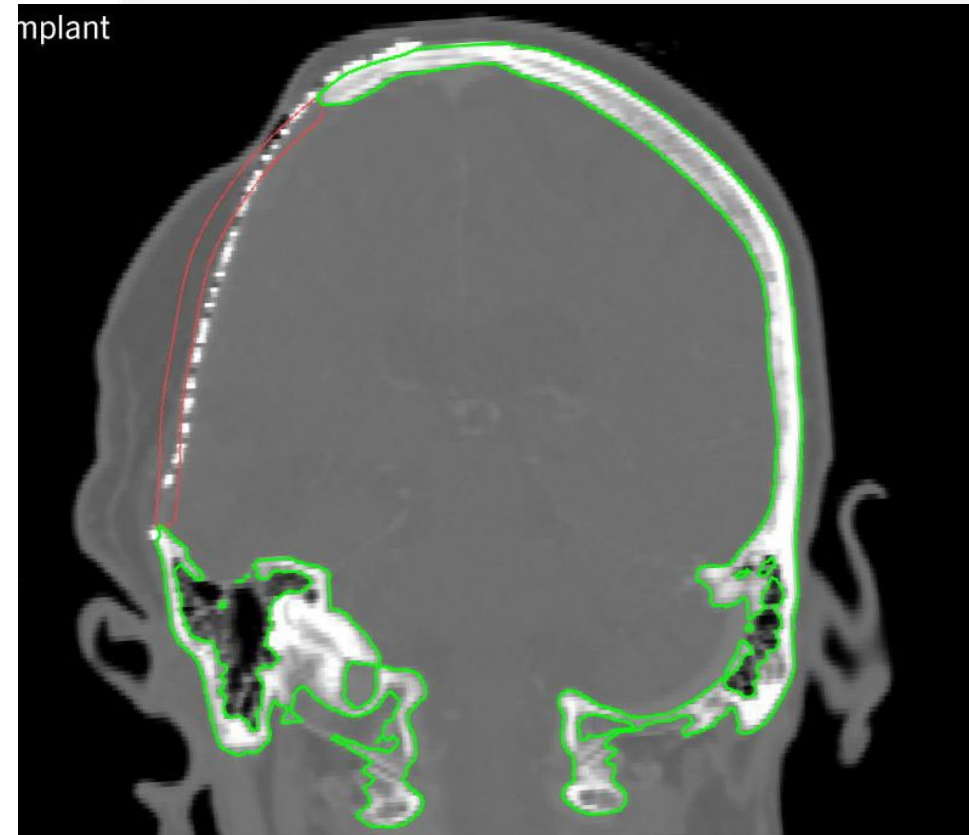
otomy

Fragments  
red





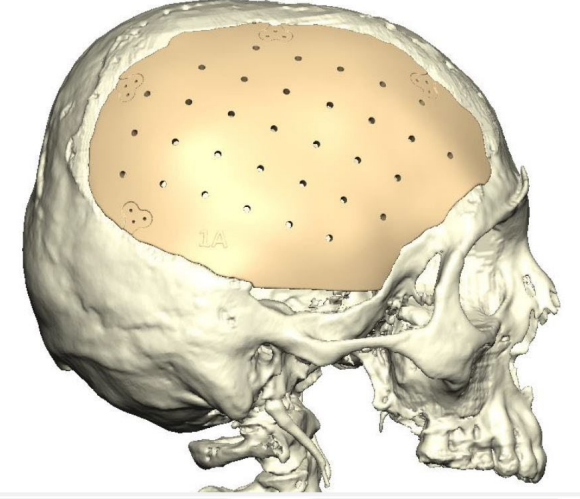
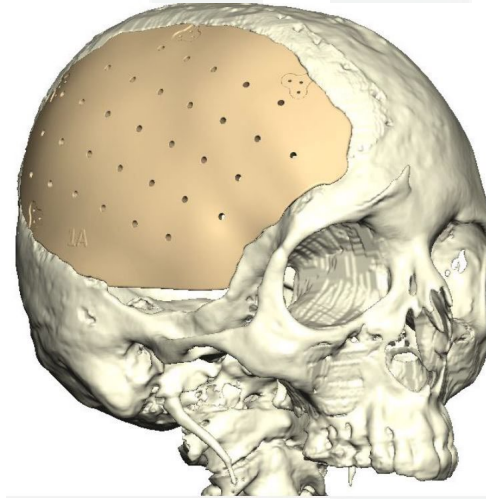
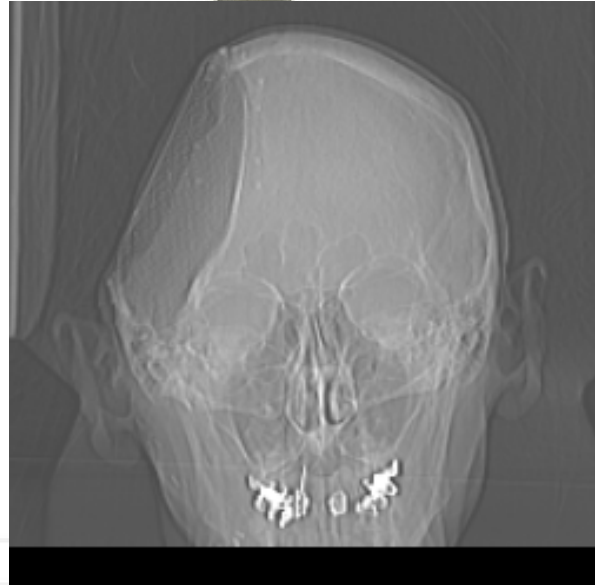
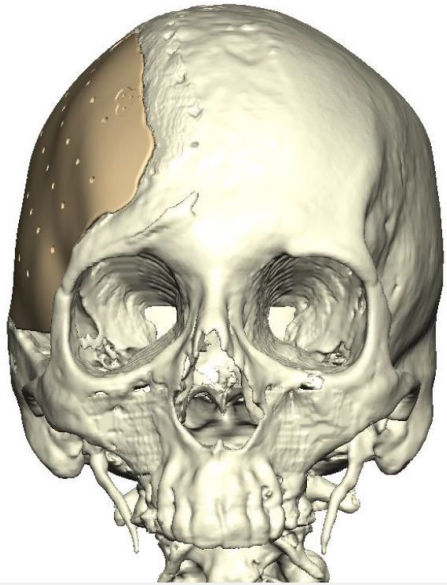
# Scalp Reconstruction/Cranioplasty



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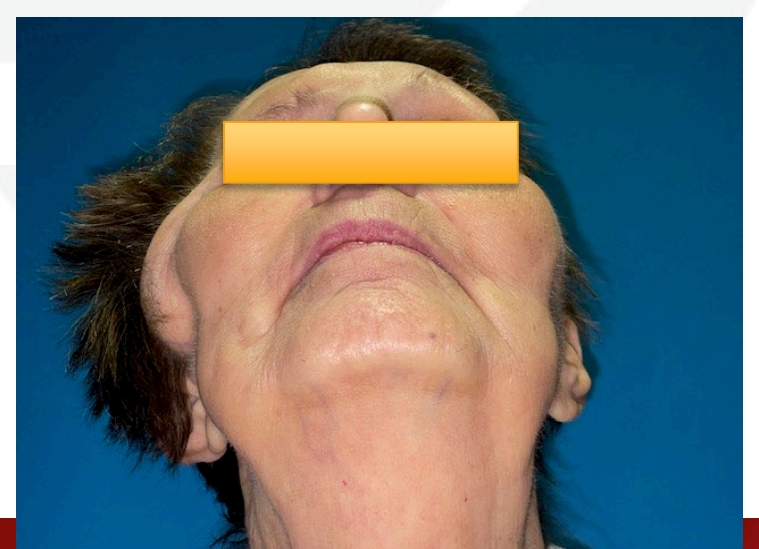
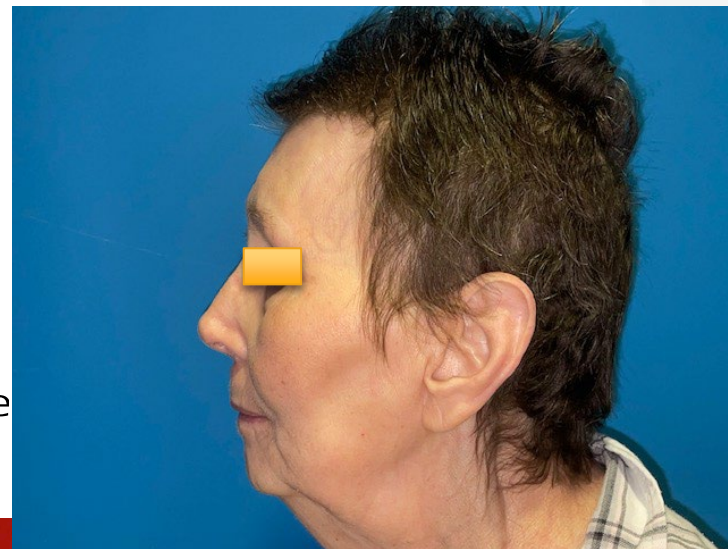
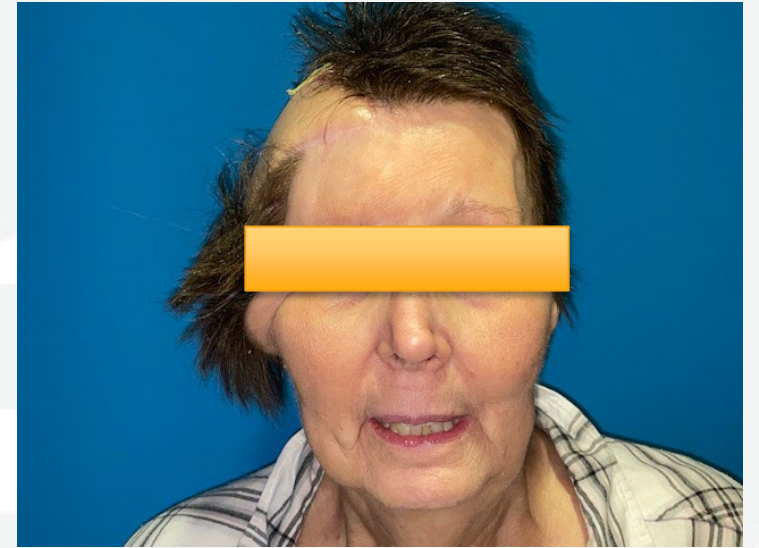
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# Scalp Reconstruction/Cranioplasty





# Scalp Reconstruction/Cranioplasty



# Conclusions

- Multiple options exist for utilizing technology for head and neck cancer patients undergoing reconstruction
  - Carefully and conscientiously apply technology for patient benefit, improved outcomes and added value
  - Balance of factors:
    - cost considerations, surgeon training and experience, residents and fellow education, system constraints, patient characteristics

