Dipartimento Testa Collo e Neuroscienze

Clinica di Chirurgia Maxillo facciale
Dir. Prof. Massimo Robiony



Le necessità diagnostiche dello specialista Ambulatoriale e Ospedaliero

Massimo Robiony

La radioprotezione ha come "oggetto" la protezione dell'uomo e dell'ambiente dagli effetti nocivi delle radiazioni. Essa si fonda su concetti di fisica, di biologia e di anatomofisiologia e si avvantaggia anche dall'utilizzo della biotecnologia.

SOSTENIBILITA’

Surgical, Clinical and cultural challenges ahead for the efficient use of Computer Guided Surgery and Big Data in healthcare

- Medicina di precisione e Chirurgia di Precisione

- Genomica
- Proteomica
- **Radiomica**

- Chirurgia computer guidata
- Virtual surgical planning
- Realtà aumentata
- Stampa 3D
- Statistical shape modeling

Un obiettivo chiave della medicina moderna è la "medicina di precisione", la cui finalità consiste nel personalizzare il trattamento sulla base delle caratteristiche specifiche del paziente e della sua malattia.

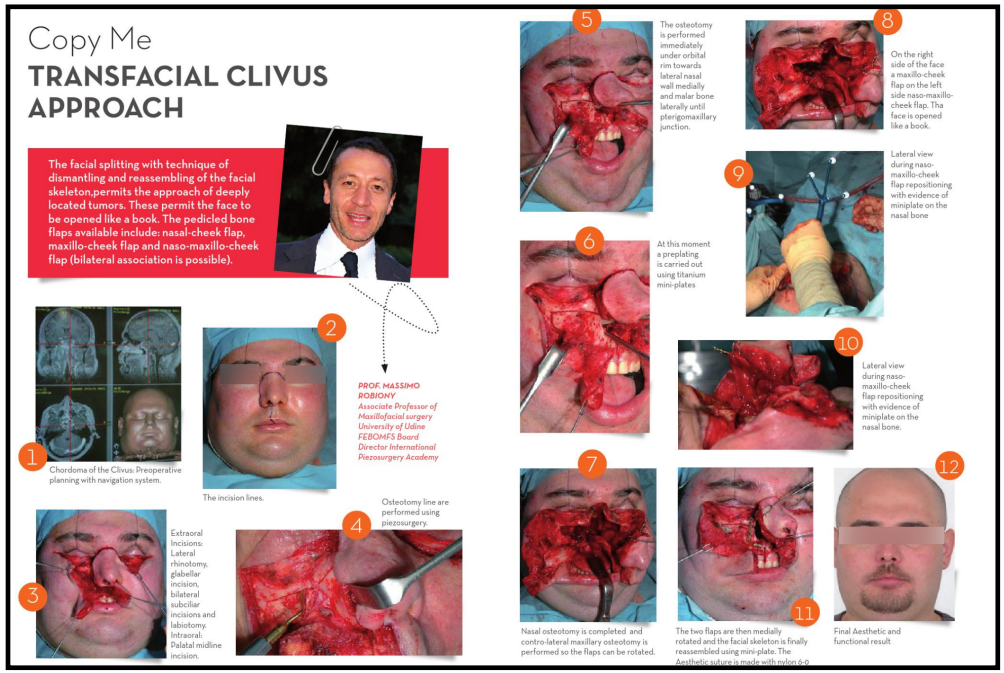
La Radiomica sta rapidamente emergendo come tecnologia della medicina personalizzata ed è attualmente uno dei campi di ricerca di maggior interesse.

Medicina di Precisione

. Oggi però la diagnostica per immagini può permettere di caratterizzare i tessuti in modo non invasivo e, in alcuni casi, di visualizzare le profonde differenze fenotipiche che i tumori umani presentano. Poiché i tumori sono eterogenei nel loro volume e si modificano nel tempo, le immagini diagnostiche possono fornire una visione completa dell'intero tumore e possono essere ripetute nel tempo per monitorare le modificazioni indotte anche dalle terapie. Attraverso la Radiomica le immagini mediche da noi conosciute, ottenute dagli esami TAC, RM o PET, vengono convertite in dati numerici. Essi vengono calcolati, in numero molto elevato, da strumenti di calcolo dedicati e la loro manipolazione e analisi richiede spesso l'utilizzo di tecniche avanzate, quali le metodiche di intelligenza artificiale per la gestione dei cosiddetti "big data".

Chirurgia di Precisione - Chirurgia computer guidata





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TRANSFACIAL CLIVUS APPROACH

The facial splitting with technique of dismantling and reassembling of the facial skeleton,permits the approach of deeply located tumors. These permit the face to be opened like a book. The pedicled bone flaps available include: nasal-cheek flap, maxillo-cheek flap and naso-maxillo-cheek flap (bilateral association is possible).

PROF. MASSIMO ROBIONY
Associate Professor of Maxillofacial surgery University of Udine
FEBOHFS Board Director International Piezosurgery Academy

1 Chordoma of the Clivus. Preoperative planning with navigation system.

2 The incision lines.

3 Extraoral Incisions: Lateral rhinotomy, glabellar incision, bilateral subciliar incisions and labiotomy. Intraoral: Palatal midline incision.

4 Osteotomy line are performed using piezosurgery.

5 The osteotomy is performed immediately under orbital rim towards lateral nasal wall medially and malar bone laterally until pterigomaxillary junction.

6 At this moment a preplating is carried out using titanium mini-plates

7 Nasal osteotomy is completed and contro-lateral maxillary osteotomy is performed so the flaps can be rotated.

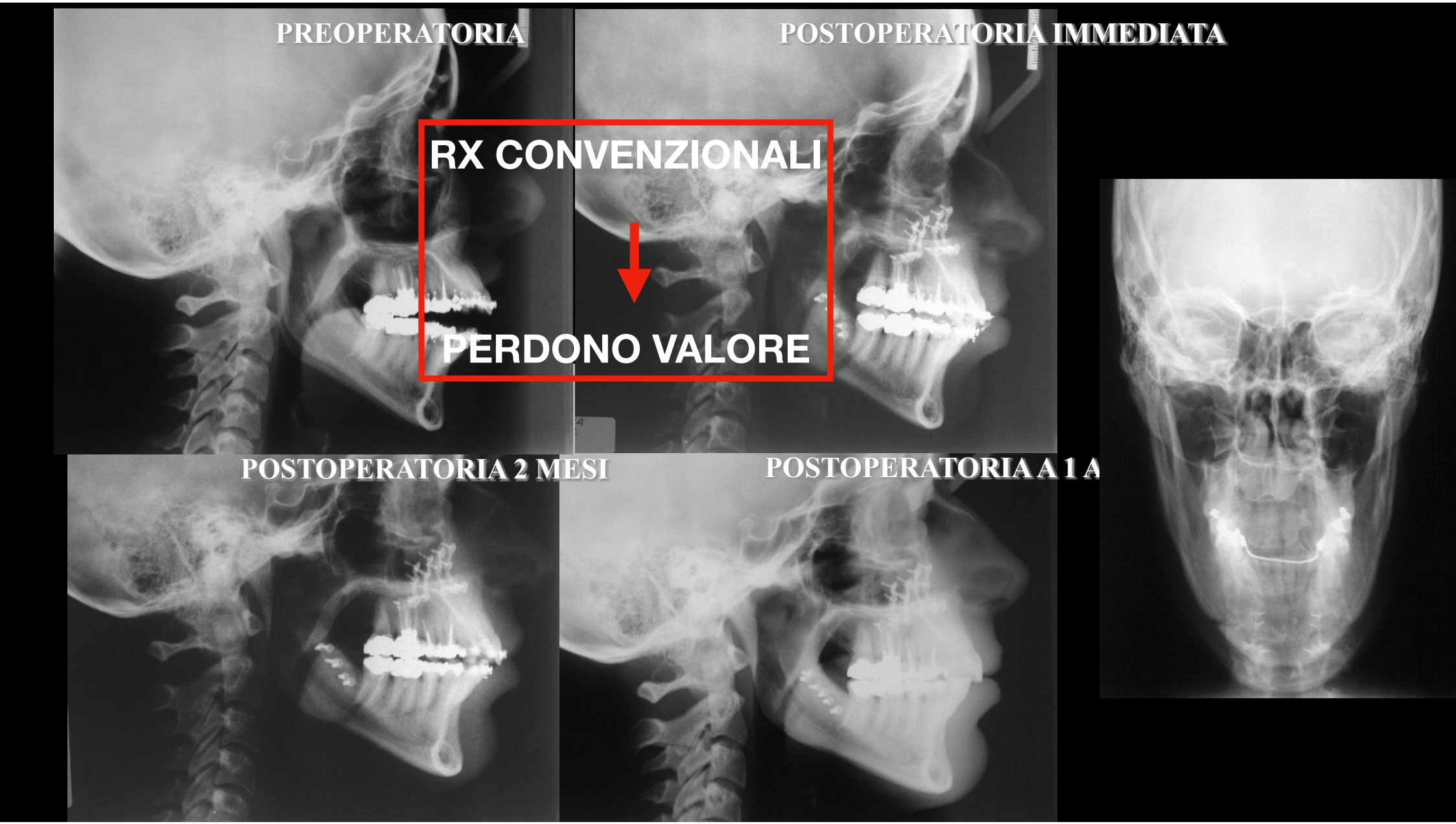
8 On the right side of the face a maxillo-cheek flap on the left side naso-maxillo-cheek flap. Tha face is opened like a book.

9 Lateral view during naso-maxillo-cheek flap repositioning with evidence of miniplate on the nasal bone

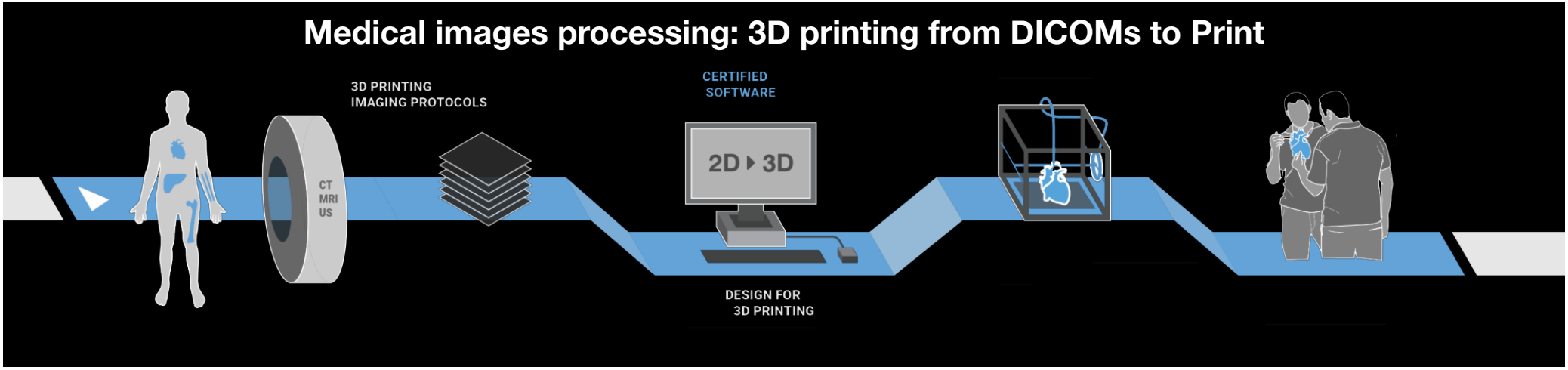
10 Lateral view during naso-maxillo-cheek flap repositioning with evidence of miniplate on the nasal bone.

11 The two flaps are then medially rotated and the facial skeleton is finally reassembled using mini-plate. The Aesthetic suture is made with nylon 6-0

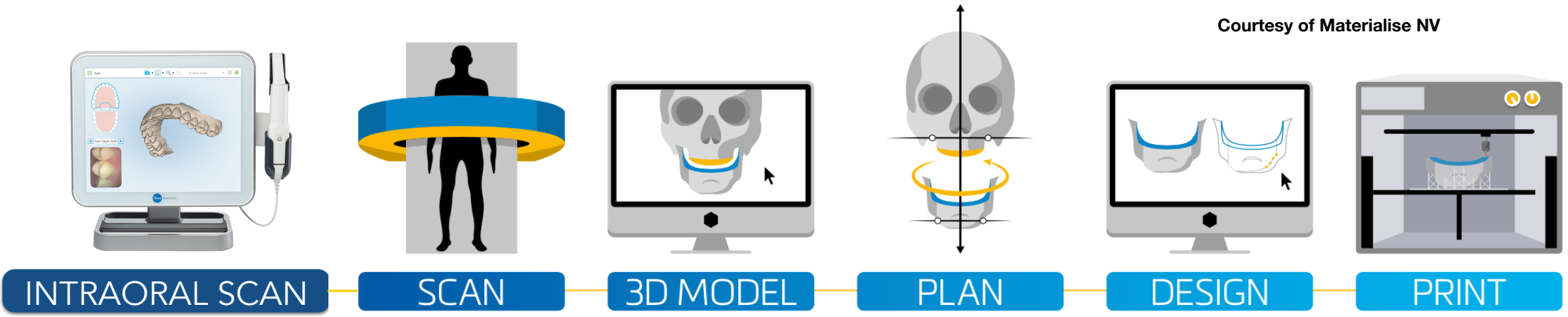
12 Final Aesthetic and functional result

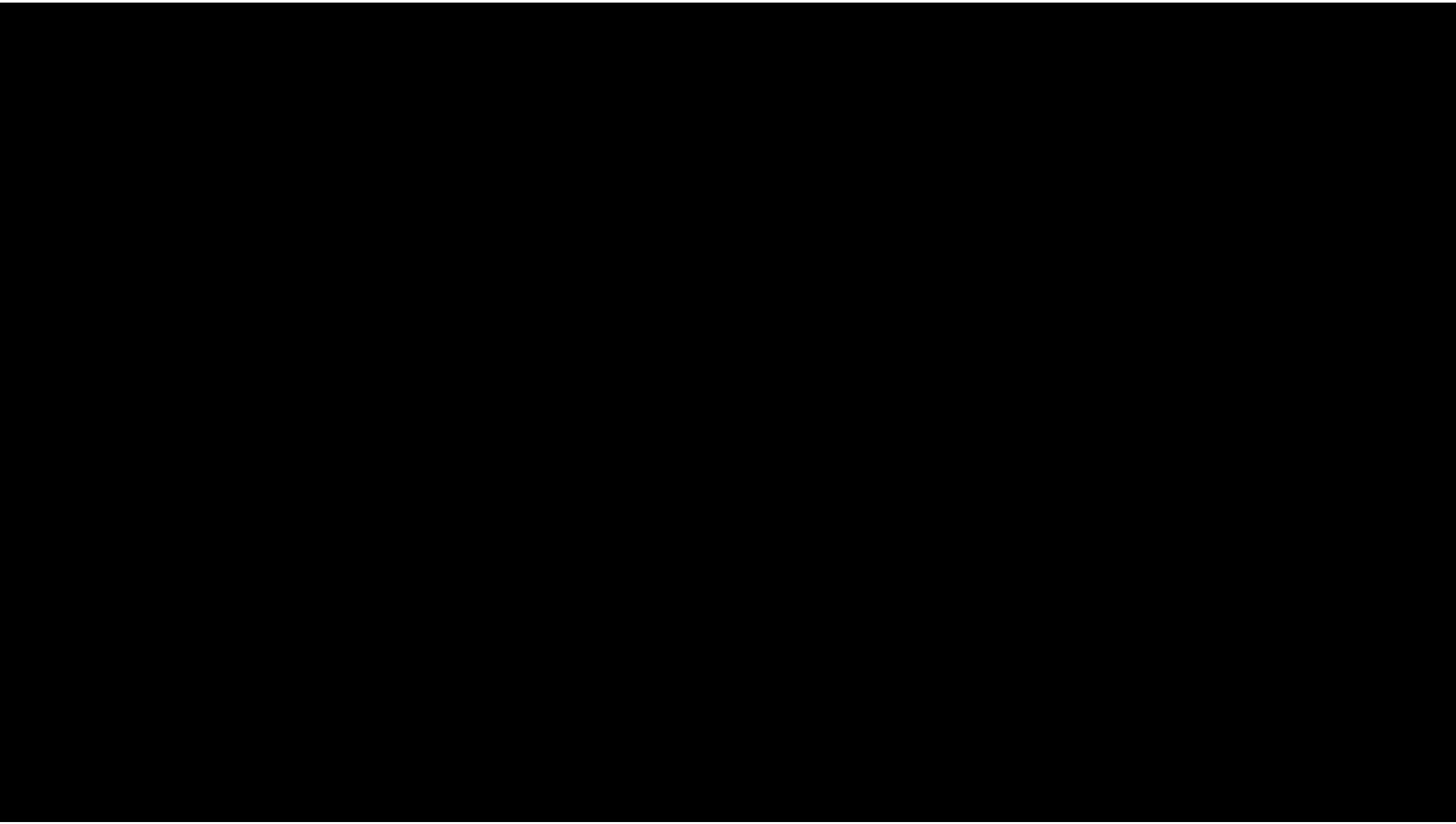

PREOPERATORIA
POSTOPERATORIA IMMEDIATA
RX CONVENZIONALI
PERDONO VALORE
POSTOPERATORIA 2 MESI
POSTOPERATORIA A 1 A

FULLY DIGITAL PROTOCOL



Courtesy of Materialise NV

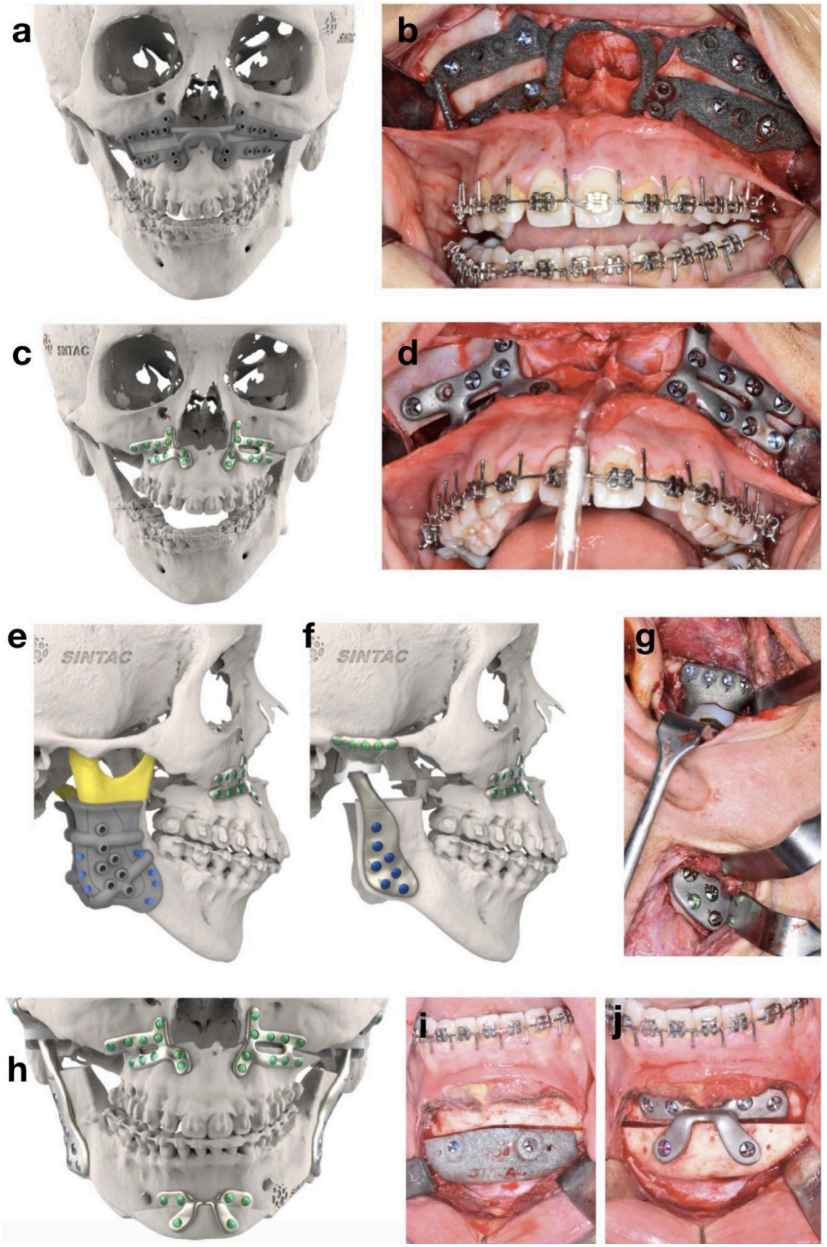




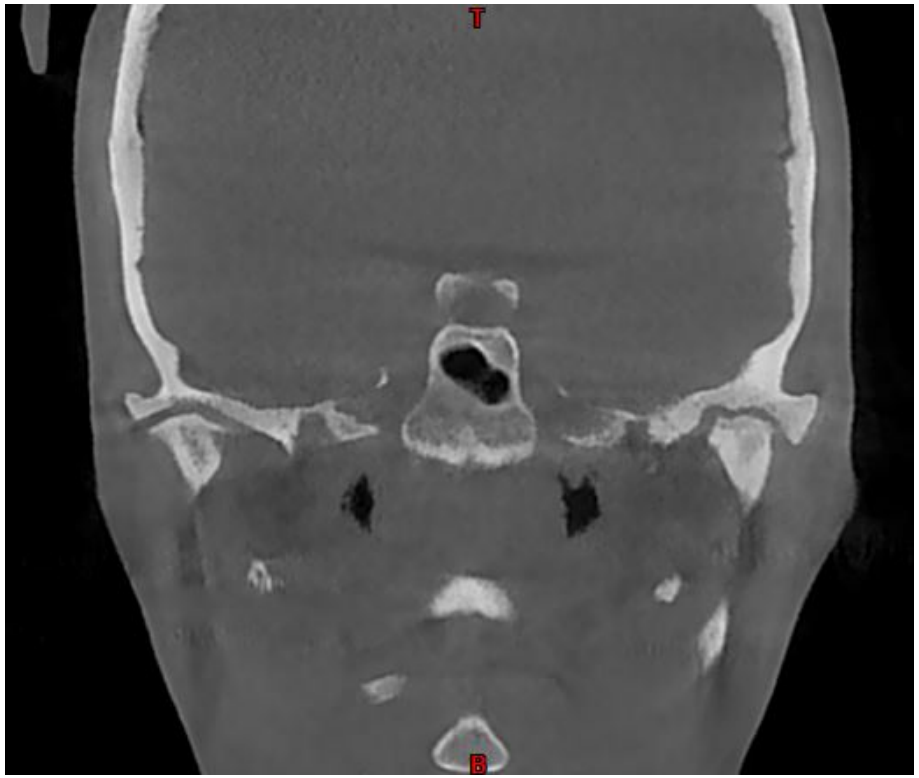
Int J Oral Maxillofac Surg. 2021
Feb;50(2):212-219. doi: 10.1016/
j.ijom.2020.04.004. Epub 2020 Jun 9.

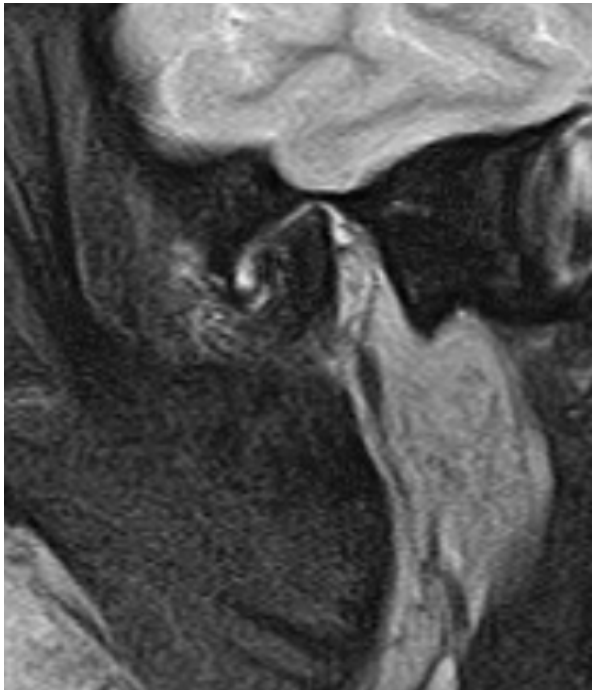
Protocol for fully digital and customized management of concomitant temporomandibular joint replacement and orthognathic surgery

S. Sembronio, A. Tel, M. Robiony: Protocol for fully digital and customized management of concomitant temporomandibular joint replacement and orthognathic surgery. Int. J. Oral Maxillofac. Surg. 2019; xxx: xxx–xxx. © 2020 International Association of Oral and Maxillofacial Surgeons. Published by Elsevier Ltd. All rights reserved.



VALUTAZIONE RADIOGRAFICA





TC:

matrice: 512 x 512 px; se possibile 756 x 756 o maggiore, anche interpolando.

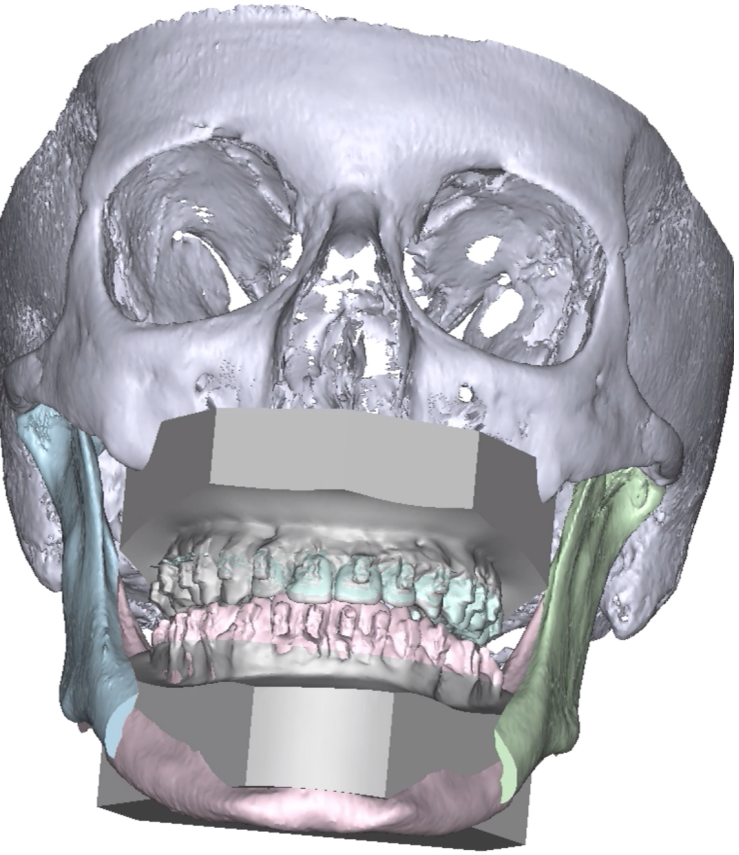
slice thickness: 0,625 mm

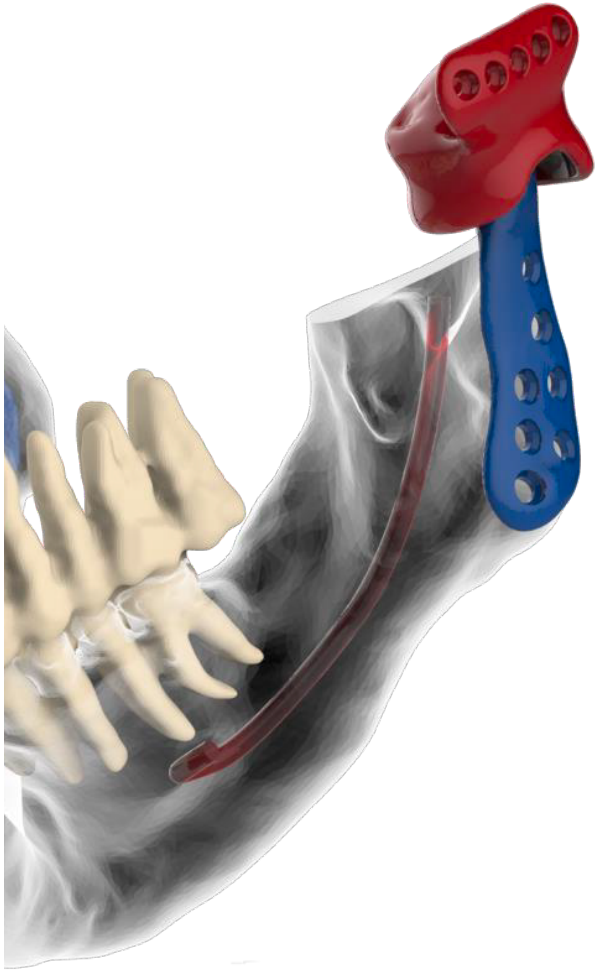
RM:

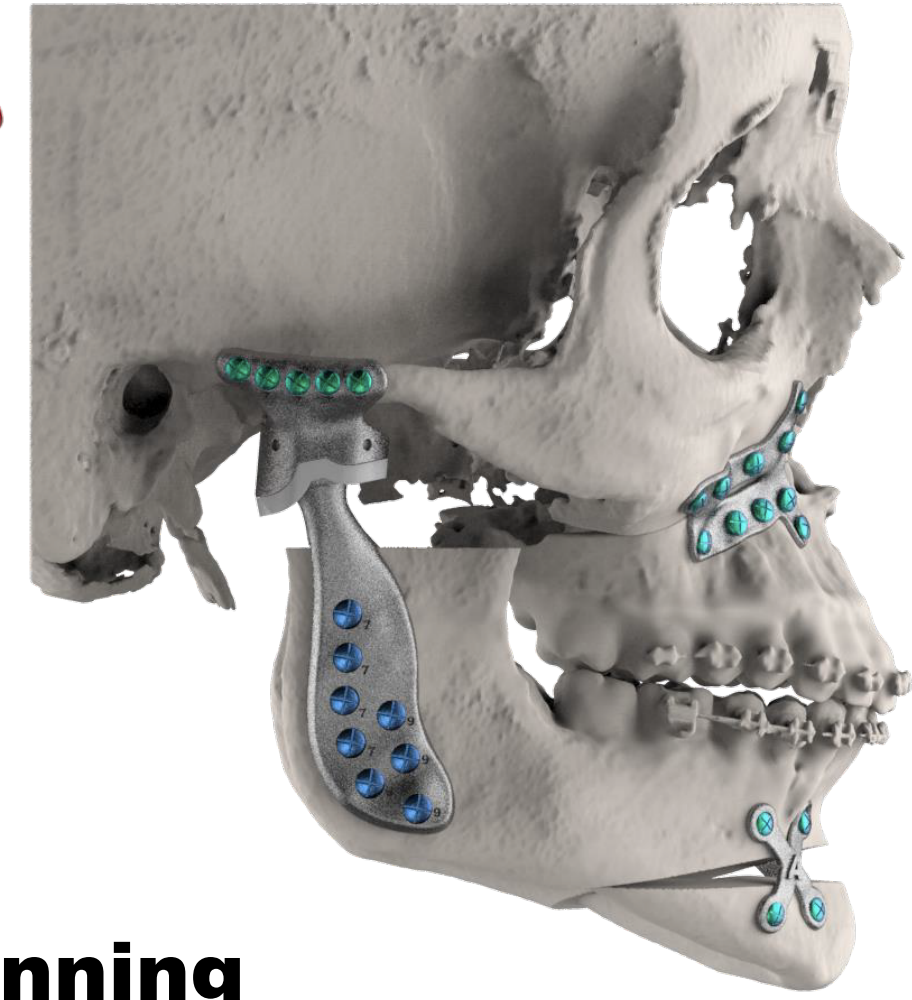
matrice: 512 x 512 (anche 256 x 256, interpolata a 512 x 512)

slice thickness: 1 mm

PROGETTUALE/CHECK DEL MANUFATTO CUSTOM







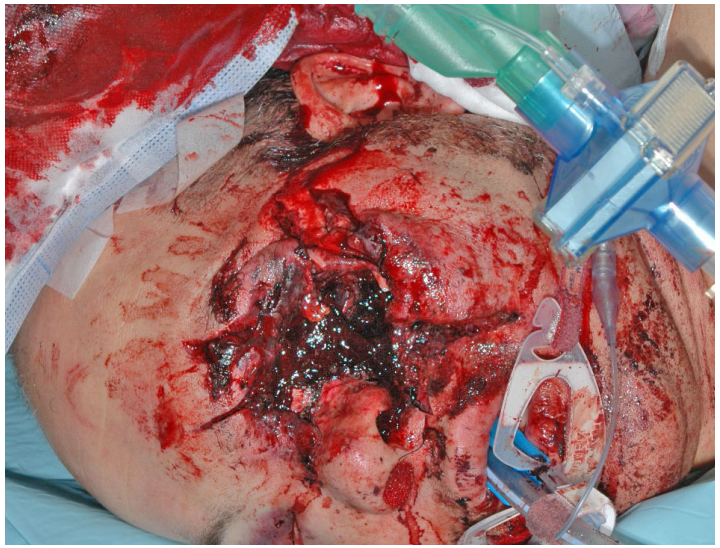
Virtual Surgical Planning

ALGORITMO DI GESTIONE DEL TRAUMA

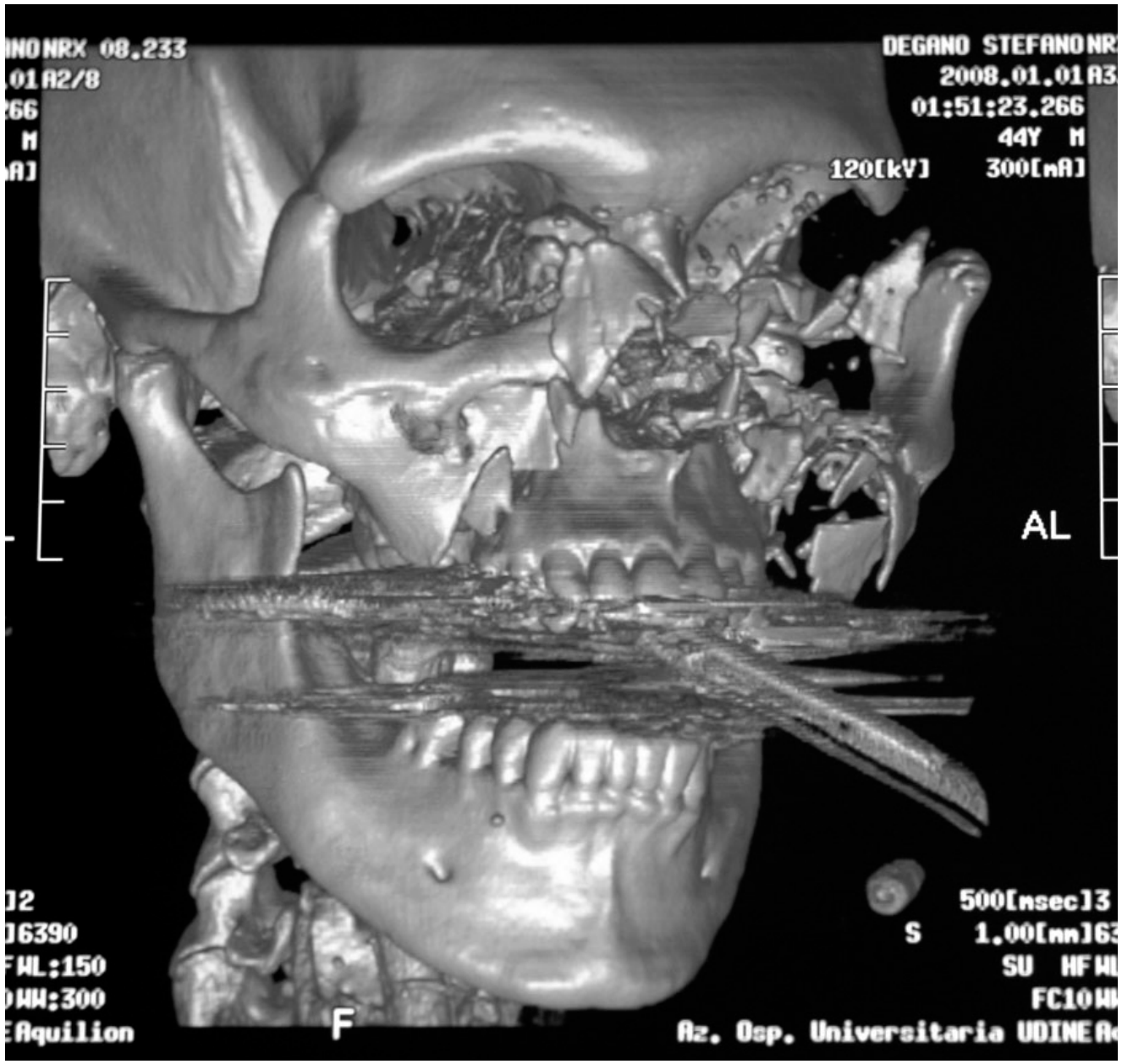
TRAUMA

ABCD → PROCEDURE IN EMERGENZA

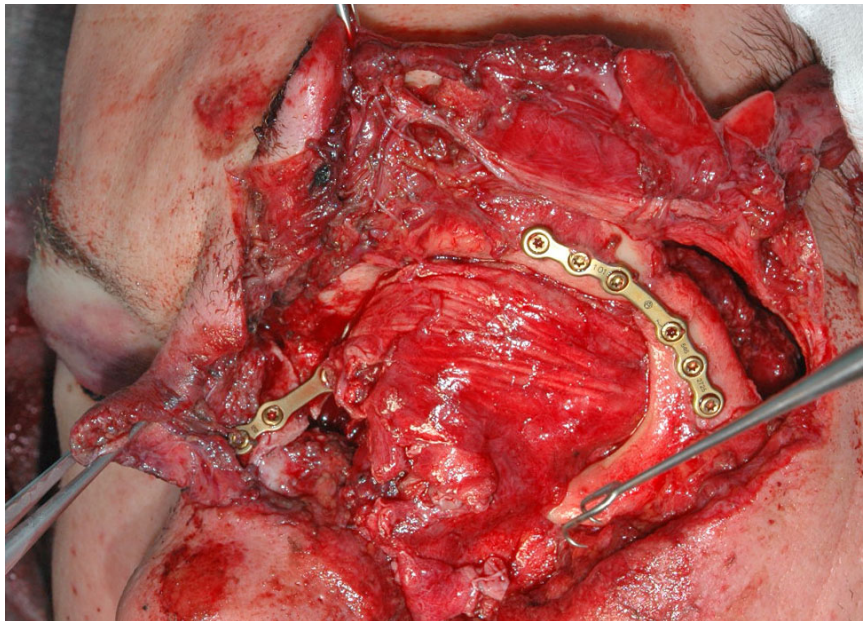
TC → URGENZA NON DIFFERIBILE → INTERVENTO NON GUIDATO

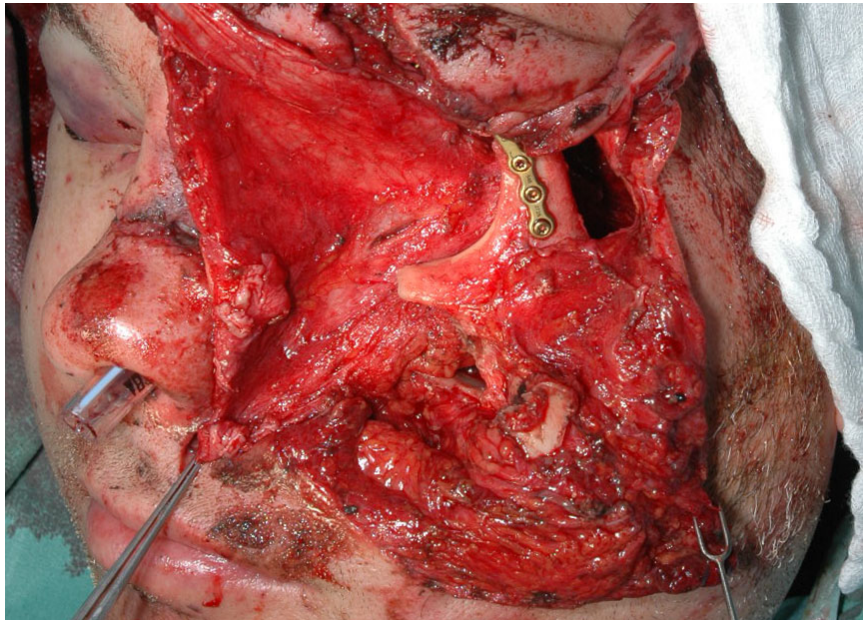




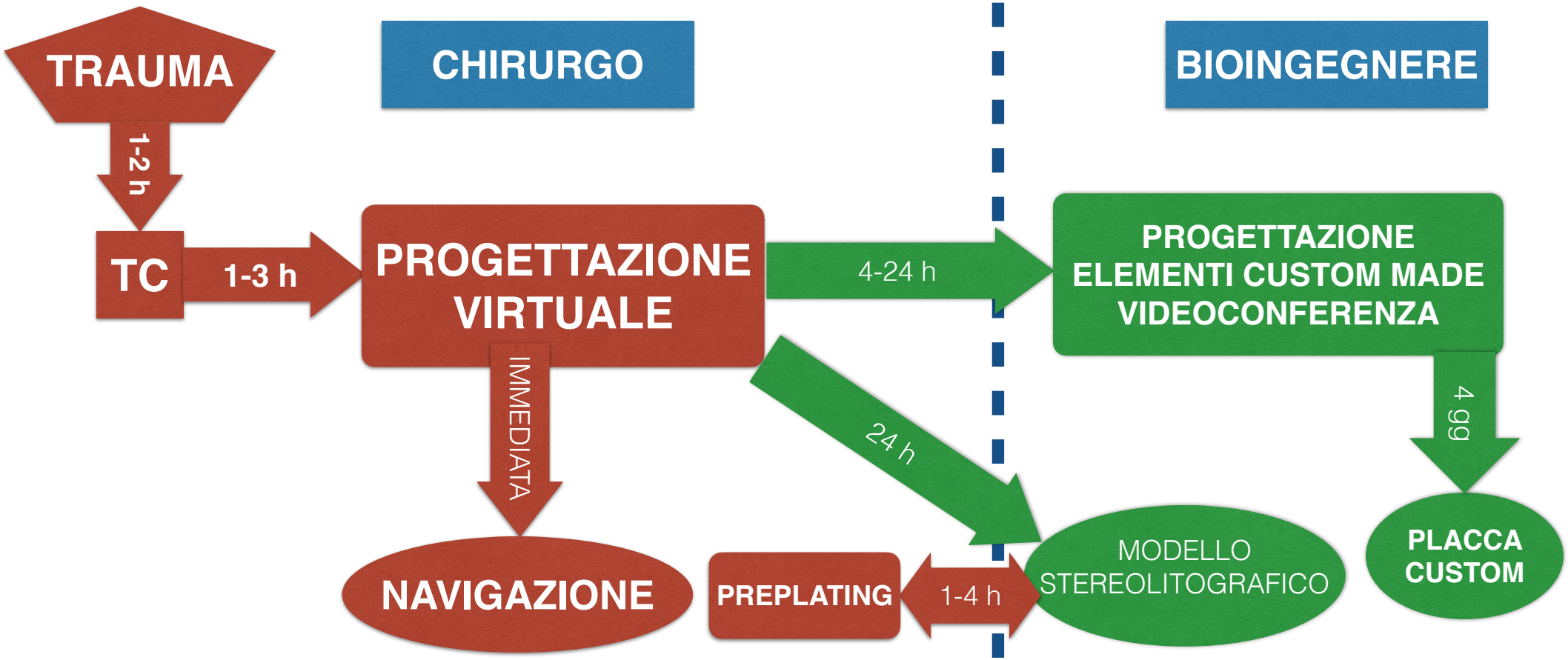

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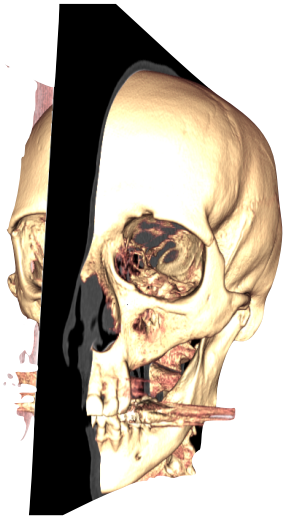


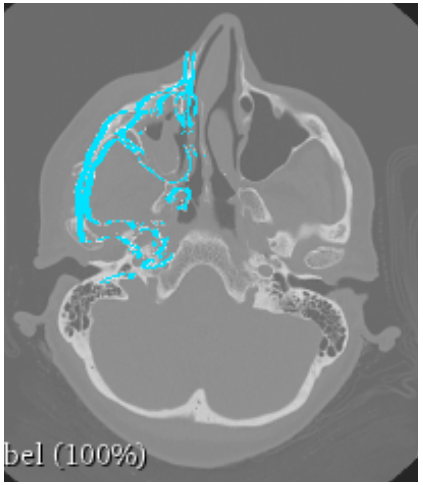


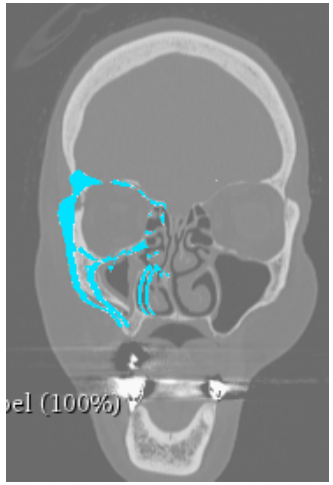
VIRTUAL SURGICAL PLANNING NEL TRAUMA: TEMPISTICA

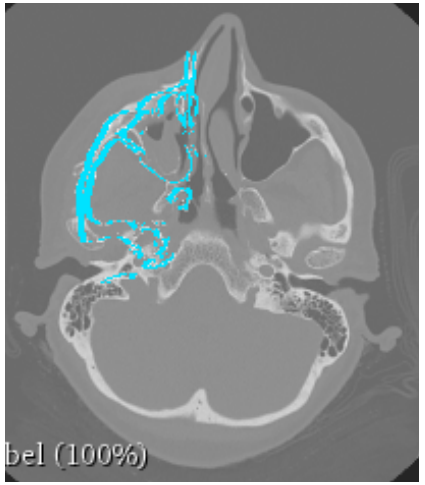


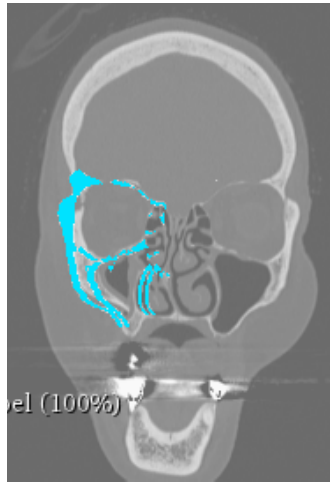
ALGORITMO DI PROGETTAZIONE: MIRRORING

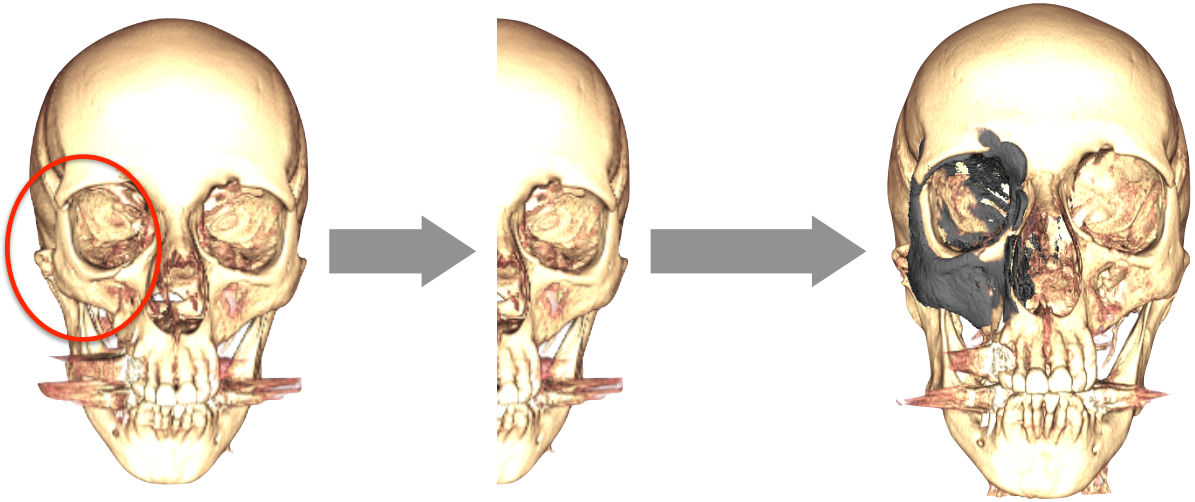


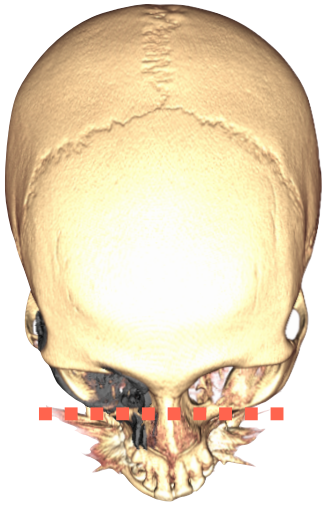




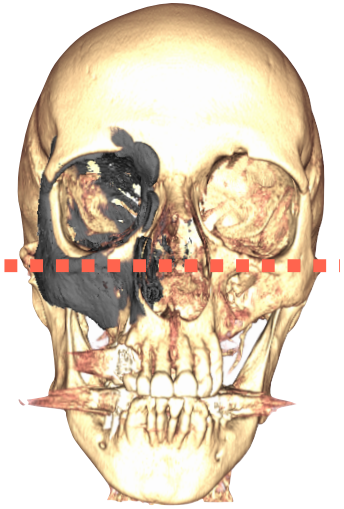








Esatta simmetria nella proiezione zigomatica

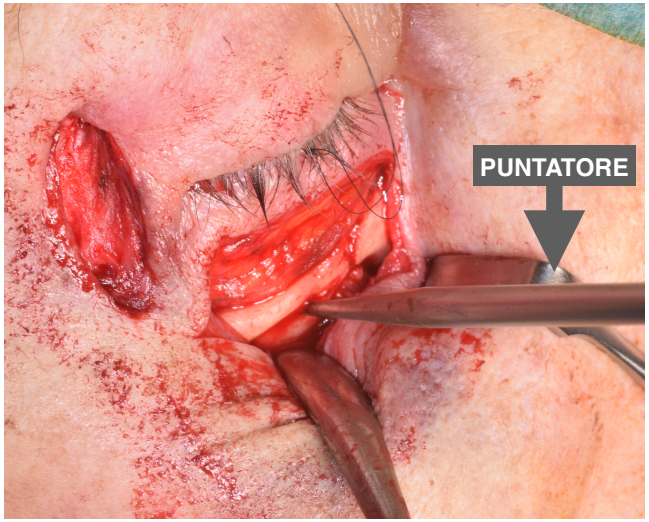


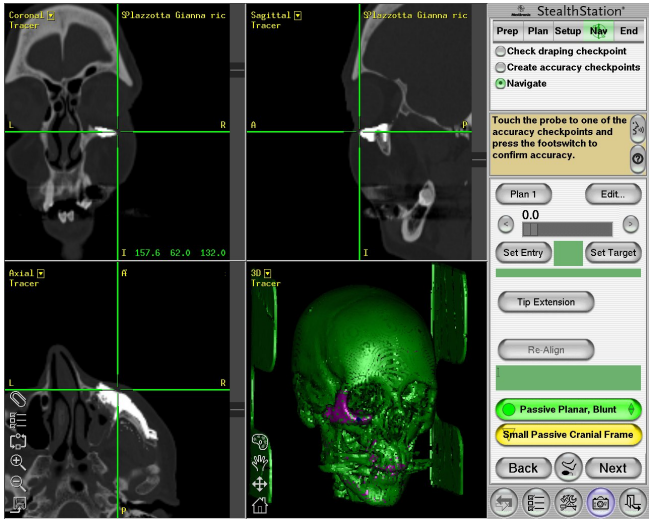
Esatta simmetria nel piano del pavimento orbitario

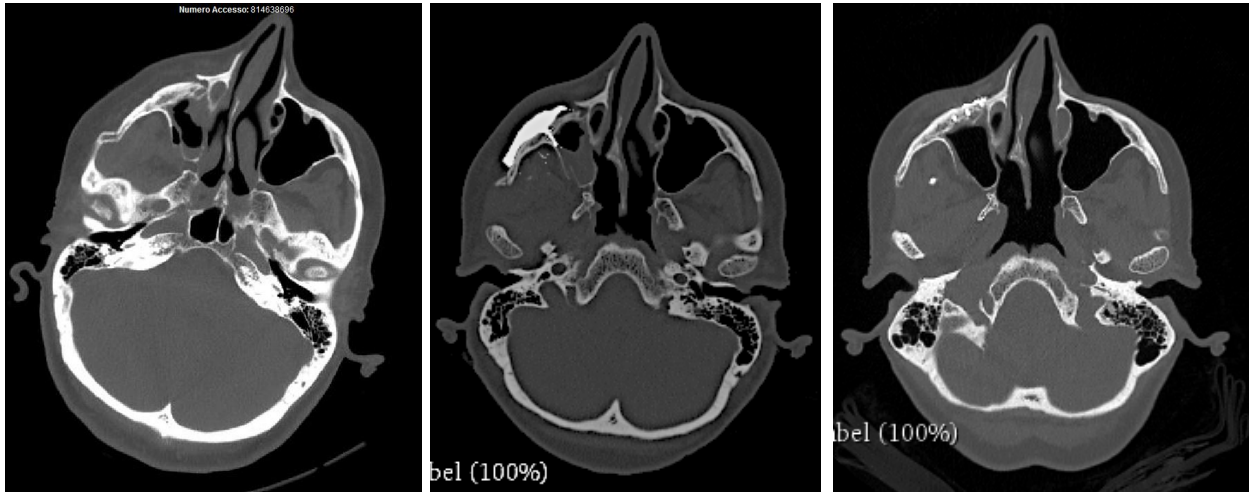


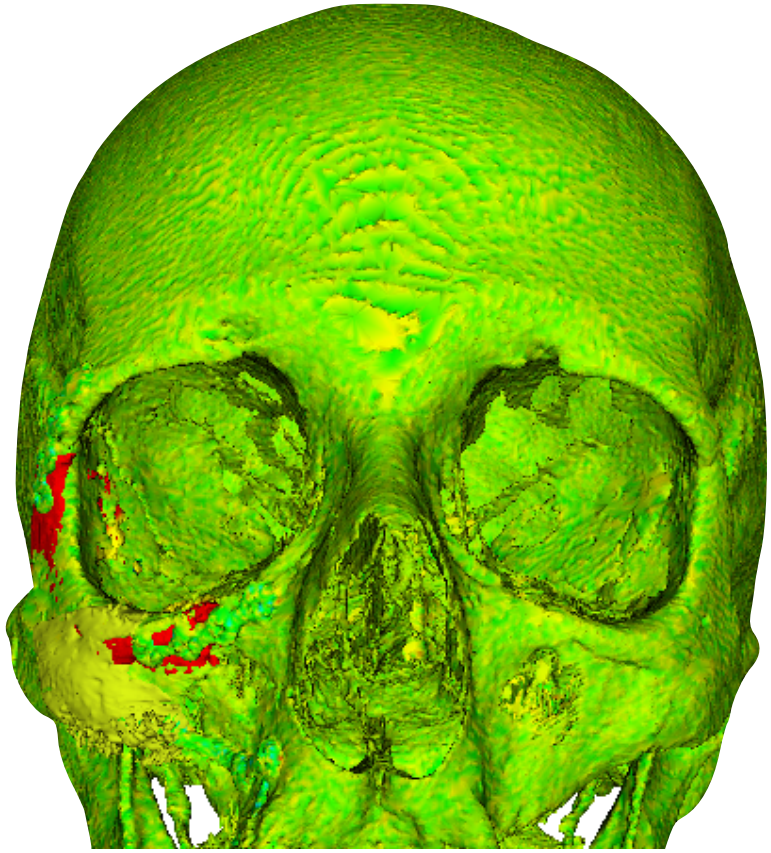

Numero Accesso: 814638696

CONTROLLO DELLA RIDUZIONE MEDIANTE NAVIGAZIONE
VALIDAZIONE DEI RISULTATI MEDIANTE COLOR MAP

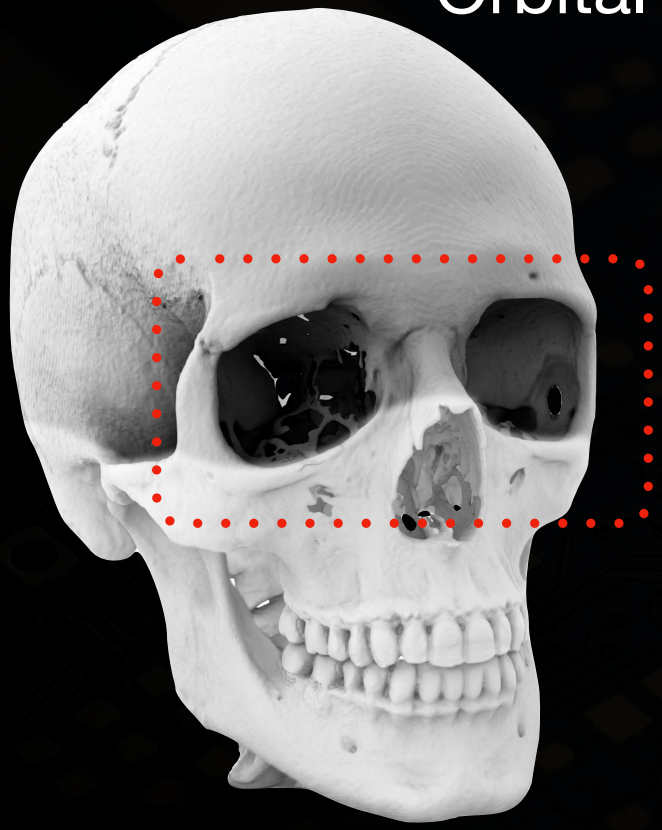








Orbital oncology



- Tumors located in depth, poorly accessible, with critical anatomical relationships

Int. J. Oral Maxillofac. Surg. 2022; 51: 269–278
https://doi.org/10.1016/j.ijom.2021.07.013, available online at https://www.sciencedirect.com

International Journal of Oral & Maxillofacial Surgery

Clinical Paper

Computer Assisted Surgery

Virtual planning and navigation for targeted excision of intraorbital space-occupying lesions: proposal of a computer-guided protocol

A. Tel[1], F. Murta[2], S. Sembronio[1], F. Costa[1], M. Robiony[1]
[1]Maxillofacial Surgery Department, Academic Hospital of Udine, Department of Medicine, University of Udine, Udine, Italy; [2]Moorfields Eye Hospital NHS Foundation Trust, London, UK

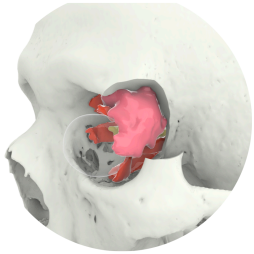


A. Tel, F. Murta, S. Sembronio, F. Costa, M. Robiony: Virtual planning and navigation for targeted excision of intraorbital space-occupying lesions: proposal of a computer-guided protocol. Int. J. Oral Maxillofac. Surg. 2022; 51: 269–278. © 2021 International Association of Oral and Maxillofacial Surgeons. Published by Elsevier Inc. All rights reserved.

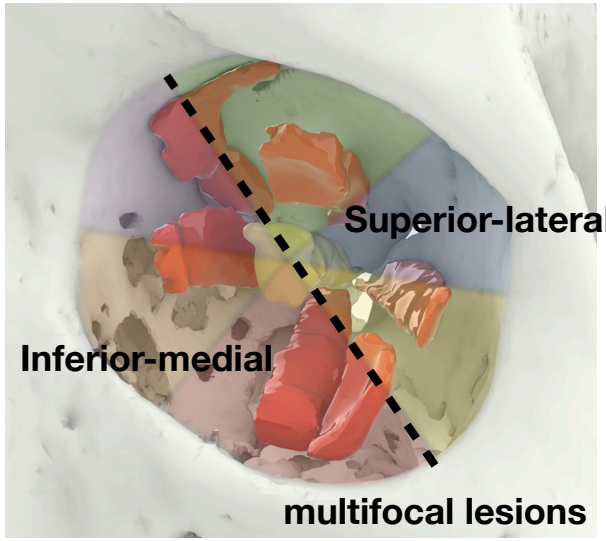
Abstract. The purpose of this study was to present an innovative approach for the preoperative assessment and intraoperative targeted excision of masses occupying the intraorbital space based on multimodal image fusion, segmentation, virtual models, digital planning, and navigation. Nineteen patients were studied and underwent surgery using the presented workflow, in both open and endoscopic procedures. Three main scenarios were standardized for the application of computer-guided surgery: single masses of the superior-lateral compartment, single masses of the inferior-medial compartment, and multifocal masses. An operative protocol was devised, and the accuracy of the osteotomies was analysed. All patients were managed successfully by applying the same protocol. No intraoperative complications were reported. The accuracy of the osteotomies was evaluated as a surrogate endpoint for the overall precision of surgery, showing average discrepancies of <1 mm for lateral marginotomies and <0.5 mm for endoscopic osteotomies. This study outlines an operative workflow for the implementation of virtual models to excise orbital masses, enhancing in-depth preoperative understanding of the anatomical relationships within the orbital space and increasing precision in both open and endoscopic approaches.

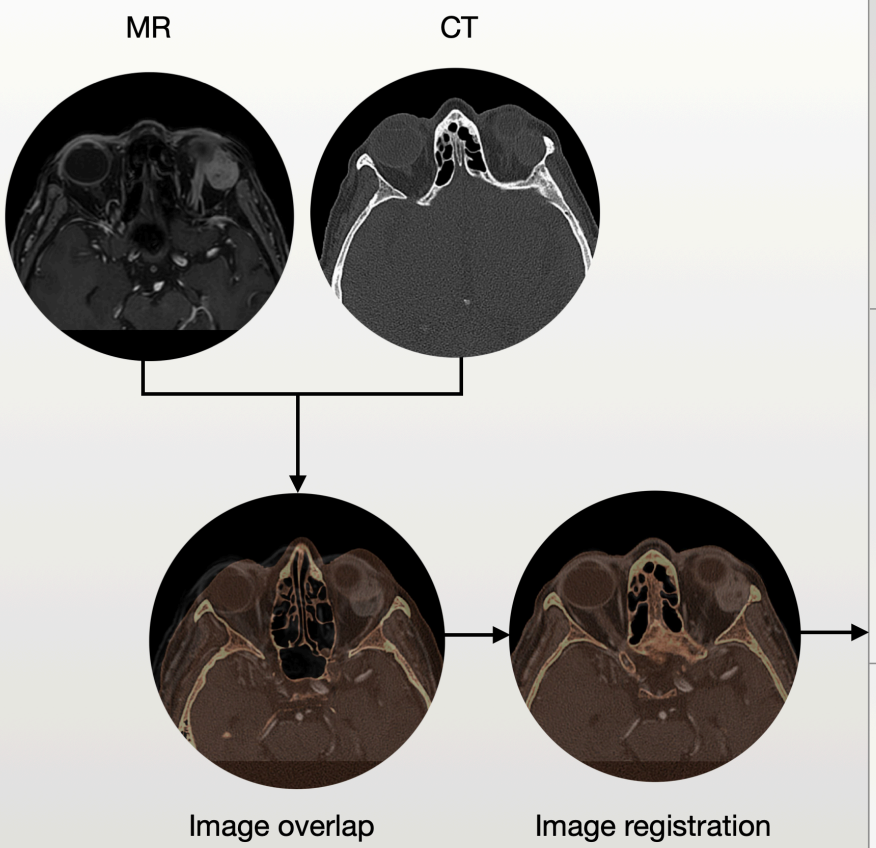
Key words: orbital neoplasms; three-dimensional imaging; computer-assisted surgery; neuronavigation; computer-aided design.

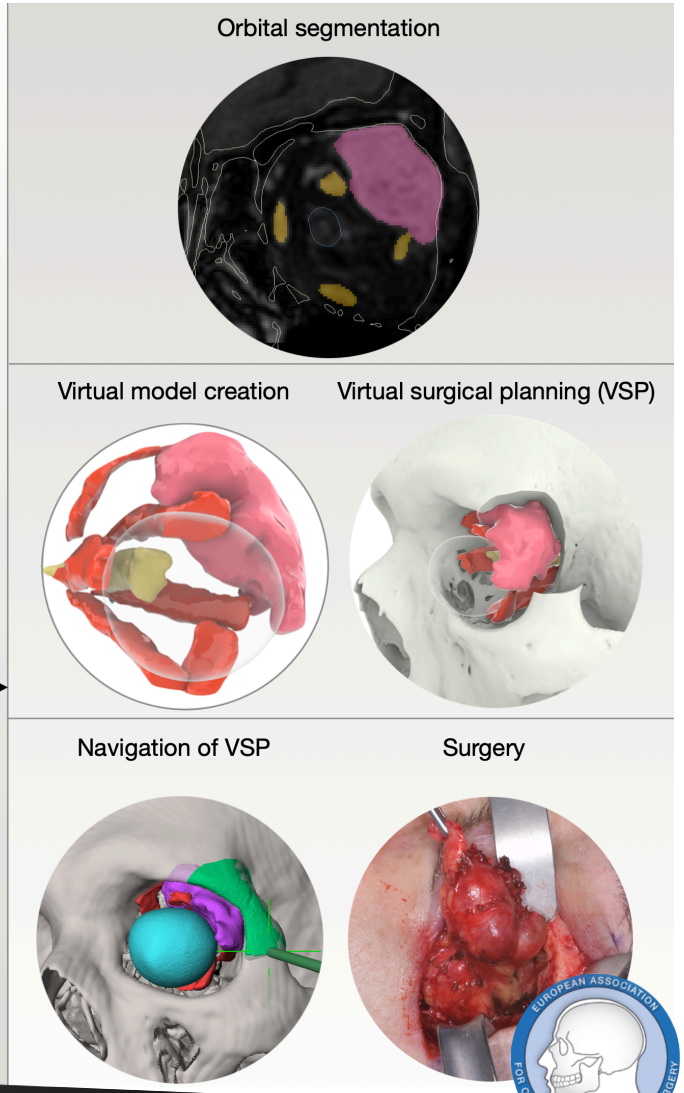
Accepted for publication 21 July 2021
Available online 7 August 2021



Orbital neoplasms

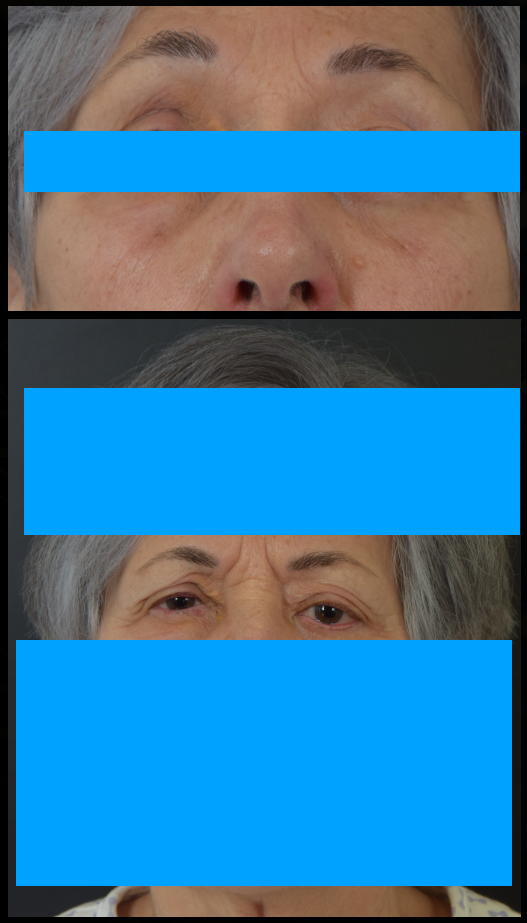


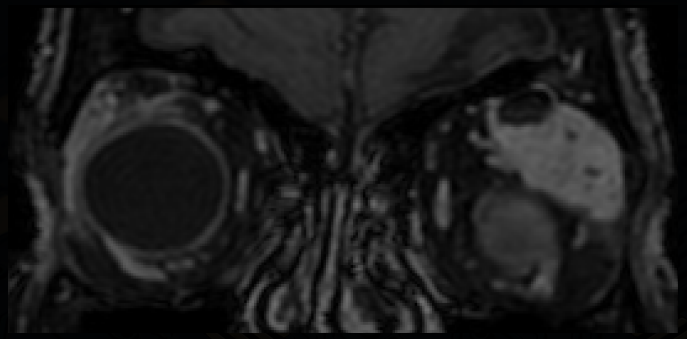


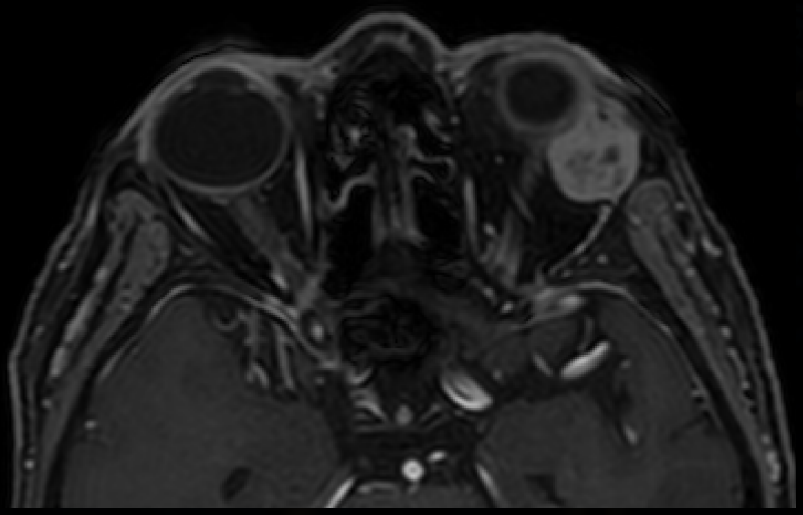


Mass of the superior-lateral compartment:

pleomorphic adenoma arising from the left lacrimal gland



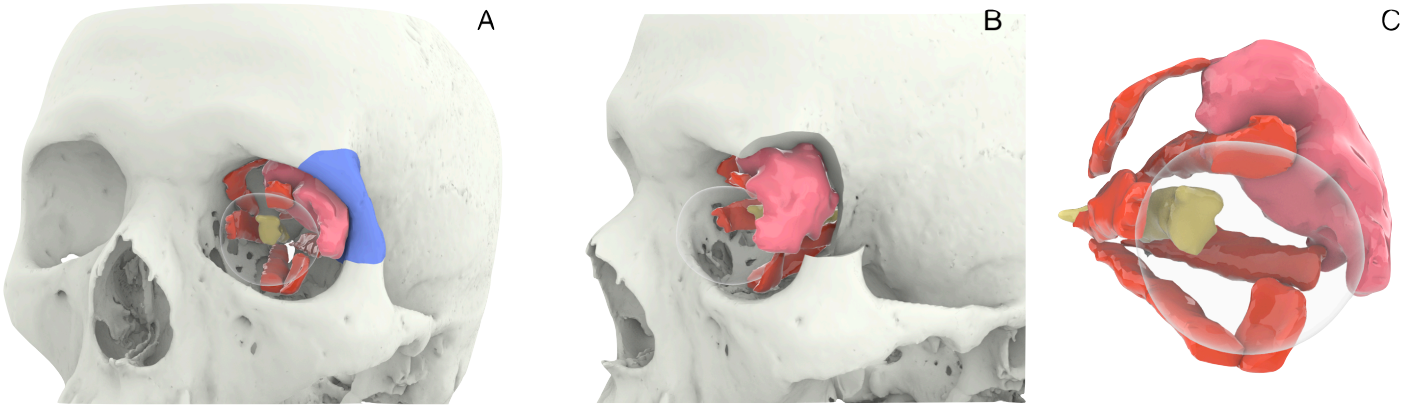




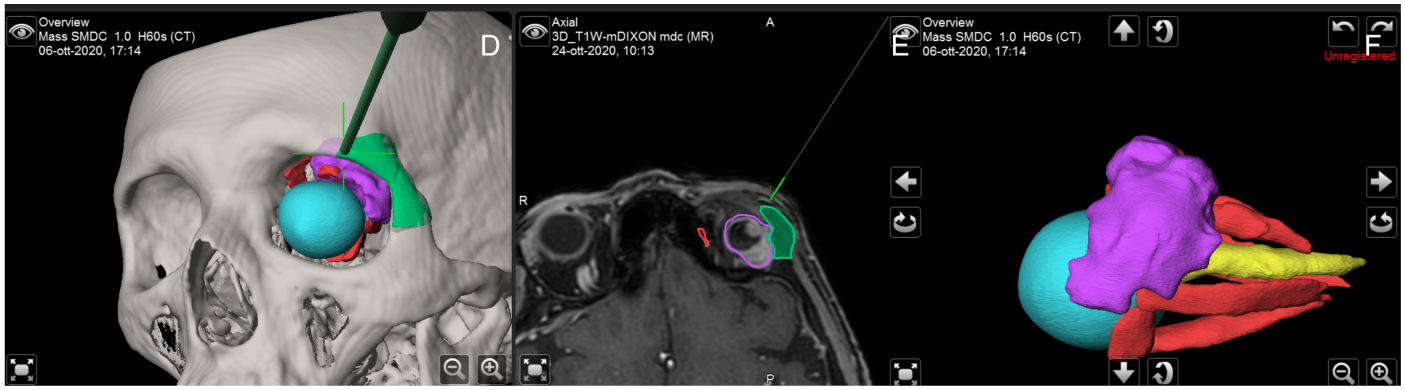


Masses of the superior-lateral division

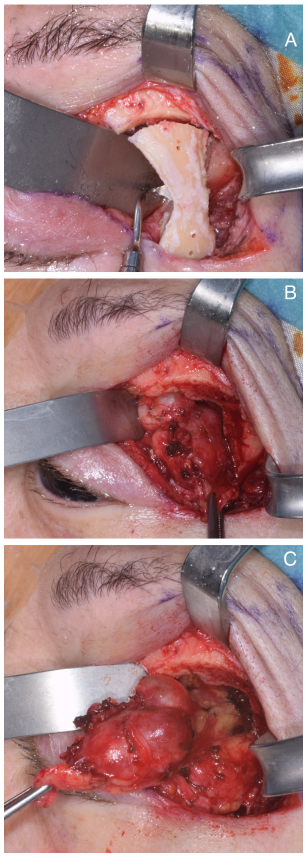
Virtual surgical planning



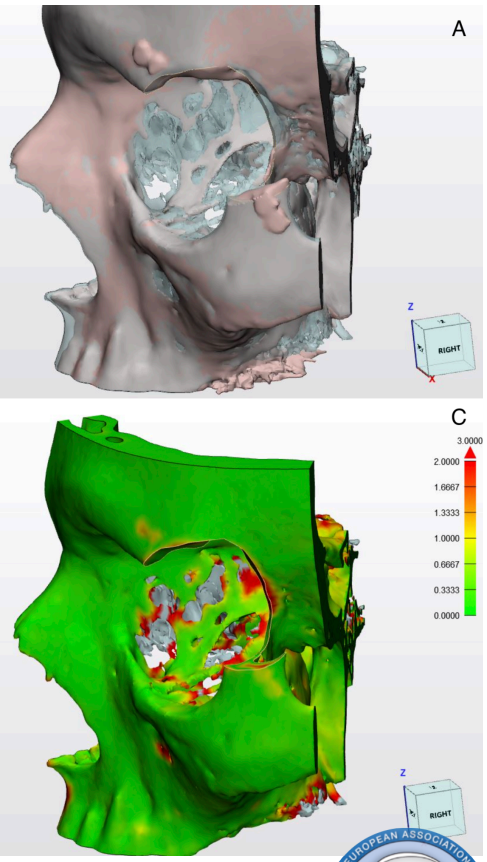
Intraoperative navigation of virtual surgical planning



Open approaches



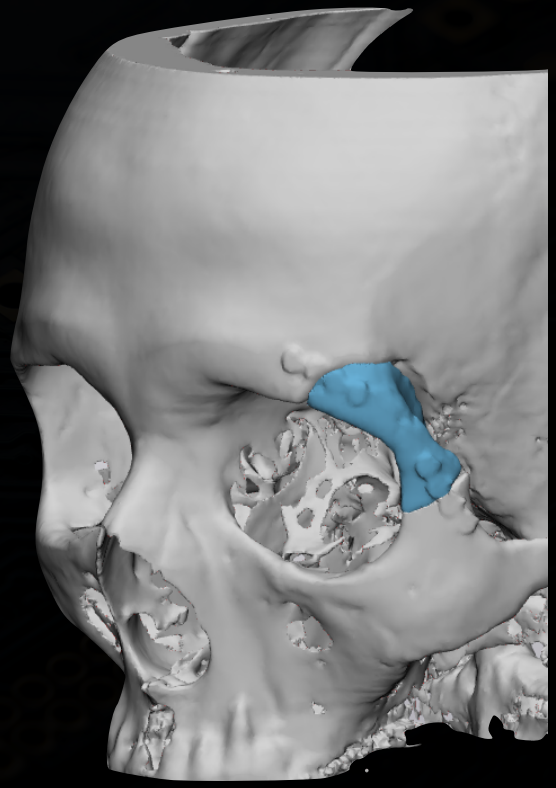
RMSE inspection



Postoperative appearance

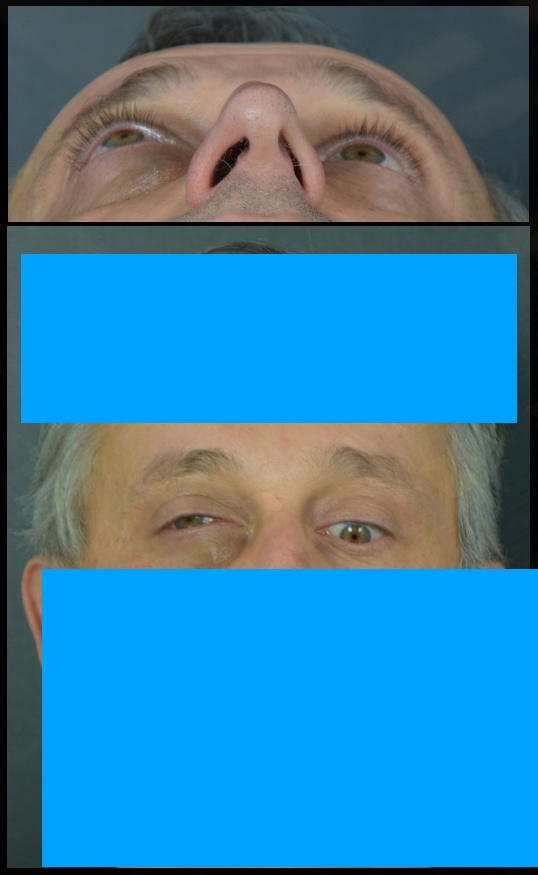


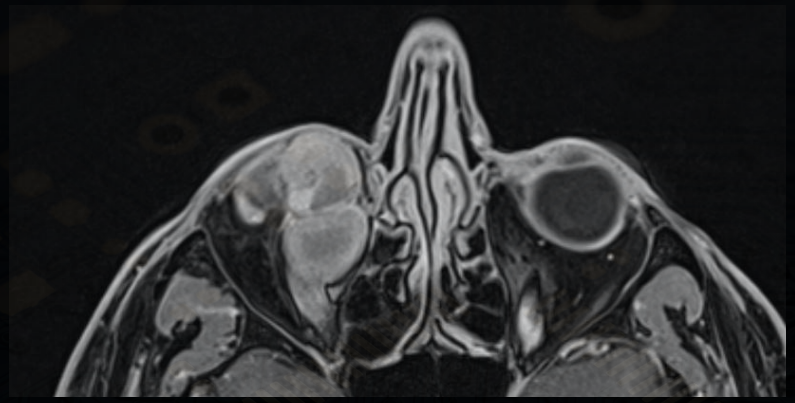


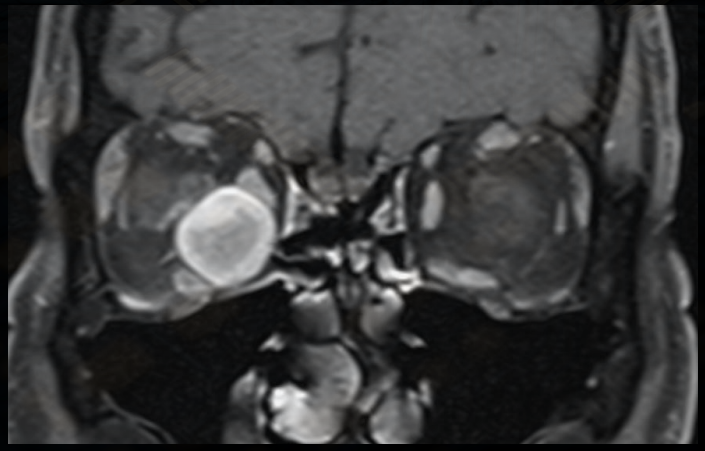


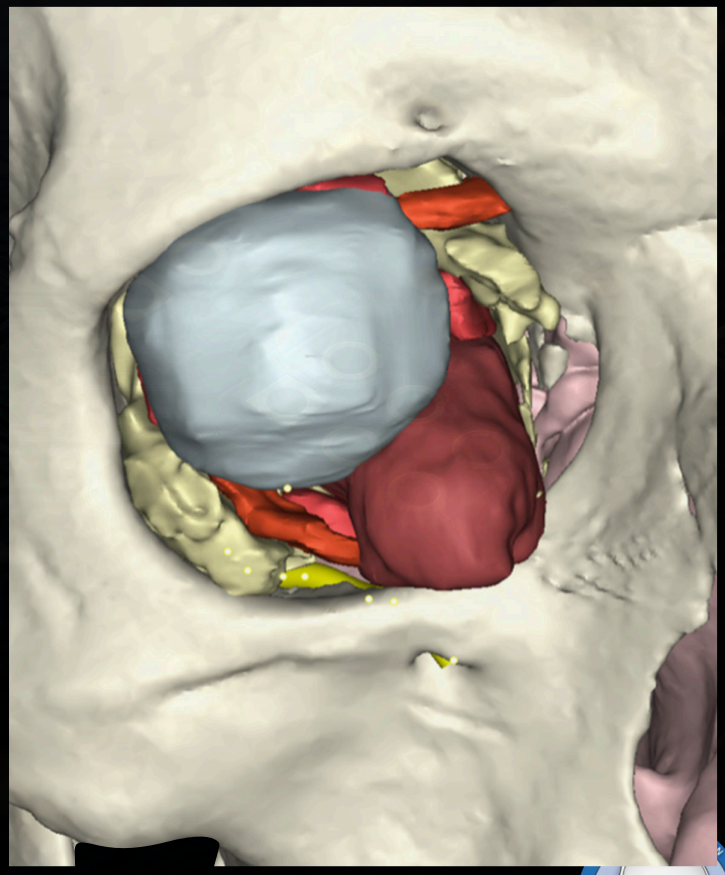
Mass of the inferior-medial compartment:

cavernous hemangioma arising above the orbital floor









frontiers in Surgery

ORIGINAL RESEARCH
published: 23 August 2021
doi: 10.3389/fsurg.2021.715262

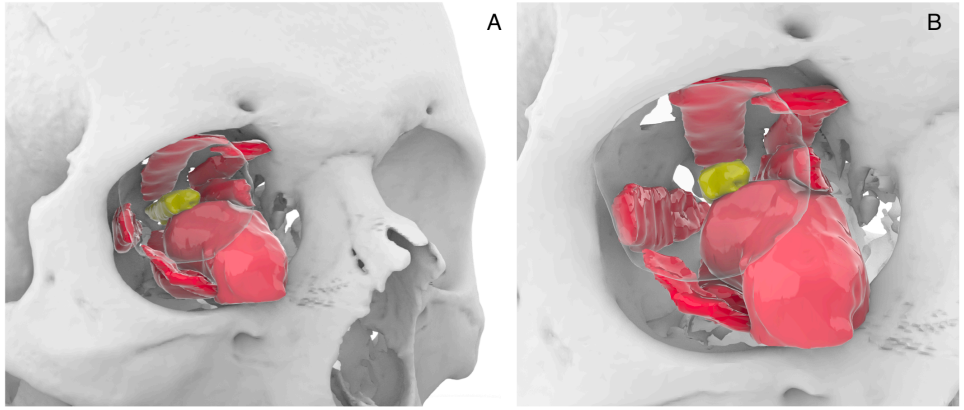
The Transantral Endoscopic Approach: A Portal for Masses of the Inferior Orbit—Improving Surgeons' Experience Through Virtual Endoscopy and Augmented Reality

*Alessandro Tel[1], Lorenzo Arboit[2], Salvatore Sembronio[1], Fabio Costa[1], Riccardo Nocini[3] and Massimo Robiony[1]**

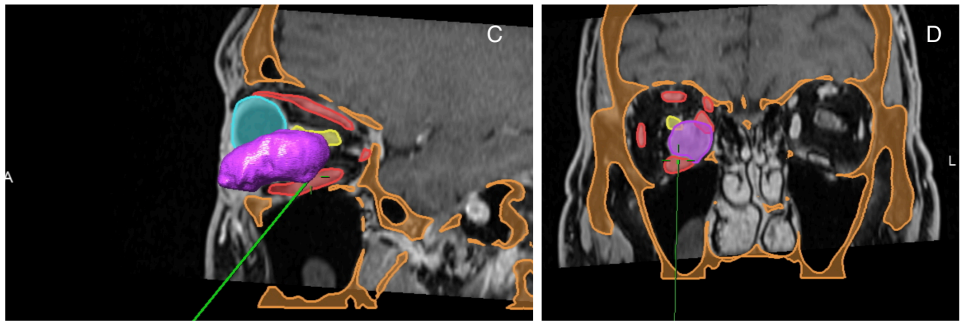
[1] Department of Maxillofacial Surgery, University Hospital of Udine, Udine, Italy, [2] Faculty of Medicine and Surgery, Sant'Anna School of Advanced Studies, Pisa, Italy, [3] Department of Otorhinolaryngology, University Hospital of Verona, Verona, Italy

Masses of the inferior-medial division

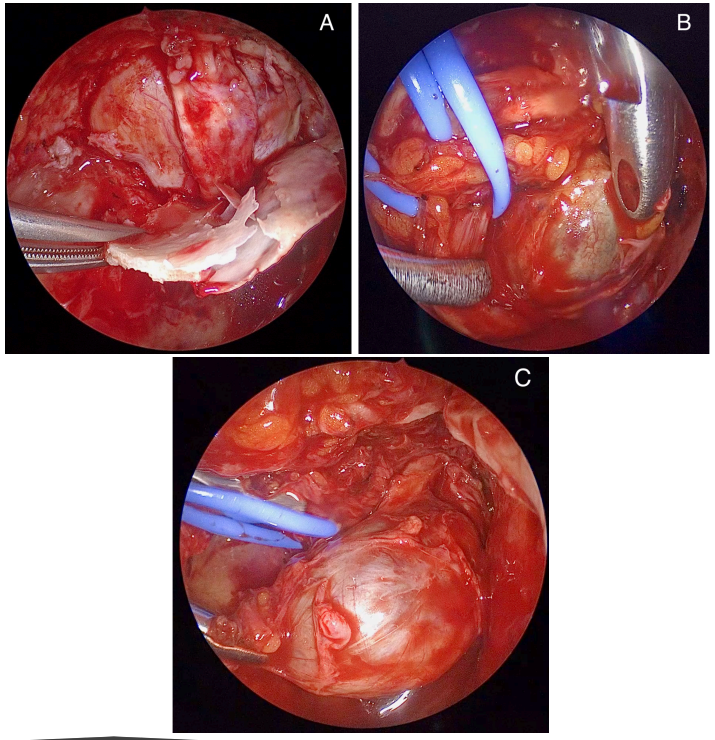
Segmentation and Virtual Surgical Planning



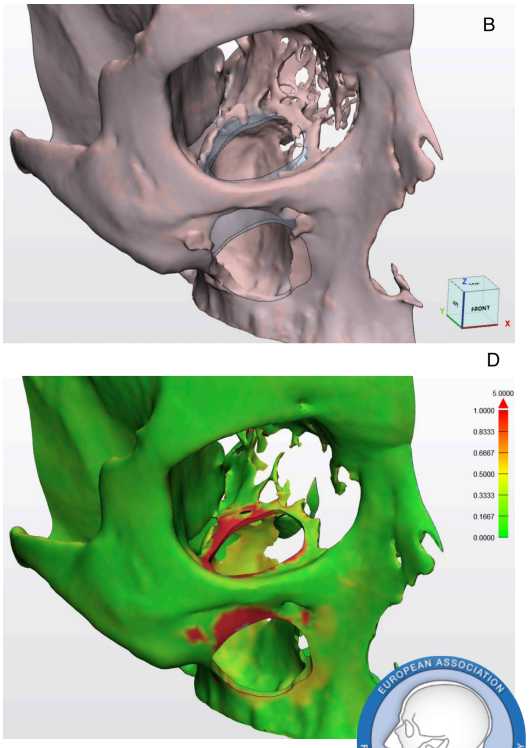
Intraoperative navigation



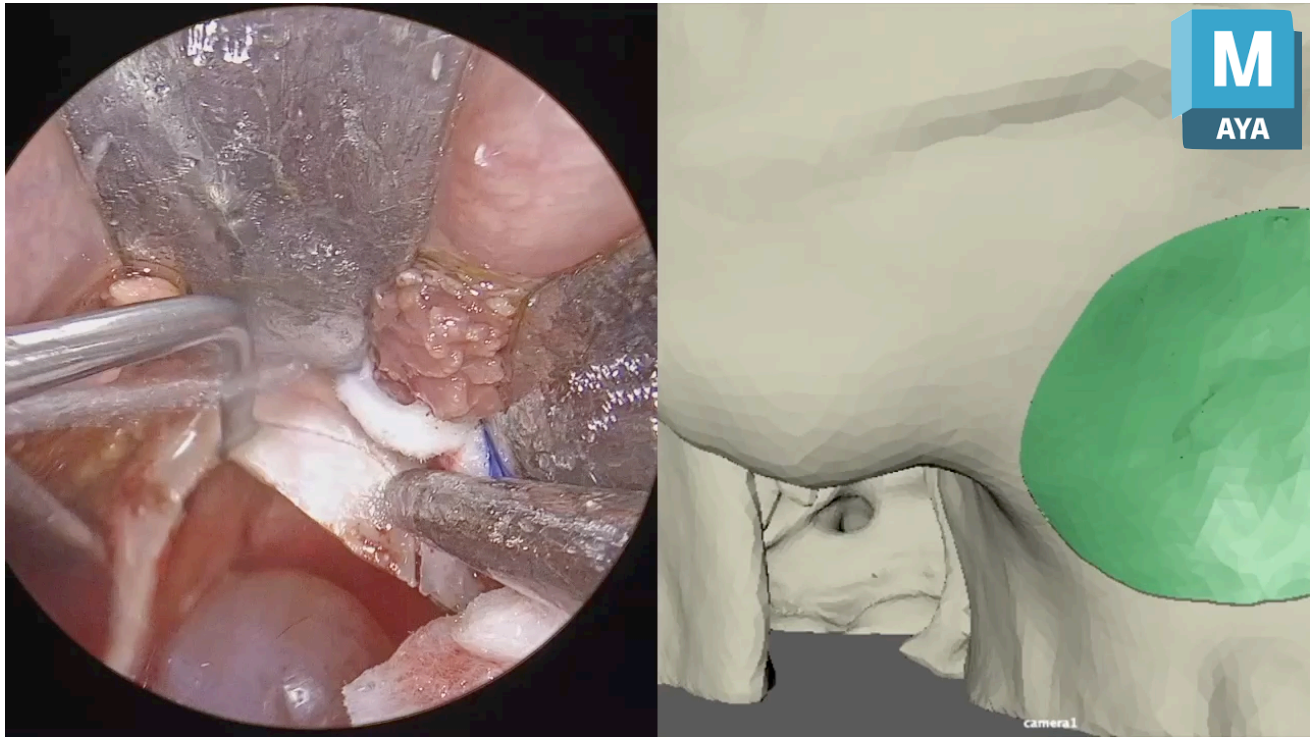
Endoscopic removal

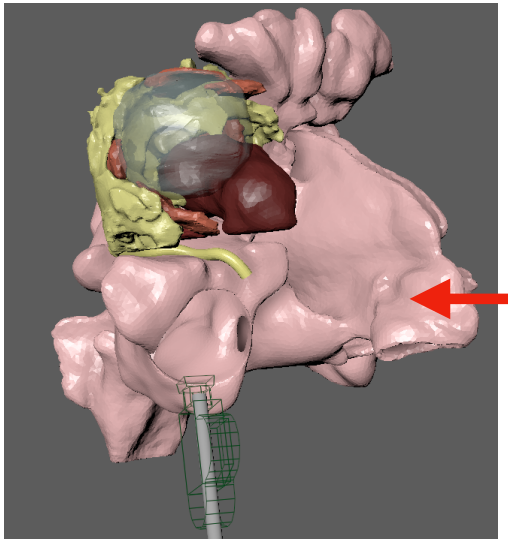


RMSE

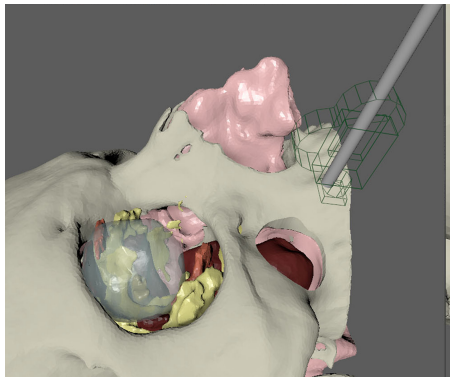


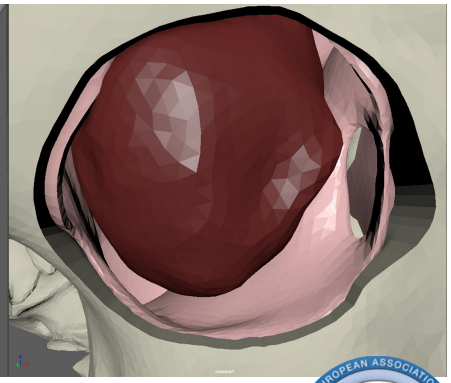
Cinematic Virtual Surgical Planning and Virtual Endoscopy











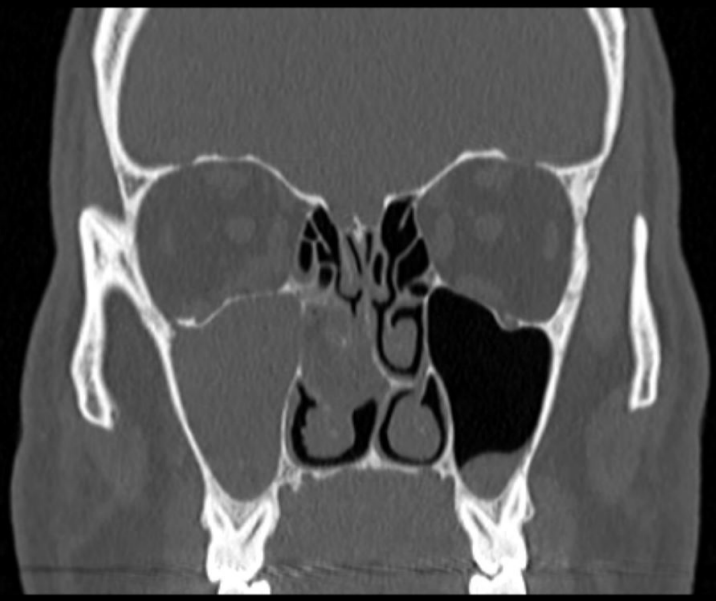
Materialise Mimics → M AYA → FBX

Complete mass excision and reconstruction of the orbital floor

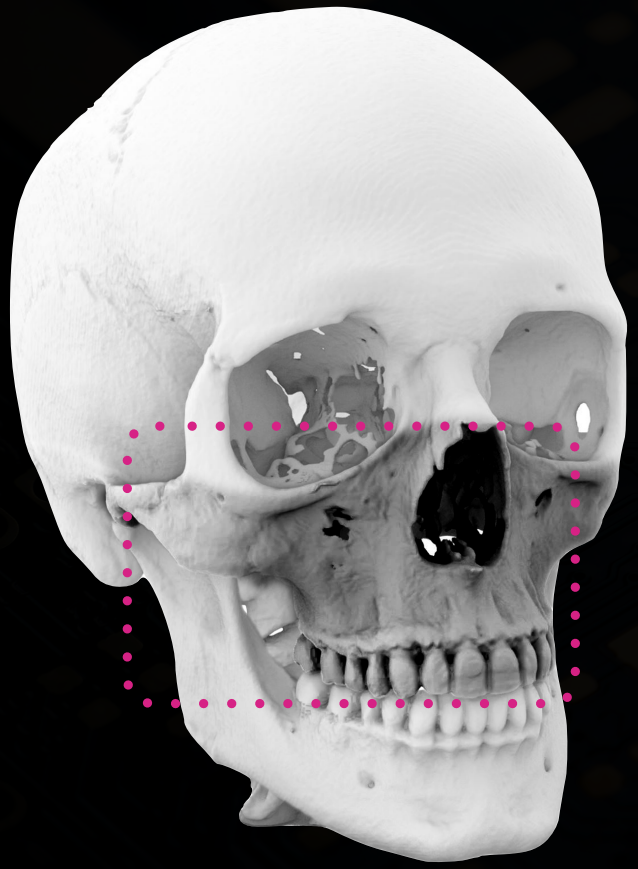
immediate postoperative CT







Deep Facial Compartments



- Tumors located in depth, in critical and difficult-to-access areas

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ORIGINAL RESEARCH
published: 13 May 2022
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Anatomical Computerized Exploration to Excise Malignancies in Deep Facial Compartments: An Advanced Virtual Reality Protocol for a Tailored Surgical Approach

Alessandro Tel[1], *Daniele Bagatto*[2], *Fabio Costa*[1], *Salvatore Sembronio*[1] *and Massimo Robiony*[1]*

[1] Department of Maxillofacial Surgery, University Hospital of Udine, Udine, Italy, [2] Department of Neuroradiology, University Hospital of Udine, Udine, Italy

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Objective/Hypothesis: This study describes the design and application of a novel advanced protocol for virtual three-dimensional anatomical reconstruction of the deep facial compartments, aiming to improve the preoperative understanding and the intraoperative assistance in complex resective surgeries performed for malignant diseases which extend in complex spaces, including the pterygomaxillopalatine fossa, the masticator space, and the infratemporal fossa.

Methods: This study is a non-profit, retrospective, and single-institution case series. The authors clearly describe in detail imaging acquisition protocols which are suitable to segment each target, and a multilayer reconstruction technique is presented to simulate anatomical structures, with particular focus on vascular networks. Virtual surgical planning techniques are individually designed for each case to provide the most effective access to the deep facial compartments. Intraoperative guidance systems, including navigation and virtual endoscopy, are presented, and their role is analyzed.

Results: The study included seven patients with malignant disease located in the deep facial compartments requiring radical resection, and all patients underwent successful application of the protocol. All lesions, except one, were subject to macroscopically radical resection. Vascular structures were identified with overall reconstruction rates superior to 90% for major caliber vessels. Prominent landmarks for virtual endoscopy were identified for each case.

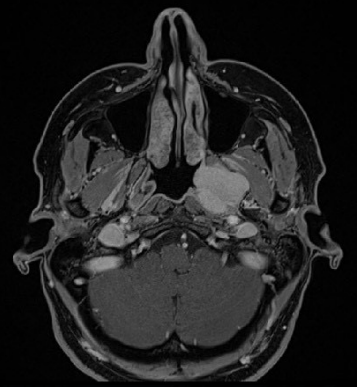
Conclusions: Virtual surgical planning and multilayer anatomical reconstruction are valuable methods to implement for surgeries in deep facial compartments, providing the surgeon with improved understanding of the preoperative condition and intraoperative guidance in critical phases for both open and endoscopic phases. Such techniques allow to tailor each surgical access, limiting morbidity to strictly necessary approaches to reach the disease target.

Keywords: virtual surgical planning, 3D vessels, deep facial compartments, navigation, virtual endoscopy

Surgery in deep facial compartments with multilayer anatomical reconstruction to remove an adenoid cystic carcinoma located in the pterygomaxillo-palatine fossa and basisphenoid

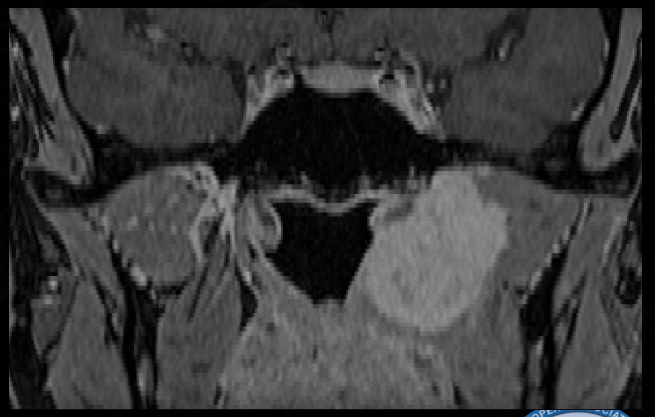




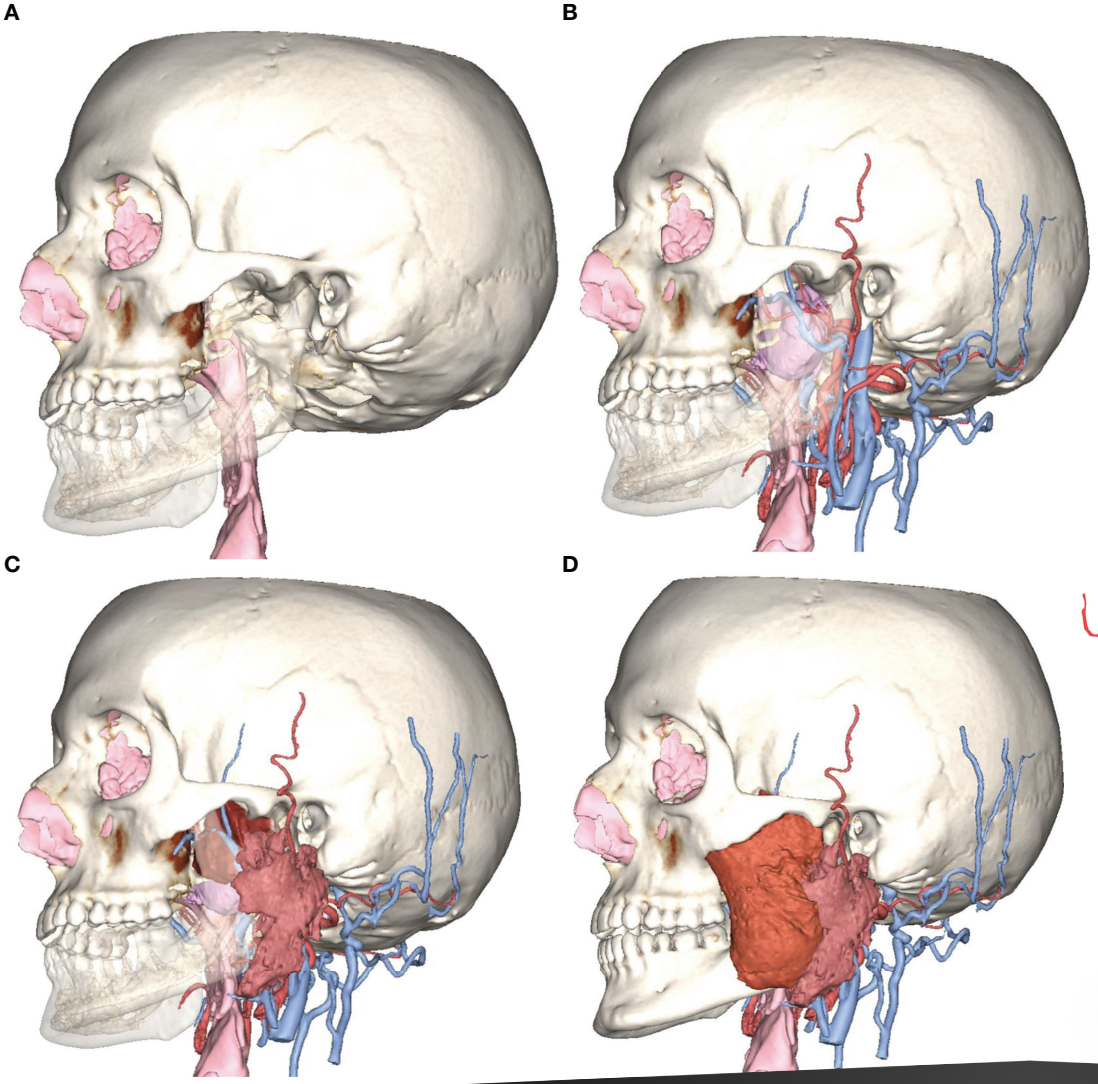




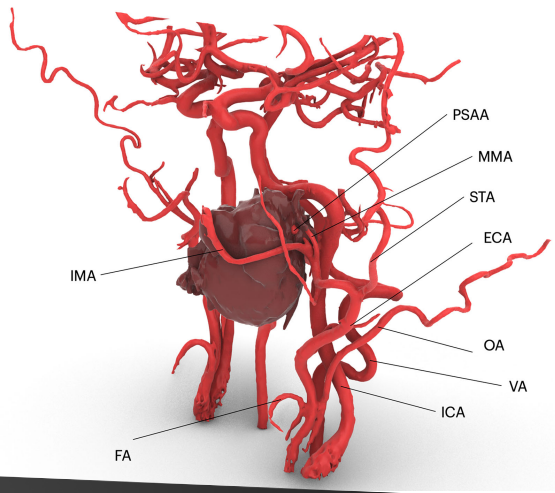


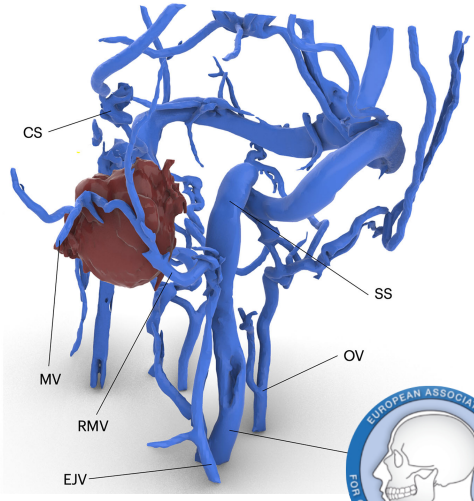


Multilayer anatomical reconstruction: a virtual, patient-specific, anatomy atlas



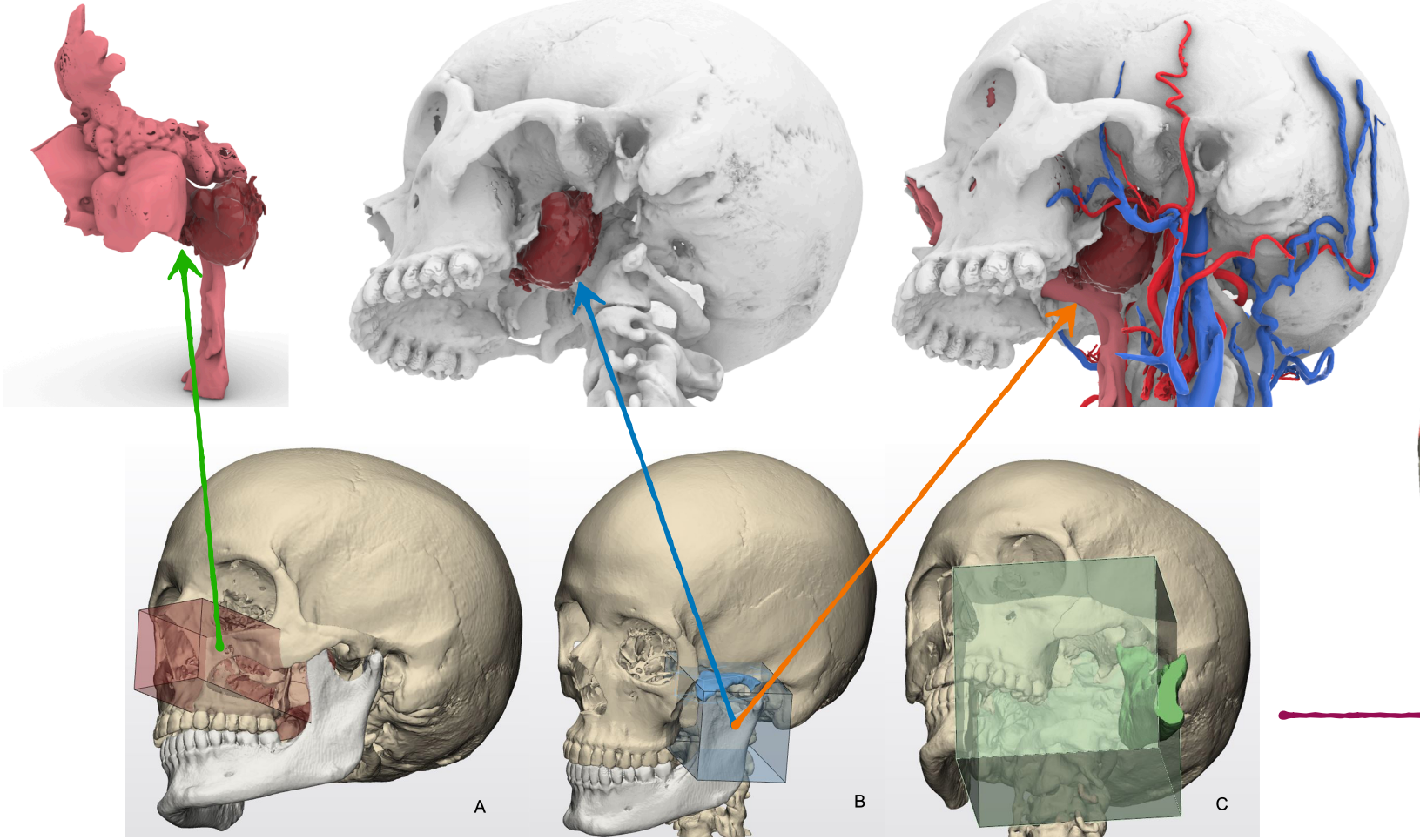
- Skeletal framework and mucosal lining: an ultrathin CT was performed
- Mucosal lining defined the spatial boundaries to simulate virtual endoscopy and was reconstructed from CT scan as well
- Tumor and other soft tissue: patients underwent MR with a 1.5 T in volumetric acquisitions
- Arteries: to better delineate the anatomical relationships between the lesion and both extracranial portion of the internal carotid artery and external carotid artery, patients underwent MR angiography.
- Veins: to detail venous vasculature a MR venography was also



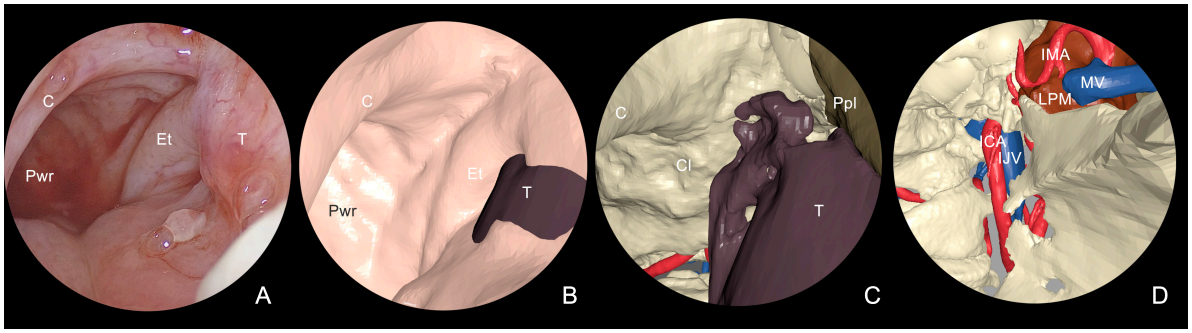


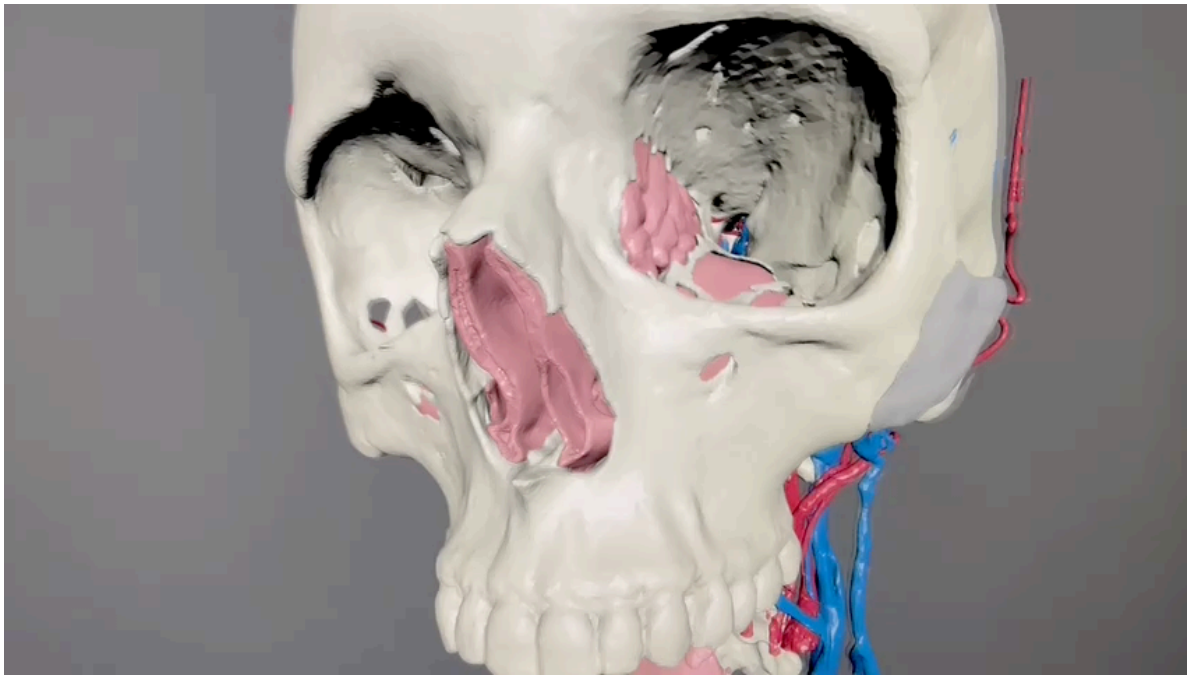
Definition of access portals in virtual surgical planning

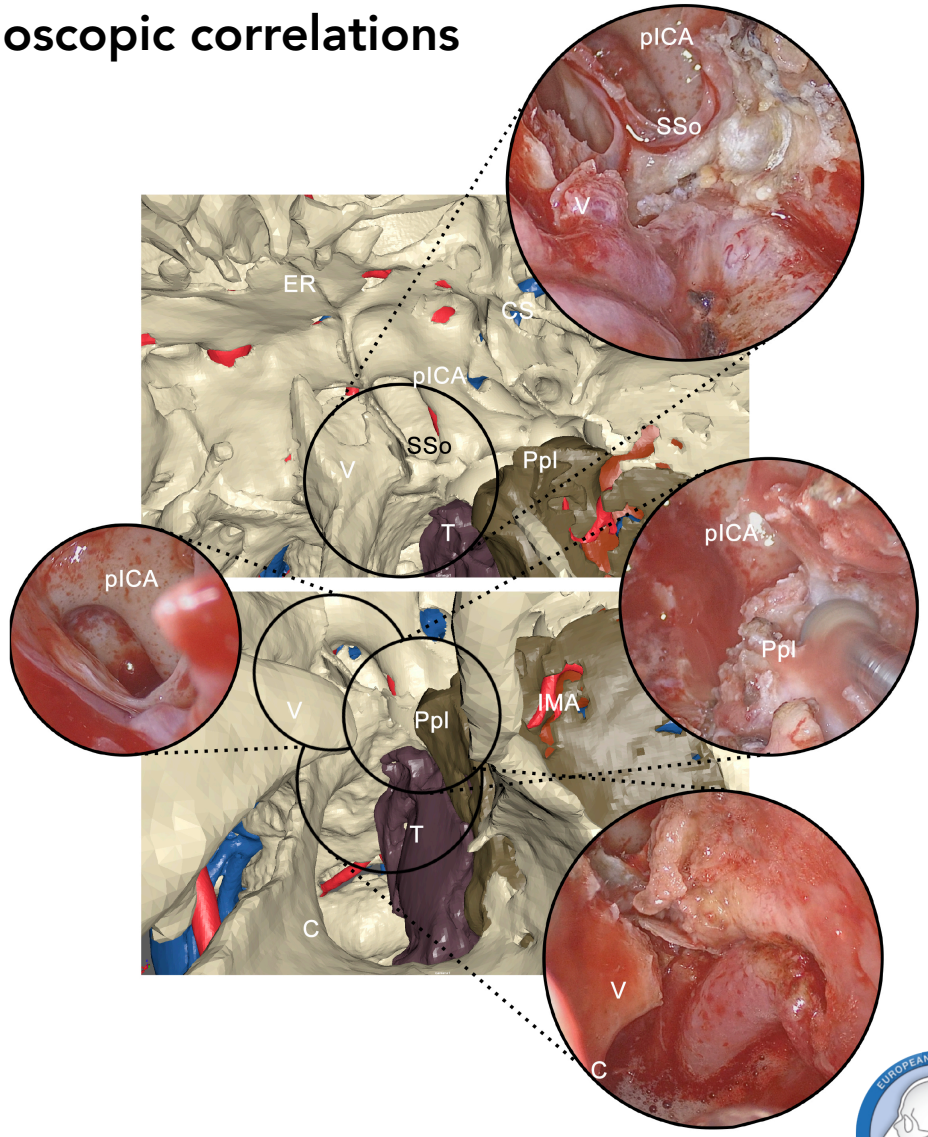
- Portal A: transnasal/transmaxillary (endoscopic)
- Portal B: transzygomatic
- Portal C: transmandibular/swing



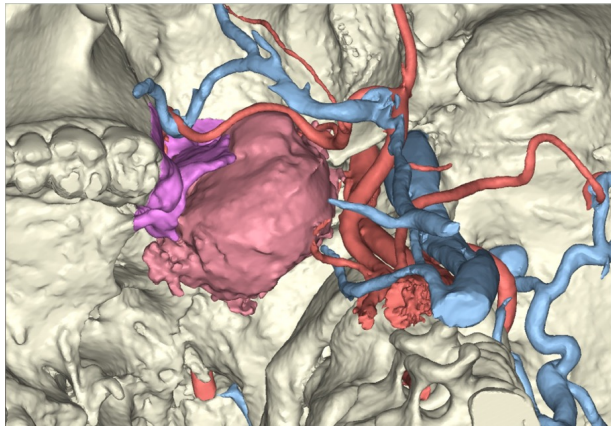
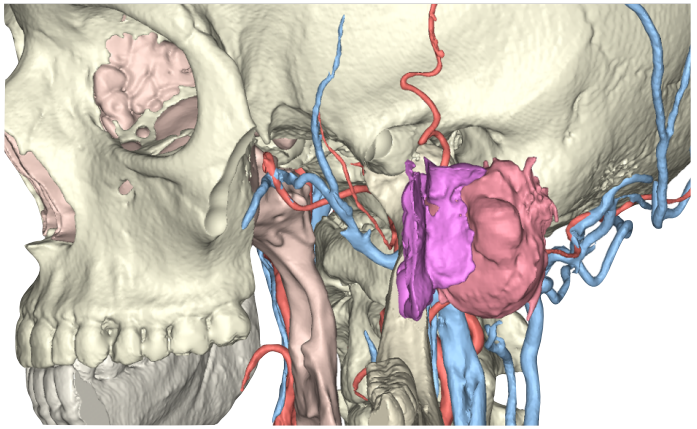
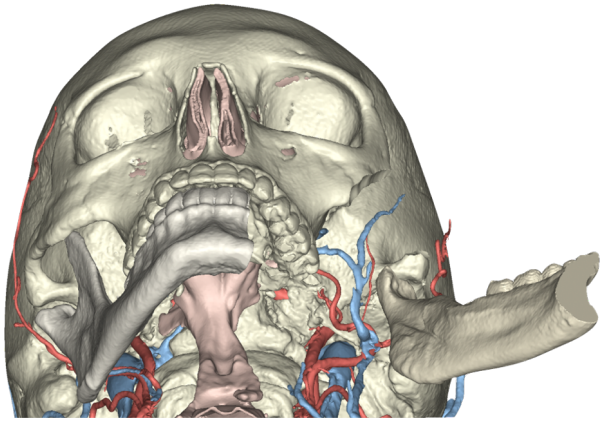
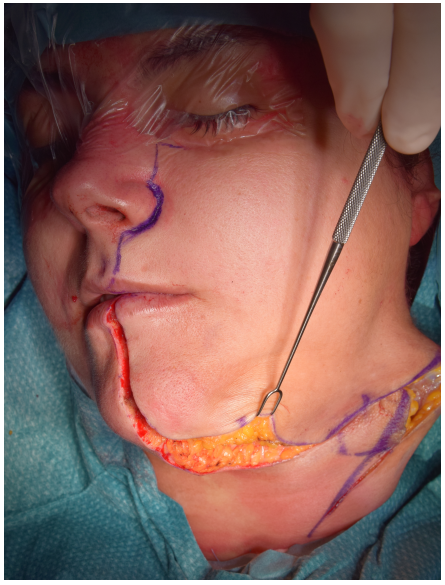
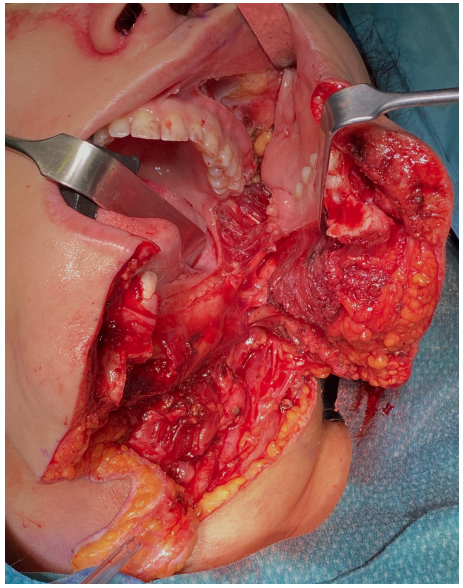
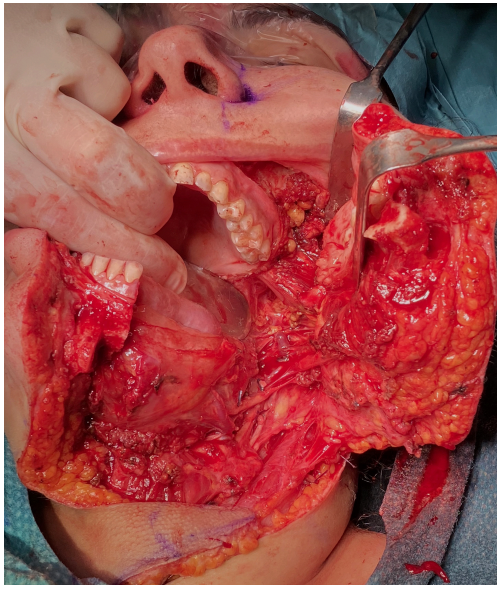
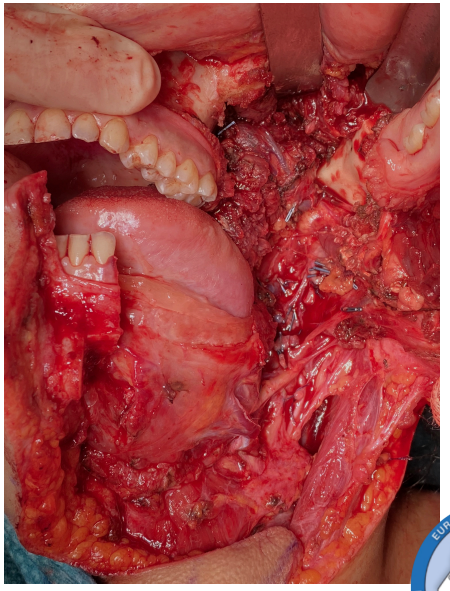
Virtual endoscopy: computer planning and endoscopic correlations



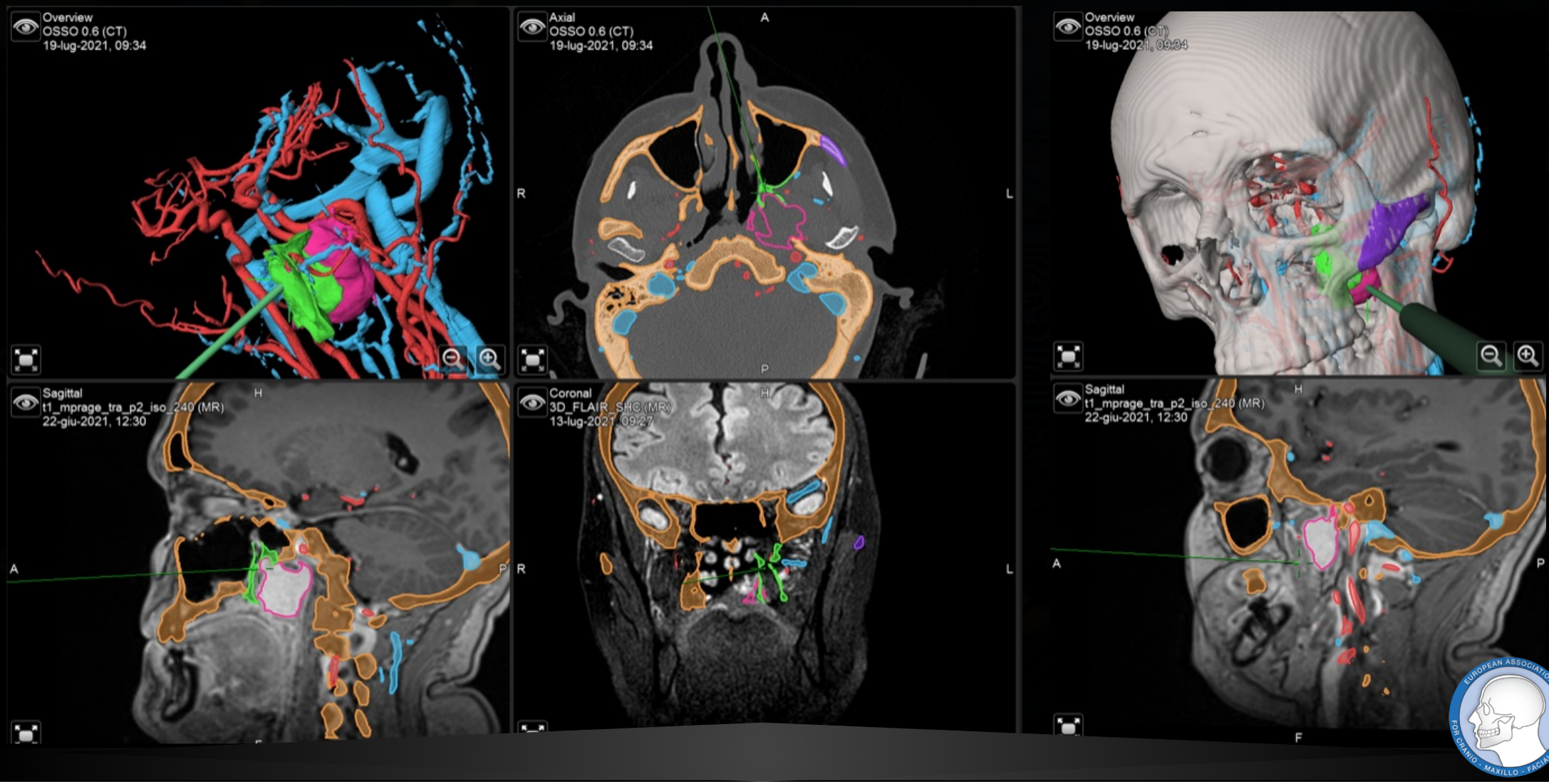




Correlation of surgical mandible opening with VSP sequences and tumor exposure

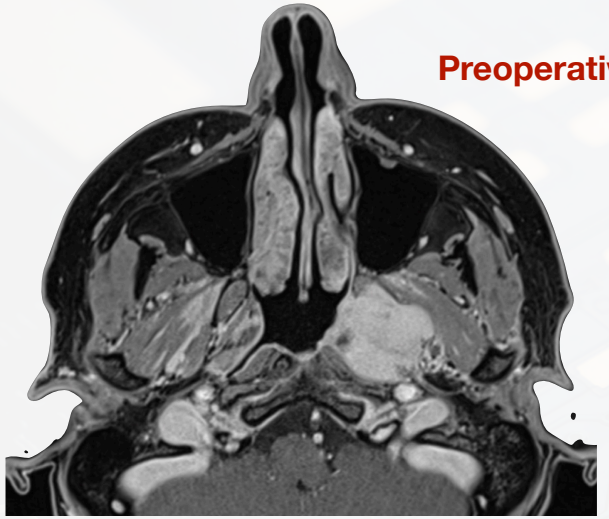








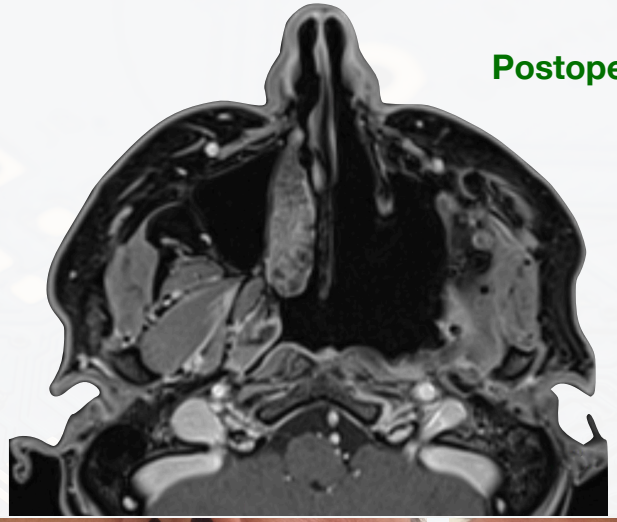
Intraoperative navigation of multilevel segmentation and VSP



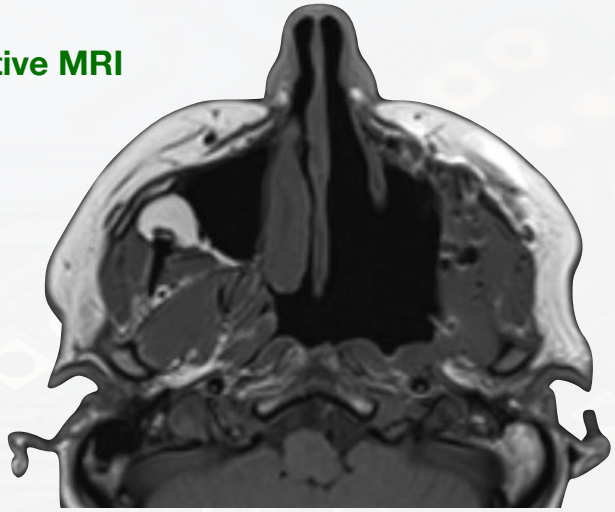
Postoperative outcome

Preoperative MRI





Postoperative MRI

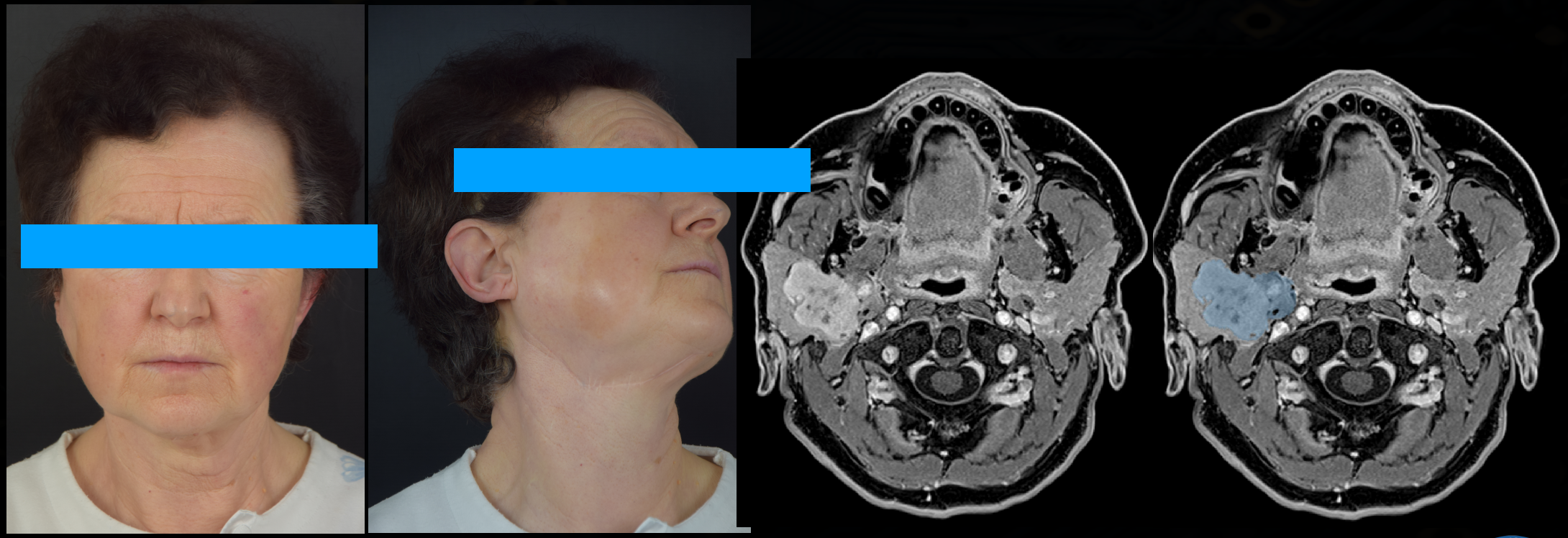




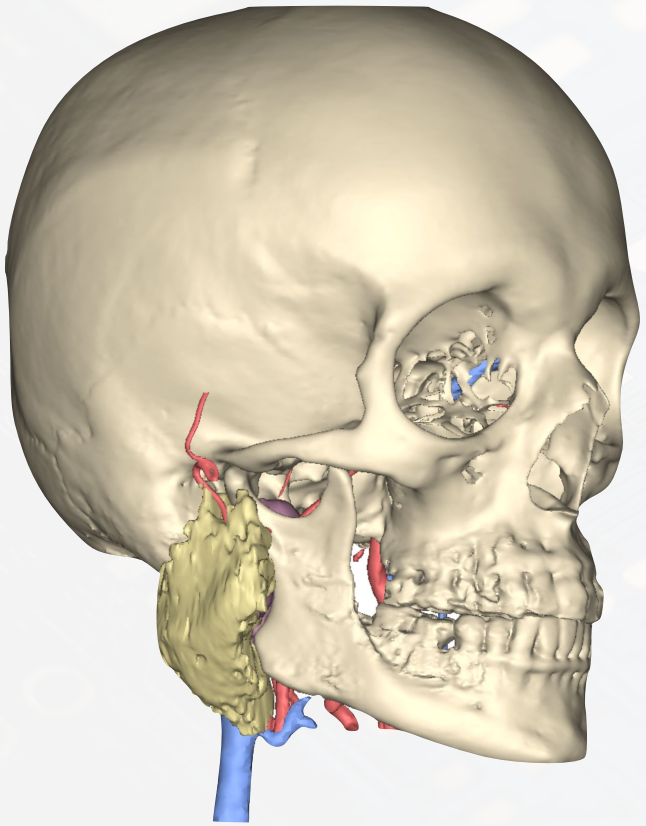


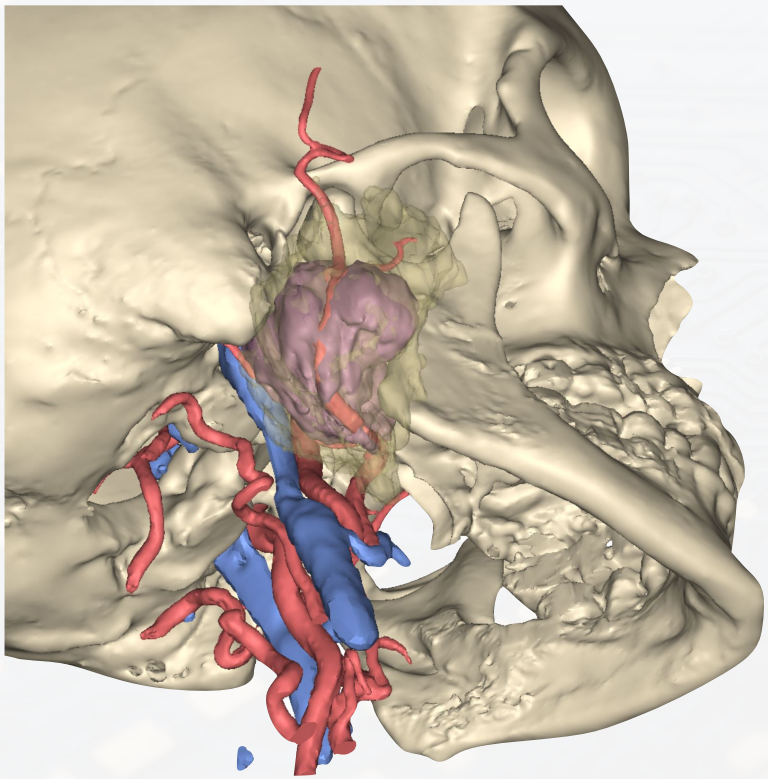


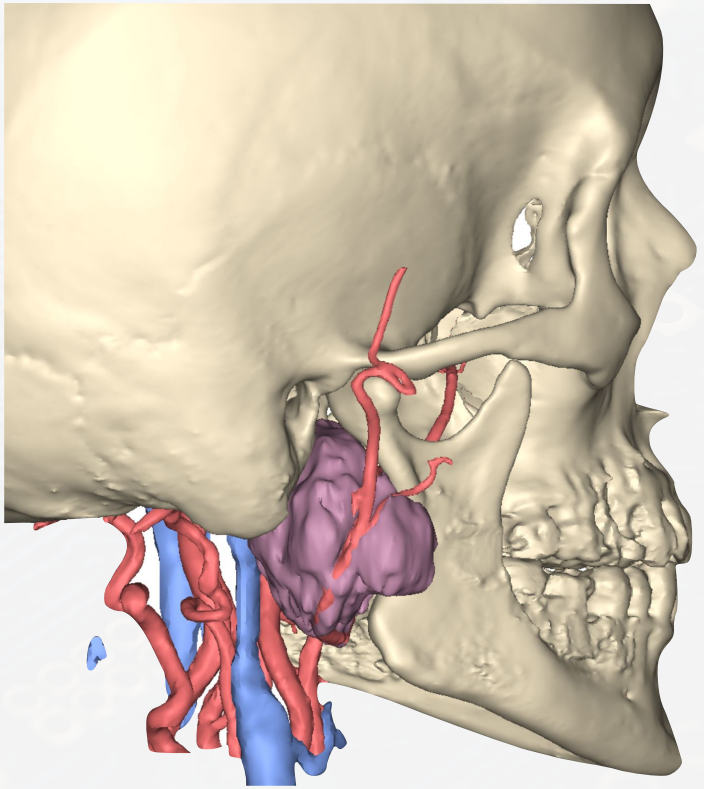
Relapsed parotid pleomorphic adenoma in the deep masticator space and the pterygo-maxillo-palatine fossa



Virtual surgical planning

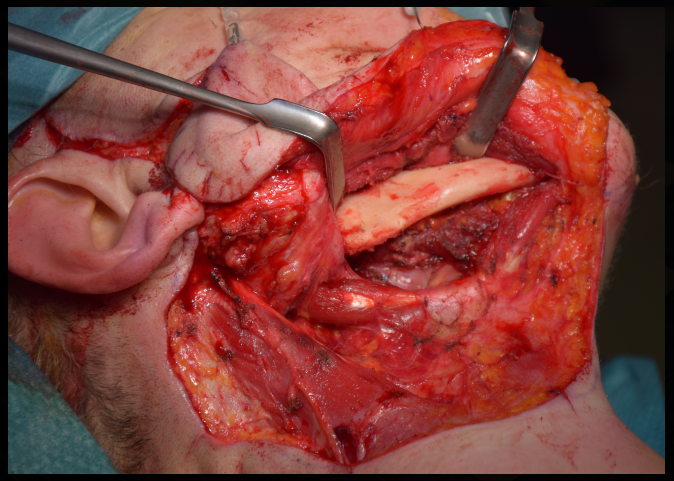




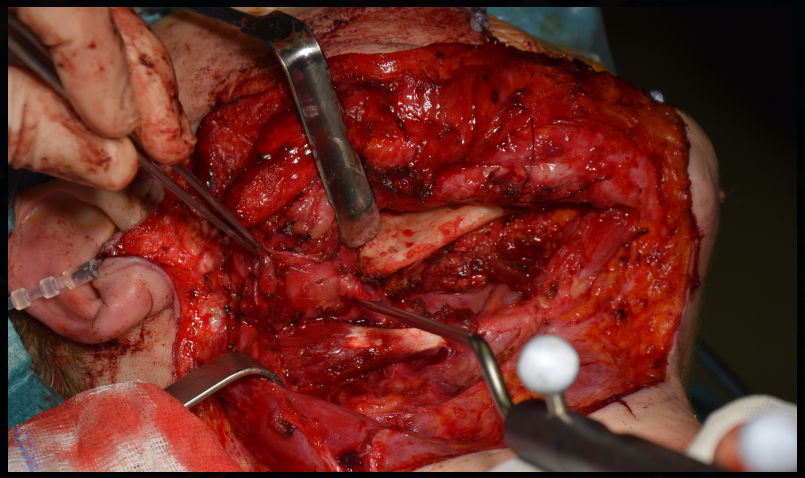


Surgical excision

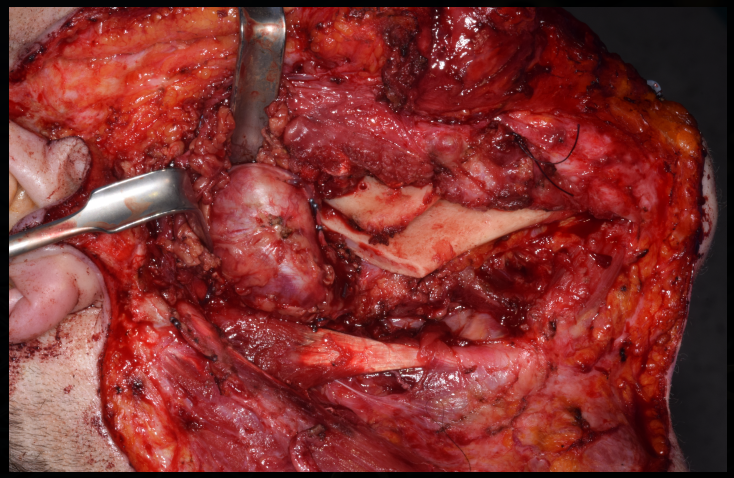
Exposure for mandibular swing



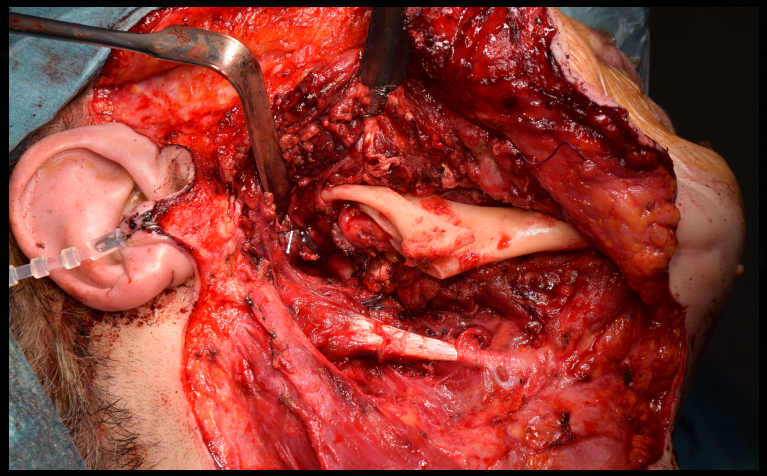
Lesion targeting with navigation

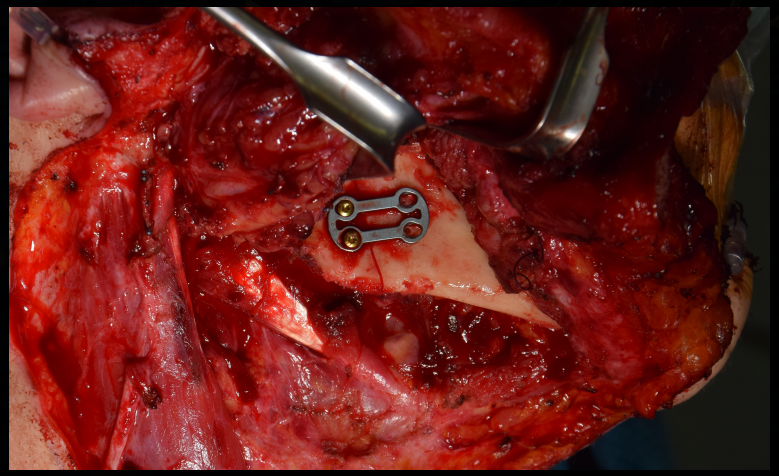


Excision of lesion



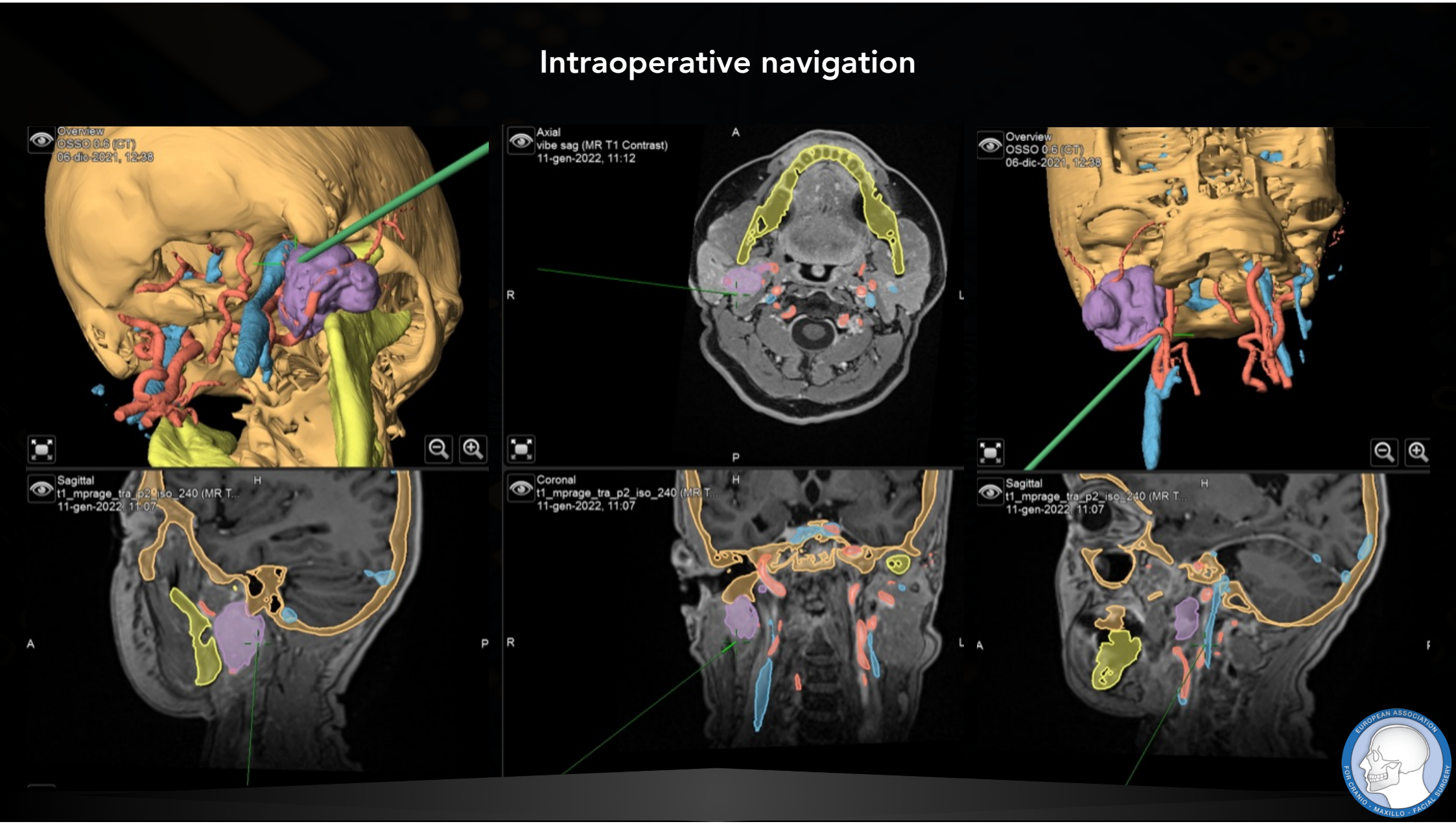
Field after lesion removal





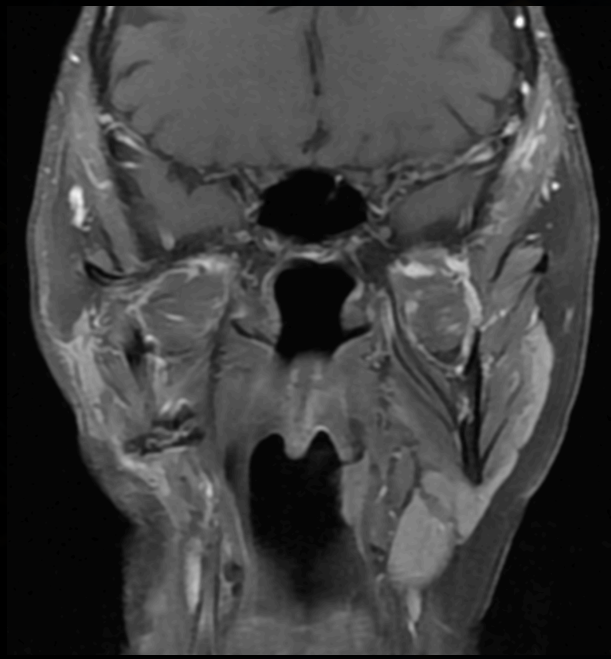
Mandible osteosynthesis

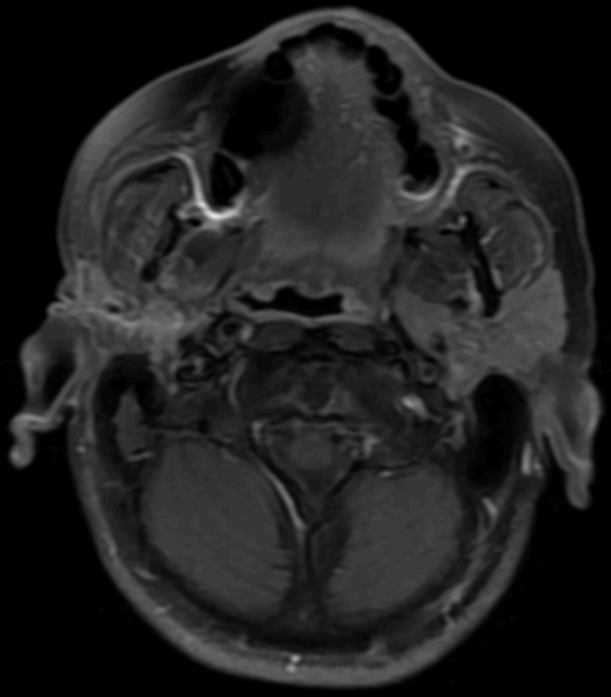
Intraoperative navigation



Postoperative MR

Complete excision of the lesion with no apparent radiological signs of relapse



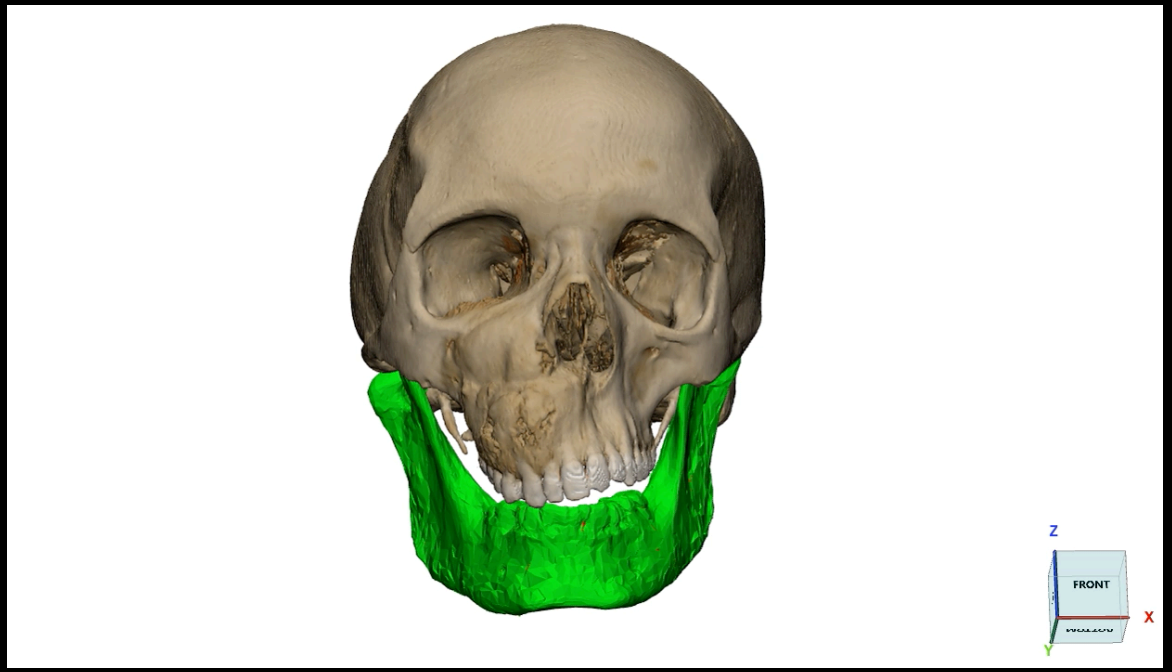


No facial nerve palsy





STATISTICAL SHAPE MODELING



Surgery (resection)

Resection specimens

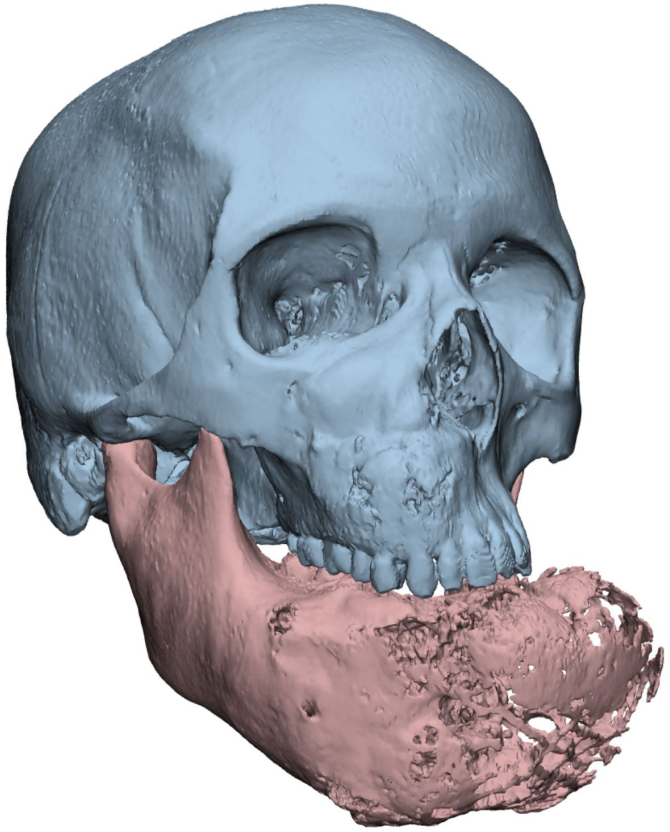


Comparison with 3D printed replicas

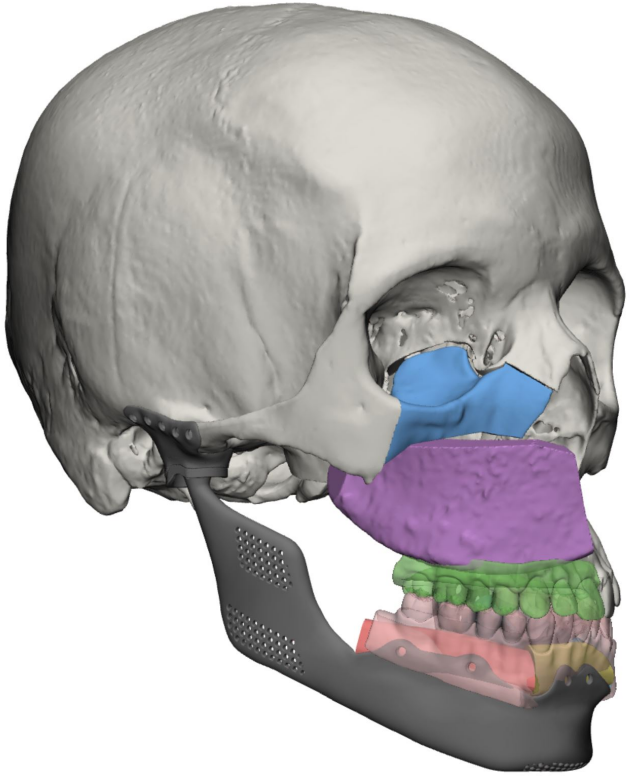


Evaluation of correspondence

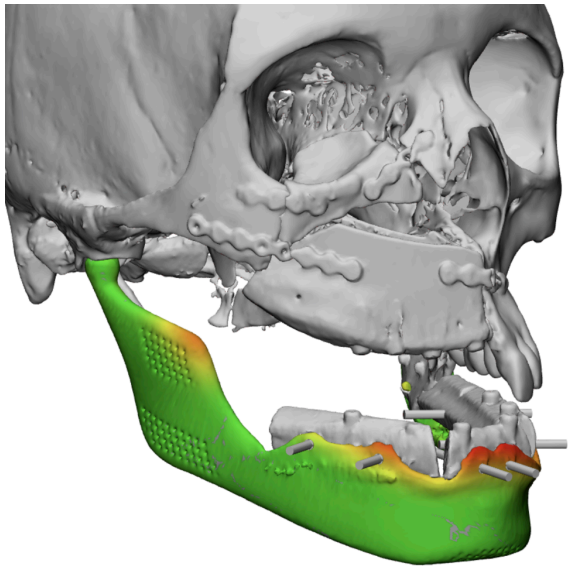
Preop

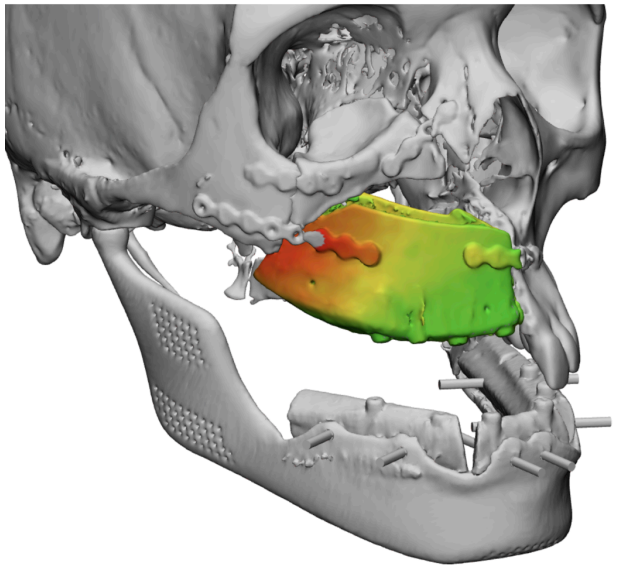


VSP



Postop with RMSE





preop

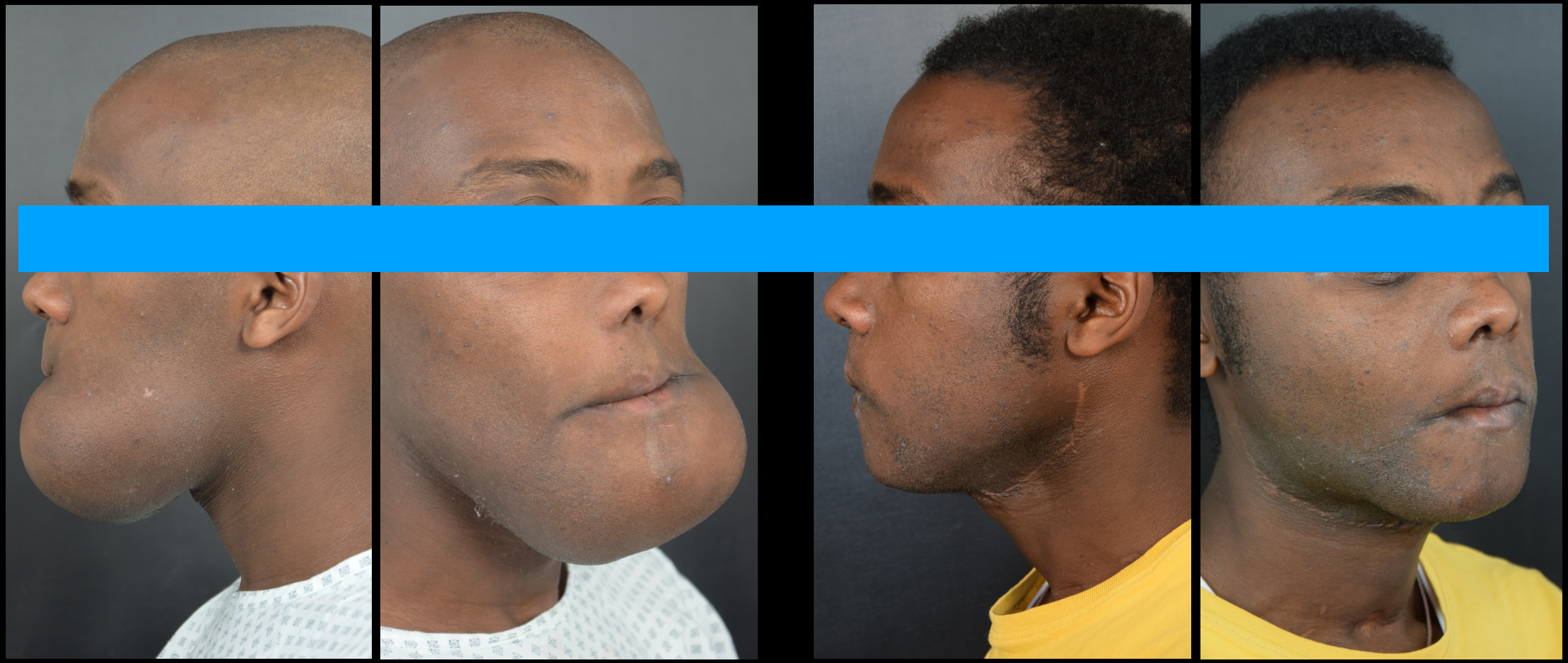


4-month postop



preop

4-month postop



Conclusioni

- ➡ Sostenibilità
- ➡ Riflessione sulla radiologia tradizionale 0pt ,telerx LL, Telerx AP…etc
- ➡ Medicina di Precisione >>>>>>>>>>**Radiomica**
- ➡ Chirurgia di precisione >>>>>>>>> **Chirurgia Computer Guidata dalle Immagini** >>>>>TAC + RMN



