Mucocele with Midface Obliteration: Reviewing Methods and Materials of Reconstruction

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INTRODUCTION

Mucoceles are benign, cystic, lesions within the mucoperiosteum. The vast majority are found within the frontal sinuses, with only 10% affecting the maxillary region. With a progressively expansile nature, these lesions advance into areas of least resistance and lead to local destruction. When disruption of function or cosmesis occurs, operative intervention is necessary for both removal and repair.

This report highlights the extent to which an untreated maxillary mucocele may progress, with impressive cosmetic degradation and structural compromise. The associated functional repair of midface deficits has undergone a paradigm shift towards patient-specific virtual planning and custom implantation.

Case Summary

70-year-old male with a medical history of alcohol abuse and facial trauma who presented to the Detroit Medical Center. EMR revealed a ballistics injury 20 years prior as well as prior mandibular fracture repair. He reports progressive facial discomfort, swelling, and ocular obstructive symptoms. Imaging revealed complete destruction of the bony malar eminence, orbital floor, and hard palate.
Due to difficulty with follow up and the COVID-19 pandemic, intervention was not performed for an additional year.

Figure 1: CT, Bone Window, Coronal - Left orbital floor destruction with absent malar prominence

Figure 2: CT, Soft Tissue, Axial - Left cystic expansion

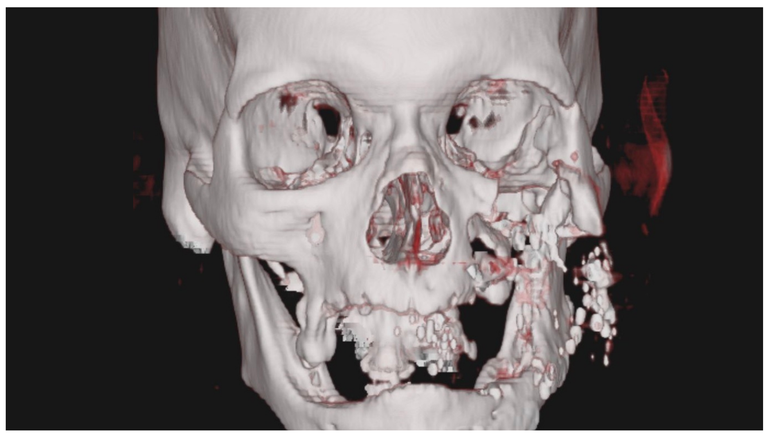

Figure 3: CT-3D Reconstruction - Preoperative Defect

VIRTUAL SURGICAL PLAN

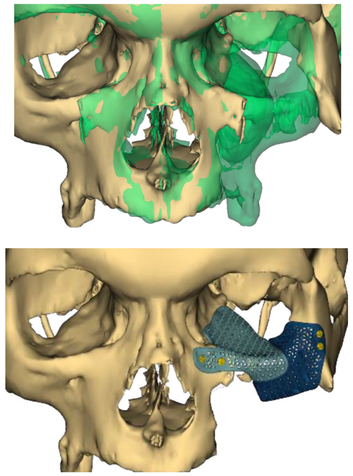

Figure 4: VSP Mirror Imaging and Plate Design

OPERATIVE INTERVENTION

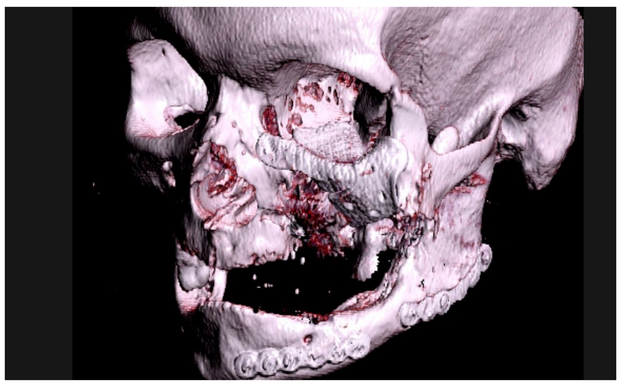

Figure 5: CT-3D Reconstruction - Post Operative

A functional endoscopic sinus surgery was performed with maxillary antrostomy and medial maxillectomy.The mucocele was subsequently removed
An open infraorbital approach was performed with minimal remaining orbital rim encountered and complete absence of the orbital floor in association with the anterior maxillary wall. **Residual bony structure to secure the implant to was impressively nominal; a one-centimeter region of bone along the nasofrontal/ascending maxilla and 0.5cm of lateral rim near the remaining malar eminence with significant demineralization**. Securement of the plates was challenging and heavily contingent upon the patient-specific 3D printed nature. Utilizing custom plates drill guides, pre-drilled holes were created, generating no ambiguity regarding placement

The medial portion was placed first, in contrast to common practice of lateral placement and the lone region for securement was just superior to the infraorbital nerve. The lateral plate secured with reestablishment of the anterior projection of the malar eminence and orbital rim. The periorbita was successfully resuspended without prolapse. Post operatively, all extraocular motion was intact and complete sensation preserved. Imaging demonstrated good placement and return of cosmesis

DISCUSSION

Extrinsic triggers for mucocele formation, such as trauma, allows mucosa to become entrapped within a fracture line [1] [2] which then expands into the regions of least resistance. The incidence of maxillary mucoceles makes up only 10% of all paranasal sites [1].
Operative intervention is warranted when functional deficit or cosmetic detriment occur. This patient had near complete disruption of the orbital floor and absence of maxillary prominence. Functional repair supports the orbit to avoid enopthalmous and associated diplopia.
Broadly, the considerations of support materials include stability, radiopacity, fluid permeability, and biocompatibility. Additional factors such as material availability, donor site morbidity, contouring, and local trauma are considered [3]

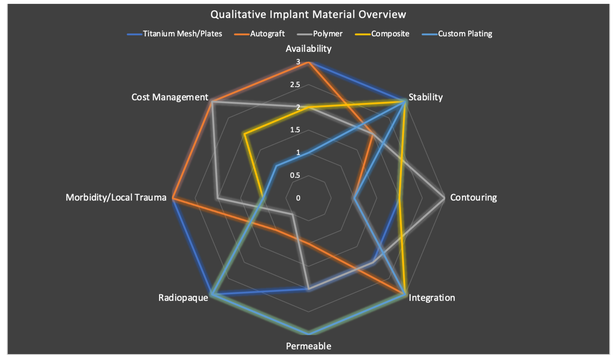

Figure 6: Qualitative Summary of Material Considerations

Alloplastic graft: is the most commonly utilized when addressing orbital floor defects. [4] Titanium mesh is a frequently used and readily available in pre-bent or flat formats. It is a preferred modality with larger defects or complex cases. [5] The porosity allows for improved osseointegration. [6] Cost is significantly less than custom 3-D plates. Disadvantages involve recognizing passive fit, multiple reinsertion trauma, and contouring expertise. [7] [8]

Autograft materials: are inherently available, biocompatible, and feasibly radiopaque. Challenges include donor morbidity, contouring osseous grafts, and reduced fluid drainage around the implant. Graft resorption may be as high as 80% as reported in iliac grafts. [9]

Polymers: exist in permanent or absorbable forms. Ultrahigh molecular weight polyethylene [UHMW-PE/marPOR] is as effective in structural repair and cost as titanium mesh.[10] [11] Medpor is traditionally for smaller defects. It's a smooth but porous surface allowing tissue ingrowth but prevents fibrous adherence. Perforated polydioxanone (PDS) is an absorbable compound with similar outcomes to autografts in moderate fractures. [3] [12]

Composite materials: Titanium hybrid implant (PPETi, Medpor Titan), demonstrate a possibility for combining materials. Comparing to preformed titanium DePuy/Synthes MatrixMIDFACE (PFTi) orbital implants, rates of post-operative complications were not significantly different. [13]

Custom plating: increases specificity and allows for localization of supportive contact points necessary in large or challenging orbital defect reconstruction, allowing the appropriate amount of intraorbital volume to maintain proper globe position. [8] [14] [15] [16] Virtual planning allows for allocation of landmarks such as the intraorbital buttress or the posterior ledge pivotal in reconstructing the sagittal sigmoidal shape of the orbital floor. Holmes [8] demonstrated that custom plates resulted in higher rates of surgical accuracy on post operative imaging, despite a higher complexity rate.
As a defect enlarges, the plate inevitably becomes larger and is progressively difficult to place. Multiple insertions potentiate trauma to surrounding tissues. Multipiece interlocking plates allow for progressive placement of smaller more controlled pieces. The material is less compliant preventing a forced fit allowing for greater intraoperative quality control.

CONCLUSION

Custom plating allows for improved accuracy despite the increased complexity of cases however, this system may be inappropriate for time-determinate etiologies or resource-impoverished regions. Surgical approaches are determined by the size of the defect. Certain surgical approaches may be inappropriate if custom guides are utilized due to increased exposure needs.

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