"Rehabilitation of a Gunshot Wound Using a Custom Sub-periosteal Implant and Prosthesis: A Case Report"

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Introduction

Ballistic injuries from firearms often lead to significant soft tissue and bone loss, posing challenges for reconstructive surgery and rehabilitation. The unpredictable nature of bullet damage necessitates a multidisciplinary approach for effective management. Gunshot wounds not only inflict severe physical damage but can also have profound psychological effects, complicating treatment for all providers. While these injuries are not always life-threatening, they often result in significant aesthetic and functional impairments, highlighting the need for advanced treatment protocols. The following treatment presents a multidisciplinary rehabilitation of a self-inflicted GSW utilizing a custom sub-periosteal implant with a screw-retained fixed partial prosthesis.

Case History

A 29 year old female presented to the Graduate Prosthodontics clinic with a history of a self-inflicted gunshot wound 3 months previous. She suffered a right sided LeFort fracture, bilateral orbital rim fractures, right and midline mandibular fractures which were debrided and repaired at the time of insult by the Oral and Maxillofacial Surgery team. Subsequent to injury, the patient presented with a 1.5cm oro-nasal communication and missing teeth #4-8. A medical grade CT was captured and used for virtual planning with OMFS, prosthodontics, and the KLS Martin laboratory teams. A waxup was provided for the planning team and the custom sub-periosteal implant was designed to have multi-unit prosthetic connections at sites #4,6,8. The custom implant was laser sintered according to specifications, and the immediate prosthesis was milled out of PMMA.

Results

The OMFS team installed the custom implant, and simultaneously performed a Bardach flap palatoplasty to close the oro-nasal communication around the prosthetic connections of the implant. The milled PMMA prosthesis was inserted using DESS direct to multi-unit screws. The immediate postoperative healing period was uneventful, and the patient will be kept in the immediate PMMA prosthesis for 6 weeks prior to insertion of the final zirconia prosthesis.

Fig. 1 Frontal repose

Fig. 2 Frontal smiling

Fig. 3 Prosthetic-gingival junction measurement

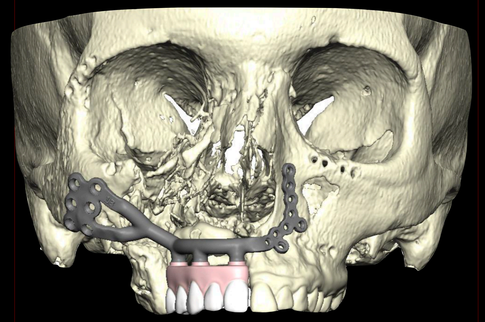

Fig. 7 CT rendering with custom implant and prosthesis

Fig. 4 Lateral MIP

Fig. 5 Occlusal view of defect

Fig. 6 Frontal MIP

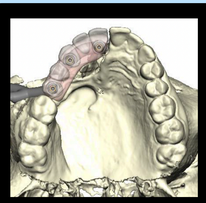

Fig. 8 Waxup occlusal view

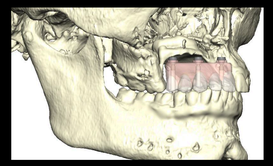

Fig. 9. Waxup lateral view

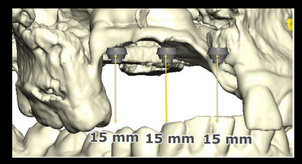

Fig. 10. Prosthetic platform height

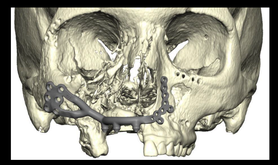

Fig. 11. Custom implant frontal view

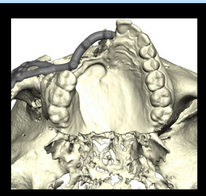

Fig.12. Custom implant occlusal view

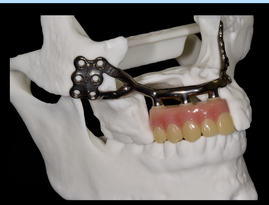

Fig.13. Implant and interim prosthesis on model

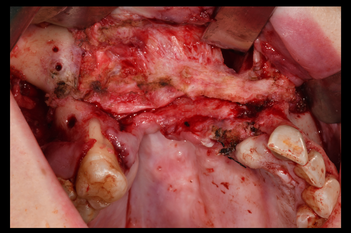

Fig. 14 Surgical site reflected

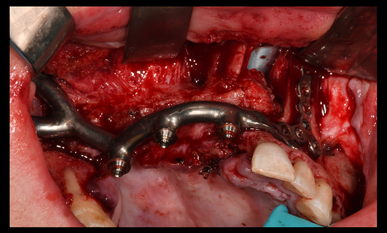

Fig. 15 Implant secured in place

Fig. 16 Interim prosthesis screwed in

Fig. 17 Final closure and MIP

Discussion

This case report highlights the importance of interplay between specialties when rehabilitating ballistic trauma patients at the highest level. Traditional management of these wounds involves an initial debridement and suturing, followed by conservative closed reduction techniques, and delayed reconstruction of hard and soft tissue defects or insertion of an obturator prosthesis. Contemporary techniques often involve early surgical reduction and fixation, with hard and soft tissue reconstructive procedures carried out simultaneously. Our treatment protocol presents an approach that rehabilitates the patient with complete oro-antral closure and a fixed prosthesis, removing the need for extensive bone grafting procedures or an obturator. Sub-periosteal implants have regained popularity among providers and recent studies have shown success rates from 70-90%. Historically, sub-periosteal implants have relied solely upon fibrous encapsulation for fixation of the implant which commonly led to implant exposure, infection, mobility, or total failure. The KLS Martin IPS sub-periosteal implant relies upon bi-cortical locking screws for fixation, reducing the risk of complication and allowing immediate loading of the prosthesis. The built-in multi-unit platform prevents the need for additional abutment components and allows for prosthesis or meso-structure fabrication to be completed with ease. The height of the prosthetic platform can be fully customized to align with the position of the prosthetic gingival junction, giving providers flexibility in material selection based on spatial needs. In conclusion, integration of custom sub-periosteal implants, careful consideration of prosthetic space and prosthetic-gingival junction, and effective surgical protocols collectively contribute to successful outcomes in complex oral rehabilitative cases. Ongoing research and technological advancements are likely to further improve the predictability and success of these interventions.

References

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