Complex mandibular rehabilitation of a self-inflicted gunshot wound: A clinical report

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This report describes the surgical and prosthodontic rehabilitation of a patient traumatized by a self-inflicted gunshot wound to the mandible which required rehabilitation with a free fibula microvascular graft, single stage dental implant placement, and rehabilitation with CAD/CAM and laser assembled prosthetic components. (J Prosthet Dent 2012;107:158-162)

Self-inflicted gunshot wounds are devastating. Frequently the larger the caliber of the bullet, the more damage can be expected to hard and soft tissues.[1,2] Rehabilitation of the resultant facial wounds is a significant challenge for the prosthodontist and surgical team. Recently the use of advanced 3-D imaging, microvascular grafts, and significant advances in prosthodontic techniques such as computer-aided design/computer-aided manufacturing (CAD/CAM) and laser assembled prostheses have allowed these patients to be rehabilitated to near normal function and esthetics.[3-5]

Several authors have illustrated the successful use of osseointegrated implants in the reconstruction of traumatic craniomaxillofacial injuries.[1-3,6-9] A multidisciplinary team of several experienced clinicians and dental laboratory technicians was required to rehabilitate the patient.

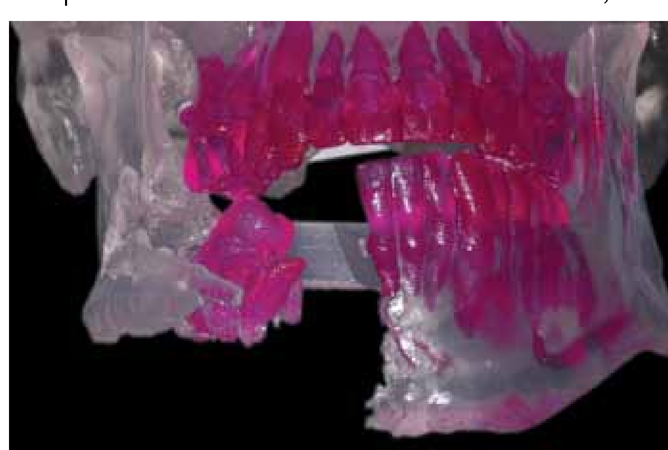
This article describes commonly used surgical techniques, dental clinical techniques, and dental laboratory procedures to provide a state of the art reconstruction of a self-inflicted gunshot wound of the mandible, emphasizing the role of a team approach to patient treatment. In difficult or complex restoration situations, modification of traditional techniques is required. Modification of standard components and techniques will be presented.

CLINICAL REPORT

A 39-year-old man presented with a self-inflicted gunshot wound from a .40 caliber handgun to his right posterior mandible. In a hospital near the incident, he underwent closure of the lip, tongue, and mouth lacerations along with debridement and a percutaneous tracheostomy. When stabilized, he was transferred to the University of Iowa Hospitals and Clinics near his hometown.

When the patient arrived at the University of Iowa Hospitals and Clinics, a computerized tomography (CT) scan and 3-D stereolithic medical model (Medical Modeling Inc, Golden, Colo) was fabricated to assist in contouring a plate for his osseous reconstruction (Fig. 1). He was taken to the operating room for further wound debridement, a left fibula free flap procedure, and mandibular reconstruction by a head and neck surgeon from the Otolaryngology department.[5,6] Initial healing was uneventful (Fig. 2).

After adequate healing of the fibula flap, the patient was referred to the Division of Maxillofacial Prosthodontics. On examination, he exhibited 1)



1 Lateral view of medical model of mandibular trauma generated from CT scan showing extensive dentoalveolar damage.

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2 Radiograph of healed fibula graft. Note thickness of skin paddle in contact with opposing occlusion.

some extraoral scarring from the fibular reconstruction in the right submandibular area, 2) a neck tracheostomy scar, and 3) a neck scar from the bullet entrance/exit wound. Intraoral evaluation of his dentition exhibited minimal restorations, no significant periodontal disease, and absence of the teeth distal to his mandibular right lateral incisor caused by the injury and resultant reconstructive surgery (Fig. 3). The occlusion was stable but not in the original maximum intercuspal position (MICP) as a result of the fibula flap. A prosthodontic concern with his rehabilitation was that the skin paddle from the flap was in occlusion with the opposing dentition in the MICP, leaving minimal space for a prosthesis. The thickness of the skin paddles with such flaps is problematic in that they frequently preclude the use of a removable prosthesis and often require debulking to provide a firmer base for the planned prosthesis, which in this patient was to be an implant-supported fixed dental prosthesis. An alternative treatment plan for fabricating a partial removable dental prosthesis was also discussed; however, the patient declined this plan. It was anticipated that the use of a removable dental prosthesis could be significantly compromised by the mobile soft tissue bed of the graft site.

After a debulking procedure of the skin paddle by the otolaryngologist and an appropriate healing period, mounted diagnostic casts were evaluated. A diagnostic waxing was completed for trial insertion and for patient evaluation and approval (Fig. 4). After approval, the patient was scheduled for implant placement by an oral and maxillofacial surgeon. A minimally restrictive surgical guide was provided to the surgeon, indicating implant type and position. The minimal restriction was important as the surgeon was managing numerous factors such as the reconstruction plate and its retaining screws. Optimal implant placement locations were limited.

Although a debulking procedure had been completed earlier, the thickness of the soft tissue at the proposed implant site was approximately 15 mm. As a single stage implant was to be used and as the maximum height of the manufactured healing abutments was 4.5 mm, tissue thickness required careful consideration. The prosthodontist waxed healing abutments to the desired height/dimension and used a CAD (computer aided design) scanner (Etkon ES1; Straumann AG, Basel, Switzerland) to design an appropriate length healing abutment and custom milled 10 mm high titanium screw-retained healing abutments This made a single stage surgery possible.

The plan specified regular width platforms for the 2 anterior implants and a wide platform for the molar. This required 2 different diameter custom designs, one for the standard diameter (4.8 mm) and one for the wide diameter (6.5 mm). The digital designs were sent to the milling center, and the healing abutments were milled from type IV titanium (Straumann AG)

The implant placement was uneventful and was completed in a single stage surgery by using the custom, extended length, healing abutments. Hyperplastic tissue overgrowth led to coverage of some dental implants with skin; this was addressed with gingivectomy and improved hygiene before the definitive impressions were made[7] (Fig. 5). Because of the atypical tissue thickness, another challenge was the length of routine stock impression copings for an implant-level impression. At the request of the prosthodontist, custom impression copings – double the standard 10 mm height – were fabricated by a dental laboratory technician. By using the custom impression copings, implant level impressions were made with a custom tray (SternTek; Sterngold Dental, Atteboro, Mass) and a heavy bodied vinyl polysiloxane (Extrude; Kerr Corporation, Romulus, Mich). A verification index is useful in restoring multiple implants to ensure the definitive cast accurately matches the patient. One custom impression coping and two 15 mm prefabricated impression


3 Frontal view of maximum intercuspation after debulking of skin paddle.


4 Frontal view of intraoral diagnostic waxing.


5 Healing and hyperplastic tissue.


6 Assembled verification index ready for oral trial insertion.


7 Intraoral trial insertion of verification index confirming accuracy of definitive cast.


8 Laser-assembled titanium framework fabricated on definitive cast with 15 mm custom milled abutments and stock components.

copings (Etkon ES1; Straumann AG) were joined on the definitive cast with an autopolymerizing acrylic resin (GC Resin; GC America, Chicago, Ill) and used intraorally to verify passive fit, radiographically and with the 1-screw test, before fabricating the prosthesis substructure[10] (Figs. 6 and 7).

The definitive framework could either be fabricated with CAD/CAM or with a laser assembled framework. Both options were explored and a titanium laser-assembled framework processed with acrylic resin prosthetic teeth was selected. The litera-

9 Completed fixed prosthesis showing soft tissue contours for optimal oral hygiene.

10 Completed prosthesis showing polished transmucosal titanium custom abutments.

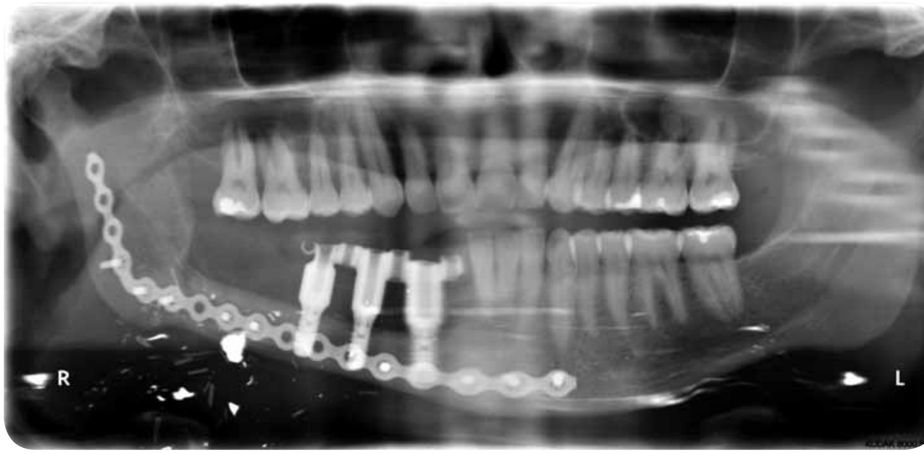
11 Frontal view of the prosthesis at insertion.

ture reveals various techniques for the successful fabrication of this type of restoration.[8,11,12] This framework provides a better retentive and material support design than the available CAD/CAM designs, especially with the extraordinary length required because of the implant level, not abutment level, prosthesis design.

The dental laboratory technician used a second set of custom healing abutments milled to 15 mm and standard titanium components to assemble the framework on the definitive cast (Fig. 8). The framework was opaqued (Gradia; GC America, Chicago, Ill) to prevent graying of the processed acrylic resin. The prosthetic teeth (Vitapan; Vident, Brea, Calif) were arranged on the framework according to the diagnostic arrangement, and the prosthesis was completed with an injection molding/polymerizing process (Ivocap; Ivoclar Vivadent Inc, Amherst, NY). This process may result in less distortion to the framework than conventional press-pack techniques.

The completed prosthesis was returned from the laboratory and inspected for accuracy (Figs. 9 and 10). Polished titanium was used for the transmucosal portion, and the gingival component of the prosthesis was designed as a modified ridge-lap pontic for ease of oral hygiene. The healing abutments were removed uneventfully, and the prosthesis was placed with the retaining screws tightened to the manufacturer's specifications (Fig. 11). Oral hygiene was demonstrated and reinforced. A radiograph was made to verify fit and to serve as a baseline for future follow-up (Fig. 12).

The patient has shown satisfactory oral hygiene for the last 2 years. A chlorhexidine rinse (GUM alcohol-free chlorhexidine; Sunstar Americas Inc, Chicago, Ill) was locally applied around the implants affected by hyperplastic tissue. It has been the experience of the authors that hyperplastic tissue is a relatively common occurrence with dental implants which protrude through skin as opposed to oral mucosa or gingiva. However, no changes in the alveolar bone levels around the implants have been noted. The patient is pleased with the esthetic and functional outcomes. The authors will continue to recall this patient annually for radiographic evaluation and every 4 months for routine scaling and prophylaxis.



12 Radiograph of prosthesis at insertion showing good fit previously evaluated with verification index.

SUMMARY

This treatment illustrates the value of a surgical and prosthetic team approach in restoring a patient to near normal function and esthetics by using current technology.

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