Prosthodontic Rehabilitation of a Shotgun Injury: A Patient Report

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Keywords
Prosthodontic; rehabilitation; shotgun.

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Accepted November 18, 2009

doi: 10.1111/j.1532-849X.2010.00645.x

Abstract

This report describes the prosthodontic rehabilitation of a shotgun patient traumatized in the maxillary, mandibular, and nasal areas resulting in severe problems in her esthetics, phonetics, and mastication. The patient was treated with removable partial prostheses using tooth, soft tissue, and implant support.

Depending on the weight and velocity of the bullet, a shotgun may cause various tissue injuries. Shotgun injuries occur with a hunting rifle, while gunshot wounds occur with other gun types. A hunting rifle shot from a distance closer than 7 m would have the same effect as a gunshot and would be called a close-range shotgun injury.[1] Rehabilitation of these patients and those attempting suicide are still a challenge for prosthodontists.[1]

Clinical report

A 23-year-old woman who had been shot by a hunting rifle in the submental area about 7 years ago presented for functional and esthetic rehabilitation to the Prosthodontic Graduate Department of Shiraz Dental School in southwest Iran. Her mandible, maxilla, and nose were severely traumatized (Fig 1). Her ACP Prosthodontic Diagnostic Index (PDI) was class IV. She had already undergone 13 reconstructive and plastic surgeries. Her mandible had been reconstructed using an iliac graft, and the maxilla had been repaired by a microvascular free flap from her forearm. Unfortunately, clinical and radiographic evaluations revealed extensive resorption of osseous tissue of the graft in the maxilla, leaving loose flabby tissue covered by skin, which was not a suitable bed for any kind of prosthetic rehabilitation.[2] In the radiographic and computerized tomography scan views of her mandible (Fig 2), presence of several screws and plates were noted.

Difficulty in speech was noted, and she wore a mask to hide her disfigured mouth. Due to widespread scars around the mouth, her mouth orifice was restricted, limiting access for making impressions and photographs. Teeth nos. 1, 6 to 12, 16 to 28, and 32 were missing. Teeth nos. 4 and 5 were severely malpositioned, and due to resorption of the bone graft and lack of bone support, these two teeth and tooth no. 13 had 10- to 11-mm pocket depth and mobility grade II to III. Tooth no. 29 was supraerupted, interfering with the proper occlusal plane. Tooth no. 30 was severely damaged by caries, separating it into two roots.

The only occlusal vertical stop was on teeth nos. 2 and 31 (Fig 3). The patient was deeply concerned about her poor esthetics and impaired masticatory performance.

Maxillary and mandibular primary impressions were made using condensation silicone impression material (Speedex, Colten AG, Altstatten, Switzerland). Diagnostic casts were fabricated from type III dental stone (Dentstone, Type III, Heraeus Kulzer, Armonk, NY) and mounted in a semi-adjustable articulator (Hanau H2, Teledyne Hanau, Buffalo, NY) using a facebow transfer and centric relation record bases for edentulous areas.

In the preprosthetic mouth preparation phase, teeth nos. 4, 5, 13, and 30 were extracted. The mandibular right second premolar was treated endodontically, a crown-lengthening procedure was conducted, and the tooth was shortened to serve as an overdenture abutment. The flabby tissue in the premaxillary area was excised to provide a better prosthetic foundation.

All screws and plates were removed from the mandible to provide adequate space for implant placement and to prevent continuous corrosion.[2] Concomitantly, the skin graft from the maxilla was transferred to this area to provide needed keratinized tissue. Skin graft is an excellent base for a vestibuloplasty, particularly in combination with dental implants.[2] After vestibuloplasty of the lower anterior segment, interim prostheses were fabricated for both arches to temporarily restore lip support and esthetics.

Figure 1 Frontal view of the patient.

Implant placement was initially considered for rehabilitation of the mandible. After 4 months of mandibular bone healing, the patient's interim prosthesis was duplicated into a surgical stent using a vacuum-formed shell (Temporary splint material, 0.02 thickness, Buffalo Dental Manufacturing Co, Syosset, NY) to insert three implants (5-mm diameter, 9-mm length, D3 Biohorizons, Birmingham, AL) in the anterior segment of the mandible in a tripod design.

Due to extensive bone deficiency for implant placement, a Kennedy class IV cobalt–chromium partial denture was planned for the maxilla. To provide the necessary retention in this edentulous configuration, the anterior-most and posterior-most teeth should be used.[2] Therefore, splinted and surveyed

Figure 2 Preoperative panoramic X-ray.

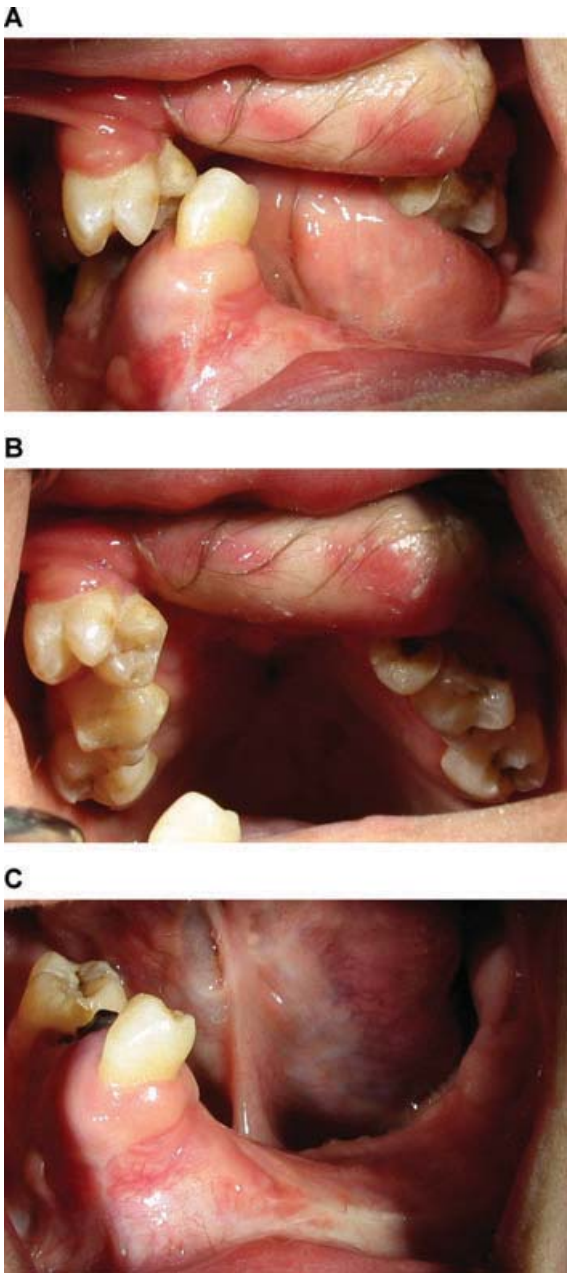

Figure 3 Intraoral view (A) Maximum intercuspation. (B) Maxillary arch. (C) Mandibular arch.

crowns were fabricated for teeth nos. 2, 3, 14, and 15 as removable partial denture (RPD) abutments with parallel guiding planes. To provide better retention, extracoronal ball attachments at the mesial surfaces of 3 and 14 were planned.

On the distal sides and mesiobuccal surfaces of teeth nos. 2 and 15, occlusal rests and proper retentive undercut areas, respectively, were planned (Fig 4A). For tooth no. 29, a gold coping was fabricated. For tooth no. 31, a surveyed metal ceramic restoration with a guiding plane, buccal retentive undercut, and lingual reciprocal ledge was fabricated (Fig 4B). To restore the

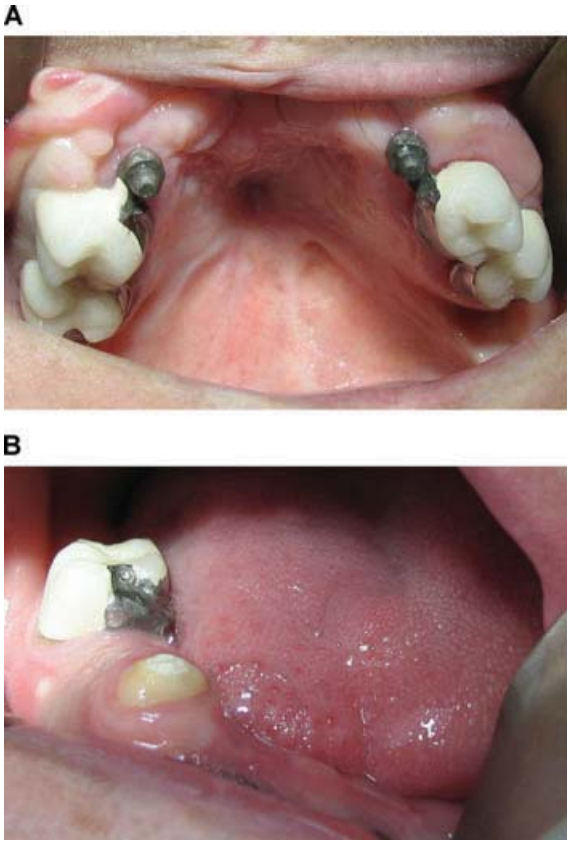

Figure 4 Intraoral view. (A) Maxillary arch. (B) Mandibular arch.

partially edentulous area of the lower jaw, a Co–Cr RPD was considered.

Mandibular implants were uncovered after 4 months. After 1 week of soft tissue healing, a primary impression with indirect impression transfer coping and ball top screws was made using condensation silicone impression material (Speedex) An open-top tray was fabricated with direct impression transfer coping and long screws, and a final impression was made with poly(vinyl siloxane) (PVS) impression material (Lastic Xtra, Kettenbach, Eschenburg, Germany).[3]

Figure 5 Mandibular bar was checked by counterbalance method.

Figure 6 Maxillary and mandibular RPD frameworks.

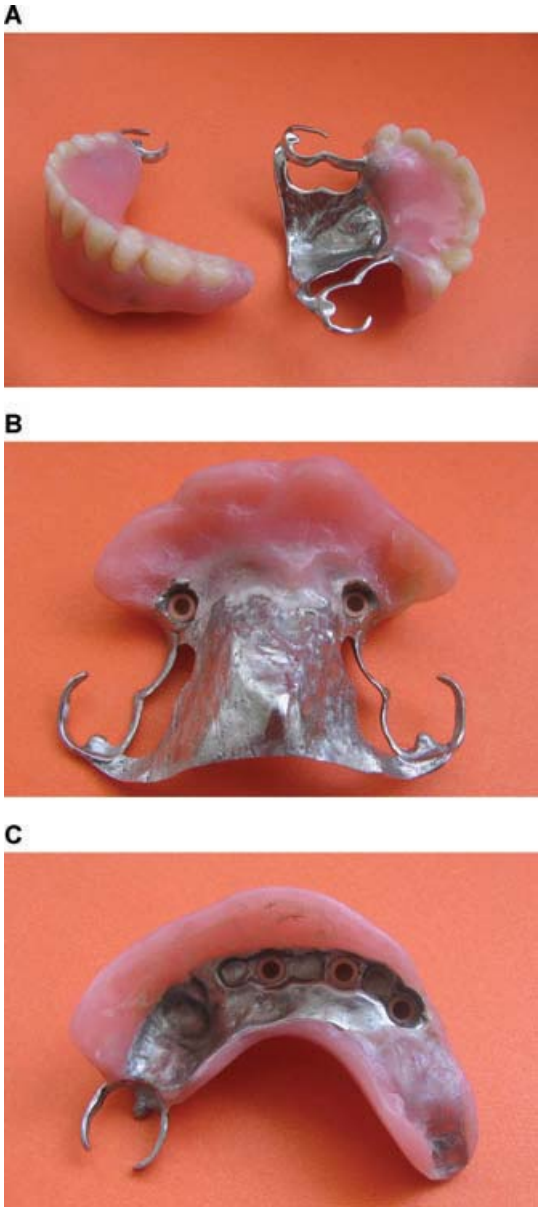

Figure 7 (A) Maxillary and mandibular RPDs. (B) Intaglio surface of maxillary RPD. (C) Intaglio surface of mandibular RPD.

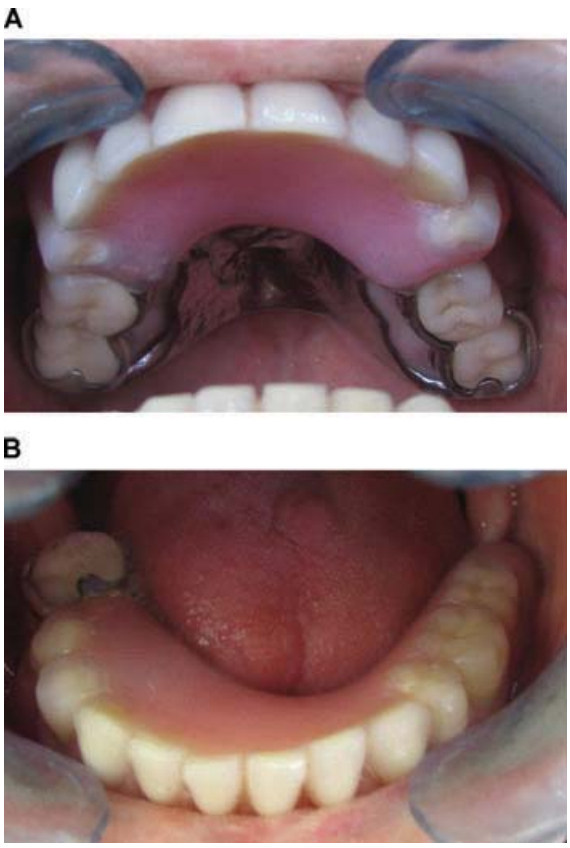

Figure 8 (A) Maxillary fixed and removable prosthesis in the mouth. (B) Mandibular fixed and removable prosthesis in the mouth.

Implants were splinted by a bar with three ball attachments. The bar was checked for passivity by counterbalance method (Fig 5).[4] The impression for the RPD was made with PVS (Lastic Xtra) and an open-top tray for the mandible.

Crowns and the mandibular bar were picked up by the RPD impression. The RPD frameworks were fabricated (Fig 6) and checked in the mouth. Denture teeth were arranged to provide suitable lip support, esthetics, and phonetics. Maxillary and mandibular partial dentures are illustrated in Figures 7A to C.

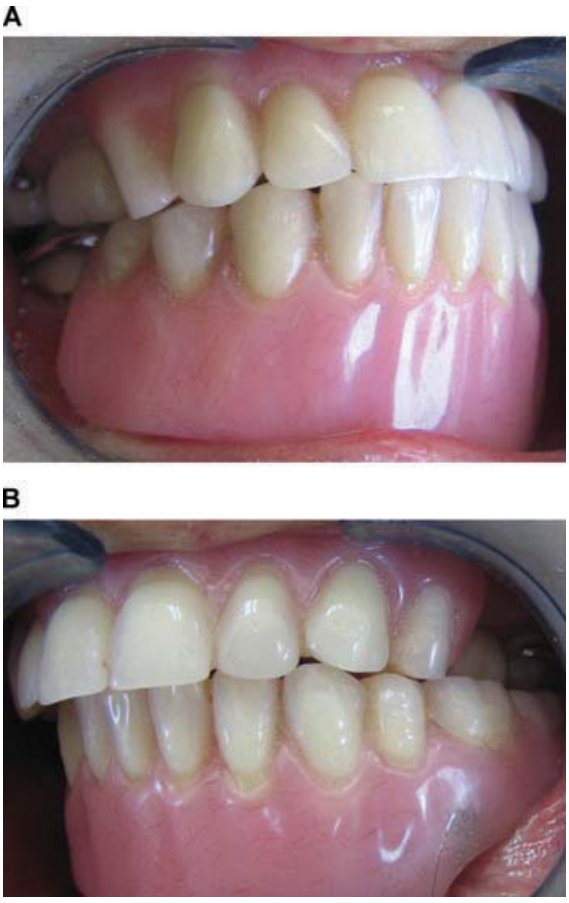

Figure 9 Intraoral view of maximum intercuspation. (A) Right lateral view. (B) Left lateral view.

Fixed and removable prostheses of the maxilla and mandible are shown in Figures 8A and 8B. Maximum intercuspation of the patient is presented in Figures 9A and 9B. An extraoral view of the final prostheses is shown in Figure 10. The postoperative panoramic X-ray is visible in Figure 11. The prostheses were delivered to the patient, and she was followed for 2 years.

Figure 10 Extraoral view of maximum intercuspation of anterior teeth.

Figure 11 Postoperative panoramic X-ray.

Discussion

Stevens et al stated that the introduction of osseointegrated dental implants had significantly improved the overall reconstruction of patients with cranio-maxillofacial injuries.[5] Siphai et al restored a gunshot maxillofacial defect with dental implants and various attachments. They rehabilitated the patient by a fixed, full-arch, implant-supported prosthesis for the mandible and an obturator retained by bar/clip and ball attachments for the maxilla;[6] however, in our patient, it was not possible to place any implants in the maxilla because there was inadequate bony tissue. Also because of extensive bone resorption of a previous microvascular free flap it was not a good recipient site for further bone grafting, so the patient rejected another bone grafting surgery. Therefore, there was no choice except to use the residual ridge and remaining teeth to support an RPD. In such a case with Kennedy Class IV partial edentulism, the most-anterior and the most-posterior teeth should be used for prosthesis retention.[2] Therefore, retentive clasps were designed on the upper second molars, and extracoronal ball attachments were used on the upper first molars.

The contact between teeth nos. 2 and 31 provided an acceptable occlusal vertical dimension (OVD). During fabrication and adjustment of interim partial dentures, these teeth were in contact. Then during preparation of these two teeth and adjustment of their fixed prostheses, the interim partial dentures were in contact. Thus, OVD was maintained.

Mijiritsky and Karas revealed that in situations where financial, systemic, or local conditions preclude the use of a fixed partial denture, a well constructed RPD can be an excellent alternative.[7] De Freitas et al concluded that although the construction of an RPD may seem paradoxical when osseointegrated implants are placed, in some cases, this option is best.[8] In the mandibular reconstruction of our patient, there was no choice except an RPD with tooth, implant, and tissue support. Therefore, three implants were placed in a tripod configuration to stabilize the prosthesis and to minimize the bending moment. Implants were splinted with a bar with three ball attachments. The lower right second premolar was used as an overdenture abutment to preserve the bony tissue, and the lower right-second molar was used to provide support and retention for the prosthesis. A balance in the lip support and competency resulted in desirable esthetics, phonetics, and functional ability for the patient. This treatment plan provided a very acceptable rehabilitation for the patient.

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