Published in final edited form as:

J Prosthodont. 2016 April ; 25(3): 241–246. doi:10.1111/jopr.12282.

Use of Orbital Conformer to Improve Speech in Patients with Confluent Maxillectomy and Orbital Defects

Amanda C. Colebeck, DDS, MS¹, Michael T. Kase, DMD², Cindy B. Nichols, DMD, Marjorie Golden¹, and Joseph M. Huryn, DDS¹

¹Dental Service, Department of Surgery, Memorial Sloan Kettering Cancer Center, New York, NY

²Division of Oral and Maxillofacial Surgery and Dental Medicine, Department of Surgery, Loyola University Medical Center, Maywood, IL

³Private Practice, Seneca, SC

Abstract

The basic objective in prosthetic restoration of confluent maxillary and orbital defects is to achieve a comfortable, cosmetically acceptable prosthesis that restores speech, deglutition, and mastication. It is a challenging task complicated by the size and shape of the defects. The maxillary obturator prosthesis often satisfies the objective of adequate deglutition; however, orbital defects that are not obturated in the medial septal or posterior walls allow air to escape, negatively impacting phonation. This article describes a technique to achieve favorable prosthetic rehabilitation in a patient with a maxillectomy and ipsilateral orbital exenteration. The prosthetic components include maxillary obturator, orbital conformer, and orbital prosthesis connected using rigid magnetic attachments.

Keywords

Maxillary obturator; ocular prosthesis; maxillofacial prosthesis; prosthetic technique

Patients who undergo maxillectomy with orbital exenteration require complex prosthetic rehabilitation due to the anatomic and functional characteristics that must be restored.¹ The maxilla functions as the keystone of the midface and unifies the orbit, zygomaticomaxillary complex, nasal unit, and stomatognathic complex into a functional and esthetic unit.² Additionally, the maxilla and nasal cavities play a large role in creating intelligible speech. When a combination obturator-orbital prosthesis fits improperly and allows air to escape, the patient's speech typically sounds hypernasal and unintelligible. Therefore, it is important for the prosthetic components to have excellent fit and retention in order to provide the patient with an acceptable rehabilitation.³

Correspondence: Amanda C. Colebeck, 206 Commodore Terrace, Cheektowaga, NY 14225. Amanda.Colebeck@gmail.com.

Contents of this paper have been presented in poster format at the American Prosthodontic Society annual meeting (Chicago, IL, February 2013).

The authors deny any conflicts of interest.

Although osseointegrated implants can provide reliable prosthesis retention, additional surgeries, inadequate bone, and prior radiation to the defect and surrounding structures often complicate this type of treatment.⁴ In 1971, Javid described the use of magnets in maxillofacial prostheses. Coin-shaped magnets were placed using hard acrylic resin with the magnetic poles in proper position to aid in the retention of an obturator and orbital prosthesis.⁵ Various authors have elaborated on this technique for the retention of midfacial prosthetics.^{6,7,8,9} The rigid connection that magnets provide allows retention of the prosthetic components, prevention of air escape, and relief of skin-supported areas.

This article presents the prosthetic restoration of speech, mastication, and deglutition for a 78-year-old woman with a 32-year prosthetic reconstruction history following a right maxillectomy with ipsilateral orbital exenteration for right maxillary antrum epidermoid carcinoma (Figs 1, 2). The patient worked as a nursery school teacher until retirement. Thus, intelligible speech and a cosmetically acceptable appearance were very important to her quality of life. Three prior prostheses were fabricated using other retentive devices without success due to the complexity of the defect. Initially, three orbital implants were placed but failed over time due to poor bone quality from decreased microvasculature following radiation therapy.¹⁰ Skin adhesives were then used, but proved unsuccessful due to skin sensitivity of the patient. Next, a keeper with magnets was embedded in the silicone orbital prosthesis and used as an intermediary device to attach the obturator prosthesis, but did not provide an adequate seal of the septal wall defect, thus allowing air to escape, yielding unintelligible speech. The patient felt that her quality of life was diminished due to the difficulty of others understanding her speech, and she desired a different prosthetic solution.

The prosthetic rehabilitation detailed here includes rigid connection of maxillary obturator, orbital conformer, ocular, and orbital prostheses using nickel-coated neodymium magnetic attachments (K&J Magnetics, Inc, Pipersville, PA). The maxillary obturator is retained by an implant-supported gold Hader bar and attached with Hader clips (Preat Corp, Santa Ynez, CA). The obturator bulb has a flat superior surface with three embedded magnets that correspond to three magnets present in the base of the intermediary orbital conformer component. The internal surface of the orbital conformer has three additional embedded magnets that correspond to magnets on the acrylic posterior side of the orbital prosthesis. A beneficial element of the prosthetic configuration is the right angle formed by the connection of the obturator and orbital prosthesis, providing an additional retentive force.

TECHNIQUE

1. Make preliminary impressions of the maxilla and mandible with irreversible hydrocolloid (Jeltrate; Dentsply Caulk, Milford, DE).
2. Fabricate a custom tray for the maxilla and make a definitive impression with poly(vinyl siloxane) (Aquasil Ultra; Dentsply Caulk). If implants are present in the maxillary arch, follow the implant manufacturer's recommended technique for pick-up of the implant orientation into the definitive impression.

3. Fabricate a maxillary baseplate with wax rim for maxillomandibular records. Try-in the baseplate, and adjust the wax rim according to the mandibular occlusal plane, lower lip, and upper lip contour. Take a maxillomandibular bite record with bite registration material (Blu-Mousse; Patterson Dental, St. Paul, MN).
4. Articulate the maxillary and mandibular models, arrange teeth in wax, and evaluate intraorally for proper esthetics and phonetics.
5. Invest and heat-process the maxillary obturator with acrylic (Hy-Pro Lucitone; Dentsply International, Ontario, Canada). Embed magnets at the superior surface of the obturator bulb with autopolymerizing acrylic resin (Tru Repair; Bosworth, Skokie, IL) (Fig 3).
6. Orient additional counter magnets on top of the embedded magnets and use autopolymerizing acrylic resin (Tru Repair) to fabricate the magnetic keeper used to orient the location of magnets on the superior surface of the obturator for future incorporation into the conformer (Fig 4).
7. Place the obturator in position and ensure proper seating on the patient's maxilla. The view of the magnets at the superior obturator bulb surface should be unobstructed when looking down into the patient's orbital defect (Fig 5).
8. Place putty inside the defect if necessary to avoid extrusion of impression material into the nasopharynx (Fig 6).
9. With obturator, putty, and magnetic keeper in place, make an alginate moulage impression of the orbital defect by flowing irreversible hydrocolloid (Jeltrate) onto the defect and borders (Fig 7). This is followed immediately by placement of gauze over the irreversible hydrocolloid to act as a retentive component for the future plaster backing (Fig 8). Once the irreversible hydrocolloid is set, apply plaster to cover the extent of the impression for reinforcement.
10. Remove the moulage from the patient's face once the plaster is set to the point of heat escape and verify all components of the impression are intact (Fig 9). Place new magnets on top of the counter magnets retained by the magnetic keeper in the impression. Pour the impression in type V stone (Die-Keen; Whip Mix Corp, Louisville, KY) and remove the impression from the stone upon complete set (Fig 10). Remove the retained components in the master impression including the block-out putty and magnetic keeper. Ensure that the counter magnets to the keeper remain in the master impression, as these are positioned identical to those on the obturator and necessary for future pick-up into the orbital conformer prosthesis.
11. Duplicate the master cast with silicone (Wirosil Duplicating Silicone; Bego USA, Lincoln, RI). On the duplicated model, fabricate the orbital conformer by waxing to a thickness of 5 mm along the internal borders of

the orbital defect. Invest the model with waxed conformer and process with heat-cured clear acrylic resin (Hygenic; Coltene/Whaledent, Cuyahoga Falls, OH). Breakout, clean, and polish acrylic conformer and place onto the original master cast. Using the location of the magnets recorded at the time of impression, hollow the inferior portion of the obturator where magnets will be picked-up. Incorporate magnets on the inferior surface using clear autopolymerizing acrylic resin (Orthodontic resin, Patterson Dental; Raleigh, NC). In addition, choose three locations on the conformer in the outer periphery (tripod orientation is preferable) and embed magnets with clear autopolymerizing resin (Orthodontic resin) for retention of the orbital prosthesis (Fig 11). Orient additional counter magnets on top of the embedded magnets in the periphery of the conformer and use autopolymerizing acrylic resin (Tru Repair) to fabricate the magnetic keeper used to orient the location of magnets in periphery of the conformer to future orbital prosthesis.

12. Insert the obturator followed by conformer with pressure indicating paste in place on the patient, verifying complete seating. Adjust areas of excessive pressure with an acrylic bur and polish. Place the magnetic keeper into the conformer prosthesis. Using the same steps for moulage as described in step 5, impress the orbital defect with conformer and keeper in place. Upon set of the plaster, remove the moulage and verify all components of the impression are intact. Remove the conformer prosthesis from the impression and place counter magnets onto the magnetic keeper.
13. Pour impression in type V stone (Die-Keen, Whip Mix). This is now the master model for orbital prosthesis fabrication. With the magnetic keeper on the master model, orient an ocular prosthesis of similar shape and color to the patient's existing eye onto the keeper with wax.
14. Insert the obturator and conformer in place on the patient, verifying complete seating. Try in the keeper with ocular prosthesis on the patient and assess the appropriate gaze and orientation of the ocular prosthesis. Once satisfied with the ocular positioning, attach the ocular prosthesis to the keeper with autopolymerizing resin (GC Resin; GC America Inc., Alsip, IL). Modify the keeper to allow for mechanical retention inside the future silicone orbital prosthesis by adding a button-shaped projection with autopolymerizing acrylic (Tru Repair) (Fig 12).
15. Return the ocular prosthesis to the master model and wax the orbital prosthesis. Try in the orbital prosthesis to assess appropriate marginal and anatomic contours. Invest and process the orbital prosthesis with silicone (Factor II, Lakeside, AZ) according to manufacturer's instructions. Try in the silicone orbital prosthesis and custom tint with medical adhesive and oil pigments to match the patient's skin tone. Heat process the pigmented silicone according to manufacturer's instructions and deliver orbital, conformer, and obturator prostheses (Figs 13, 14).

16. Provide instructions to the patient regarding the application, removal, and care of the prostheses. Recall the patient every 4 to 6 months for observation and prosthetic maintenance.

DISCUSSION

Restoration of midfacial defects can be accomplished surgically, prosthetically, or through a combination of both. Patients who undergo maxillectomy with orbital exenteration present a unique challenge to reconstructive surgeons.¹¹ While recent advances in locoregional and microvascular reconstruction have lead to successful surgical outcomes, patients are not always candidates for surgical reconstruction.¹² Complicating factors include the patient's comorbid medical conditions, motivation, history of radiation therapy, and willingness to undergo extensive surgical procedures.¹³ Additionally, patients must consider the functional and esthetic compromises when considering surgical reconstruction versus prosthetic rehabilitation. Often, a combination of surgery and prosthetic rehabilitation is preferred in these cases of large midfacial defects to adequately restore the patient's functional needs and esthetic requirements.¹⁴ In the case of the patient discussed here, her initial surgery, including right maxillectomy and ipsilateral exenteration, was performed in 1978 when surgical reconstructive techniques often resulted in bulky, unesthetic facial flaps.² The patient expressed overall satisfaction with the appearance of her prostheses over the years, but as stated previously, was dissatisfied with her speech intelligibility. Had the patient's defects been successfully reconstructed at the time of surgical ablation, she may have had higher satisfaction with her quality of speech; however, esthetics would have been compromised.

The cosmetic deformity of confluent maxillary and orbital defects has a significant psychological and functional impact.^{15,16} It is the challenge of the prosthodontist to adequately restore these patients to allow for proper speech, mastication, swallowing, and improved self-esteem.¹⁷ With proper planning and use of the remaining anatomic structures, it is feasible to construct intraoral and extraoral prostheses that are mutually retained by one another. Many retentive devices for maxillofacial prosthetics have been described in the literature and implemented in practice, including eyeglasses, magnets, tissue adhesives, mechanical retention, coronal attachments, and craniofacial implants.^{4,5,6,7,8,18,19,20,21} Due to the size and shape of this patient's confluent defect, retention of her previous prostheses was always a concern. The contours of the orbital conformer and magnetic connection to the obturator allow sufficient stability and retention to properly restore the patient's speech, mastication, and esthetics. Additionally, the silicone orbital prosthesis margins were well adapted to the patient's skin, allowing elimination of inherent problems associated with the use of adhesives. The patient expressed improved quality of life and satisfaction with her speech intelligibility with this combination of prostheses.

The patient documented in this case had maxillary implants with a bar superstructure that allowed increased retention of the obturator prosthesis. This technique can be modified to accommodate patients with natural dentition or complete edentulism in the maxilla; however, in the case of an edentulous maxilla where the obturator is only retained by adhesive or tissue undercuts, mobility of the obturator can impact mobility of the facial

prosthesis, especially during function. An additional technique that can be used to reduce the weight of the obturator prosthesis, and thereby contribute to improved retention, is fabrication of a hollow bulb as described by Asher et al.²² The top of the hollow bulb needs to be of sufficient thickness to allow embedding of the magnets necessary for retention of the conformer prosthesis. A hollow bulb obturator was not considered for the patient described here because her obturator bulb was relatively small and did not greatly contribute to the overall weight of the prosthesis.

The mechanical limitations of the prostheses should be discussed with the patient prior to undergoing prosthetic rehabilitation. The patient should be aware that over time the magnets in the prosthesis may need to be changed. Using magnets with strong surface coatings will help to prolong their lifespan. Periodic recall appointments at the interval of 4 to 6 months are advisable for assessment of the prostheses and supporting tissues. The patient should be instructed on good oral hygiene techniques and maintenance of the midfacial defect. The orbital/conformer and obturator prostheses should be removed at night and cleaned with mild soap. Mucous and debris in the defects should be removed by irrigation or wet gauze. It is also beneficial for the patient to sleep at night with a humidifier present and a patch over the facial defect to allow the delicate tissue membranes to remain moist.

CONCLUSION

Prosthetic restoration of confluent maxillectomy and orbital defects with use of the intermediary orbital conformer prosthesis optimizes closure of passages for air leaks, especially the septal defect area, which has often compromised phonation and deglutition in these patients. It also serves to firmly seat the obturator in a relatively fixed position to allow for repetition of tongue-palate distance. This will aid in consistently intelligible speech. Additionally, the orbital conformer aids in proper orientation of the obturator and orbital prosthetic components for better esthetics, retention, and stability. The outcome of this technique is evident, as patients rehabilitated with the obturator-conformer-orbital prosthesis with magnetic attachments report long-term success, satisfaction, and improved quality of life.

Acknowledgments

The grant is P30 CA008748

References

1. Beumer J, Calcaterra TC. Prosthetic rehabilitation of large midfacial defects. *Laryngoscope*. 1976; 86:280–285. [PubMed: 1053376]
2. Muzaffar AR, Adams WP Jr, Hartog JM, et al. Maxillary reconstruction: functional and aesthetic considerations. *Plast Reconstr Surg*. 1999; 104:2172–2183. [PubMed: 11149786]
3. Desjardins RP. Obturator prosthesis design for acquired maxillary defects. *J Prosthet Dent*. 1978; 39:424–435. [PubMed: 273694]
4. Arcuri MR, LaVelle WE, Fyler E, et al. Prosthetic complications of extraoral implants. *J Prosthet Dent*. 1993; 69:289–292. [PubMed: 8445560]
5. Javid N. The use of magnets in a maxillofacial prosthesis. *J Prosthet Dent*. 1971; 25:334–341. [PubMed: 5276856]

6. Brignoni R, Dominici JT. An intraoral-extraoral combination prosthesis using an intermediate framework and magnets: a clinical report. *J Prosthet Dent*. 2001; 85:7–11. [PubMed: 11174670]
7. Dumbrigue HB, Fylerb A. Minimizing prosthesis movement in a midfacial defect: a clinical report. *J Prosthet Dent*. 1997; 78:341–345. [PubMed: 9338864]
8. Bidra AS, Montgomery PC, Jacob RF. Maxillofacial rehabilitation of a microstomic patient after resection of nose, lip, and maxilla. *J Oral Maxillofac Surg*. 2010; 68:2513–2519. [PubMed: 20678846]
9. Patil P. Modified technique to fabricate a hollow light-weight facial prosthesis for lateral midfacial defect. *J Adv Prosthodont*. 2010; 2:65–70. [PubMed: 21165271]
10. Toljanic JA, Eckert SE, Roumanas E, et al. Osseointegrated craniofacial implants in the rehabilitation of orbital defects: an update of a retrospective experience in the United States. *J Prosthet Dent*. 2005; 94:177–182. [PubMed: 16046970]
11. Cordeiro PG, Chen CM. A 15-year review of midface reconstruction after total and subtotal maxillectomy: Part II. Technical modifications to maximized aesthetic and functional outcomes. *Plast Reconstr Surg*. 2012; 129:139–147. [PubMed: 21681127]
12. O'Connell DA, Futran ND. Reconstruction of the midface and maxilla. *Curr Opin Otolaryngol Head Neck Surg*. 2010; 18:304–310. [PubMed: 20543697]
13. Futran ND, Mendez E. Developments in reconstruction of the midface and maxilla. *Lancet Oncol*. 2006; 7:249–258. [PubMed: 16510334]
14. Robb GL, Marunick MT, Martin JW, et al. Midface reconstruction: surgical reconstruction versus prosthesis. *Head Neck*. 2001; 23:48–58.
15. Argerakis GP. Psychosocial considerations of the post-treatment of head and neck cancer patients. *Dent Clin North Am*. 1990; 34:285–305. [PubMed: 2186935]
16. Tobey EA, Lincks J. Acoustic analyses of speech changes after maxillectomy and prosthodontic management. *J Prosthet Dent*. 1989; 62:449–455. [PubMed: 2685247]
17. Kornblith AB, Zlotolow IM, Goen J, et al. Quality of life of maxillectomy patients using an obturator prosthesis. *Head Neck*. 1996; 18:323–334. [PubMed: 8780943]
18. Lerner TH, Huryn JM. Orbital prosthesis with a magnetically retained ocular component supported by osseointegrated implants. *J Prosthet Dent*. 1993; 69:378–380. [PubMed: 8463966]
19. Sykes LM, Essop RM. Combination intraoral and extraoral prosthesis used for rehabilitation of a patient treated for cancrum oris: a clinical report. *J Pros Dent*. 2000; 83:613–616.
20. Hecker DM. Maxillofacial rehabilitation of a large facial defect resulting from an arteriovenous malformation utilizing a two-piece prosthesis. *J Prosthet Dent*. 2003; 89:109–113. [PubMed: 12616227]
21. Evans JH, Schweiger JW, Wright RF. Craniofacial osseointegration of a large midfacial bone-anchored combination maxillofacial prosthesis: a clinical report. *J Prosthet Dent*. 1996; 75:483–486. [PubMed: 8709011]
22. Asher ES, Psillakis JJ, Piro JD, et al. Technique for quick conversion of an obturator into a hollow bulb. *J Prosthet Dent*. 2001; 85:419–420. [PubMed: 11319544]

Figure 1. Maxillectomy defect with Hader bar on osseointegrated implants in the patient's left maxilla.

Figure 2.
View of patient's orbital defect. Septal wall, superior nasal pharynx, middle nasal pharynx, inferior nasal pharynx.

Figure 3.
Maxillary obturator with magnets on superior surface of obturator bulb.

Figure 4.
Magnetic keeper in place used to orient the location of the magnets on the obturator to the location in the conformer.

Figure 5.
Maxillary obturator with view of magnets at superior obturator bulb surface in the base of the orbital defect.

Figure 6.
Placement of putty along medial wall of orbital defect to avoid extrusion on impression material into nasopharynx.

Figure 7.
Obturator, putty, and magnet keeper in place prior to impression procedure.

Figure 8.
Alginite moulage impression of orbital defect prior to placement of plaster reinforcement.

Figure 9.
Verify accuracy and orientation of impres- sion components.

Figure 10.
Stone model of orbital defect with putty and magnetic keeper intact.

Figure 11. Orbital conformer in place with magnets incorporated in inferior surface for retention against obturator as well as at outer periphery of conformer for orbital prosthesis retention.

Figure 12. Obturator, conformer, and ocular prostheses separated (top) and attached (bottom). Each prosthetic component is held in place by magnetic retention.

Figure 13.
Obturator, conformer, ocular, and orbital prostheses attached.

Figure 14.
Prosthetic restoration of confluent maxillectomy and orbital defect.