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CLINICAL REPORT

Prosthetic rehabilitation of a maxillary defect with a bone anchored prosthesis: A clinical report

Thomas J. Salinas, DDS,[a] Nikita Sinha, BDS, MDS,[b] Venkata Revuru, BDS,[c] and Kevin Arce, DMD, MD[d]

ABSTRACT

Mucormycosis is an opportunistic fungal infection that frequently infects sinuses, brain, or lungs and arises mostly in immunocompromised patients. Although its occurrence in the maxilla is rare, debridement and resection of the infected and necrotic area is often the best treatment but usually results in an extensive maxillary defect. Protocols for prosthetic obturation versus microvascular reconstruction have been established and used effectively in tertiary institutions for patients with such large defects. Aramany Class VI defects involving more than half of the palatal surface can be managed effectively by surgical reconstruction using microvascular free flaps as a platform for supporting bone-anchored prostheses. Providing fixed prostheses may offer advantages over a conventional obturator prosthesis in terms of hygiene, function, and esthetics. Nonetheless, fixed prostheses retained by endosseous implants in patients with reconstructive osteomyocutaneous flaps often require a sequential team approach by the surgeon and prosthodontist. This clinical report describes the reconstruction of a maxilla by using a scapular free flap with subsequent prosthetic rehabilitation in a patient with maxillary sinus infection secondary to mucormycosis. (J Prosthet Dent 2019;121:173-8)

Immunocompromised patients are at high risk of developing various infections because the patients lack the basic mechanisms of cellular defense. The most common sources of infections are due to bacteria, fungi, and viruses. Among fungal infections, mucormycosis is the third most common opportunistic infection recorded after candidiasis and aspergillosis.[1] Widespread angioinvasion that results in thrombosis and tissue necrosis is the most characteristic histopathologic feature of mucormycosis. When the nasal and paranasal sinuses are involved, the standard treatment for such patients is surgical debridement of the infected tissue, which can often result in various mid-facial defects that may or may not include part of the palatal-maxillary complex. To address this deficiency, it is necessary to determine the feasibility of creating a stable obturator prosthesis.

Although the conventional use of prosthetic obturators has been the immediate treatment for restoring maxillectomy defects, the benefits of surgical reconstruction to address larger maxillary defects has notable advantages in terms of esthetics and function. Some of the first attempts at microvascular reconstruction of maxillary defects were successful with the use of the radius or rectus abdominus.[2] This was especially helpful when combined with endosseous implant-retained prostheses.[3] The successful use of free vascularized bone flaps for maxillary reconstruction has been well documented, with scapular and iliac flaps providing large amounts of soft tissues with minimal donor site morbidity. This allows the restoration of complex composite defects of the head and neck with large soft tissue requirements.[1,4,5]

The patient presented in the current report had a large intraoral defect, which was reconstructed in a staged manner by using a microvascular (scapular and parascapular) free flap for the osseous defect and prosthetic rehabilitation with a metal-ceramic fixed prosthesis supported by 8 osseointegrated dental implants. The prosthesis acted as a fixation device leading to increased functionality and patient satisfaction. This treatment illustrates the innovative use of interim and definitive prostheses acting to stabilize the surgical reconstruction.

[a]Professor of Dentistry, Department of Dental Specialties, Mayo Clinic, Rochester, Minn.
[b]Research Trainee, Department of Dental Specialties, Mayo Clinic, Rochester, Minn.
[c]Research Trainee, Department of Dental Specialties, Mayo Clinic, Rochester, Minn.
[d]Assistant Professor of Surgery, Department of Surgery, Division of Oral and Maxillofacial Surgery, Mayo Clinic, Rochester, Minn.

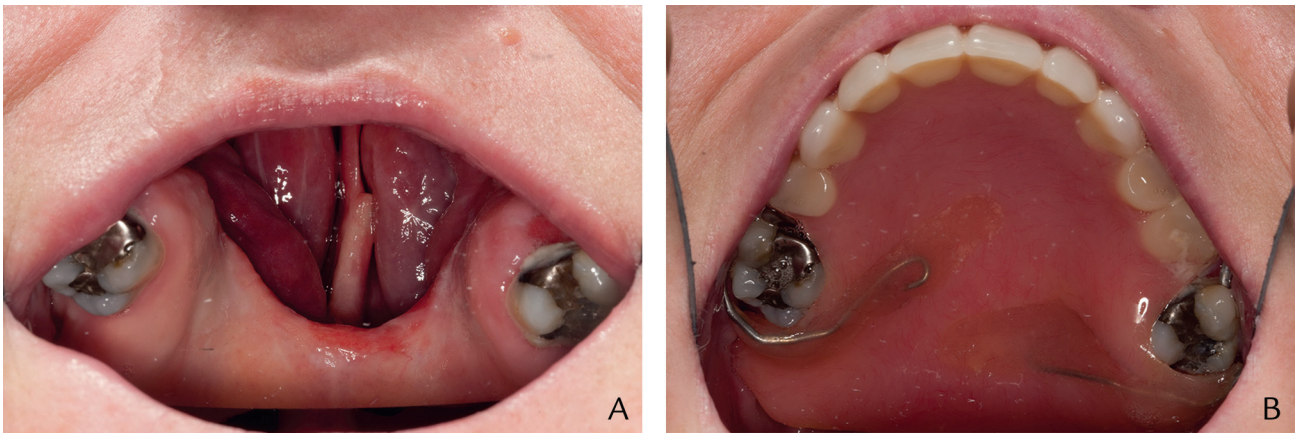

Figure 1. A, Intraoral defect after maxillectomy. B, Interim prosthetic obturator.

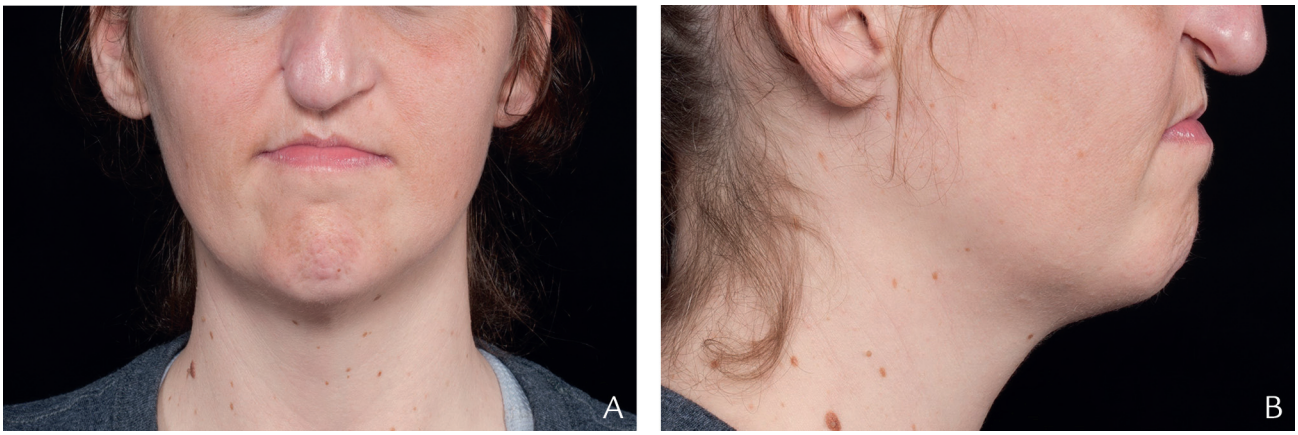

Figure 2. A, Extraoral defect without prosthesis indicates mid-facial loss of tissue. B, Involution of superior vermillion border and tipping of nose inferiorly.

The following prosthodontic-surgical collaboration illustrates contemporary approaches to complex maxillofacial reconstruction.

CLINICAL REPORT

A 32-year-old woman was referred to Dental Specialties, Mayo Clinic, Rochester, MN, in 2013 for reconstructive surgery of her maxilla. Lymphoblastic lymphoma had been diagnosed in 2011, and she had undergone chemotherapy. Her treatment was complicated by occurrence of invasive mucormycosis of the inferior nasal region and anterior palate, which was not responsive to antifungal medications. Consequently, the patient underwent serial debridement of the maxilla that eventually led to an anterior maxillectomy, right intranasal, and alar resection. Intraorally, the defect was an Aramany class VI encompassing 4×4 cm in greatest dimension anterior to the remaining dentition. Although the intraoral defect (Fig. 1) was reconstructed with a prosthetic obturator, the patient's chief complaint with the prosthesis was related to function, appearance, and speech impairment. Extraoral clinical examination revealed the patient had a mid-facial loss of tissue, involution of the superior vermillion lip border, and migration of the nasal tip inferiorly (Fig. 2).

An osteomyocutaneous scapula tip free flap procedure was planned for the reconstruction of the anterior maxillary defect. A surgical stent was fabricated from a duplicate of the patient's obturator prosthesis. The scapular free flap was harvested and contoured accordingly. It was centered on the tip of the right scapula with the angular arteries perfusing the serratus muscle for the palate, anastomosing into the vessels on the left side of her face and neck. The scapular tip bone was plated to the zygoma bilaterally. Soft tissues of the serratus were tailored to the surrounding free mucosal edges of the palate and lips to completely obturate the oral defect.

Transfer of the osteomyocutaneous flap was successful and without any complications of necrosis or local infection. Migration of oral mucosa over the serratus muscle appeared complete at 4 weeks (Fig. 3). Although intraoral swelling was expected after surgery, the patient recovered after a month, with excellent increase in upper

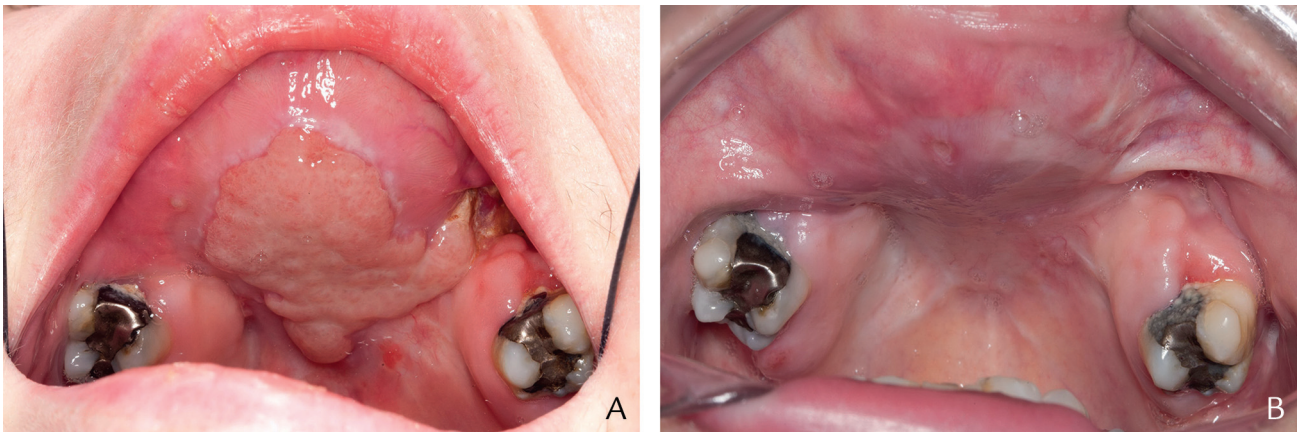

Figure 3. A, Status after placement of vascularized scapular graft. B, Note progressive mucosalization after 6 weeks.

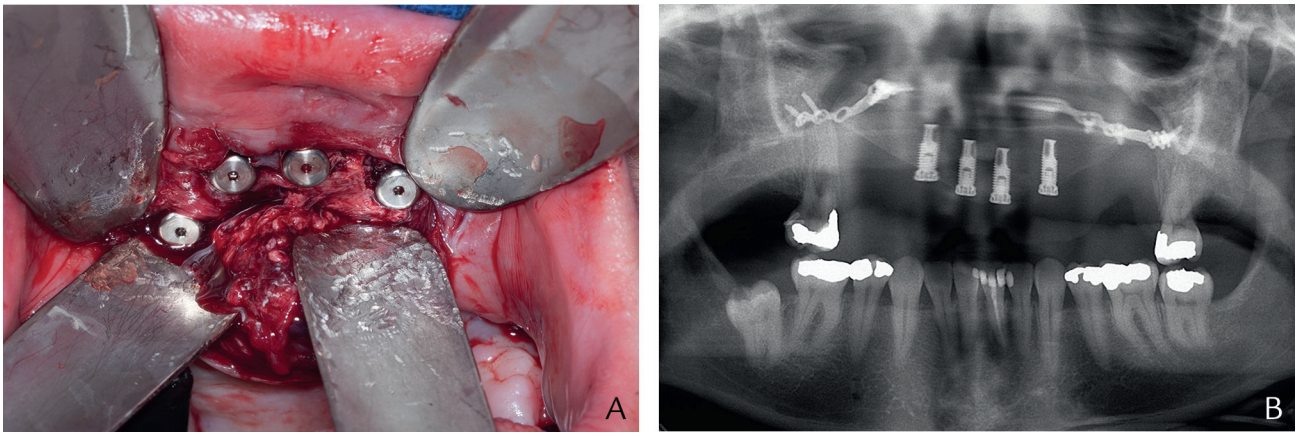

Figure 4. A, Placement of 4 dental implants in scapular graft. B, Panoramic radiograph indicating interim treatment situation.

lip length and adequate nasal tip support. In a second operation, dental implants were placed in the scapular flap in conjunction with soft tissue debulking and were submerged radiographically (Fig. 4). It became apparent upon implant placement that the left side of the bone flap was nonunionized to the left maxilla. Other surgical methods to correct nonunionized bone incorporate the use of bone morphogenetic protein,[6] which requires time and does not result in immediate stability. Although viable, the left maxilla did not exhibit stability comparable with that of the right side, so it was decided to span implants across this region to act as a fixation device.

The next phase of surgical intervention was undertaken after an additional 3 months and involved placing endosseous implants in the posterior native maxilla in the maxillary left second and third molars and right first and second molar regions. Provisionally splinting all 8 implants was advantageous, as slight mobility occurred from the left scapular grafted segment to the maxilla due to the nonunion. The implants placed previously were uncovered and fitted with component copings, and the patient's prosthesis was converted by using acrylic resin after trial removal and placement (Fig. 5).

After an additional 3 months, the interim prosthesis was removed, and the copings were splinted together with autopolymerizing acrylic resin. An open tray definitive impression was made with polyvinyl siloxane material. The interocclusal relationship was registered from the interim prosthesis. After a satisfactory trial, a metal-ceramic maxillary resection prosthesis was fabricated (Fig. 6) and secured using 8 abutment screws.

A palladium-silver alloy (W-1; Ivoclar Vivadent AG) was veneered with porcelain (In-line; Ivoclar Vivadent AG). Radiographic verification showed a reduction of all bony segments (Fig. 7A). All abutment screws were tightened to 35 Ncm to secure the 1-piece metal-ceramic prosthesis with stable occlusion (Fig. 7B). The definitive prosthesis was inserted in May 2015 and has since been in function without complication.

The fixed dental prosthesis fixed the left side across the areas of the native and reconstructed maxilla to augment the left reconstruction plate. This remains, verified by radiographic examination, with the fixed dental prosthesis bridging these areas and functioning

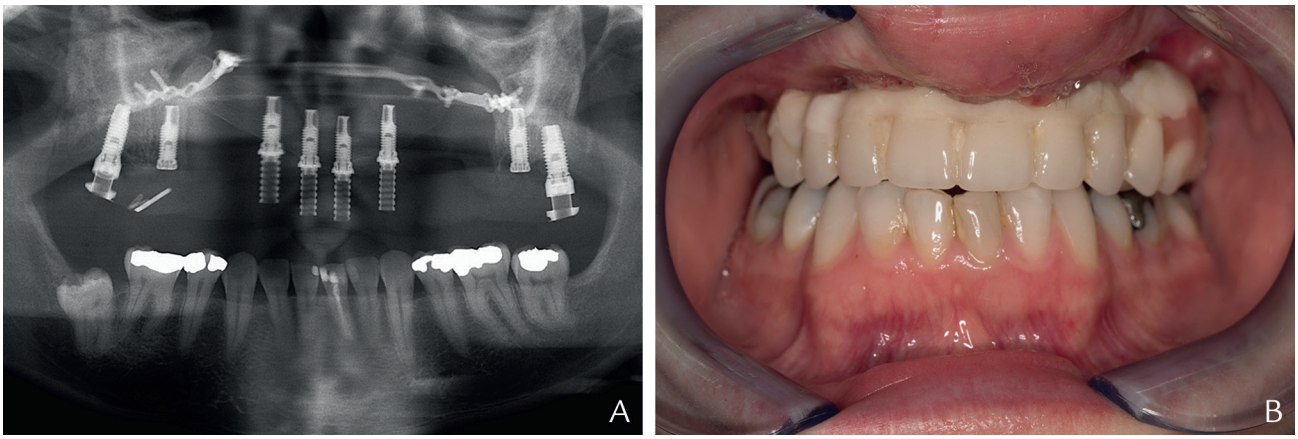

Figure 5. A, Stepwise progression radiograph after additional implant placement. B, Interim prostheses after placement of implants to native maxilla.

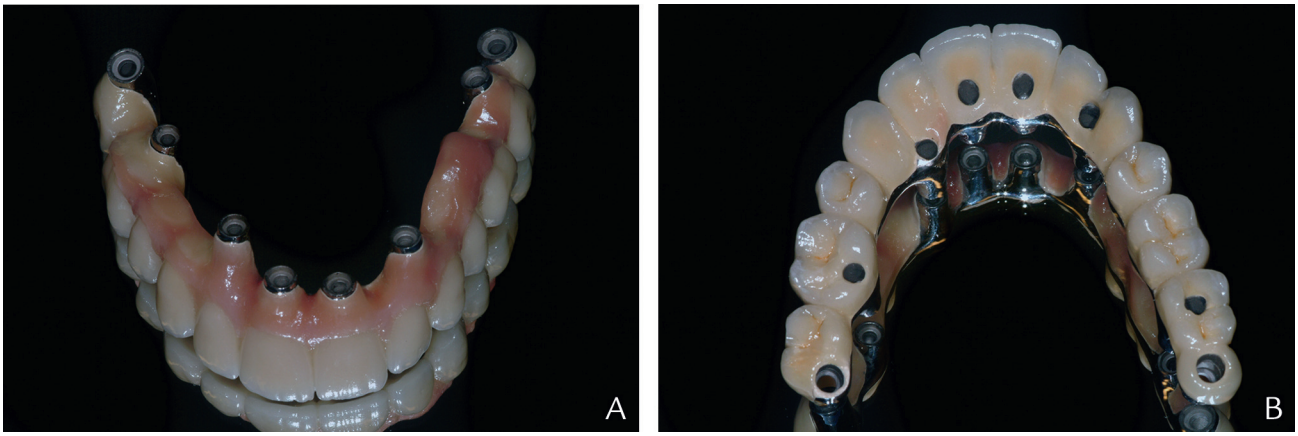

Figure 6. One-piece, screw-retained metal-ceramic prosthesis. A, Intaglio view. B, Occlusal view.

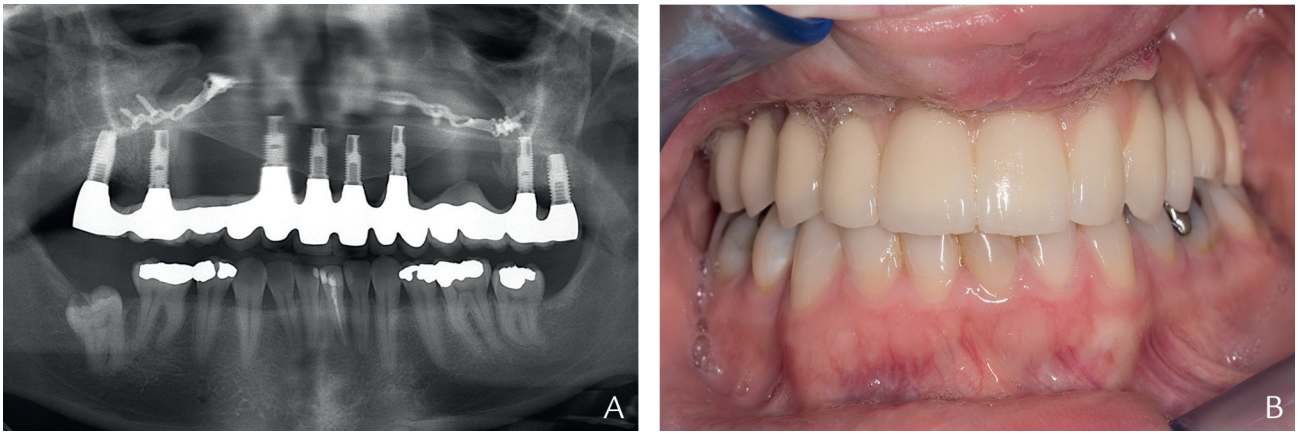

Figure 7. A, Panoramic radiograph of 1-piece fixed metal-ceramic prosthesis with stable occlusion. B, Frontal centric occlusal view of definitive prosthesis.

well. The patient is managing hygiene well and is pleased with esthetics, function, and speech (Fig. 8).

DISCUSSION

Recent advances in microvascular flap surgery have resulted in remarkable head and neck reconstruction procedures that were not previously possible. Moreover, microvascular free flap reconstruction of large maxillectomy defects can exceed the benefits of undergoing conventional prosthetic rehabilitation, as these flaps are the best for separating the oral and sinonasal cavities. Extensive resections result in large intraoral defects with significant problems encountered with retention,

Figure 8. A, Extraoral frontal view of definitive rehabilitation. B, Extraoral profile after prosthetic rehabilitation with appropriate lip support.

support, and stability after ablation of the retentive maxillary anatomy.[7]

Typically, reports describing the outcomes of surgical reconstruction of maxillary defects present favorable results. The large Aramany class VI defect[8] presented in this clinical report is relatively uncommon and presents an unfavorable situation for conventional prosthetic rehabilitation. As the size of some defects is large, microvascular reconstruction can overcome the difficulty for residual structures that stabilize the prosthesis. Surgical reconstruction procedures help preserve and enhance supporting areas around the maxillectomy defect in comparison with the conventional prosthetic obturation alone.[9,10]

The composite tissue microvascular transfers available for maxillary reconstruction include the fibula, iliac crest, radial forearm, and scapular flaps. An understanding of the requirements for prosthetic rehabilitation versus surgical reconstruction in situations associated with local and distant tissue transfer procedures is a prerequisite.[11] In this patient, the prosthetic rehabilitation served as a fixation device between the native maxilla and the scapular graft.[12] Osseointegrated implants placed in the microvascularized grafted bone have a better prospect for enhanced function and patient contentment.[13]

The scapular free flap offered advantages over the fibula or iliac crest (deep circumflex iliac artery) free flap.[14] Due to its specific form, the scapular graft was considered appropriate to reconstruct the palate and maxillary alveolar ridge and to enable subsequent implant-retained rehabilitation.[15] It also has low donor site morbidity[16]; a pedicle with good quality, shape, and length (up to 20 cm) acceptable for midface projection[17]; and respectable versatility. The main disadvantage of using a scapular flap was the difficulty of 2 teams working in tandem, as the intraoperative patient positioning was changed, increasing the average operating time. The insertion of dental implants has been shown to be predictably stable when installed in bony flaps, perhaps further aiding the stabilization of the microvascular reconstruction.[18]

SUMMARY

Rehabilitation of large maxillary defects can be a challenge in terms of creating proper support, especially in areas of expanded functional stress. Scapular and parascapular flaps provide a reliable means for bone anchorage support in head and neck reconstruction. The efficacious treatment of a maxillofacial disability can be approached with knowledge and by emphasizing the possibilities of reconstruction in the interest of the patient.

REFERENCES

1. Perusquia-Ortiz AM, Vazquez-Gonzalez D, Bonifaz A. Opportunistic filamentous mycoses: aspergillosis, mucormycosis, phaeohyphomycosis and hyalohyphomycosis. J Dtsch Dermatol Ges 2012;10:611-21; quiz 21-2.
2. Cordeiro PG, Santamaria E. A classification system and algorithm for reconstruction of maxillectomy and midfacial defects. Plast Reconstr Surg 2000;105:2331-46; discussion 47-8.
3. Iyer S, Thankappan K. Maxillary reconstruction: current concepts and controversies. Indian J Plast Surg 2014;47:8-19.
4. Valentini V, Gennaro P, Torroni A, Longo G, Aboh IV, Cassoni A, et al. Scapula free flap for complex maxillofacial reconstruction. J Craniofac Surg 2009;20:1125-31.
5. Aviv JE, Urken ML, Vickery C, Weinberg H, Buchbinder D, Biller HF. The combined latissimus dorsi-scapular free flap in head and neck reconstruction. Arch Otolaryngol Head Neck Surg 1991;117:1242-50.
6. Sweeny L, Lancaster WP, Dean NR, Magnuson JS, Carroll WR, Louis PJ, et al. Use of recombinant bone morphogenetic protein 2 in free flap reconstruction for osteonecrosis of the mandible. J Oral Maxillofac Surg 2012;70:1991-6.
7. Okay DJ, Genden E, Buchbinder D, Urken M. Prosthodontic guidelines for surgical reconstruction of the maxilla: a classification system of defects. J Prosthet Dent 2001;86:352-63.
8. Aramany MA. Basic principles of obturator design for partially edentulous patients. Part I: classification. J Prosthet Dent 1978;40:554-7.
9. Roumanas ED, Nishimura RD, Davis BK, Beumer J III. Clinical evaluation of implants retaining edentulous maxillary obturator prostheses. J Prosthet Dent 1997;77:184-90.
10. Chung KH, Chung CY, Cagna DR, Cronin RJ Jr. Retention characteristics of attachment systems for implant overdentures. J Prosthodont 2004;13:221-6.
11. Hanasono MM. Reconstructive surgery for head and neck cancer patients. Adv Med 2014;2014:795483.

12. Parel SM, Branemark PI, Ohrnell LO, Svensson B. Remote implant anchorage for the rehabilitation of maxillary defects. J Prosthet Dent 2001;86:377-81.
13. Dalkiz M, Beydemir B, Gunaydin Y. Treatment of a microvascular reconstructed mandible using an implant-supported fixed partial denture: case report. Implant Dent 2001;10:121-5.
14. Miles BA, Gilbert RW. Maxillary reconstruction with the scapular angle osteomyogenous free flap. Arch Otolaryngol Head Neck Surg 2011;137:1130-5.
15. Mertens C, Freudlsperger C, Bodem J, Engel M, Hoffman J, Feier K. Reconstruction of the maxilla following hemimaxillectomy defects with scapular tip grafts and dental implants. J Craniomaxillofac Surg 2016;44:1806-11.
16. Clark JR, Vesely M, Gilbert R. Scapular angle osteomyogenous flap in postmaxillectomy reconstruction: defect, reconstruction, shoulder function, and harvest technique. Head Neck 2008;30:10-20.
17. Uglesic V, Virag M, Varga S, Knezevic P, Milenovic A. Reconstruction following radical maxillectomy with flaps supplied by the subscapular artery. J Craniomaxillofac Surg 2000;28:153-60.
18. Maluf PS, Ching AW, Angeletti P, Bretos JL, Ferreira LM. Insertion torque of dental implants after microvascular fibular grafting. Br J Oral Maxillofac Surg 2015;53:647-9.

Corresponding author:
Dr Thomas J. Salinas
200 1st Street SW
Rochester, MN 55905
Email: Salinas.thomas@mayo.edu

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