

How to Cite:

Yadav, B., Malhotra, T., Ritwal, P., Shetty, O., Nagpal, A., & Singh, D. (2022). Various prosthetic rehabilitation for mucormycosis. *International Journal of Health Sciences*, 6(S2), 8501–8509. <https://doi.org/10.53730/ijhs.v6nS2.7183>

Various prosthetic rehabilitation for mucormycosis

Bhupender Yadav

Professor, Department of prosthodontics, Faculty of dental sciences SGT University, Budhera, Gurugram, Haryana, India
Corresponding author email: drbhupinderyadav@gmail.com

Taniya Malhotra

PG Student, Department of prosthodontics, Faculty of dental sciences SGT University, Budhera, Gurugram, Haryana, India

Pankaj Ritwal

Senior lecturer Department of prosthodontics, Faculty of dental sciences SGT University, Budhera, Gurugram, Haryana, India

Omkar Shetty

Dean and Professor of prosthodontics, Faculty of dental sciences SGT University, Budhera, Gurugram, Haryana, India

Abhishek Nagpal

Professor and Head Department of prosthodontics, Faculty of dental sciences SGT University, Budhera, Gurugram, Haryana, India

Diksha Singh

Senior lecturer Department of prosthodontics, Faculty of dental sciences SGT University, Budhera, Gurugram, Haryana, India

Abstract---Mucormycosis is a form of fungal infection that is invasive and rapidly progressive, thereby including nose and paranasal sinuses of the head and neck region with high mortality and morbidity. Compromised immunity such as uncontrolled diabetes mellitus, Leukaemia, long-term use of steroids are the most common causes of the disease. Acute surgical resection is performed that involves the resectioning of the affected maxillofacial structures such as orbit, maxilla and / or nose in such conditions. Prosthodontic rehabilitation of these large maxillofacial defects is challenging. Lack of retention due to dislodging forces exerted by scarred post-surgical soft tissues, lack of bony base, missing structures of the posterior palatal seal area, multiple defect sites and compromised medical status due to comorbidities are the numerous problems are encountered during the

rehabilitation of such defects. The basic principle of any prosthetic rehabilitation design includes the preservation of the remaining natural tissues along with retention, stability, support, and aesthetics. Fixed or Removable Prosthodontic rehabilitation can be performed depending on the available supporting structures.

Keywords---mucormycosis, prosthodontic rehabilitation, surgical resection.

Introduction

Mucormycosis is one of several opportunistic fungi that become invasive and pathogenic in patients with altered metabolic status or in those who are immunologically compromised) The organism involved is a branching, non septate hypha that invades and extends along arterial pathways, causing arterial thrombosis and tissue infarction. Initial invasion is through the nasal mucosa, and extension is through the paranasal sinuses, pharynx, palate, orbit, and brain¹. The term Mucormycosis includes infections caused by any of these pathogens. Mucorales is a ubiquitous, opportunistic bread mold that is pathogenic only in severely compromised patients. Because it is a common laboratory contaminant, culturing the organism is not adequate for diagnosis; identification of the organism is made by histologic examination of multiple biopsy specimens.

Necrotic tissue may not contain identifiable segments of the organism. Initial diagnosis of the organism can be made on a direct wet-mount preparation by mixing necrotic specimens with 10% to 20% aqueous KOH) Identification of the organism by this method is adequate to allow the initiation of treatment; in fact, therapy should be initiated as soon as possible on the basis of clinical signs and symptoms to prevent massive tissue destruction. Tissue specimens are stained with hematoxylin and eosin.

The degree of morbidity in patients who have survived Mucormycosis depends primarily on how quickly the disease is diagnosed and treated. The disease has the potential to advance throughout the entire midfacial region causing destruction of both the maxilla and orbital contents and then advancing further into the cranium². Mobile rehabilitative systems are the systems of choice, both of which related to the traditional concepts of retention and stability and systems of self-stabilizing prostheses according to J. Di champ, albeit modified in materials, limiting, when possible, the use of prostheses which are fixed on natural teeth, on appliances or combined.

Prosthodontic Rehabilitation Procedures

Removable Prosthesis

Obturator

The Palatal obturator can be used alone or in combination, including plastic

reconstruction surgery. There are various methods and techniques for fabricating obturator prostheses, hence it is possible to create an obturator with full or partial dentures based on existing dentition. One of the fundamental problems with the maxillary obturator prosthesis is weight, the larger the defect the heavier the prosthesis.

The bulb type obturators make it possible to keep the weight within the physiological limits, as compared to the weight of a standard complete maxillary prosthesis. This additionally offers a harmonic resonance field which enhances the patient's phonation. The prosthesis, initially applied to a single block, is then welded to make it lighter and more comfortable. The view is made by opening, which is used to insert a grinding cutter, and to adjust the resin area that will close the opening³.

The type of palatal obturator, which we now use, is described as "stabilizing" by J. Dichamp also has a silicon component that fits well with the maxillectomy as well as a device that adheres to dental implants in acrylic resin. The silicone layer closes the element and in the absence of a prosthesis, thus allowing the element to close and close immediately. The grooved adhesive system provides high retention in the prosthesis even if there are no remaining teeth or basic support⁴. The complete reconstruction of the post-maxillectomy feature is still controversial according to Rogers et al. compared adjustment with obturator or free flap in relation to work and dependence on quality of adoption life. The maxillary-face prosthesis is often associated with endothelial structures, which prevent nasal congestion and the passage of fluid into the nasal cavity. Etienne et al. maintain that maintenance is easier to obtain in the clinical management of patients with dental maxillectomy compared to those without. The structure of the obturator prosthesis in patients with partial teeth usually includes attachment components⁵. According to Blair et al. maxillary resection has a high incidence of illness with significant functional and psychological consequences for the patient. Reactivating adequate shut-off feature is essential to prevent the passage of air, fluid and nutrients between the nose and the mouth⁶. Ortegon et al. described the first adhesive method of pre-maxillary opening to increase retinal obturator retention in bilateral subtotal defect post-maxillectomy. The method is simple to perform and can be used to close quickly, temporarily and / or for sure⁷. Gupta C has published a series of Prosthodontic rehabilitation cases of combined maxillectomy and orbital defect using three different types of attachments such as magnets, the author concludes that increased retention improves patient comfort and confidence while wearing a facial prosthesis in work and places.

Palatal obturators may be used alone or in combination, integrating plastic reconstructive surgery. Various methods and techniques have been described for the preparation of obturator prostheses. It is possible to create an obturator with full or partial dentures on the basis of existing dentition. One of the main problems of an obturator maxillary prosthesis is weight, the larger the defect the heavier the prosthesis, to the extent that for defects of over a certain size the force of gravity prevails over the capacity of retention of the substructures and residual elements. Obturators the bulb of which is hollow makes it possible to maintain the weight within acceptable values, comparable to the weight of a normal complete upper prosthesis. This also offers a harmonic resonance box which

enhances the patient's phonation. The prosthesis, initially applied in a single block, is then milled to make it lighter and more comfortable. An impression is made of the opening, used to insert the milling cutter, and a resin surface is prepared which will close the opening. The maxillary-facial prosthesis is often correlated with properties of retention, which prevent nasal speech and the passage of liquids into the nasal cavity.

Cast Partial Denture

The design of cast partial over denture resembles the design of mandibular partial over denture supported by implants and posterior natural abutment teeth. But the differences exist in exclusion of attachments and the support for over denture, which was from underlying natural teeth instead of implants. On the whole there was a definite reduction in the total cost of treatment as implants and precision attachments were not incorporated. There was also an added advantage of preserving patient's own natural teeth and potential benefits of reduced ridge resorption with enhanced retention, stability and support for the prosthesis.

Louis and associates reported that patients can masticate food more efficiently with over dentures than with complete dentures which justify the increased cost and time involved in their construction. Moreover prosthesis retained by prefabricated intra-radicular retainers offer greater flexibility with regard to extension of base of prosthesis and the coverage of alveolar ridge in areas of missing teeth. In the present case, clasps engaging the abutment teeth offer additional prosthetic retention.

Fixed Prosthesis

Fixed Obturator

The new design for a fixed obturator is based on the Nance appliance, which was originally used as a space maintainer, but has been redesigned for closing an anterior palatal fistula in a patient with cleft lip and palate. The Nance obturator may be used when the surgical closure of the fistula is not feasible and a removable device is not successful. As it is a fixed device, it does not require remaking with maxillary growth. The new design may also function as a fixed space maintainer to preserve molar anchorage and maxillary transverse width. The Nance appliance is an orthodontic appliance that is temporarily cemented to the maxillary molar teeth. It maintains the maxillary molar position and keeps the molars from drifting forward into an extraction space or holding the space for the eruption of permanent canines and premolars. The Nance appliance has two molar bands cemented on the maxillary first permanent molars, and a connecting trans-palatal wire with an acrylic pad (button) in the middle of the wire that rests against the anterior curvature of the palate. The Nance obturator can represent a method to help the patient obturate and improve quality of life.

Implant Supported Prosthesis

According to Chiapasco et al ., the exclusion criteria for treatment with implants are⁸:

- a) patients with very poor prognosis or whose health is systemically compromised.
- b) patients who have undergone resection of the posterior part of the maxillary or the mandibular with sufficient remaining dentition to guarantee acceptable mastication;
- c) patients with recurrences of oral carcinoma but who continue to use alcohol or tobacco; or
- d) noncompliant patients.

The only limitation of the fibula free flap may be the height of the step of over 14 mm. This can create aesthetic problems, in particular in patients who have residual dentition on the healthy side

Implant Rehabilitation

Osseointegrated implants have been successful in providing retention, support, and stability of dental and craniofacial prostheses. Distraction osteogenesis is a useful reconstructive surgical technique that involves osteotomy and gradual displacement of a bony segment, either vertically or horizontally, to expand soft tissue and bone volume. The biologic basis and concept of the surgical process described by Ilizarov, a Russian orthopedic surgeon, have been adapted and modified for use in facial skeletal reconstruction, deformities of the jaws, and dentoalveolar process. The regenerated tissue formed by the controlled transport of skeletal fragments provides a stable, functional bone volume for an endosseous implant-supported dental restoration.

The principles of distraction osteogenesis have been well established in endochondral bones and, more recently, applied to the craniofacial skeleton to generate viable osseous tissue by gradual separation of osteotomized bone edges. Endochondral revascularization potential is secured for the mobilized segment during the latency period, which plays an important role in supporting matrix proliferation as distraction osteogenesis progresses (1 mm per day). An autologous bone graft can be taken from the iliac crest in a more posterior location to preserve the option of a free tissue transfer for future palatal restoration. Both cancellous and cortical grafts were harvested and placed in soft tissue envelopes with the intention to augment the existing facial skeleton to support the implants and provide stability of the obturator prosthesis. Healing of the submerged implants was not disturbed until the transmucosal exposure, which was performed 1 year after the initial placement. Implant sites were newly formed from distraction osteogenesis and augmented with bone graft that was soft and deficient in volume, although a lengthy healing period was allowed.

Dental Implants with Magnetic Attachments

Hence, the option of using endosseous implants to increase obturator retention has been introduced in the present case. Udea et al suggested the overall survival rate for implants supporting maxillofacial prosthesis was reported to be as high as 96.1%¹⁰. Gowda M rehabilitated an edentulous patient with partial maxillectomy using dental implants and magnetic attachment to achieve a retentive and stable obturator prosthesis⁹.

Although magnets may not result in adequate denture retention in every case, it is apparent that the nature of the magnetic force in controlling vertical displacement of the denture is likely to result in an improvement in retention. Riley et al suggested magnetic retention units in the form of cobalt samarium magnets can be embodied conveniently in the conventional obturators. The technique is simple to use, particularly when compared with other retention procedures, which can be both complicated and time consuming. Moreover, magnets avoid lateral stresses which are essential for long-term implant success¹¹.

Zygomatic Implants Rehabilitation

Bedrossian et al. reported that zygoma implants are less resistant to rotational forces. It has been suggested that for better distribution of these forces, zygoma implants should be placed to allow the greatest AP spread. In addition, cantilevers in the prosthetic reconstruction should be avoided; cross-arch stabilization by splinting of all the implants is also recommended. Gaur V published a clinical report on rehabilitation of extensive hard and soft tissue defects caused by rhino-orbital-cerebral mucormycosis as a result of untreated diabetes mellitus. The patient underwent subtotal maxillectomy and was rehabilitated with an implant-supported maxillofacial prosthesis with zygomatic and pterygoid implants by following an immediate loading protocol ¹². Zygoma implant reconstruction of acquired maxillary defects is a safe, predictable, and cost-effective treatment modality. It should be part of the armamentarium of every clinician treating these complex defects. An implant bar-supported prosthesis can be chosen for rehabilitation of mucormycosis. The prosthetic reconstruction can comprise of 2 separate parts, a cobalt-chromium bar, that can be cemented on implants and an acrylic resin denture with soft reline material. This option can provide better retention and avoid pull-out forces. The tooth arrangement with monoplane bilaterally balanced occlusion and lingualized occlusion is usually preferred which can help stabilize the obturator. If bicortical implants are to be placed, a few rules need to be respected. As these implants have smooth surfaces and rely on osseofixation, the main goal is to accurately anchor them in cortical bone.

Pterygoid Implants

Pterygoid implant has been defined as “implant placement through the maxillary tuberosity and into the pterygoid plate.” These implants were first introduced by Tulasne in 1989. The pterygoid implant originates in the tuberosity region and then follows an oblique mesiocranial direction proceeding posteriorly toward the pyramidal process; it subsequently proceeds upward between both wings of the pterygoid processes and finds its encroachment in the pterygoid or scaphoid fossa of the sphenoid bone. The length of these implants ranges from 15 to 20 mm, and they are generally placed at an angle of 45° to 50° to the horizontal plane. Usually, a combination of osteotomes and surgical drills with long extensions are used because of the semi-blinded nature of the surgical procedure and the bone density of the pterygoid plates and to minimize the potential for injuring vital structures.

Though previous reports have advocated the use of general anesthesia for implant placement in this region, more recent reports have described the use of local anesthesia. Some of the complications with surgical placement reported in the literature include slight venous bleeding, minor trismus, misplacement of the implant, and a unique case of continuous episode of pain and discomfort¹³. A recent case report described the use of a long zygomatic implant in the pterygoid region that resulted in an intracerebral penetration. Careful planning and use of cone-beam computerized tomography imaging may help prevent some of these complications.

Discussion

One form of Mucormycosis is called rhino cerebral Mucormycosis, which typically targets the maxillary antrum and invades the surrounding tissue, causing a blackish slough of necrotizing ulceration of the palate with exposure of underlying bone. These patients usually present with facial pain, nasal discharge, and sinusitis with clinical signs of orbital cellulitis and necrotic black tissue in the nasal turbinates and septum. As the condition progresses, patients suffer from metabolic derangements, such as liver/renal failure and uncontrolled diabetes with ketoacidosis, later with a confused state of mind and then may slip into a coma. Aggressive surgical debridement is commonly instituted, which results in the loss of the palate, maxilla, and contiguous structures, followed by difficulties with speech, deglutition, mastication, and respiration. Even with recent advances in diagnosis and treatment, a high mortality of 30 - 70% has been documented in the literature with no age or gender predilection. An obturator prosthesis is the treatment of choice because it creates a partition between the oral and nasal cavities, restores facial contour, improves mastication, articulation and speech intelligibility, and provides lip support. Support and retention of the prosthesis are often difficult to achieve due to the absence of teeth, a lack of favorable undercuts, and the presence of non-keratinized nasal mucosa¹⁴.

Impairment of senses, such as taste, smell, and hearing, along with functional disabilities and compromised esthetics, promotes a negative impact on the patient's OHR-QoL. Psychological depression is the final outcome of life stresses like medical illness. Maxillectomy adversely affects not only function and aesthetics but also results in emotional disturbances. As stated, the above factors could be the possible reason for depression in the case presented. Under the following circumstances, an immediate prosthesis becomes a necessity to lessen the psychological impact. Postoperatively, the obturator was delivered after a month due to delayed reporting of the patient for prosthetic rehabilitation, thus adding to the patient's psychological distress. Hence, the trauma from the surgery, her edentulous condition, and impaired function, along with the delayed prosthesis, were the possible factors for the patient's distress and anxiety. There was improved speech post-treatment, which was due to the better stability of the prosthesis. A good denture also provides improved masticatory efficiency that leads to improved taste perception.

The post-treatment responses were recorded after three months. There was a gradual shift in the OHIP-14 from the right side to the left side in the Likert's scale between pre- and post-treatment responses. Improved post-treatment

impact in the OHR-QoL could be due to several reasons, such as elaborative counseling, improved prosthesis stability, masticatory efficiency along with taste, and the patient's enhanced mental health. It is required to record similar responses at a later period, so further follow-up appointments were scheduled with the anticipation of further improvement of OHR-QoL.

Thus, a prosthodontist plays a vital role in the rehabilitation of total/subtotal maxillectomy patients by separating the oral and the nasal cavities, restoring the normal speech and mastication, along with improved aesthetics. In the presented case, the emphasis was more on the intaglio surface and occlusion with reduced cuspal angles for better retention and stability of the prosthesis functionally. Though an acrylic prosthesis was fabricated, metal could have been a better option; however, owing to the cost factor and the increase in the number of visits, acrylic was preferred. An implant-supported prosthesis was a viable treatment option for better retention, but conventional obturators were preferred to avoid further surgical intervention. Several studies have reported the successful rehabilitation of maxillectomy patients with conventional obturators.

Conclusion

The major role of a prosthodontist in treating maxillectomy patients does not end by rehabilitation of the lost oral function and aesthetics but also by rehabilitating and restoring the patient's mental health. Early diagnosis, eradication of the predisposing factor, and surgical debridement, along with antifungal therapy, are of prime importance for successful treatment and patient survival. Although the difference in pre- and post-treatment responses was minimal owing to the sample size and duration, it definitely showed a positive impact on the patient's mental health, thereby improving her oral health-related quality of life. Hence, further studies with a good sample size and duration are required for further validation.

References

1. Margo CE, Linden C, Strickland-Marmol LB, Denietolis AL, McCaffrey JC, Kirk N, et al. Rhinocerebral Mucormycosis With Perineural Spread. *Ophthal Plast Reconstr Surg*. 2007;23(4):326-7.
2. Reddy SS, Rakesh N, Chauhan P, Sharma S. Rhinocerebral Mucormycosis Among Diabetic Patients: An Emerging Trend. *Mycopathologia*. 2015;180(5-6):389-96.
3. Etienne OMG, Taddei AMI. Case report. Use of bar-clip attachments to enhance the retention of a maxillofacial prosthetic obturator: a clinical report. *J Oral Rehabil* 2004;31:618-21.
4. Dichamp J, Razouk O, Sidibe CA, et al. An obturator prosthesis in a patient with perfect dentition. Functional, esthetic approach. *Rev Stomatol Chir Maxillofac* 1994;95:195-6.
5. Etienne OMG, Taddei AMI. Case report. Use of bar-clip attachments to enhance the retention of a maxillofacial prosthetic obturator: a clinical report. *J Oral Rehabil* 2004;31:618-21.
6. Blair FM, Hunter NR. The hollow box maxillary obturator. *Br Dent J* 1998;184:484-7.

7. Ortegon SM, Martin JW, Lewin JS. A hollow delayed surgical obturator for a bilateral subtotal maxillectomy patient: a clinical report. *J Prosthet Dent* 2008;99:14-8.
8. Chiapasco M, Biglioli F, Auteliano L, et al. Clinical outcome of dental implants placed in fibula-free flaps used for the reconstruction of maxillo-mandibular defects following ablation for tumors or osteoradionecrosis. *Clin Oral Impl Res* 2006;17:220-8.
9. Gowda ME, Mohan MS, Verma K, Roy ID. Implant rehabilitation of partial maxillectomy edentulous patient. *ContempClinDent*.2013;4(3):393-396.
10. Ueda M, Hibino Y, Niimi A. Usefulness of dental implants in maxillofacial reconstruction. *J Long Term Eff Med Implants* 1999;9:349-66.
11. Riley MA, Walmsley AD, Harris IR. Magnets in prosthetic dentistry. *J Prosthet Dent* 2001;86:137-42.
12. Gaur V, Patel K, Palka L An implant-supported prosthetic rehabilitation of a patient with a bilateral subtotal maxillectomy defect secondary to rhino-orbital-cerebral mucormycosis: A clinical report of a graftless approach,*J Prosthet Dent* 2021
13. Sakuraba M, Kimata Y, Ota Y, et al. Simple maxillary reconstruction using free tissue transfer and protheses. *Plast Reconstr Surg* 2003;111:594-8.
14. Yoshinaka M, Yoshinaka MF, Ikebe Y, et al.: Factors associated with taste dissatisfaction in the elderly. *J Oral Rehabil*. 2007, 34:497-502.