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REVIEW ARTICLE **OPEN ACCESS**

Prosthodontic Rehabilitation in Mucormycosis Patients: A Review

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ABSTRACT
Mucormycosis is an opportunistic, rapidly progressive, invasive fungal infection involving the nose, and paranasal sinuses of the head and neck region with high mortality and morbidity rate. A tremendous rise in Mucormycosis cases was seen during the COVID-19 Period and Mucormycosis has emerged as a lethal disease. It mainly affects individuals with comorbidities and who are already immune compromised. This article reviews various treatment modalities for the rehabilitation of Mucormycosis patients with different rehabilitation options in removable or fixed forms. Rehabilitation of defects aims to restore the patient's confidence, quality of life, speech, masticatory functions, etc. It's a challenge for the prosthodontist to restore and rehabilitate the lost function and psychological balance, hence rehabilitation of Mucormycosis patients can be a life-changing experience in one's life.
KEYWORDS: *Mucormycosis, Surgical resection, Obturator, Prosthodontic Rehabilitation*

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INTRODUCTION

Mucormycosis is an opportunistic, rapidly progressive, invasive fungal infection involving the nose, and paranasal sinuses of the head and neck region with high mortality and morbidity rate caused by Mucorales. Amidst the rise in Coronavirus cases, a rise in the number of Mucormycosis cases was also seen. In severe cases of Covid-19 infection, there is activation of the immune system which raises the blood ferritin levels and causes lymphopenia [1] And due to this, there is an increase in the pathogenicity of fungi and enhancement of their adherence to the endothelium, therefore, patients who have uncontrollable diabetes with iron overload are susceptible to mucormycosis [2]

The reasons why there was a breakthrough in Mucormycosis cases in COVID-19 cases are:

1. Hypergycemic conditions due to pre-existing uncontrolled diabetes
2. Irrational and Overuse of steroids for the management of Covid-19.
3. New onset diabetes due to steroid overuse or severe cases of Covid – 19 per in cases of previously normal patients.
4. Irrational overuse of broad-spectrum antibiotics for the management of Covid-19 accompanying prolonged ICU stays.
5. Presence of other co-morbidities.
6. Breakthrough infections in patients on Voriconazole (anti–fungal) prophylaxis [3].

The Fungal form which is of utmost concern to a prosthodontist is of the Rhinocerebral type, which affects the nasal cavity, paranasal sinus, maxilla and in severe cases the brain. Majority of cases include immunocompromised patients, patients treated with steroids, bone marrow transplantation, etc.

The signs and symptoms associated with Mucormycosis are [4-5]:

1. Facial pain, (which may involve sinus) along with pain in teeth and gums
2. Palatal ulceration and mucosal sloughing (most common and serious finding for mucormycosis)
3. Paraesthesia of half of the face.
4. Blackish discoloration of skin and mucosa around the ala of nose.
4. Blood tinged or blackish nasal crusting or discharge.
5. Periorbital oedema, Blurring of vision, and diplopia
6. Headache, chest pain, and worsening of respiratory symptoms such as hemoptysis.

ROLE OF A PROSTHODONTIST

Treatment of Mucormycosis mostly involves aggressive surgical debridement, which results in loss of hard and soft palate, maxilla, and other associated structures which follows difficulty in mastication, nasal regurgitation, and difficulty in speech and respiration. All of this negatively impacts the patient's mental health and compromises the patient's social life. Through rehabilitation by an obturator, partition between the oral and nasal cavity can be created, mastication can be improved, and facial contours can be restored. Through Prosthodontic Rehabilitation improve the quality of life of the patient which is of utmost necessity. The degree of morbidity in patients who have survived Mucormycosis depends primarily on when the disease was diagnosed and treated. Mucormycosis can involve the entire maxilla, nasal cavity, orbital content and then it can advance into the cranium.

Prosthodontic Rehabilitation:

Removable Prosthesis

Obturators: Obturator eliminates the communication between the oral and the nasal cavity and provides better mastication, swallowing, speech and acceptable esthetics [4]. Prosthodontic rehabilitation for patients after maxillary resection due to Mucormycosis is done in three phases by different obturators, which are as follows:

Surgical Obturators: Surgical obturators are further divided into two types – Immediate and Delayed Surgical obturators. The immediate surgical obturator is placed at the time of surgery. This obturator acts as a prosthesis for the placement of surgical dressing, as it creates a barrier between the surgical site and the oral environment, hence prevents the contamination of the surgical site [6].

The delayed surgical obturator is fabricated after a few days of resection. It is mostly given in cases where extensive surgical debridement of the area is needed or where explicit planning for the margins is not possible. The impression for the obturator is made after the surgery but the prosthesis is delivered later, it is advised to lessen this time duration due to contracture and edema of the tissues [7].

In surgical obturators, Prosthetic teeth are not provided to avoid occlusal load transferring to the surgically treated site [7].

Interim Obturators: Interim obturators are interposed between the surgical and definitive obturators [8].It is fabricated 3-4 weeks after surgery. As oral tissues undergo significant variation in shape and size after surgery. This can be fabricated either by taking a whole new impression or by relining the previous surgical obturator. Prosthetic teeth can be added in the anterior region for the esthetic purpose. Posterior teeth are still avoided in the interim obturators.

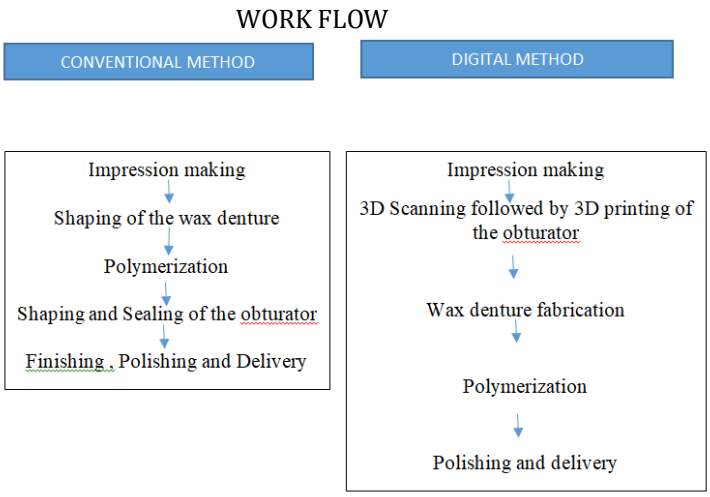
Definitive Obturators: It is fabricated 6 months after the surgery, after assuring the complete healing of the surgical site. Diagnostic casts should be surveyed for the location of undercuts, path of insertion, and guide planes. In dentulous individuals, multiple rests should be incorporated for improving support and stability for the prosthesis [9]. In edentulous patient's fabrication of obturator is comparatively difficult. In edentulous patient obturator prosthesis will show some movement due to lesser availability of hard tissue present, in such cases retention is needed from the undercuts present. Engagement of the defect, increases the stability, support and retention of the prosthesis extensively.

A conventional obturator is fabricated using acrylic with cobalt chromium framework, along with this the acrylic portion is hollowed so as to reduce the bulk of the prosthesis and make it lighter in weight. This has a built-in disadvantage of difficulty in insertion and removal as this is a single large piece rigid prosthesis.

To overcome this problem various other designs of obturators are used. Javid introduced a Magnetic Obturator, which aims to improve retention of the prosthesis,

Stabilizing obturator [10] – It is a "self-stabilizing device" which has a silicone portion which is towards the defect. The silicone layer closes the defect effectively and immediately. The advantage of this prosthesis is – fungal growth or any deformation is prevented for atleast 3 years.

Hollow Obturator fabricated by Digital technology: As the conventional method has numerous pitfalls. An Obturator can be fabricated using the recent technology through intraoral scanning, in a single piece with no joints using a laminating moulding device. This uses an optical shaping instrument with rapid prototyping [11-12].



FIXED PROSTHESIS

FIXED OBTURATOR: The new design of fixed obturator is based on Nance's appliance design which is used as a space maintainer in the maxillary arch, in some studies it has been utilized for closing oroantral communication in patients with cleft lip and palate. It has the additional advantage of maintaining maxillary transverse width. Nance fixed obturator can be utilized as an appliance for improving a patient's quality of life [13]

IM PLANTS

Implants are able to provide adequate retention, support, and stability for the dental and maxillofacial prosthesis in case of hard and soft tissue maxillofacial defects. Various implant treatment modalities are present today for rehabilitation of Mucormycosis patients for instance – Zygomatic implants, Pterygoid implants and Dental implants with magnetic attachment.

Zygomatic implants: Zygoma implants provide a wider anteroposterior spread for the better distribution of forces. Zygoma implant rehabilitation is safe, efficient and cost-effective treatment option for acquired maxillary defects. Implant bar-supported prosthesis can be considered as an effective option for rehabilitation of Mucormycosis. The prosthetic component comprises of two parts, A cobalt-chromium bar which can be cemented on implants and acrylic denture base with soft liner material. This option has better retention and pull-out forces can also be avoided .Prosthetic teeth are arranged in Monoplane, Balanced occlusion, or lingualized occlusion to stabilize the obturator.

Pterygoid implants: Implant placement is challenging due to the loss of bone needed for surgical placement of the implant. Therefore, placement of implants in remote sites such as zygoma and pterygoid has been advocated [14] "Implant placement through the maxillary tuberosity and into the pterygoid plate is done for the placement of pterygoid implants" These implants were introduced by Tulsane in 1989. This has an advantage of avoiding sinus augmentation procedures.The length of these implants are 15-20mm and placed at an angle of 45 to 50 degrees to the horizontal plane. Certain complications are associated with the placement of pterygoid implants. These are slight venous bleeding, misplacement of implant, trismus, pain and discomfort.

RECENT ADVANCES

In recent years, rapid prototyping has changed the dimensions of maxillofacial prosthetics. For the fabrication of complex prosthesis digital technology is combined with traditional materials and techniques to generate a 3D model. Intraoral scanners in conjugation with the CAD/CAM can provide digital impressions of teeth, soft tissues, implants as well as undercuts. Certain researchers have used facial scanners and intraoral scanners for providing skin texture-like details to the extraoral prosthesis.[13]They only drawback of CAD/CAM prosthesis is its high cost, so it can't be used in every clinic.

Tissue engineering can be considered an option for replacing complex reconstruction methods for the defect. The principle behind this is that stem cells are capable of forming tissue and organ. So these cells are harvested and scaffolds are made to mimic the desired tissue. Research is needed in this field as simple structural regeneration has shown effective results but the development in harvesting the complex tissues is required.

CONCLUSION

A maxillofacial prosthodontist plays a very important role in the rehabilitation of patients with acquired maxillary defects to improve the quality of their life. It's a challenge as the expectations of these patients are very high. Early diagnosis and proper treatment can reduce the mortality and morbidity of Mucormycosis. Critical evaluation and treatment planning of the remaining structures is required to fabricate the prosthesis that has retention, stability, and provides esthetics. Various pitfalls are associated with traditional techniques hence advancement in CAD/CAM can be considered as a boon for maxillofacial prosthodontics, though research in this field is still required.

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