Orbital Support Device Via Intranasal Approach – An Unconventional Design

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INTRODUCTION

Maxilla can be considered a hexahedrium with close relationship to surrounding critical anatomic structures, and thereby invariably involved in the resection process of tumours that arise from maxillary sinus, palate, nasal cavity, orbital contents, or intro-oral mucosa.[1] Maxillary defects created after tumour ablation can cause severe functional and aesthetic deficits. Orbital floor defects with displacement of the eyeball results in deformities with possible consequences of enophthalmos, diplopia and impaired visual acuity.

The eyeball can become displaced either due to alteration in the position of the orbital walls caused by trauma, or due to loss of support of the orbital floor during resection of a lesion. The role of the suspensory ligament of Lockwood in maintaining the superio - inferior position of the visual apparatus is recognized. The preservation of this ligament, which acts like a hammock holding the eyeball in position, prevents any drastic downward displacement except for the small limit which the slack of the ligament allows. Surgical reconstruction of orbital floor defects is the primary treatment modality, but remains nonetheless a challenge for surgeons. Currently various types of materials such as titanium meshes, hydroxyapatite, silica gel, Teflon, Medpor and autogenous bones are used for orbital reconstruction.[2,3] Prosthetic rehabilitation of maxillary surgical defects is so predictable and effective that reconstructive surgery is not indicated in most instances.[4,5] Prosthetic management of defects with orbital floor resection is usually obturators with extensions to support the visual apparatus.[6]

In clinical situations involving the resection of the orbital floor and maxillary sinus, without the sacrifice of the floor of maxilla, no oro-antral communication is created. This eliminates the need for an obturator prosthesis. In this scenario the support for the visual apparatus will be solely dependent on surgical reconstruction. However, when dealing with invasive and progressive diseases of fungal and bacterial origin, immediate surgical reconstruction is not generally recommended till complete resolution of the disease is achieved. The potential for recurrence of tumours varies from 10 - 30 % with benign tumours and over 50 % with malignant tumours. This creates a need for long term follow up, to assess the resection margins for signs of recurrence.[4]

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DOI: 10.14260/jemds/2021/454

How to Cite This Article:
Mohamed K, Maheshwaran KS. Orbital support device via intra-nasal approach – an unconventional design. J Evolution Med Dent Sci 2021;10(29):2221-2224, DOI: 10.14260/jemds/2021/454

Submission 09-03-2021,
Peer Review 18-05-2021,
Acceptance 24-05-2021,
Published 19-07-2021.

The wound healing and contracture during this period can lead to a downward displacement of the visual apparatus, which if supported would be crucial in maintaining the position of the globe. Prosthetically the only access to the visual apparatus in such situations is via an intranasal approach. Theoretically, there is no precedence for an intra-nasal approach to the visual apparatus. No case reports have been documented describing an outline or process to fabricate a prosthesis to support the visual apparatus intranasally. This case report entails such a scenario, wherein a device was designed and fabricated to be inserted intranasally, for the purpose of supporting the visual apparatus temporarily till healing and wound contracture was stabilized.

PRESENTATION OF CASE

A 35 - year - old patient reported to the Department of Head and Neck Surgery, with a chief complaint of frequent headaches and occasional nasal discharge for the past 2 months [Fig 1]. On eliciting the medical history, it was revealed that the patient had suffered from fungal sinusitis a few years ago and was treated with anti-fungal medications. Following a computed tomography (CT) scan evaluation, a preliminary diagnosis of fungal osteomyelitis of the right maxilla was made. Subtotal maxillectomy of the right maxilla involving the antral walls, the dentoalveolar structures from midline till the tuberosity, with preservation the orbital floor was planned. A Browns' Class IIb[7] defect was anticipated, and the patient was referred to the Department of Prosthodontics, for the purpose of an immediate surgical obturator. Upon intraoral examination no visible lesion was present. An immediate surgical obturator was fabricated in auto polymerizing acrylic resin material (DPI - RR Cold Cure, India), based on the extension given by the surgeon.

DISCUSSION OF MANAGEMENT

In surgery, following elevation of cheek flap using a Weber Ferguson incision, the exact extent of the lesion was assessed. The lesion was found to be more aggressive towards the orbit, than the floor of the sinus and dentoalveolar structures. Based on this extension, a more conservative excision of the maxilla was made, which included the anterior, medial, lateral walls and the orbital floor, while preserving the palate and dentoalveolar complex [Fig. 2]. The surgical obturator was not required as no oro-antral communication was created. Care was taken to preserve the suspensory ligament of Lockwood. Histopathological examination of the tissue revealed the diagnosis of primary nasal tuberculosis. The patient was started on anti-tuberculosis therapy. Surgical reconstruction was not planned till complete resolution of the disease was achieved. Two weeks following the surgery, the otolaryngologist referred the patient to the Department of Prosthodontics, to discuss the possibility of providing a support for the visual apparatus through a device that could be introduced intranasally. The exenteration of tissues and antral walls had created an empty space lateral to the nose and inferior to the orbit on the right side. The otolaryngologist suggested that this space could be used to introduce and manipulate a device within the sinus, and provide support to the visual apparatus. The purpose of the support was to maintain the function of the eye by preventing downward displacement during wound contracture and healing [3], and alleviate the asymmetry associated with it. There was mild asymmetry between the eye levels with the right eye slightly inferior to the left [Fig. 3]. The patient did not have any symptoms of altered vision or tenderness.

A tentative sketch for an orbital support device was contrived following extra oral measurements [Fig. 4]. The vertical measurement was made from the ala of the nose to the inner canthus of the eye, and horizontal measurement from the inner canthus to the outer canthus of the eye on the defect side. This gave an understanding of the available exploratory space within the defect. After numerous trial and error procedures with a wax model, and under the guidance of the otolaryngologist using nasal endoscopy, the design of the device was finalized. The device was "L" shaped with the short upper arm contacting the visual apparatus. The superior contacting surface of this arm was made into a shallow concavity to conform to the under surface of the eye. The longer arm, which was at right angles to the upper arm acted as the handle and was slightly curved away from the facial midline. The device could be inserted by beginning with the short upper arm oriented parallel to the vertical plane. Once within the antrum the device was rotated allowing the long arm to become parallel to the vertical plane and was then advanced upward till a resistance was felt. The curvature of the handle prevented any impingement against the nasal septum. Now with careful subjective feedback from the patient, the device was advanced upwards which resulted in a slight upward movement of the right eye. The device was then duplicated in heat cure acrylic resin material (DPI Heat Cure, India) and highly polished [Fig. 5].

For the application of sustained support to the eye, an extra oral anchorage for the orbital support device was required. This was achieved by the fabrication of a head band using auto-polymerizing acrylic resin, (DPI - RR Cold Cure, India) and elastics were used to connect the frontal and occipital components of the headband [Fig. 6]. The support for the visual apparatus required the application of an upward obliquely directed vector of force, which was attained using a connector with mortar. The connector was made with a double wire of 19 gauge, twisted throughout its length to make it less flexible. The top end of the connector was attached to the headband and the other end to a mortar [Fig. 7]. The mortar fitted snugly to the handle of the orbital support device connecting it to the extra-oral anchorage. The final fit and support provided by the device was reviewed at regular intervals for ten days, both by the prosthodontist and the otolaryngologist [Fig 8]. The patient was instructed to disinfect the device everyday with alcohol based chemical disinfectant and thoroughly wash with water prior to use. The patient was educated about the function of the device and his role in complying with its use to achieve a successful outcome. At the end of four months there was no gross difference in the position of the visual apparatus, and no signs of altered vision. Examination of the defect region with nasal endoscopy showed satisfactory healing with no signs of infection or inflammation. The patient was also concerned with his facial appearance due to the asymmetry associated with the defect.

Figure 1. Presurgical Presentation

Figure 5. Orbital Support Device

Figure 2. Surgical Phase

Figure 6. Extra-Oral Anchorage

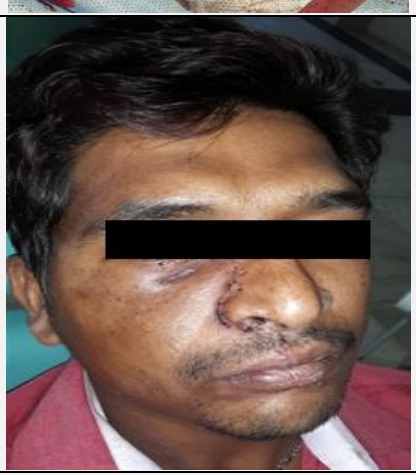

Figure 3. Post-surgical Presentation

Figure 7. Connector with Mortar

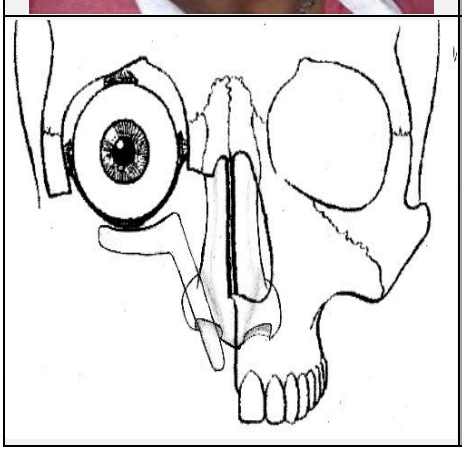

Figure 4. Tentative Sketch for Orbital Support Device

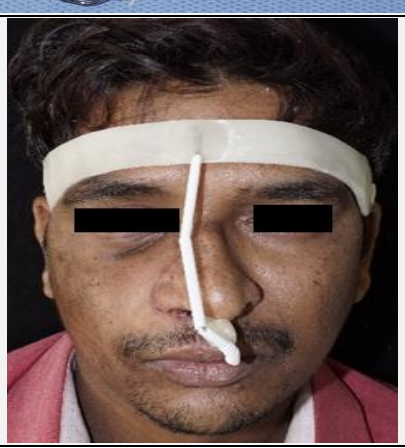

Figure 8. Orbital Support Device in Place

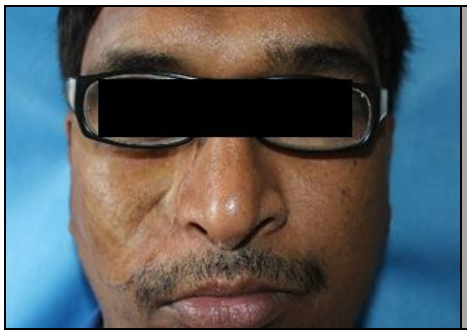

Figure 9. Facial Prosthesis – Spectacle Retained

A silicone facial prosthesis retained with spectacles was planned and fabricated. The facial prosthesis had an acrylic substructure for stability over the facial skin [Fig. 9]. The patient was educated regarding the limitations of a silicone facial prosthesis overlying movable tissues, and that surgical reconstruction would provide a definitive solution.

DISCUSSION

Most rehabilitation of maxillectomy patients can be accomplished through the fabrication of an obturator which can successfully restore the oro-antral patency. The general benefit of Prosthodontic rehabilitation over autogenous tissue reconstruction is that it allows for ease of access to the oncological site during review.[8,9] The resection of orbital floor introduces complications on a cosmetic and functional level. Commonly in these situations, the obturator is designed with an antral extension that provides the necessary support to the visual apparatus.[6] However, when the palate is preserved, the only access to the floor of the orbit is intranasal. The purpose of this device was to hold the eyeball in its position temporarily, till wound contracture and healing had completed thereby alleviating the risk of a downward displacement. Surgical reconstruction can be attempted once complete resolution of the lesion has occurred. This novel design was made possible due to the space available within the antrum once its contents along with the anterior, medial and lateral walls were resected. At present no documented evidence of a blueprint for any prosthesis like this is available. Specific case criterion such as preservation of the ligament of Lockwood and good initial wound healing are important in attempting such a prosthetic approach. In the general population, physical attractiveness contributes to a positive self-concept and social wellbeing.[10] The loss of the contents of maxillary sinus following resection of the tumour created a crater like defect beneath the right eye. A spectacle retained facial prosthesis was thus designed and fabricated with silicone. This was only a temporary solution as the facial prosthesis would be able to restore the facial symmetry during static position, but would fail to do so during movement of underlying skin. Surgical reconstruction of the defect would be the definitive solution.

CONCLUSIONS

The orbital support device was a novel attempt at using a prosthetic method, in providing a temporary support to the visual apparatus. It is a technique sensitive procedure and requires a trial - and - error strategy to perfect it. This design was specifically created for maxillectomy involving the removal of orbital floor, without the creation of an oro-antral communication. The device is of particular value in progressive and recurrent lesions of the maxilla, where surgical reconstruction is not recommended immediately. Interdisciplinary planning between the prosthodontist and otolaryngologist plays a vital part in the success of this approach. Further refinement of the design and replication of the process in similar case scenarios, would greatly help to standardize this technique.

Financial or other competing interests: None.
Disclosure forms provided by the authors are available with the full text of this article at jemds.com.

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