Silicone Obturator with Reduced Bulb Extension: Enhancing Quality of Life in Post-surgical Maxillectomy Defect
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Abstract:
The essence in cancer care has shifted from mere “survival” to “rehabilitation,” which aims to improve multiple impairments and quality of life. Head and neck cancers constitute one of the most devastating forms of cancer resulting in maxillofacial defects. Rehabilitation of acquired maxillofacial defects is accomplished either by surgical or prosthodontic rehabilitation. The goal of prosthetic rehabilitation is to obturate the defect, allowing for optimum esthetics and function. However, this has remained as a challenging process due to the lack of adequate retention, stability, and support of the prosthesis. This study presents a simplified approach to rehabilitate an extensive maxillectomy defect secondary to surgical resection in a patient with the limited oral opening. The patient had undergone left hemimaxillectomy for squamous cell carcinoma of the left alveolus 7 days back. The patient did not have a surgical obturator and required prosthesis to restore the lost teeth and function. The treatment plan initially was to improve the mouth opening using screw gag prosthesis to facilitate the clinical steps, and then rehabilitate the defect using interim obturator prosthesis. Some modifications in the impression procedure like the use of modified stock trays and sectional custom trays also aided in obtaining adequate impressions. The obturator comprised silicon obturator with reduced bulb extension and heat cure acrylic denture base which were attached using cyanoacrylate adhesive. Different design features have been incorporated into the design to achieve adequate prosthesis retention, support, and stability. Post-insertion instructions were given to the patient and were scheduled on a regular recall protocol to evaluate the fit and functioning of the prosthesis Post-insertion results showed improvement in speech, mastication, swallowing, and facial aesthetics. The primary objectives of maxillofacial prosthetic rehabilitation were achieved with this novel design contributing to enhancement of quality of life of the cancer patient.

Key Words: Hemimaxillectomy, interim obturator, maxillary defect, maxillofacial prostheses, reduced bulb extension, silicone obturator

Introduction
Head and neck cancers constitute one of the most devastating forms of cancer resulting in maxillofacial defects. The treatment modalities for cancers include surgery, radiation, and/or chemotherapy. Surgical treatment usually results in cosmetic, functional, and psychological impairment affecting the patient’s quality of life.1 Prosthetic rehabilitation is usually indicated in these patients to allow for optimum esthetics and function. Maxillofacial defects can be classified into maxillary and mandibular defects. The prosthesis constructed to rehabilitate maxillary defect is termed as a maxillary obturator. An obturator (Latin; obturare, to stop up) is a maxillofacial prosthesis used to close a congenital or acquired tissue opening, primarily of the hard palate and/or contiguous alveolar/soft tissue structures.2 This case report describes the rehabilitation of an extensive maxillofacial defect in a patient with limited oral opening using a silicone interim obturator with reduced bulb extension attached to acrylic denture base.

Case Report
A 60-year-old patient was referred by a surgical oncologist to the Department of Prosthodontics at Pushpagiri College of Dental Sciences for prosthodontic rehabilitation of a post-surgical extensive maxillofacial defect secondary to surgical resection for squamous cell carcinoma. The patient’s chief complaint was missing teeth and difficulty in mastication and swallowing due to a large defect in the roof of the mouth. The medical history revealed that the patient had undergone left hemimaxillectomy for squamous cell carcinoma of the left alveolus 7 days back and was kept under the supervision of the oncologist for recurrence of the lesion. Extra-oral examination revealed obvious unilateral facial disfigurement on the left side (Figure 1a). The patient had a severe restricted mouth opening of 15-18 mm. Intra-oral examination revealed Class IV Armany’s defect in the maxilla. The extension of the defect was difficult to gauge as the patient had reduced oral opening (Figure 1b). However, the defect was confined to the left maxilla with a definite oronasal and oroantral communication. The defect was filled with granulation tissue and necrotic slough. The remaining dentition included the maxillary right posterior teeth and all teeth in the mandibular arch. During a
conversation with the patient, an obvious hypernasal speech was noted. The patient did not have a surgical obturator and required prosthesis to restore lost teeth and function. The treatment plan initially was to improve the mouth opening using screw gag prosthesis to facilitate the clinical steps, and then rehabilitate the maxillectomy defect using interim obturator prosthesis. An informed consent was obtained from the patient after discussing the treatment plan with the patient. Screw gag prosthesis was delivered to the patient at the diagnostic appointment. The mouth opening was evaluated and recorded at all subsequent appointments.

**Procedure for fabrication of interim obturator**

Because of limited oral opening, a suitable perforated stock tray was selected (tray used for making edentulous alginate impressions) for the maxillary arch and modified using modeling wax (Hindustan Modelling Wax No.2, India) until it could be inserted in patient’s mouth. After careful blockage of severe tissue undercuts in the maxillary defect with the help of petrolatum coated moist gauze, a primary impression was made using alginate impression material (Ruthinium Alginate, Ruthinium Dental Products Pvt. Ltd., India) (Figure 2a). The making of mandibular primary impression was delayed due to the difficulty in inserting the stock tray due to limited oral opening. A sectional autopolymerizing acrylic (Orthoplast RR Cold Cure, India) tray with anterior and posterior locking mechanism using press fit buttons (Pony, Needle Industries, India) was fabricated from the diagnostic cast (Figure 2b). The secondary impression was made using low fusing impression compound (DPI Pinnacle Tracing Sticks, India) and light body addition silicone impression material (Variotime Light Flow, Heraeus Kulzer GmbH) (Figure 2c). No attempt was made to extend to full extension of the defect as the tissue healing was not completed. Care was taken to ensure coverage of the lateral, medial, and anteroposterior extensions of the defect. The depth of the defect was determined by adequate suction of the secondary impression. The impression was boxed and poured with dental stone (Goldstone, Asian Chemicals, India) and unfavorable undercuts on the master cast were blocked. After application of a coat of separating medium, (Deepti Dental Products, India) the defect in the master cast was packed with room temperature vulcanizing (RTV) silicone (MP Sai Enterprise, India) which was allowed to set for 1 day (Figure 2d). After complete setting, autopolymerizing acrylic resin is used for fabrication of a temporary denture base. Jaw relationship recording was done using wax occlusion rims. The mandibular impression was made with alginate impression material using perforated stock tray (tray used for making edentulous alginate impressions) as the mouth opening improved to 20-25 mm. The jaw relation records were transferred to the articulator for completion

![Figure 1: (a) Extra-oral view of the patient-pre-treatment, (b) intra-oral view of the patient-pre-treatment.](image1)

![Figure 2: (a-j) Steps in fabrication of silicon interim obturator with reduced bulb extension attached to heat cure acrylic resin denture base. (a) Primary impression, (b) dissembled sectional tray, (c) secondary impression, (d) fabrication of silicon bulb obturator on master cast, (e) obturator try-in, (f) wax-up of the obturator, (g) assembly after dewaxing, (h) obturator fabricated showing heat cure denture base and silicon bulb, (i) surface of the obturator prosthesis-intaglio surface, (j) surface of the obturator prosthesis-polished surface.](image2)
of teeth arrangement. The trial denture was checked for the aesthetics and functional occlusion (Figure 2e). The wax-up for the buccal flange was done extending to the cervical aspect of the remaining posterior teeth (Figure 2f). An 18-gauge orthodontic wire (Konark Stainless Steel Wire, India) was adapted encircling the distal most posterior teeth and connecting the buccal and palatal flanges. The trial denture was invested, dewaxed, and the remaining mold space was packed with heat-cure acrylic resin (Orthoplast Heat Cure, India) (Figure 2g). The obturator was processed in the conventional manner. After deflasking, the heat cured section of the obturator prosthesis is finished and polished (Figure 2h). Fortunately, the mouth opening of the patient improved to about 30-35 mm, which allowed the fabrication of a single piece obturator. The obturator comprised silicon obturator with reduced bulb extension and heat cure acrylic denture base which were attached using cyanoacrylate adhesive (Figure 2i and j).

Instructions to the patient and post-insertion recall

1. The patient was instructed regarding insertion and removal of the prosthesis
2. The patient was also instructed regarding the cleaning of the defect with betadine mouthwash and also home care of the prosthesis using water and chlorhexidine
3. The patient was recalled every 2 weeks up to 6 months in view of the continuously changing tissue conformation for regular modification and adjustment. Relining was done with a permanent soft relining material (molloplast B).

Post-insertion results showed improvement in speech, mastication, swallowing, and facial aesthetics (Figure 3a and b). The patient was satisfied with the prosthesis during the recall appointments. The mouth opening of the patient improved to normal limits (40-45 mm) at the 3rd month recall appointment. Definitive obturator was planned to perform at a later date (after 6 months) when healed and the stable defective site is present.

Discussion

The essence in cancer care has shifted from mere “survival” to “rehabilitation,” which aims to improve multiple impairments and quality of life. Rehabilitation of acquired maxillofacial defects is accomplished either by surgical or prosthodontic rehabilitation. Surgical reconstructions may be achieved using regional flaps or free-tissue transfers and are indicated to close small defects. The main advantages of surgical reconstruction are permanent closure of oronasal or oroantral communication. In larger defects, prosthetic rehabilitation using obturators seems to be a better choice. The advantages of obturators include avoidance of further surgeries, allow the defect to keep under control in case of recurrence of primary disease, provision for replacement of teeth and can be planned at any time soon after surgical resection. This particular case favors prosthetic rehabilitation as the patient was kept under supervision for recurrence of the lesion and required the provision for replacement of missing teeth.

Depending on the time elapsed after maxillectomy, obturators are constructed in three phases-surgical, interim, or definitive obturator. A surgical obturator is inserted during or immediately after surgical resection to allow for initial healing of the surgical site. Interim obturator prosthesis is normally placed 7-10 days after surgery. There may be post-surgical tissue changes in the resected area which may continue up to 6 months. During this period, the interim obturator may have to be relined to compensate for alteration in tissues. This interim phase of treatment is an unpleasant experience for both the patient and clinician. The patient considers the obturator as a source of pain and infection, although it is required for wound healing. The clinician will encounter patient’s difficulties and also deal with mobile, non-cicatrized, bleeding tissues with mucous secretions, restricted jaw movements, and oral opening. The definitive obturator is a permanent prosthesis indicated after complete healing of the surgical site and after local recurrence has been ruled out.

The limitation of the oral opening in another challenge in the rehabilitation of such patients as it precludes optimum impression procedures. The patient’s mouth opening was considerably reduced during the impression phase (15-18 mm). Hence, modifications were made in the stock tray to facilitate insertion into the mouth. A sectional tray with anterior and posterior locking mechanism using press-fit pins was utilized as the custom tray to make the secondary impression. This method was utilized due to its cost-effectiveness, ease of fabrication, insertion, and removal of the tray from the mouth. The use of screw gag prosthesis substantially improved the mouth opening in 3 months (40-45 mm). This is the most simplest, non-invasive and economical management modality. However, patient compliance is critical for the success for this therapy.

Figure 3: (a) Extra-oral view of the patient-post-treatment, (b) intra-oral view of the patient-post-treatment.
During the interim phase, the mode of retention for the prosthesis requires priority. The interim prosthetic retention, stability, and support are questionable in Class IV maxillary defects. Different design features have been incorporated in our design to achieve this. The softness and resiliency of the RTV silicone materials enable it to engage undercuts within the defects, thus providing retention, support, and stability of the prosthesis. The flexibility of the material allows it to be slowly teased out from the defect site without injuring the healing soft tissues. The modified buccal flange acts as acrylic resin mask and functions to prevent rotation of the prosthesis and provides cross arch stability. The use of 18-gauge orthodontic wire encircling the distal most posterior teeth and connecting the palatal and buccal flanges also augment the retention and guide the easy placement of the prosthesis. For improving stability, the maximum extension of the prosthesis in all lateral directions was provided so that the defect itself would enhance stability of the prosthesis.

The reduced bulb extension is a novel concept and another highlight of this design. Different obturator designs which are routinely followed include the solid bulb obturator, open and closed hollow obturators, inflatable obturators, single-piece, and two-piece hollow obturator prostheses.11-15 Turkaslan et al.16 evaluated the articulation performance of obturators patients with three different buccal extension designs which included 15 mm (high), 10 mm (medium), and 5 mm (low) extensions, respectively. It was concluded that obturators improve speech intelligibility irrespective of their buccal extension levels and the medium size buccal extension enables the optimum sealing for better articulation. The reduced bulb design of this case (medium extension-10 mm) could also improve the articulation and speech intelligibility of this patient without compromising the retention of the prosthesis. In addition, it also facilitated easy insertion and removal of the prosthesis. This design was also helpful in reducing the weight of the prosthesis, promoting undisturbed healing of soft tissues and also reduced patient discomfort from complete extension of the prosthesis impinging the residual soft tissues. Other possible advantages include rapid construction and ease of ongoing adjustment during the healing period. The disadvantages of this design include discoloration of prosthesis and poor bond strength between the silicone bulb and acrylic denture base.

The longevity of the prosthesis is not of much concern as the interim obturator is meant to last for 6 months, which is fulfilled by this design. However, rehabilitation is not a passive process. Strict adherence to post-treatment instructions is mandatory to ensure success with interim obturators.

Conclusion
Rehabilitation of patients with acquired maxillofacial defects has been a challenging process due to the unpredictable nature of the defects and the uncertainty of recurrence. The treatment should be patient oriented which will help to bring smile and hope for patients with head and neck cancer. The primary objectives of maxillofacial prosthetic rehabilitation which includes obturating the defect, restoring aesthetics, speech, mastication, and deglutition was achieved with this novel design contributing to enhancement of quality of life of the cancer patient.

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