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Case Study

Post Surgical Rhino-Oral Prosthetic Reconstruction: A Case Study

Chermine Nasser* and Peter Shempemba

Department of Restorative Dentistry, School of Dentistry, Muhimbili University of Health and Allied Sciences, Tanzania

***Corresponding Author:** Chermine Nasser, Department of Restorative Dentistry, School of Dentistry, Muhimbili University of Health and Allied Sciences, Tanzania.

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Abstract

Maxillofacial prosthetics is among the foremost rapidly growing areas of dentistry. It has become a key area, especially when it involves rehabilitation of postsurgical cases. 1-5% of oral lesions are malignant tumors that commonly affect the hard and soft palate and the gingiva. Squamous cell carcinoma accounts for 60% of the tumors that affect these areas. Most of those carcinomas are diagnosed very late i.e., when there is bone invasion. Treatment modalities of choice for removal of SCC are: alveolectomy, palatectomy or maxillectomy which could either be partial or total resection. The rehabilitation of such patients may be a daunting task. Rehabilitating patients with maxillofacial defects are among the foremost difficult therapies of the stomatognathic system and requires a multidisciplinary approach including surgery, radio/chemotherapy, phonetic rehabilitation, physiotherapy and prosthetic treatment. The defect/deformity characteristics, the number of teeth present and the amount of supporting structures determine the management of maxillary defects. Unfavorable characteristics of the defect can negatively affect the prosthetic management and treatment outcome. Good prognosis of the prosthesis requires adequate retention, light in weight and has to be comfortable to the patient and the surrounding tissues holding it. This article describes a case of a rhino-oral defect (Aramany class VI resection) whereby an acrylic hollow bulb obturator and an acrylic nasal prosthesis attached to spectacle were used for case rehabilitation.

Keywords: *Acrylic Obturator; Aramany Class VI; Hollow Bulb Obturator Prosthesis; Prosthetic Rehabilitation; Prosthetic Nose; SCC*

Introduction

The most common type of head and neck malignancy which accounts for more than 50% of the malignancies of the nasal cavity and the paranasal sinuses is Squamous Cell Carcinoma (SCC) [1-3]. Treatment of such conditions include: surgical excision, cryotherapy and/or radiation [4] improving the quality of life for such patients through eliminating the disease is the fundamental goal of rehabilitating and restoring these defects [5]. An obturator prosthesis is one of the several methods and techniques that have been used for reconstructing such defects [6]. An obturator is defined as "prosthesis used to close a congenital or an acquired tissue opening, primarily of hard palate and/or contiguous alveolar structures" [7]. Appropriate obturation of maxillary defects divides the oral cavity and the nasal cavity which improves speech, mastication, swallowing, and aesthetics [8]. At the time of surgical resection, prosthetic management should be carried out since the prosthesis will be necessary for the rest of the patient life. A light weight prosthesis is recommended without compromising retention and comfort of the patient [9]. This clinical report describes the fabrication of an acrylic hollow bulb obturator and an acrylic nasal prosthesis attached to spectacles for a patient with Aramany Class VI Maxillary defect [10-12].

Case Report

A 42-year-old female patient who is a farmer in Mbeya (Tanzania) presented to the Department of Restorative Dentistry - Prosthodontic Unit with a defect in the anterior center of the hard palate (Figure 1A and 1B) and a missing nose (Figure 1C and 1D). The patient was referred from the Oro-maxillofacial Surgery department after surgery, following a diagnosis of SCC (T4bN3M0) involving the hard palate on the median line anteriorly involving the upper anterior teeth and infiltration of the floor of the nasal fossa, the nasal septum, the columella and the nose externally. Before the surgery, oral evaluation was carried out in the absence of the prosthodontist. All the affected tissues were resected during the surgery, with the patient subsequently referred to Ocean Road Cancer Institute for Chemo- radiotherapy. Upon completion of the chemo-radiotherapy the patient was referred to the Restorative department for further management and rehabilitation.

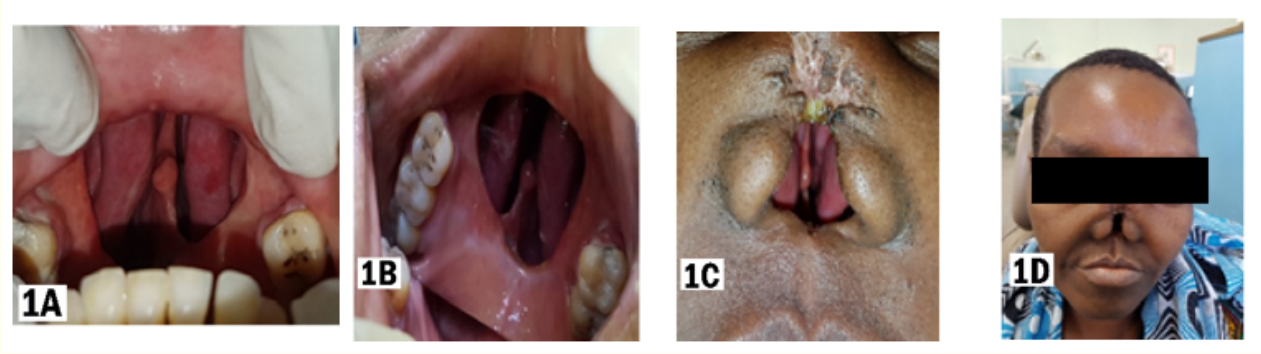

Figure 1: *Appearance of defect: (A) and (B) intraoral view; (C) and (D) extraoral view after the surgery.*

Procedure

After the operation and tumor resection, the patient had a large defect on the upper jaw involving the anterior part of the hard palate and a missing nose creating an oro- nasal fistula. Teeth 16 - 25 were also missing. Since the patient had not been provided with any immediate obturators (interim obturators) during her healing phase, most of the tissues now were scared and taut. Preliminary impressions of maxillary and mandibular arches were obtained using alginate (irreversible hydrocolloid) impression material for the subsequent fabrication of a post-surgical interim obturator. The process of fabricating the obturator at this stage was a very uncomfortable and painful procedure for the patient. However, the most challenging part of the rehabilitation was the fabrication of the nasal prosthesis. The interim obturator was fabricated for the patient to wear and become adjusted to before planning for the definitive obturator.

Interim prosthesis

The impression was made using a perforated plastic stock tray that was modified using impression compound. The primary impression for the upper and lower jaws was made using irreversible hydrocolloid material whereby for the maxillary arch the area of the defect was blocked out using wet cotton. The preliminary casts were obtained from the impression (Figure 2). These casts were examined using a surveyor and all the necessary mouth preparations were carried out in accordance. A custom tray was fabricated from the casts with auto-polymerizing resin (Figure 3). To record the functional depth and width of the labial and buccal soft tissues surrounding the defect, a green stick compound was used to establish the tray's border. The final impression (using alginate) of the defect and remaining natural teeth were made (Figure 4). The master cast was made of type IV stone, and the prosthesis was waxed up on the master cast using model-

ling wax to ensure that the acrylic material was thick enough to provide the obturator with the strength it required. Bite blocks were made to register the bite (Figure 5A and 5B) and jaw relations and then a try-in was performed at wax stage in the patient's mouth to check for the fit, esthetics and function with the missing teeth replaced (Figure 6). Finally, the obturator with teeth attached was processed in acrylic and delivered (Figure 7A and 7B). When creating the obturator, a small escape vent was cut into the bulb with a straight fissure bur, and the bulb was then placed in a basin of water to dissolve the salt crystals and hollow it out. The flask was prepared and the hollow bulb put into the defect within the flask. A 1 mm clearance was maintained between the outer layer of the bulb and the defect, which was filled with heat cure resin. The prosthesis was trimmed, finished, and polished after the deflasking processes. After minor chairside adjustments, the prosthesis was handed to the patient. Post-delivery instructions (prosthesis use and care) were given to the patient. Post-delivery checkup was first conducted after 24 hours and recall visits were scheduled after 1 week, 1 month, 3 months, 6 months and yearly for 5 years.

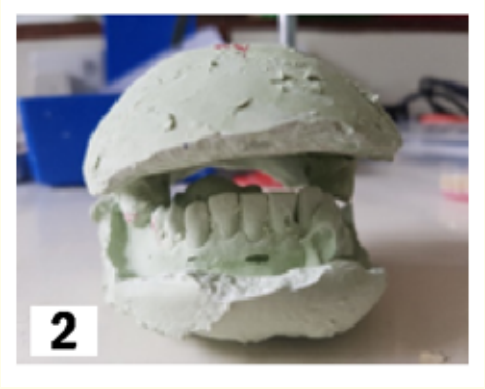

Figure 2: *Preliminary casts.*

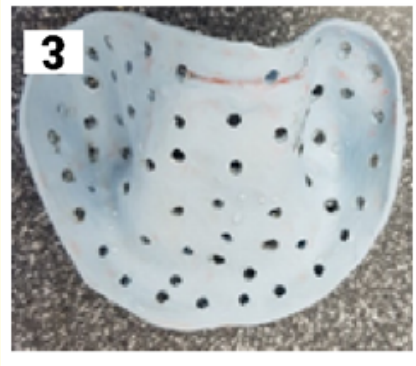

Figure 3: *Custom tray made of auto-polymerizing resin.*

Figure 4: *Final impression made using alginate.*

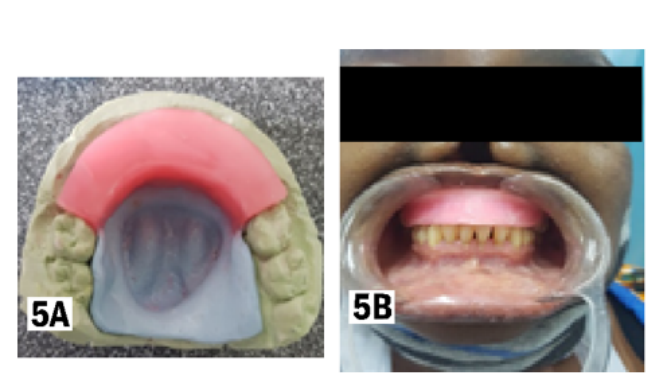

Figure 5: *Bite registration procedure: (A) Bite block in the cast; (B) Bite registration in the patient's mouth.*

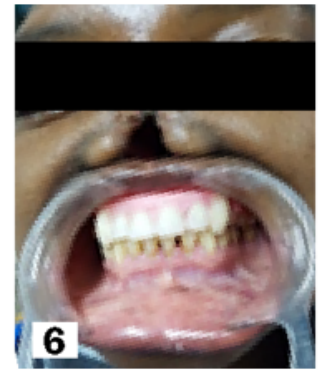

Figure 6: *Try in stage of the wax-up.*

Figure 7: *Acrylic hollow obturator: (A) Obturator with teeth and metal clasps; (B) Delivered obturator in patient's mouth.*

Nasal prosthesis

Using the same technique used to construct the oro-nasal obturator, the nasal piece was fabricated. Since there was no impression tray for a nasal impression, an upper tray was inverted and used to take the primary impression for the nose (Figure 8A). The primary impression of the maxillary arch was made using irreversible hydrocolloid, after blocking out the defect area using wet cotton (Figure 8B). Several wax-up designs of noses were made for try in to ascertain how they would look on the patient (Figure 9). In order to attach the nose piece onto the face, lens-less spectacles were used. During the try in stage, the spectacles and nose piece were tried and adjusted. The patient noted that the spectacles were too big for her face, so a change of the frame was required. Finally, the nose piece was heat cured in the same manner as the interim obturator and later painted using dark brown varnish to try to match it the facial skin color and tone. The nose piece was attached to the frame of the spectacles and delivered to the patient (Figure 10A and 10B).

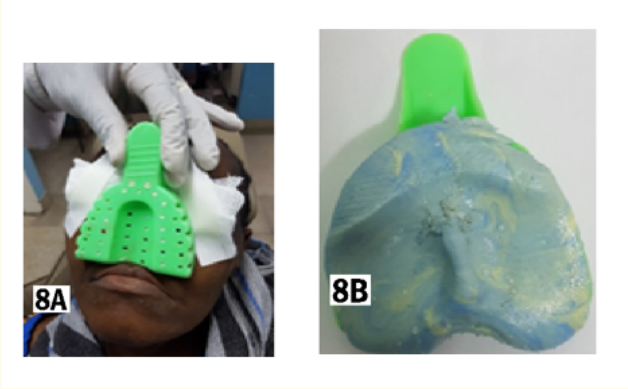

Figure 8: *Impression of the nasal defect: (A) The use of maxillary perforated stock tray to take the impression; (B) The impression of the defect*

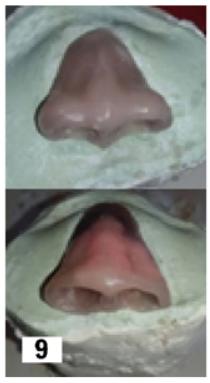

Figure 9: *Wax-up nose designs.*

Figure 10: *Acrylic nose piece attached to lens-less spectacles: (A) Final acrylic nose piece attached to spectacles; (B) Delivery of the nasal prosthesis.*

Discussion

The obturator prosthesis has several advantages, including providing a stable matrix for surgical packing, reducing oral contamination, allowing effective speech post-operatively, allowing deglutition, reducing the psychological impact of surgery, reducing the length of hospitalization, allowing immediate dentition restoration without the need for additional surgery, and allowing the residual cavity to be monitored for any future recurrencies [13-15]. However, larger mid-facial defects represent a challenge for functional and esthetic rehabilitation due to a number of factors which include but are not limited to: retention problems, soft tissue mobility and weight of the prosthesis [16]. The retention of the prosthesis is very vital for the success of the appliance and hence should be taken care of during the treatment planning stage. Patients with insufficient alveolar ridge anatomy or poor tissue quality surrounding the defect may cause challenging prosthetic rehabilitation and may require a combination of digital and conventional approaches [6,17,18].

Conventional method of obturator fabrication entails making the obturator light weighted by making hollow bulbs [19]. A variety of materials have been used over the years to create the hollow bulb effect and these materials include: salt crystals, sugar crystals, clay, sand

particles and crushed ice to name a few [9,20-23]. On the other hand, permanent closure of the oro-nasal passage using osteo-integrated implant can be achieved provided there is a viable (healthy) flap for surgery that is conducted in the presence of a vascular bone, but this can cause systemic complications such as necrosis which may necessitate re-exploration [15,24,25].

For the patient in this case study, an acrylic partial hollow bulb obturator was made. The defect was classified as an Aramany class VI scenario after surgical excision. The prosthesis fabricated is considered to be an interim one as it may need to be modified and enhanced in the future using better material. During the fabrication of both the prosthesis (obturator with teeth and the nose piece), there were some limitations encountered. These include: the use of alginate impression instead of wash and putty reducing the accuracy. Working in low- and middle-income country (LMIC) and in a hospital with limited resources, we could not use silicon-based impression material, this would have made the treatment more accurate [26]. Likewise, acrylic resin material was used to fabricate the nasal prosthesis instead of silicone-based material. The silicon-based material for nasal prosthesis would make the nose piece look more natural and softer in texture [27]. Alternative to the use of spectacles for nose piece attachment, the use of mini - implants around the zygoma to which the nasal prosthesis can be attached using magnetic means would have made the patient look more like herself before undergoing the surgery [16,28]. The use of metal framework instead of the acrylic frame for the obturator would be recommended for the definitive prosthesis [29]. The metal framework would offer good retention, support, stability and longevity of the prosthesis [30,31]. The patient will accept the metal prosthesis better as it will be sensitive to temperature changes in the mouth. The obturator's hollow bulb shape made the prosthesis lighter, more comfortable for the patient, and increased resonance, which improved speech quality [32,33]. The patient's quality of life bettered as a result of the prosthesis. Patient education is most often the initial step in the recovery process. Prior to surgery, the patient should be informed about the functional and cosmetic expectations as well as the limitations of the maxillofacial prosthesis [8,34].

Conclusion

The present case report demonstrated the prosthetic rehabilitation of Aramany class VI maxillary defect patient using an acrylic hollow bulb interim obturator. It involved the fabrication of an acrylic obturator with teeth attached and an acrylic nasal prosthesis. The prosthetic rehabilitation improved the patients: function (better masticatory efficiency), phonetics (adding resonance to the voice- clarity of speech) and esthetics. The hollow bulb design reduced the weight of the prosthesis, making it more comfortable for the patient. The use of spectacles attached nose piece improved the patient's esthetics and boosted her confidence.

Recommendations

Traditionally oral and facial prosthesis have been made by hand worked sculpted wax or clay patterns [21]. Cone Beam Computed Tomography (CBCT) guidance may allow osteo-integrated implants to give the most dependable form of prosthesis retention, but in case of the large size of the defect, poor mucosal quality, and minimal bony supporting structure may make implant placement impractical [31]. Recently Computer Aided Design/ Computed Assisted Manufacturing (CAD/CAM) technologies related to imaging and manufacturing tend to provide a simple, precise and predictable solution for the optimal reconstruction of oro-facial defects [29,30,35,36]. This technology reduces the number of procedural steps and eliminates multiple impressions and records [27,35]. This protocol can also be used to scan spectacles, and it can be used to plan and evaluate the relative location of the nasal prosthesis in a virtual environment without the requirement for a try-in appointment. The non-contact optical impression procedure eliminates the patient's discomfort, while three-dimensional data imaging allows visualization of the entire face without distortion. All of these technologies are still in their infancy, and many patients in countries like Tanzania are unable to afford them due to the high costs.

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Ethics Approval and Consent to Participate

Ethical clearance to carry out this study was requested from the MUHAS Research and Publications Committee and permission to conduct the study was sought from the Head of Department - Restorative Department, School of Dentistry MUHAS. The participant was asked to sign a written informed consent.

Competing Interests

The author(s) declare that they have no competing interests.

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Authors' Contributions

CN: Principal investigator approached the patient and carried out all the steps of fabrication of the prosthesis, documentation of each step and preparation of the manuscript.

PS: Co-investigator participated in case report, supervised each step carried out and preparation of the manuscript.

Finally, both authors, read, agreed to its contents and approved the final manuscript in its present form.

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