

Immediately loaded zygomatic implants used for a functional and aesthetic rehabilitation following a combined maxillectomy and rhinectomy

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ABSTRACT

Malignancies of the nasal vestibule are rare, yet may result in massive destruction of the face if left untreated. The position and extent of the resulting defects is not only a rehabilitative challenge but also a major psychological burden for the patient. This paper describes a technique for designing and fabricating an immediate surgical obturator and nasal prosthesis to help minimize the post-surgical impact following a total rhinectomy and partial maxillectomy procedure in a patient diagnosed with a squamous cell carcinoma of the nasal septum. The restoration consisted of bilateral zygomatic implants attached to a resin framework housing a central magnet.

The latter was used to retain the nasal prosthesis and help support an interim maxillary obturator. Conventional impressions of the dentition and a moulage of the nasal defect were taken. The master casts were poured and used for design and fabrication of the obturator and nasal wax pattern. Colour matching of the nose and facial areas was performed with the aid of a digital

spectrophotometer (Quickweigh; Spectromatch Ltd., UK), and a silicone nasal prosthesis was fabricated. This case demonstrated how both a functional rehabilitation and reduced psychological impact was achieved by delivering an immediate surgical obturator and facial prosthesis.

INTRODUCTION

Oral and facial defects following ablative cancer surgery can have profound functional, aesthetic and psychosocial effects that may negatively impact on a patient's quality of life. Malignancies of the nasal vestibule are rare accounting for 9% of cancers of the nasal cavity and <1% of all malignant tumours of the upper aero digestive tract¹. They occur most commonly in males between the ages of 60 and 65 years. These malignancies behave differently histologically and clinically when compared with tumours arising from the nasal cavity, being more like squamous cell carcinomas of the skin². For this reason, they are considered separately for diagnosis and treatment purposes. Other skin cancers found to also arise in the nasal vestibule include basal cell carcinoma and melanoma, with sun exposure and smoking, listed as risk factors. Research shows that malignancies of the nasal vestibule carry a far more favourable prognosis than malignancies of the posterior nasal cavity or paranasal sinuses, and a slightly worse prognosis than those of the nasal skin². Treatment of these tumours depends on the size and the presence of regional lymph node metastasis. The latter being regarded as a sign of poor prognosis. For small lesions (T1), radiotherapy is the treatment of choice due to superior cosmetic results, whereas surgery is the primary treatment for larger lesions (T2 & T3) where there is cartilage or bone involvement, and is generally followed by radiotherapy². Primary nasal vestibule tumours are usually small at presentation with no evidence of cartilage or bone invasion whereas tumours ≥ 4 cm in diameter are associated with invasion of the pre-maxilla and usually require extensive surgical resection.³

When carrying out surgical procedures in the midfacial region, a clear understanding of the anatomical limitations of the area is needed. The nasal vestibule is a pear-shaped opening in the most anterior portion

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of the nasal cavity, and functions as the entrance to the cavity. It is bounded medially by the nasal septum and columella, laterally by the lower lateral nasal cartilage and inferiorly by the premaxilla. The vestibule is separated anatomically from the nasal cavity by the limen nasi, which is the junction of the upper and lower lateral cartilages, and the transition from the skin to the mucosa is lined with skin-bearing hair follicles, sebaceous glands, and sweat glands². The nasal cavity on the other hand, is bounded above by the anterior cranial fossa, laterally by the orbit and the maxillary sinus, and below by the hard palate⁴. These anatomic regions house important structures that include the orbital contents, the pterygopalatine ganglion, and the descending palatine artery.

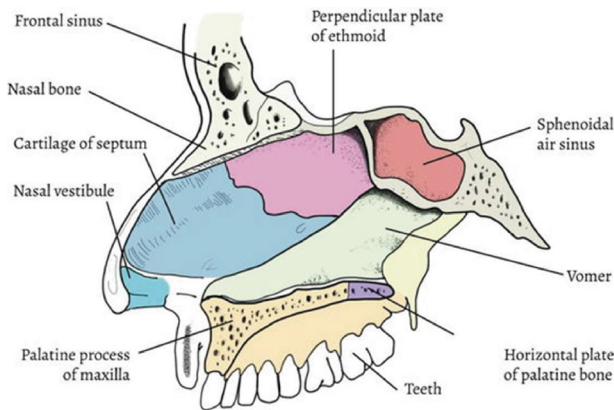


Fig.1 - A sagittal view of the nasal cavity and vestibule

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Maxillofacial defects resulting from surgical resection of this area are difficult to treat with conventional prosthodontics due to their location, the lack of suitable supporting bone, and surface lining of friable nasal mucosa. The recent use of zygomatic implants has provided significant benefits for prosthesis retention and speech and masticatory functions^{5,6}.

This case report describes a technique of designing and fabricating an immediate facial prosthesis for a patient who was diagnosed with squamous cell carcinoma of the nasal septum, in order to minimize the psychological impact following a rhinectomy and partial maxillectomy.

CASE REPORT

A 43-year old female patient diagnosed with a squamous cell carcinoma of the nasal septum, was referred to the multidisciplinary maxillofacial clinic at the University of Pretoria Oral Health Centre for presurgical assessment and management (Fig 2). Computer tomographical spiral axial scans revealed total destruction of the nasal septum as well as the bony nasal floor. During a multidisciplinary treatment planning session, it was decided that the first phase of treatment would be to carry out a total rhinectomy and partial maxillectomy, with immediate placement of bilateral zygomatic implants and provisionalization of the defect. Post-surgical radiotherapy was planned to begin a month later. Pre-surgical prosthetic planning included

designing an interim denture which would serve as an obturator, as well as a prefabricated silicone nasal prosthesis with a central magnet that would attach to a reciprocal magnet housed in a resin framework. The framework would then be screw-retained on bilateral zygomatic implants (Zygan® - Southern Implants, South Africa). This treatment protocol would allow for



Fig. 2 Patient at the time of presentation



Fig. 3 Immediate maxillary denture/obturator



Fig. 4 Impression taking using Body Double™ and a plaster of Paris backing

immediate restoration of speech, limited masticatory function and psychological advantages.

Treatment sequence:

Prior to surgery

Conventional impressions of the dentition were taken using an irreversible hydrocolloid regular set alginate impression material (Blueprint® 20+, Dentsply Sirona,



Fig 5. Moulage impression prior to casting in dental stone

USA). Master casts were poured in Type III dental stone and used to fabricate a surgical stent/interim denture/obturator was fabricated in clear acrylic. ProtempTM Plus (3M, USA) provisionalizing material was injected into the anterior segment of the clear acrylic obturator, to give an illusion of teeth, and pink acrylic added from the gingival margins to the edges of the denture flange to give an illusion of the gingiva (Fig 3). At the same time a facial moulage was taken using Body Double™ (Smooth-On, Inc., USA), a silicone rubber material that is directly applied in order to make the facial cast (Fig 4). Dental plaster was applied over it to provide a rigid support for the impression (Fig 4). Body Double™ is preferred over alginate because it has the ability to reproduce finer detail, and many casts can be produced from one impression. (Fig 5)

The Body Double™ cast (Fig 6) was used to sculpt a trial nose and upper lip in pink modelling wax (Tenawax®, Zeta) (Fig 7). This was flaked in dental plaster, wax boiled out and packed with layers of pigmented silicone (Fig 8). Colour matching was carried out with the help of a spectrophotometer (Quickweigh; Spectromatch Ltd., Bath, UK). Moulds were clamped together, and excess material removed before the silicone was processed at room temperature.

Thereafter, the silicone nasal prosthesis was removed, and excess material trimmed off with a knife and a pair of scissors. A central magnet was embedded on the fitting surface of the nasal prosthesis using a self-cure acrylic resin to assist the patient in orientating and seating of the prosthesis. Considering that the nasal prosthesis would be small and light, it was presumed that this would place little additional load on the implants

Silicones remains the most widely used material for facial prostheses due to their good surface texture and elasticity. They have traditionally been retained with medical adhesives, however several clinical problems have been reported, including allergic skin reactions, wear and tear of the edges of the prostheses, and difficulty in cleaning off residual amounts of adhesive agent. Retention is also poor due to the moisture and mobility of the surrounding skin which may aggravate the delicate surgical margins and facial tissue each time the prosthesis is removed and the glue cleaned off. It is also often too painful to try improve retention by



Fig 6: Final cast poured in Type III dental stone



Fig 7: Wax pattern of the facial prosthesis.



Fig 8: Provisional silicone nasal and facial prosthesis.

extending the prosthesis into soft tissue undercuts in the newly resected mucosal areas.

Surgical phase

A total rhinectomy and partial maxillectomy was performed and frozen sections were taken in theatre to confirm clear margins (Fig 9). Two 30 mm zygomatic implants with 4.0 mm wide restorative platforms were placed bilaterally (Zygan - Southern Implants, South Africa) and used to retain the pre-fabricated resin framework. The interim denture was inserted and

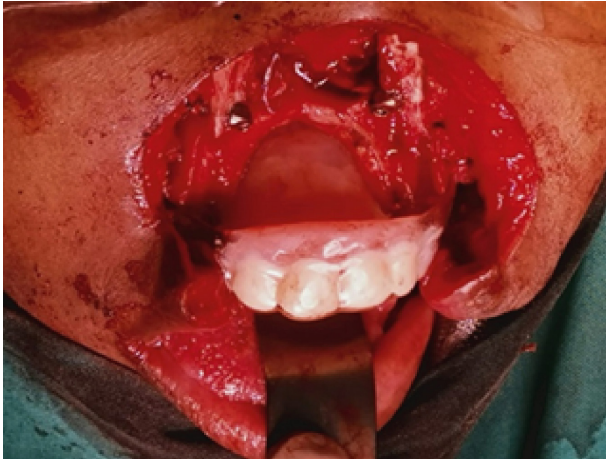


Fig 9: Intraoperative views. A: The resected premaxilla



Fig 10: Surgical obturator positioned prior to being secured with surgical screws

secured in position with trauma screws (Fig 10). The upper lip was then sutured back into position providing some additional support for the obturator.

Restorative phase

During the same surgical procedure, titanium temporary abutment cylinders were fitted on the zygomatic implants. The screw holes were plugged with bone wax to avoid the resin pick up material from clogging the screw access holes. A fast-setting cold cured acrylic resin (Pattern Resin™ LS, GC-America INC, USA) was syringed around the cylinders and moulded into a triangular shape to mimic the shape of the defect. A magnet was positioned centrally to correspond to the position of the reciprocating magnet in the facial prosthesis (Fig 11). Once set, the framework was removed, along with the temporary abutment cylinders. The framework was finished off and



Fig 11: Positioning of the magnet in the acrylic resin superstructure



Fig 12: Placement of the nasal/ facial prosthesis

polished and then immediately screwed back onto the zygomatic implants. This allowed the facial prosthesis to be placed before the patient woke up from the general anaesthetic (Fig 12). The patient was recalled at 1 week to check on the surgical site and prostheses prior to being sent for radiotherapy (Figs 13 a and b).

DISCUSSION

Maxillofacial rehabilitation is a challenging aspects of prosthodontics, yet it can play a pivotal role in the aesthetic, functional and psychosocial rehabilitation of



Figs 13 a) and b) Prosthesis in place at the 1-week recall visit.

patients with large head and neck defects⁷. In patients diagnosed with carcinomas of this region, the initial consultation should be by a multidisciplinary team to ensure that the proposed treatment addresses issues of tumour ablation as well as oral rehabilitation. The proposed surgery should attempt to preserve the continuity of as many anatomic structures as possible in order to provide a foundation for restoration with an aesthetic and functional prosthesis. This will contribute greatly to the patient's psychological well-being and quality-of-life⁸. Recent advances in treatment and rehabilitation, particularly in the field of maxillofacial prosthodontics has helped alleviate many of the adverse sequelae of the often disfiguring surgery, and aided in the post-operative restoration of speech and masticatory functions⁹.

Treatment planning for the prosthodontic rehabilitation for patients due to undergo any large oral and/or midfacial surgery must involve a multidisciplinary team and be carried out prior to any surgical intervention. This usually necessitates carrying out a comprehensive evaluation in a limited time so as to not delay the surgery, but at the same time aim to optimize their psychosocial and oral health status after surgery. Wherever possible the procedures should strive to maintain as many remaining teeth and oral / facial structures without compromising the success of the surgery¹⁰.

Post-surgical sequelae may include loss of substantial amounts of bone and soft tissue, constriction and collapse of the face and lips, poor aesthetics, impaired speech and mastication, nasal regurgitation of food

and liquids and incompetent lip seal¹¹. A combination of intraoral surgical obturators and extra oral facial prostheses play a vital role in addressing some of these problems and restoring limited function.

Planning for the oral and /or facial prostheses needs to take into consideration issues of retention. Intra-orally this is accomplished by retention of as many viable teeth and surrounding structures as possible, creation of useable undercuts, and preservation of lip continuity. Extra oral retention poses a bigger problem. Various methods have been used in the past including mechanical attachments such as eyeglasses and magnets, engaging hard and soft tissue undercuts, and the use of medical adhesives. None of these are ideal.

The use of zygomatic implants in the rehabilitation of these patients has vastly improved treatment outcomes and rehabilitative success. These implants were first introduced as an alternative to bone augmentation in the severely resorbed posterior maxillae, but have since been placed in a number of maxillofacial prosthodontics patients to provide retention for both intra-oral and extra-oral craniofacial prostheses⁶. There are various schools of thought as to the timing of implant placement in oncology patients. However, placement at the time of surgery has gained popularity, as this reduces the need for additional surgical procedures, and there appears to be better survival of the implants if placed prior to radiotherapy. In addition the immediate placement of implants together with delivery of an interim obturator and facial prostheses has major

functional and psychosocial benefits for the patients. For this patient, a combination of zygomatic implants and mechanical retentive mechanisms (resin framework with magnets) were used to retain the maxillary obturator and nasal prosthesis respectively. The magnets within the framework and facial prosthesis are small yet have strong attractive forces which allow for ease of placement, accurate positioning, automatic repositioning, ease of removal for cleaning, and are simple and cheap to replace¹².

CONCLUSIONS

Despite its small size, untreated tumours of the nasal vestibule can spread to involve large areas of the nose and midface which will then require extensive surgical ablation. The resulting defects can have major aesthetic, functional and psychosocial consequences for a patient. This case illustrates the use of immediately loaded zygomatic implants to support and retain a maxillary obturator and facial prosthesis, thus sparing the patient from multiple surgical procedures, and reducing the devastating trauma of the post-resection facial disfigurement.

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