Mechanically-retained facial prosthesis for a large defect following Cancrum Oris: a clinical report

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Abstract

Retention is of critical importance in the satisfactory performance of a large maxillofacial prosthesis. Large defects often lack sufficient undercut to allow prostheses to be self-retentive. External modifications of the prosthesis are often required to provide an acceptable result. **Clinical history:** A 10-year-old male presented with a large facial defect and gross scarring following radical ablative surgery in treatment of cancrum oris. The intention of treatment was to restore esthetics to the patient using a removable facial prosthesis until the patient is old enough to receive an implant retained prosthesis. **Methods:** Due to the patient's age and nature of the defect, the prospective size and weight of the prosthesis required the use of mechanical retention that could not be achieved with conventional retentive methodology. An acrylic framework was manufactured as a substructure for the silicon prosthesis. Elastic-retained spectacles were luted via a custom screw-retained chrome-cobalt nose pad. To stabilize the inferior border of the prosthesis, a clear soft thermoplastic polyurethane brassiere strap was threaded through the chin cup and connected to the spectacle strap. This provided the prosthesis with adequate resistance to vertical displacement. **Conclusion:** The patient's appearance was enhanced, enabling early rehabilitation and psychosocial reintegration until a more rigid, implant based prosthesis becomes a viable treatment option. Rapid facial growth is expected over the years to follow and regular maintenance visits will be required.

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Introduction

Trauma, congenital malformation, and ablative surgery may result in large facial defects that cannot be surgically restored. Such defects lead to aesthetic, functional, and phonetic insufficiencies.[1] These are associated with severe psychological strain, often giving rise to alteration in a patient's self-esteem, emotional stability, personality, and social interaction.[2] A facial prosthesis, whether provisional or definitive, therefore enables an environment that is conducive to better function, aesthetics and social reintegration.[3]

Rehabilitation of such defects however, presents a unique challenge for the restoring maxillofacial prosthodontist. The typical result is that the inferior base of a prospective prosthesis typically rests on movable tissue.[4] When coupled with the lack of sufficient undercut, the inevitable consequence is the inability of the prosthesis to be self-retentive.[5] Retention is of critical importance in the satisfactory performance of a maxillofacial prosthesis. It aids to enhance aesthetics, comfort, function, adaptation, and the concealing of the prosthesis. Extrinsic retention is typically attained via secondary mechanical factors, skin adhesives and implants (magnets, ball or bar attachments).[6]

The use of adhesives in large facial defects is limited as it may irritate the supporting tissues, may not withstand the prosthesis weight, and causes deliquescence of the adhesive material when exposed to moisture.

Modifications to overcome difficulties are often required to provide an acceptable result. This requires certain innovative methodology as outlined in this article and techniques that can be extrapolated to treatment of patients with similar defects.

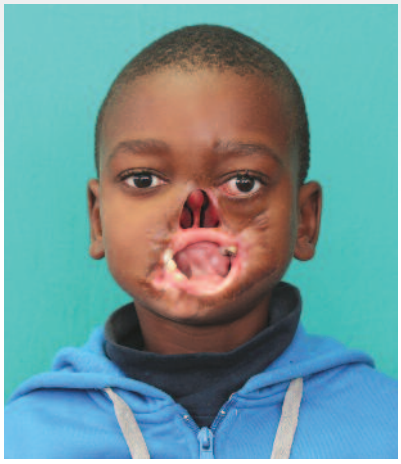

Fig. 1: Frontal profile photo of the patient 2 years following treatment of cancrum oris. Note severe facial scarring and the union of external and internal facial structures.

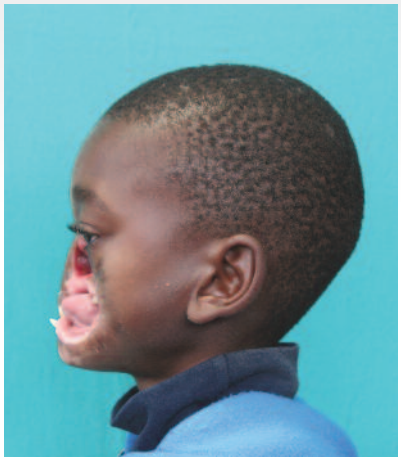

Fig. 2: Left profile photo depicting severe loss of facial prominence due to loss of the nasal cartilage, premaxilla, anterior mandible and associated labial tissue.

Fig. 3: Right profile of the patient.

Clinical report

A 10-year-old male was referred to the post-graduate prosthodontic clinic of the University of Pretoria Oral and Dental Hospital, South Africa, for prosthetic assessment and management. The patient presented with a large facial defect and gross scarring following radical ablative surgery 2 years prior, for the treatment of Cancrum Oris (Noma) (Fig. 1, 2 and 3). Clinical and radiographic evaluations were carried out. Clinical examination revealed that extensive fibrosis was present as a consequence of the resection, resulting in a maximum mouth opening of 1mm. The exposed oral and nasal mucosa were dry and tender to palpation. Despite the gross extent of scarring, the patient was phonetically functional, and was able to compress most foods against his palate using the tongue, as a form of mastication.

A three-dimensional cone beam computerized tomographic evaluation (Planmeca, ProMax3D Max) of the patient revealed a resection of the pre-maxilla, ranging from tooth 13 to 24, and alveolectomy of the left anterior mandible. Developing tooth buds were present in the distal segments of both the maxilla and mandible. Limited retained secondary dentition was evident in the anterior segments. The treatment aim was to achieve closure of the defect, and attain concurrent re-establishment of an aesthetic profile.

Attempts at retention of the prosthesis were expected to be challenging; due to the age of the patient, implant retained prostheses were contra-indicated. Furthermore, financial constraints and the expected weight of the prosthesis as a consequence of size precluded the use of dermal adhesives in aiding retention. As an alternative, eyeglass frames have historically proven helpful in providing mechanical retention and concealing prostheses. To improve mechanical stability of a large prosthesis, elastic strips are often placed around the back of the head to join both ends of the eyeglass frames.[3] It was therefore decided to utilize a spectacle-aided retention method with reinforcing elastics to stabilize the superior and inferior aspects of the prosthesis onto the patient's face.

Treatment sequence

The initial phases of the construction followed conventional maxillofacial impression protocols. The nasal cavity was packed with cotton wool and lined with petroleum jelly (Vaseline Jelly, Original) to prevent nasal aspiration of the primary impression material. The patient was taught to breathe through a high-volume evacuator tip (Dochem, Evacuator tips, 1A5151 vented "S" white) placed between his palate and tongue, and was further instructed to close his eyes and not make any facial movements during the impression taking procedure. A dam-technique was used to acquire a full facial impression; bands of periphery wax (Kemdent, white periphery wax) were linked together and adapted to the border of the intended impression. Pink modelling wax (Zeta, Tenawax) was moulded and attached to this periphery to form the dam walls. Bite registration material (Heraeus, Flexitime) was injected onto the periphery wax to create a seal against the patient's skin and prevent the impression material from leaking beyond the dam as seen in figure 4.

Figure 4: Fabrication of an impression-dam to retain the flowable alginate impression material. Note the high-volume evacuator tip retained between the patient's tongue and residual hard palate to act as a breathing apparatus during the impression taking procedure. The nasal aperture has been blocked out with cotton wool.

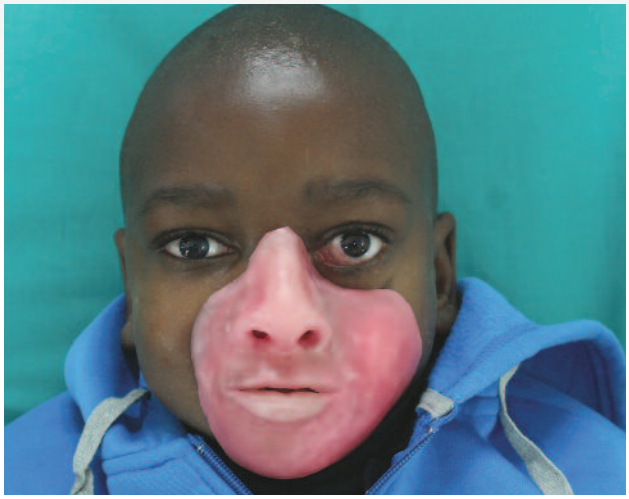

Figure 5: Wax try-in of the sculpted prosthesis

Regular set alginate (Dentsply, Blueprint 20+) was mixed to a high-flow consistency and poured into the dam, and reinforced with pieces of wooden tongue blades (Astra Med, tongue depressor) incorporated into the impression material. The primary cast was poured in hard dental stone (Wiegelmann Dental, Bondur M yellow), and a light-cured acrylic (Willman and Pein, GmbH Plaque photo) special tray was fabricated based on this impression.

At the secondary impression stage, the patient was again instructed on the procedure and breathing exercises were practiced using the high-volume evacuator tip. Cotton wool was again packed into the nasal cavity to prevent material aspiration and petroleum jelly was used as a separator over structures that could be incorporated into the impression, such as eyebrows and eyelashes. Impressions were taken using a polyether impression material (3M ESPE Impregum Penta) in the custom tray, and a master cast was poured in die stone (Velmix, Whip Mix - Resin rock). The advantage of this technique is that all facial landmarks are present on the casts, which enable the ideal sculpting of prosthetic structures in anatomically correct positions without the need for the patient being present for repeated trials.

A wax try-in was sculpted in pink modelling wax on the master cast in co-ordination with respective facial landmarks. The initial try-in of the wax-up (Fig. 5) was performed where rapid alterations of the facial contours were made using modelling clay (Staedtler, Noris Club Modelling Clay), which provided good stability while adhering to the wax pattern. The wax try-in was adjusted and a second try in was performed. A satisfactory marginal fit and suitable aesthetic profile were acquired. The skin shade and tone were determined using a colour chart. As the position of the spectacle frame could only be verified at chair-side, a template of the nasal bridge was created using silicone putty (Zhermack, Zetalabor 85 Shore A). With the template, the correct position of the exposed acrylic spots for luting could be determined, by transferring it to the plaster cast.

A polymethyl methacrylate (PMMA) substructure was constructed in high-impact acrylic (Vertex, Castavaria) to reinforce the silicone and prevent excessive flexure of the prosthesis. As PMMA has limited adherence chemically and mechanically with platinum cured silicones, the substructure was exposed along the prosthetic nasal bridge to allow for the luting process of the spectacles. Acrylic denture teeth (Ivoclar, Ivostar, shade A2, mould 01) were further luted to the substructure to provide a more aesthetic appearance of the facial prosthesis. Once the substructure was complete, processing of the silicone was initiated.

Special care had to be taken not to include any residues of latex (gloves), sulphur (silicone based impression materials), tin (Impression paste catalyst) or acetate (Cyanoacrylate glue) during the multiple treatment stages. This was done to ensure that no contamination of the silicone had occurred during the curing process.

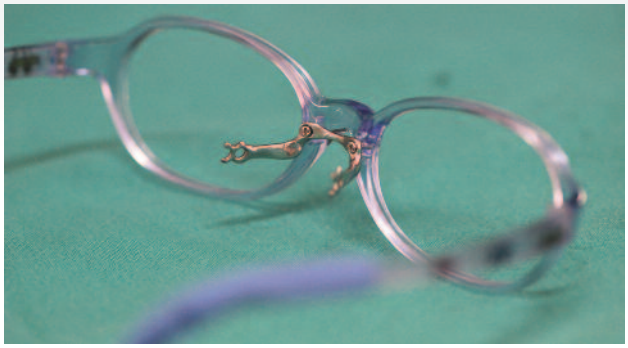

Figure 6: Eyeglass frames (Tomato Glasses, TKAC3) with custom chrome-cobalt nose pad designed to be luted to the acrylic substructure of the prosthesis

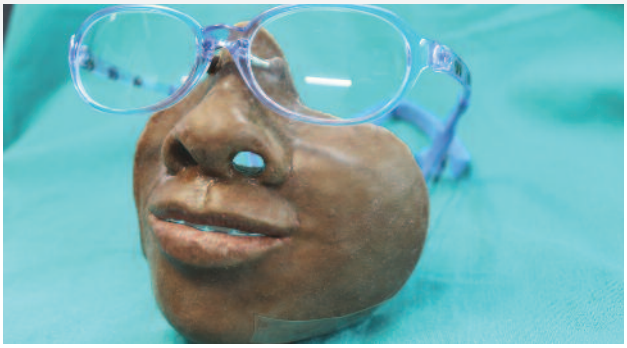

Figure 7: Completed facial prosthesis. Note the patent nasal and oral orifices to allow breathing through the prosthesis.

Figure 8: Frontal profile of the patient with the facial prosthesis in place.

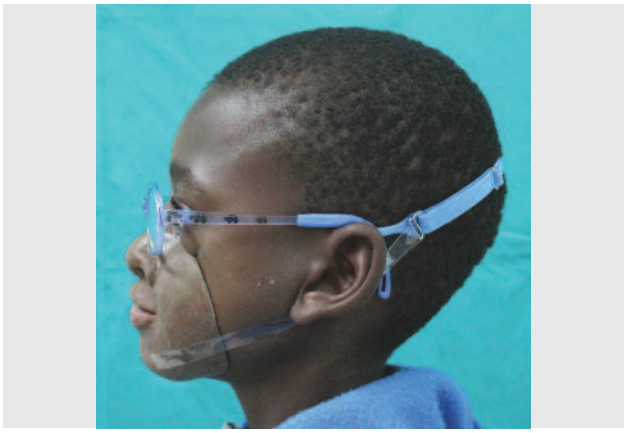

Figure 9: Left lateral profile of the completed prosthesis in situ. The eyeglass frames and brassiere strap link together posterior to the auricle via a discrete hook to provide resistance of the prosthesis to vertical displacement.

The size of the prosthesis prevented conventional flasking processes, and custom plaster split-moulds were created. The silicone (Technovent, M511 Platinum cured silicone) of the prosthesis was coloured intrinsically, using polychromatic pigments (Technovent, intrinsic silicone pigment). Following final fabrication of the prosthesis, the spectacle framework (Tomato Glasses, TKAC3) attached to a custom chrome-cobalt nose pad (Fig. 6) was luted to the exposed sub-structure via using cold cure PMMA. Final extrinsic staining (Technovent, extrinsic pigment) was performed and treated with a sealant. The nasal apertures and mouth were perforated in accordance with the acrylic substructure to allow the patient to breathe through the prosthesis.

To prevent movement of the inferior border of the prosthesis, a transparent soft thermoplastic polyurethane brassiere strap (MRP, SKU17027100001001) was threaded through the chin cup anteriorly and connected to the spectacle strap posteriorly, as seen in figures 7 and 8. Adequate retention was achieved and a satisfactory seal was established on the prosthesis boundary (Fig. 8 and 9).

Rapid facial growth is expected over the years to follow and regular maintenance visits will be required. The brassiere straps and spectacle elastics were selected for their adjustable nature and can allow interim alterations between replacements. This is expected to be done at 2-year intervals until the patient is old enough to receive an implant retained prosthesis. Regular follow up will entail exploring improvement of the patient's mouth opening and the further possibility of restoring his dentition and masticatory function.

Discussion

Due to the gross amount of extraoral scarring, the patient's mouth opening was limited to 1mm and masticatory efforts were accomplished using pressure of the patient's tongue against his palate. It was deduced that minimal mobility of the extraoral tissue would be present and that a full-facial prosthesis may be constructed to restore aesthetics to the patient. The primary concern during the process of treatment planning however, was retention. Typically, eyeglass frames used in maxillofacial prosthetics rely on the presence of ears and a nose-bridge for support. However, this effect is compromised, and in some cases, negated in patients having undergone surgical removal of either of these anatomical structures.[5] Furthermore, this form of support suspends the prosthesis from the supero-lateral aspects, providing resistance in the vertical plane from these two points only.[4] In these instances, clinicians consequently make use of adhesives to retain parts of the prosthesis albeit to a less effective result. The weight and span of the prosthesis in this specific patient rendered the use of adhesives inadequate.

Alternative methods or retention were therefore approached until the child is of the age to receive an implant retained prosthesis, as skeletal growth is a less-understood variable when implants are used in children.[7] The procedure described exhibits an effective alternative means of retaining a large facial prosthesis where retention would otherwise be severely compromised.

The incorporation of the brassiere straps effectively reduced movement of the inferior aspect and provided even load distribution along the support structures incorporated into the prosthesis. The tension on the prosthesis can also be attuned via the adjustable straps to maintain close approximation to the tissues as the child grows. In the South African context, a holistic view needs to be taken and factors such as finance, distance to reach treatment centres, and maintenance of prostheses need to be factored into a treatment plan. It is for this reason that a multidisciplinary team approach is needed to ensure appropriate care is given.

Conclusion

The crucial role of facial features in daily interpersonal relationships is easily appreciated. In most societies, personal attractiveness plays an integral role in a patient's self-esteem.[2] With a rudimentary extra-oral prosthesis retained by glasses and a facial strap, the patient's appearance was enhanced, enabling early rehabilitation and allowing psychosocial reintegration until a more rigid, implant based prosthesis becomes a viable treatment option.

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