British Journal of Medicine & Medical Research
6(8): 841-847, 2015, Article no.BJMMR.2015.258
ISSN: 2231-0614

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Use of Anatomical Undercut in Adhesive Retained Orbital Prosthesis: An Alternative to Osseointegration to Improve Retention and Reduce Margin Gap

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Authors' contributions

This work was carried out in collaboration between all authors. Author AW did the case, wrote the protocol and wrote the first draft of the manuscript. Author NBJ wrote checked the manuscript and managed the literature searches. Authors AW did case under author TS guidance. Author MKA wrote and checked the manuscript and managed the literature searches. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/BJMMR/2015/15237
Editor(s):
(1) Mieszko Wieckiewicz, Division of Dental Materials, Wroclaw Medical University, Poland.
(2) Chan Shen, Department of Biostatistics, MD Anderson Cancer Center, University of Texas, USA.
Reviewers:
(1) Zishan Dangra, Mumbai, India.
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(3) Anonymous, India.
Complete Peer review History: http://www.sciencedomain.org/review-history.php?iid=907&id=12&aid=7712

Case Study

Received 15th November 2014
Accepted 22nd December 2014
Published 9th January 2015

ABSTRACT

Introduction: Poor retention, stability and margin gap due to excessive bone lose following surgery is one of the major problems of rehabilitation in orbital defect with adhesive retained orbital prosthesis.
Presentation of Case: This clinical report describes a simplified technique for the fabrication of an adhesive retained silicone orbital prosthesis by proper evaluation and using of remaining tissue undercuts to achieve ideal fit and aesthetics in a patient who has severely loss orbital bone after

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the surgery.
Discussion: Aesthetics will be compromised if the proper evaluation of remaining tissue and treatment plan is not done prior prosthetic rehabilitation. To solve this issue sometimes maxillofacial prosthodontist may have to think for implant retained facial prosthesis. This is also sometime not possible due to several factors such as peri-implantitis, hygiene practice and dose of radiation etc.
Conclusion: Proper use of remaining anatomical undercuts can be an alternative way to overcome the issue.

Keywords: Undercut; orbital prosthesis; adhesive; margin gap; retention; stability.

1. INTRODUCTION

Stock or custom made ocular prosthesis are used to replace lost eyes for many years. In subjects with lost ocular structures, custom made ocular prosthesis, delivers accurate and satisfactory esthetic appearance [1]. Sometimes ocular prostheses are not enough to restore a large ocular defect which involves soft tissues adjacent to the globe. A large defect will require an equivalent prosthesis which is known as orbital prosthesis [2]. Orbital prosthesis sometimes would call for an additional retention such as remaining anatomical retention besides adhesives. Extension of large prostheses on the facial tissues could create open margins through adhesives during function if the prosthesis has the less retention from the remaining anatomical undercuts [3]. Therefore, prosthesis with broader perimeter will be easily noticeable with poor retention which will be an important concern in patient's satisfaction [4].

2. CASE PRESENTATION

A 65 years old Thai male, presented at Maxillofacial Prosthetic Service, with a chief complaint of left orbital defect. Patient had squamous cell carcinoma in the left eye and palate. The sign and symptoms were cystic lesion occurring in the mesial corner of the eye and bleeding from nose. He had undergone removal of a tumor with enucleation followed by 6 cycles of chemotherapy. Afterward, he was diagnosed as recurrent squamous cell carcinoma at the same area: stage T4N0M0, therefore a radical exenteration was performed with flap reconstruction on the orbital region using full thickness free from right thigh. Anterior and posterior defect size was 3 cm. Post-operative radiotherapy of 6000 cGy was used as a combination therapy. After 6 months, the rehabilitation treatment plan was to fabricate an adhesive retained silicone orbital prosthesis is decided.

On examination the defect extended superiorly from the supra orbital rim sparing the eyebrow slightly and inferiorly involving the orbital process and anterior wall of left maxilla, making the resultant defect shallow (Fig. 1). On examination there was slight discharge from the wound for a long time without any pain. Prior impression taken had been consulted with surgeon.

Orientation marks done on the patient which was denoting the supra orbital rim, nasal midline, medial canthus area, iris and lateral canthus in the vertical plane. The inter pupil line was also marked with a point on the nasal bridge of the lateral canthus area. These lines were detected in the impression and transferred on to the cast which will provide an orientation for the wax sculpt.

The previously fabricated boxing wax rim was adapted onto the appropriate location of the face. Regular set alginate (Jeltrate, Densply Ind, USA) was mixed to a high flow consistency and poured onto the boxed area, immediately a layer of wet gauze was placed onto the surface of alginate and allowed to set. Once this was set, a layer of plaster mixed with slurry water was applied onto the surface of gauze. The completed set alginate material was carefully removed and examined for any defects. The orientation points were redefined. The impression was casted by type IV dental stone (Dental Vision, Thailand) (Fig. 2).

A custom made ocular prosthesis was fabricated matching the color, shade of the iris and sclera. Wax sculpting was done using modeling wax; the fabricated ocular prosthesis was placed in position by the help of the orientation marks on the cast and try in on patient (Fig. 3).

In try in phase position of ocular prosthesis, contour and margin of wax prosthesis was checked. Rest of the sculpting session was carried out in presence of the patient restoring all

deficient contours and finally finished with patient consent. The finalized sculpt was placed on the cast and the margin was sealed (Fig. 4). The margin areas were evenly made thin out by using carbide bur for proper adaptation in the silicone prosthesis.

Fig. 1. Extra oral view: a. right lateral, b. frontal and c. left lateral

Fig. 2. Impression Taking and cast fabrication: a. boxing, b. alginate impression and c. working cast made by type III stone

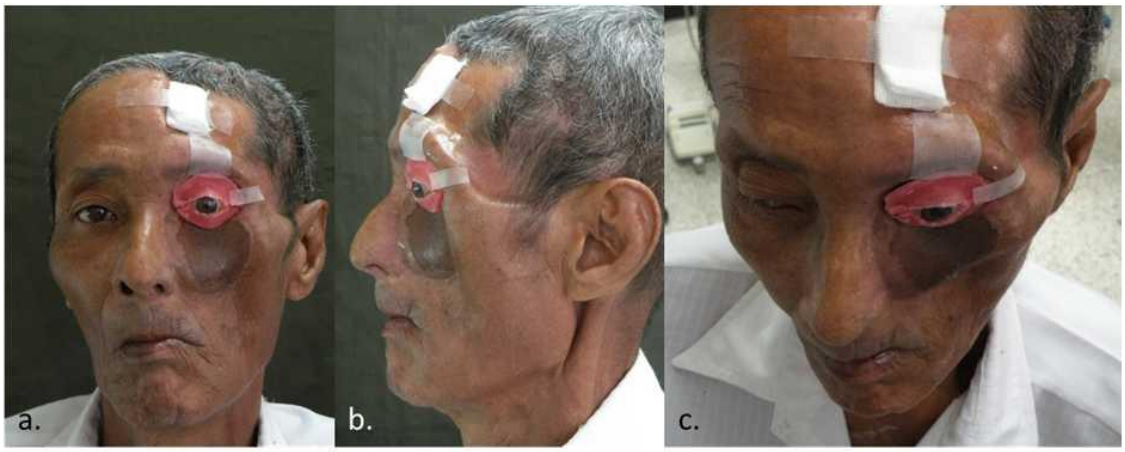

Fig. 3. Wax try in: a. frontal view, b. left lateral view and c. upper view

Medical grade, room temperature vulcanized silicone MDX 4-4210 (Factor II, Lakeside, AZ, USA), base and catalyst were mixed in the ratio 10:1 respectively with 1 drop of Thixo agent (Factor II, Lakeside, AZ, USA) for every 10 grams of silicone. The skin color of the patient was obtained by mixing three primary silicone base pigments (red, yellow, blue (Factor II, Lakeside, AZ, USA)). Appropriate nylon flocking mixed into the silicone to obtain color depth of the skin tone. Tin foil separating medium (Factor II, Lakeside, AZ, USA) was applied onto the mold. The mixed silicone was carefully loaded onto the mold avoiding entrapment of air bubbles (Fig. 5).

The upper and lower molds were approximated with the help of preformed indices on the base mold and secured with bar clamps producing an appropriate pressure of 2.0 PSI. This was left for 72 hours for attaining a complete cure as per manufacturer's recommendations. Following the final set, mold was opened and the flash was trimmed and ready for extrinsic coloring.

Dry pigments (Factor II, Lakeside, AZ, USA) were used as extrinsic stains, fixed with Epifin (Dreve-Dentamid, Unna, Germany) and allowed to cure for 30 minutes (Fig. 6). This procedure was carried in the presence of the patient for a near perfect match. Then the final prosthesis was ready and inserted applying water based adhesive onto the margins and tissue undercuts were utilized to retain the prosthesis (Fig. 7). The patient was esthetically satisfied and further instructions were given for maintenance of the prosthesis (Fig. 8). The instructions given are –

- Wear the prosthesis at a time of maximum 2-3 hours, when go for social outing
- Clean the tissue area before wearing with normal water
- Need to apply Daro adhesive in a thin layer on tissue surface of the prosthesis prior wearing
- When excessive sweating need to remove the prosthesis.
- Every six month follow-up visit for extrinsic coloration.

In the 1 year follow up period no evidence of inflammation or irritation has been found (Fig. 9).

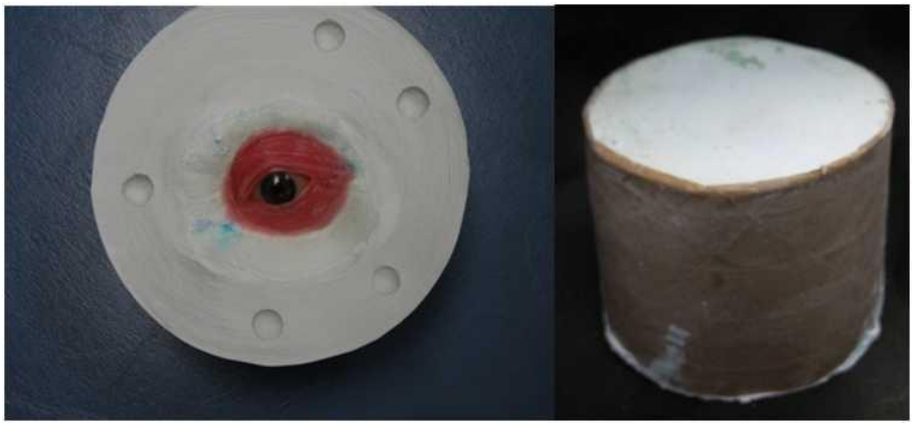

Fig. 4. Mold preparation

Fig. 5. Orbital prosthesis after processing: a. silicon part with lower mold, b. ocular prosthesis with upper mold and c. removal of the silicon part from the mold

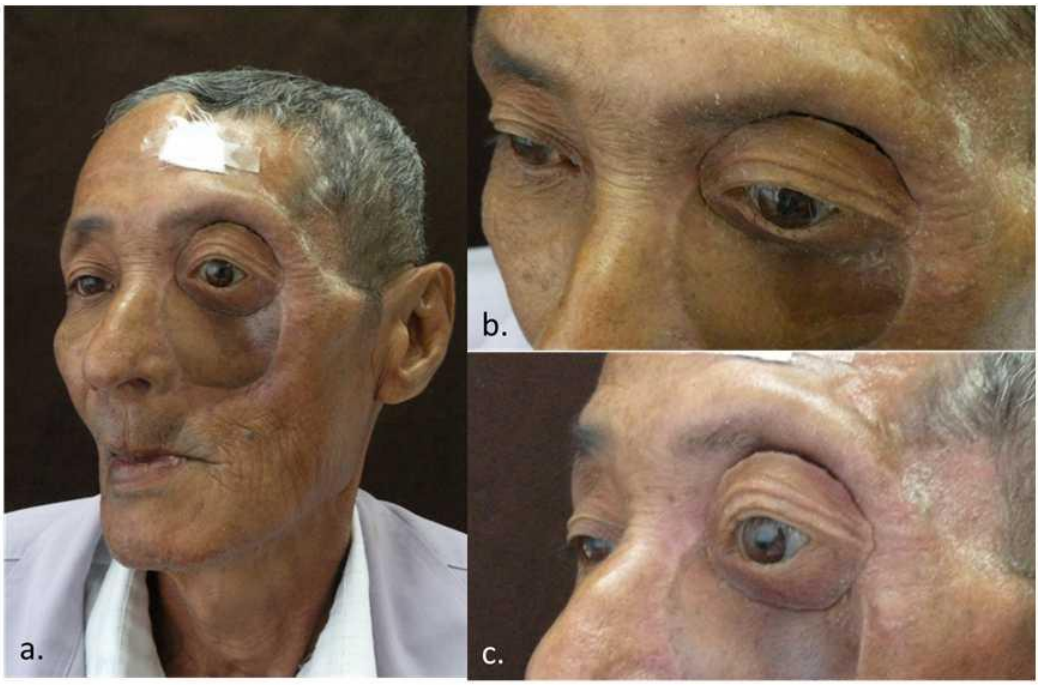

Fig. 6. Final insertion with margin gap and instability: a. left lateral view, b. upper close view c. right lateral close view

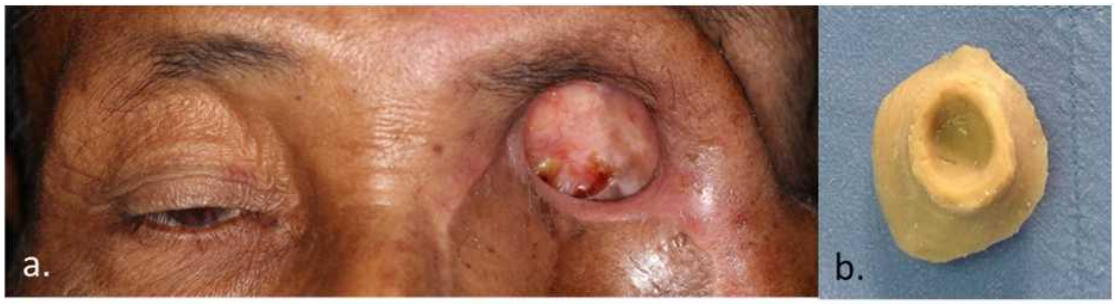

Fig. 7a. Evaluation of anatomical undercut and b. engaging of silicon material at tissue part of the prosthesis

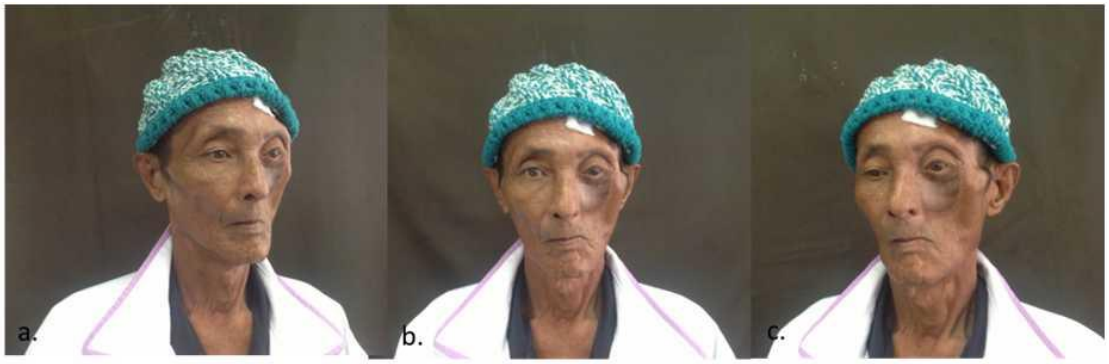

Fig. 8. Final prosthesis: a. right lateral view b. frontal view c. left lateral view

Fig. 9. Final prosthesis: 1 year after follow up

3. DISCUSSION

Variety of adhesives with mechanical retention like spectacle frame are used when orbital prosthesis cannot be retained by craniofacial implants or remaining tissue has lack of anatomical undercut. Several authors stated that with minimum or absence of undercuts like shallow orbital cavity, mimic motion and sneezing may lead to adhesive failure. As a result movement of the orbital prosthesis can occur during chewing and other masticatory function [5,6].

In this case due to the excess amount of bone loss following surgery, prosthesis has a chance to lose the stability and move vertically which is reported by other case studies. In such cases the movement of orbital prosthesis away from the tissue can occur if the connection is not rigid between the prostheses and remaining soft tissue that will create a margin gap which leads to poor esthetics and less stability of the prosthesis [7]. According to Taicher et al. [8], the prostheses which are rigidly attached by adhesives can have retention failure during chewing functions because of this masticatory strain. Thus, it is resulted in loss of contact of the silicone prosthesis margins. For that reason, careful evaluations of remaining undercuts were done for the increase of stability of the prosthesis in clinical examinations and on the working cast [9].

The advantages of using proper undercuts are, prostheses tend to move less during functional movement if that is properly engaged in to the remaining undercut; due to increase stability there will less open margin and no need to go for invasive procedures such osseointegration [9].

In this case, to improve the retention, the anatomical remaining under cuts such as mesial and superior bony undercut in conjunction with adhesives was used. If the undercuts are using for retention then the path of insertion is very important to the patient for insertion and removal of the prosthesis. For the prosthesis the path of insertion was first engaged the mesial and superior bony under cut and then engaged the lateral soft tissue. So patient must know and understand the exact path of insertion and removal of the prosthesis. Proper insertion will reduce the chances of open margin less. In this case major function of adhesive was to seal the border of the prosthesis. So this prosthesis got the final retention from the anatomical undercut with adhesive.

The use of osseointegrated implant can reduce complication of orbital prosthesis due to adhesive irritation and have improved long term success rates for orbital prosthesis [10,11]. However, several factors such as peri-implantitis, hygiene practice, dose of radiation should be considered for implant retained orbital prostheses. These factors include the thickness of bone and the load-bearing capacity of the implant in bone [12].

Therefore, if the prosthesis is properly designed and the patient is motivated to care for the underlying and supporting tissue, then anatomical undercut can be used successfully to retain a orbital prosthesis.

4. CONCLUSION

Retention is the one of the important consideration for success of the orbital prosthesis. The use of anatomical undercut combined with adhesive to retain orbital prosthesis has been described. Within the limitations, the prosthesis design is the most important for the success of the prosthesis.

CONSENT

All authors declare that ‘written informed consent was obtained from the patient (or other approved parties) for publication of this case report and accompanying images.

ETHICAL APPROVAL

Not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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