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Original Research

Tear reservoir prosthesis: A novel approach to manage dry anophthalmic socket

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ABSTRACT:
Enucleation along with adjuvant radiotherapy is the treatment of choice for many intractable ocular malignancies which are not amenable to conservative treatment. But, enucleation and radiotherapy by themselves pave way to multitude of problems. Dryness is one of the most common problems associated with such cases, which often lead to socket irritation and crustations resulting in poor prosthesis adaptation. This article elucidates a novel technique for management of dryness associated with an anophthalmic socket with a tear reservoir ocular conformer to combat dryness.
Keywords: Dry anophthalmic socket, Reservoir prosthesis, Ocular prosthesis

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INTRODUCTION

Anophthalmia can be unilateral or bilateral and congenital or acquired. Indications for enucleation include irreparable trauma, tumor (eg.Retinoblastoma), a blind painful eye, phthisis bulbi, the need for histological confirmation of a suspected diagnosis, the possible prevention of a sympathetic ophthalmia and cosmetic reason.[1]

Rehabilitating an anophthalmic patient becomes challenging when post enucleation complications exist, which frequently result in an inability to wear an ocular prosthesis. The most common complaint in irradiated anophthamic sockets is mucoid discharge (52%) followed by itchiness (40%), tearing (36%), and dryness (16%).[2,3] All these complaints can be attributed to the fact that anophthalmia predisposes to various ocular surface problems, such as a change in the composition of tears, specifically an increase in the mucin component and a decrease in the aqueous and lipid components, resulting to increased tear viscosity and decreased tear production.[2] Many studies have been conducted to explain the etiology behind these complaints.[2-9]

Tears are much more complex than mere "salty water." Tears are introduced into the conjunctival sac to sheet over the eye in a tear film and exit the eye into the nose via the lacrimal excretory (drainage) system. There are three elements in layers of the tearfilm: from the eye outward it contains something to help it adhere to the eye (mucus), a wetting element (aqueous), and something to keep it from evaporating (melbom). The primary tear glands are the lacrimal gland in the upper lateral orbit, the Meibomian glands in the tarsal plates, and glands of Zeis and Moll in the conjunctiva. Slow-motion microphotography has shown that the lids actually push the globe back incrementally for tear distribution, so a near-perfect fit (with an ocular prosthesis) is required for a smooth, wettable surface.[10]

The causes of dryness in anophthalmic sockets can be disruption of the normal anatomical and structural architecture of the cornea and conjunctiva, decreased aqueous component of tears,[3] abolished corneal reflex secondary to enucleation,[2,4] meibomian gland dysfunction or radiation therapy in enucleated sockets and certain drugs. The most common treatment for dryness is artificial tears. Lacrimal or punctal plugs have been tried in anophthalmic sockets.[11]But these are highly sophisticated and complex procedures which cannot be routinely employed.

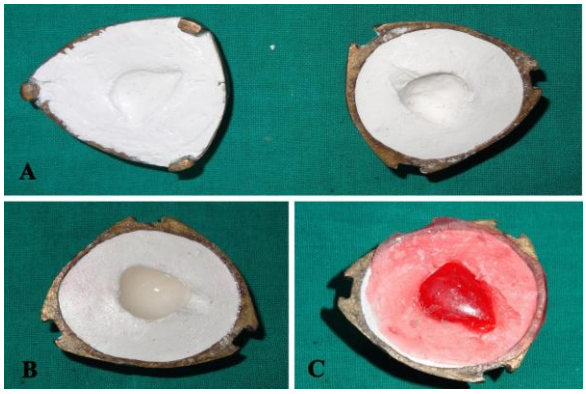
So the purpose of this article is to elucidate a novel and simple procedure for fabrication of a custom made tear reservoir to combat dryness associated with anophthalmic sockets.

TECHNICAL PROCEDURE

Tear reservoir is a custom made, uniform artificial tear filled cavity inbuilt in either the conformer or definitive prosthesis. It should have an inlet for filling and outlet for flowing and distribution of tears on the surface of residual socket and conformer or prosthesis.

1) Do all the steps involved in the fabrication of ocular conformer till final wax pattern trial in the conventional manner. [12]

Fig 1.(a)- Dewaxed moulds, (b)- 2mm of cured acrylic resin, (c)- Wax spacer over cured acrylic resin



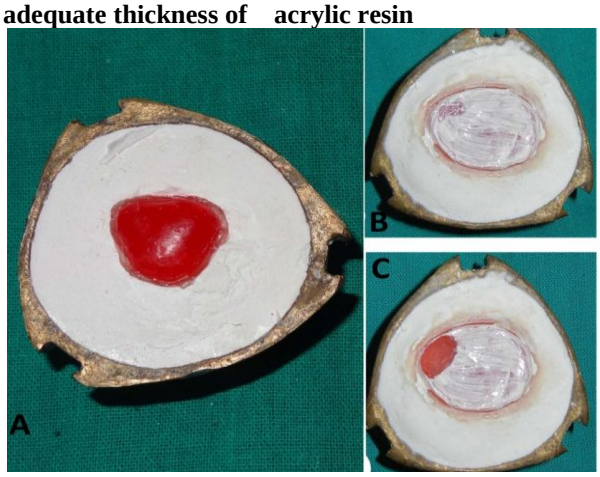
2) The procedure varies at the processing step wherein after investing and dewaxing of the moulds (Fig. 1A), pack the acrylic resin by two step technique.

3) In the drag part of flask, sprinkle the clear autopolymerized acrylic resin (SC 10, Pyrax, Roorkee, India) to a thickness of about 2mm to form the polished surface of the conformer (Fig. 1B).

4) After curing of the resin material, place excess of softened wax spacer over it and close the flask so acclimatize the wax to the remaining space of the mould

5) Open the flask (Fig. 1C) and scrape 2 mm from top surface of wax spacer and also approximately 2 mm from circumferential marginal area, where two layers of resin will bond (Fig. 2A).

Fig 2.(a)- Wax spacer after scrapping 2mm, (b) & (c) Applied pressure indicator paste to ensure adequate thickness of acrylic resin



In order to ensure for the adequate thickness of acrylic resin, apply pressure indicating paste (Pressure Indicator. Paste; Mizzy, Inc, Cherry Hill, New Jersey) over the wax spacer. and close the flask.

7) Smudging and removal of pressure indicating paste reveals areas where insufficient space exists for resin material (Fig. 2B).

8) Thin the wax spacer in pressure point areas accordingly (Fig. 2C).

9) Pack the second layer of clear autopolymerized resin in dough stage and close the flask.

9) After curing, retrieve the prosthesis carefully.

10) Make a 2mm opening in the superior margin of the prosthesis, to serve as an inlet for artificial tears.

11) Make another 2mm opening in the lower margin of the prosthesis for gravity mediated outflow of artificial tears (Fig. 3A).

Fig 3. Processed tear reservoir conformer

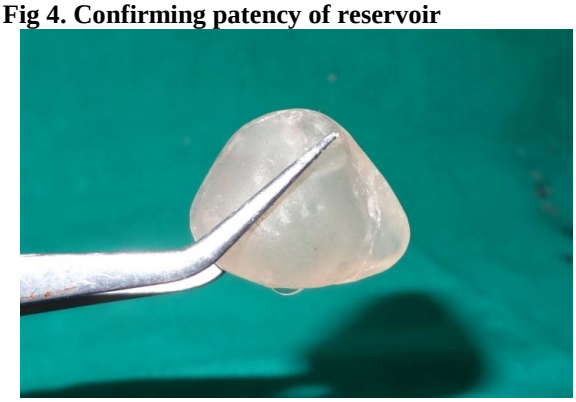
12) Immerse the prosthesis in the steam cleaner to remove the wax spacer (Fig. 3B).

13) After complete removal of wax, finish and polish the prosthesis in the conventional manner.

14) Fill the prosthesis with artificial tears (Ecotears; Intas Pharmaceuticals,Mumbai,India) from the inlet with the help of disposable syringe.

15) Confirm the patency of lower opening by observing flow of artificial tears from the outlet (Fig. 4).

Fig 4. Confirming patency of reservoir



16) Give proper home care instructions regarding handling of the prosthesis and demonstrate the method of filling the reservoir.

DISCUSSION

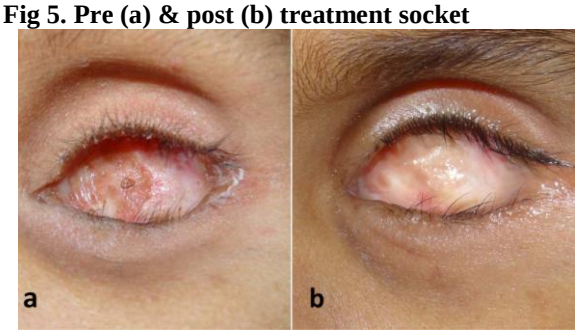
Dryness is one of the most common post enucleation complications in irradiated anophthalmic sockets. The important structural relationship between the conjunctiva of the upper lid and surface of the cornea needed for tear film physiology is obviously absent in such sockets.[3] The resultant dryness has adverse effects not only on the residual socket leading to crustations, soreness and irritation, but also severely affects the tolerance and the prognosis of the planned ocular prosthesis. Tears act as a lubricant for easy insertion and removal of ocular prosthesis, allow the eyelids to slide effortlessly over the prosthesis and give the characteristic reflection necessary for the life like appearance of the ocular prosthesis.

Medications, lacrimal or punctal plugs[11], subcutaneous abdominal artificial tears pump reservoir[13] and physiological means to induce lacrimation[14] have been tried in the past. Artificial lubricants containing dimethylpolysiloxane silicone and other compounds of silicone in gel or drops form have also been used to facilitate the use of prosthesis in dry sockets. But none of them could be effectively and conveniently applied.

The distinct advantages of the above described novel technique are:-

1. It resolves dryness and facilitates a comfortable use of ocular prosthesis (Fig. 5).

Fig 5. Pre (a) & post (b) treatment socket



2. It is simple and non-invasive as compared to other techniques.[11, 13, 14]

3. Being light weight prosthesis as compared to conventional solid prosthesis, the lower lid distortion is reduced.

4. Being a plastic prosthesis, it has an easy handling and can be polished efficiently when compared to glass ocular prosthesis.

5. A 2 mm acrylic resin all around the reservoir ensures proper structural durability and strength of the prosthesis.

The limitations of described prosthesis include:

1. It cannot be used in patients allergic to methylmethacrylate.
2. It has poor wear resistance.

Nevertheless, the benefits of tear reservoir prosthesis overweigh the few limitations in its use to combat dryness in dry sockets.

CONCLUSION

The present article describes a novel, simple, feasible and non-invasive approach for the fabrication of a custom made tear reservoir prosthesis to overcome the problems associated with dryness in anophthalmic sockets. In future, semi-permeable membranes can be adapted to modify the intaglio surface of these acrylic tear reservoir prostheses to improve biocompatibility and alleviate the concern of any allergic reactions.

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