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The unknown source of communicable Diseases

A New Discovery

Ocularist Zahid H Sheikh and Wasif Hafeez

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ABSTRACT

The desire to look pretty/handsome is quite natural. The ocularist plays an important role in rehabilitation of patients suffering from ugly looking ophthalmic socket. His role is a disciplinary one involving a broad range of services in overall management of the patient. (1) Ocularists endeavour to restore the natural aesthetics of individuals having anophthalmic socket. Presently there are three practices in ophthalmic cosmetics field i.e. Stock based practice, Stock modification practice and Custom made practice. Generally Stock based practice is in vogue in sub-continent due to economic reasons. However, patients fitted with ocular prosthesis under stock practices have a potential to develop communicable infections in one form or another. In addition, Peroxide initiated prostheses are irritant and hence uncomfortable. Histopathology and immunohistochemistry suggest that fibronectin plays a vital role in bacterial adherence and infections due to inherent porosity of the Peroxide-Initiated Polymerized Stock Prostheses.

INTRODUCTION

Stock based practice

Mechanical methods are used for the manufacture of these prostheses. Pre-determined shapes, sizes and shades are produced at commercial scale. Apart from their structural drawbacks, mechanically produced prostheses do not match well with the fellow eye.

The first prosthesis makes its place in the anophthalmic socket hence starts looking smaller than its companion eye after sometime. In young children this phenomenon is even more evident and frequent. A stock practitioner with little knowledge, expertise and facilities in remodeling can hardly carry out the modifications so required. Therefore, in most of the cases a stockist would replace the settled prosthesis with the bigger one from his ready stocks which, he most likely has retrieved from some other patient. This would expose the patient to cross infections of communicable diseases because of the lacrimal secretions absorbed in the pores of the used prosthesis.

Since Peroxide initiated stock prostheses are produced at commercial scale in predetermined shapes and sizes therefore, positioning of iris and neutralization of negative and positive pressures is virtually not possible. This further hampers the movement of the prosthesis.

Stock modification practice

In this practice, the nearest size and shade of ocular prosthesis is selected from stock and modification is carried out to match the healthy eye of the patient. In such cases the satisfaction of the patient can be achieved in up to 80-85% cases. Most of the limitations attributed to prefabricated eyes can be overcome if modification is carried out with professional care.

Custom made practice

It has been observed that quite frequently an excellent job done by the oculoplastic surgeon/oculist goes waste when the patient suffers from inconvenience resulting from stock based practices mentioned above. Effective cosmetic rehabilitation of patients with anophthalmia can be activated provided cosmetic parameters based methods are employed; a few of which are given as under:

- Eyelid position and relief
- Eye opening
- Position of the iris and pupil
- Diameters of the iris and pupil
- Position and decline of the prosthesis
- Depth of the prosthesis position in the orbit
- Cavity filling with the prosthesis
- Prosthesis mobility
- Sclera color
- Conjunctival vascularization
- Iris color

The above parameters are of paramount importance and can be adhered to effectively only with custom-made prostheses. This practice calls for a high degree of precision, skill and exacting standards. It involves use of precision instruments, exacting impression lifting and critical prosthetic measurements. Such custom prosthesis contributes to enhanced tissue health of the anophthalmic socket.(2) fig.1

The following advantages can be derived through custom-made prostheses.

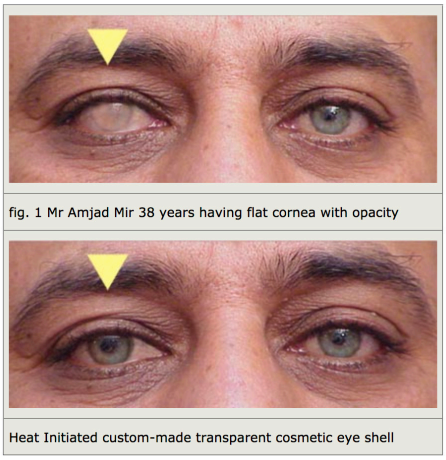

fig. 1 Mr Amjad Mir 38 years having flat cornea with opacity

Heat Initiated custom-made transparent cosmetic eye shell

- Individual characteristics peculiar to each patient
- Fulfilling physical requirements of the patients
- Personalized color matching
- Curvatures matching
- Natural look
- Exacting fitment on to the contours of the ocular socket
- Uniform distribution of pressure. (3)
- Enhanced movement of the prosthesis
- Practically no conjunctival erosion
- Greater comfort
- Eliminating risk of cross-infection

The loss of eye is often followed by scar tissue contracture. The custom-made conformers can be used to enlarge unfavorably small sockets, improve hygiene, assist the clinician develop the final shape for the definitive prosthesis, and to cut on the post-insertion adjustments. As such custom conformers can work as a viable initial treatment option in patients with ocular defects. (4)

MATERIALS AND METHODS

The ocular prosthesis involves materials and processes, end product of which would remain in constant contact with tissues in the eye socket i.e. interaction between the ocular prosthesis and the tissues. Therefore, an extreme care has to be exercised in selecting materials used therein.

The raw materials used in ophthalmic prosthesis are essentially of the following two groups:

- Methylmethacrylate (monomer)
- Polymethylmethacrylate (polymer)

The mixture of the above two materials is polymerized by one of the following four catalysts/initiators to produce PMMA.

- Microwave
- Lightwave
- Heat
- Peroxide

fig. 2 Surface Comparison

Peroxide Initiated Prosthesis | fig. 4 Heat Initiated Prosthesis

The processing by the first two initiators i.e. microwave and lightwave are not used in developing countries being prohibitively expensive. Therefore, we shall confine our discussions only to the later two i.e. Heat initiated and Peroxide initiated, used in the sub-continent.

Heat initiated polymerization

is either Dry heat or Wet heat. In order to obtain a non-porous solid mass of very high molecular weight for ocular

prosthesis, a mixture of monomer and polymer is processed in a mould of required size and shape under controlled environment. The mould is then given a hot water bath at 100 C under a uniform pressure of 156 PSI for one hour.

Peroxide initiated polymerization

Ocular prostheses available from ready stocks are generally produced through this process. Mechanical moulding of mixture of monomer and polymer is initiated with Benzoyl

fig. 3 Socket Condition

Just after 2 months use of Peroxide Initiated Stock Prosthesis | After 5 years of constant use of Heat Initiated custom-made Prosthesis

peroxide for quick polymerization for 5-10 minutes at ambient temperature under open environment. This process of-course may not only save time but is economical too and the solid mass so produced is polymer of low molecular weight and porous in nature making this material a health hazard due to porosity and other structural faults.(5) fig.2

Porous structure of the prosthesis absorbs lacrimal fluids which are good culture medium for bacterial growth. Monocular patients who wear a porous ocular prosthesis may harbor pathogenic conjunctival flora both in the socket and in the contralateral eye. (6) Histopathology and immunohistochemistry suggest that fibronectin plays a definite role in bacterial adherence and foreign body infections in porous eye prosthesis.

Fig. 3 shows condition of ocular socket after 2 months of wearing of Peroxide initiated polymerized stock prosthesis. The same ocular socket

Physico-chemical properties	Heat initiated custom-made prosthesis	Peroxide initiated stock prosthesis
Polymerization time	1 hour	5-10 minutes
Temperature	100 C.	Ambient temperature
Molecular weight	High	Low
Molecular structure	Non-porous	Porous
Physical properties	Non-absorptive	Highly absorptive
Odor	Odorless	Unpleasant smell
Color durability	Life long	Limited life
Appearance	Natural look	Variable
Surface	Regular, smooth, glistening	Irregular, uneven, non-glistening
Character	Non-abrasive	Abrasive
Conjunctival erosions	None	Common
Behavior	Non- irritant	Irritant
Socket	Quiet	Inflamed
Discharge	Negligible	Continuous, offensive
Cross-Infection	None	High probability
Prosthesis	Stays inert	Carries bacteria

was later on fitted with Heat initiated polymerized custom-made prosthesis in 1995. A close monitoring of the phthysical eye revealed that during five years of constant use the ocular socket showed no abnormal signs with regards to complications stated earlier.

COMPLICATIONS

Peroxide initiated stock based prostheses are a health hazard and have definite potential to transmit cross infection if replaced from one patient to the other.

A wide range of complications in an anophthalmic socket can develop after enucleation such as enophthalmos, superior-sulcus deformities, eyelid malpositioning, implant migration and extrusion, poor prosthetic mobility, and socket contraction.

The circulation dynamics and blood flow to orbital tissues do not change after enucleation surgery. (8) This means that the lack of blood supply is not a contributory factor for the development of the infection in the socket.

Culture samples obtained from the anophthalmic sockets of patients using a prosthetic eye have shown an increased prevalence of bacteria like staphylococcus aureus, streptococcus pneumoniae, haemophilus influenzae, staphylococcus epidermidis, streptococcus pyogenes, proteus mirabilis, klebsiella pneumoniae, propionibacterium acnes, lactobacillus species and veillonella species in the conjunctiva of anophthalmic sockets. Similarly patients who frequently manipulate their prosthesis have a significantly higher proportion of gram-negative bacteria, suggesting that manipulation of the prosthesis should be avoided.(9)

Leukotrienes have been shown to play a role in the pathogenesis of ocular inflammatory and allergic reactions like vernal keratoconjunctivitis. Elevated LTB4 and LTC4 levels in tears of ocular prosthesis related giant papillary conjunctivitis patients have been documented and it points towards the possible role of leukotrienes in the immunopathogenesis of OP-GPC. The results also indicate that lodoxamide 0.1%, a mast cell membrane stabilizer, is effective in significantly reducing tear LTB4 and LTC4 levels in OP-GPC patients.(10)

Anaerobic organisms are common flora in normal conjunctival sacs and in anophthalmic sockets, as well as in the sacs of acquired immunodeficiency syndrome patients. The latter group has a higher incidence and a spectrum of organisms that is different from that of the other two groups.(11)

CONCLUSION

Heat initiated PMMA custom prostheses should be an obvious choice in an ophthalmic socket as they are aesthetically acceptable, hygienically safe and non-irritant to the tissues. Peroxide stock prostheses are a potential health hazard by virtue of their porous structure which harbors infective organisms and can transmit serious infections if they are reused as in stock practice. One such prosthesis can infect a number of patients. Therefore, it is unethical to reuse such prostheses for hygienic reasons. Initial savings in the cost by using peroxide prostheses as in stock practice may turn out to be dangerous for the patients in the long run.

To minimize the risks of peroxide stock practice, the following suggestions may be adopted:

- Stock prosthesis should be polymerized by heat.
- The porous peroxide prosthesis may be coated with heat initiated PMMA coating to make it non-porous.
- Peroxide stock prosthesis must be sterilized by gamma radiation before reuse.

The Authors:

Zahid H Sheikh

ASC, ASO (USA)

Practising Ocularist

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