ISSN Print: 2394-7489
ISSN Online: 2394-7497
IJADS 2018; 4(2): 218-222

www.oraljournal.com
Received: 06-02-2018
Accepted: 07-03-2018

Dr. Richa Aggarwal
MDS Assistant Professor, Department of Dental Surgery, Muzaffarnagar Medical College, Dept. of Dental surgery, Muzaffarnagar Medical College, Muzaffarnagar, Uttar Pradesh, India

Dr. Rubina Gupta
Professor & Head Department of Dental Surgery, Muzaffarnagar Medical College and Hospital, Opp. Begrajpur Industrial Area Muzaffarnagar, Uttar Pradesh, India

Correspondence
Dr. Rubina Gupta
Professor & Head Department of Dental Surgery, Muzaffarnagar Medical College and Hospital, Opp. Begrajpur Industrial Area Muzaffarnagar, Uttar Pradesh, India

Evaluation of different procedures for iris reproduction for customized liquid ocular prosthesis for an ophthalmic patients

Dr. Richa Aggarwal and Dr. Rubina Gupta

Abstract
Purpose: To reduce the discomfort caused due to dryness of ocular prosthesis and to increase the esthetic acceptance of the prosthesis using various techniques for iris reproduction.
Material and Method: Forty patients wearing unilateral artificial eye for a period of more than 6 months were evaluated. A customized hollow prosthesis is fabricated which was incorporated with a hollow reservoir containing a combination of a tear substitute along with cyclosporine A 0.05% acting as the lubricant. For esthetics, four different procedures were used: oil paints on paper and acrylic, digital photographs and iris from stock eye. Dryness was evaluated with tear test strips both before and after insertion of prosthesis. The esthetics was evaluated with the help of a questionnaire. A self formulated grading system was used to record the scores.
Result: Post insertion of this hollow prosthesis, there was a marked reduction in the dryness and high acceptance esthetically especially with digital photographs.
Conclusion: It was concluded that the Iris fabricated from digital photographs were highly acceptable followed by stock iris.

Keywords: Hollow ocular prosthesis, prosthesis for dry eyes, oil painted iris, digital photographic iris, stock eye iris

Introduction
"It is the God given right of every human being to appear human".
Since the sixteenth century prosthetic reconstruction is employed to restore anatomy, function, and aesthetics of acquired surgical defects (Chalian *et al*, 1972). (Adisman, 1990).
Among various paraoral structures, eye is the most important organ. Most patients experience significant stress, primarily due to adjusting to the functional disability caused by the eye loss, and to societal reactions to the facial impairment [1, 2] Thus, ocular prosthesis should be provided as soon as possible for the psychological well-being of the patient [3]
An ocular prosthesis can be either ready-made (stock) or custom-made. Stock prosthesis comes in standard sizes, shapes, and colours. They can be used for interim or postoperative purposes [4-7].
Custom eyes have several advantages over stock prosthesis, including better eyelid movements; even distribution of pressure due to equal movement thereby reducing the incidence of ulceration, improved fit, comfort, and adaptation improved facial contours, and enhanced esthetics gained from the control over the size of the iris, pupil and colour of the iris and sclera [8-10].
Patients wearing prosthetic eyes often complain of dryness, irritation, discomfort, and discharge [11]. This makes wearing prosthetic eye very uncomfortable. A method of fabricating custom made hollow prosthesis is described.
The importance of an ocular prosthesis with acceptable esthetics in restoring normal appearance in patients with anophthalmia has long been recognized. Many procedures have been described in literature to achieve near normal esthetics in the prosthesis. Some of these procedures were compared in the present study.

Material and Method
Forty patients who had undergone anophthalmic surgery in 1 eye and had been wearing artificial eyes for a period of more than 6 months were included.

Subjects with contracted sockets, or other known lid disorders were excluded.

The subjects reported with the chief complaint of unacceptable esthetics and dryness. Custom made acrylic ocular prosthesis was fabricated for the subjects. The prosthesis were incorporated with an hollow reservoir containing tear substitute.

For esthetics, the patients were divided into 4 categories (10 patients in each category).

Group I: iris was painted using conventional oil paints on paper and covered with cyanoacrylate to make it water resistant.

Group II: iris was painted using conventional oil paints on an acrylic peg which was attached to the wax pattern.

Group III: Digital photographs of Iris was clicked and edited and covered with cyanoacrylate to make it water resistant.

Group IV: iris portion of stock eye shell was trimmed and incorporated in the custom Prosthesis

The procedure for prosthesis fabrication is as under

1) A tray of self-cure acrylic resin was made in the shape of the eye socket. It was checked for the fit & trimmed if required. The front end of the needle cap was cut & fixed in the centre of the acrylic tray (Fig. 1). The irreversible hydrocolloid impression material was mixed with excess water until it is very free flowing as suggested by BARLETT & MOORE [12]. The material was then injected into the socket with help of the cap. Once filled, the head was moved back to the vertical position and the patient was directed to move his eyes up and down. This will facilitate the flow of the impression material to all aspects of the socket. Patient was asked to look at a distant spot at eye level with his gaze maintained in a forward direction. After the material was set, cheek, nose and eyebrow regions were massaged to break the seal. Impression was removed and checked for accuracy. Excess material was trimmed [13].
2) The color for the sclera portion was selected using the tooth-color acrylic shade guide [14]
3) The impression was poured in dental stone. Four pyramid shaped keys were then made on the base of set cast & a plaster index was poured. The stone cast was then cut into two using the die preparation saw facilitating the removal of the wax pattern from the cast.
4) Base plate wax was then molded in the shape of the eye & tried in the patient's socket. The wax pattern was modified in order to achieve patient comfort, appropriate anterior/posterior dimension, palpebral fissure curvature and iris centre position. It was also examined for the size, contour, esthetics, support from tissue, simulation of the eye movement and eyelid coverage. The iris plane and pupil point were evaluated by drawing guide lines on the patient's face. This was confirmed with the contralateral normal eye. Care was taken to see that the eye lid closed over the scleral blank normally like the contralateral normal eye.
5) For group I patients, the iris was painted using acrylic paints replicating the iris color of the natural eye on a thin paper sheet. This paper sheet was then attached to an acrylic iris peg. The assembly was then placed on the wax pattern at the designated place [15]. (Fig. 2).
6) For group II patients, the iris replicating the color of the natural eye was painted on the acrylic peg (Fig. 3) using acrylic paints mixed with polymethyl methylacrylate painting medium. The painted iris disk was then placed on the wax pattern prior to curing [16].
7) For group III patients, a digital photograph of the patient's iris was made using a digital camera (SLR camera, Canon 60D). The shutter speed was set at 1/5 seconds with an aperture of F32, and the film sensitivity was set at International Organization for Standardization 200 sensitivity mode with 1:1 lens magnification. In order to calibrate the red, green, and blue (RGB) values of the images, the white balance was set to customized 'preset mode' following the manufacturer's instructions using a standard grey card. Using graphics software (Adobe Photoshop, version 8.0; Adobe Systems Inc., San Jose, California, USA), the image was adjusted for slight differences in colour, brightness, contrast, or hue, and formatted. (Fig. 4) Final image was printed on 130 gsm white paper with differing brightness, contrast and intensity using a laser printer with a color-ink print cartridge. The paper iris was covered with cyanoacrylate to make it water resistant [9, 17].
8) For group IV patients, a stock prosthesis having a cornea of similar size and colour was selected and the cornea was cut of it using acrylic trimmer. This cornea was then placed on the pre-determined position in the wax pattern such that the margins of cornea were flush with the wax pattern. (Fig. 5) [18, 19]
9) After the try-in is complete, a two part mold is constructed using dental gypsum within a stainless steel or brass flask. The anterior portion of the mold is invested, a separating medium is applied. 4-5 small pieces of 26 gauze wire were placed around the iris peg in the wax pattern. The posterior portion of the mold is then invested and dewaxing is carried out.
10) The flask is then opened. The wire pieces are attached to the posterior portion of the mold. While preparing the white posterior section of the prosthesis, the above mentioned two-part mold is cleaned and examined, and a liquid separator is applied to each gypsum section. These wire pieces helped in making minute holes on the anterior surface of the prosthesis so as to facilitate the drainage of lubricant onto the anterior surface of prosthesis.
11) Half of the heat cure PMMA (trevalon, dentsply India pvt ltd,) in dough stage was positioned accurately over dewaxed mould & then salt crystals were placed over it. The remaining heat cure was placed over it & packed. The mold is placed in a mechanical or hydraulic press and excess Poly Metha Methyl Acrylate is squeezed out; the mold is then placed in a curing device and heat is applied until polymerization is complete.
12) After curing, the prosthesis is removed from the mould. A small hole was drilled in the posterior section of the prosthesis. The salt is flushed out by injecting water under high pressure. A wax impression of the hole is made and invested in cold cure PMMA to form a removable cap over the hole (Fig. 6).
13) The prosthesis is then smoothed with a paste of pumice flour and water. Progressively, finer abrasives are used until all surfaces are smooth and show no scratches [20]. (Fig. 7).
14) Prior to insertion of the finished prosthesis, it was disinfected using 70% isopropyl alcohol and 0.5% chlorhexidine solution. After thoroughly cleaning the

prosthesis with saline solution to prevent chemical irritation, it was inserted and checked for fit, contour, and movements [21].

15) Periodic recall appointments were scheduled 1 week, 3 weeks and 3 months after the insertion of the prosthesis.
16) Patient was advised to clean the internal surface of the reservoir by forcefully injecting the water through the openings everyday and once in 15 days with 7% sodium hypochlorite solution to prevent any growth of micro-organisms [22].

The dryness was evaluated using tear strips (Schirmer Tear Test). The reading below 5mm was regarded as severe dryness, 10mm – 5mm as moderate dryness and more than 10mm as mild drynes (Fig. 8).

The patients were asked to grade their satisfaction with esthetics on a scale of 1 to 5...1 being the least and 5 being the maximum.

The statistical analysis was done by using "CHI-SQAURE" statistic and the 5% level of significance had been used ($p< 0{\cdot}05$ is taken as statistically significant).

Results

Out of 40 subjects included in the study, 25 were wearing stock prosthesis while 13 were custom made ocular prosthetic wearers for a period of minimum 6mths. The chief complaints included unacceptable esthetics and irritation, discomfort, soreness, pain and inflammation due to dryness.

In this questionnaire-based investigation, it was found that about 25 patients were using lubricant drops 4-5 times daily, but were not satisfied. The average scale of dryness was 4.29 for non-lubricant users while was approx 3.75 for lubricant users. Artificial tear drops were most commonly used lubricants. Post insertion of hollow prosthesis, this dryness scale reduced to an average of 0.55. Three patients complained of excessive flow post insertion.

The esthetics were found to be unsatisfactory for the stock prosthesis. Though the esthetics were better in case of custom prosthesis but was not highly acceptable. Out of the four groups, best near-normal colour and contour was obtained in group III patients with digital photography (4.65). Group IV patients were also satisfied with the esthetics (4.3) followed by group I (3.25) and group II patients (2.5).

Discussion

An anophthalmic socket has a different anatomical and physiological environment, as compared with a normal eye.

Allen *et al.* [23] reported that prosthetic eye wearers did not produce as much tear fluid as people with normal eyes do. In practice, many prosthetic eye patients with ocular discomfort are prescribed artificial lubricants to relieve their ocular symptoms. Artificial tears provide palliative relief to eye irritation in patients with aqueous tear deficiency, but do not prevent the underlying inflammation or reverse conjunctival squamous metaplasia [24].

In the present study, an innovative technique is described for fabrication of a hollow custom made ocular prosthesis. "The lost salt technique" was used for fabricating hollow prosthesis [24]. The hollow prosthesis was light in weight even after filled with lubricant. This increased patient comfort and ease of wearing**.** The reservoir in the ocular prosthesis is used to store liquid artificial lubricants & cyclosporine A 0.05%. The liquid is discharged on the anterior surface of the prosthesis by minute holes. During the blinking of the eyelids, this liquid spreads on the complete surface by capillary action. The liquid helped in keeping the eyes wet, thus reducing the dryness, irritation and discomfort. The equal distribution of pressure and continuous lubrication helped in reducing the soreness and pain in the eye.

Accurate iris reproduction in the fabrication of ocular prosthesis in order to match the remaining eye is a key factor to mask the loss and achieve an esthetic outcome for anophthalmic patients. Traditionally, oil paints have been used to duplicate the iris. Oil paints though produce good results; they are generally not highly acceptable by the patients. Also the technique is time consuming and needs high artistic quality.

In group III, the iris is reproduced with the help of digital imaging. Thus complete resemblance to the adjacent eye is achieved [25]. The color for the sclera portion was selected using the tooth-color acrylic shade guide [14] Thus high esthetics was achieved leading to good patient acceptance and satisfaction.

Using iris from stock eye is a simple and easy technique. Custom-made sclera gives the advantage of good fit and comfort and using stock iris gives good esthetic results. The disadvantage is of not complete resemblance, hence less patient satisfaction.

Ocular prosthesis installation may allow the adherence of fungi and/or bacteria due to the superficial characteristics of the prosthesis material, or because the void located between the internal portion of the prosthesis and the anophthalmic cavity mucosa. Hence the patient was asked to clean the prosthesis regularly and visit the doctor every 6 monthly.

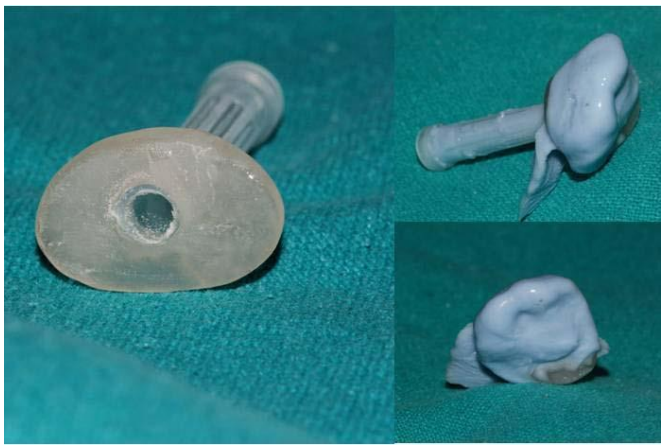

Fig 1: hydrocolloid impressions

Fig 2: iris painted with oil colours on thin paper

Fig 3: acrylic button with painted iris.

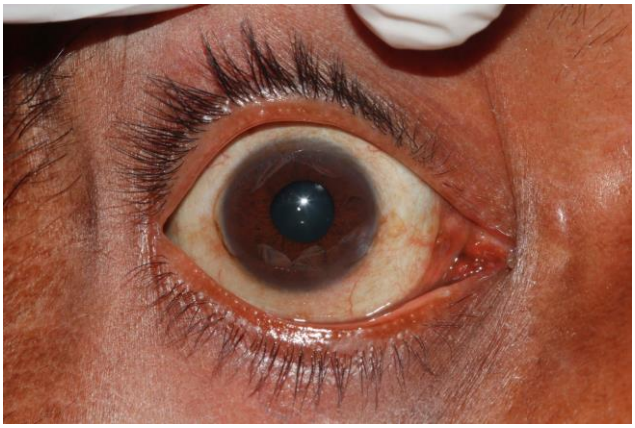

Fig 4: Taking digital impression of normal eye

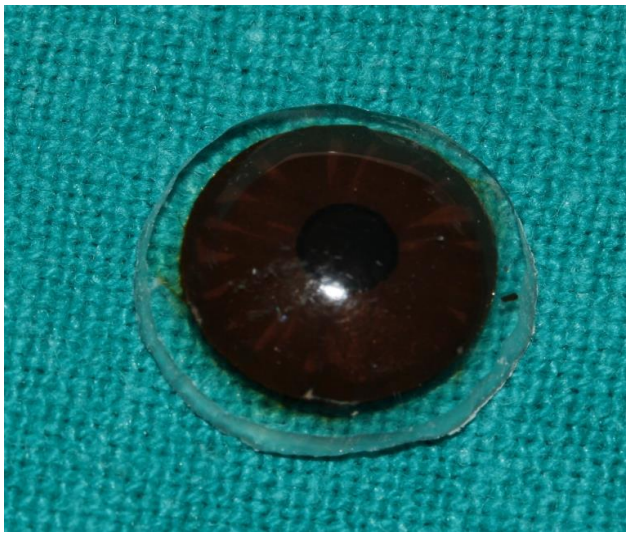

Fig 5: iris trimmed from stock eye

Fig 6: A small hole drilled in the posterior section of the prosthesis with removable cap.

Fig 7: Final prosthesis after finishing and polishing

Fig 8: Readings of Tear Strip before and after insertion of prosthesis

Conclusion

The eye is a vital organ not only in terms of vision but also being an important component of facial expression. Loss of eye has a crippling effect on the psychology of the patient.

The use of custom-made ocular prosthesis has been a boon to the average patient who cannot afford the expensive treatment options available. The esthetic and functional outcome of the prosthesis is superior to the stock ocular prosthesis. The reservoir in the prosthesis filled with lubricant drops helped in reducing dryness and hence irritation, discomfort, soreness and inflammation, thereby increasing patients acceptance and comfort.

The fabrication of extra-oral porsthesis is as much an art as it is science. Prosthesis form, coloration & texture must be as indiscernible as possible from the surrounding natural tissues. Four different procedures for iris replication have been used and compared. Digital photography has been found to be the best method with highest patient satisfaction. Rehabilitation efforts can be successful when patients appear in public without fear of attracting unwanted attention

References

1. Lubkin V, Sloan S. Enucleation and psychic trauma. Adv Ophthalmic Plast Reconstr Surg. 1990; 8:259-62.

2. Barnett MO, Chalian VA. Psychological & economic aspects of maxillofacial patients. The willams & wilkins co, Baltimore, USA, 1972
3. Taylor T. Clinical Maxillofacial Prosthetics, 233-76
4. Goel BS, Kumar D. Evaluation of ocular prosthesis. Journal of the All-India Ophthalmological Society. 1969; 17(6):266-69.
5. El-Dakkak M. Problem solving technique in ocular prosthetic reconstruction, Saudi Dental Journal. 1990; 2:7-10.
6. Kale E, Mes Ae, Izgi AD. A technique for fabrication of an interim ocular prosthesis, J Prosthodont. 2008; 17(8):654-661.
7. Smith RM. Relining an ocular prosthesis: a case report. J Prosthodont. 1995; 4(3):160-3.
8. Beumer J, Zlotolow I. Restoration of facial defects in Maxillofacial Rehabilitation — Prosthodontic and Surgical Considerations, J Beumer, Ed., Mosby, St. Louis,Mo, USA, 1996, 350-364.
9. Artopoulou II, Montgomery PC, Wesley PJ, Lemon JC. Digital imaging in the fabrication of ocular prostheses. J Prosthet Dent. 2006; 95:327-30.
10. Ow RKK, Amrith S. Ocular prosthetics: use of a tissue conditioner material to modify a stock ocular prosthesis. J Prosthet Dent. 1997; 78(2):218-22.
11. Pine K, Sloan B, Stewart J, Jacobs RJ. Concerns of anophthalmic patients wearing artificial eyes. Clin Exp Ophthalmol. 2011; 39:47-52.
12. Barlett SO, Moore DJ. Ocular prosthesis. A physiologic system. J prosthet dent. 1973; 29:450-59
13. Adarsh N, Pradeep, Suresh BS, Yogesh RB, Rachana KB. Ocular Prosthesis Made Easy A Case Report. International J. of dental clinics. 2011; 3(1):105-106
14. McArthur DR. Aids for positioning prosthetic eyes in orbital prosthesis. J Prosthet Dent. 1977; 37:192-3.
15. Gupta SK, Gupta Rubina, Nijhawan S. Custom Made Ocular Prosthesis - A Simplified Technique. Journal of Advance Researches in Biological Sciences. 2010; 2(1):105-110.
16. Fernandes AU, Goiato MC, Jacó Batista MA, dos Santos DM. Color alteration of the paint used for iris painting in ocular prostheses. Braz Oral Res. 2009; 23(4):386-92
17. Jayaswal GP, Dange SP, Khalikar AN. Restoration of an atrophic eye socket with custom made eye prosthesis, utilizing digital photography. Indian Journal of Dental Research. 2011; 22(3):482-85
18. Sonia Bhat. Ocular prosthesis: art meets science. Rev. Clín. Pesq. Odontol. 2010; 6(3):287-292
19. Ram HK, Shah RJ. Simplified method for Ocular Rehabilitation: A Case Report, Journal of Dental and Medical Sciences. 2013; 3(4):10-13
20. Shah FK, Aeran H. Prosthetic management of ocular defect: Esthetics for social acceptance. J Indian Prosthodont Soc. 2008; 8:66-70
21. Gunaseelaraj R, Karthikeyan S, Kumar MN, Balamurugan T, Jagadeeshwaran AR. Custom-made ocular prosthesis. J Pharm Bioallied Sci. 2012; 4(2):177-179
22. Arora V, Kumar D, Legha VS, Kumar KVA. Management of xerostomia patient with salivary reservoir designed in upper complete denture and lower cast partial denture. Journal of contemp dent. 2014; 4(1):56-59
23. Allen L, Kolder HE, Bulgarelli EM, Bulgarelli DM. Artificial eyes and tear measurements. Ophthalmology. 1980; 87:155-157.
24. Aggarwal H, Jurel SK, Singh RD, Chand P, Kumar P. Lost Salt Technique for severely resorbed alveolar ridges: an innovative approach. Contemp Clin Dent. 2012; 3(3):352-55.
25. Jayaswal GP, Dange SP, Khalikar AN. Restoration of an atrophic eye socket with custom made eye prosthesis, utilizing digital photography. Indian J Dent Res. 2011; 22:482-5.