Fabrication of Ocular Prosthesis with a Digital Customization Technique – A Case Report

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Abstract

The loss of an eye may be caused by cancer, trauma, or congenital defects. The loss of the eye creates functional, esthetic, and psychological lacunae in individual's personal and social life. Rehabilitation of ocular defect can be done by a custom ocular prosthesis fabricated with heat cure polymethylmethacrylate. The custom-made prosthesis provides a higher fit, is softer to use and offers better cosmetic results than a stock prosthesis. This case report is to provide an explain on a brand-new technique of customization using digital scanning of the patient's iris made using a photographic scanner and 3D printing technology to grant excellent cosmetic results to the patient.

Keywords: Custom made artificial eye, maxillofacial prosthesis, ocular defect, ocular prosthesis,3D printing.

Introduction

Eye removal not only induces unaesthetic appearance, but also impacts, functions, and encompasses a psychological effect on the patient, either due do tumors, trauma or another illness.

Therefore, ocular prosthesis replaces an absent natural eye that fits under the eyelids. People with ocular prosthesis can do anything that normal people with both eyes are able to do. The material used for fabricating an ocular prosthesis is mainly hard acrylic resin, for its numerous advantages.

The new breakthrough in the area of customized production of prostheses is using innovative digital technology.

Nowadays, CAD/3D printing systems are introduced in the market and are used for fabrication of the artificial dental prosthesis, and fabrication of the ocular prosthesis. However, till now there is no enough or little study papers available that are discuses between 3D printing ocular prosthesis.

Therefore, this case report is aimed to evaluate the ocular prosthesis fabrication by the recent method of using 3D printing and face scanning technology.

Case Report

A 25-year-old female patient reported to the dental office complaining of unaesthetic appearance of face and missing right eye. Medical history revealed enucleation of right eye 6 months back [Fig. 1]. On examination, the anophthalmic socket has healed completely, it retains muscle activity of surrounding muscles, it was planned to fabricate a custom-made ocular prosthesis.

Extra-ocular examination was performed for the socket of the eye to detect any inflammation or secretion.

For the 3D printed ocular prosthesis fabrication:-

- An accurate impression of the patient's eye socket is obtained to prepare a suitable wax model .

a. Computerized Tomography (CT) scan image of the wax model was made for the wax model.

b. The CT image is then converted into three-dimensional (3D) format using the Materialize Interactive Medical Image Control System (MIMICS) software.

c. The 3D model that created was exported into a 3-Matic software which is an inbuilt module of MIMICS.

d. The model developed was fed into a rapid manufacturing machine which fabricated the prototype model of the ocular prosthesis.

e. A face scanning was done for the patient face and healthy eye using highly accurate scanner.

f. MIMICS software was used for designing and constructed the ocular prosthesis from photopolymerised acrylic resin and coloring it using the scanned image of the healthy

iris with its colors to the prototype 3D model of the prosthetic eye on the predetermined position of the iris.

g. patient delivery the ocular prosthesis.

Discussion

The goal of any prosthetic treatment is to return the patient to society with a traditional appearance. Till 1940s glass was the fabric of choice for fabrication of ocular prosthesis. With the invention and development of polymers PMMA (Polymethylmethacrylate) it became material of choice. Custom made Ocular prosthesis using PMMA has various advantages such as—non brittle, better adaptation, more leisurely, better esthetics, longer serviceability, and simple to repair or polish.

Various impression techniques are reported in literature such as direct impression/external impression technique, using stock ocular tray, impression with custom ocular tray, impression with stock ocular prosthesis, and wax scleral blank technique. Other impression materials like irreversible hydrocolloid, ophthalmic alginate, polyvinyl siloxane, tissue conditioners, and dental impression waxes are often used as in the case report. The impression was made with a custom-made ocular tray using addition silicone impression material, light body consistency.

Customization is a very important aspect of prosthetic rehabilitation which brings the cosmetic appearance to proximity with the normal levels. In an ocular prosthesis the challenge is to breed the iris alter the prosthesis. Various techniques are used by various authors like Iris painting, using most closely matching iris button from a stock eye or making a digital image of iris of the contralateral natural eye.

In our case report a digital scan of the iris of the patient's natural eye was made, which was later printed on a high polished surface and was attached to scleral blank to fabricate the prosthesis. The described technique could be a simple, practical, and time efficient method to fabricate the ocular prosthesis. The rehabilitation of ocular defect gave the patient self-esteem and greatly improved the social acceptance.

Summary

The eyes are organs of interest not only to ophthalmologist but also to psychologists, painters, poet during this era even personal identification via computer analysis of iris. The management of an anophthalmic socket requires the combined

effort of surgeon and prosthodontist, an intensive knowledge of the anatomy, treatment options, and techniques is important for successful treatment to reach the most cosmetic proximity with the natural appearance of the human eye.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understands that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.