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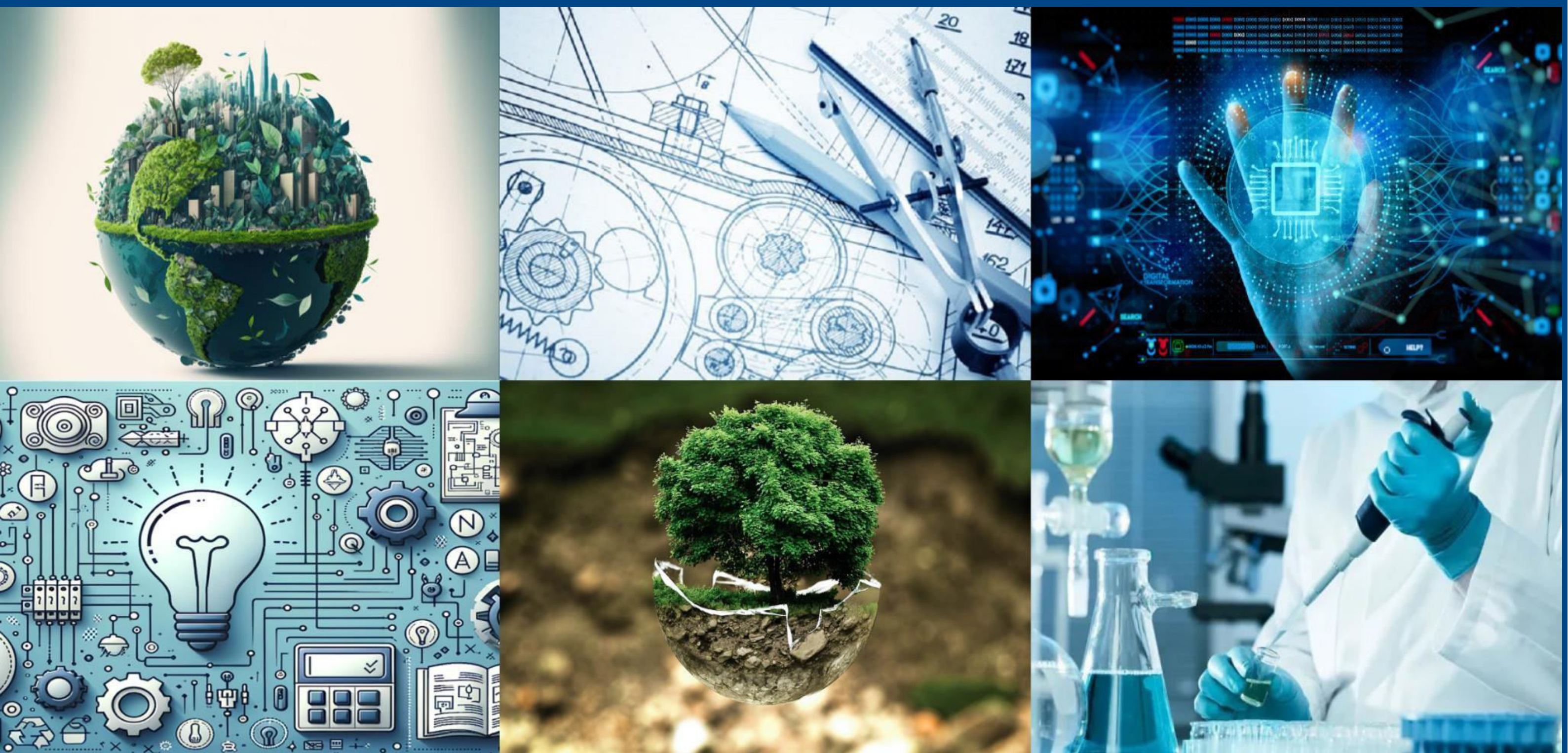

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Prosthetic Rehabilitation of an Orbital Defect: A Clinical Case Study

Gaurav Gupta[1], Shaveta Bansal[2], Simmi Sharma[3], Ibadatpreet kaur mann[4]

Professor & Head, Department of Prosthodontics and Crown & Bridge, Guru Nanak Dev Dental College and Research Institute, Sunam, Punjab, India[1]

Professor, Department of Prosthodontics and Crown & Bridge, Guru Nanak Dev Dental College and Research Institute, Sunam, Punjab, India[2]

Senior Lecturer, Department of Prosthodontics and Crown & Bridge, Guru Nanak Dev Dental College and Research Institute, Sunam, Punjab, India[3]

Postgraduate Student, Department of Prosthodontics and Crown & Bridge, Guru Nanak Dev Dental College and Research Institute, Sunam, Punjab, India[4]

ABSTRACT: The complete loss of orbital content can have a profound psychological and functional impact on affected individuals, often leading to significant facial disfigurement. Prompt rehabilitation is vital for restoring normal anatomical contours and aesthetics. While reconstructive surgery has limited success in extensive orbital defects involving the eyeball and eyelids, prosthetic rehabilitation offers a practical and esthetically pleasing solution. This case study outlines a simplified and cost-effective approach to fabricate a custom orbital prosthesis using polymethyl methacrylate, secured via a spectacle frame. The described method emphasizes anatomical accuracy and cosmetic integration, offering psychological and social benefits to the patient.

KEYWORDS: Orbital Prosthesis, Ocular Defect, Modelling wax, Polymethyl Methacrylate

I. INTRODUCTION

Orbital defects may arise from congenital malformations, traumatic injuries, surgical excision of malignancies, or infections requiring aggressive surgical intervention such as exenteration. These conditions result in not only a physical deformity but also significant psychological trauma, affecting the individual's self-esteem and social life. The eye, being a prominent facial feature, when lost, leads to marked asymmetry and a constant reminder of the trauma endured. Orbital prostheses are employed to restore both aesthetics and facial harmony, thereby enhancing the patient's quality of life. Various materials such as PMMA, silicone elastomers, and medical-grade urethane have been used with success. Among these, PMMA stands out for its affordability, durability, and satisfactory cosmetic results.

II. CASE REPORT

A 60-year-old male patient reported to the Department of Prosthodontics with a primary concern of facial deformity due to the absence of his left eye (as shown in figure 1). His medical history indicated that he had undergone orbital exenteration three years ago as a treatment for mucormycosis, a life-threatening fungal infection. On clinical examination, a large orbital defect was observed on the left side with minimal anatomical features to facilitate natural prosthesis retention. Due to the absence of sufficient undercuts, a spectacle-retained acrylic prosthesis was chosen as the most viable solution. The patient provided informed consent for the procedure after understanding the proposed treatment plan.

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Figure 1

CLINICAL PROCEDURE

Impression Making

To begin, an impression tray was fabricated using a thin cardboard sheet with a central opening to expose the orbital defect and adjacent nasal bridge. An impression was recorded using irreversible hydrocolloid (alginate), ensuring accurate capture of the defect's surface anatomy (as shown in figure 2). The impression was then reinforced externally with quick-setting plaster for added stability. Two plaster mounds were added to the base of the impression plaster to stabilize the impression during the cast fabrication (as shown in figure 3). This entire impression assembly was carefully removed from the patient in one piece to avoid distortion (as shown in figure 4).

Figure 2

Figure 3

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Figure 4

Cast Fabrication and Wax Sheet Adaptation

The impression was then inverted onto the plaster supports, and dental stone was poured to obtain a positive replica of the defect. Once set, the cast was retrieved and examined for accuracy (as shown in figure 5). A sheet of modeling wax was adapted over the orbital area on the cast, forming the base upon which the prosthesis would be constructed.

Figure 5

Selection and Indexing of Ocular Shell

A suitable stock ocular shell that closely resembled the color, shape, and size of the contralateral eye was selected. To ensure correct alignment and orientation during processing, two pyramidal projections were fabricated on the posterior surface of the ocular shell.

Ocular Shell Orientation

The wax-adapted shell was placed in the patient's orbital area for clinical assessment(as shown in figure 6). Using a tongue blade, the ocular shell was aligned to match the contralateral eye. Anatomical landmarks were marked on the tongue blade to indicate the medial canthus, pupil centre, and lateral canthus (as shown in figure 7). These references helped in precisely positioning the ocular shell.

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Figure 6

Figure 7

Sculpting the Wax Pattern

After verifying the ocular shell position, the shell-wax assembly was returned to the cast. Additional wax was built up around the ocular shell to mimic the eyelids and facial contours. Fine sculpting was done to replicate natural skin features such as eyelid folds and wrinkles (as shown in figure 8), thus enhancing the lifelike appearance of the prosthesis.

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Figure 8

Try-In and Shade Matching

A clinical trial of the wax prosthesis was conducted to assess symmetry, retention, and esthetic integration. Skin shade matching was performed by blending pigments like burnt amber and sunset yellow (in a 4:1 ratio) into clear PMMA. This mixture was kept into a transparent strip and compared against the patient's adjacent skin for accurate color matching (as shown in figure 9).

Figure 9

Prosthesis Processing

The putty mold was used to record tissue surface of wax pattern (as shown in figure 10). Light-body silicone was injected onto the front side of the wax pattern (as shown in figure 11&12), and putty was placed over it, encapsulating the wax structure. After the impression material set, the wax pattern was removed, leaving a mold cavity (as shown in figure 13). The color-matched polymethyl methacrylate was packed into this mold (as shown in figure 15&16), and polymerization was carried out as per manufacturer's guidelines. The cured prosthesis was retrieved, finished, and polished.

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Figure 10

Figure 11

Figure 12

Figure 13

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Figure 14

Figure 15

Figure 16

Final Assembly, fitting and staining

The finished prosthesis was trial-fitted to assess its adaptation (as shown in figure 17). Spectacles were positioned to ensure the prosthesis remained securely in place. The centre of the prosthesis was trimmed for attachment of ocular shell to the prosthesis(as shown in figure 18). The ocular shell was precisely aligned within its indexed slot using cyanoacrylate for initial fixation (as shown in figure 19). Further reinforcement was done with polymethyl methacrylate to enhance the structural stability. Final pigmentation adjustments were made using a mix of burnt amber, yellow, and white pigments to achieve a seamless match with the patient's skin tone. The prosthesis was permanently attached with cyanoacrylate to the spectacles frame, which served as the primary retention mechanism.

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.Figure 17

Figure 18

Figure 19

Figure 20

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Figure 21

Insertion and Patient Education

The prosthesis was inserted into the orbital cavity and checked for comfort, symmetry, and esthetic harmony (as shown in figure 22). The patient was provided with detailed instructions on placement, removal, daily cleaning, and long-term maintenance. The patient expressed satisfaction with the prosthesis and demonstrated confidence in handling it independently.

Figure 22

III. DISCUSSION

This technique emphasizes ease of execution, cost-effectiveness, and reliable esthetic outcomes. Using alginate for impression-making ensures adequate detail reproduction with minimal patient discomfort. The integration of an ocular shell improves realism, while wax sculpting helps mimic anatomical nuances. The mold technique allows for multiple reproductions of the prosthesis in the future if patient revisists with broken prosthesis, facilitating long-term maintenance. Mechanical retention via spectacles offers a noninvasive and practical solution, particularly in cases lacking undercuts or implant support. This approach provides a balanced combination of function, aesthetics, and patient comfort.

IV. CONCLUSION

Timely prosthetic rehabilitation following orbital exenteration is essential for the psychological and physical well-being of the patient. The described technique provides a simplified, reproducible, and effective method for restoring orbital defects using commonly available materials. By prioritizing patient comfort, cost-efficiency, and realistic aesthetics, prosthodontists can significantly improve the quality of life for individuals coping with orbital disfigurement.

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