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CONTENTS

Reconstruction of a cranial defect with an alloplastic implant

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Cranial defects occur most frequently during wartime, but their incidence during peace time, as a result of accident or disease, makes knowledge of cranioplasty useful to the interested practitioner. Trauma accounts for most of the cranial defects. Numerous materials have been historically employed for the restoration of cranial defects. Heat-polymerized methyl methacrylate alloplastic cranial implant requires presurgical fabrication of the implants. It facilitates the reproduction of the contours, and the tissue bed is not exposed to the heat of polymerization or to the free monomer. In this study, a case report has been presented in which heat-cured acrylic resin alloplastic implant has been fabricated for a patient with left frontal bone defect.

Key words: Alloplastic implant, autogenous bone, cranial defect, cranial implant, cranioplasty, osteoplastic reconstruction

INTRODUCTION

From a long time, cranial defects resulting from trauma or disease have been described. Since the end of nineteenth century, numerous repair procedures have been described and advocated. After World War II, dentists became involved in the fabrication and insertion of alloplastic implants, particularly in large cranial defects. These defects occur most frequently during wartime, but their incidence during peace time, as a result of accident or disease, makes the knowledge of cranioplasty useful to the interested practitioner. Trauma accounts for most of the cranial defects.[1]

Indications for cranioplasty

- Pulsating and painful defects.
- Danger of trauma at the site of defect.
- Deforming and unsightly defects.
- Headache and other symptoms such as pain, apprehension or tenderness at the site of defect.

Most neurosurgeons agree that cranioplasty should be delayed from 6-12 months to allow appropriate organization and revascularization of scalp flaps.[2,3] Two basic methods for cranioplasty are widely accepted:[4]

1) Osteoplastic reconstruction
2) Restoration with alloplastic implants

Osteoplastic reconstruction

Osteoplastic reconstruction[1] by autogenous bone offers a number of disadvantages as follows:

- Possible absorption and loss of contour.
- Availability of sufficient graft material for large defects.
- Two incisions are necessary, i.e., one for removing the donor material and one for the cranioplasty.
- Osteoplastic reconstruction with cartilage, fat and dermis provide little protection to the brain as the graft remains soft.[5]

Alloplastic implants

In the past, numerous metals and alloys, e.g., Tantalum and Vitallium, have been employed for the restoration of cranial defects; however, due to the number of disadvantages such as high thermal conductivity (precipitate headache and other neurologic symptoms) and their electrical conductivity preclude the accurate interpretation of electroencephalogram; these are rarely used nowadays.[1]

Autopolymerizing acrylic resin has been used since World War II because of its tissue compatibility and the ease with which it can be manipulated. Small defects can be easily filled with cold-curing acrylic resin.[6] The repair of large defects is complicated by the irregular shape and size of the defects. In particular, it is difficult to achieve a smooth contour and precise fit at the margins of the implants. To avoid marginal discrepancies, Gordon and Blair[7] advocated the fabrication of an impression with irreversible hydrocolloid material directly on the bone at the time

of surgery. Although effective, this technique delays the surgical procedure. The principle disadvantages of the direct application of autopolymerizing acrylic resin are the heat of polymerization, presence of free monomer and difficulty in contouring an implant.

To overcome the difficulties of the autopolymerizing acrylic resin, heat-polymerizing methyl methacrylate is used which requires the presurgical fabrication of the implants. It facilitates the reproduction of contours and tissue bed is not exposed to the heat of polymerization or to the free monomer.

CASE REPORT

A 26-year-old male patient referred to the department of Prosthodontics and Maxillofacial Prosthetics, Manipal College of dental sciences, Manipal, from the department of neurosurgery for the fabrication of a cranial implant. The patient had met with a road accident while the two-wheeler in which he was traveling hit a tempo. It was a known case of open head injury with a bilateral frontal bone fracture along with left frontal contusion with a shattered bone of skull and fractured mandible and maxilla. Patient was treated by emergency left frontotemporal craniotomy and the evacuation of left frontal contusion by a neurosurgeon. The stabilization

Figure 3: Wax pattern for defect on a stone cast

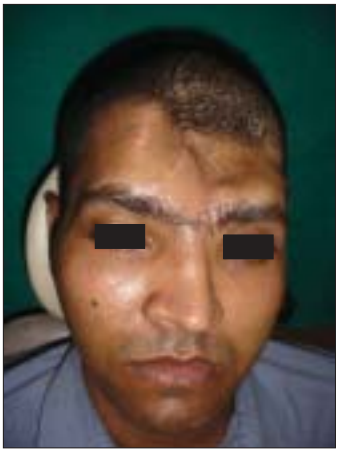

Figure 1: Preoperative photograph showing left frontal bone defect

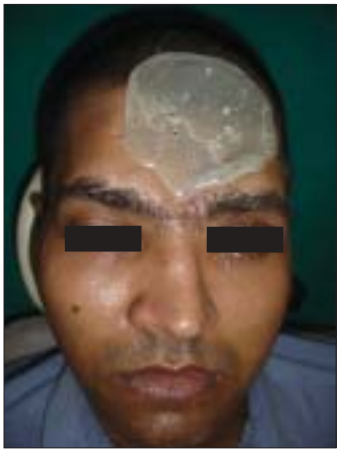

Figure 4: Finished and polished prosthesis with holes throughout

Figure 2: Facial impression made with irreversible hydrocolloid

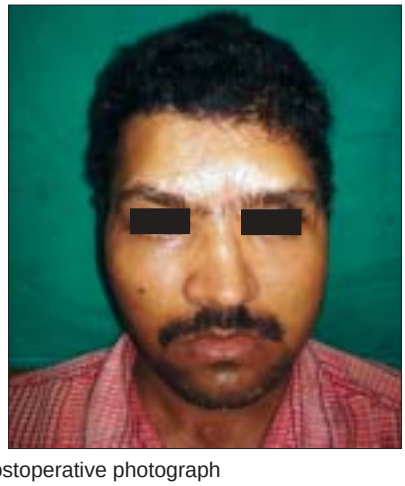

Figure 5: Postoperative photograph

of the maxilla and mandible was performed by an oral and maxillofacial surgeon. In the postoperative period, the patient was found to have bitemporal hemianopia and third nerve palsy on the right side and a large bony defect on the left frontal bone. The patient was admitted for cranioplasty and referred to the Department of Prosthodontics for the fabrication of cranial implants. On examination, the defect was found to be 7 × 7 cm and the light reflexes for the right eye were absent [Figure 1]. Osteoplastic reconstruction option was eliminated taking its disadvantages into consideration. The fabrication of alloplastic implant with heat-cured acrylic resin was decided.

Procedure

The facial impression of the patient including the defect was made with irreversible hydrocolloid (Alginate). Then, L-shaped clips were inserted. Plaster of Paris was applied over the alginate. When the plaster had set, the impression was removed [Figure 2] and poured with dental stone.

The defect was marked on the stone cast. As the defect was large, it was blocked out with the modeling clay in the centre to reduce the thickness of the acrylic resin implant. A wax pattern was fabricated to fit the defect on the stone cast [Figure 3]. The wax pattern was then tried on to the defect. The contours of the implant were viewed and adjusted from all angles (frontal, lateral, superior and inferior) to restore the normal anatomy and appearance. After the corrections were made, the pattern was invested by conventional means and processed with heat-cured acrylic resin. The prosthesis was deflasked and polished. A no. 8 round bur was used to place holes[1] throughout the implant to achieve the following [Figure 4]:

- Allow accumulated fluid to flow out of the subgaleal spaces.
- Permit adhesion and migration of connective tissues, which enhances the stabilization of the prosthesis.
- Provide an adequate blood supply to the overlying scalp.
- Allow suturing.

The implant was gas sterilized and degassed for 3 days prior to insertion. During cranioplasty (performed after 8 months) by a neurosurgeon, the prosthesis was placed on the exposed defect. Marginal discrepancies were noted, and the overextensions were marked. The acrylic resin implant was then adjusted to fit the defect as closely as possible and secured with sutures to the surrounding bone; the defect was then closed. Postoperatively, the patient had a good recovery, and drain was removed on second postoperative day. There was drastic improvement in the contour of the skull [Figure 5].

SUMMARY

The cranioplasties have been used since early 1950s.[8] Acrylic resin materials have been used as bone substitutes in dentistry, neurosurgery and orthopedics surgery for three decades.[9] The heat-cured resin prosthesis offer many advantages. A prefabricated implant can save valuable time in the operating room and better cosmetic results can be achieved as the contours are checked against a master cast and the patient, and the adjustments are made before the patient undergoes surgery. Excess free monomer is removed because of time of curing and preparation before implantation.

REFERENCES

1. Beumer J, Curtis TA, Firtell DN. Maxillofacial rehabilitation-prosthodontic and surgical considerations. The CV Mosby Company: St. Louis; 1979.
2. Hammon WM, Kempe LG. Methyl methacrylate cranioplasty: 13 years experience with 417 patients. Acta Neurochir (Wien) 1971;25:69-77.
3. Timmous RL. Cranial defects and their repair. *In*: Youmans JR, editor. Neurological surgery. WB Saunders Co: Philadelphia; 1973.
4. Martin JW, Ganz SD, King GE, Jacob RF. Cranial implant modification. J Prosthet Dent 1984;52:414-6.
5. Dancev I. Reconstruction of frontal bone of the skull with cartilage implants. Br J Plast Surg 1965;18:288-90.
6. Firtell DN, Moore DJ, Bartlett SO. Radiographic grid for contouring cranial prostheses. J Prosthet Dent 1971;25:439-45.
7. Gordon DS, Blair GA. Titanium cranioplasty. Br Med J 1974;2:478-81.
8. Spence WT. Form fitting cranioplasty. J Neurosurg 1954;11:219-25.
9. Chalian V, Drane J, Maroon J, Matalon V, Standish M. Cranial and facial implants. *In*: Chalian V, Drane J, Maroon J, Matalon V, Standish M, editors. Maxillofacial prosthetics. The William and Wilkins Co: Baltimore; 1971.

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