CASE REPORT

Prosthetic approach using titanium mesh for rehabilitation of frontal bone defect: A Case Report

Sulabh Kumar*, Prashant Mishra**, Shivakumar***

Abstract

The cosmetic and functional disabilities following radical surgery for traumatic injuries are significant and disabling. Definitive reconstruction should be performed wherever possible as part of the ablative procedure. When definitive reconstruction is coordinated and combined with maxillofacial prosthetic rehabilitation, head and neck defects can be restored to near-normal function and appearance in many cases. Polymethylmethacrylate (PMMA) has been extensively used as a dental prosthesis and as a cranial-bone substitute for years. It is a very reliable thermoplastic that can be prefabricated or even molded intraoperatively to create an adequate prosthesis. From this case report, we propose to describe some personal points of view concerning the repair of large cranial defects, incorporating titanium mesh in PMMA to fabricate the definitive prosthesis.

Key words: calvarial, polyurethane, cranioplasty methyl methacrylate


Introduction

The successful management of a case of trauma in an emergency situation requires quick evacuation of the haematoma, repair of the dura and the scalp but not necessarily the integrity of the calvarial segment as an immediate measure. So the reconstruction of the calvarial defect in these cases is mostly carried out as a secondary procedure.

There are a lot of pathological processes with involve the cranium including cranial and skull base anatomical regions, traumatic defects, congenital, iatrogenic injuries, septic and all this processes leave the cranial defects exposing in this manner the brain with the soft covers, dura mater and the skin layers and also the imperfection of the skull shape induce important variations in intracranial pressure especially in positional movements orto-clinostatism.
Prosthodontic results are limited by the materials used in the construction and fabrication of facial prosthesis as the success depends mainly on the physical and mechanical properties of that material. Materials commonly used for fabrication of facial prosthesis are acrylic resins, acrylic copolymers, vinyl polymers, polyurethane elastomers and silicone elastomers but none of them fulfil all the requirements for a satisfactory prosthesis.

Several methods exist for presurgical fabrication of acrylic resin cranial prostheses. Impression of the defect may be made and a wax pattern fabricated on the cast, restoring anatomic contours. Acrylic resin has advantages of colour stability, remains serviceable upto 2 years and can be relined if required. However, silicones remain the more widely used materials for facial restorations because of their good surface texture and hardness. This case report describes prosthetic rehabilitation of a large frontal bone defect caused by the accidental injury.

Case Report

A 17 year old male reported to the Department of Prosthodontics with a chief complaint of cranial defect caused by accidental injury, which lead to removal part of the right half of the frontal bone (Fig. 1).

On examination mushroom shaped defect which measures about 9 cm in width and 7 cm in height involving right side frontal bone just above close to optical floor. Wax was used as an adjunct to support the impression from the sides (Fig 2).

Irreversible hydrocolloid impression material was used to make the impression of the cranium base (Fig. 3). Hydrocolloid impression was reinforced with a matrix of quick setting plaster of Paris and gauges to prevent distortion of the impression. The reinforced impression was gently removed from the patient’s face, and a working cast was poured with dental stone (Fig. 4).

The contour of wax pattern was then determined by passing a sharpened pencil along the perimeter of the defect. Modelling wax was used to reconstruct the defective area to the desired dimensions on the working cast. Completed wax pattern was then placed over the
defect on patient face to verify the contour (Fig. 5). Titanium mesh (3x3 inches) was used and incorporated to strengthen and allow easy for suturing, into the bone (Fig. 6) and permit adhesions between the prosthesis and the soft tissue which helps to secure the former and allows adequate blood supply to the overlying flap.

The flasking and curing was done with the heat cure acrylic and the prosthesis is finished and polished (Fig.7). Surgical procedure was carried out in the department of plastic surgery at Vivekananda hospital, Lucknow in a month under general anaesthesia. Scalp tissues were reflected to ensure good vascular supply and adequate exposure of the defect. Fabricated prosthesis was then checked for proper adaptation to the bony margin and its over-all conformity with the face.

Discussion

Plastic and reconstructive surgery may be a treatment of choice for patients with facial defects, but for larger defects with extensive anatomical loss, a more suitable alternative is prosthetic rehabilitation. This article described the process for fabrication and construction of facial prosthesis, by use of simple available materials like acrylic resin. This was fabricated and delivered to the patients within a week to achieve the objectives outlined. Although autogenous bone grafts are the materials of choice for cranioplasties, acquisition of such bone grafts usually requires another incision and discomfort. At times it is difficult to shape the graft to conform to contour of the cranial vault because of large defect size.5

In this case, the final results after prosthetic treatment were reasonable from a cosmetic point but did not address the functional impairment. Methylmethacrylate has been extensively used as a dental prosthetic and as a cranial-bone substitute for over two decades. Thomas et al investigated the possible causes of, and contributing factors to death under anaesthesia, during an operation for hip joint replacement with a prosthesis, using methyl- methacrylate monomer bone cement.6 Changes of the central venous pressure and electrocardiogram were recorded following the insertion of cold curing acrylic bone cement. The author stated that great care should be taken to limit absorption of monomer. Although most studies have focused on the cytotoxicity of leached methyl methacrylate.7 The residual monomer content in heat-cured acrylic appears to be resistant to removal by immersion in water8. However one of the most interesting benefits of cranioplasty is the improvement of neurologic function, which was proven on this paper with the significant improvement of the GOSs from 3 to 4 ($P = 0.008$) from the time of cranioplasty to last follow-up visit. The improvement of neurologic function is attributed to changes in brain physiology, particularly improvements on cerebral blood flow, cerebrovascular reserve capacity, and even cerebral glucose metabolism.9

PMMA has the advantages of being inert, radio-transparent, nonmagnetic, simple to shape, relatively inexpensive and with adequate mechanical properties. As mentioned earlier, PMMA implants can be prefabricated or molded intraoperatively.10 Prefabrication is technically simpler, and it has the advantage over
intraoperative molding of reduced surgical time, blood loss and infection rate; satisfaction of aesthetic result is also greater.

The objective in treating such patients is to restore the lost natural tissue immediately or later after surgery so to maintain appearance, morale and confidence of the patient and to facilitate the social acceptance among public and their families, which simple dressing or templates do not achieve.

**Conclusion**

This article describes a procedure that allows duplication of cranial bone flaps with irregular shapes for use in cranioplasty. An intermediate step of bone flap duplication in wax, using irreversible hydrocolloid impression material, overcomes the difficulties inherent in direct duplication of bone flaps. The benefits of cranioplasty on neurologic function are also validated. This technique has proven to be safe and has yielded excellent results.

**References**