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PROSTHETIC REHABILITATION OF A PATIENT WITH CRANIAL DEFECT USING A NOVEL TECHNIQUE - A CASE REPORT

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Abstract:

With advanced treatment options for treating head injuries and diseases of the brain, a large number of patients are reporting for cranial prostheses. Cranial prosthesis not only relieves pain and discomfort but also improves the psychological well-being of the patient. Smaller defects can be closed surgically. But larger defects require prosthesis mainly; implants. Titanium is the material of choice for the implant prosthesis. The prosthesis should be made precisely. It is usually made on or from a wax pattern. The case report describes an easy and inexpensive method of contouring the wax pattern. The wax pattern was made on a model and was contoured using a 19 gauge stainless steel wire. It was tried on the patient and then the implant prosthesis was fabricated.

Keywords: Cranioplasty, Cranial Implant, Rehabilitation, Titanium Prosthesis.

Introduction

Nowadays, rehabilitation of cranioplasty patients is becoming quite common. This may be due to the advances in the field of medicine that newer surgical techniques are used to treat patients with head injuries and other diseases affecting the brain.[1, 2] Usually a portion of the skull or the cranium is removed as part of the treatment to avoid compression of the brain. Later, it becomes mandatory to use prosthesis or an implant to protect the underlying brain tissue and to improve esthetics[3]. Various techniques and biocompatible materials are available for esthetic reconstruction of the skull defect[4]. The following is a newer technique for the rehabilitation of such patients.

Case report

A thirty year old male patient reported as a reference from the Department of Neurosurgery for prosthetic rehabilitation of a cranial defect. The chief complaint of the patient was disfigurement. The patient had undergone craniectomy of the

fractured fragments of frontal, temporal and parietal bones on the left side and a cranial implant made of Titanium was fabricated.

Technique

1. The outline of the defect was marked with an indelible pencil and Vaseline applied (fig.1).
2. An impression was made with irreversible hydrocolloid (Zelgan Plus) (fig.2) which was reinforced with a plaster base.
3. After the plaster was set, the impression was removed from the patient and was poured in dental stone (fig. 3).
4. The stone model was retrieved after an hour, was made wet and the wax was poured into the defect for the fabrication of wax pattern.
5. The wax was then contoured to match the normal side using a 19 gauge wire. Three points were marked on the normal side of the skull, 1 inch apart and the wire was adapted (fig. 4) and was pulled over the wax pattern to contour it according to the normal side (fig.5).
6. The thickness of the wax pattern was modified by carving it out from the inside to simulate the thickness of the bone.
7. An extra lip of 3-4mm wax was kept all around for placement of the implant during surgery.

Fig. 1: Preparation of the Patient

Fig. 2: Impression made with Irreversible Hydrocolloid

Fig. 3: Cast made from Dental Stone

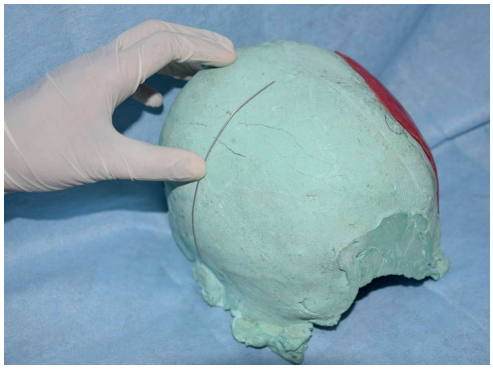

Fig. 4: 19 gauge wire adapted to follow the contour of the normal side

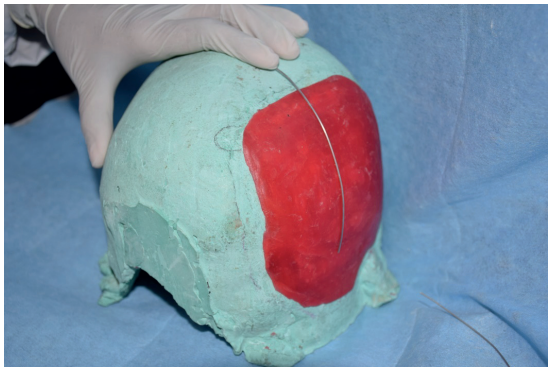

Fig. 5: the bent wire pulled over the wax pattern to contour it according to the normal side

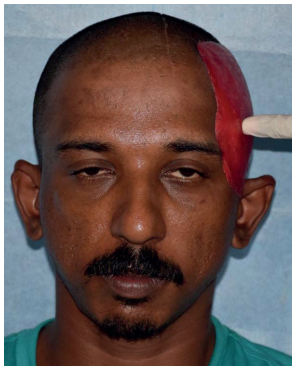

Fig.6: wax trial (frontal view)

8. The pattern was tried on the patient's head and approval was obtained from the Neurosurgeon (fig.6, 7).

9. The wax pattern along with the model (fig.8) was sent to the lab for the fabrication of the Titanium implant (HLL Lifecare Limited, Thiruvananthapuram).

10. The implant was tried on the surgical site (fig.9). The implant had perforations to prevent fluid accumulation beneath the prosthesis and for growth of fibrous connective tissue to assist in stabilization. Any points of premature contacts were removed either by reducing the implant or by nibbling the bone.

11. Holes were made in the bones using surgical drill bits and the implant was secured using Titanium screws.

12. The flap was sutured back into position after placing a surgical drain (fig. 10). Sutures were removed after 1 week and the patient had an uneventful healing (fig.11, 12, 13).

Discussion

Trauma accounts for most of the cranial defects. During the repair of compound skull fractures or fractures penetrating the brain, removal of significant portions of the skull may be required.

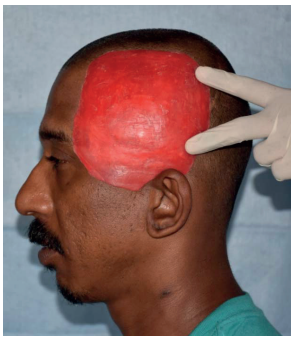

Fig. 7: wax trial (left lateral view)

Fig. 8: wax pattern along with stone model

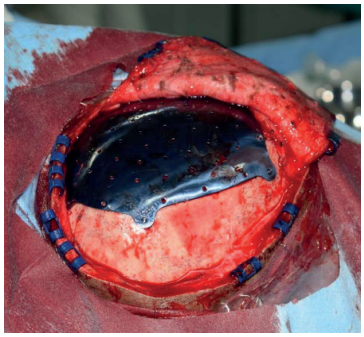

Fig.9: Cranial implant tried on the surgical site

Fig.10: flap sutured back along with a surgical drain

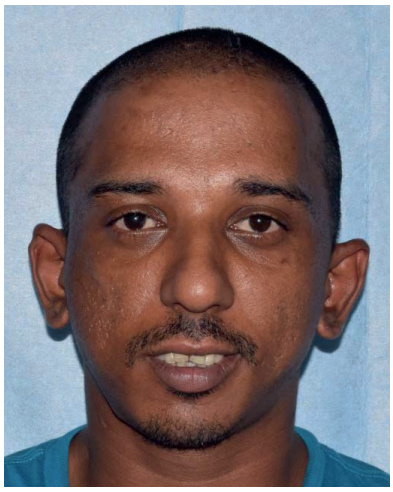

Fig.11: post-operative frontal view

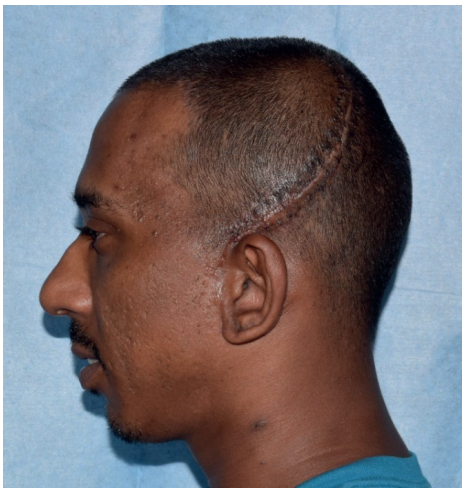

Fig.12: post-operative left lateral view

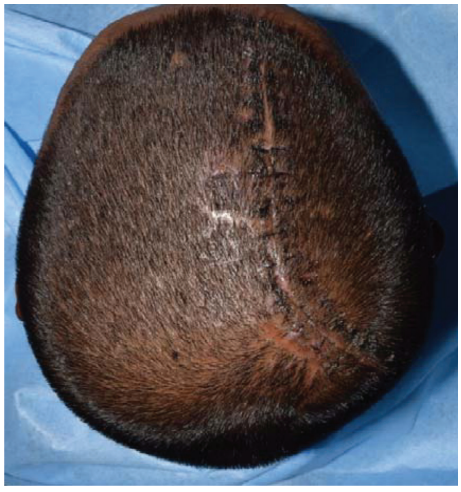

Fig. 13: post-operative bird's eye view

Successful restoration of these defects then demands prosthetic rehabilitation[5]. Pronounced cranial defects produce psychological trauma for the patients and consequently the patient refrains from carrying out their daily activities[6]. Also exertion and rapid movement can result in pain and discomfort. Some clinicians feel that the cranial implant "splints" the brain, decreases its mobility, and thereby relieves these symptoms[5].

Small defects (2-3cm) located immediately above the orbital rim or nasion is probably reconstructed for esthetic reasons while restoration of large defects includes esthetic enhancement along with protection of the brain[5]. Reconstruction of the cranial defect can be taken up as a primary or secondary procedure depending upon the duration, severity of injury, location of the defect and condition of the overlying soft tissues. Immediate repair of cranial defects is discouraged by most clinicians[4].

Osteoplastic reconstruction by the use of autografts from iliac crest, rib, tibia and calvarium, either as a free graft or transferred on a vascularized pedicle is a proposed method for repairing defects less than 5 cm in diameter. Although biocompatible and easily harvested, there is risk of resorption and loss of contour. Sometimes they can get infected and warrant removal. Allografts and xenografts have also been used but the outcomes attained are not very promising. Some of the alloplastic materials that may be used for such reconstruction include metal, acrylic resin, polyethylene and silicone[4]. Rehabilitation of larger defects is possible mostly with alloplastic materials. Fabrication of such prosthesis should be done with great care as it affects esthetics and function[7,8].

The complexity in rehabilitating cranioplasty defect increases with increased defect size. It is difficult to produce a symmetric, accurate implant presurgically or at the time of surgery when the defect is greater than 50 cm2[9]. Many methods exist for the fabrication of presurgical customized cranioplastic implants, including the recently introduced medical imaging and three-dimensional (3D) biomodeling. Here, the operation time may be reduced, but in cases of bilateral cranial defects and asymmetrical skulls, the mirror-image process cannot be used[10].

The described technique for the rehabilitation of a patient with a cranial defect using 19 gauge stainless steel wire for wax pattern contouring is a novel, easy and a less expensive method. Using this technique considerably decreases the number of patient appointments with lesser number of wax trials. The rounded edges of the stainless steel wire produce a smooth even surface finish for the wax pattern. The Prosthodontist is able to achieve a more accurate and predictable esthetic result in a limited time frame. The patient is not exposed to any radiation for the fabrication of the cranial implant. But this technique cannot be used in case of bilateral cranial defects.

Conclusion

Fabrication of the prosthesis for larger defects in cranium is usually made from wax pattern. The fabrication should be done with great care especially when it is in the esthetic zone. The above described technique is a novel and easy method for fabrication of wax pattern used for making titanium implant cranial prosthesis.

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