

Cranial Deformity, Reconstruction of Cranium

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Abstract

Cranioplasty is defined as the surgical repair of acquired defects or congenital deformities of the cranium. It is performed mainly for anatomical reconstruction, brain protection, and cosmetics, but evidence has shown that there is also improvement of brain physiology. The aims of this paper are to describe a technique to fabricate polymethylmethacrylate prostheses by hand during operation and at the same time describe the surgical outcomes of this procedure. Between the years 2007 and 2011, 20 patients were complaining from cranial bone defect due to many causes underwent cranioplasty operation in Mosul Medical Center/IRAQ for reconstructed the defect using the polymethylmethacrylate that fabricated by hand during the operation. The operations were done by the same maxillofacial surgeon with different neurosurgeons. Age of patients extended from 14 years to 42 years with mean 33.2 years. The main cause of cranial defect was trauma resulting from missiles injuries that involved 14 patients and formed 70%. During the follow-up, all patients were satisfied with the cosmetic result and no revision for cosmetic reasons was required. One patient developed infection in one of stainless steel wire postoperatively that controlled and resolved the problem by remove this wire only. Thus, the implanted material was well tolerated in all cases. The majority of patients were males while the most common cause of cranial defect was due to traumatic cranial injury by missiles injuries. Infection, being the most feared complication of allograft implants, but there was a very low rate with the technique described in this paper. This technique is quick and easy to perform, and provide a cheap and safe way produces a strong implant very good cosmetic.

Keywords

Cranioplasty; Cranial deformity; Cranium; Traumatic cranial injury

Introduction

Cranioplasty is the surgical intervention to repair cranial acquired defects or congenital deformities. The aim of cranioplasty is not only a cosmetic issue and reduce headaches due to previous surgery or injury, also the repair of cranial defects improve brain physiology, protect the brain and increases the social performances [1-5]. With emerging evidence for the benefit of early decompressive craniectomy for ischemic stroke [6] diffuse traumatic brain injury [7], and skull-infiltrating tumours [8] the cranioplastic surgery has widely increased. The first goals are get good biocompatibility, defect closure with accurate fitting of the plastic material to the bone borders and mainly a satisfying cosmetic result is get [9]. Materials utilized for cranial reshaping include bone, auto/allografts, distinct biomaterials, and even osteoinductive growth factors [10]. Polymethylmethacrylate (PMMA), a conventional transparent thermoplastic is one of the most popular alloplastic materials used in treatment of cranial defect during and after World War II [11,12]. PMMA has advantage that it can be moulded during surgery into the shape of the cranial defect. Performing a cranioplasty poses a challenge to neurosurgeons, plastic reconstructive surgeons, and maxillofacial surgeons since the procedure often comprises very large skull defects. The most postoperative complications may include haemorrhage, cerebrospinal fluid (CSF) leaks and infections which due to foreign material implantation while the seizures, and neurological deficits are less common. [13-15].

Aim

The aims of this study to describe a technique to fabricate PMMA prostheses by hand during operation and at the same time describe the surgical outcomes of this procedure.

Materials and Methods

Between the years 2007 and 2011, 20 patients were complaining from cranial bone defect due to many causes underwent Cranioplasty operation in Mosul Medical Center/ IRAQ for cranial reshaping using the polymethylmethacrylate (Figure 1) that fabricated

Article Information

DOI: 10.31021/jddm.20192130

Article Type: Research Article

Journal Type: Open Access

Volume: 2 Issue: 1

Manuscript ID: JDDM-2-130

Publisher: Boffin Access Limited

Received Date: 30 January 2019

Accepted Date: 08 March 2019

Published Date: 11 March 2019

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Citation: Abd al-Hameed IA, Mahmood AS, Taka YA. Cranial deformity, Reconstruction of cranium. J Dents Dent Med. 2019 Mar;2(1):130

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by hand during the surgery. All patients examined by CT scan for the cranium before the operation (Figure 2). Under general anaesthesia, the soft tissue of scalp is reopened and dissected from the dura to explain the borders of bone defect and freed from any adjacent tissue. The edges of cranial defect prepared by using acrylic bur to bevelling them and bed formation for the prosthesis to prevent slippage it inside the cranium (Figure 3). The polymethylmethacrylate (PMMA) was prepared by mixing the liquid with powder then waiting 3 minutes before reach the material to dough stage for fabricated the prosthesis by the hands on the site of defect (Figure 4), when the thermal reaction started the splint should be removed away from the defect site to prevent morbidity on brain, then we remove the excess and shaping the prosthesis using acrylic bur, finally, fixation the prostheses using stainless steel wire and closed the flap (Figures 5 & 6) and follow-up for 2 years was done.

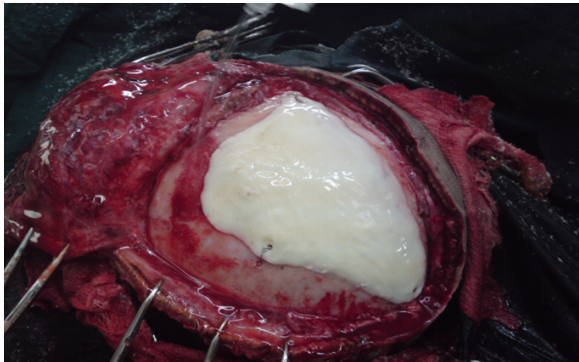


Figure 4: The prosthesis after fixation

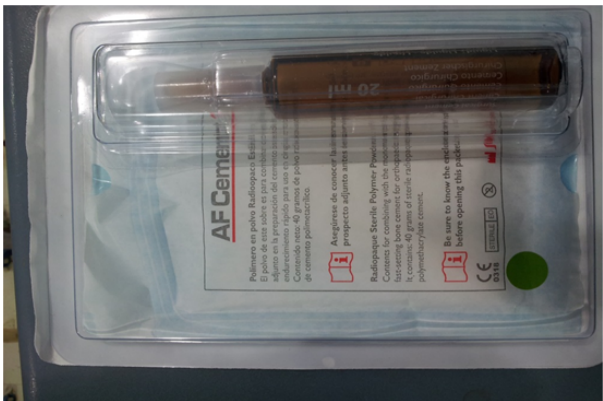


Figure 1: Polymethylmethacrylate (PMMA)

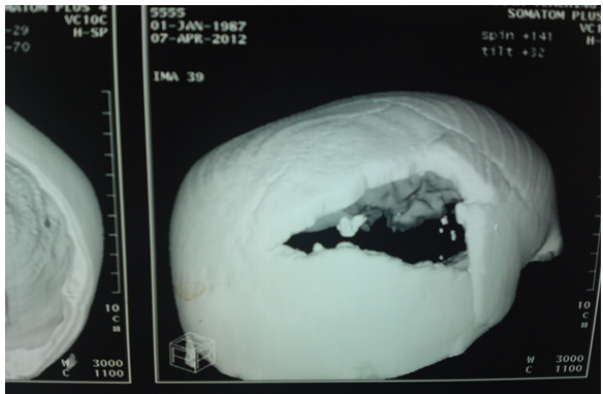


Figure 2: CT scan for the cranial bone defect



Figure 5: The patient after surgery (posterior view)



Figure 6: The patient after surgery (anterior view)

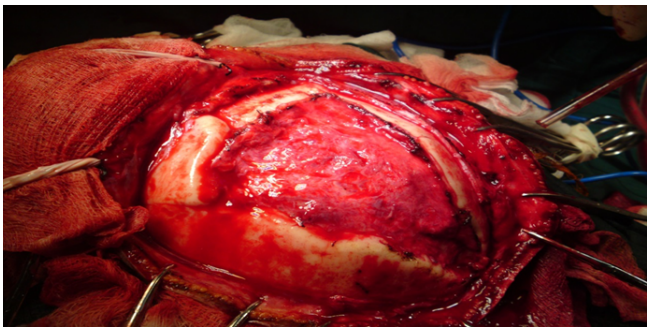


Figure 3: Cranial bone defect and prepare the site for prosthesis

Results

Age of patients extended from 14 years to 42 years with mean 33.2 years, the male was 17 patients that formed 85% while the female was only three patients that found in 15% (Table 1). The most cause of cranial defect was trauma resulting from missiles injuries that involved 14 patients and formed 70% while cranial defect due to tumour was involved four patients that presented in 20% and lastly the cranial decompression involved two patients

Male	%	Female	%
17	85%	3	15%

Table 1: Sex incidence

Trauma	%	Tumor	%	Decompression	%
14	70%	4	20%	2	10%

Table 2: Causes of cranial defect

and formed 10% (Table 2). During the follow-up, all patients were satisfied with the cosmetic result. No revision for cosmetic reasons was required. One patient developed an infection in one of stainless steel wire postoperatively that controlled and resolved the problem by removing this wire only. Thus, the perioperative morbidity was 5%. We recorded that there is no deterioration in neurological status and neuropathies (chronic pain after wound healing), postoperatively. Patients showed well tolerated with prosthesis material in all cases.

Discussion

The majority of patients were males while the most common cause of cranial defect was due to traumatic cranial injury by missiles injuries. When time and cost are the goal, this procedure is a cheap and safe way to treat cranial defect. Infection is the common cause of complication in cases of allograft implants, but there was a very low rate with the procedure that described in this paper. The benefits of cranioplasty on neurologic function are also validated. This technique has proven to be easy, safe and has excellent results.

Conclusion

This technique is quick and easy to perform, and provide a cheap and safe way produces a strong implant with very good cosmetic result.

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