

Cranioplasty (Monomeric Acrylic Designed in Dental Laboratory Versus Methylmethacrylate Codman's Type)

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ABSTRACT:

BACKGROUND

Cranioplasty is a surgical procedure for closure of skull defect either due to traumatic or non traumatic causes, using a synthetic or natural materials for repair

METHODS:

14 patients collected from AL-Kadhimiya teaching hospital ,complaining of skull defect ,12 males,2 females. 8 patients had history of bullet injury.

RESULTS:

Surgery done for all using methylmethacrylate Codman's type for 8,the other 6, monomeric acrylic designed in the hospital.1 patient had history of loss of consciousness postoperatively, 1 patient had postoperative dizziness, mild improvement of headache in two patients.

CONCLUSION:

Monomeric acrylic designed preoperatively decreasing the time of surgical maneuvere

KEYWORDS: cranioplasty ,methylmethacrylate, monomeric acrylic

INTRODUCTION:

Cranioplasty is a surgical repair of a defect or deformity of skull ,which may result from trauma ,either contaminated compound depressed skull # among civilians ,penetrating head injuries among military personnel or result from growing skull# which has been found in children usually under 3 y of age ,or due to excision of tumors (osteomas, meningiomas, etc..) or from infections(osteomyelitis, infected skull flap) or from aseptic necrosis of skull flaps, from congenital absence of portions of skull or from external decompressions to decrease cerebral swellings due to (trauma, brain tumor, lead intoxication)⁽¹⁾. Historically, from the days of Ambrose pare, surgeons have been reconstructing skull defects, surgeons used inorganic materials like gold,lead,silver & stainless steel ⁽²⁾. Alloplastic implants having the advantage of avoiding a second incision to source the bone graft and can be fabricated to the desired shape prior to surgery reducing operating time, however these materials are not resistant to infection and may get exposed as a late complication⁽³⁾. Foreign body reaction , resorption of surroundings bone & migration are some of the drawbacks of methylmethacrylate⁽³⁾. Among the possible indications for cranioplasty are four persuasive

pressure relationship⁽⁴⁾. provision of an intact vault for normal growth and development of cephalic structure in the young⁽¹⁾. Cranioplasty is carried out not only for preserving normal appearance and physical barrier but also for neurological improvement and can be explained by improvement of cerebral haemodynamics⁽⁴⁾. Sometimes cranioplasty should be done to protect the patient from cerebral seizures , to relieve the syndrome of trephine((consisting of headaches,dizziness,intolerance of vibration and noise , irritability, fatigability, loss of motivation and concentration , depression and anxiety)⁽¹⁾. To protect the brain from direct atmospheric pressure and to correct the shift of central structures ,however these are not generally accepted as an indication for cranioplasty ^(5,6,7,8). The present observations demonstrate that chronic decompressive craniectomy not only impair postural blood flow regulation in the ipsilateral hemisphere but also cerebrovascular reserve capacity in the brain as a whole ,cranioplasty improves both parameters ,where as only minor effects were observed regarding resting blood flow. Accordingly cranioplasty resulted in marked improvement of metabolic activity , not only in the decompressed hemisphere but also in the contra

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indications which are ⁽¹⁾.restoration of cerebral protection,⁽²⁾physical appearance. ⁽³⁾.intracranial

CRANIOPLASTY

lateral hemisphere⁽⁵⁾. In postoperative patients with headache at the surgical site which radiates to the sub occipital and occipital region and who demonstrate a positive lanman's sign. Cranioplasty with M.M.A (methyl methacrylate) held rigidly in place within miniplate and screws is highly effective relieving postoperative headache⁽⁹⁾.

AIMS:

To evaluate the two cranioplastic materials, and compare between them

MATERIALS & METHODS:

14 patients were collected as prospective cases from AL-Kadhimiya teaching hospital, Iraq selected over a period of 3 years (2007-2009) were cranioplasty decided for them & surgery done for them & they divided into two groups depending on the cranioplastic materials that used. (Group-1) consist of 8 patients which methylmethacrylate Codman's cranioplastic kits U.S.A type used for them, (Group-2) consist of 6 patients which monomeric acrylic designed in dental laboratory used for them. 12 males & 2 female, all operated, the cause of bone defect in 8 patients was bullet injuries, 5 patients was due to depressed fracture due to fall from height & road traffic accidents, 1 patient due to encephalocele. All patients had skull defect with cosmetic problem, headache presented in 3 patients, generalized fit in 2 patients, right sided spastic weakness in 1 patient. Right frontal bone defect in 4 patients, right frontoparietal in 4, right parietal in 3 patients, left occipital in 2, left frontoparieto-occipital in 1. Age distribution from (4-50 years) with mean age (27y) 2 of them below 10 years, 3 from (11-20y), 8 from (21-30y), 1 patient (41-50). Indications for surgery, protection & cosmetic cause for 12 patient, 2 due to chronic headache. Timing of cranioplasty surgery decided at least after 1 year from the first insult, 6 patients after 15 months of insult, 5 patients after 2 years, 3 patients after 1 year, one patient included above with closed depressed fracture were both craniectomy & cranioplasty done in the same session after 2 years from insult. Surgical manouvers, either a previous scar extended or a new scalp flap done if it's not interfere with the original scar to prevent ischemia

& for cosmetic purposes. (Group-1) who treated with methyl methacrylate Codman's, type the cranioplastic material designed & prepared intraoperatively to fit the bone defect, while (Group-2) the cranioplastic materials designed preoperatively using dental molding on the bone defect then the designed material sterilized using sidex for at least 1 day preoperatively then fixed on the region of defect intraoperatively. Regarding postoperative complications for (Group-1) cranioplasty, 1 patient had postoperative loss of consciousness, 1 patient had dizziness, while (Group-2) no complications identified postoperatively or during the follow up period.

RESULTS :

14 patients complaining of skull defect, surgery done for all the patients, 12 male (85.7%) & 2 female (14.3%) (6:1). 8 patients (57.15%) due to bullet & shell injuries (penetrating injuries), 5 patients (35.70%) due to depressed # following fall from height & road traffic accidents, 1 patient (7.15%) skull defect due to congenital encephalocele. Regarding the age distribution 2 patients (14.28%) less than 10 years, 3 patients (21.43%) are 11-20 years, 8 patients (57.14%) are 21-30 years & 1 patient (7.15%) are 41-50 years, with mean age (27 years). Regarding the site 4 patients (28.56%) are right frontal, 4 patients (28.56%) are right frontoparietal, 3 patients (21.43%) are right parietal, 2 (14.3%) are left occipital, 1 patient (7.14%) is left fronto-parieto-occipital. Regarding postoperative complications, 1 patient (7.14%) had loss of consciousness, 1 patient (7.14%) complaining of dizziness. Other 12 patients (85.72%) had no complications. The 2 patients were of age 11-20 & 21-30 years respectively. Regarding the presenting symptoms, 2 patients with headache, the headache improved mildly postoperatively, while fit, plegia still present. Case 1: 30 years old male with previous history of head trauma leading to depressed fracture, big craniectomy done for him before more than 1 year (pic. 1), cranioplasty done for him using the newly designed cranioplastic materials (pic. 2)

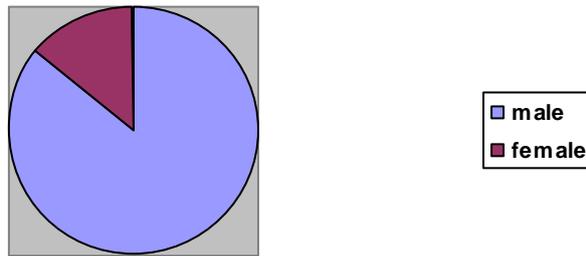


Figure 1: Male to female ratio

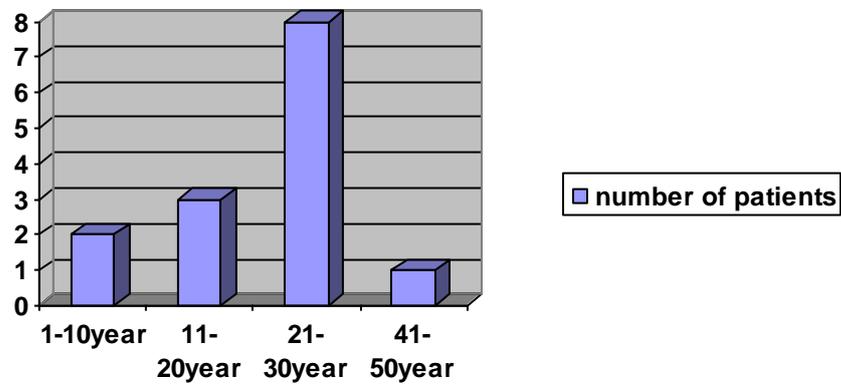


Figure 2 :Age distribution

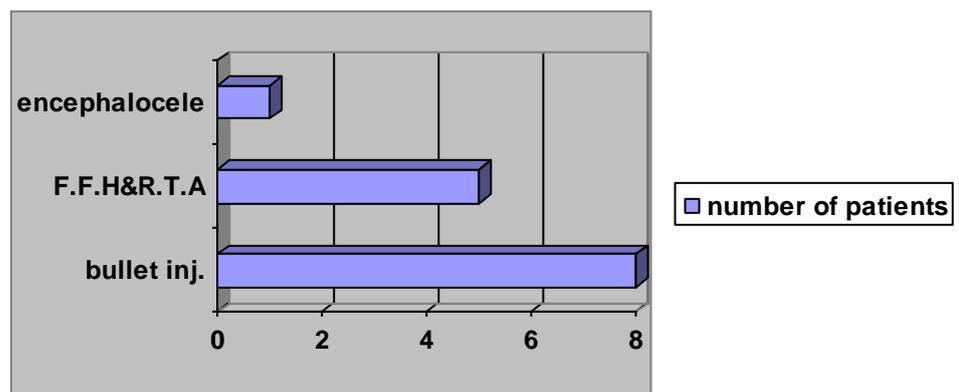


Figure 3: Causes of bone defect

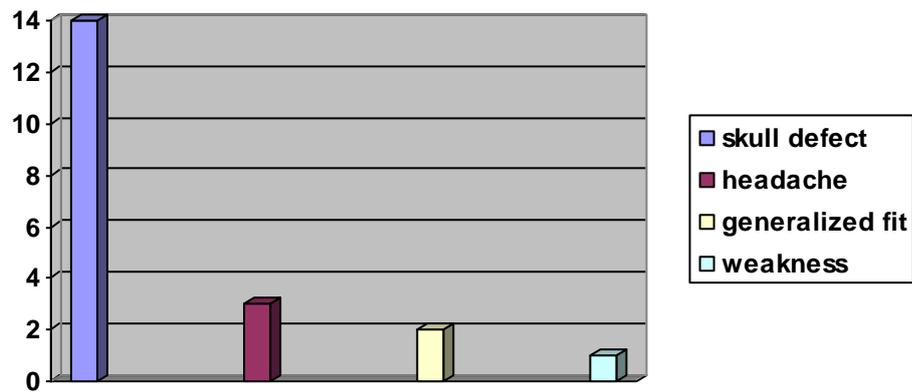


Figure 4: Presenting signs & symptoms

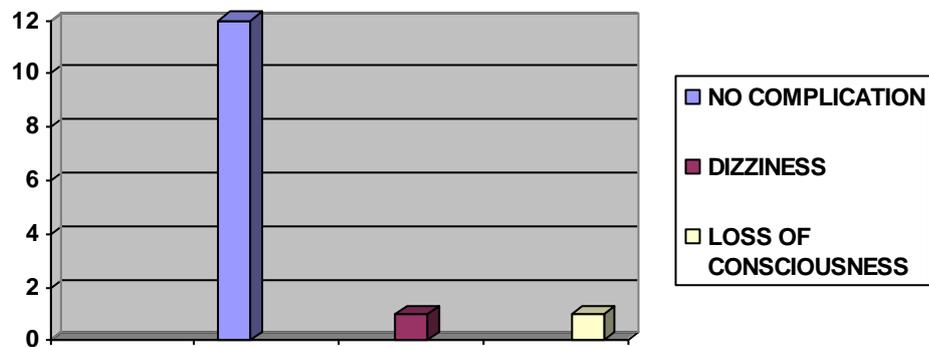
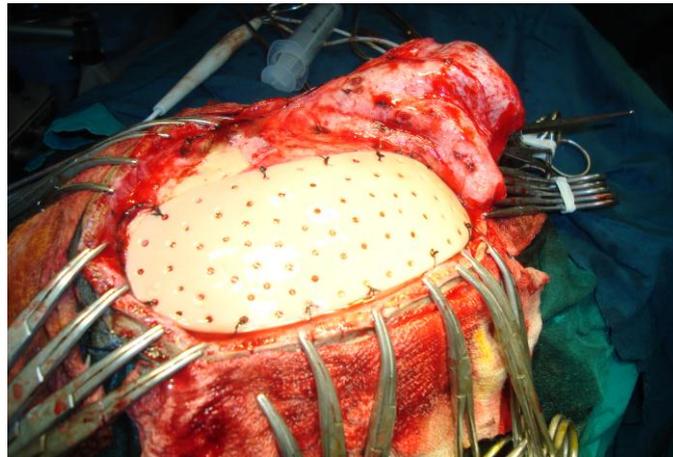


Figure 5 :Post operative complications



picture1:Big skull defect involving frontal, parietal and occipital regions



picture 2: Cranioplastic material fits on the defect

DISCUSSION:

To be ideal for cranioplasty, the material must be viable (i.e., capable of growth and resistant to infection), radiolucent, thermally nonconductive (with an expansion coefficient identical to that of the surrounding cranium), nonionizing and noncorrosive, stable, inert, aesthetically pleasing, protective (with biomechanical properties equal to those of the cranium), malleable and easily contoured, inexpensive, readily available, and sterilizable. No currently available materials satisfy all of these criteria.⁽¹⁰⁾

Early reports of cranioplasty highlighted different techniques. Gold plate was used in the 16th century by Fallopius; in 1919, Wegforth extolled the advantages of using an autologous bone flap⁽¹¹⁾. Regarding the most common causes of skull defect that need repair by cranioplasty; 10 patients were treated for traumatic disorders (contaminated compound depressed fracture), 3 patients with bone tumors, out of which two had osteoma and one transitional cell meningioma that destroyed almost the whole of frontal bone on one side, the remaining 4 patients were treated for bone infection (osteomyelitis)⁽¹²⁾, whereas in our study, 13 patients due to traumatic disorders and 1 patient had congenital defect due to encephalocele.

Regarding the sexual & age distribution, a total of 17 patients (5 males & 12 females) with a mean age of 30.4 years were treated⁽¹²⁾. In our study, a total of 14 patients (12 males & 2 females) with a mean age of 27 years were treated.

Regarding the site of defect, parietal and frontal were observed in 14 patients of total 18 (77.77%) [4], in our study 12 patients of total 14

(85.7%) are frontal, parietal, frontoparietal & frontoparieto-occipital.

The median time before cranioplasty was 12 months (ranging between 9 & 22)⁽⁴⁾, in other study the average time that elapsed between injury and cranioplasty was 190 days (range 7-546 days)⁽¹³⁾, whereas in our study the median time was 18 months (ranging between 12-24). methylmethacrylate plates for cranioplasty. Maniscalco et al. used plaster applied to the patient's head as a "negative" impression and eventually (after it took multiple steps to form a mold) created an acrylic flap. Jordan et al. used alginate poured directly onto the patient's cranial defect, with the alginate confined by a cardboard and gummed tape retainer. None of these techniques need the original bone flap, but they are complex and require skilled personnel to curve the mold or prosthesis for exact fitting⁽¹⁴⁾. In our study, the cranioplastic materials designed preoperatively using dental molding on the bone defect, then the designed material sterilized using Sidx for at least 1 day preoperatively, then fixed on the region of defect intraoperatively (Group-2) versus (Group-1) using methylmethacrylate Codman's cranioplastic kits U.S.A type, we found that time consumption intraoperatively doubled in G1 than G2, the postoperative complications happened in 2:8 from G1, whereas no complications identified in G2, also the materials used in G1 are much expensive than the materials used in G2. Although the mechanism of neurological recovery after cranioplasty is controversial, the occurrence of such improvement may be a sufficient indication for cranioplasty in certain patients⁽¹⁵⁾. Headache

also is a subjective complaint that cannot be documented and is difficult to quantify. It is present for many reasons, and the fact that headache exists after craniectomy does not necessarily signify a cause and effect relationship. The response to this symptom also varies tremendously and is determined by factors that may not be related to the surgery⁽¹⁶⁾. In our study the headache mildly improved postoperatively while plegia & fit still present.

CONCLUSION:

Head injury is the most common cause of skull defect. The incidence of cranioplasty more in males than females, because the incidence of head trauma with skull defect more in males. Using a new designed material in surgical treatment decreasing the time of surgery which in turn decreasing complications & surgical risk. The new designed material is cheaper than the ordinary cranioplastic material, so its economically superior.

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