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First bilateral computer assisted cranial reconstruction in Boyacá / Colombia- Case Report.

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Abstract: Cranial reconstructions (Cranioplasties) are a neurosurgical procedure which the last years have been developing in an accelerated way. The coming of made to size patients materials the functional and cosmetic results have been improved, besides reducing the surgical and anesthetic time. The above situation in order to avoid unnecessary remodeling and osteotomies, with these new prosthetics that was made just tailored to each defect. It's for this reason that we present, In this article, the first bilateral cranial reconstruction assisted by computer in Boyacá and also we make a brief review of the literature.
Keywords: Cranioplasty, polymethylmethacrylate, acrylic resin, 3D models.

INTRODUCTION

The earliest known cranial reconstructions date back 3000 years BC in Egypt. In the pre-Inca culture in Peru, also, there are data from cranioplasties made with silver and gold plates. In the sixteenth century Fallopius proposed that the trephine bone could be replaced with gold plates only if the dura mater was intact [1-3].

During much of the nineteenth century and until the mid-twentieth century, many metals were used in cranial reconstructions such as aluminum, lead, platinum, vitalium, ticonium, chromium, molybdenum, among others. However, these metals were abandoned due to multiple adverse effects among those who were discarded: local tissue reaction, epileptogenic effects, toxicity, poor malleability, etc

Later these materials were replaced by acrylics, stainless steel and titanium, the latter is inert, non-carcinogenic and non-allergenic, and in addition it can be combined with other biomaterials such as hydroxyapatite. Another material used was methylmethacrylate, which has excellent biocompatibility with adjacent tissues. Nevertheless, foreign body reactions, infections, and a high exothermic reaction have been reported that can injure local tissues [4,5]. Among the materials currently used are autologous bone grafts, titanium meshes, methyl methacrylate, porous polyethylene, hydroxyapatite cement, polymethylmethacrylate, polyhydroxyethylated calcium hydroxide, silicone polymer, polyurethane and polyether ether ketone, it can be seen, the optimal advancementin the use of alloplastic materials and using computerized tomography of skull as an aid in the design and prefabrication.

The surgical solutions tailored to the patient (PSST- Patient Specific Surgical Tools) Or specific acrylic implants for the patient (APSI – Acrylic Patient Specific Implants) are made with polymethylmethacrylate polymers that have a high resistance to compression forces and within their advantages are the clear vision through the implant (to be transparent), fast fixation that decreases surgical and anesthetic time, its compatibility with tomography and Magnetic resonance imaging for postoperative imaging follow-up and requiring no remodeling or additional osteotomies during trans-operative [6,7]. For its design and manufacture, a skull CT with three-dimensional reconstruction of high resolution (cuts of 1mm) is made that determine the defect exactly.

CASE REPORT

A 28-year-old male patient with a bifrontal decompression surgery history cause by to cranioencephalic trauma 1 year ago, with no history of importance and no neurological sequelae. A study protocol for bilateral cranial reconstruction with axial cranial tomography (CT) with three-dimensional reconstruction (3D) and with 1 mm slices was started (Figure 1A, 1B, 1C), stereolithography was performed as a supplementary medium for the planning of bilateral cranial reconstruction (Figure 2), which was sent to Anatomics C3D PTY LTD in the city of Melbourne /

Victoria / Australia for implant development. (Figure 3A, 3B, 3C)

Under general anesthesia and orotracheal intubation and previous asepsis and antisepsis and infiltration with lidocaine and epinephrine to 2% of the surgical area a subgaleal bicoronal flap is made with dissection of the dura mater, bifrontal bone defects are identified (Figure 4), the prosthesis is adjusted at its edges and fixed with miniplates and screws (Figure 5A,5B,6A).The bicoronal flap is repositioned with continuous points of vicryl 2-0 and prolene 3-0 leaving drainage bilaterally. (Figure 6B). Operative post (10 days after). (Figure 7A,7B,7C).

Fig-1A,1B,1C: Skull CT Scan with Reconstruction 3D

Fig-2: Stereolithography of the implant

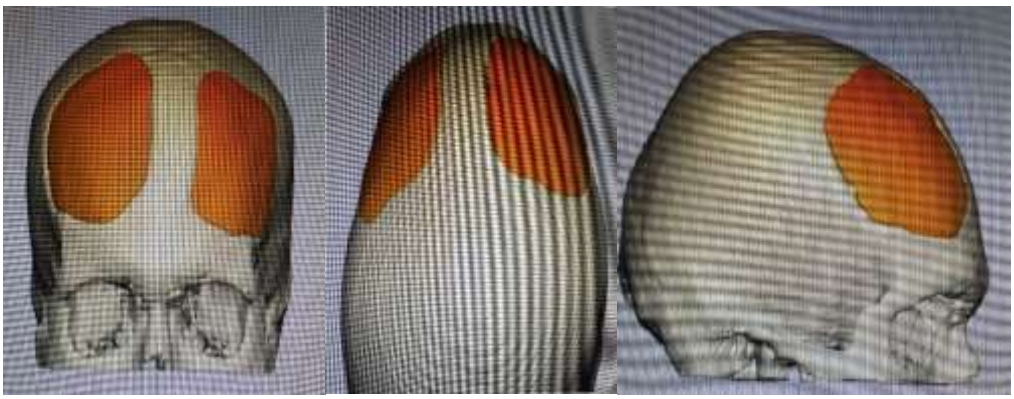

Fig-3A, 3B, 3C: Virtual prosthesis design

Fig-4: Bifront osseous defects

Fig-5A, 5B: Placement and fixation of the left prosthesis

Fig-6A,6B: Fixation of both prostheses, surgical wound suture, bilateral drainage

Fig-7A, 7B, 7C: Operative post (10 days after)

DISCUSSION

The alloplastic materials use has greater reconstructive advantages in relation to the grafts Autologous by providing lower morbidity, since they do not require a donor site. The PSST-APSI, being a prefabrication material, does not require implant remodeling or additional osteotomies during the trans-operative. In addition, as already mentioned it is compatible with tomography and magnetic resonance imaging and, in the long term, provides better aesthetic results in the patient.

CONCLUSION

Nowadays computer-designed PSST-APSI have the enormous advantage of being faithful to the bone defect that is intended to be reconstructed, obtaining highly satisfactory results and with minimum complication rates compared to other previously used methods and materials.

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