Polymethylmethacrylate cranioplasty

a) Polymethylmethacrylate (PMMA): created by mixing methylmethacrylate powder with liquid methylmethacrylate monomer in the O.R., which is molded to the desired shape, and allowed to set (harden) before being attached to the skull with plates, sutures or wire. The setting reaction is exothermic, and to prevent heat injury to the underlying brain, insulate the brain with wet surgical sponges and irrigate copiously during the setting process, or preferably, once the material is reasonably firm it can be removed from the operative site to complete the setting.

A new era in reconstructive cranial surgery began in 1951, as Woringer published his method of cranioplasty with quick hardening acrylates and Heppner put aside the earlier fears of cancer-stimulating acrylates.

Cranioplasty with methylacrylates has won first place in reconstructive cranial surgery thanks to its tissue compatibility and form stability.

3D printing-based patient-specific design and fabrication of Polymethylmethacrylate cranioplasty is safe and achieves acceptable cosmetic and clinical outcomes in patients with decompressive craniectomy. A study ensured clinically acceptable structural and mechanical properties of implanted PMMA, suggesting that a low-cost 3D printer-based PMMA flap is an affordable option for cranioplasty in resource-constrained settings [1)].

Two patients with cranial defects were presented to describe the 3D printing technique for cranial reconstruction. A digital prosthesis model is designed and manufactured with the aid of a 3D computed tomography. Both the data of large sized cranial defects and the prosthesis are transferred to a 3D printer to obtain a physical model in polylactic acid which is then used in a laboratory to cast the final customized prosthesis in polymethyl methacrylate (PMMA).

Precise compliance of the prosthesis to the osseous defect was achieved. At the 6 month postoperative follow-up no complications were observed i.e. rejection, toxicity, local or systemic infection, and the aesthetic change was very significant and satisfactory. Customized 3D PMMA prosthesis offers cost advantages, a great aesthetic result, reduced operating time and good biocompatibility [2)].

1)
Basu B, Bhaskar N, Barui S, Sharma V, Das S, Govindarajan N, Hegde P, Perikal PJ, Antharasanahalli Shivakumar M, Khanapure K, Tekkatte Jagannatha A. Evaluation of implant properties, safety profile and clinical efficacy of patient-specific acrylic prosthesis in cranioplasty using 3D binderjet printed cranium model: A pilot study. J Clin Neurosci. 2021 Mar;85:132-142. doi: 10.1016/j.jocn.2020.12.020. Epub 2021 Jan 23. PMID: 33581784.
2)
De La Peña A, De La Peña-Brambila J, Pérez-De La Torre J, Ochoa M, Gallardo GJ. Low-cost customized cranioplasty using a 3D digital printing model: a case report. 3D Print Med. 2018;4(1):4. doi: 10.1186/s41205-018-0026-7. Epub 2018 Apr 12. PubMed PMID: 29782609; PubMed Central PMCID:

PMC5954791.