

## **Cranial reconstruction after decompressive craniectomy: the status of the art**

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Thanks to recent class I studies, it has been shown that decompressive craniectomy (DC) is an effective rescue procedure in patients affected by traumatic brain injury (TBI) and ischemic stroke, and its use is expanding to other pathologies. The increasing number of DC requires reconstruction, and very often heterologous materials are more used because of failure of autologous bone implantation. Method. In order to define the main different heterologous (Titanium, PEEK, PMMA and HA) material used for cranioplasty (CP), we performed a meta-analysis Results. After a screening of 6023 papers, we considered only 24 studies. Among a total of 1560 custom-made prosthesis implanted, 554 were Titanium (35.51%), 276 PMMA (17.69%), 222 PEEK (14.23%), and 508 were HA (32.56%). In the Titanium group 109 complications were recorded (19.7%); in PMMA group 55 (20%), in the PEEK group 48 (21.6%) and in HA group 103 (20.3%) were recorded. Because multicentric and prospective studies have a higher level of evidence, we considered these studies separately; in multicentric studies, there were less postoperative fluid collections for Titanium patients ( $p < 0.02$ ), less postoperative infections and less cranioplasty explantation for infections in the HA group, ( $p < 0.001$ ), more prosthesis displacement in the HA group ( $p < 0.03$ ) and more postoperative hydrocephalus in the PEEK group ( $p < 0.003$ ). In prospective studies, PMMA and HA patients had fewer post-operative infections and less surgical revision for infection ( $p < 0.04$ ) than Titanium patients. In prospective multicentric studies HA patients had fewer infections, also requiring surgery ( $p < 0.003$ ), but a higher rate of displacement compared to titanium ( $p < 0.02$ ). Conclusions. The ideal material has not yet been identified. The choice of material should be based on the clinical data of patients, such as the craniectomy's size, presence of seizures, possibility of recovery, good long-term outcome associated with a cost analysis AND NOT on a national preference.

**KEYWORDS:** cranioplasty; cranial reconstruction; decompressive craniectomy

**ABBREVIATIONS:** DC: decompressive craniectomy; PEEK: polyetheretheketone; PMMA: polymethylmethacrylate; HA: hydroxyapatite