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Current Research Progress in Cranioplasty and Related Repair Materials

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Abstract

Skull defect is a common and challenging clinical problem in the field of neurosurgery, which can be caused by a variety of reasons, such as brain trauma, brain tumor resection, intracranial hemorrhage, cerebral infarction, cerebral edema, skull fracture, or infection. Skull defect not only weakens the protection of brain tissue, increasing the risk of potential neurological deficits and seizures, but also seriously affects the patient's appearance and quality of life. Therefore, from the patient's perspective, the repair of skull defects is often driven by the dual needs of aesthetics and functional recovery. This review deeply explores the history, pathophysiology, indications, and complications of cranioplasty through an extensive literature search. In addition, we will also analyze the research progress of traditional and new biomaterials currently used in cranial repair. Specifically, we will delve into recent research on emerging technologies and cranial bone regeneration, providing valuable references for future clinical practice and research.

Keywords: 3D printing; bone regeneration; bone tissue engineering; cranioplasty; repair materials; skull defect.

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