TITLE: Bone cement augmented cranioplasty with resorbable mesh: case series and computational model.

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ABSTRACT:

Introduction
Pediatric skull defects may be congenital or acquired from trauma or surgery. High bone resorption rates may be caused by brain pulsations preventing solid bone formation in rapidly growing skulls. This study describes radiographic and clinical outcomes after cranioplasty using calcium phosphate bone cement and resorbable mesh.

Methods
Retrospective review of patients who underwent skull defect repair procedures after resection of bone-based lesions or correction of non-healing skull defects from September, 2014 to July, 2016. Surgical technique included: 1) epidural placement of resorbable mesh for brain pulsation dampening and, 2) calcium phosphate bone cement contoured to the natural calvarial shape. Imaging was performed with computer tomography (CT) before and after repair at various time points (age-dependent). Clinical follow-up ranged from 1 to 18 months post-operatively. A computational model is used to calculate size threshold for successful cement augmentation cranioplasty.

Results
13 patients underwent 15 surgical repairs for chronic non-healing skull defects or removal of calvarial lesions. Diagnoses included: Skull mass (n=5), expanding defect (n=5), congenital defect (n=2), growing skull fracture (n=1). Ages = 5 weeks to 19 years (mean = 5.3 years). No surgical complications were noted. Follow up imaging ranged from 2-18 months with CT confirmation of bone integration into cement. Reoperation with split thickness bone graft was required in two patients.

Conclusions
Using calcium phosphate bone cement for cranial defects provides immediate brain protection, moreover, prevention of CSF pulsation with an absorbable mesh may allow augmented biologic bone scaffolding to integrate host bone immediately. Continued remodeling contours the calvarium to the patients native skull. Larger cranial defects may be less likely to succeed with bony integration. This technique may obviate the need for autologous split thickness bone grafts as a first choice.