timepoint, samples demonstrated a significantly greater mean of available space occupied by bone (23.33±3.4% vs 14.35±3.72%; p<0.01). When bone and scaffold were considered together, there was no significant difference in mean space occupancy (6-Week: 56.86±5.88%, 3-Week: 63.27±12.98%; p=0.43), suggesting a stable rate of scaffold degradation/osseous remodeling over time.

CONCLUSION: 3DBC scaffolds composed of β-TCP are capable of inducing bone growth in an undisturbed osseous environment. This osteogenic influence is continually exerted over time, necessitating longer-term follow-up to determine the temporality of the bone-forming capacity of this tissue engineering construct.

*Christopher D Lopez and Jonathan M Bekisz contributed equally to this work.

Dipyridamole Enhances Osteogenesis of 3D-Printed Bioactive Ceramic Scaffolds in Calvarial Defects

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INTRODUCTION: The objective of this study was to test the osteogenic capacity of dipyridamole-loaded, 3D-printed bioactive ceramic (3DPBC) scaffolds utilizing a translational, skeletally-mature, large animal calvarial defect model.

METHODS: Custom 3DPBC scaffolds designed to present lattice-based porosity only towards the dural surface were either coated with collagen (control) or coated with collagen and immersed in a 100 μM concentration dipyridamole (DIPY) solution. Sheep (n=5) were subjected to 2 ipsilateral trephine-induced (11 mm diameter) calvarial defects. Either a control or a DIPY scaffold was placed in each defect and the surgery was repeated on the contralateral side 3 weeks later. Following sacrifice, defects were evaluated through micro-computed tomography and histologic analysis for bone, scaffold, and soft tissue quantification throughout the defect. Parametric and non-parametric methods were utilized to determine statistical significance based on data distribution.

RESULTS: No exuberant or ectopic bone formation was observed and no histologic evidence of inflammation was noted within the defects. Osteogenesis was higher in DIPY-coated scaffolds compared to controls at 3 weeks (p=0.013) and 6 weeks (p=0.046) *in vivo*. When bone formation was evaluated as a function of defect radius, average bone formation was higher for DIPY relative to control scaffolds at both time points (significant at defect central regions at 3 weeks and at margins at 6 weeks; p=0.046 and p=0.031, respectively).

CONCLUSION: Dipyridamole significantly improves the calvarial bone regeneration capacity of 3D-printed bioactive ceramic scaffolds. The most significant difference in bone regeneration was observed centrally within the interface between the 3DPBC scaffold and the dura mater.

Dipyridamole Releasing 3D Printed Bioactive Ceramic Scaffolds with Osseoconductive Geometries Promote Craniofacial Bone Regeneration

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INTRODUCTION: The standard of care for critical-sized bony defects is autologous bone tissue transfer. However, its limitations (e.g., morbidity, secondary procedures, cost) have driven progress in alternatives such as tissue engineering-based treatments. We explored the bone regenerative