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ABSTRACT SYMPOSIUM PROGRAM AREA NAME: PMSE
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TITLE: Title: Cartilage tissue engineering: using soft material scaffolds
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ABSTRACT BODY:
Abstract: Degeneration and injury of articular cartilage is the leading cause of disability in Americans, accounting for approximately 20% of all disabilities. Advances in cartilage tissue engineering have moved towards developing personalized biological treatment strategies for musculoskeletal diseases. However, developing large scale engineered cartilage with clinically relevant geometry and morphology has been a significant challenge to limited nutrient diffusion in larger scaffolds. We developed an approach for creating large-scale tissue surfaces through modular fabrication, where smaller components were cultivated initially to allow for sufficient nutrient diffusion and tissue growth.

Chondrocytes were harvested from juvenile bovine knees. Passaged cells were encapsulated within agarose for a final concentration of 2% w/v agarose. Individual constructs were prepared using a 4 mm diameter biopsy punch. To create modular engineered tissue surfaces (METS), individual constructs were cultured in a 3D printed porous mold. Individual constructs served as controls. Mechanical and biochemical properties were determined biweekly for individual constructs and METS samples.

METS formed stable bonds, and there were no significant differences in compressive mechanics between individual controls and any location on the METS samples. Furthermore, the strength of the bonded tissue continued to increase over time. This study demonstrates that the METS technique presents a solution to scale hydrogel cartilage constructs to clinically relevant sizes. More importantly, it demonstrates the need for macro-porosity, in addition to nano-scale porosity, in scaffolds for tissue engineering and regenerative medicine approaches.

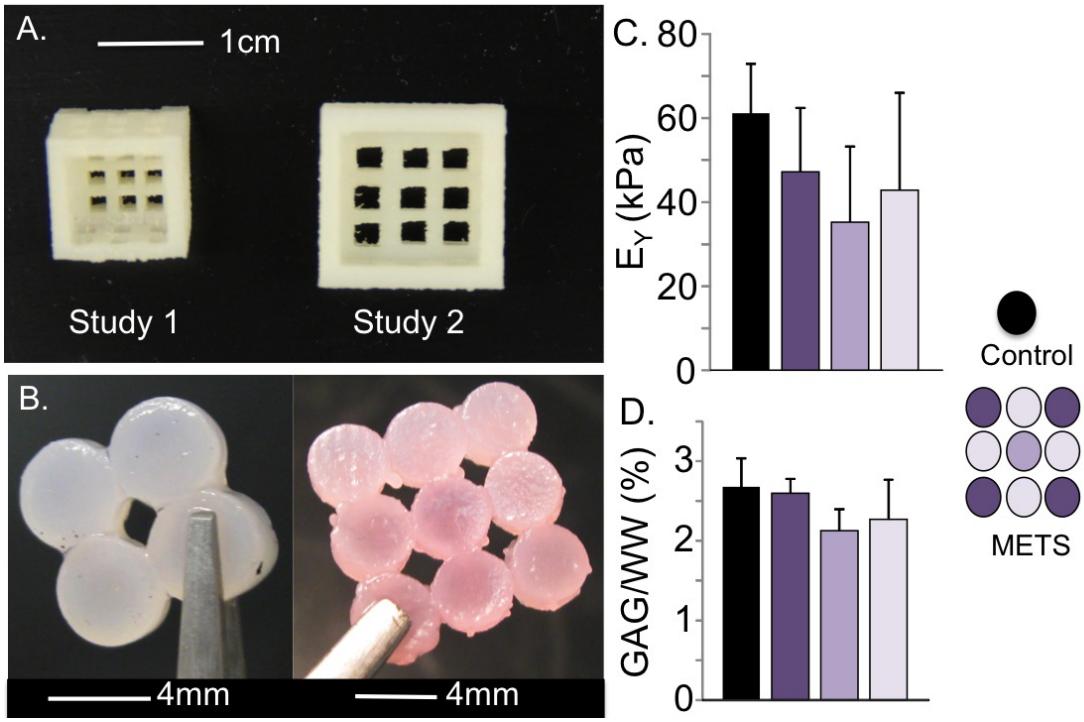

Figure. A) 3D printed porous molds. B) 2x2 and 3x3 METS samples. C) Compressive Young's modulus and D) glycosaminoglycan content of individual controls (black bars) and various regions in the METS (purple). No differences were observed with respect to the control.