Design of Woven Fabric Mimetic 3D Printed hierarchical porous scaffolds

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Abstract: Bone tissue's limited self-healing capacity struggles to address significant defects in articular cartilage caused by trauma, infection, or aging. Regeneration requires intricate interactions among molecular, cellular, biochemical, and mechanical factors. Hierarchical porous 3D scaffolds made from biodegradable polymers play a crucial role in tissue repair by mimicking and controlling cellular responses. However, traditional scaffold fabrication methods lack interconnectivity, precise architectural control, and tissue specificity. Textile technology stands out for its ability to replicate crucial features of human tissues, including hierarchical structure, anisotropy, and strain-stiffening properties. In this study, we showcased the potential of textile-based scaffolds in tissue engineering by replicating 3D woven fabric architecture using a combination of high internal phase emulsion (HIPE) templating and 3D printing. The resulting biomimetic fabric mats exhibit bone-like morphology and mechanical strength comparable to human cartilage [1]. Fine-tuning of pore morphology and scaffold mechanical properties is achievable by adjusting emulsion composition and 3D printing parameters. Cytocompatibility tests, in vivo studies, biodegradation assessments, drug release profiles, and bio-mineralization experiments underscore the promising potential of such architectures in bone tissue engineering.

Keywords: *3D printing, HIPE, Woven fabric mimicking.*

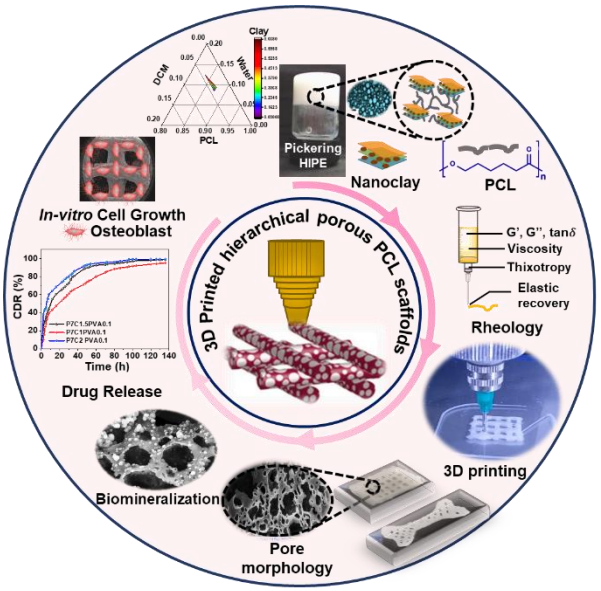

Figure 1 Stages involving the fabrication and characterization of woven fabric mimetic porous scaffolds.

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REFERENCES

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