

## Abstract

# Fiber-reinforced hydrogel constructs based on melt electrowritten scaffolds for osteochondral tissue engineering

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Due to the limited intrinsic regenerative capacity of chondrocytes, osteochondral defects caused by trauma or ageing often lead to the rise of osteoarthritis (OA). Articular cartilage plays an important role in load-bearing joints during physical movements. It can be considered as a composite structure, consisting of a collagen fiber network embedded in a hydrated proteoglycan matrix [1]. The usage of fiber-reinforced hydrogels mimics the physiological structure of the tissue and represents a new approach to treat OA. Here, we present an approach that integrates melt electrowritten (MEW) fiber scaffolds with hydrogels to create fiber-reinforced constructs for osteochondral tissue engineering.

In the present study, alginate-dialdehyde-gelatin (ADA-GEL) formulations were cast around MEW meshes fabricated from Polycaprolactone (PCL). Two scaffold architectures with rectangular and triangular pore geometries were investigated. The hydrogels were subsequently stabilized using a dual-crosslinking strategy. The resulting reinforced hydrogels underwent a comprehensive mechanical characterization, including compressive testing, dynamic-mechanical analysis, and relaxation assays, and were compared with non-reinforced hydrogels. Preliminary results indicate that MEW reinforcement substantially enhances the mechanical performance of the hydrogel constructs, suggesting improved suitability for load-bearing cartilage applications. In summary, our findings highlight the potential of combining MEW-fabricated scaffolds with tailored hydrogel systems to engineer functional osteochondral constructs.

## AUTHOR'S STATEMENT

Conflict of interest: Authors state no conflict of interest. Animal models: No animal experiments were conducted. Ethical approval: The research related to human use complies with all the relevant national regulations, institutional policies and was performed in accordance with the tenets of the Helsinki Declaration, and has been approved by the authors' institutional review board or equivalent committee. Local Ethical Committee approval number: 2010-10. Informed consent: Informed consent has been obtained from all individuals included in this study. Acknowledgments: Research funding: This study is funded by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) - SFB 1270/1-299150580.

## REFERENCES

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