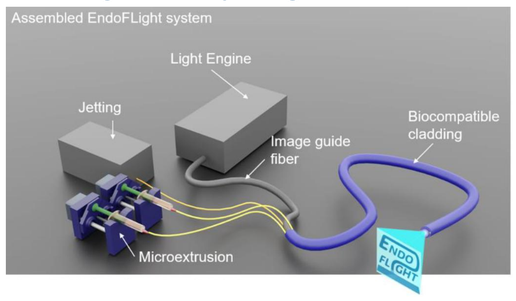
Bioink development for *in situ* osteochondral regeneration through microextrusion and filamented light bioprinting

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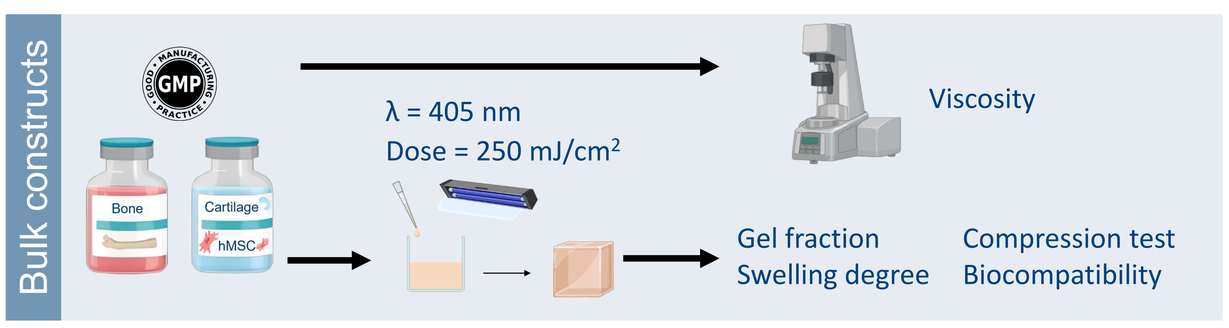
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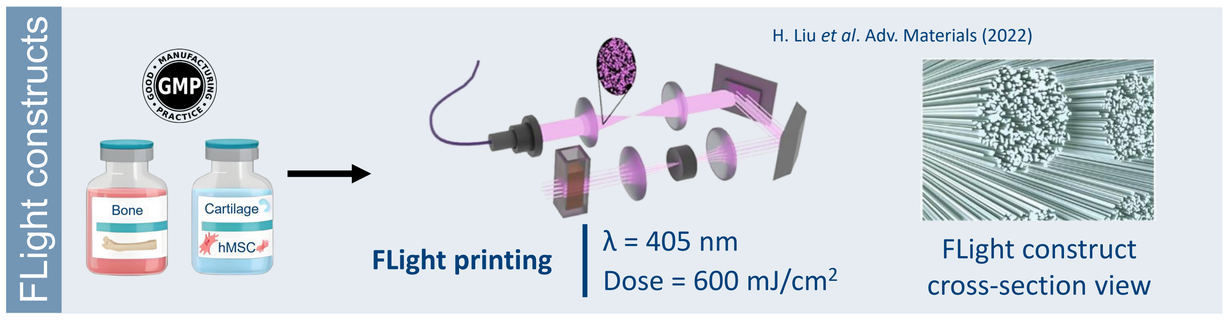
INTRODUCTION

- **Osteoarthritis (OA)** is a degenerative disease affecting **osteochondral (OC)** tissue, leading to pain and joint dysfunction. **Current treatments** are often **limited** highlighting the need for innovative therapeutic approaches.
- To address this challenge, we propose a novel tool **EndoFLight**, an advanced **in situ 3D bioprinting platform** designed for **minimally invasive** regeneration of large OC lesions. This system combines **bioink extrusion** through standard arthroscopic instruments with **filamented light (FLight) printing** to enable precise deposition and crosslinking of **cell-laden photoresins** directly at the injury site.
- This study presents the characterization of photoresins using three **X-pure grade** **Gelatin methacrylamide** (**GelMA**) concentrations (low, mid and high) either alone or blended with **hydroxyapatite** (**HAp**) or **methacrylated hyaluronic acid** (**HAMA**) for EndoFLight technology, which aims to provide a clinically translatable solution for OC regeneration in OA treatment.



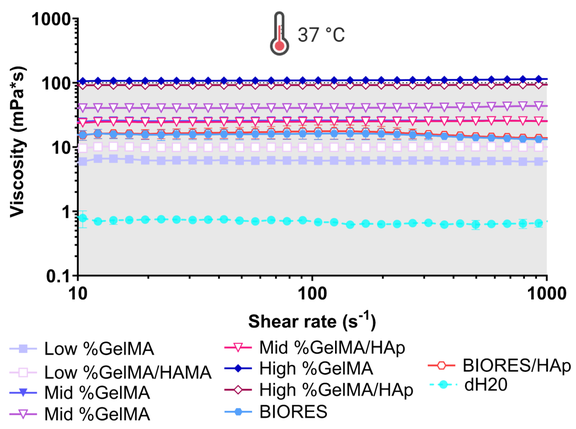
MATERIALS & METHODS





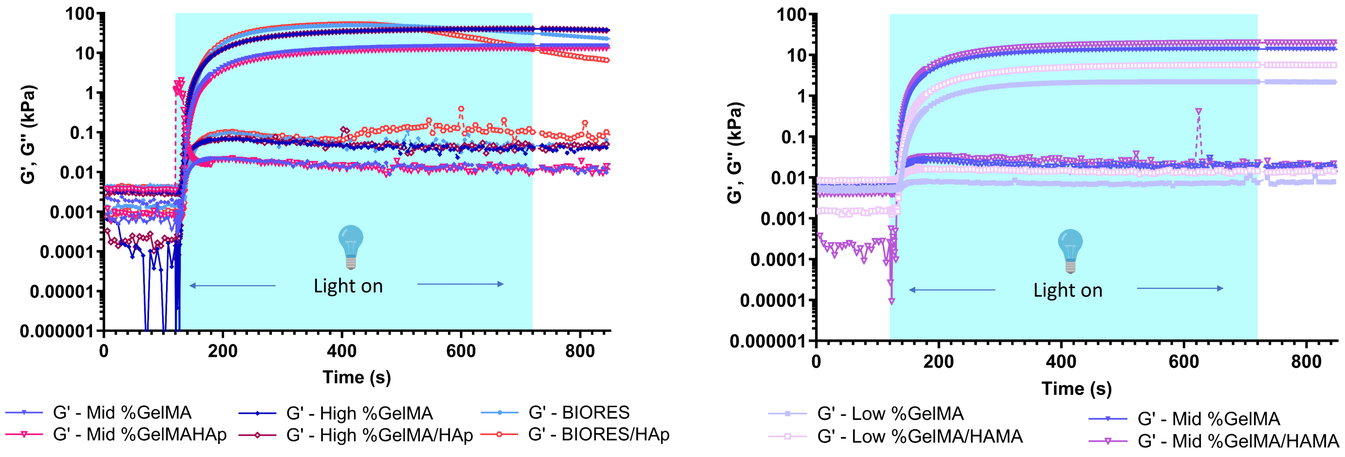
RESULTS

Viscosity



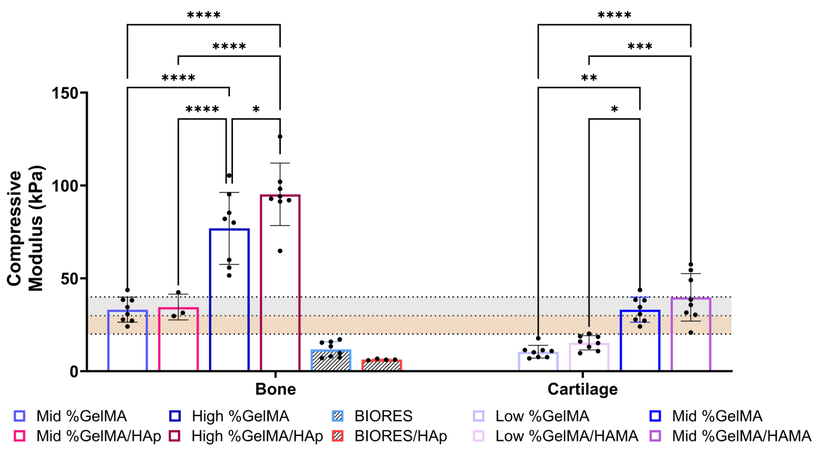
Most compositions exhibit an appropriate viscosity for extrusion through EndoFLight (<100 mPa*s).

Photorheology



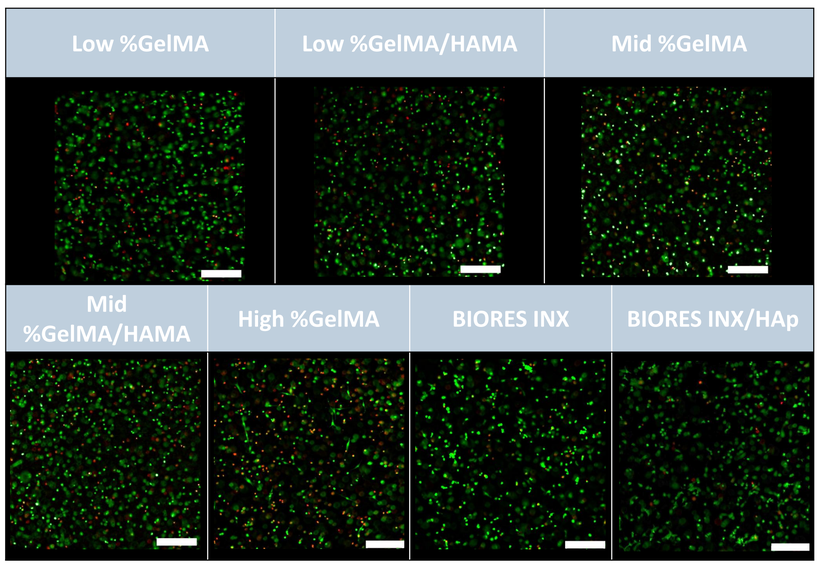
Photorheology tests showed rapid crosslinking across all compositions. A higher GelMA concentration resulted in an increase in G'.

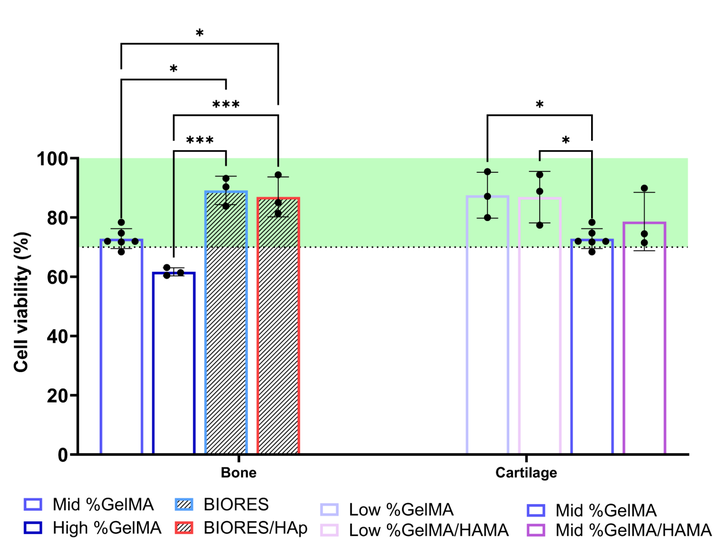
Compressive modulus



Compressive modulus are within values reported to promote bone (20-40 kPa) and cartilage (20-30 kPa) formation.
B. Bachmann *et al. (2020), Tae Ho Kim, et al., 2015.*

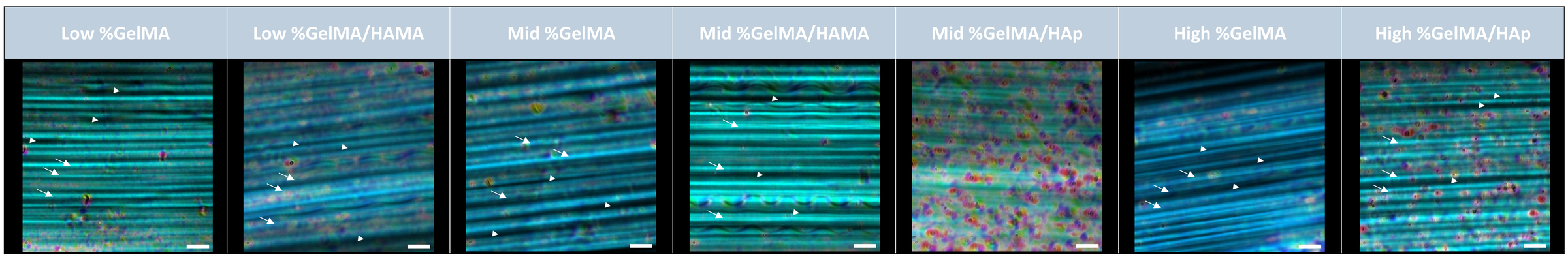
Biocompatibility





Live/dead images of MC3T3-E1 cells encapsulated in hydrogels (2*10⁶ cells/mL) after 24h. ImageJ analysis showed all formulations except high GelMA exhibit a cell viability > 70%. Scale bar = 275 µm.

FLight constructs



Z-stack images of FLight constructs fabricated through FLight printing technology after analysis using the ImageJ plug-in OrientationJ. Notably, highly aligned unidirectional microfilaments (arrows) and microchannel voids (arrowheads) are observed at cell-scale resolution. These structures foster cell migration and alignment. Scale bars: 50 µm.

CONCLUSION

- We have successfully characterized and developed **X-pure grade GelMA-based photoresins** suitable for **bone** and **cartilage repair**.
- Seven photoresins could be biofabricated using the **FLight printing** technology exhibiting **highly aligned microfilaments.**
- Most photoresins showed **high biocompatibility** after cell encapsulation (>70% viability after 24h) highlighting their potential use as (**bio)inks** for **OC repair.**

ACKNOWLEDGEMENTS & CONTACTS

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