IOCBE 2024 Conference
The 1st International Online Conference on Bioengineering
16–18 October 2024 | Online
MDPI

Three-dimensional bioprinted bioink with nanosilicate and pluronic p-123 for bone tissue engineering

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INTRODUCTION & AIM

Recent studies show that the combination of biomaterials and 3D bioprinting is a promising approach for treating extensive bone injuries. The aim of this study was to develop a bone bioink containing nanosilicate, which enhances the biomaterial's mechanical and biological properties, and pluronic p123 due to its hydrophilic potential, which make this a good candidate for drug delivery.

METHOD

The nanosilicate was prepared with tetraethyl orthosilicate and the hydrogel was composed of sodium alginate 5%, pluronic p-123 20% and nanosilicate 2% and was characterized by rheological tests, scanning electron microscopy (SEM), degradation and swelling tests.

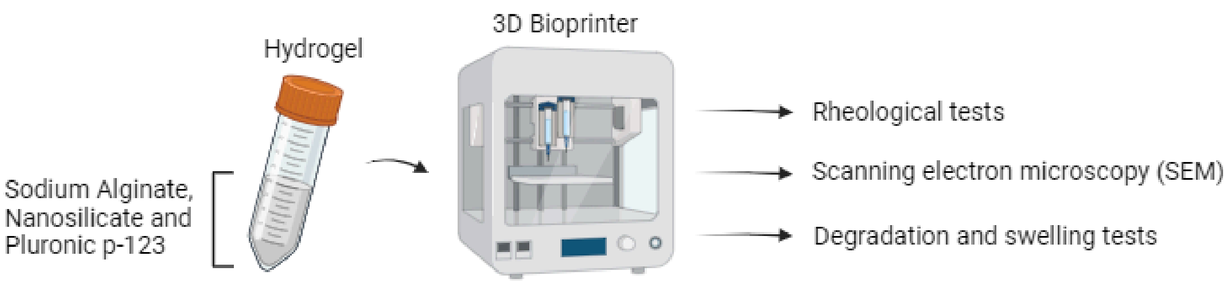

Fig 1. Experimental design for hydrogel tests.

The biocompatibility of the hydrogel was analysed by live/dead assay at day 1. A bioink was prepared containing the hydrogel and 10^6 mesenchymal cells/ml and bioprinted with an 3D Octopus bioprinter.

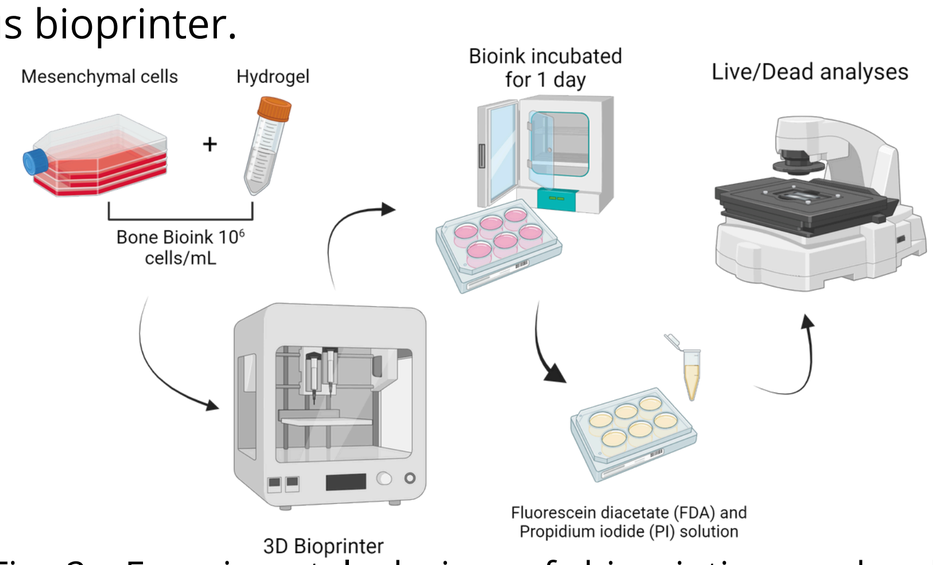

Fig 2. Experimental design of bioprinting and cell viability tests .

RESULTS & DISCUSSION

The nanosilicate showed an average diameter of 392.78 ± 85.08 nm, a zeta potential of -39.65 ± 6.1 mV, and a PDI of 0.105 ± 0.09.

Support:

RESULTS & DISCUSSION

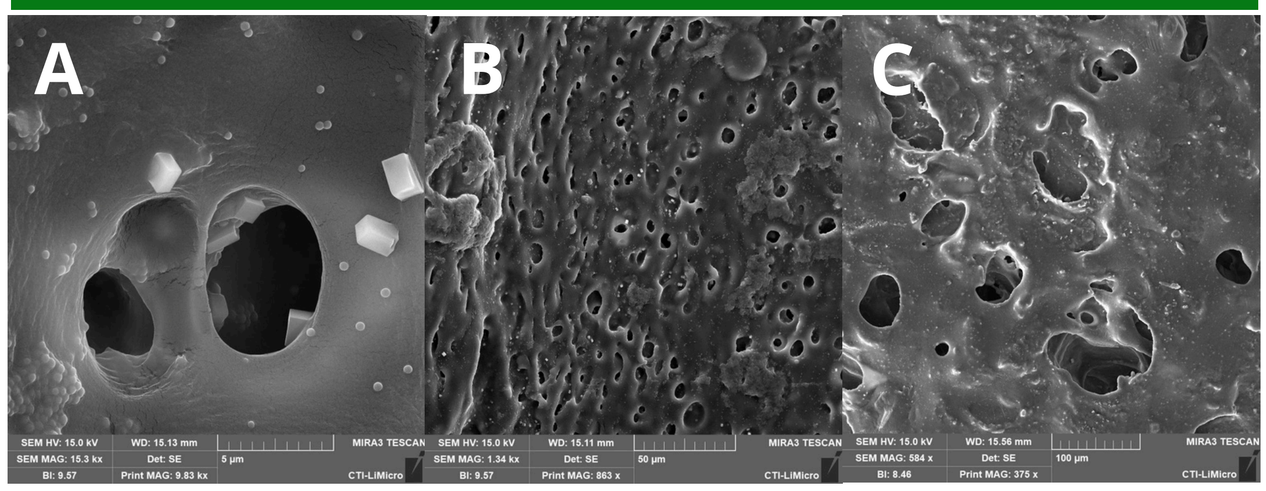

Fig 3. SEM images: A) Surface section on a 5 µm scale bar; B) Surface section on a 50 µm scale bar; C) Side cut on a 100 µm scale bar.

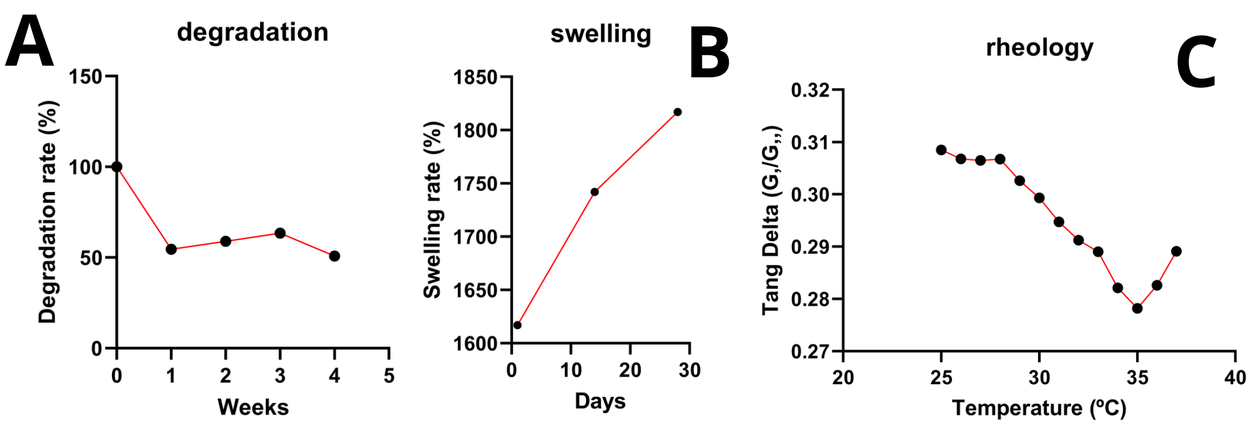

Fig 4. A) Degradation behavior of the hydrogel, 50% of the weight was lost in the first week and kept constant for the following four weeks; B) Swelling behavior of the hydrogel; C) Rheological properties of hydrogel.

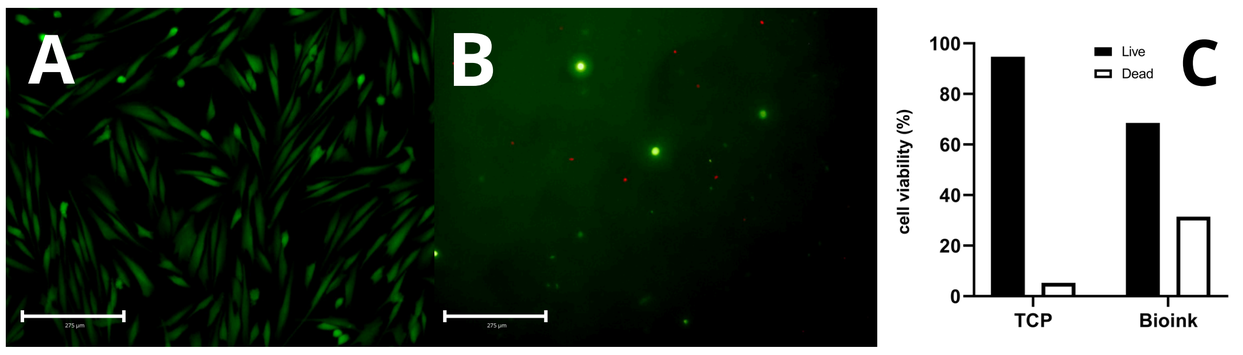

Fig 5. Live/Dead assay: A) Mesenchymal cells on a tissue culture plate (TCP); B) Bone Bioink, Green - Live cells, Red - Dead cells; on a 275 µm scale bar; C) Live/Dead quantification.

CONCLUSION

The results of this study showed that the described bioink is a promising material for bone tissue engineering and repair.

FUTURE WORK / REFERENCES

The incorporation of osteoinductive drugs into the bioink and osteogenic differentiation are the next steps of the study, along with *in vivo* testing on an animal model of bone lesion.

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