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Technological University of the Shannon:
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TUS Research

TITLE: OSTEOINDUCTION OF C2C12 MYOBLAST CELL-LINE TREATED WITH GROWTH FACTOR-INCORPORATED BIOCOMPOSITES

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INTRODUCTION

Bone regeneration scaffold serves as an alternative treatment to critical bone defects, substituting the traditional gold standard autologous bone grafting. A number of biomaterials and osteogenic growth factors are of the scientists' interest in developing this bone scaffolds, to satisfy the required characteristics including having the osteoconductive and osteoinductive features.

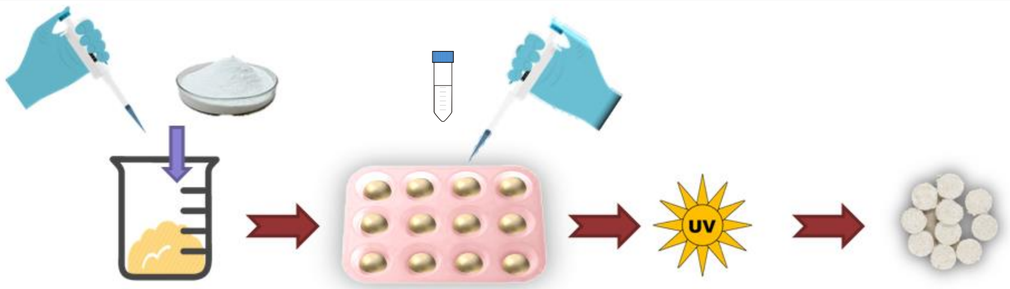
FDA-approved treatments are known as Medtronic Infuse™ rhBMP-2 and Stryker Osigraft™ rhBMP-7, where both are osteogenic proteins. However, Infuse™ was shown to induce ectopic bone growth, while Osigraft™ was unable to prove its effectiveness in treating non-unions, thus being discontinued from the market.

This research is interested in comparing the use of an alternative active pharmaceutical ingredients (API) to have a comparable osteogenic performance to the protein, since it is advantageous in terms of greater conformational control, giving higher stability over cellular interactions.

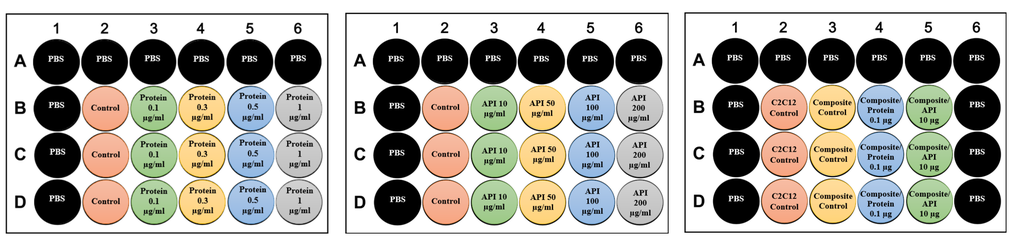
OBJECTIVES

- Investigating the ability of an API acting as an osteoinductive growth factor in changing the C2C12 differentiation pathway from myoblast to an osteoblastic phenotype comparable to the osteogenic protein performance.
- Evaluating the *in vitro* bioactivity of the covalently-bonded protein/API to biomimetic scaffold composite in UV crosslinking procedures, through Alizarin red staining and followed by quantitative cetylperiudium chloride destaining.

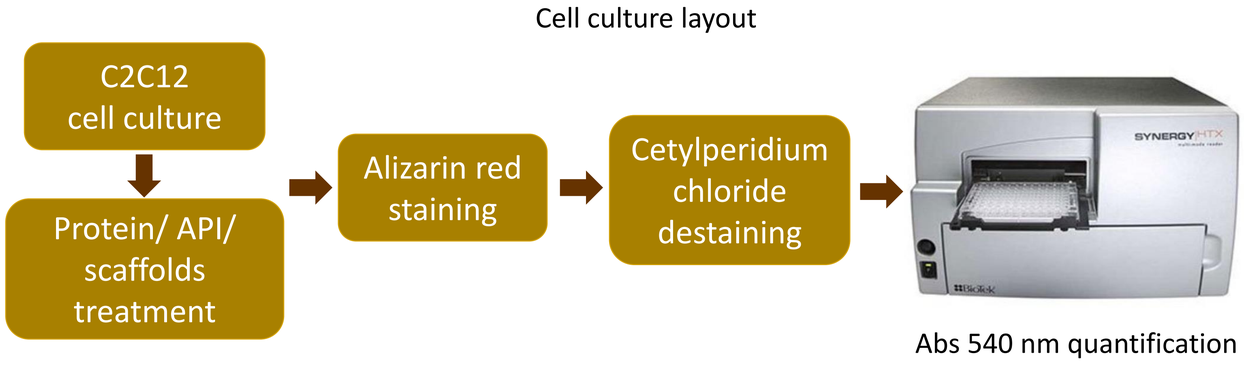
METHODS



Scaffold fabrication



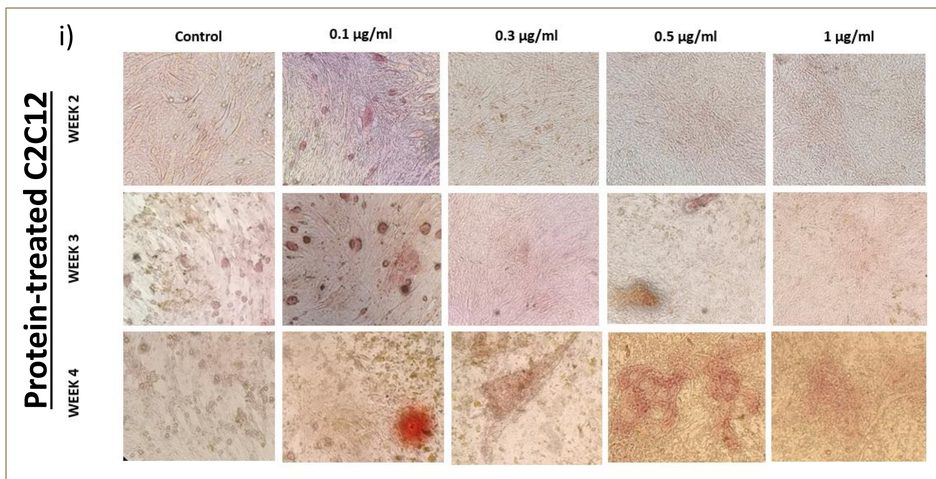
Cell culture layout



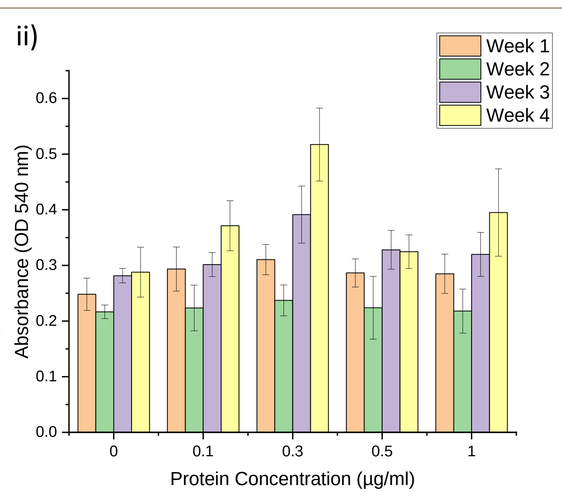
Abs 540 nm quantification

RESULTS & DISCUSSION

ALIZARIN RED STAINING

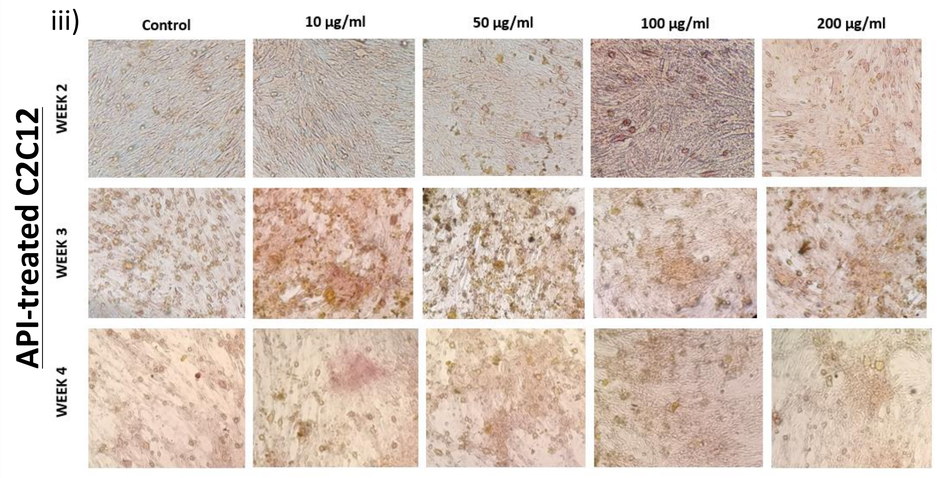


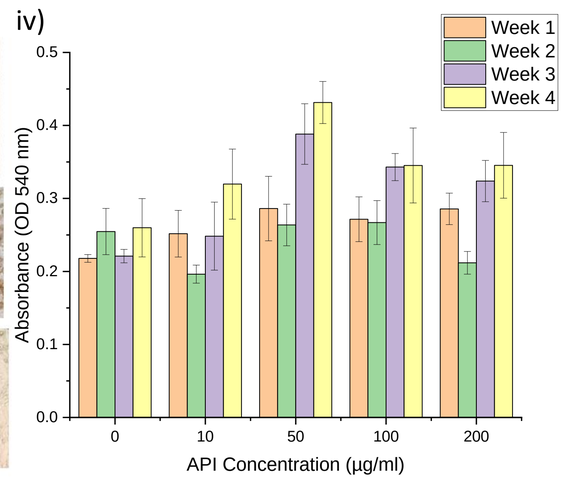
CETYLPERIDIUM CHLORIDE DESTAINING



i) Development of calcification patterns in protein-treated C2C12 from alizarin red staining in 4 weeks.

ii) Increased CPC absorbance from the stained C2C12, with significant difference observed in 0.3 µg/ml protein treatment in week 4. ($p<0.05$)

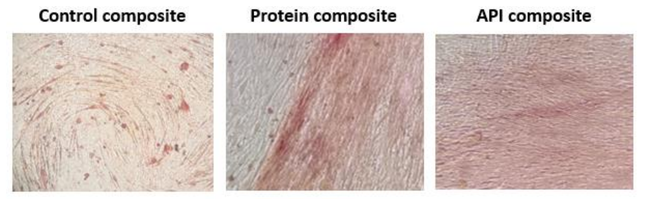




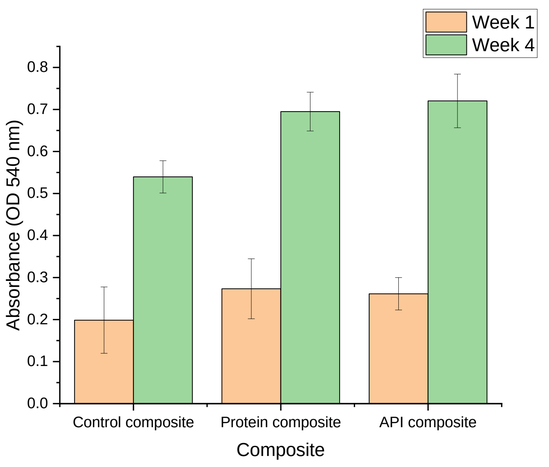
iii) Comparable intensity of calcification patterns in API-treated C2C12 from alizarin red staining in 4 weeks.

iv) CPC absorbance from the stained API-treated C2C12 almost on par to the protein, with significant difference observed in 50 µg/ml in week 4. ($p<0.05$)

SCAFFOLDS



Alizarin red-stained C2C12 calcification patterns after 4-weeks in the presence of biocomposites incorporated with and without growth factors.



Significant increase in CPC absorbance from the stained C2C12 after 4-weeks of incubation in the presence of biocomposites, where no significant difference was observe between protein and API biocomposite. ($p<0.05$)

CONCLUSION

- API shows comparable osteoinductivity to the protein of origin.
- Protein and API retained their osteogenicity following the covalent bonding through UV crosslinking to the biomimetic scaffold composite.

ACKNOWLEDGEMENTS

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European Union
European Regional Development Fund
CF-2016-0600-P

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