Modulation of UCSSC osteogenesis in a carbon-based scaffold

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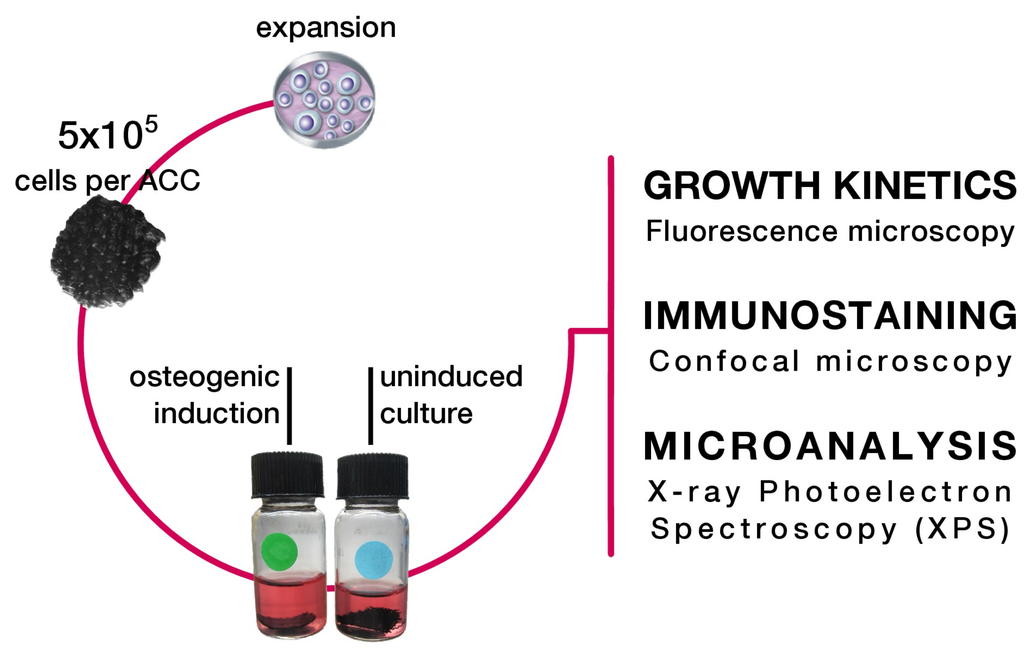
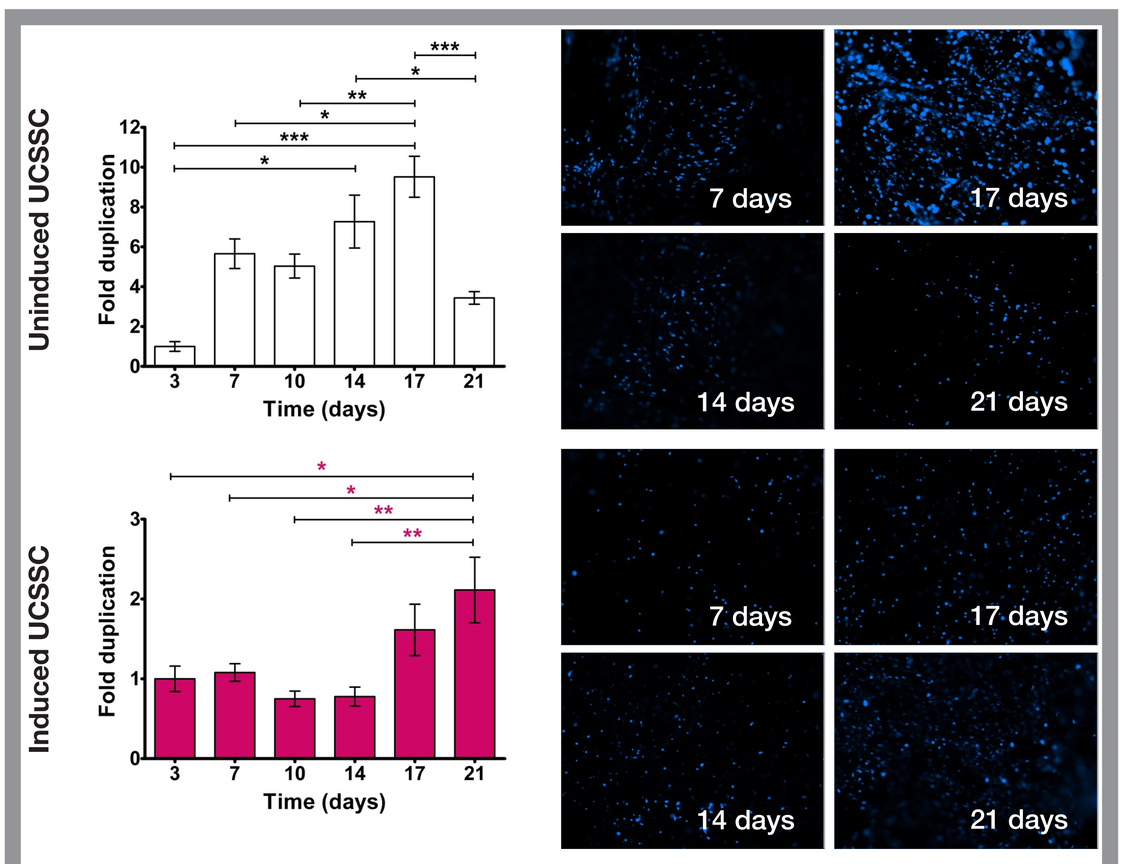
Introduction

Living cells can attach to the surface of activated carbon via absorption and this process can be explained by colloid and surface chemistry in terms of electrostatic and hydrophobic interactions (1). The activated carbon cloth (ACC), presents a large surface area with some of the fundamental features of biomaterial for effective applications in bone regeneration because of its appropriate biocompatibility and a highly interconnected porous network that allows proper tissue growth. We have introduced an innovative cell culture method whereby the culture surface on ACCs is huge and able to maintain constantly high cell density while preventing contact inhibition of growth (1). By using this approach, we tried to improve the cell culture procedure and reduce the laboratory time required to obtain amounts of mesenchymal cells suitable for utilization or differentiation.

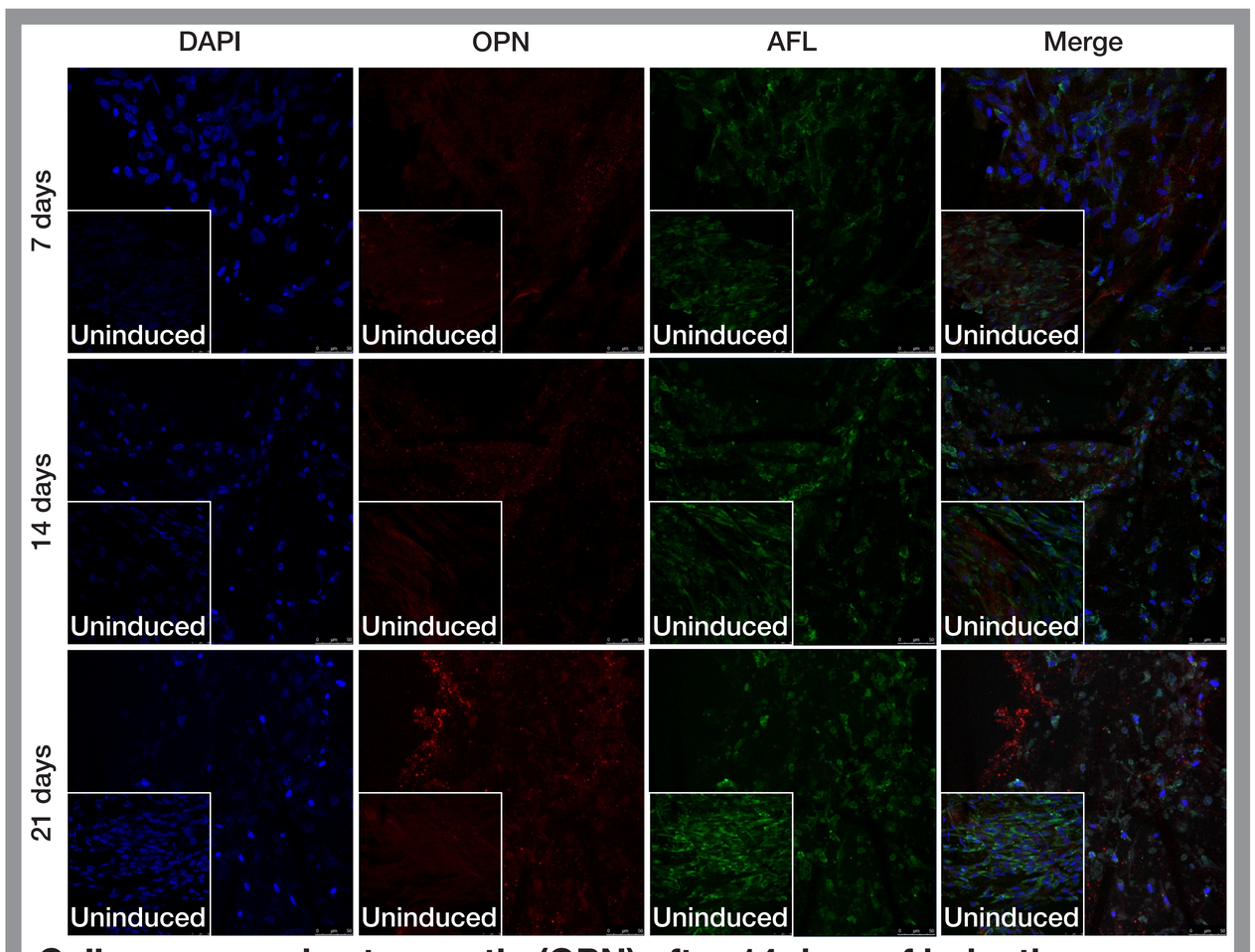
Materials and Methods



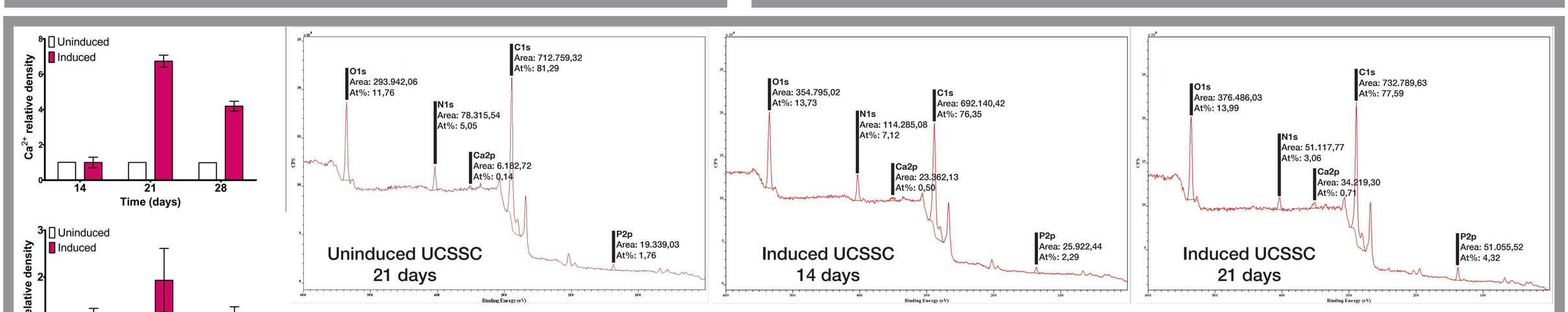
Results



Growth kinetics of induced and uninduced UCSSC.
Uninduced UCSSC (white bars) proliferated on the ACC with a duplication time of 88 hours. Osteogenically induced (magenta bars) cell number increase was significant after 21 days of differentiation.



Cells expressed osteopontin (OPN) after 14 days of induction.
Osteopontin expression increased with days of osteogenic induction. Autofluorescence (AFL).



Ca^{2+} and $[PO_4]^{2-}$ content duplications over the 21 days of differentiation.
Both ion content increases dramatically on ACC surface during osteogenic induction in contrast with the inaprecciable changes under standard culture conditions.

Conclusions

Our results show that activated carbon cloths have the capacity to promote umbilical cord stromal stem cells proliferation and clearly demonstrate their excellent ability to support induced osteogenic differentiation.

Acknowledgements

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