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Functional gellan gum hydrogels and cell based therapies – A novel therapeutic approach for spinal cord injury regeneration

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Introduction: Spinal Cord Injury (SCI) remains one of the most devastating diseases of the Central Nervous System, for which there is still no effective treatment. Multidisciplinary approaches such those presented by tissue engineering concepts hold great promise for SCI treatment. In this sense we previously functionalized a gellan gum hydrogel (GG) with a fibronectin derived peptide - GRGDS.[1] Moreover, it was already demonstrated that Adipose Mesenchymal Stem Cells (ASCs) secrete factors that promote neuronal proliferation; in addition, Olfactory Ensheathing Cells (OECs) are well known for promoting neuronal regeneration and guidance. Furthermore, our group has shown that ASCs and OECs present positive interactions.[2] Therefore, we propose to conjugate GG-GRGDS hydrogel with ASCs and OECs in order to promote SCI repair.
Materials and methods: To study possible interactions, ASCs and OECs were co-cultured for 7 days either in 2D or in 3D surfaces. In addition, Dorsal Root Ganglia (DRG) explant cultures were used, as an *in vitro* model of axonal regeneration, to test the secretome effects of both cell types under study. An *in vivo* experiment, in which adult rats were subjected to a hemisection lesion, was also performed. The animals were divided into different groups according to the treatment: non-treated animals; transplant of ASCs and OECs; implantation of the GG-GRGDS hydrogel scaffold or a combination of the previous two (cells encapsulated in the hydrogel).
Results and Discussion: Results demonstrated that the number and morphology of ASCs and OECs was not affected when in direct co-cultures, either on 2D or 3D (inside the hydrogel). Regarding DRG cultures, ASCs and OECs secretome presented regenerative effects, as assessed by the total area of neurite outgrowth. Finally, *in vivo* results showed that OECs and ASCs encapsulated in GG-GRGDS were able to induce functional recovery in SCI animals, assessed by different locomotor tests. In addition, the combinatorial treatment provided a reduction in astroglyosis, inflammatory response and increase of neurofilament-positive cells.
Conclusions: GG-GRGDS hydrogel proved to be a good vehicle for cellular transplantation in SCI models. In fact the obtained results revealed that GG-GRGDS hydrogel in combination with ASCs and OECs might be a valid alternative for SCI regenerative medicine.

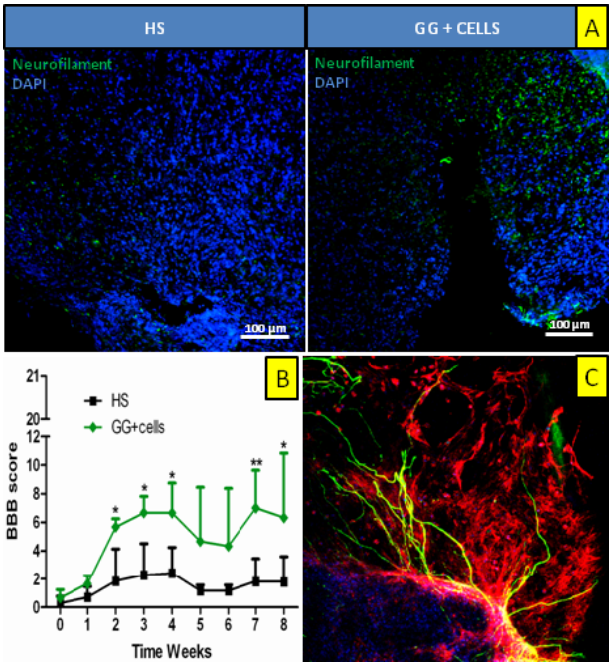

Figure 1 Comparison between non-treated rats (HS) and GG-GRGDS-treated rats (GG+cells) for neurofilament staining (A) and BBB locomotor score (B). DRG explants cultured in GG-GRGDS with ASCs (C).

Acknowledgments: Portuguese Foundation for Science and Technology (FCT) (Grant N° PTDC/SAU-BMA/114059/2009; IF development grant to A.J. Salgado)
Disclosures: The authors declare that there are no conflicts of interest.
References
1. Silva NA, *et al.* Biomaterials. 33, 27, 2012.
2. Silva NA, *et al.* Stem Cells and Development. 22, 8, 2013.