Magnetic responsive hydrogels for neural regeneration

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Spinal cord injuries affect 2,000,000 people worldwide. However, an effective and definite treatment does not exist yet due to the complexity and limited regeneration potential of the central nervous system. For this reason, developing new regenerative approaches is required.
With that aim, we initiated the exploration of some new strategies involving hydrogels derived from natural polymers and magnetic iron oxide nanoparticles, considering their attractive properties for biomedical applications1,2,3.

On the one hand, magnetic nanoparticles were coated with hydrogels (e.g. chitosan and hyaluronic acid). For chitosan coating, ionic gelation with sodium tripolyphosphate (non-toxic polyanion) was used. Whereas for hyaluronic acid coating, only incubation and sonication were required. On the other hand, natural hydrogels were obtained by lyophilisation of polymer solutions containing the selected magnetic nanoparticles. The coated particles present high colloidal stability, while hydrogels were porous with superior mechanical properties in the case of collagen hydrogels. Preliminary cell assays with primary neural cells showed high cell viability in collagen and gelatin hydrogels and chitosan and hyaluronic acid coated nanoparticles.

To sum up, natural hydrogels and nanoparticles coated with natural polymers seem to arouse a positive response in primary neural cells. Nonetheless, some of their properties need to be optimized and further research on cell responses is needed to confirm the actual regenerative potential of these biomaterials

References

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Figures

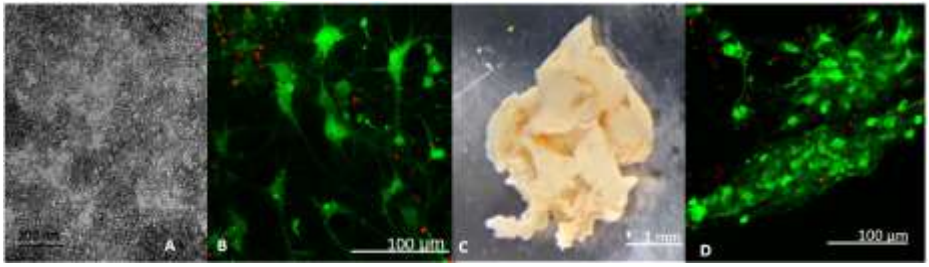

Figure 1: a) Magnetic nanoparticles; b) Primary neural cells after 24h of exposure to 0.1 mg/mL of chitosan coated nanoparticles; c) collagen hydrogel with nanoparticles; and d) neural cells cultured on the collagen hydrogel. Alive cells stained with calcein (green) and dead cells with ethidium homodimer 1 (red).