MNPs-enriched biomaterials as promising candidates for nervous tissue engineering applications

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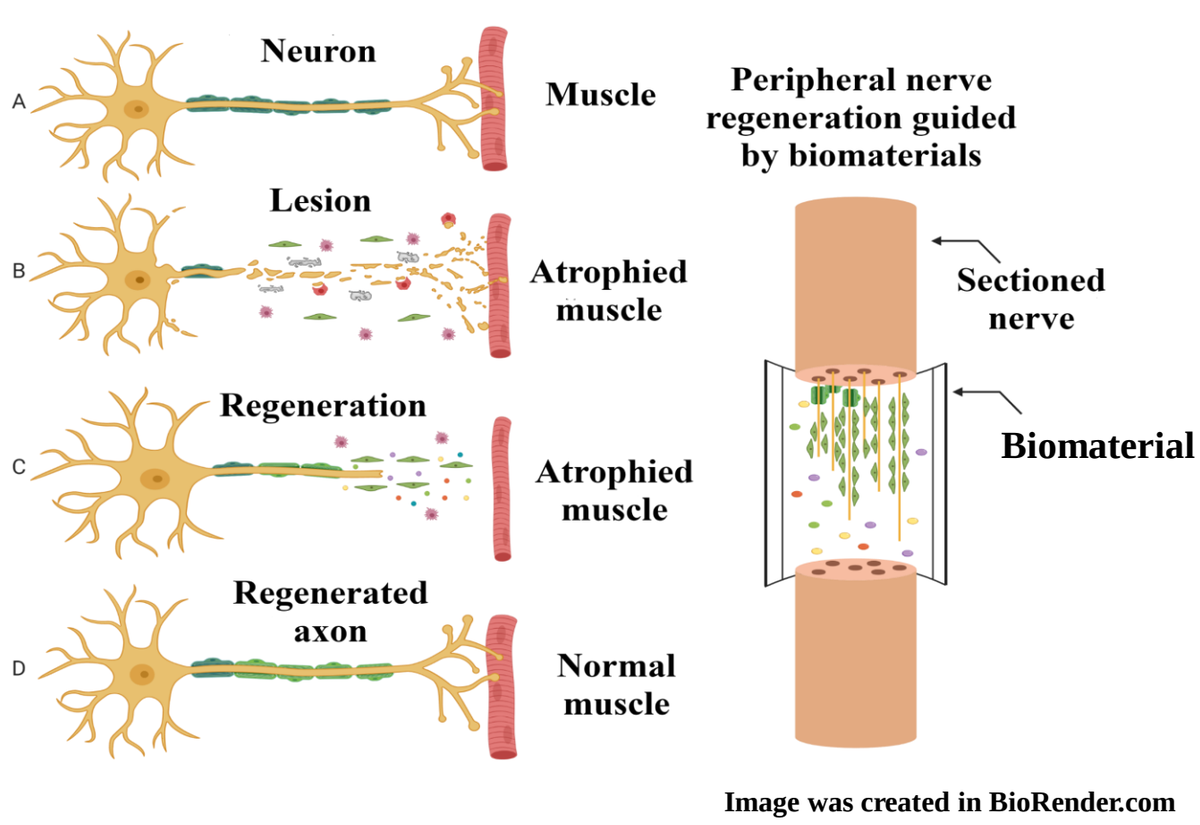
Background

Nervous tissue regeneration represents a huge challenge in tissue engineering and therefore, numerous strategies are being investigated for this purpose. Current approaches are focused on the use of magnetic biomaterials to support nerve regeneration, since magnetic field was proved to have a beneficial effect on neuronal differentiation.

Aim

Our aim was to develop and investigate the cytocompatibility and potential of natural-based materials enriched with magnetic nanoparticles (MNPs) to support the growth, viability and proliferation of the neural stem cells (representaed by NE-4C cell line, CRL-2925, ATCC.



Materials and Methods

These composites were developed using electrospinning technique and were enriched with different concentration of MNPs (0.5% -2%, to be compared to a pure fish gelatin control material) then they were seeded with NE-4C cells and maintained in standard culture conditions for up to seven days. Cell viability and proliferation were tested using the **MTT** assay, while eventual cytotoxic effects were evaluated based on lactic dehydrogenase (**LDH**) release in culture medium. The proportion of live and dead cells in contact with MNPs-enriched scaffolds was revealed using Live/Dead assay. Investigation of changes in cytoskeleton distribution and focal adhesion assembly was observed by immunolabeling and confocal microscopy

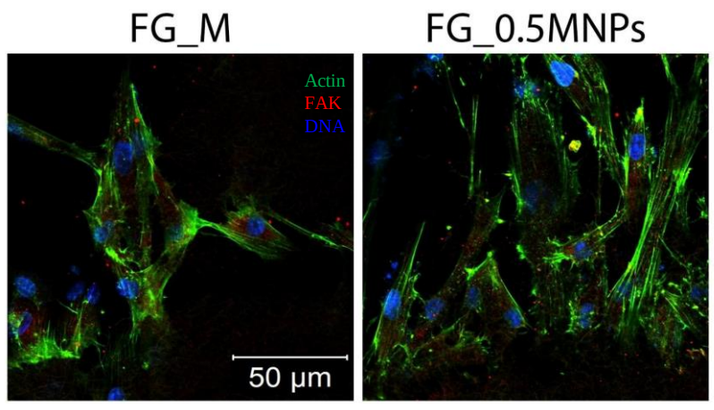


Figure 4. Cytoskeleton staining of NE-4C cell line in contact with magnetic scaffolds

Results

Our results indicated that all tested scaffolds proved to be **biocompatible** with neural stem cells and didn't induce any significant cytotoxic effects for up to one week of *in vitro* culture. MNPs concentration influenced proportionally the rate of cell growth and proliferation, while cytoskeleton immunolabeling revealed an **elongated profile of actin microfilaments** and emphasized **focal adhesion kinase (FAK)** distribution, suggesting **beneficial effects of MNPs-enriched composites.**

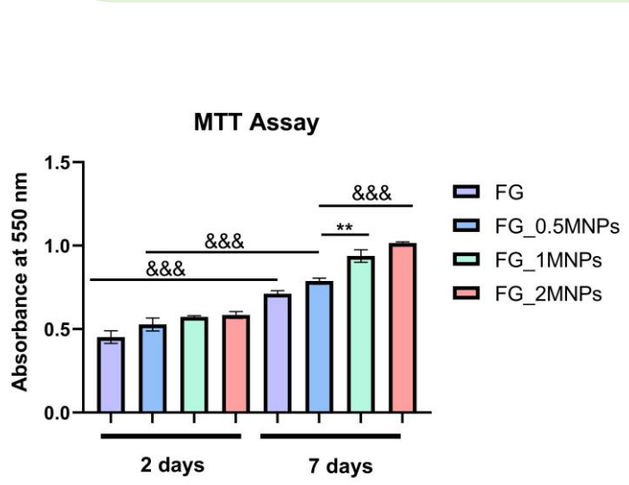


Figure 1. Viability profile of NE-4C cell line in contact with magnetic scaffolds ($p<0.01$ **, $p<0.001$ &&&)

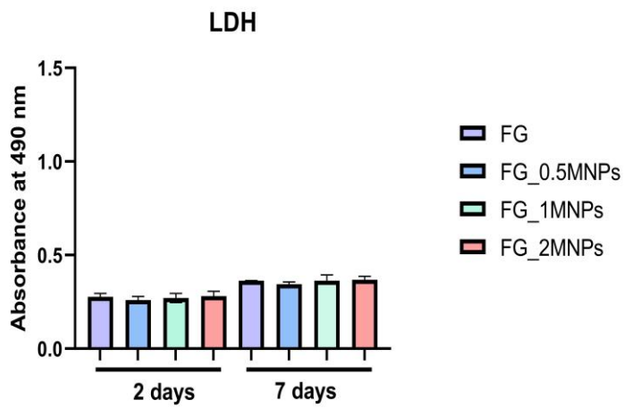


Figure 2. Cytotoxic profile of MNP-enriched scaffolds towards NE-4C cell line

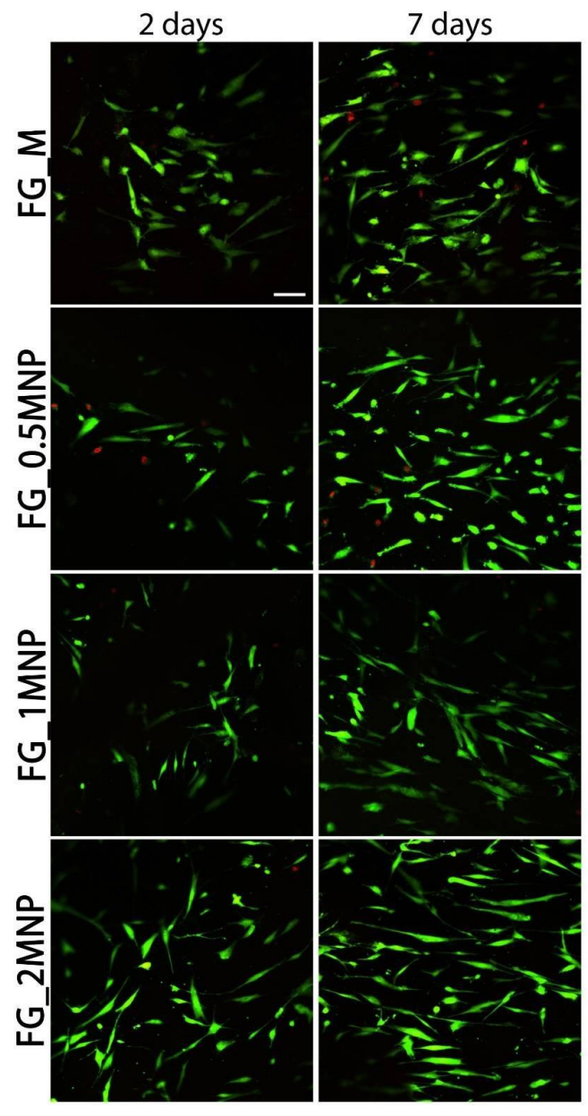


Figure 3. Labeling of both live (green) and dead cells' nuclei (red) in contact with magnetic scaffolds, scale bar = 100µm

Conclusions

Thus, biomaterials embedding low concentrations of MNPs display **good interaction** with neural stem cells and could be used in further studies for nervous tissue regeneration. This work was supported by PN-III-P1-1.1-TE-2019-1191/MAGNIFICENT grant.