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A graphene-oxide-collagen scaffold as a versatile three-dimensional biomimetic microenvironment for tissue engineering applications

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During the past few years, graphene and its hybrids have become increasingly popular biomaterials for tissue engineering (TE) applications due to not only their excellent biochemical, electrical and mechanical properties, but also because of their potential to be combined with other materials in order to fabricate biocompatible composites with superior behavior. In this regard, graphene oxide (GO) has emerged as front runner to act like a functional building block of complex 3D cellular microenvironments since the oxygen functional groups located onto the surface of its sheets can be complementary used to directly enhance cell response and to be combined with specific biomolecules and polymers.[1,2]

Thus, in this work we successfully explore the electrostatic interactions between the negatively charged GO sheets and the positively charged collagen (Col) particles in order to fabricate a self-assembled 3D porous scaffold capable of guarantee suitable biochemical and biomechanical features for a wide range of TE strategies, involving both static and dynamic cell culture protocols.[3] Indeed, the chemical, mechanical and morphological properties of the GO-Col scaffold were minutely analyzed and its capability to potentiate an enhanced cellular microenvironment was confirmed by preliminary biocompatibility tests using Rat Schwann cells. The versatility of the scaffold was also revealed through their compression-recovery features since independently of the degree of deformation applied (1%, 3% and 7%) via a bioreactor apparatus, its integrity was not affected. Additionally, these promising results boosted the adaptation of this GO-Col scaffold into the cartilage TE applications by innovatively incorporating inside the porous network an anisotropic electrospun scaffold able to mimic with great morphological accuracy the cartilaginous natural fibrous network.

REFERENCES:
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