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Abstract

Graphene: A new material for wound healing †

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Abstract: One of the hot topics in medical research involves using new materials for repairing human tissues. Graphene and its derivatives (which would be abbreviated as graphene in the following text for simplicity) happens to be one such novel material and has excellent properties due to ability to help regenerate tissues. This could be potentially useful for tissue engineering, and skin/muscle/nerve/bone/cartilage repair. Wound healing in eczema, bed sores or burning accidents have a high risk of bacterial infection, and some graphene materials have shown to provide good therapeutic efficacy in the improvement of wound healing with new dressing materials. The mechanism of wound healing might be due to its anti-bacterial properties, immunomodulatory effect, anti-inflammatory effect as well as angiogenic properties. The reason behind this unique properties could be its lack of cytotoxicity, its compatibility with biological material in terms of adhesiveness, and its lack of inhibition of healthy cell migration. Graphene could also have some antibacterial properties which might be due to its dehydrating properties or the ability of some functional groups to generate free radicals that kill pathogenic bacteria. The biocompatibility could be demonstrated by examination of the adhesion of fibroblasts cell lines and the morphology of their filopodia (or the feet). While many model systems concentrate on skin repair and wound healing, the use of graphene is not limited to skin cells: A human stem cell model has also been used to mimic cell regeneration from acute myocardial infarction (MI) using graphene in the form of hydrogels. This model has established the enhanced cell survival rate, increased expression of pro-inflammatory factors, factors that aid in the formation of new blood vessels, and early cardiogenic biomarkers, using graphene quantum dots as a soft injectable hydrogel for heart regenerative function after MI. The study of graphene and graphene-based materials on inflammatory biomarkers and acute phase proteins will be the subject of investigation in this review.

Keywords: inflammatory biomarkers; actue phase proteins; tissue regeneration; free radical; stem cell

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