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Abstract

Graphene: A New Material for Wound Healing †

Mary Miu Yee Waye [1,2,*], Carmen Wing Han Chan [1] and Ruquan Ye [3]

[1] The Nethersole School of Nursing, The Chinese University of Hong Kong, Hong Kong SAR, China
[2] Croucher Laboratory for Human Genomics, The Chinese University of Hong Kong, Hong Kong SAR, China
[3] Department of Chemistry, City University of Hong Kong, Hong Kong SAR, China
* Correspondence: mary-waye@cuhk.edu.hk

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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 will be abbreviated as "graphene" in the following text for the sake of simplicity) happens to be one such novel material and has excellent properties due to its 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 effects, anti-inflammatory effects, as well as angiogenic properties. The reason behind these unique properties could be graphene's 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 fibroblast 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. For instance, 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 an enhanced cell survival rate, an increased expression of pro-inflammatory factors that aid in the formation of new blood vessels, and early cardiogenic biomarkers that use 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; acute phase proteins; tissue regeneration; free radical; stem cell

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