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Influence of nanotechnology in skin tissue engineering

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Skin grafts have been used to treat burns and wounded skin for decades; however, no skin graft produced yet has replicated the normal skin. Since nanoparticles exhibit enhanced biocompatibility and activity with surface modification at the nanoscale level, they are highly effective in numerous biomedical applications. Hence, the application of nanotechnology is also being witnessed in tissue engineering to bring about a revolution in the engineering of artificial skin to provide improved treatment for acute and chronic skin wounds. The process of tissue engineering should involve both epidermal and dermal layers together to produce skin, which can be used as a replacement. But this process gets obstructed by two major challenges, the first being the biomaterials used, which should be degradable as the biomaterials currently used are poorly degradable. The second is the processing of the biomaterials into scaffolds with defined pore size and shape. These obstacles can be overcome with the use of nanotechnology, such as three-dimensional printing and electrospinning. The properties of the biomaterials change when their size is reduced to nanoparticles level. The use of a small amount of nanomaterial mixed with a polymer matrix results in improved performance of the graft to an unpredictable level. Besides, the implementation of nanoscale structures in 3D skin tissue construction could control cellular activities, such as adhesion, propagation, etc. and they can be easily monitored for cellular performance too with their visual and magnetic properties. Nanoparticles can have a great potential on skin tissue engineering with their potential properties but extensive in vivo studies could make these nanoparticles dictate skin tissue formation in the future.

Keywords: Nanotechnology, Tissue engineering, Biomaterials, Scaffolds, Electrospinning, Nanoparticles, Skin, Wounds, Treatment

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