



Hair Follicle Stem Cells used in Wound Healing Process in Male Rats

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DESCRIPTION

The biologically intricate process of wound healing involves interactions between cells, extracellular matrix, and mediatory substances (growth factors and cytokines). An inflammatory cell-driven chain of events leads to the migration, proliferation, and creation of collagen strands by fibroblast cells. In the meantime, new epithelial layers are formed on the wound surface, and vasculogenesis causes new blood vessels to grow at the wound site, restoring blood flow. The oxygen pressure, low pH, and high lactate levels in the wound media are a few local variables that promote angiogenesis.

Additionally, some soluble mediators, such as transforming growth factor, basic fibroblast growth factor, and Vascular Endothelial Growth Factor (VEGF), are thought to be extremely potent angiogenic agents for endothelial cells. Through interactions with their receptors, VEGFs have an effect. The biological action of VEGF-A, often known as VEGF, is mediated via interactions with the receptors FLT-1 and FLT-2, which are preferentially expressed on vascular endothelial cells. VEGFR-2 appears to be the primary VEGF-A receptor and is the angiogenic factor.

Diabetes mellitus is a metabolic condition that persistent wounds and delayed wound healing are two prominent consequences of this sickness. Impairment in the inflammatory phase, reduced migration and division of fibroblasts, reduced angiogenesis, and increased wound proteases occur. Stem cell therapy and biomaterials can be advantageous to wound healing by encouraging growth and enabling cell migration. Tissue engineering is a young field that can assist in creating the biological components necessary for repairing and preserving the functionality of damaged tissues. The main principles of tissue engineering entail integrating living cells with a biodegradable natural/artificial scaffold to produce a live three Dimensional (3D) structure that functionally, mechanically, and physically resembles the tissue it replaces. In tissue engineering, the constituent materials of the scaffolds are crucial because they control cell migration, proliferation, and differentiation as a context material. Electrospinning can be used to design and

create nanoscale fibres that are close to the extracellular matrix's true size. Biomaterials, which can be divided into stem cell, scaffolds, drugs, and hydrogels, have transformed the fields of drug delivery and stem cell therapeutic applications. Collagen-derived matrices are among the commonly utilised scaffolds; for biological applications, electrospun nanofiber matrices like Polycaprolactone scaffold (PCL) and Poly-L-lactic Acid (PLA) are chosen. These scaffolds offer a 3D architecture that resembles the nanoarchitecture of stem cells and a face suitable for various biological processes.

PCL is an aliphatic polyester that can be easily electrospun and is biocompatible and biodegradable. The Food and Drug Administration has given it the go-ahead for use in human body parts. Due to its similar tensile strength to skin, PCL is a possible candidate for wound healing. Hair Follicle Stem Cells (HFSCs), which are found in the bulge region, can act as a cellular source for this purpose and can transform into epithelial compounds after skin damage. These cells can differentiate into many different types of cells, including keratinocytes and CD31-positive cells, and they have high rates of cell division. Due to their accessibility, ease of culture, lack of moral dilemmas, and lack of major histocompatibility complex class I expression, HFSCs are suitable. Human skin has a distinct anatomy from that of rodents. For instance, rodents' thin epidermis, weak skin adhesion, and dense fur hasten the healing of wounds. The subcutaneous panniculus carnosus-striated muscle, which promotes quick wound contraction, is one of the most notable variations. And lastly, compared to humans, rodents have stronger immune systems. Rodent and human skin structure differ significantly, but both are nonetheless extensively employed in the research of wound healing. They are excellent for large-scale investigations, especially when evaluating the effectiveness of novel therapeutics prior to clinical trials, because of their accessibility, low cost, and tiny size, which lowers statistical mistakes. HFSCs demonstrate a high rate of renewal. Usually, stem cells are gathered and used for therapeutic purposes. As a result, processing compromises the component's integrity, efficacy, and activity. Here, for the first time, evaluate the effect of utilising HFSCs with PCL nanofiber scaffold on

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skin wound healing in streptozotocin-induced diabetic rat models. Due to their potential to help diabetics, HFSCs have

the rare capacity to support PCL, which has been shown to hasten wound healing.