Journal Plastic Surgery and Cosmetology

Commentary A SCITECHNOL JOURNAL

Wound Healing is Characterized by Proliferation

Yamam York*

Department of Surgery, MedStar Union Memorial Hospital, Baltimore, Maryland, USA

***Corresponding author:** Yamam York, Department of Surgery, MedStar Union Memorial Hospital, Baltimore, Maryland, USA, E-mail: yamam@gmail.com

Received date: 29 March, 2022, Manuscript No. JPSC-22-56327;

Editor assigned date: 31 March, 2022, PreQC No. JPSC-22-56327 (PQ);

Reviewed date: 11 April, 2022, QC No. JPSC-22-56327;

Revised date: 21 April, 2022, Manuscript No. JPSC-22-56327 (R);

Published date: 28 April, 2022, DOI: 10.4172/jpsc.100033

Description

The skin is the largest organ of humans that acts as the first mechanical barrier between the organism and the external environmental, to protect organism against deleterious agents, control thermal regulation, and regulate water and electrolytes homeostasis. The morphologic structure of skin comprises two layers, the epidermis and dermis. The epidermis is the most external layer of the skin and is divided into four or five sub-layers, depending on the region of the body. Among the cells that constitute the epidermis are by far the major cell type, the keratinocytes, as well as melanocytes, Langerhans cells, and Merkel cells. The dermis is the layer of connective tissue that supports the epidermis, constituted by extracellular matrix proteins (collagens, elastin, proteoglycans, and glycosaminoglycan's) synthesized by fibroblasts. If there is a disruption of one or both layers of the skin, the organism starts the wound healing process to regenerate the injured area, involving cellular, molecular and biochemical mechanisms divided in three healing phases: inflammatory, proliferative, and remodeling. In this review, we discuss the physiologic mechanism of wound healing; the risk factors that affect healing and provides an update on the main therapies to treat skin wounds.

Pathological Healing

The proliferative phase of wound healing is characterized by the intense migration and proliferation of cells and synthesis of granulation tissue, comprised of provisional extracellular matrix, macrophages, endothelial cells, and fibroblasts. The cells in the injury secrete FGF, VEGF, EGF (epidermal growth factor), and TGF-β1 (transforming growth factor-β1) to promote the proliferation of fibroblasts, keratinocytes, and endothelial cells. Fibroblasts also synthesize compounds of provisional extracellular matrix, including type III collagen, proteoglycans and fibronectin, in order to support cell migration into the area. The restructuring of vascularization at the wound begins immediately after the injury, but has higher activity in the proliferative phase, providing oxygen and nutrients needed for the migration and proliferation of cells and synthesis of extracellular matrix compounds. Secreted mediators as VEGF and angiopoietins stimulate the proliferation of endothelial cells and restructuring of the vascular system at the wound site. During the proliferative phase, re-epithelialization occurs to close the epithelial gap and restores the barrier function of the skin. Firstly, the keratinocytes at the border of wounds are stimulated by growth factors, resulting in the proliferation and differentiation of the keratinocytes. This stimulus triggers the loss of keratinocyte adhesion molecules, inhibiting the physical contact with desmosomes and hemi desmosomes, and increasing the migration of these cells through the extracellular matrix.

As epidermis analogues, these therapies are suitable as temporary wound coverage in patients who lose a big part of their total body surface area, accelerating the wound epithelialization. However, there are some disadvantages such as long-time preparation, hyperkeratosis and scar possibility. When it is necessary a greater mechanical stability, dermal substitutes are more suitable than epidermal. Derma graft and transcyte are cellular commercial dermal substitutes composed by cultured allogeneic neonatal skin fibroblasts seeded in type I collagen/silicone film. These extracellular matrix analogues and their fibroblasts secrete growth factors and proteins that enhance epithelialization by the patient's keratinocytes in partial and full-thickness wounds. In some injuries, the treatment with epidermal (keratinocyte) or dermal (fibroblast) substitutes alone can result in improper healing. Thus, more sophisticated cellular skin substitutes have been developed, mimicking epidermal and dermal layers and providing growth factors, cytokines and extracellular matrix components for initiation/regulation of wound healing.

Neovascularization

Neovascularization represents an essential component in uncompromised wound healing due to its fundamental impact from the very beginning after skin injury until the end of the wound remodeling. The micro vasculature contributes to the initial hemostasis, reduces blood loss and establishes a provisional wound matrix. Blood clot-derived cytokines and growth factors drive the recruitment of pivotal cells that are crucial for the healing process. This provisional wound microenvironment depicts the starting point for new vessel formation and regeneration thereby ensuring the nutritive perfusion of the wound and the delivery of immune cells that remove the cell debris. At first sight, the neovascularization process seems very disordered as the healing wound generates a high density of functional as well as dysfunctional new capillaries. Nonfunctional vessels will regress by time via maturation or apoptotic processes. However, a distinct pattern of the neovascularization process can be described forming a circle with an inner ring of circularly organized vessels directly at the wound border followed by radially shaped vessels supplying the inner ones and connecting to the normal, uninjured skin. Disruption in the neovascularization process consecutively leads to wound healing disturbances or chronic ulcers, typically seen in venous insufficiency, arteriosclerotic disease or diabetic foot sores. This pathophysiological phenomenon deserves further attention. Recent research projects focus on blood vessel neo formation and/or delivery to the injury site in order to restore the perfusion and support the healing process. A prerequisite for these approaches is a profound understanding and acknowledgement of the underlying pathophysiological processes that lead to disturbed wound repair.

Scar formation demarcates the end of the last wound healing phase, e.g., the remodeling phase. In contrast to fetal wound repair, normal adult wound healing ultimately results in wound closure and replacement of the original tissue with a collagenous scar. The miracle of perfect, scar less embryonic wound repair is currently poorly understood.

The early-gestation fetus can heal skin wounds with regenerative-type repair and without scar formation. In scar less fetal wounds, the epidermis and dermis are restored to a normal architecture. The collagen dermal matrix pattern is reticular and unchanged from unwounded dermis. The wound hair follicle and sweat gland patterns are normal as well. Previous studies on fetal wound repair in sheep showed that wounds healed with complete skin restoration until the end of the second trimenon. In humans, however, scarring occurs earlier in fetal wound repair. This might be due to the specific response of fetal fibroblasts to the pro-fibrotic mediator TGF-β.

Scar formation is the ultimate outcome of wound repair in children and adults. Cutaneous scars have no epidermal appendages (hair follicles and sebaceous glands) and a collagen pattern that is distinctly different from unwounded skin. New collagen fibers secreted by fibroblasts are present as early as 3 days after wounding. As the collagen matrix forms, densely packed fibers fill the wound site. The ultimate pattern of collagen in scar is one of densely packed fibers and not the reticular pattern found in unwounded dermis.