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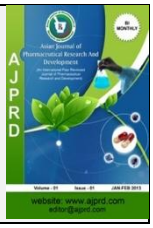

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Review Article

Review on Collagen as a wound healer.

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A B S T R A C T

In reaction to the tissue injury, normal wound healing process goes through inflammatory, proliferative, and remodeling stages. Impairments any one of these stages cause the wound to become chronic and non-healing, necessitating intervention to bring returning the process to its original state. Collagen, a fundamental has a role in the matrix extracellular an important function in wound healing regulation, whether in its native fibrillar form or in the wound as soluble components environment. Collagen has been used as an additional wound treatment to aid healing since it is involved in the control a combination of a few of these processes. The importance of collagen in various biological processes related to wound healing is discussed in this paper, additionally to a survey of the existing research in regards to the utilization of collagen-based wound care. There are several techniques to developing recommendations, but no gold standard has emerged so till now.

Keyword: Collagen; matrix; inflammatory; proliferative; remodeling; MMPs.

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INTRODUCTION:

Because wounds, particularly chronic wounds, are causing a growing concern, recommendations should be developed as soon as possible. Wound care on the spot throughout the previous few decades, due to which the way wounds are treated has evolved considerably. Hundreds of various dressings that have been created based on the notion of moist wound healing. Choosing the best option dressing for specific wound needs significant thought as well as knowledge. [1,2]

Collagen is a structurally and functionally important extracellular matrix protein which is also present in scar tissue& utilized during connective tissue repair. Several dressings made of collagen are developed to aid wound healing, especially in the case of non-infected, chronic, and Skin lesions that are slow to heal.

Due to substantially differed claimed benefits and mechanisms of action, as well as future advancements and evaluations of collagen dressings. The concept of 'critical colonization", Alternatively, it is commonly means an excessive local bioburden functions as a prelude to infection. but is not accurately measurable is evolved.[3]Dermis has been reconstructed using both synthetic and natural polymers. Collagen has just been rediscovered. Collagen stimulates cellular proliferation and differentiation by acting as a natural substrate for cellular adhesion, growth, and differentiation.

The usage dressings made of collagen becoming more popular, but with limited and insufficient scientific evidence. In this review we have discussed various stages of wound healing, collagen as an important component in the wound healing along with its application in different types of wounds.

Types of wounds: -

Injuries to the skin and other bodily tissues are known as wounds. Cuts, scratches, scrapes, & perforated skin are among them. Wounds are commonly caused by accidents, but they can also be caused by surgery, sutures, and stitches. Minor wounds are typically not dangerous, but they must be cleaned. Serious & infected wounds may necessitate immediate medical attention and a trip to the doctor. If the incision is deep, you can't close it yourself, you can't stop the bleeding or to get the dust out, or it doesn't heal, you should seek medical help.[4]

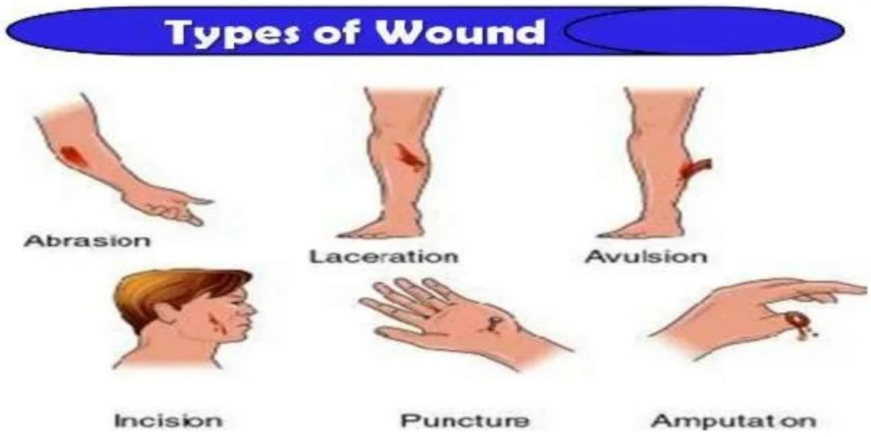

Figure1: Types of wounds

This are the types of wounds as show in the above figure 1.

1. Laceration is a term that describes uneven tear-like wounds created by physical trauma.
2. Abrasions are minor wounds whereby the top layer of skin is scraped away.
3. Avulsion injuries occur when a bodily structure is yanked away from its natural insertion place.
4. Puncture: An instrument puncturing the skin causes a puncture wound.
5. Penetration wound: A penetrating wound is one that is created by an item entering and exiting the skin, such as a knife.
6. Gun shot: A bullet causes a gunshot.
7. Closed wound: Hematomas (blood tumors) are caused by a blood artery being injured, causing blood to pool beneath the skin.

Stages of Wound Healing.

Hemostasis:

Hemostasis and inflammation are part of the wound's inflammatory phase healing. When collagen is exposed consequently an injury, it triggers the clotting cascade, resulting in a fibrin clot that stops the bleeding. (Shown in fig 2) Collagen I and IV fragments can operate as effective chemo attractant for neutrophils, increasing phagocytosis and immunological responses, and regulating gene expression, making them potential mediators of inflammation. Inflammation is a vital component of the normal wound healing process because it stimulates the proliferation of fibroblasts, which produce collagen and ECM.[1,4]

Clotting is the process of closing a wound.

1. It occurs quite rapidly.
2. Begins with blood leaking from the body, which causes tightening of blood vessels, restricting blood flow.
3. Within seconds of the epithelial wall of the blood vessel rupturing, platelets aggregate and stick to the topography of the sub-endothelium.
4. After that, after around sixty seconds, Fibrin strands begin form to bind.
5. Because of the fibrin mesh takes shape, Prothrombin production and procoagulants change the blood from liquid to gel.
6. Platelets and blood cells are stuck in the wound region due to the emergence of a thrombus or clot.

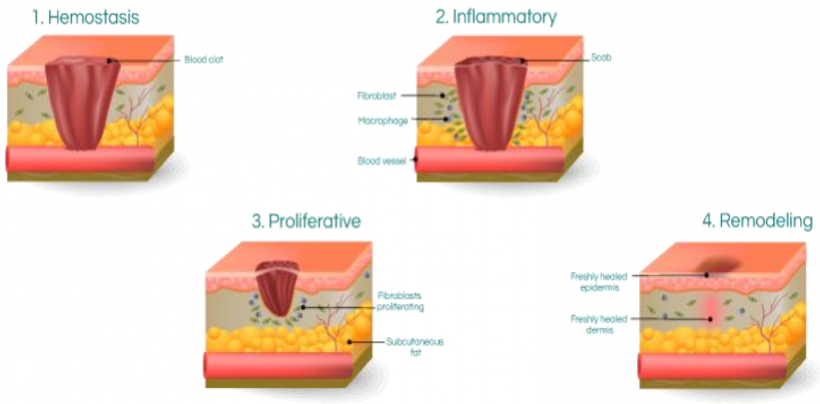

Figure 2: Stages of wound healing.

Inflammatory phase:

The cardinal indicators of the inflammatory phase are rubor (redness), color (warmth), he terms tumour (inflammation), dolor (pain) and, and functiolaesa are all used to describe the same thing (functioning) (loss of function). Hemostatic mechanisms and routes begin almost immediately after an acute skin injury. Injury to vascular tissue causes reflex vasoconstriction, which extrinsic coagulation is started cascade. Tissue factors and calcium activate factor VII, which then activates the whole coagulation cascade, resulting in blood clotting and constriction. This stops any further blood loss as shown in figure 2. [4,16]

Vascular permeability is increased as vascular endothelial gaps widen, allowing plasma proteins to functionfluid to escape into the interstitial space. These alterations are aided by PGE2 and prostaglandin F2a, which promote the presence of inflammatory cells into the injured region.

This results in a rise in local temperature (color), which supports a microorganism-hostile environment. Prostacyclin, PGE and PGE2 operate on nociceptors in the periphery to perceive dolor (pain).[3,4]

Proliferative phase

Fibroblasts migrate inward across the fibrinous matrix from wound edges. Basic fibroblast growth factor (bFGF) & tumour growth factor-b from macrophages, as well as platelet derived growth factor (PDGF) from platelets, stimulate them. The primary extracellular constituents of granulation tissue are glycosaminoglycans (hyaluronic acid), proteoglycans, &collagen, which are produced by fibroblasts in the first week as a result, in the wounded tissue, fibroblasts become the most frequent cell type. PDGF, tumour growth factor-b, Insulin-like growth factor-1, bFGF, and keratinocyte growth factor are all cytokines produced by proteoglycans and collagen, in addition to glycosaminoglycans. From the wound margins, fibroblasts move inside via the fibrinous matrix. They are stimulated by macrophage-derived growth factors basic fibroblast growth factor, for example (bFGF) and tumour growth factor-b, as well as platelet-derived growth factor (PDGF) from platelets.[4]

Maturation phase

The haphazardly deposited newly generated collagen in the granulation tissue is indicative of newly created granulation tissue (described earlier). Collagen is then transformed into a more ordered structure with greater tensile strength as a result. Type I collagen gradually takes the place of collagen type III until the natural a 4:1 skin ratio is reached. Collagen production and matrix metalloproteinase collagenolysis reach a stable level while remodeling occurs. Approximately one year following damage, tensile strength reaches a plateau of 80% of its former strength.

Role of collagen in burn cases:

There are times when a temporary cover covering raw wounds is required in surgery. Burning, Amputation, trauma, and persistent ulcers, leprosy, and skin transplant sites are all examples of skin loss. The body requires its own period for regeneration, and issues resulting from the loss of skin layer are always possible.[5,6]

The epithelium's orderly development over denuded regions require the layer with collagen sheet that function as a scaffold from which to develop and organize itself. Denuded regions are unable to adequately do this, resulting in significant scarring and even keloids. Denuded regions require a temporary cover for these reasons until the body is ready to generate its own cover.[9,11]

Desamidation - Collagen is a one-of-a-kind substance and generally underutilized method for creating chemically modified collagen. Desamidation of such wastes provides a significantly better yielding supply of solubilized collagen.[6]

Our goal is to examine the value of deamidated collagen like a biomaterial, notably as a drug carrier, a hemostat, and a wound cover. Vitamin A, vitamin C, 50 percent glucose, and gentamicin were tested for their efficacy when administered topically to an open wound. Any biomaterial must be non-toxic towards the biological environment in which it is used.[6,10]

Healing of burn wounds:

The goal of the entire burn team is to accomplish wound care, proper nutrition, function maintenance, a positive attitude, and patient cooperation.

i. Promote spontaneous healing
ii. Prevent infection
iii. prevent additional tissue loss
iv. Identify the need for surgery early
v. Relieve the patient's pain and worry.[14]

Ideal dressing for burn wounds:

Burn wounds are treated using a variety of biologic, biosynthetic, and synthetic dressings, depending on the state of the wound bed and the dressings' intrinsic qualities.[17]

The following characteristics define an optimal burn dressing:

1. Prevent physical injury and microorganisms from entering the wound.
2. Be at ease, obedient, and long-lasting.
3. Allow gaseous exchange and be non-toxic, non-adherent, and non-irritant.
4. Let the wound absorb a lot of moisture.
5. Be able to work with topical anti-inflammatories
6. Be able to enable maximal activity for the wound to heal without delaying or hindering the healing process at any stage.[6,7,12]

Role of collagen in wound care

Collagen dressings may seem tempting since they can:

1. block or deactivate MMPs.
2. Increase the proliferation and penetration of fibroblasts.
3. Assist in the absorption and bioavailability of fibronectin
4. Cells such as leukocytes, macrophages, fibroblasts, & epithelial cells will be retained.
5. Assist with the wound's chemical and thermostatic microenvironment. [6,8,10]

Case study: On Collagen as Wound Healer:

S.S., an 80-year-old patient, was taken to the hospital with discomfort in both toes, with the pain being particularly severe with in second toe of both the left foot as well as the mid toe of right foot. The patient reported no vascular system discomforts, such as circulation problems in the lower limbs. The pains began following chiropodist therapy, that is, after the patient's toe nails were clipped and treated. The patient was evaluated by a surgeon at another hospital before being admitted to our institution.[5,6,16]

We discovered:

1. Insufficient circulation inside the second toe of left foot as well as the middle toe of right foot during the examination.
2. Distal necrosis & infection at the toes' tips. [13-15]

Observation and therapy:

Treatment of the wound surgically

1. Using local anesthetic, debridement was conducted up to the healthy tissue, as well as excision of the tips of the distal phalanges on the afflicted toes.
2. The wound was not bandaged.
3. Vitamin A (1 ml), vitamin C (5 ml), 50 percent glucose (10 ml), and gentamicin were all given locally to the open wound, followed by a collagen sheet-biological cover (layer).
4. Over the biological cover, the remaining vitamin A, vitamin C, 50 percent glucose, and gentamicin were applied.
5. Five layers of gauze were then applied to the wound.
6. The patient was released from the hospital and returned to work, albeit with certain limitations in terms of movement in order to prevent mechanical sliding of the collagen cover over the wound.
7. Wound bandaging was done every other day for the first month, with the addition of the prescribed medications.
8. Wound bandaging was continued every fourth day after a month.
9. Only when there was an adhesive surface disturbance between the wound and the collagen layer itself did the collagen cover slide (collagen layer sterility was disturbed by contact with the greater surface of the skin layer).
10. The presence of exudate or mechanical sliding during the patient's movement caused adhesive surface disruption. [6,10,11]

CONCLUSION:

There are several methods for speeding up the recovery of cutaneous wounds. The discovery of in vitro regenerate skin that can be transplanted immediately to the wound and replace damaged tissue permanently has piqued curiosity in the recent decade. Neither available commercially products nor those in clinical studies can fully replace real live skin. However, a substantial amount of effort has gone into replenishing the lost connective tissue matrix that constitutes the human dermis, which is the most important component of any incision. In addition, because collagen provides a protective coating, the risk of infection is low.

Collagen may aid wound healing by acting as a decoy/sink for raging MMPs as well as other enzymes in the wound, decrease inflammation and restoring progression into to the reparative stages; a substrate aiding in the migration of key cellular elements of healing process; or even a promoter of a proangiogenic, anti-inflammatory surroundings to resolve the injury towards healing.

Conflict of Interest - "The authors declare that they have no conflict of interest".

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