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CHRONIC WOUND HEALING GEL USING SILVER NANOPARTICLES

Monisha A [1], Shareen M [2], Sneha V[3] ,Sowmiya V[4], sweatha N[5]

[1,2,3,4], 8th semester , Department of Biomedical Engineering
[5], Assitstant professor , Department of Biomedical Engineering

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Abstract – *This paper aims at the idea of developing a wound healing gel using silver nanoparticles for treating chronic wounds and deep cuts. This technique achieves recovery the injured parts and reducing the scar to the minimum. Metal nanoparticles like silver, gold and zinc are increasingly being used for treating the bacterial infections. This paper is about how silver nanoparticles are being used for the treatment of chronic wounds and other deep cuts.*

***Key Words*: wound healing, chronic wound, nanoparticles, gelatin, hydrogel.**

1. INTRODUCTION

This Wound healing involves three biological stages: inflammation, which usually lasts up to six days, proliferation, which typically covers the following two weeks and remodeling which continues for up to two years. It is important to mention that in vivo the phases overlap due to several anatomical and physiological factors such as the constant intercellular signaling that implies real-time feedback control of pro-inflammatory and anti anti inflammatory cytokine release. The inflammatory phase begins with a vascular response that ensures hemostasis through the formation of blood clots. Secondarily, distress molecules released by injured cells act as chemoattractansfor leukocytes which exhibit two main functions: recognition and destructionof infectious agents and it releasecytokine r that stimulates cells involved in the proliferative phase. The moment when granulation tissue begins to cover the wound surface marks the transition to the proliferative phase. Key factors in the second stage are represented by activation of fibroblasts which produce collagen and other extracellular matrices, as well as by neoangiogenesis. The third phase, of remodeling stores the morphology and function of the tissue

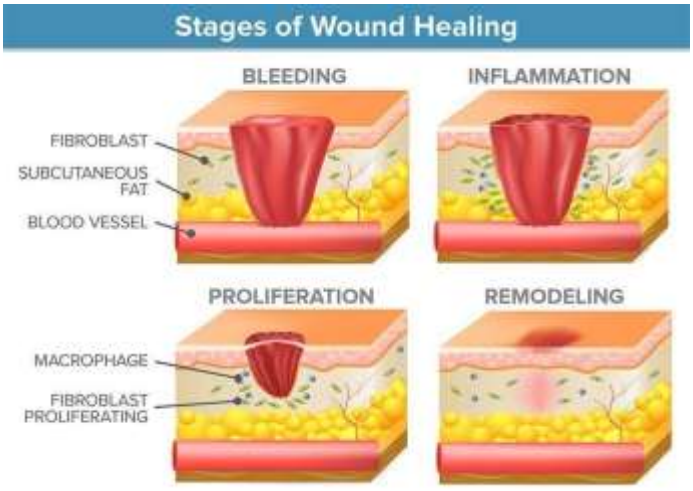


figure 1: wound healing stage

The physiology of the healing process may be perturbed by both external and internal factors such as necrotic tissue, contamination with pathogens and foreign material. Chronic wound infection are commonly polymicrobial, due to synergistic bacterial development patterns.

Hydrogel consists of a polymeric network with numerous hydrophilic groups that cross-interact, forming a three dimensional matrix which traps liquids, such a water. Hydrogel based wound dressing overcome the limitation of classical dressing by creating a moist environment.

Silver products are commonly used in infected chronic wounds and burns dressings, due to release of silver ions that will exhibit an antibacterial effect. Silver ions bind to thiol groups causing bacterial cell. Silver compounds are effective against bacteria as well as bacterial biofilms. After demonstrated chronic wounds are characterized by a local depletion of growth factors.

2. COMPONENTS

The major components used for preparing the gel is,

Silver nanoparticles

Gelatin

Hydrogel

Chitosan

figure 2: silver nanoparticles

Silver nanoparticles: Silver is the soft, white and transition metal, the size of silver nanoparticles is between one nanometer and hundred nanometer, silver is composed of large percentage of silver oxide, commonly used silver nanoparticle are spherical, diamond and octagonal. Silver nanoparticle have unique optical, electrical and thermal properties. The biological activity of silver depends on the factor include size, size distribution, shape, particle morphology, particle composition and efficiency of ions.

figure 3: gelatin

Gelatin: gelatin is the colourless, flavourless and it is derived from collagen taken from animal body parts and a mixture peptides and proteins, it is the hydrolyzed form of collagen. Gelatin are biocompatible and non –immunogenic substrate of matrix metalloproteinase. Gelatin are commonly two types, they are gelatin A and B have been used as wound healing biomaterial.

Hydrogel: A hydrogel is a network of polymer chains that are hydrophilic, sometimes found as colloidal gel, hydrogel coated wells have been used for cell culture. Self healing hydrogels are special type of polymer hydrogel. It is a macromolecular polymer gel, self-healing refers to the spontaneous formation of new bond when old bond within a material.

Chitosan: Chitosan is a linear polysaccharide composed of D-glucosamine and N-acetyl-D- glucosamine, it is made by chitin shells of shrimp and other alkaline substances, like sodium hydroxide. Chitosan as a number of possible biomedical uses it can be used in a self-healing polyurethane paint coating. In medicine they used to prevent bleeding and act as antibacterial agent

3. METHODLOGY

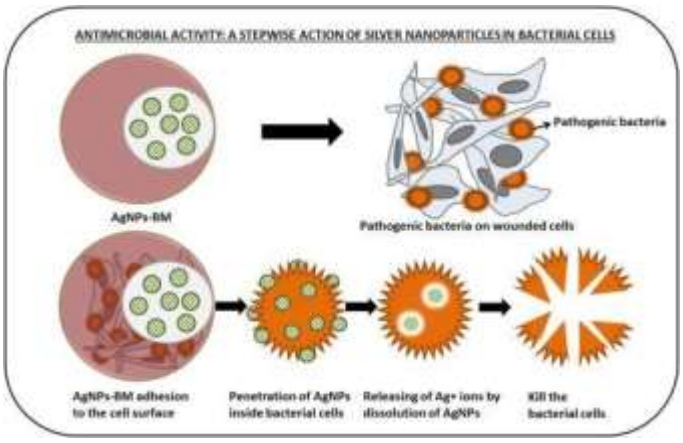
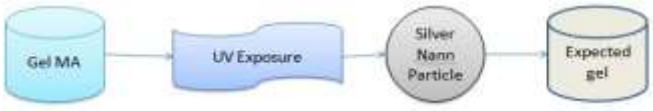


figure 4: methodology of silver nanoparticles

Gelatin is a substance, which is collected from an animal body, having a collagen property and solid in nature. It should be exposed to UV (uv-b) in the range of 200nm to 315nm. After that, methyl acrylate is added to increase the collagen property. The silver should be converted to nanoparticles and the converted particles are mixed with the GEL-MA (gelatin-methyl acrylate). The resulted gel is used for enhancing the skin and healing faster than the skin and healing normal wound healing by using gel.

4. PREPARATION OF GEL

Wound healing gel was prepared by using silvernanoparticles is added to a gelatin which is act as a biomaterial and recovered the wound, it is a biocompatible material and it does not cause any harm to the subject



I The gelatin is the solid substance to make it as a gel we put the gelatin in UV exposure ranging from 215 to 300 nm of five minutes and the gel is mixed with methyl acrylate is an organic compound it is a colourless liquid with a characteristics acrid odor. The gel is mixed with silver nanoparticles, silver has antimicrobial and antifungal property so that it heals the wound much faster when compare to all other gels, after few weeks we get a complete gel which is used for chronic wound healing.

5. CONCLUSION

In this paper I have proposed a method for the preparation of chronic wound healing gel, it has explain the concept and use of silver nanoparticles for the healing of wounds and deep cuts. Excellent wound healing efficiency of silver Nano gel in comparison to traditional formulation, nano-silver gel using biosynthesized silver nanoparticles is a highly effective formula towards wound healing

ACKNOWLEDGEMENT

Chronic injuries are caused because of accidents, trauma and other conditions which cause severe injury, lifetime pain, and inflammation. Chronic injuries are not completely cured by the normal wound healing gel. So these silver nanoparticles are used for chronic and other injuries. Since silver is a natural antimicrobial agent, it can heal the wound and clear the microbes. But for some people the silver act as a toxic substance. And

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