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A REVIEW ON ADVANCED WOUND CARE PRODUCTS AND THEIR CLINICAL APPLICATIONS

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ABSTRACT

Because of inadequate biological signalling, the intricate organic process of wound healing is frequently slowed down in chronic and non-healing wounds. Traditional mechanical running is proposed by outdated remedies like coil bandages and covering inserts, but they lack the bioactive components needed for well-organized tissue regeneration. Due to recent advancements in reformative medicine, secretum-loaded biomaterials have emerged as a useful adjunct to conventional wound care methods. Cells such as mesenchymal stem cells create the secretum, which contains bioactive chemicals such as growth effects, cytokines, and extracellular vesicles. These particles are essential for skin growth and renewal as well as for controlling inflammation.

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INTRODUCTION

The complex process of wound healing involves several overlapping phases, including haemostasis and bleeding, inflammation, proliferation, and remodelling. Any injury to the caused by burns and heart damage, diabetes, mechanical trauma and injury, genetic disorders, or surgery. varied wound types call for varied treatment approaches, depending on the hospital and the physician. Our skin shields us from the weather and against microbial invasion. Different wound kinds require different treatment strategies, which vary based on the hospital and the doctor. he complex process of wound healing involves several overlapping phases, including haemostasis and bleeding, inflammation, proliferation, and remodelling. Any injury to the skin can lead to infection because it lets bacteria into the body. Wounds are caused by damage and any disturbance of the normal structure and function of the skin, and they are often caused by burns and heart damage, diabetes, mechanical trauma and injury, genetic disorders, or surgery. varied wound types call for varied treatment approaches, depending on the hospital and the physician [1]. Our skin shields us from the weather and against microbial invasion. Different wound kinds require different treatment strategies, which vary based on the hospital and the doctor. They require an extended period to heal (more than 12 weeks) and often never go back to a normal, healthy state. In addition, the layers and areas of skin affected by a wound are used to classify it. Burns are serious injuries that can cause intense pain and even death. These lesions of the skin tend to be the most difficult to diagnose and treat clinically [2]. In reality, they provide challenges not only for pain but also for the restoration of patient functionality and cosmetic healing. Wound healing is influenced by a variety of internal and environmental variables. Bioactive compounds enhance wound healing by tissue regeneration, cellular response regulation, and inflammation reduction [3].

1. PHYSIOLOGY OF WOUND HEALING PROCESS

Cells, growth factors, and cytokines work together to seal the wound during the healing process. The four phases of wound healing include remodelling, proliferation, inflammation, and haemostasis. The organism's quick reaction to an injury is called haemostasis, and its goal is to halt blood loss. Platelets that form blood clots influence this phase. After the injury occurs, the second stage, known as the inflammatory phase, starts and can continue for up to six days [4]. The cells in charge of this stage, neutrophils and macrophages, remove tissue fragments and foreign objects from the wound. At this point,

fibroblasts and myofibroblasts are stimulated by the production of cytokines and enzymes [5].

The exudate gives the wound the moisture it needs to heal. Reactive oxygen species (ROS) are produced by inflammatory cells and are more prevalent in burns and chronic wounds. ROS stops bacteria and other germs from penetrating. Proliferation is the following stage, which starts four days after the damage and can continue for up to fourteen days. Granulation tissue development and reepithelialization take place during this stage and lastly, the formation of the extracellular matrix (ECM). Last but not least, collagen-based crosslinking creates a tight 3D network during the remodelling phase, boosting the resultant tissue's tensile strength. The process of wound healing can be influenced by a number of things. They are listed and can be separated into systemic and local categories [6].

2. CHALLENGES OF WOUND HEALING

It is a primary cause of delayed wound healing, biofilm stimulates constant inflammation, which releases extra MMPs that destroy the ECM. When patients are unable to comply, it becomes even more difficult to control the healing environment. Patients with chronic wounds would rather have their care managed solely by their physician or nurse since they are afraid to touch their own wounds [7]. Wounds may be exposed to the home during treatments that require patients to change their own primary bandages, which could result in contamination. Research in the medical field indicates that when therapies need less intervention, patient adherence improves [8]. Periplasm and Perplex can assist in removing the need for patients to change their primary dressings at home. Medical research indicates that when therapies call for less intervention, patient adherence increases.8 Between patient treatments, Periplasm and Perplex can assist reduce the need for at-home primary dressing changes and therapies [9].

3. BIOFILM & BIOBURDEN

Delayed recovery Biofilm triggers Biofilm is thought to be the primary source of ongoing, persistent immune-mediated inflammation in wounds. Although sharp debridement is necessary, it cannot stop biofilm re-formation or regulate microbial growth on its own. In order to manage bioburden and biofilm regrowth, it should be paired with a native ECM scaffold that offers broad-spectrum antimicrobial efficacy within the product.

4. NOVEL APPROACHES OF WOUND HEALING

Numerous physical, chemical, biological, and microbiological elements interact to promote faster wound healing, and an interdisciplinary bridge helps offset the variables that slow wound healing. The most obvious elements that have a significant impact on wound healing are mainly.

5. HYDROGELS: MECHANISM EFFICACY AND SAFETY

A moist wound environment is essential for the best healing results, and hydrogels, which are made of networks of hydrophilic polymers, are renowned for their capacity to hold onto enormous amounts of water [10]. Hydrogels are especially helpful for wounds with low to moderate exudate because they can absorb extra fluid while keeping a gel-like consistency by reacting with the exudate [11]. Additionally, hydrogels can be used as vehicles for medicinal substances like enzymes, growth factors, or antibiotics, facilitating their gradual release and speeding up the healing process. For example, amorphous hydrogels are free-flowing gels that may be applied directly to the wound, which makes them perfect for cavities or wounds with uneven shapes.

6. ABSORBABLE GELATIN SPONGES

Since its invention in the early 1900s, absorbable gelatine sponges have been a mainstay of surgical haemostasis. They were initially intended to offer a dependable way to stop bleeding, particularly in circumstances when mechanical techniques like cautery or sutures might not be adequate or feasible. Gelatine sponges' composition and production have improved throughout time, increasing their efficacy and versatility across a range of surgical specialties [12].

7. OXIDIZED REGENERATED CELLULOSE (ORC)

In advanced wound care and surgical settings, oxidized regenerated cellulose (ORC), a bioabsorbable haemostatic agent, is frequently used. The most prevalent biopolymer in nature, cellulose, is converted into ORC by an oxidation process that preserves its bio absorbability while improving its haemostatic qualities. Because of its adaptability and biocompatibility, ORC is crucial for wound care, particularly in situations when traditional techniques are impracticable or infection risk is high. A bioabsorbable haemostatic substance, Oxidized Regenerated Cellulose (ORC) is made from cellulose, the main structural polymer present in plant cell walls. Usually, regenerated cellulose from cotton or wood pulp is oxidized to create ORC.

8. COLLAGEN DRESSINGS

Collagen dressings use the body's natural healing processes to naturally occurring protein that supports structure and promotes tissue regeneration Advanced wound care products called collagen wound dressings are made to speed up the healing of a variety of wounds, especially chronic and non-healing ones. An essential part of the Extracellular Matrix (ECM), collagen is a regulate wound exudate, lower inflammation, and encourage the growth of new tissue. They work especially well on wounds when the body's natural healing mechanisms are compromised, like pressure ulcers, diabetic foot ulcers, and venous leg

ulcers. In order to replace damaged tissue and restore the integrity of the skin, they first offer a scaffold for the deposition of new cells, such as fibroblasts and keratinocytes, which are essential for wound closure and tissue regeneration [13].

9. STERILIZED BONE WAX

surgery for more than a hundred years. Its main application is in orthopaedic, neurosurgery, and maxillofacial operations where homeostasis treatments may not be as successful in controlling bleeding from bone surfaces as typical sterilized bone wax. In 1892, neurosurgeon Sir Victor Horsley invented bone wax because he sought a way to stop bleeding from cancellous bone. Bone wax is still used because of its special qualities, which include its ability to physically block blood flow from the bone, its ease of use during surgery, and its low biological reactivity.

10. SILICONE GEL SHEET

Silicone gel sheets are among the most widely used non-invasive treatments for keloid and hypertrophic scars. These sheets come in a range of sizes and shapes and are made to fit certain scar locations, such as joints or large surface areas. Several theories have been proposed in light of scientific research and clinical experience, even if the exact mechanisms by which silicone gel sheets improve scar results are not fully understood. Additionally, silicone sheets are believed to regulate the temperature and pressure around the scar site, which may have an impact on fibroblast activity and collagen regeneration [14].

11.CLINICAL APPLICATIONS

Because bioactive chemicals can alter some biological processes that are necessary for tissue regeneration, they are being incorporated into clinical wound treatment regimens more and more. Among these, growth factor-based treatments have shown considerable therapeutic benefit, including recombinant platelet-derived growth factor (PDGF-BB) and epidermal growth factor (EGF). Notably, the FDA has licensed PDGF-BB gel (becalming) to treat diabetic foot ulcers, and numerous randomized controlled trials (RCTs) have shown that it improves wound closure rates and speeds up recovery. Similar to this, EGF formulations have been used to treat burn injuries and pressure ulcers, mainly by promoting angiogenesis and epithelial regeneration. In practical practice, advanced bioactive dressings that contain antimicrobial agents-such as iodine, medical-grade honey, and silver nanoparticles-are frequently used to reduce infection and encourage the creation of granulation tissue. According to RCTs, honey-based dressings exhibit broad-spectrum antibacterial activity and dramatically shorten the healing time for surgical wounds and venous leg ulcers. Peptides such as thymosin beta-4 are also being investigated for their capacity to stimulate keratinocyte migration, modulate inflammatory signalling and promote extracellular matrix remodelling, all of which are pivotal for effective wound repair. An illustration of infected wounds being treated using natural bioactive substances [16].

12. RECENT ADVANCEMENTS AND CLINICAL TRAILS IN WOUND HEALING

Silver In addition to being one of the most recent developments in the field of antimicrobial prophylaxis, the use of silver to prevent and treat infection is among the oldest methods of wound care, dating back to 69 BC. Numerous new silver-containing wound products have been developed to take advantage of the benefits of silver's broad-spectrum coverage, particularly in organisms resistant to antibiotics, while making sure that the delivery method is as effective as possible and has the fewest negative effects. Negative Pressure Wound Device: Thirteen years ago, the first publication detailing the application of a negative pressure wound device (NPWD) in a series of patients was published. Although there have been some small technological advancements in the device itself, the indications for use have seen the biggest alterationsSkin SubstitutesWith the development of biomaterials and tissue engineering techniques, there have been notable advancements in both temporary and permanent wound covering. The primary indication for these products is burning wounds. The problem of covering huge wounds has arisen as a result of improvements in critical care management and burn resuscitation, which have allowed more people with severe burns to survive [17]. Growth Factors and Biologic Wound ProductsAs our knowledge of the specifics of the wound healing response has grown, so too has the field of biologic wound products. The inflammatory, proliferation, and remodelling/maturation phases of wound healing follow a systematic, predictable order.

Hyperbaric oxygen

For forty years, this therapy method has been employed as a supplement to wound healing. Over the course of several treatments, the patient is placed in a sealed chamber and 100% oxygen is pressured to 1.5 to 3 atmospheres absolute (ATA) for 60 to 120 minutes. is prostaglandin E1, which promotes vasodilation by relaxing vascular smooth muscle, lowers blood viscosity, stimulates the generation of tissue plasminogen activator, and inhibits platelet and neutrophil activation.

Advanced Dressings

While plain gauze is still the most commonly used dressing in hospitals today, new wound understanding and technology have produced advanced products that help the body achieve the ideal moist, warm, protected wound healing environment [18].

13. SAFETY CONSIDERATIONS

A crucial component of healthcare is wound care, which necessitates careful consideration of patient safety. In addition to speeding up healing, proper wound care dramatically lowers the chance of

complications. We will discuss the significance of patient safety in wound care in this blog, with a focus on risk reduction, infection control, and best practices.
Importance of Patient Safety in Wound Care.The Value of Patient Safety in the Treatment of Wounds.In wound care, patient safety entails taking precautions to avoid injury and guarantee security during the course of therapy. This entails preventing infections, reducing discomfort, and making sure wounds heal appropriately. The health of the patient depends on a safe wound care setting, which can also stop additional health issues.
Best Practices in Wound Care
Assessment and Planning:
Thorough Assessment Start with a thorough examination of the wound, taking into account its size, depth, location, comorbid conditions, exudate characteristics, periwound state, pain level, and wound type. Recognize the patient's general health, including any underlying ailments that could impede recovery.
Individualized Care Plan: Create a customized treatment plan that takes into account the wound's and the patient's unique requirements. Update the strategy frequently in light of the wound's healing [19].

14. WOUND DRESSINGS

by taking advantage of the natural wound types seen in the body, especially chronic and non-healing wounds. Advanced wound care solutions called collagen dressings use this naturally occurring protein to speed up the healing of a variety of wounds, especially chronic and non-healing ones. Collagen dressings encourage the development of new tissue, lower inflammation, and treat wounds. Collagen is a naturally occurring protein that is an essential part of the Extracellular Matrix (ECM), offering structural support and facilitating tissue regeneration and healing capabilities. Advanced wound care solutions called wound dressings are made to improve the healing of different Extracellular Matrix (ECM) components by supporting structural integrity and promoting tissue regeneration. Collagen dressings help the body's natural healing processes by promoting the growth of new tissue, lowering inflammation, and managing wounds. Traditional, passive, and modern wound dressings are the three general categories into which wound dressings fall. In ancient times, traditional wound dressings were made from plant and tree leaves, spider webs, and honey to stop bleeding.
and keep the wound from coming into contact with the outside world.67 Passive dressings (such bandages, cotton pads, and sterile gauze) can only cover the surface of the wound and absorb exudates; they may stick to the newly formed granular tissue and hurt to remove. Nevertheless, they are the most commonly used therapeutic dressings because of their inexpensive cost and straightforward manufacturing procedure. Foams, films, hydrocolloids, and hydrogels are examples of contemporary wound dressings. Because of their increased endurance and reduced cost, these wound dressings can be made of synthetic materials or extremely biocompatible and biological materials like collagen.68,69 Additionally, a lot of attention has been paid to wound dressings that contain cells and growth factors, like Altigraph (Organogenesis Inc., MA, USA), which is the first engineered skin.

15. FUTURE PROSECEPTS AND DIRECTIONS

Advanced wound care is rapidly evolving through emerging technologies that aim to improve healing outcomes and expand treatment options. Nanotechnology has become a promising area of research, with nanomaterials such as nanoparticles, nanofibers, and nanoscale hydrogels being developed for targeted delivery of drugs, growth factors, and antimicrobial agents directly to wound sites. These systems enhance drug stability, controlled release, and bioavailability while reducing infection risks. Silver nanoparticles exhibit strong antimicrobial activity, whereas liposomes, dendrimers, and gold nanoparticles support tissue regeneration and wound repair.
Gene therapy also offers significant potential by enabling the targeted delivery of genes encoding bioactive proteins such as fibroblast growth factor (FGF) and vascular endothelial growth factor (VEGF), thereby promoting angiogenesis, collagen synthesis, and tissue regeneration, particularly in chronic wounds. Furthermore, smart wound dressings integrated with bioactive compounds and sensor technologies can respond to physiological changes and provide real-time monitoring. Hydrogel and hydrocolloid-based smart dressings combined with micro-electromechanical systems represent a promising future direction for personalized wound management and improved therapeutic outcomes [20].

16. CONCLUSION

In summary, advancements in biomaterials, drug delivery systems, monitoring technologies, regenerative medicine, and sustainable practices are opening the door to better patient outcomes, making the future of advanced wound care extremely promising. These developments will improve the quality of treatment for people with complex and chronic wounds by creating safer, more individualized, and more effective wound care solutions. Treatment may take a while, depending on the type of wound, and in the worst situation, there may be no improvement and amputation may be necessary. There are numerous therapy approaches, but none of them are 100% effective, as the review makes clear. As a result, wound care is still regarded as an unmet therapeutic need, and both academia and industry are looking for more effective methods. Growth factors and cytokines generated by platelets and leukocytes are currently the subject of extensive investigation because they have a major impact on cellular processes like migration, differentiation, and proliferation and can control the wound healing process. Depending on the type of

wound and its location, wound dressings are the most affordable and easily available form of wound care. Antibacterial, biocompatible, non-toxic, stable, hydrophilic, and swelling are all desirable properties for a wound dressing. The use of smart materials as scaffolds and improved, less demanding wound healing processes, along with controlled medication, growth factor, and cell release, may offer hope for wound treatment. It is an excellent scaffold for wound healing since it is strong, elastic, light, antimicrobial, electrically and thermally conductive, and inexpensive. It is making its way into medical equipment and surgical implants.

17. AUTHOR CONTRIBUTIONS

All authors are contributed equally.

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19. DECLARATION COMPETING INTEREST

The authors have no conflicts of interest to declare.

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21. REFERENCES

1. Pan H, Fan D, Cao W, Zhu C, Duan Z. Preparation and characterization of breathable haemostatic hydrogel dressings and determination of their effects on full-thickness defects. Polymers (Basel). 2017;9(12):727.
2. Finnegan S, Percival SL. Clinical and antibiofilm efficacy of antimicrobial hydrogels. Adv Wound Care (New Rochelle). 2015;4(7):398-406.
3. Hwisa NT, Gindi S, Rao CB, Katakam P, Chandu BR. Evaluation of antiulcer activity of *Picrasma quassioides* Bennett aqueous extract in rodents. Vedic Res Int Phytomedicine. 2013;1:27.
4. Kiranmai M, Renuka P, Brahmaiah B, Chandu BR. Vitamin D as a promising anticancer agent. Int J Res Pharm Chem. 2012;2(2):636-649.
5. Sreekanth N, Awen BZ, Rao CB. Development and validation of new analytical methods for the estimation of capecitabine in pharmaceutical dosage form. Res J Pharm Biol Chem Sci. 2012;1(2):39-46.
6. Schmeck HE, Sileshi B, Jamiolkowski RM, Albala DM, Shapiro ML, Lawson JH. A comprehensive review of topical haemostatic agents: Efficacy and recommendations for surgical practice. Ann Surg. 2010;251(2):217-228.
7. Nama S, Chandu BR, Awen BZ, Khagga M. Development and validation of a new RP-HPLC method for the determination of aprepitant in bulk and pharmaceutical dosage forms. Trop J Pharm Res. 2011;10(4):489-495.
8. Vijayalakshmi P, Girish C, Mendham R, Rao CB, Nama S. A review on Alzheimer's disease. Int J Pharma Biosci. 2014;4(2):19-27.
9. Johnson TP, Thompson MJ. Collagen's role in chronic wound healing. Wound Healing Sci Rev. 2019;14(3):45-53.
10. Rani TT, Brahmaiah B, Revathi B, Nama S, Chandu B. Targeting of anti-cancer drugs through nanoparticles. Int J Pharm Ther. 2013;4(3):154-159.
11. Zhang M, Wang G, Wang D, et al. Ag@MOF-loaded chitosan nanoparticle and polyvinyl alcohol/sodium alginate/chitosan bilayer dressing for wound healing applications. Int J Biol Macromol. 2021;175:481-494.
12. Wan R, Weissman JP, Grundman K, Lang L, Grybowski DJ, Galiano RD. Diabetic wound healing: The impact of diabetes on myofibroblast activity and its potential therapeutic treatments. Wound Repair Regen. 2021;29(4):573-581.
13. Moini A, Pedram P, Makvandi P, Malinconico M, d'Ayala GG. Wound healing and antimicrobial effect of active secondary metabolites in chitosan-based wound dressings: A review. Carbohydr Polym. 2020;233:115839.
14. Suarato G, Bertorelli R, Athanassiou A. Borrowing from nature: Biopolymers and biocomposites as smart wound care materials. Front Bioeng Biotechnol. 2018;6:137.
15. Barrientos S, Stojadinovic O, Golinko MS, Brem H, Tomic-Canic M. Growth factors and cytokines in wound healing. Wound Repair Regen. 2008;16(5):585-601.
16. Frykberg RG, et al. Chronic wounds: Management and treatment strategies. Adv Wound Care (New Rochelle). 2015;4(9):560-582.
17. Organogenesis Inc. Puraply Antimicrobial [package insert]. Canton (MA): Organogenesis Inc.; 2020.
18. McCarty SM, et al. The role of antimicrobial dressings in wound management. Adv Wound Care (New Rochelle). 2013;2(8):438-447.
19. Wright JB, Lam K, Burrell RE. Wound management in an era of increasing bacterial antibiotic resistance: A role for topical silver treatment. Am J Infect Control. 1998;26(6):572-577.
20. O'Callaghan S, Galvin P, O'Mahony C, Moore Z, Derwin R. "Smart" wound dressings for advanced wound care: A review. J Wound Care. 2020;29(7):394-406.