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Review



A Review On Resin Shell A Natures Duo For Healing And Repair

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	Abstract
Published on: 24 Jun 2025	<p>This study leverages both traditional healing characteristics and ecological techniques by introducing a novel healing cream made with eggshell membrane and resin (Indian frankincense). The complicated biological process of wound healing is frequently impeded by delayed tissue regeneration, infection, and inflammation. Combining active ingredients derived from plants and biomaterials offers a promising strategy in light of the increased interest in natural therapies. The two bioactive ingredients in this review eggshell membrane powder, which is made from avian eggshells, and Boswellic acid, which is extracted from <i>Boswellia serrata</i> are used in a unique wound-healing cream formulation. Pentacyclic triterpenoid Boswellic acid is well-known for its analgesic, anti-inflammatory, antibacterial, and antioxidant qualities. Its main anti-inflammatory effect is achieved by blocking 5-lipoxygenase, which lowers the production of leukotrienes, a major mediator of chronic inflammation. While its antioxidant potential guards against oxidative damage in wound tissues, its antibacterial action also helps to reduce wound infections. The collagen, hyaluronic acid, glucosamine, and glycoproteins found in eggshell membrane which is frequently disregarded as biowaste all aid in tissue regeneration, cell migration, and extracellular matrix re modelling. It is the perfect restorative component due to its biocompatibility and capacity to promote collagen deposition and fibroblast proliferation. Additionally, the formulation's usage of eggshell membrane is an example of a sustainable, "best out of waste" strategy, turning a common by-product into a useful ingredient for skin care. An environmentally responsible substitute for synthetic therapies, the combined qualities of eggshell membrane and resin offer a comprehensive and long-lasting solution for burn injuries and skin pigmentation issues.</p>
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	<p>Keywords: Anti-inflammatory, Skin Regeneration, Collagen Synthesis, Skin Elasticity, Wound Healing, Bioactive Ingredients, Antioxidant Properties, Regenerative Medicine, Eco-friendly Skincare.</p>

INTRODUCTION

Why It's Important to Heal the Invisible Injuries

The topic of healing invisible wounds is deep and complex, affecting mental, emotional, and even

physical facets of the human experience. Even though these "wounds" whether they result from trauma, ongoing stress, abuse, loss, or protracted adversity may not be readily apparent, they can have a significant and long-lasting impact on a person's wellbeing. An in-depth examination of the significance of healing these wounds and how it can change people's lives and communities can be found below.

Wound healing's significance in global healthcare

One important but frequently disregarded component of global healthcare is wound healing. In addition to restoring the skin's integrity, efficient healing helps avoid problems including infections, amputations, and long-term disability in wounds ranging from minor injuries to chronic ulcers and post-surgical wounds. A large percentage of people worldwide suffer from chronic wounds, such as diabetic foot ulcers and pressure sores, particularly those who have diabetes, cancer, or limited access to healthcare. Limited resources for wound treatment can cause chronic misery, disability, or even death in underdeveloped nations. Countries like the United States spend more than \$25 billion a year on wound care, indicating the significant financial burden. Furthermore, unhealed wounds can have a negative impact on a person's quality of life by resulting in social isolation, emotional discomfort, and physical pain. There has never been a more pressing need to provide cutting-edge and efficient wound healing treatments due to issues like antibiotic resistance. [1]

Particularly for chronic and difficult-to-treat wounds, recent advancements in biomaterials, nanotechnology, tissue engineering, and proteomics have created new opportunities to speed healing. Access to these technologies is still uneven, though. Therefore, it is imperative that wound care treatments be accessible, inexpensive, and culturally sensitive in every area. Given this, wound healing is not only a clinical issue but also a global health priority that necessitates consideration, creativity, and action. Rising burden of chronic wounds: diabetes, infections, post-surgical trauma Globally, the prevalence of chronic wounds is rising quickly, which presents a significant problem for healthcare systems. The main reasons of wounds that don't heal adequately include diabetes, chronic infections, and trauma following surgery. [2]Due to poor circulation and nerve loss, diabetic individuals are particularly vulnerable to foot ulcers, which can lead to extended recovery durations or even amputations. Similarly, if infections are not properly treated, they can cause serious complications like sepsis and postpone wound closure. Surgical wounds can potentially develop chronic and necessitate long-term treatment if they are worsened by immunological suppression or inadequate hygiene. The incidence of these wounds keeps increasing as life expectancy and the prevalence of chronic diseases rise, highlighting the critical need for creative, affordable, and widely available wound healing therapies.[3]

When modern medicine isn't enough: rethinking current therapies

Even in a time when advances in medicine are drastically changing how we think about health, there are still some circumstances in which contemporary treatments are insufficient. Patients are frequently left with few viable options because to the limitations of current treatments for complex wounds, chronic disorders, and diseases that may not respond to standard treatment. While effective for many ailments, traditional treatments can fall short in addressing the root causes of illnesses or offering sustained relief. This is especially true for chronic wounds, where issues like infection, poor circulation, and immunological dysfunction—difficulties that contemporary medicine finds difficult to fully address—can slow the healing process. Furthermore, problems including complex tissue regeneration, chronic inflammation, and antibiotic resistance continue to be obstacles in wound care and other medical specialties. Wounds that do not heal after extended treatment are one important area where existing remedies frequently fall short. [4]Diabetic foot ulcers, pressure ulcers, and venous leg ulcers are examples of chronic sores that need more than simple care. They call for a comprehensive strategy that takes into account environmental, psychological, and physical issues. Modern medicine frequently provides short-term solutions in these situations but is unable to provide long-term, sustainable recovery. Further complicating patient care are the potentially dangerous long-term adverse effects of medications such corticosteroids and antibiotics.[5] This restriction has led to the hunt for complementary and alternative medicines that can be used in conjunction with traditional approaches. Due to their ability to improve tissue repair without the negative effects of medications, natural remedies—such as plant-based formulations like *Boswellia serrata* for anti-inflammatory and wound-healing properties—are gaining popularity. There is potential for more comprehensive, individualized treatment plans when these medicines are combined with biomaterials, tissue engineering, and proteomics. It is obvious that we need to reconsider and broaden our strategy in order to meet the changing difficulties in healthcare. Despite its strength, modern medicine shouldn't be our sole resource. Many illnesses could be prevented as well as treated with a multidisciplinary, integrative approach that incorporates both traditional knowledge and contemporary advancements, providing a better future for those who need it most. [6]

Limitations of synthetic drugs (delayed healing, antibiotic resistance)

Despite having transformed modern medicine, synthetic medications have drawbacks, especially when it comes to treating infections and persistent wounds. The delayed healing impact of synthetic medications is one of its major disadvantages, particularly for patients with complicated or non-healing wounds. Many antibiotics and

corticosteroids,[7] for example, might slow down recovery by interfering with the skin's and tissues' normal regenerating processes, even though they are excellent at fighting infection and inflammation.[8] These medications frequently only offer short-term respite without addressing the underlying issues that cause delayed healing, such as inadequate tissue regeneration, underlying chronic conditions like diabetes, or poor circulation. Furthermore, common bacterial illnesses are becoming more difficult to cure due to the global epidemic of antibiotic resistance brought on by the overuse and misuse of antibiotics. In addition to delaying the healing process, this resistance raises the possibility of consequences like sepsis and systemic infections.[9]

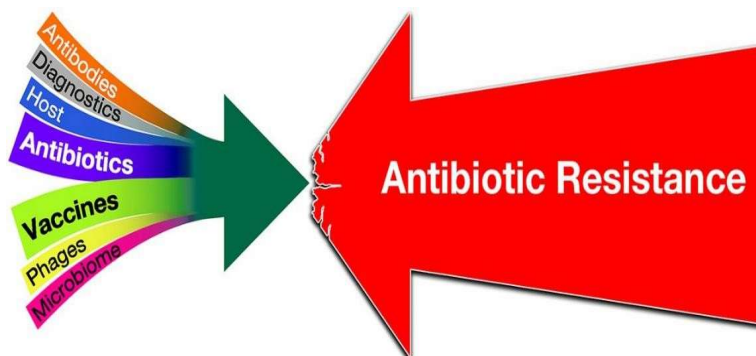


Fig 1: explains how antibody resistance is delaying healing process

Over-reliance on corticosteroids and nsaid

Because of their long-term effects and potential for consequences, the overuse of corticosteroids and nonsteroidal anti-inflammatory medications NSAIDs in the treatment of wounds, chronic pain, and inflammatory disorders has sparked concerns. Although NSAIDs and corticosteroids are both very good at lowering inflammation and relieving pain, long-term usage of both medications can have negative side effects that interfere with the body's natural healing mechanisms.[10] For example, corticosteroids have the potential to counteract the healing of chronic wounds by suppressing immunological function, which lowers the body's capacity to fight infections and regenerate tissue. Furthermore, prolonged use of corticosteroids can cause delayed wound healing, vascular fragility, and skin thinning, all of which make treating chronic wounds more challenging, particularly in individuals with diabetes or the elderly. NSAIDs, on the other hand, can hinder platelet aggregation and wound healing because they block cyclooxygenase (COX) enzymes, which are essential for tissue repair, even though they are helpful for managing pain. When these medications are used frequently without taking into account other treatment options, it can lead to drug resistance, dependency, and the exacerbation of preexisting diseases.[11] This over-reliance highlights the need for more all-encompassing treatment strategies, like using natural anti-inflammatory drugs like *Boswellia serrata*, which have therapeutic advantages but less negative effects.[12]

The case for safer, natural alternatives

The argument for safer, natural substitutes is growing stronger as the drawbacks of synthetic medications like NSAIDs and corticosteroids become more obvious. These substitutes provide encouraging therapeutic advantages without the serious adverse effects linked to prolonged usage of synthetic drugs. A comprehensive strategy for controlling chronic inflammation and encouraging tissue repair is offered by natural treatments like *Boswellia serrata*, a plant with strong anti-inflammatory and wound-healing qualities. [13] *Boswellia* reduces inflammation at the molecular level without interfering with the body's natural defenses, in contrast to corticosteroids, which can weaken the immune system and delay healing. Likewise, the collagen, elastin, and glycosaminoglycan-rich eggshell membrane promotes tissue regeneration and has been demonstrated to hasten wound healing, making it a perfect substitute for treating both acute and chronic wounds. For patients looking for long-term treatment, these natural ingredients offer a kinder, more sustainable alternative in addition to lowering the risk of side effects including infection and delayed healing. We may advance toward more individualized and side-effect-free treatment plans that address the underlying causes of illnesses without the negative effects of synthetic medications by incorporating these natural therapies into conventional medical practice.[14]

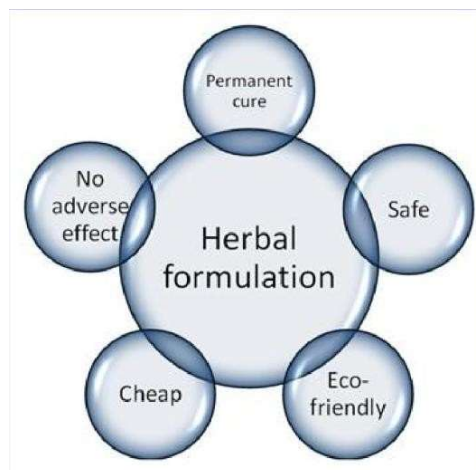


Fig 2: Advantages of using herbs

Power from plants and shells

Although the medicinal value of nature has long been recognized, new research is illuminating the strong bioactive chemicals present in plants and shells, which are currently being investigated for their potential use in contemporary medicine. [15] It has been demonstrated that these natural substances, which are frequently disregarded in favor of synthetic medications, have anti-inflammatory, antioxidant, and wound-healing qualities that can equal or even outperform the results of traditional therapies. The herb *Boswellia serrata*, whose resin has been used for millennia in traditional medicine, is one of the most promising sources of bioactive chemicals. Boswellic acids, which are found in *Boswellia*, are known to have anti-inflammatory properties because they block the enzymes that cause inflammation in the body. By lowering inflammation and increasing tissue regeneration, these substances have demonstrated great promise in the treatment of long-term ailments like arthritis and inflammatory bowel disease. [16] They may even aid in the healing of chronic wounds. Similarly, the rich composition of collagen, elastin, and glycosaminoglycans in the eggshell membrane, a naturally occurring by-product of eggs, has drawn attention. By encouraging the synthesis of collagen and other essential proteins required for tissue repair, these bioactive substances promote joint health, improve skin regeneration, and quicken wound healing. [17] Eggshell membrane's bioactive ingredients are perfect for use in formulations intended to treat chronic wounds and injuries since they not only promote healing but also fortify the skin and stop additional harm. Scientists are starting to close the gap between traditional knowledge and contemporary medicine by discovering and comprehending the bioactive potential of these natural materials. [18] The use of these chemicals from plants and shells in medicinal products provides a more sustainable and safer substitute for synthetic medications, which frequently have negative side effects and few long-term advantages. We might witness a move toward more natural and holistic medicines as research advances, leading to the development of cutting-edge anti-inflammatory medications and wound care products that fully utilize the potential of plants and shells. [19]

Boswellic acid: the botanical flame quencher

The main bioactive ingredient in *Boswellia serrata*, Boswellic acid, has gained notoriety as the "botanical flame quencher" because of its strong anti-inflammatory and restorative qualities. This natural substance, which comes from the resin of the *Boswellia* tree, has been used for centuries in traditional and Ayurvedic medicine to treat a range of inflammatory ailments, from chronic wounds to arthritis. [20]

Boswellic acid is special because it can target the underlying molecular causes of inflammation. Boswellic acid helps lessen the swelling and inflammation that are frequently linked to diseases like osteoarthritis, inflammatory bowel disease, and respiratory disorders by blocking 5-lipoxygenase, an enzyme that produces pro-inflammatory chemicals called leukotrienes. Boswellic acid provides a gentler, safer substitute for nonsteroidal anti-inflammatory medicines, which can cause gastrointestinal problems and longer healing times, without interfering with the body's natural healing process. In addition to its anti-inflammatory qualities, Boswellic acid has been shown to accelerate wound healing by boosting the growth of fibroblasts, which are essential cells for tissue regeneration and repair. This makes it especially helpful in treating chronic wounds where delayed healing is a major problem, including pressure sores and diabetic foot ulcers. Furthermore, by lowering oxidative stress, a major barrier to healing, its antioxidant properties help tissue repair even more. Boswellic acid

essentially acts as a natural flame extinguisher, extinguishing the flames of persistent inflammation and promoting the body's healing mechanisms. Boswellic acid has great potential to improve wound care and anti-inflammatory treatments, whether it is applied topically or via supplements or other medicinal formulations. The incorporation of this botanical chemical into contemporary healthcare provides a comprehensive substitute for the side-effect-laden medications that currently rule the medical scene, while science continues to investigate and prove its power.[21]

Boswellia serrata

The tree *Boswellia serrata*, also called Indian frankincense, is indigenous to the arid regions of the Middle East, northern Africa, and India.



Fig 3: Image of Indian frankincense

Chemical Constituents of Boswellia serrata

Acids Boswellic

These are the most significant bioactive substances found in *Boswellia serrata*, and they have analgesic, anti-inflammatory, and restorative qualities. AKBA, or acetyl-keto-boswellic acid by blocking 5-lipoxygenase (5-LOX), the most potent of the Boswellic acids is well-known for its strong anti-inflammatory properties. KBA, or keto-Boswellic acid reduces inflammation by inhibiting 5-LOX and aids in tissue healing. BA, or β -Boswellic Acid although less effective than AKBA and KBA, this Boswellic acid also has anti-inflammatory qualities. ABA, or alpha-Boswellic acid It also adds to the resin's anti-inflammatory properties when present in smaller amounts.[22]

Triterpenes

Numerous triterpenes found in *Boswellia* resin support its antioxidant and anti-inflammatory properties. 19-Hydroxy-Boswellic Acid, Epi-Boswellic Acid, and Iso boswellic Acid It is believed that these triterpenes enhance *Boswellia*'s general anti-inflammatory and tissue-healing properties.[23]

Vital Oils

Boswellia resin's aromatic and therapeutic qualities are influenced by the essential oils that are derived from it. Among the essential components are: Alpha-pinene renowned for its bronchodilator and anti-inflammatory properties.

Flavonoids

Flavonoids, which give *Boswellia serrata* its anti-inflammatory and antioxidant qualities, are present in the plant. Flavonoids have been shown to boost immunological function and provide protection against oxidative damage. Quercetin well-known for lowering oxidative stress and inflammation. Kaempferol an additional flavonoid with antioxidant and anti-inflammatory properties.[24]

Additional Substances

A variety of carbohydrates, amino acids, and glycosaminoglycans are also present in *Boswellia* resin, which supports the plant's capacity to repair wounds and produce collagen. Arabiconoses, galactose, and glucose these sugars aid in wound healing and tissue regeneration in conjunction with glycosaminoglycans.

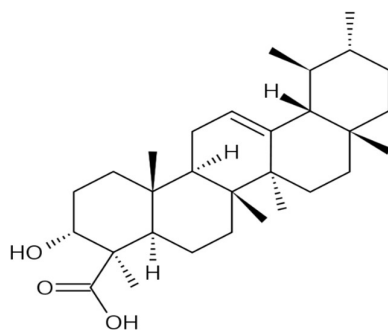


Fig 4: chemical constituent boswellic acid

Mechanisms: anti-inflammatory, antioxidant, antimicrobial. Mechanism of Anti-Inflammation

Boswellic acids, particularly AKBA and KBA, are the main source of *Boswellia serrata*'s well-known anti-inflammatory qualities. These substances work in a number of ways, including:

- **5-Lipoxygenase inhibition:** *Boswellia*'s capacity to inhibit 5-lipoxygenase, an enzyme involved in the manufacture of leukotrienes, is the primary mechanism underlying its anti-inflammatory properties. Pro-inflammatory mediators called leukotrienes are implicated in a number of inflammatory diseases, including inflammatory bowel disease, asthma, and arthritis. *Boswellia* decreases the synthesis of these inflammatory chemicals by blocking 5-lipoxygenase, which lessens swelling and inflammation in the afflicted tissues.
- **Inhibition of cyclooxygenase-2:** AKBA has also been demonstrated to inhibit cyclooxygenase-2, an additional enzyme implicated in the synthesis of pro-inflammatory prostaglandins, in addition to 5-LOX inhibition. This lessens the discomfort and edema brought on by inflammatory diseases.
- **Control of Cytokine Inflammation:** Additionally, *Boswellia* regulates the secretion of inflammatory cytokines such as IL-1 β , IL-6, and TNF- α . These cytokines contribute to the spread of the inflammatory response, and *Boswellia*'s capacity to control their synthesis amplifies its anti-inflammatory properties.[25]

The Mechanism of Antioxidants

Additionally, *Boswellia serrata* has strong antioxidant qualities, which are critical for shielding the body from oxidative stress and free radical-induced cellular damage. *Boswellia* functions as an antioxidant in the following ways:

Taking out free radicals: It has been demonstrated that the triterpenoids, flavonoids, and boswellic acids found in *Boswellia* can counteract free radicals, which are reactive substances that can lead to inflammation, cellular damage, and early aging. *Boswellia* helps lower oxidative stress, which is linked to diseases like cancer, neurological disorders, and cardiovascular disorders, by scavenging these free radicals.

Improving Enzymes for Antioxidants: It has been demonstrated that *Boswellia* increases the activity of antioxidant enzymes such as glutathione peroxidase and superoxide dismutase, which are essential for eliminating oxidative damage and detoxifying free radicals. This promotes tissue repair and lowers inflammation by shielding cells and tissues from oxidative damage.

Lipid Peroxidation Reduction: Additionally, *Boswellia* aids in the prevention of lipid peroxidation, a process whereby free radicals harm cell membranes, resulting in inflammation and the advancement of disease. *Boswellia* promotes tissue health and cell integrity by stabilizing cell membranes.

Mechanism of Antimicrobial Action

Because of its antibacterial qualities, *Boswellia serrata* is a useful tool for preventing infections, especially in inflammatory diseases and chronic wounds where the immune system may be weakened. Its antibacterial properties are ascribed to:

- **Direct Antimicrobial Activity:** *Boswellia*'s essential oils and boswellic acids have been shown to have bactericidal properties against a range of pathogens, such as *Pseudomonas aeruginosa*, *Escherichia coli*, and *Staphylococcus aureus*. Skin disorders and persistent wound infections are frequently caused by these bacteria. *Boswellia* aids in the body's defense against infections and speeds up wound healing by limiting bacterial growth and biofilm development.[26]
- **Antifungal Characteristics:** Additionally, *Boswellia* has antifungal properties against pathogens such as *Candida albicans*, which can infect people with weakened immune systems. Because of these qualities, it can be used to treat skin irritations as well as fungal infections.
- **Antiviral Properties:** Although additional research is required to properly demonstrate *Boswellia*'s

efficacy in antiviral treatments, preliminary studies indicate that it may also have antiviral benefits, specifically against influenza and herpes simplex virus.[27]

"Best out of waste": reusing home discards for sustainable healing

In the context of *Boswellia serrata*, the phrase "Best out of Waste" refers to the environmentally friendly utilization of plant components and byproducts in medicinal applications, especially for wound healing. This idea is in line with current sustainability trends, which seek to reduce waste and environmental damage while using natural resources and wasted materials for efficient treatments.

Boswellia serrata is a resin that comes from the *Boswellia* tree, and its waste materials from resin extraction or plant residues can be used in topical preparations to promote healing. Using this "best out of waste" strategy, plant material is recycled, important bioactive chemicals are extracted from what would otherwise be thrown away, and these resources are then used to make ointments, gels, and therapeutic creams. The main aim of taking this concept is usage of egg shell membrane annually many egg shells are thrown into bins we wanted to create something unique from the waste.

Sustainability and Environmental Impact: We may greatly lessen the environmental impact of using *Boswellia* in therapeutic products by utilizing unused or abandoned ingredients from the resin's production. By ensuring that *Boswellia*'s full potential is achieved, this technique benefits the environment and human health. Additionally, particularly in areas where *Boswellia* trees are harvested, it boosts the local economy.[28]

Wound healing, reimagined: the synergy of boswellic acid and eggshell membrane Regenerative scaffold + anti-inflammatory shield

Inflammation, tissue regeneration, and remodeling are all part of the intricate, multi-phase process of wound healing. Boswellic acid and ESM work together to provide a scaffold for tissue regeneration as well as anti-inflammatory qualities: By lowering the expression of pro-inflammatory mediators and enzymes, boswellic acid (*Boswellia serrata*) has anti-inflammatory properties. It aids in regulating the inflammatory stage of wound healing, accelerating the healing process and avoiding undue tissue damage. The eggshell membrane, which contains important structural proteins like collagen, elastin, and glycosaminoglycans, offers a natural foundation for tissue regeneration. ESM improves cellular migration and adhesion, which promotes skin regeneration.

The Role of Boswellic Acid in Wound Healing

Decreases Inflammation: During the early stages of wound healing, boswellic acid helps to reduce inflammation by inhibiting 5-lipoxygenase and other inflammatory cytokines.

Decreases Oxidative Stress: Through its antioxidant properties, it counteracts free radicals that fuel oxidative stress, a major cause of persistent inflammation and postponed wound healing.

Pain Relief: The anti-inflammatory activity also aids in pain relief, which improves patient comfort during the healing process.[29]

The Role of Eggshell Membrane in the Healing of Wounds

Tissue Regeneration: The collagen-rich extracellular matrix promotes the development of a healthy extracellular matrix and improves tissue integrity by acting as a natural scaffold for the genesis of new tissue. **Collagen Synthesis:** egg shell membrane includes proteins such as type I collagen, which are crucial for providing new tissue with structural stability and promoting more robust skin regeneration. **Angiogenesis:** ESM promotes the development of new blood vessels, or angiogenesis, which is essential for providing oxygen and nutrients to the healing tissue and accelerating the healing of wounds in general.



Fig 5: Egg shell membrane

Synergistic Recovery Using Organic Routes

A balanced approach to wound healing is ensured by the combined effects of boswellic acid and ESM: By lowering inflammation, oxidative stress, and discomfort, boswellic acid mainly acts during the inflammatory phase, preventing chronic or protracted inflammation. The proliferative and remodeling stages, which include angiogenesis, collagen synthesis, and tissue regeneration, are supported by the eggshell membrane. When combined, they aid in: Strengthened collagen matrix and improved tissue regeneration raise the general caliber of the repaired tissue.[30]

Natural actives in future wound care: greener routes ahead

The use of natural actives to aid in healing is becoming more and more popular as the field of wound care develops. Growing awareness of sustainability and the potential of natural ingredients to promote wound healing is in line with the emphasis on eco-conscious innovation. Let's examine how certain active ingredients, such as eggshell membrane and boswellic acid, are expected to influence skin treatments in the future.[31]

Environmentally Aware Innovation in Skin Care

Natural, sustainable alternatives to conventional chemical-based wound care are becoming more and more popular. Natural active ingredients for wound healing formulations, such as boswellic acid and ESM, are renewable resources because they come from both plant and animal sources. The following are some advantages of environmentally responsible innovation in wound care: Less environmental impact: Compared to synthetic chemicals, natural components frequently have a smaller ecological footprint, which lessens the production and disposal burden on the environment. Improved patient safety: Compared to synthetic medications, most patients tolerate natural active ingredients well and experience fewer adverse effects. Bioavailability and synergy: The body can absorb and use many natural substances more readily, which makes them useful for fostering recovery.

Possible Application in Burns, Pressure Sores, and Diabetic Ulcers

Burns, diabetic ulcers, and pressure sores are only a few of the chronic wounds that can be effectively treated with boswellic acid and ESM due to their special qualities: Diabetic Ulcers: Patients with diabetes experience delayed healing due to chronic inflammation and poor circulation. The anti-inflammatory and antioxidant qualities of boswellic acid aid in lowering oxidative stress and inflammation, and ESM promotes collagen formation and tissue regeneration for quicker and more effective healing. Burns: ESM and boswellic acid both support tissue healing and the growth of new skin, minimizing discomfort and encouraging renewal. Collagen and glycosaminoglycans found in ESM help to restore the structural integrity of the skin. Pressure Sores: Because of the continuous pressure that impedes blood flow, these wounds frequently take a long time to heal. The anti-inflammatory properties of Boswellic acid and the angiogenesis and collagen-forming properties of ESM help hasten the healing process of pressure sores.

Combining Conventional Knowledge with Contemporary Biotechnology

For wound care to advance, contemporary biotechnology and ancient wisdom must be combined. Through technical advancements and scientific validation, ancient medicinal methods that use compounds derived from plants, such as Boswellic acid, are being investigated. The two can cooperate in the following ways: Traditional Wisdom: For decades, traditional medicine has employed a variety of natural medicines to treat cuts, wounds, and skin disorders. For instance, the anti-inflammatory and restorative qualities of *Boswellia* have long been acknowledged in Ayurvedic therapy. Modern Biotechnology: These natural actives can be precisely extracted, formulated, and delivered using modern procedures, increasing their efficacy. Biotech advancements like tissue engineering and nano formulations can speed up the healing process and increase the effectiveness and accessibility of conventional treatments.[32]

CONCLUSION

A promising area for pharmacological and biological applications is the combination of resin and eggshell membrane. Because of its structural qualities and biocompatibility, extracellular matrix, a naturally occurring byproduct that is abundant in collagen, glycosaminoglycans, and other bioactive substances, has shown great promise in supporting bone regeneration, fostering joint health, and acting as a scaffold in tissue engineering. ESM has been successfully combined with resins, which are well-known for their structural and adhesive qualities, to improve the mechanical strength and stability of composite materials. By repurposing waste materials, this collaboration not only enhances the biomedical equipment's practical qualities but also advances the creation of sustainable materials. The combination of resin and egg shell membrane has great potential to generate novel biomaterials and advance therapeutic approaches. The optimization of processing methods, comprehension of these composites' long-term biocompatibility, and investigation of their full potential in therapeutic applications should be the main goals of future study.

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