

BioMedical Emporium

SKIN REPAIR SERUM

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COSMECEUTICAL SIGNIFICANCE

The skin constantly maintains its barrier function, primarily to protect the body against external environmental factors and possible permeants. The integrity of the SC is the primary determinant of the skin's barrier function. Deficiencies in the SC lipid composition would result in skin barrier function abnormalities, which in turn would affect skin barrier permeability. This skin layer is constantly constituted by corneocytes embedded in a multilamellar lipid matrix comprising ceramides, cholesterol, and free fatty acids in an equimolar ratio, maintained by regulatory fine-tuning mechanisms. As the skin is exposed to multiple exogenous factors that may lead to epidermal barrier impairment, the SC is continuously and actively maintaining a functional physiologic state by resorting to a variety of self-repair mechanisms. Skin barrier function impairment leads to increased TEWL, erythema, and altered blood flow. Once TEWL is increased beyond the normal homeostatic level, multiple self-repair mechanisms are induced within the SC and at the granular zone transition layer of the epidermis. Disruption of the dermal barrier will predispose skin injuries while enabling the entry of microorganisms. Certain underlying pathologies

such as lupus erythematosus and AD can increase the fragility of the skin barrier and compromise dermal self-repair mechanisms. Therefore, to enhance skin repair processes, the topical application consisting of bioactive functional, skin-calming, ingredient combinations, can support aesthetic dermal healing.

The BioMedical Emporium Skin Repair Serum comprises an expertly selected combination of ingredients to support skin barrier function while preventing the entry of microorganisms. Salicylic acid, a naturally occurring β HA, facilitates fast and effective skin soothing due to its anti-inflammatory properties. According to the literature, salicylic acid also presents keratolytic, bacteriostatic, fungicidal and photoprotective characteristics. Concerning dermal barrier restoration, salicylic acid increases cellular turnover to generate an intact skin barrier.

Niacinamide, an active form of vitamin B3, is included as a photoprotective agent able to stabilize the epidermal barrier by reducing TEWL which increases the moisture content of the SC.

Niacinamide also facilitates increased synthesis of dermal proteins like keratin, stimulates ceramide production and accelerates differentiation of keratinocytes to efficiently restore the dermal barrier.

Moisturisation via inclusion of an antioxidant like tocopherol acetate aids in limiting TEWL to support multiple dermal self-repair mechanisms. Tocopherol acetate has a photo-protective effect on the skin and

is a trusted antioxidant used in skincare capable of preventing free radicals generated by UV radiation. Hence, skin damage such as erythema, oedema, and sunburns can be reduced by applying vitamin E topically before UV exposure due to its inherent skin barrier-restoring capacity.

Additionally, inclusion of a topical antimicrobial, highly bioactive component such as tea tree oil (i.e., *Melaleuca alternifolia*) can calm the skin down while protecting the skin from bacterial entry. This highly bioactive essential oil, is globally used as an effective bactericidal, fungicide, and antiseptic agent. Tea tree oil is obtained by steam distillation of the leaves and twigs of the native Australian tree *Melaleuca alternifolia* (Maiden & Betche) of the Myrtaceae family. The oil contains about 100 components present in various concentrations, among which the following predominate: terpenen-4-ol, γ -terpinene, α -pinene, and α -terpinene. In addition, it exhibits antioxidant, anti-inflammatory, and analgesic activity. The lipophilic components of the oil can also accelerate permeation into the cells of microorganisms, inhibiting metabolism and facilitating subsequent death. In addition, it offers advantages over antibiotics since tee tree oil is less susceptible to developing antimicrobial resistance. Therefore, supporting optimized barrier function of the outermost skin layer by protecting against the entry of microorganisms.

As the final ingredient of the BioMedical Emporium Skin Repair Serum, allantoin (a derivative of urea exhibits) exhibits keratolytic action by affecting connections between corneocytes. This leads to the removal of excess keratinized epidermis. At the same time, allantoin stimulates cell division and epithelization, which accelerates the regeneration process of damaged skin inflammation. Moreover, allantoin also presents strong moisturizing properties allowing rapid skin recovery by reducing TEWL to rebuild the protective hydro-lipid coat. This feature of allantoin resolves troublesome subjective symptoms associated with dry skin, especially the feeling of tension and burning. Therefore, preparations containing allantoin is recommended as an adjunct in the treatment of chronic skin diseases with impaired keratosis or skin damage.

The BioMedical Emporium Skin Repair Serum harnesses a meticulously curated blend of ingredients to effectively facilitate skin barrier repair and protection. Each component plays a critical role in this synergistic formulation.

Together, these ingredients form a comprehensive solution that not only repairs but also fortifies the skin barrier, making the BioMedical Emporium Skin Repair Serum a superior choice for those seeking to restore and maintain optimal skin health.

HOW SKIN REPAIR IS FACILITATED: SALICYLIC ACID

Fast, effective skin-calming agent

Cosmeceutical features:

↓ swelling, ↓ redness, ↓ pain

Physiology: ↓ NF-κB, ↓ AMPK/SREBP-1 pathway, ↓ COX-2 expression, ↓ IL-1β, ↓ IL-6, ↓ TNF-α

Immediate skin healing and inflammation relief

Cosmeceutical features:

↑ wound closure, ↑ skin barrier function

Physiology: ↓ NF-κB, ↓ AMPK/SREBP-1 pathway, ↓ FAS, ↓ ACC, ↓ COX-2 expression, ↓ IL-1β, ↓ IL-6, ↓ TNF-α, ↑ PPAR signaling pathway, ↑ genes related to ECM structure

HOW SKIN REPAIR IS FACILITATED: NIACINAMIDE

Fast, effective skin-calming agent

Cosmeceutical features:

↑ skin moisturisation

Physiology: ↑ ceramides, ↑ intercellular lipids, ↑ SPT mRNA, ↑ keratinocytes

Immediate skin healing and inflammation relief

Cosmeceutical features:

↑ wound closure, ↑ skin barrier function, ↑ dermal moisture, ↑ UV exposure protection

Physiology: ↑ ceramides, ↓ TEWL, ↑ free fatty acids, ↑ cholesterol, ↓ ROS, ↓ SIRT, ↑ PARP-1, ↓ COX-2, ↑ BCL6 expression, ↓ PGE2, ↓ NOS, ↓ TNF-α, ↓ IL-1, ↓ IL-6, ↓ IL-8, NF-κB, ↑ IL-10, ↑ MRC-1, ↓ MHC class II, ↓ interferon-γ, ↓ SASP, ↓ mast cell degranulation in dermis, ↑ cellular equilibrium, ↓ biofilm formation, ↑ AMP, ↑ LL-37 bioavailability

HOW SKIN REPAIR IS FACILITATED: TOCOPHEROL ACETATE

Fast, effective skin-calming agent

Cosmeceutical features:

↑ skin moisturisation, ↑ UV exposure protection

Physiology: ↑ protects epidermal cell membranes, ↑ protects lipids from oxidative damage

Immediate skin healing and inflammation relief

Cosmeceutical features:

↑ wound closure, ↑ skin barrier function, ↑ dermal moisture

Physiology: ↑ keratinocyte production, ↑ fibroblast viability, ↓ ROS

HOW SKIN REPAIR IS FACILITATED: TEA TREE OIL

Fast, effective skin-calming agent

Cosmeceutical features:

↓ swelling, ↓ redness

Physiology: ↓ excessive production of ROS, ↑ GSH levels, ↑ CAT activity, ↓ intracellular H_2O_2 formation

Immediate skin healing and inflammation relief

Cosmeceutical features:

↑ wound closure, ↑ skin barrier function, ↓ occurrence of infection

Physiology: ↓ IL-1, ↓ IL-6, ↓ iNOS, ↓ COX2, ↓ IL-23, ↓ IL-17, ↓ NF-κB, ↓ IL-3, ↓ IL-10, ↓ GM-CSF, ↓ IFN-γ, ↓ IL-1β, ↓ IL-8, ↓ PGE2, ↓ NTPDase, ↑ the intracellular ROS produced by monocytes, ↓ superoxide anion radical formation

HOW SKIN REPAIR IS FACILITATED: ALLANTOIN

Fast, effective skin-calming agent

Cosmeceutical features:

↓ swelling, ↓ redness, ↓ pain

Physiology: ↑ opioid receptors, ↑ ATP-dependent kappa BETA channels

Immediate skin healing and inflammation relief

Cosmeceutical features:

↑ wound closure, ↑ skin barrier function, ↑ dermal moisture

Physiology: ↑ H_2O_2 , ↑ tyrosine kinase activity of numerous proteins, ↑ NF-κB, ↑ enzyme antioxidant system activity

Table 1: Classification and clinical significance of ingredients included in the BioMedical Emporium Skin Repair Serum

INGREDIENT	CLASSIFICATION	REASON FOR INCLUSION
Salicylic acid	β HA, phenolic aromatic acid	Anti-inflammatory action, increases cellular turnover and calms the skin.
Niacinamide	Water soluble vitamin, antioxidant	Photo-protective and improves barrier protective function of the skin
Tocopherol acetate (vitamin E)	Lipid soluble vitamin, antioxidant	Reduces lipid peroxidation, photo protecting and improves skin moisturisation
Tea Tree Oil	Essential oil obtained from <i>Melaleuca alternifolia</i>	Antibacterial, antifungal, antiviral, anti-inflammatory and scavenger of ROS
Allantoin	Diureide of glyoxylic acid that is produced from uric acid, metabolic intermediate and active skin protectant	Anti-inflammatory, stimulates the synthesis of the extracellular matrix, and promotes the proliferation of fibroblasts, reduces skin irritation and maintains optimal skin hydration

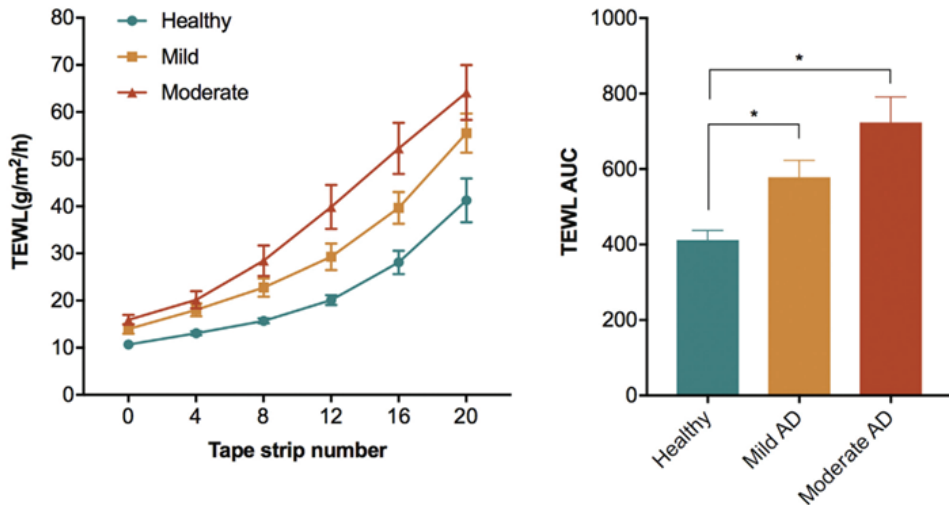


Figure 1. Visual representation of the impact of TEWL regulation on maintaining a healthy skin barrier in AD patients (Alexander *et al.*, 2018).

ABBREVIATIONS

ACC:	acetyl coenzyme A carboxylase
AD:	atopic dermatitis
AMP:	antimicrobial peptide
AMPK:	5' adenosine monophosphate-activated protein kinase
ATP:	adenosine triphosphate
βHA:	beta-hydroxy acid
BCL6:	B-cell lymphoma 6
CAT:	catalase
COX-2:	cyclooxygenase-2
CSF:	colony-stimulating factor
ECM:	extracellular matrix
FAS:	fatty acid synthase
GM:	granulocyte-macrophage
GSH:	glutathione
H₂O₂:	hydrogen peroxide
IL:	interleukin
iNOS:	inducible nitric oxide synthases
LL-37:	cathelicidin antimicrobial peptide
MHC:	major histocompatibility complex
MRC:	mannose receptor C
mRNA:	messenger Ribonucleic Acid
NF-κB:	nuclear factor κB
NOS:	nitric oxide synthase

NTPDase:	nucleoside triphosphate diphosphohydrolase
PARP:	poly (adenosine diphosphate ribose) polymerase
PGE2:	prostaglandin E2
PPAR:	peroxisome proliferator-activated receptor
ROS:	reactive oxygen species
SASP:	senescence-associated secretory phenotype
SC:	stratum corneum
SIRT:	sirtuin
SPT:	single particle tracking
SREBP:	sterol response element-binding proteins
TEWL:	transepidermal water loss
TNF-α:	tumor necrosis factor- α
UV:	ultraviolet

WARNINGS

Topical salicylic acid formulations are generally well-tolerated by all skin types. However, salicylic acid application should be avoided in individuals with salicylate allergy, active dermatitis and skin infections. Moreover, avoid using salicylic acid in combination with an agent that causes dry skin (some individuals can be more sensitive to experiencing dermal dryness). Topical use of salicylic acid during pregnancy is not associated with an increased risk of congenital malformation as is the case with systemic salicylic acid administration due to its structural similarity to aspirin. However, it is recommended to limit the size of the area exposed to salicylic acid, avoid occlusion of the site where salicylic acid is applied and limit the duration of topical salicylic acid use during pregnancy.

Side effects from the topical application of niacinamide are minor and rare. Reported side effects include mild burning, pruritis, and erythema. However, these side effects tend to improve with continued use.

Vitamin E and its derivatives are widely used in many cosmetic and dermatological products, in general, literature reporting side effects such as allergic or irritant skin reactions are rare.

The volatiles that constitute tea tree oil can penetrate the skin or increase penetration of other compounds and trigger toxicity. Severe reactions can be considered extremely rare in the absence of ingestion, although some components of tea tree oil are responsible for some allergic reactions.

Allantoin is considered of high safety as a therapeutic agent, is not allergenic, and does not normally cause skin irritation.

STORAGE INSTRUCTIONS

The product must be stored in an airtight container, protected from light, and kept at or below 25°C.

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