ISSN: 2456-8090 (online)
DOI: https://doi.org/10.26440/IHRJ/0607.10571

REVIEW

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# Artificial Skin: A Review

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ABSTRACT

The skin is a multifunctional organ that is protective, self healing and sensing and many forms of artificial skin have also been developed, having properties and functionalities approximating to natural skin. Artificial skin can be formed by biological substances as well as non-biological substances. This article maps out the structural difference between natural and artificial skin, the need for formation of artificial skin which is very useful for treating patients with burn injuries and various other skin conditions.

**KEYWORDS:** Artificial Skin, Epidermis, Collagen

## INTRODUCTION

The outermost epidermis and the deeper dermis make up the majority of the intricately layered structure of the skin, the biggest organ in the human body. The skin also contains different appendages including hair follicles, sweat glands, sebaceous glands, nerves, lymphatics, and blood arteries, as well as a subcutaneous hypodermis layer that stores adipose tissue. These numerous skin constituents, which perform vital protection, thermoregulation, excretion, absorption, metabolic processes, sensory, evaporation control, and aesthetic activities, ensure existence.

Artificial skin is a synthetic version of human skin created in a lab and is frequently applied to heal massive burns.

## METHODS

Standard monolayer (2D) cell cultures do not accurately reproduce the physiological architecture of the skin because the cells that make up human skin tissue grow inside an ordered three dimensional (3D) matrix that is always surrounded by surrounding cells. It has now been accomplished to reconstruct in vitro a variety of human skin recombinants, also known as artificial skin, which offer this crucial 3-D structure. This review considers alternatives to animal testing as well as other uses for these organotypic skin models.[1]

Artificial skin is a collagen scaffold that induces regeneration of skin in mammals such as humans. The term was used in the late 1970s and early 1980s to describe a new treatment for massive burns.

## USES OF ARTIFICIAL SKIN

**1. Burn injuries:** They are frequently treated with artificial skin, particularly when the patient doesn't have enough good skin to cover the wound.[2]

Such injuries may become fatal due to considerable fluid loss and infection since the body cannot produce skin cells quickly enough to repair the injured skin. Thus, using artificial skin to heal the incision right away will increase survivability.

**2. Skin conditions:** Apligraf, a product made of artificial skin, has been used to treat open lesions on the skin that heal slowly and chronically, such as ulcers. Additionally, they can be used to treat skin conditions like eczema and psoriasis, which frequently impact a big region of the body and may benefit from artificial skins that are loaded with medication and are simple to wrap around the affected area.[3]

**3. For research:** Apart from its applications in the clinical context, artificial skin may also be used to simulate human skin for research in consumer goods and medicine. Animal testing, which is frequently utilised to determine how a cosmetics or medical product may impact the skin, is one example of how fake skin is employed as an alternative.

However, this testing could be painful and uncomfortable for the animals and is not always a good indicator of how human skin will react. Many chemical compounds and products have already been tested on


**Submitted on:** 12-Jul-2022; **Accepted on:** 17-Oct-2022

artificial skin by some businesses.

**4. Study purposes:** Artificial skin may also serve as a model for human skin in other types of study, such as studies on the effects of UV radiation on skin and the passage of chemicals in cosmetics and pharmaceuticals through skin.

## TYPES OF ARTIFICIAL SKIN

Artificial skin substitutes can imitate either the epidermis or the dermis, or both in a "full-thickness" skin replacement.

Some items are made from biodegradable substances that are not found in the human body or biological substances like collagen. Another component of these skins may be made of non-biological materials, such as Integra's silicone epidermis.[4]

Additionally, sheets of skin grown from the patient's or another person's live skin cells have been used to create artificial skins.

The foreskins of babies collected following circumcision are a significant source. Such cells are frequently immune system-suppressive, which makes them considerably less likely to be rejected by the patient's body and enables foetuses to develop in their mothers' wombs without being rejected.[5]

## HOW SKIN GRAFTS DIFFER FROM ARTIFICIAL SKIN?

It is important to distinguish artificial skin from skin grafts.

Skin grafts involve removing healthy skin from a donor and attaching it to a wound. The patient would want to be the donor, but it might also come from other people, including cadavers, or from animals, such as pigs.

Whereas artificial skin is made in a laboratory. The extracted fibroblasts are added to collagen which is a fibrous protein found in connective tissue.[6]

When the compound is heated, the collagen gels and then it traps the fibroblasts, which in turn arrange themselves around the collagen, becoming compact, dense, and fibrous. After several weeks, the keratinocytes which are extracted from the donated foreskins, are seeded onto the new dermal tissue, where they create an epidermal layer.

## FUTURE ARTIFICIAL SKIN IMPROVEMENTS

Even though artificial skin has helped a lot of individuals, there are still issues that can be fixed.

For instance, the cost of artificial skin is high since it requires a labor-intensive and complicated manufacturing process. Additionally, artificial skin—such as sheets made from skin cells—can potentially be more brittle than actual skin.

But the developed skins will continue to save lives as long as researchers work to improve these and other factors.

## THE NEED FOR ARTIFICIAL SKIN

When the skin has been seriously damaged through disease or burns, the body cannot act fast enough to manufacture the necessary replacement cells. This lead to the development of Skin Grafts.

Skin grafts can be obtained from patient's own donor site, another person, cadaver skin or from other species such as pig.

But skin grafts have some disadvantages. Infections or in cases of cadaver skin, rejection were primary concerns. Cadaver skin can provide protection and loss of fluids during a burn victim's initial healing period, but a subsequent graft of patient's own skin is often required which restricts the physician to what skin the patient has available.[7]

So, In the mid-1980s, several medical researchers joined forces to develop tissue engineering to reduce the incidences of infection and rejection. This lead to the formation of Artificial Skin.[8]

An artificial skin graft has several advantages over those derived from the patients, cadavers or other species. It eliminates the need for tissue typing.[9]

## CONCLUSION

The ideal artificial skin should be screened for pathogens, severely curtailing to the chance of infection. The artificial skin is not rejected by the patient's body as it does not contain any immunogenic cells such as dendritic cells and capillary endothelial cells. Nevertheless, recent rapid progress in the field of engineering of biomaterials and tissue engineering offers hope for the development of new technology, allowing for fast, personalized, and cost-effective production of functional cell-based artificial skin

substitutes which will treat several patients with burn injuries or other skin diseases.

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**Cite this article as:**
Kaur R, Kaushal C. Artificial Skin: A Review. Int Healthc Res J. 2022;6(7):RV4-RV6. https://doi.org/10.26440/IHRJ/0607.10571

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**Source of support:** Nil, **Conflict of interest:** None declared

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