How Can Tissue Engineering Be Used To Create Bio-Artificial Skin For Burn Victims Or Other Injuries?

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1. Introduction

1.1 What is artificial skin?

Artificial skin is a skin substitute for those who, due to damage from wounds, burns, or even cancer, have lost feeling - or experienced rejection - in their skin or skin grafts. This skin is made of numerous materials, including hydrogel, collagen, and gelatin. Artificial skin is a relatively new concept, but already is allowing individuals to experience fully functioning skin that can protect their body and act as a messenger as well as, if not better than, their natural skin.

1.2 Why Do We Need It?

Multiple factors must be considered when performing a skin graft, especially sources/availability of donor tissue and immune complications/rejection. Some injuries may require a larger amount of donated tissue, which requires a large enough harvest site to supply the injured area with effective coverage. Another limitation, although not as common, is immune rejection. In these

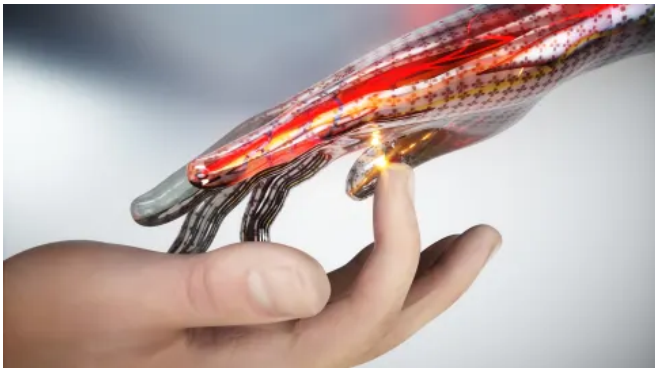
situations, the patient's immune system will attack the new skin as a foreign body, ultimately damaging or even destroying it. Common skin grafts also bring risk of infection, and are therefore not an option for every patient with skin damage. Failure of the graft to attach to the wound opens the body to infection. Because these patients are often put on immune-suppressors to allow the graft to attach, the risk of infection is exacerbated. Beyond these risks, even successful grafts can result in a reduction (or loss) of skin sensation, or occasionally increased sensitivity. While this outcome is rare (skin grafts having a failure rate around 7%), a re-grafting procedure is sometimes necessary to ensure complete healing of the graft. Another limiting factor in skin graft adhesion is vascular supply: skin grafts rely on a vascularized wound field to embed donor skin into existing skin. In these situations, when a skin graft is not an option, artificial skin provides patients with an alternative source of fully functioning skin. The artificial materials seal the wounded/damaged area quickly, preventing not only fluid loss, but also defending against bacterial contamination.

1.3 Who Needs It?

The target population for artificial skin includes those who have suffered from substantial injuries that leave a large area of skin damaged, thus limiting effective solutions. However, it is still to be determined how tissue engineering can be used to create bio-artificial skin for burn victims or other injuries.

2. Findings

2.1 What Technology is Used?

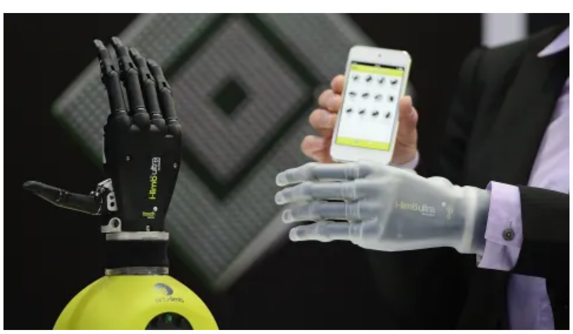


In response to stimuli such as pressure, heat, or cold, the pain receptors in human skin send electrical signals into the central nervous system. The materials used in artificial skin mimic the physical traits of skin, incorporating an outer layer of silicone rubber that protects a layer of electronic circuits within. These electronic circuits, which have sensors embedded within them, perform similarly to the body's natural nerves by sending signals that initiate a response to the stimuli.

2.2 How Does This Technology Communicate With The Body?

The artificial skin's control system converts the signals from the sensors to create electrical signals that stimulate a nerve leading to the brain. This allows the brain to perceive outside forces in contact with the skin. When external force is put upon the plastic of the artificial arm, the tubes within the skin are pushed closer together, enabling them to conduct electricity. As such, pressure put on the skin allows information from the skin to be sent to the brain in short pulses. While the skin detects all stimuli, it only acts on stimuli that exceed a threshold. The skin is programmed to compare different levels of stimuli on a scale. Once a stimuli is detected as dangerous, signals are sent through nerves to the brain in order to act on it. Through this system, the skin can differentiate between various forces, from a soft touch to a painful injury.

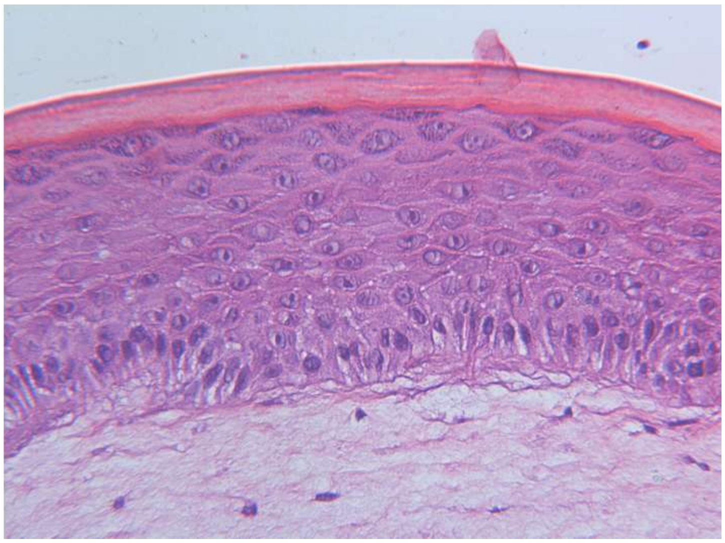
2.3 Significance



The significance of this study is that, thanks to the advances in sensory artificial skin, we can apply these methods to prosthetics, allowing the wearer to become aware of the surfaces they are touching.

2.4 Artificial Skin's Effects on Skin Cancer

The study's development of artificial skin demonstrates its remarkable capability to prevent a wide range of skin disorders, including skin cancer. This breakthrough is achieved through the utilization of genetically manipulated human skin cells in the artificial skin, enabling researchers to monitor genetic changes effectively. While the current model primarily focuses on evaluating the effects of cosmetics on the skin, its effectiveness in blocking invasive growth is evident when cancer cells emerge and attempt to invade the surrounding tissue. However, it is important to note that this model specifically targets skin-related conditions and does not provide insights into the effects on the entire organism.



3. Discussion

The findings of this study hold great significance as they offer alternative solutions for individuals requiring skin substitutes due to significant damage. These advancements present new opportunities, but they also come with challenges, such as the need to scale up the production of these skin substitutes and the potential risk of immune responses in patients. Nevertheless, by addressing these challenges, such as successfully translating the research into clinical trials and real-world scenarios, the development of tissue constructs and regenerative therapies will continue to make remarkable progress.

Works Cited

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