Preparation and optimization of elastin/plasma hydrogels for skin engineering

Author: Erika Meyer Kvalem Soto

Director: Marija Stojic

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Abstract

The aim of this study is to improve the physicochemical limitations of human plasma-based autologous bilayer dermo-epidermal skin equivalents developed by Tissue Engineering and Regenerative Medicine Group (TERMeG) at Universidad Carlos III of Madrid (UC3M). The application of these artificial grafts in clinical use is currently limited due to their fragility and high degradation rates. They shrink rapidly and therefore are difficult to handle. In order to overcome the aforementioned mechanical issues, functionalized Elastin-like recombinamers (ELRs) were introduced into the skin substitutes. Elastin is an inherent protein of the skin. It has low elastic modulus and high resilience, hence it is a great complement to reinforce collagen tensile strength providing skin with elastic and recoiling behavior. Elastin percentage in the dermis is known to be an increasing gradient from the epidermis to the dermis of 1% to 5%. The scope of this work is to prove the effectiveness of introducing functionalized ELRs into the grafts by quantifying the improvements in its physicochemical properties. This has been done through swelling, contraction and protein release studies. Cell viability of both primary human keratinocytes (hKCs) and primary human fibroblasts (hFBs) has also been measured. An MTS test was performed in order to ensure hKCs attachment to the surface of the graft. Furthermore, scanning electron microscope (SEM) pictures were obtained to characterize the interior of the plasma-elastin matrix. The collected data suggested that the incorporation of functionalized Elastin-like recombinamers (ELRs) were favorable for the autologous plasma-based hydrogels . They imporved the shrinkage restraint without affecting keratinocyte viability on the first two days. More experimental data should be collected to obtain evidence on fibroblast viability and keratinocyte viability on the long term.

Declaration

I confirm that the contents of this dissertation are originally written by me and except when reference I have not copied the work of others.

Author: Erika Meyer Kvalem Soto
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