SKIN2SKIN - DECELLULARIZED RABBIT DERMAL MATRIX AS A POTENTIAL BIO-SUBSTITUTE OF HUMAN SKIN

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Introduction

In full-thickness skin lesions, including in burn patients, dermal reconstruction may be difficult through classic plastic surgery. The use of autologous substitutes may be an alternative, however for extensive burn areas it can be a limitation[1]. Artificial dermal substitutes can be used, composed of extracellular matrix components (i.e. collagen, glycosaminoglycans, and hyaluronic acid) and covered by autologous split-thickness skin grafts[2]. However, this is a two step procedure in which the scaffolds are first incorporated to obtain neovascularization (up to 21 days) and then the autologous skin grafts are implanted, able to be blood supplied by the dermal substitutes. More recently, skin allografts evolved as skin bio-substitutes, in which decellularized tissues with an intact extracellular matrix (dECM) were proposed for skin regeneration[3]. This study, describes the optimization of a protocol for the decellularization of full-thickness rabbit skin grafts in order to obtain extensive and intact dermal matrices applied as skin bio-substitutes in humans.

Methods

Complete full-thikness skin grafts from rabbit, obtained at the company Cortadoria Nacional de Pêlo, S.A., S. João da Madeira, Portugal, were decellularized through the combination of green chemical and enzymatic methods. The absence of epidermis and dermal decellularization effectiveness were evaluated by histological analysis and DNA quantification. The integrity and preservation of the ECM structure were assessed through SEM and histology. The effects of the decellularization protocols on tensile mechanical properties of skin tissue were also evaluated. Human dermal fibroblasts (hDFs) were used for testing the *in vitro* cytocompatibility of the intact dECMs.

Results

The decellularization protocols proved to be effective, denoting residual genetic content (below 50 ng/mg dry tissue) and preservation of the ECM at different extents. The mechanical tests also confirmed the integrity of the native tissue properties after decellularization. Furthermore, preliminary *in vitro* studies showed that the dECMs supported human dermal fibroblasts (hDF) activity and proliferation.

Conclusion

This study shows, for the first time, that it is possible to use green methods to decellularize full-thickness rabbit skin while maintaining the integrity and mechanical performence of the ECM. A large sample volume can be used for decellularization, allowing to obtain dermal allografts with a set of biological, structural and biomechanical properties to cover large areas of the human body while promoting the regeneration of skin.

Figure and Tables

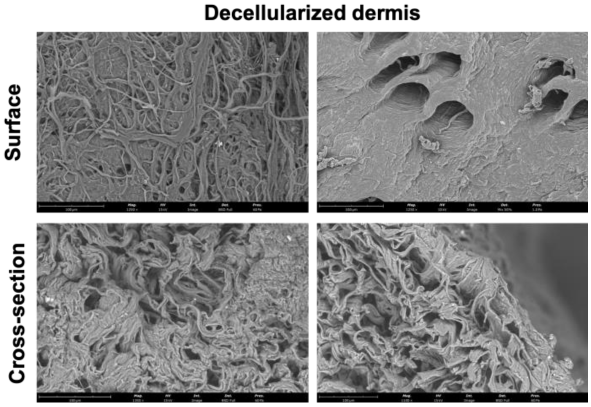

Figure 1: Secanning electron microscopy (SEM) images of the surface layers and cross-section of decellularized dermal matrices from full-thickness rabbit skin grafts.

References

1. Boyce and Lalley, Burns & Trauma, 6:4, 2018.
2. Philandrianos et al, Burns, 38:820-829, 2012.
3. Pérez et al, Tissue and Cell, 72:101572, 2021.

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