Synopsis of Original Research Paper

Development of progressive human cutaneous 3D model

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Establishment of full-thickness human cutaneous three-dimensional (3D) equivalent containing blood and/ or lymphatic vasculature is required for drug discovery and development of chemicals and cosmetics, because microcirculatory system in nature human skin plays an important role in regulating cutaneous morphogenesis and physiological function. The present study employed our developed layer-by-layer (LbL) nanofilm coating and unique collagen gel cell-accumulation techniques to fabricate human epidermis on dermis-like cellular and fibrous tissue with or without blood or lymphatic capillary network. Our constructs without vascular network exhibited a well-organized epidermal tissue involving cellular differentiation of keratinocytes and distinctive layer formation with cornification on basement membrane of dermal connective tissue and a high barrier function after exposure to a cytotoxic corrosive. Additional equipment of horizontal capillary network within the dermal tissue by LbL coating method facilitates formation of every layer in epidermis, as well as dermal tissue, to increase thickness of each tissue. Three-dimensional configuration of the vascular network introduced by collagen gel cell-accumulation procedure further accelerates maturation and thickening of both tissues. However, the lymphatic network prepared by the current LbL coating method was somewhat different in its form from that in normal nature human skin and leave little impression on both epidermal and dermal structure in the engineered cutaneous tissue, so that improved procedure for building lymphatic vasculature, being closely like that in nature dermis, has been currently developed. The present results consequently demonstrate that our peculiar tissue-engineering methods afford *in vitro* full-thickness human cutaneous 3D model like nature skin simply and substantial vascular network, being effective in tissue maturation, in a shorter period than that described previously. Our vascularized cutaneous tissue constructs are expected as next-generation *in vitro* skin models for drug and cosmetic development and as biomaterials for regenerative medicine.