

Preparation of a collagen matrix for regeneration of the skin tissue

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Most of the collagen matrix which is being used in tissue engineering and regenerative medicine is gel or sponge. This type of collagen matrix is good *in vitro* cell culture, but cannot be directly used in our body, for its high inflammatory response and poor mechanical property performance. Our goal is to prepare an artificial skin which possesses the same physical and biological property as that of native skin. As a first step for constructing an artificial skin, we tried to prepare a collagen matrix with similar structure of native skin. To achieve this goal, we executed fibrillogenesis of collagen triple helix in 0.9wt% NaCl and 0.02M Na₂HPO₄ aqueous solution using dialysis cassette. The resulting collagen matrix (F-Col) was composed of microfibrils which regulated D-periodicity. The collagen matrix prepared in this manner showed unfrangible mechanical strength and high swelling ratio. To make the collagen matrix much stronger, we executed air-drying to obtain a tougher collagen matrix (T-Col) which possesses viscoelastic property and high Young's modulus. The dry collagen matrix was composed of microlayers formed by the slow water evaporation. The lack in the collagen fibril triggered the macrophage invasion although the degradation was almost same as F-Col after implantation. Furthermore, the fibrous encapsulation promoted much faster for F-Col, leading to healing response. These indicate that the difference in the landscape (surface geometry) and morphology is crucial for the control of biological properties. These results also indicate that the constructing of a collagen matrix which possesses the resembling structure to that of native skin would be able to lead us to apply the collagen in tissue engineering and regenerative medicine.