Synopsis of Original Research Paper

Design of collagen microparticles by introducing supramolecular cross-linkers

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In order to fabricate collagen microparticles with high water content and chemical stability, the collagen microparticles cross-linked with carboxylmethylated α-cyclodextrin (α-CD)-threaded polyrotaxanes (CMPRs) were prepared. First, the cross-linking of collagen hydrogels with CMPRs were tested. CMPR-cross-linked collagen hydrogels showed higher mechanical and swelling properties than those of EDC/NHS-cross-linked and carboxymethyl cellulose (CMC)-cross-linked collagen hydrogels. These results suggest that the mobility of cross-linking points in CMPR-cross-linked collagen hydrogels contributed to improving mechanical and swelling properties. Additionally, the chemical compositions of CMPR greatly affected mechanical and swelling properties of CMPR-cross-linked collagen hydrogels, and CMPR comprising high molecular weight axle polymer and high α-CD threading ratio was suitable for improving the functions of collagen hydrogels. Moreover, CMPR-cross-linked collagen hydrogels showed high adhesiveness of mouse fibroblasts compared with EDC/NHS-cross-linked and CMC-cross-linked collagen hydrogels, presumably due to the high elasticity of CMPR-cross-linked collagen hydrogels. Finally, CMPR-cross-linked collagen microparticles with 3.38 ± 1.42 μm in diameter were successfully prepared. These cross-linked collagen microparticles showed excellent chemical stability. Altogether with these results, the cross-linking of collagen with CMPR is an effective method to modulate the mechanical properties and cytocompatibility, and CMPR-cross-linked collagen microparticles would be applied as a cosmetic ingredient.