Effect of vitamin C and its derivatives on collagen synthesis and cross-linking by normal human fibroblasts

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Abstract

Vitamin C (VitC) plays a critical role in the maintenance of a normal mature collagen network in humans (anti-scurvy properties) by preventing the auto-inactivation of lysyl and prolyl hyroxylase, two key enzymes in collagen biosynthesis. In this study two in vitro models were designed to evaluate the effects of VitC on collagen biosynthesis and cross-linking at cellular and tissue levels. It was shown that VitC induced a dose-dependent increase in collagen type I deposits by normal human fibroblasts (NHF) cultured in monolayer, and enhanced extracellular matrix contraction by NHF in a lattice model, in a non-cytotoxic range of concentrations (103m, 104m, 105m). Exogenous VitC supply could thus contribute to the maintenance of optimal collagenic density in the dermis and locally strengthen the collagen network. Vitamin C-phosphate (VitC-P) and vitamin C-glucoside (VitC-Glu) (two VitC derivatives presenting higher chemical stability in aqueous solution) were also tested in our two models, and showed similar biological properties, but with different potencies. These two compounds can be considered as pro-vitamins for skin, and could thus advantageously substitute for VitC in VitC-based anti-ageing products, as they allow the development of stable, easy-to-use formulations.