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〈Regular Article〉

# Chondroitin Sulfate Disaccharide Enhances Extracellular Matrix-Related Gene and Protein Expression in Normal Human Dermal Fibroblasts *in Vitro*

Kazuyuki KITAZAWA[1], Satoshi KANO[2], Fumie HASHIMOTO[1], Kenji SUGIBAYASHI[1], Yoshihiro TOKUDOME[1,*]

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**Abstract**

The physiological effects of chondroitin sulfate (CS) depend on the extent of its sulfation. This study focused on the effects of highly sulfated CS with different molecular weights in normal human dermal fibroblasts (NHDFs). NHDFs were treated with each CS. The expression of various genes was assessed by real-time PCR. Type I collagen content and elastin protein expression levels were assessed by ELISA and Western blotting, respectively. Disaccharide CS significantly increased the expression of genes required for extracellular matrix (collagen, type I, alpha I, decorin, elastin, lysyl oxidase, SMAD2 and SMAD3). In addition, we confirmed that collagen and elastin increased at the protein level. In contrast, high- and low-molecular-weight CS polymer had no significant effect. Therefore, highly sulfated disaccharide CS increased the expression of extracellular matrix-related genes and proteins. It may be possible that the highly sulfated disaccharide CS may increase firmness and elasticity of skin.

**Key words:** disaccharide chondroitin sulfate, type I collagen, decorin, elastin, lysyl oxidase.