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Using Atomic Force Microscope to Investigate the Influence of UVA Radiation and HA on Cell Behaviour and Elasticity of Dermal Fibroblasts

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Abstract : In this research, we used UVA irradiation, which can penetrate into dermis and fibroblasts, the most abundant cells in dermis, to investigate the effect of UV light on dermis, such as inflammation, ECM degradation and elasticity loss. Moreover, this research is focused on the influence of hyaluronic acid (HA) on UVA treated dermal fibroblasts. We aim to establish whether HA can effectively relief ECM degradation, and restore the elasticity of UVA-damaged fibroblasts. Prolonged exposure to UVA radiation can damage fibroblasts and led variation in cell morphology and reduction in cell viability. Besides, UVA radiation can induce IL-1β expression on fibroblasts and then promote MMP-1 and MMP-3 expression, which can accelerate ECM degradation. On the other hand, prolonged exposure to UVA radiation reduced collagen and elastin synthesis on fibroblasts. Due to the acceleration of ECM degradation and the reduction of ECM synthesis, Atomic force microscope (AFM) was used to analyze the elasticity reduction on UVA-damaged fibroblasts. UVA irradiation causes photoaging on fibroblasts. UVA damaged fibroblasts with HA treatment can down-regulate the gene expression of MMP-1, MMP-3, and then slow down ECM degradation. On the other hand, HA may restore elastin and collagen synthesis in UV-damaged fibroblasts. Based on the slowdown of ECM degradation, UVA-damaged fibroblast elasticity can be effectively restored by HA treatment. In summary, HA can relief the photoaging conditions on fibroblasts, but may not be able to return fibroblasts to normal, healthy state. Although HA cannot fully recover UVA-damaged fibroblasts, HA is still potential for repairing photoaging skin.

Keywords : atomic force microscope, hyaluronic acid, UVA radiation, dermal fibroblasts
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