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加齢による皮膚を非侵襲的に観る

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Non-Invasive Visualization of Aged Skin

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Abstract

Second-harmonic-generation (SHG) microscopy has attracted attentions for *in situ* visualization of human dermal collagen fibers. Due to its specific collagen selectivity without staining, non-invasiveness, and high-resolution 3D imaging capability, collagen fiber structure can be visualized as high-contrast SHG image *in situ*. However, it is difficult to extract quantitative parameters reflecting the collagen fiber structure from SHG image. Also, its practical use is limited in the dermatological field due to its bulky and complicated setup. In this review paper, we first review the application of the two-dimensional auto-correlation analysis for SHG image of the dermal collagen fibers in the human cheek skin. The extracted index for the collagen fiber structure significantly decreased with aging. Furthermore, we confirmed the moderate correlation between the collagen fiber structure index and the skin elasticity measured by Cutometer[®]. This correlation indicated that the dermal collagen fiber structure play an important role to determine the skin elasticity. In other words, the auto-correlation analysis of SHG image can be used for evaluation of the skin elasticity from the viewpoint of the dermal collagen. We next review the construction of a photonic-crystal-fiber (PCF)-coupled, hand-held SHG microscope for *in situ* monitoring of collagen fibers in human skin. While the ultrashort pulse light is delivered from a laser source to the SHG microscope *via* a large mode area PCF, SHG microscope was enclosed into a hand-held probe head. We compare the imaging performance between the conventional SHG microscope and the hand-held SHG microscope, and confirmed the comparable performance to each other. Finally, we demonstrated *in situ* visualization of collagen fibers in human skin. The combination of quantitative texture analysis with the hand-held SHG microscope will move SHG microscopy closer to the clinical applications in fields of skin cosmetics and anti-aging dermatology.

Key words: skin, collagen, second-harmonic-generation, nonlinear optical microscopy.