Synopsis of Original Research Paper

Spatiotemporal Evaluation of Light Treatment for Skin Barrier Based on Transepidermal Potential Difference

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As the involvement of epidermal keratinocytes in signal transduction triggered by various external stimuli attracts attention, red light irradiation has been suggested to promote the recovery process of skin barrier disorder. For its practical application as a therapy, further elucidation of the underlying mechanism and the optimum parameter of the stimuli is needed. In this study, transepidermal potential difference (TEP), the electrical voltage generated across the epidermal tissue, was utilized as a measurement indicator to evaluate the integrity of the skin barrier. TEP can be measured by a simple system with a pair of reference electrodes connected to the top and bottom of the tissue via salt bridges. The potential difference is derived from the localization of ions in the epithelial tissue, and the disturbance of normal distribution caused by damage to the skin structure decreases the potential difference. Skin specimens extracted from hairless mice were used for ex vivo measurement. The specimens showed ca. -6 mV of TEP and promoted recovery of TEP by red light irradiation after the barrier destruction by acetone. The acceleration of recovery varied depending on the radiance and the duration of the stimulation. Higher radiance showed better recovery even in short duration, but it seemed to have a “window” for maximizing the therapeutic effect and avoiding the toxic effect of high-intensity light. Then, continuous TEP measurement was carried out to observe the acute response to the irradiation. Hydrogel salt bridges composed of polyvinyl alcohol were shown as a promising material to avoid excessive hydration of the tissue during the measurement. This method will enable the *in situ* evaluation for elucidating the therapeutic effect of the light stimuli and its safe application.