Establishment and application of a novel experimental model of stratum corneum carbonylation induced by UV and sebum

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Conclusion
We established an experimental stratum corneum carbonyl protein (SCCP) induction model mimicking oxidative modification at the skin surface using a tape-stripped stratum corneum (SC) irradiated with ultraviolet (UV) + squalene (SQ). This experimental system made it possible to evaluate the efficacy of cosmetic ingredients in suppressing SCCP to shield healthy skin.

Materials and Methods

Materials
- Hydrolyzed soy protein (hSP): Mixture of peptides (Average molecular weight 700 Da, Many basic amino acid residues such as Lys, Concentration 20%)
- TOFUPRO® U, IKEEDA CORPORATION
- SC collection: The inside of the upper arms by tape-stripping
- Carboxylation (induce SCCP): UV (JAX-C100 solar simulator (Asahi Spectra Co., Ltd.), SQ + UV, Acr
- Evaluation of SCCP: Fluorescent-5-thiosemicarbazide (FTSC), EVOX-FL Fluorescence microscope (Thermo Fisher Scientific)
- Wash out: Soaking the SC in 2 mol/L NaCl

Tape-stripping

Effect of UV irradiation on SQ peroxide value

Detection of carbonyl protein by Acr antibody

Inhibitory effect of hSP on UV-induced SCCP induction in the presence of SQ

Inhibitory effect of hSP on Acr-induced SCCP induction

SC was treated without or with hSP, then irradiated with UV + SQ. hSP application to the tape-stripped SC prior to UV + SQ resulted in significant inhibition of SCCP generation.

SCC was successfully induced by UV irradiation in a dose-dependent manner. We established a novel experimental model of SC carbonylation induced by UV + sebum component.

Typical images of SCCP following treatment without UV, with 120 J/cm² UV, or 120 J/cm² UV + SQ. UV promoted greater SCCP induction in the presence of SQ.

Inhibitory effect of cosmetic ingredients on UV-induced SCCP induction in the presence of SQ

SCC was treated without or with hSP, then irradiated with UV + SQ. hSP application to the tape-stripped SC prior to UV + SQ resulted in significant inhibition of SCCP generation.

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Removal of adsorbed hSP prior to SCCP induction (pre-wash) eliminated the inhibitory effect of hSP against UV-induced SCCP induction in the presence of SQ.