Skin aging induced by ultraviolet exposure and tobacco smoking: evidence from epidemiological and molecular studies

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Source

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Abstract

BACKGROUND:

Tobacco smoking, similar to ultraviolet (UV) A radiation exposure, has previously been identified as an important factor contributing to premature aging of human skin.

OBJECTIVE AND DESIGN:

To investigate the relationship between these two environmental factors, we have conducted a cross-sectional study of 83 subjects (48 males, 35 females, age range 23-95), in which sun exposure, pack-years of smoking history and potential confounding variables were assessed by questionnaire. Facial wrinkles were quantified using the Daniell score. In order to study the molecular mechanism by which smoking caused wrinkle formation, in vitro studies were conducted to assess the alteration of matrix metalloproteinase-1 (MMP-1) mRNA expression in human fibroblasts stimulated with tobacco smoke extract and/or UVA.

RESULTS:

Logistic statistic analysis of the data revealed that age [odds ratio (OR)=7.5, 95% confidence interval (CI)=1.87-30.161, pack-years (OR=5.8, 95% CI=1.72-19.87), and sun exposure (OR=2.65, 95% CI=1.0-7.0) independently contributed to facial wrinkle formation. When excessive sun exposure (>2 h/day) and heavy smoking (35 pack-years) occurred together, the risk for developing wrinkles was 11.4 times higher than that of non-smokers and those with less sun exposure (<2 h/day) at the same age. The in vitro studies revealed that MMP-1 expression was significantly increased in fibroblasts after the stimulation with either tobacco smoke extract or UVA. Maximum induction was observed when cells were treated with tobacco smoke extract plus UVA, indicating that the two factors act in an additive manner. MMP-1 induction was significantly higher in the low glutathione (GSH) content fibroblast compared to that in the high GSH fibroblast, indicating that the differences in glutathione content define the susceptibility of fibroblasts towards UV- or tobacco smoking-induced MMP-1 expression.

CONCLUSION:

Tobacco smoke and UVA cause wrinkle formation independently of each other. We propose that both factors cause aging of human skin through additive induction of MMP-1 expression.