Effect of UVA1 (high wavelength-ultraviolet rays) in sunlight on formation of skin cancer

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Worldwide, WHO says, there are an estimated 132000 cases of malignant melanoma annually, and an estimated 66000 deaths from malignant melanoma and other skin cancer. Ultraviolet (UV) has been known to be a cause of the skin cancer. The effect of UVB (290~320nm) and UVA2 (320~340nm) on formation of skin cancer has been well-examined; however, that of UVA1 (340~400nm) has not. In this study, the effect of UVA1 on (1) UVB-induced apoptosis and DNA damage, and (2) environmental pollutants-induced DNA damage.

(1) Effect of UVA1 on UVB-induced apoptosis and DNA damage

First, UVA1 was exposed to hairless mice with UVB. UVB induced sunburn cells in epidermis 24h after exposure, which was suppressed by UVA1. The formation of cyclobutane pyrimidine dimers was simillar regardless of UVA1 exposure. On the other hand, the suppression of UVB-induced apoptosis by UVA1 was not observed in cultured keratinocytes. These results suggested that participation of other kinds of cells except for kerationocytes in skin might have a role in UVA1-induced suppression of apoptosis. As UVA1-exposed cells were considered to be survived with keeping of UVB-induced damage, the suppression of apoptosis might lead to cancer formation.

(2) Effect of UVA1 on environmental pollutants-induced DNA damage

Next, we examined the effect of UVA1 on DNA double strand breaks (DSBs) generated by environmental chemicals. After the treatment with chemicals, more significant DSBs were induced in UVA1-preirradiated skin cells than in unirradiated cells. Considering that the DSBs are the most serious DNA damage and associate with genomic instability, multiple effects of environmental pollutants and UVA1 might be related to the increase of skin cancer.

Repair of DNA damage and induction of apoptosis are essential for the deletion of damaged and mutated cells. The change of the response to environmental factors involving UVB and chemicals after exposure to UVA1 might have some roles in skin cancer formation by sunlight exposure.