Skin and eye lens as biological UVR dosimeters

Jane Sandby-Møller

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Correspondence: Jane Sandby-Møller, Dermatologisk Afd. D92, H:S Bispebjerg Hospital, Bispebjerg Bakke 23, DK-2400 Copenhagen NV. E-mail: jsm01@bbh.hosp.dk

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ABSTRACT

The work has been carried out at Department of Dermatology, H:S Bispebjerg Hospital, Copenhagen. The main objective of the project was to explore, if the skin and the eye lens could be used as biological Ultraviolet Radiation (UVR) dosimeters. Solar UVR exposure is an important risk factor for development of skin cancer. A usable method for monitoring individual UVR exposure is therefore prerequisite for assessment of individual risk for development of skin cancers. A biomarker for UVR exposure constitutes a person's own "built in" UVR risk monitoring device, and the biomarker might be used as an indirect expression of individual lifetime UVR exposure.

It was investigated, if skin echogenicity using ultrasonography and skin collagen autofluorescence and ocular lens blue autofluorescence using spectroscopy were usable as biomarkers for UVR exposure. Altogether 153 healthy subjects and 63 patients with previously basal cell carcinoma (BCC) or malignant melanoma (MM) participated in the study. Different approaches were used to explore the relation between the biomarkers and UVR exposure: 1) an effect of age might partly cover an effect of UVR; 2) differences between body sites with different UVR exposure pattern; 3) differences between groups with expected high and low UVR exposure due to occupation or leisure time behaviour; 4) the relation to direct measurements of individual UVR exposure using questionnaire, sun diary and personal UVR dosimeter worn by the individuals, and 5) differences between healthy subjects and skin cancer patients expected to have received more UVR.

Only skin collagen autofluorescence seems to be a promising biomarker for lifetime UVR exposure. Collagen fluorescence seems to decrease for increasing cumulative UVR exposure. In vivo skin autofluorescence spectroscopy might be a better method for evaluating individual UVR exposure than the previously used methods to obtain direct individual UVR exposure measurements. For skin cancer risk assessment, collagen autofluorescence can therefore be used as one factor evaluating individual UVR exposure. Other aetiological factors also seem to play a role and must also be incorporated in the model, e.g. genetic disposition.

More research concerning the use of other potential biomarkers for lifetime UVR exposure and further investigation of the use of skin collagen autofluorescence spectroscopy for measuring UVR exposure is needed with specific reference to UVR dose-response, specificity and sensitivity of the method.