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Increased moisture content in children's atopic skin.

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Summary Skin hydration measurements were carried out on 20 school children, 9 of which suffered from atopic dermatitis. Skin hydration was assessed by means of low frequency electrical susceptance measurements. Non eczematous atopic skin was found to be more hydrated than normal skin and skin hydration was furthermore found to be dependent on environmental relative humidity.

Key words Atopic skin, hydration, moisture content, electrical impedance, susceptance, season.

Water is essential to skin function and the degree of hydration is closely linked to the vital plasticity and barrier function of the skin (1, 2). Some skin diseases influence the barrier function and hence the water content of the skin. Even apparently normal skin may be affected in generalized skin diseases like e.g. atopic dermatitis (4).

There is a need for objective measuring methods for evaluating the barrier function and hydration state of the skin. Such methods may be used not only as tools in the diagnose of skin diseases, but also for the assessment of different kinds of treatment for the same.

Low frequency electrical impedance measurements have earlier been found suitable for the assessment of skin hydration (3, 6, 7, 10, 12), and an instrument based on low frequency electrical susceptance measurements has been described and tested in previous articles (8).

The instrument uses low frequency, which ensures that the measurements are focused on the stratum corneum only (11). Furthermore, measuring only the susceptance and not the conductance, eliminates any contribution from sweat duct filling (9).

We wanted to investigate whether significant differences exist between skin hydration measured on subjects with atopic dermatitis as opposed to normal skin, and also to see how time of year influences on the results.

Methods

Skin hydration measurements were performed as electrical susceptance measurements at 88 Hz with a three-electrode system, as previously described (8). This method is also utilised in the commercially available SensoDerm® instrument. The measuring set-up included a Stanford Research SR 830 lock-in amplifier and a PC running a data acquisition program made in National Instruments' LabVIEW. An electrode pressure of 100 g/cm^2 and a measuring voltage of 20 mV rms were used. The electrode was applied on the skin 5 sec. before the measured value was recorded.

Measurements were done on 20 Caucasian school children aged 8-9 years when the study commenced. Their parents gave informed consent and, moreover, the project was approved by the local Committee of Medical Research Ethics.

The group included 9 boys (3 with present atopic dermatitis and 6 with normal skin) and 11 girls (6 with present atopic dermatitis and 5 with normal skin). The patients were instructed not to use any moisturising creams the last 24 hours before the measurements, and to avoid beverages containing caffeine on the day of the measurements.

The measurements were done in October and then repeated in March and June. Each time the test subject rested for 10 min wearing shorts and a T-shirt before the measurements started. The skin hydration was then measured on 11 sites on the right side of the body and never directly on eczematous skin (see table 1). Room temperature and ambient relative humidity (RH) was (mean SD):

October: 22.3 ± 1.1°C and 37.5 ± 4.5% RH;
March: 21.1 ± 1.0°C and 30.6 ± 4.1 % RH;
June: 21.8 ± 1.0°C and 55.7 ± 4.2 % RH.

The measured susceptance data were found to be log-normal distributed and all statistical calculations were hence preformed on the logarithm of the data.

TABLE 1: Values of mean susceptance for skin site (1st column), for month (2nd, 3rd and 4th column), mean of values of 3 months for site on atopic (5th column) and control skin (6th column). Statistical comparison (p significant less than 0.05 in bold) for month (7th column) and for skin condition -atopic(AD)/control- (8th column).

MEAN SUSCEPTANCE, μS/cm²							
	MONTH			TYPE OF SKIN		VALUE OF p	
SKIN SITE	OCTOBER	JUNE	MARCH	AD	CONTROL	MONTH	TYPE OF SKIN
Elbow, flexor	0.147	0.183	0.154	0.215	0.120	0.791	0.058
Ankle	0.073	0.107	0.099	0.176	0.048	0.695	**0.011**
Chest	0.189	0.161	0.089	0.172	0.113	**0.014**	0.108
Wrist	0.662	0.170	0.302	0.440	0.238	**0.012**	0.057
Cheek	0.266	0.196	0.178	0.284	0.156	0.269	**0.044**
Knee, ventral	0.076	0.098	0.059	0.118	0.049	0.529	**0.006**
Hip, lateral	0.050	0.101	0.045	0.076	0.049	0.673	0.222
Arm, dorsal	0.051	0.111	0.041	0.063	0.059	0.258	0.791
Forehead	0.671	0.746	0.562	0.851	0.504	0.562	**0.037**
Back, superior	0.195	0.243	0.119	0.229	0.139	0.190	0.110
Armpit	0.083	0.080	0.045	0.092	0.049	0.109	0.064

Results

The results from the measurements are listed in table 1 as mean measured electrical suscpetance for each skin site and month. The table also shows mean susceptance for all months grouped according to skin status, i.e. atopic dermatitis (AD) or normal. A two-way ANOVA (factors = skin status and month) was then performed and the p-values from the analysis are also listed in table 1.

Discussion

The results show that all measured skin sites on children with atopic dermatitis had higher numerical value for the mean electrical susceptance than those of children with normal skin, but were statistically significant within a 95% confidence level for only four sites. These skin sites were ankle, cheek, ventral knee and forehead.

Hydration also changes with time of year and was e.g. for most skin sites higher in June with 55.7% RH than in March with 30.6% RH. The differences are significant for two skin sites, namely chest and wrist. It should be noted, however, that although the RH was lower in October than in June, the measured mean susceptance was higher in October in these two sites.

We found that the children with atopic dermatitis had higher mean electrical susceptance in all measured skin sites than the children with normal skin, which we interpret as higher stratum corneum hydration (7, 8, 10), and that the differences were statistically significant for some of the sites. We also found that skin hydration changed for most skin sites during the year, but the findings were not consistent, except for two sites.

The finding that non eczematous atopic skin is more hydrated than normal skin is in disagreement with the common notion that atopic skin is "dry" skin. Atopic skin may have a "drier" appearance because of the altered characteristics of the sebaceous glands (13). Our results confirm the findings achieved by means of other methods, however (5). An increased hydration in atopic skin can be explained as being due to the impaired barrier function of the epidermis, resulting in an increased water flux through the stratum corneum. This is supported by studies showing an increased transepidermal water loss in atopic skin (14).

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