

# 'Dry' Skin in Atopic Dermatitis

## I. A Clinical Study

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**A common finding in patients with atopic dermatitis is the occurrence of 'dry' skin on non-eczematous regions. 'Dry' skin is here defined as a clinical condition meaning a rough, finely scaling non-inflamed skin surface. The frequency and extension of 'dry' skin were examined in 50 patients with atopic dermatitis and were compared with those in 50 non-atopics. A discrepancy was found in both groups between the subjective opinion of the presence of 'dry' skin and the objectively noted 'dry' skin. Among the atopics, 48% were found to have 'dry' skin compared with 14% among the controls ( $p < 0.01$ ). The most frequent location of 'dry' skin in both groups was the back. Intolerance to wool was found to be significantly high ( $p < 0.01$ ) in the atopic group, although it was also quite common in non-atopics. In order to correlate the clinical observation to skin morphology, a replica-technique was used to visualize the surface of 'dry' skin in the scanning electron microscope. Key words: Replica technique; Scanning electron microscopy.**

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Among the diagnostic criteria of atopic dermatitis (AD) defined by Hanifin & Rajka (1), xerosis or 'dry' skin is a minor feature but 'highly suggestive of atopic dermatitis'. A history of 'dry/itchy' skin in adult life turned out to be an unfavorable factor in a long-term follow-up study of almost 1,000 patients with atopic dermatitis (2). The only clinical investigation of the frequency and extension of 'dry' skin in atopic patients was recently conducted by Uehara & Harumitsu (3) in Japan. However, genetic disposition to atopy as well as to 'dry' skin may vary due to racial characteristics, and may thus vary in different parts of the world.

'Dry' skin is a clinical finding in many different diseases such as ichthyosis vulgaris, uremia and atopic dermatitis. The clinical appearance of this 'dryness'

also varies. In ichthyosis there is often a reticulate pattern of scaling, and in uremia there is a fine scaling with greyish discoloration of the skin. In atopic dermatitis, the xerosis has quite a uniform appearance, with a finely scaling, non-eczematous skin surface, which feels rough to the touch, often with a perifollicular accentuation.

The aim of the present study was to examine the frequency, the extension, and the seasonal variation of 'dry' skin in patients with atopic dermatitis from a clinical point of view. In an attempt to correlate the clinical definition of 'dry' skin to an objective assessment of morphological characteristics, a replica-technique was used to visualize the skin surface in the scanning electron microscope in a few representative patients.

## MATERIAL AND METHODS

Fifty patients (39 women and 11 men, age 18-40 years), attending the out-patient clinic at the Department of Dermatology, Södersjukhuset, Stockholm, were included in the study. They fulfilled all four major criteria and at least three of the minor ones (xerosis excluded) assessed by Hanifin & Rajka (1). All clinical examinations were performed by the author during wintertime (Jan-Febr 1987). Fifteen patients were re-examined the following winter (Jan-Febr 1988). As controls, persons were randomly collected from the venereal disease outpatient clinic at the Department of Dermatology, Södersjukhuset. In the selection of controls, 65 persons were consecutively examined. Out of these, 15 persons were excluded due to some kind of atopy. Fifty persons (39 women, 11 men, age 18-40 years) remained as controls. The objective finding of 'dry' skin and dermatitis on the face, arms, neck, back, trunk, and legs was recorded. The criteria of 'dry' skin was the clinical finding of a surface rough to the touch, combined with a finely scaling non-erythematous skin (3).

### Statistics

The  $\chi^2$ -test was used. Statistical significance was tested regarding the occurrence of 'dry' skin and of wool intolerance between the groups. The level of significance was chosen at 1% ( $p < 0.01$ ). The sign test was used to compare the extension of symptoms in the 15 patients examined on two occasions.

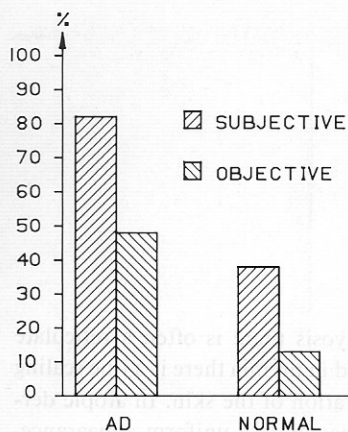


Fig. 1. The distribution of subjectively and objectively found 'dry' skin.

#### Scanning electron microscopy

A replica technique was used to describe the surface of the stratum corneum in more detail (Replica Kit for SEM G 3627, Agar Scientific Ltd.).

A silicone rubber, which becomes fluid on moderate heating, is applied in the fluid state to the skin surface over an area of 1.6 cm<sup>2</sup>. Within 2–3 min the material has solidified on cooling and can be gently lifted off. A positive replica is made of a methacrylate-based plastic with 0.5% hardener added, which is poured over the previously obtained negative replica. After about one hour, the positive cast has hardened and can be easily separated from the silica rubber.

Replicas were obtained from the back of 3 atopic patients with 'dry' skin and from the normal skin of 3 control persons. The positive replicas were mounted on aluminium SEM pegs, sputter-coated with gold (100 Å), and examined in a scanning electron microscope (Philips SEM 515) with an accelerating voltage of 15 kV and a tilt angle of 40°.

## RESULTS

The results are given in Figs. 1 and 2. In both groups, there was a discrepancy between the subjective opinion of the presence of 'dry' skin and objectively noted 'dry' skin. Among the patients with atopic dermatitis, 84% (42 patients) regarded their skin as 'dry', compared with 36% (18 persons) in the control group. This difference is statistically significant ( $p < 0.01$ ). On examination, 48% of the patients with AD were found to have 'dry' skin on some part of the body, compared with 14% in the control group ( $p < 0.01$ ). Among atopics, the most frequent location of 'dry' skin was the back (26%)—a non-predilection area for dermatitis. The skin on the neck, arms, and back was found to be 'dry' in 14% and the skin of the face in

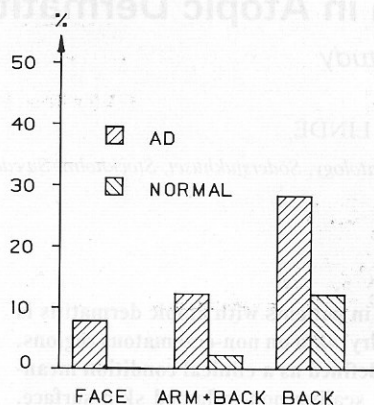


Fig. 2. The distribution of objectively 'dry' skin.

8%. In the control group 'dry' skin was noted on the back in 12%, and in one person (2%) on the arms and back.

Among the atopics, 46% were of the opinion that the distribution of 'dry' skin was a product of the severity of the dermatitis. On clinical examination, most patients with widespread dermatitis also had extended areas of 'dry' skin. Among the atopics, 30% used local steroids and 18% used emollients alone. Thus, more than half were not receiving treatment at all at the time of investigation. In the control group, 10% of the subjects used emollients daily and 16% only after taking a shower. Thus, the majority of this group never used any local ointment at all.

In the atopic group, 92% had noted an intolerance to wool, compared with 56% in the control group ( $p < 0.01$ ).

Concomitant ichthyosis vulgaris was found in 3 atopic patients (6%). Among the 15 patients with AD who were examined during a cold winter and re-examined the following winter which was mild, no significant difference was found in the extension of 'dry' skin or dermatitis.

In the scanning electron microscope, replicas from the normal skin of the back showed a very regular pattern, consisting of major furrows running parallel, and between these, triangles were formed by minor furrows (Fig. 3).

In replicas from 'dry' atopic skin, this regular model was not recovered. Here, the major furrows ran more irregularly and the minor furrows had almost disappeared (Fig. 4).

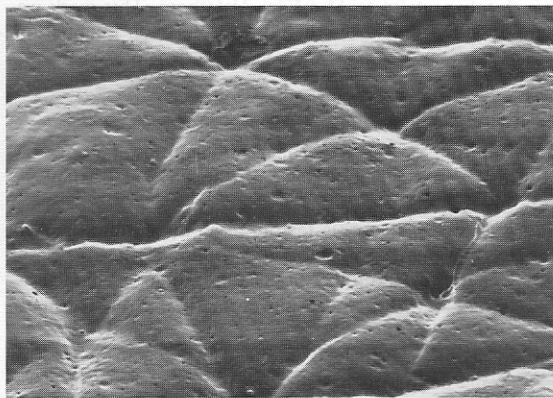


Fig. 3. Replica of the skin surface of normal skin in the scanning electron microscope. Same magnification as in Fig. 4.

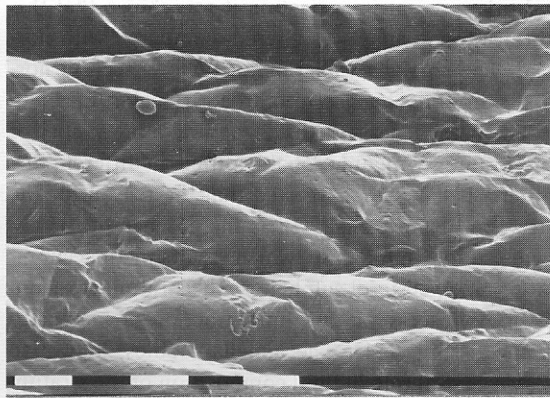


Fig. 4. Replica of the skin surface of 'dry' atopic skin in the scanning electron microscope (bar=0.1 mm).

## DISCUSSION

More than 80% of the patients with AD regarded their skin as 'dry', and about 50% objectively had areas of 'dry' skin upon clinical examination. This is in agreement with Uehara & Harumitsu (3) who found that 63% of 303 patients with AD exhibited focal areas of 'dry' skin. The discrepancy between subjective and objective opinion may in part be due to the frequent use of local treatment. About half of the atopics used local treatment, compared with 16% in the control group. The high frequency of a subjective assessment of 'dry' skin in the atopic group (84%) is consistent with Rystedt's findings (2) where 69% of the patients with AD claimed to have a history of 'dry' skin. In that study, no clinical examination of the objective frequency of 'dry' skin was undertaken. Svensson et al. (4) found that 98% of the patients with AD had both a history of 'dry' skin and clinical signs of xerosis on examination. This remarkably high frequency does not tally with the results of the present investigation. However, in both studies, the intolerance to wool was found to be widespread in the atopic group as well as quite frequent among non-atopics.

The distribution of 'dry' skin was often related to the severity of the dermatitis in the present study. This accords with the opinion that 'dryness' often fluctuates with disease severity and disappears during remission (5). The most common region for 'dry' skin was the back, a non-predilection area for dermatitis. However, this was also the case in the control group.

Uehara & Harumitsu (3) found a frequency of 30% of concomitant ichthyosis vulgaris compared with 6%

in the present study. This discrepancy may be due to genetic and/or racial factors. Rajka (5) has reported a frequency of 1.6–6% of ichthyosis vulgaris among atopics in five different investigations, all performed on clinical criteria with the signs of 'dry' skin symmetrically on the legs and hyperlinear palms.

Among the persons selected to be controls, 15 persons (23%) were excluded due to some kind of atopy. This is consistent with the reported prevalence of atopy in a recent Swedish study (6).

Among the 15 patients examined twice, during a cold winter and the following mild winter, no significant differences in the extension of 'dry' skin or dermatitis were seen. Factors such as infection and psychological stress seem to have greater impact on the status of the skin than does the climate *per se*.

The skin surface pattern has been studied with different techniques. With the use of macrophotography the normal skin surface has been shown to consist of an orderly system of major furrows running parallel. Between these, a triangular network is formed by minor furrows (7). Piérard-Franchimont & Piérard (8) have described the 'xerotic' skin using the 'skin surface biopsy-technique' in polarized light microscopy. An increasing disarrangement of minor furrows and later also major furrows is reported in 'xerosis'. In recessive X-linked ichthyosis (RXLI), the skin surface pattern is shown to be more coarse and irregular (9).

To our knowledge the surface of 'dry' atopic skin has not previously been described using the replica technique in scanning electron microscopy.



In the present investigation it was shown that this surface topography was altered, compared with normal. The regular parallel major furrows seen in normal skin were changed into broad irregular lines.

The pathogenesis of this structural abnormality of the stratum corneum probably differs in different disorders. It has been suggested that the reason for the structural change in RXLI is the absence of the enzyme steroid sulphatase, which results in an accumulation of cholesterol sulphate in the stratum corneum (10). An excess of this lipid fraction is known to induce scaling (11). The lamellar bodies, known to play a central role in lipid composition of the stratum corneum, have been shown to have an increased relative volume in 'dry' atopic skin, suggesting a defect in the lipid composition (12). Changes in the composition of the stratum corneum lipids in patients with atopic dermatitis have recently been described (13). It is possible that changes in the intracorneal lipids may cause structural changes of the stratum corneum surface.

In conclusion, while most patients with atopic dermatitis regard their skin as 'dry', only about 50% objectively have areas of 'dry' skin, here defined in clinical terms, and meaning a rough, finely scaling non-erythematous skin surface. This roughness is visualized in the scanning electron microscope as a change of the normal regular pattern to a coarser and less regular one.

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