

# Scanning Electron Microscopy Study of Hair Shaft Disorders in Psoriasis

C. PLOZZER, C. COLETTI, F. KOKELJ and G. TREVISAN

*Institute of Dermatology, University of Trieste, Trieste, Italy*

**Studies on scalp hair from psoriatic lesions have revealed marked irregularities in the cuticular pattern. The aim of this study was to investigate the incidence of hair shaft disorders in psoriatic patients and to evaluate the possibility of a correlation with scalp involvement. We examined hair from 39 psoriatic patients using scanning electron microscopy and compared it with hair from a control group of 12 healthy people. We confined our observations of the hair fibres to the areas nearest the root. Our data confirm previous observations indicating that dystrophic changes in hair cuticle cells occur more often in hairs from both unaffected and affected skin of psoriatic patients compared with normal subjects. No differences were observed between hair shafts taken from affected and unaffected psoriatic areas; cuticular breakage and an abraded cuticular surface were present only in the hair of psoriatic patients. **Key words:** psoriasis; scanning electron microscopy; hair shaft disorders.**

Acta Derm Venereol 2000; Suppl 211: 9–11.

Dr. C. Plozzier, MD, Institute of Dermatology, University of Trieste, Ospedale di Cattinara, IT-34100, Trieste, Italy

## INTRODUCTION

Several observations have indicated the possible involvement of hair shafts and follicles in psoriasis (1–4). Orfanos (5), using scanning electron microscopy (SEM), revealed marked irregularities in the cuticular pattern of scalp hair from psoriatic lesions: malformations of the cuticle cells included micropitting and ridge breakage. Subsequently, transmission electron microscopy of these hairs confirmed a disorder of the general architecture and an abnormal process of keratinization in several areas, particularly in the lower parts close to the hair cortex (5, 6).

In this study we evaluated the incidence of hair alterations in a group of psoriatic patients and in a control group, in order to investigate a possible correlation with scalp involvement.

## MATERIALS AND METHODS

Hair samples were obtained from 39 outpatients (12 females, 27 males; mean age 52 years, range 24–74 years) suffering from vulgar psoriasis (mean psoriasis area and severity index 13; range 8–15) admitted to our Institute. Patients were randomly enrolled in the study. Three were affected by nummular psoriasis and 36 presented with vulgar chronic plaque psoriasis. Twenty-one were affected by psoriatic scalp lesions. Twelve healthy controls, without any history or signs of psoriasis or other alterations in keratinization, participated in the investigation.

Patients were included only on fulfilling the following criteria:

1. no oral therapy had been given in the past;
2. the scalp hair had been washed at least 5 days prior to the study;

3. no topical anti-psoriatic treatment, “permanent” waving or hair dyeing had been carried out <2 weeks prior to hair sampling;

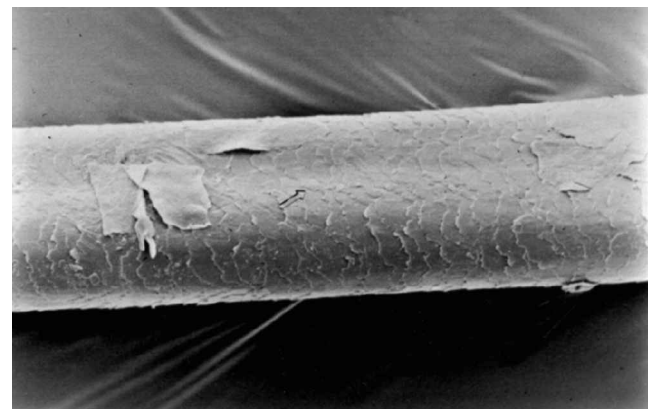
Patients with erythrodermic or pustular psoriasis or those affected by psoriatic lesions that had worsened during the 2 weeks prior to enrolment were excluded.

Hair cropping was performed in patients and controls on the scalp very close to the root (1–3 mm), and exclusively from the parietal and occipital regions, using scissors to minimize the trauma to the shaft. Two samples were taken from each psoriatic patient with scalp lesions: one from a psoriatic plaque and the other from a clinically uninvolved area free from erythema or scaling. Hairs with macroscopically intact roots were cut into 1-cm long segments and laid on the 4-mm wide central cylinder of a 12-mm wide and 5-mm deep aluminium cylinder support. The hair samples were then coated with gold in a vacuum (Sputter Coater S150A; Edwards). The metallized specimens were examined using a scanning electron microscope (Stereoscan 430I; Laika Cambridge Ltd.) and subsequently photographed using Ilford FP4 125 ASA film.

## RESULTS

Changes in the cuticular surface were observed in all the hair samples from the psoriatic patients; in 70% of them  $\geq 2$  alterations were simultaneously present in the same sample. The most frequently found alterations were: longitudinal grooves (22 patients) (Fig. 1); pitting (18 cases) (Fig. 2); and ridge breakage (20 cases). In 5 patients all 3 alterations were present in the same sample; 2 patients had both longitudinal grooves and ridge breakage; and 2 had both pitting and longitudinal grooves.

Cuticular breakage (Fig. 3), raised ridges, an abraded cuticular surface (Fig. 4) and absence of cuticular structure were less frequent. In 4 patients we found cuticular breakage and areas with an absence of cuticular structure, with a glimpse of fusiform cells below the cortical layer. In 3 patients



**Fig. 1.** Scanning electron micrograph showing longitudinal grooves (original magnification  $\times 1520$ ).

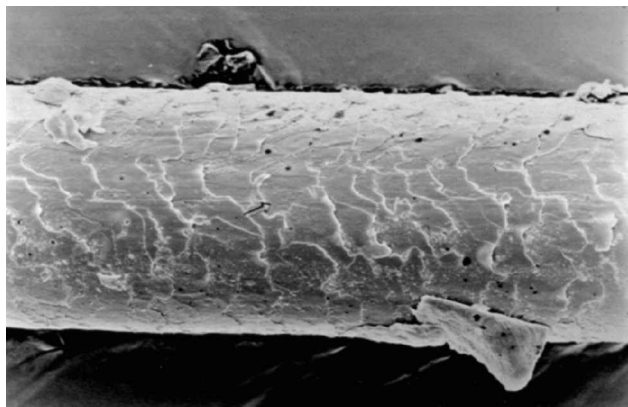


Fig. 2. Scanning electron micrograph showing pitting (original magnification  $\times 2430$ ).

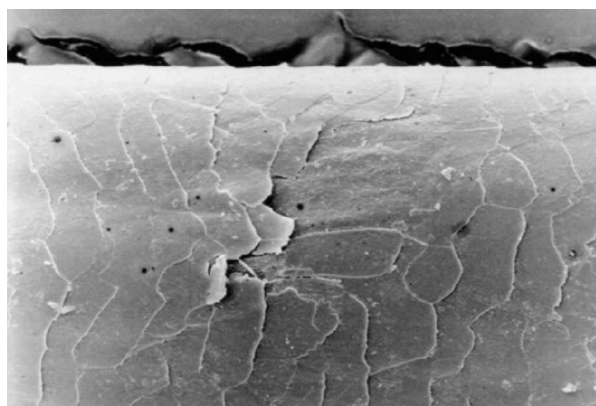


Fig. 3. Scanning electron micrograph showing cuticular breakage, which was present only in scalp hair from psoriatic patients (original magnification  $\times 1550$ ).

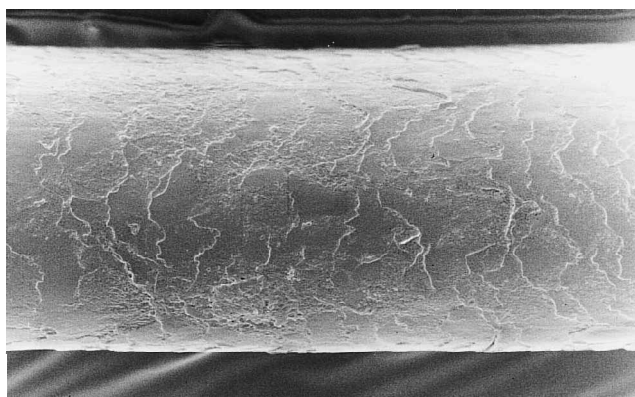


Fig. 4. Scanning electron micrograph showing an abraded cuticular surface; this alteration, not previously described, was present only in psoriatic patients (original magnification  $\times 2990$ ).

in the control group there was no alteration in the hair shaft samples; 7 patients presented only 1 dystrophy (4 longitudinal grooves; 1 ridge breakage; 1 pitting; 1 abraded cuticular surface); in the hair shafts of 1 patient we observed both ridge breakage and raised ridges and in another patient 3

Table I. Percentage incidence of alterations in psoriatic patients and controls

| Alteration                     | Patients | Controls |
|--------------------------------|----------|----------|
| Pitting                        | 46       | 8        |
| Longitudinal grooves           | 56       | 31       |
| Cuticular breakage             | 28       | 0        |
| Ridge breakage                 | 51       | 23       |
| Raised ridges                  | 23       | 15       |
| Abraded cuticular surface      | 18       | 0        |
| Absence of cuticular structure | 13       | 15       |

Table II. Percentage incidence of dystrophic changes in affected and unaffected skin of psoriatic patients and in controls

| Alteration                     | Patients |            | Controls |
|--------------------------------|----------|------------|----------|
|                                | Affected | Unaffected |          |
| Pitting                        | 33       | 12         | 8        |
| Longitudinal grooves           | 35       | 20         | 31       |
| Cuticular breakage             | 17       | 10         | 0        |
| Ridge breakage                 | 38       | 12         | 23       |
| Raised ridges                  | 15       | 7          | 15       |
| Abraded cuticular surface      | 10       | 7          | 0        |
| Absence of cuticular structure | 5        | 7          | 15       |

alterations were present in the same sample: ridge breakage; raised ridges and an abraded cuticular surface.

Cuticular breakage and an abraded cuticular surface were present only in psoriatic patients. Tables I and II summarize the percentage incidence of alterations in psoriatic patients and controls.

## DISCUSSION

Psoriasis is a dermatological disorder which, in addition to typical skin lesions, may also involve the nails and mucous membranes; it commonly affects the scalp (7) and hair growth. This latter effect is not widely known although studies on hair growth in psoriatic patients have revealed considerable changes in telogen count, with consequent alopecia (8, 9). Schoorl et al. (6) carried out a study on 22 psoriatic patients and controls which showed a consistent increase in the percentages of telogen and catagen hair in psoriatic plaques compared with those in uninvolved areas and normal controls. Wyatt et al. (10) have shown, using SEM, that the diameters of the hair shafts from the affected skin of 21 psoriatic patients were significantly narrower than those taken from controls (10, 11). They have also reported that dystrophic changes in cuticle cells occur in hair from both unaffected and affected portions of the scalp of psoriatic patients significantly more often than in normal subjects. Histological examination confirmed that the hair shaft may be significantly thinner in psoriatic plaques than in unaffected skin or in normal people (5, 12). Orfanos (5), using SEM, observed changes in the hair shafts of 2 psoriatic patients compatible with an abnormal keratinization process; histological examination of the psoriatic plaque revealed that, in several areas, the keratin pattern of the cuticle cells was

incomplete, particularly in the lower part close to the hair cortex (5), showing expansion of the upper outer root sheath (13) and shrinkage of the sebaceous gland (12). In our study all the psoriatic patients enrolled presented hair shaft abnormalities and the alterations were found in both psoriatic plaques and in unaffected areas.

We underline that our study has been confined to observations made on a section of the hair obtained close to the root, where normal hairs show regular overlapping cuticular cells. It is known, in fact, that crenellated edges of the cuticular cells, as well as other alterations, become more pronounced with increasing distance from the surface of the scalp epidermis, as a result of wear and tear (14, 15).

No correlation seemed to exist between hair disorders and psoriatic scalp involvement; in fact, in psoriatic patients, the dystrophic changes occurred with similar frequency in the hair of both apparently normal skin and psoriatic plaques. We did not find differences between patients with nummular or vulgar chronic plaque psoriasis.

Two types of alteration were observed only in psoriatic patients: cuticular breakage, present in 11 patients, and an abraded cuticular surface (Fig. 4), an abnormality not previously described, observed in 7 psoriatic patients. In contrast, only 3 patients in the control group did not present any alteration in hair shafts.

## REFERENCES

1. Matsunaga J, Maibach HI. Scalp and hair. In: Roenigk HH, Maibach HI, eds. *Psoriasis*. New York: Marcel Dekker Inc., 1985: 95–100.
2. Schuster S. Psoriatic alopecia. *Br J Dermatol* 1972; 87: 73–77.
3. Orfanos CE, Frost PH. Seborrheic dermatitis, scalp psoriasis and hair. In: Orfanos CE, Happle R, eds. *Hair and hair diseases*. New York: Springer Verlag, 1990; 641–661.
4. Wright AL, Messenger AG. Scarring alopecia in psoriasis. *Acta Derm Venereol* 1990; 70: 156–159.
5. Orfanos CE. Verhornungsstörungen am Haar bei Psoriasis. *Arch Klin Exp Dermatol* 1970; 236: 107–114.
6. Schoorl WJ, Van Baar HJ, Van de Kerkhof PCM. The hair root pattern in psoriasis of the scalp. *Acta Derm Venereol* 1992; 72: 141–142.
7. Fry L. Psoriasis. *Br J Dermatol* 1988; 119: 445–461.
8. Runne N, Kroinensen-Wiersma P. Psoriatic alopecia: acute and chronic hair loss in 47 patients with scalp psoriasis. *Dermatology* 1992; 185: 82–87.
9. Wyatt EH, Riggott JM. The influence of psoriasis on hair diameter. *Br J Dermatol* 1981; 105: 349–350.
10. Wyatt E, Bottoms E, Comaish S. Abnormal hair shafts in psoriasis on scanning electron microscopy. *Br J Dermatol* 1972; 87: 368–373.
11. Bottoms E, Wyatt E, Comaish S. Progressive changes in cuticular pattern along the shafts of human hair as seen by scanning electron microscopy. *Br J Dermatol* 1972; 86: 379–384.
12. Headington JT, Gupta AK, Goldfarb MT, Nickoloff BJ, Hamilton TA, Ellis CN, et al. A morphometric and histologic study of the scalp in psoriasis. *Arch Dermatol* 1989; 125: 639–642.
13. Shahrads P, Marks R. Hair follicle kinetics in psoriasis. *Br J Dermatol* 1976; 94: 7–12.
14. Whiting DA. Structural abnormalities of the hair shaft. *J Am Acad Dermatol* 1987; 16: 1–25.
15. Caputo R, Crosti C. Le anomalie di struttura del capello. *Gazz Ital Derm Venereol* 1988; 123: 521–523.