



Assessment and Validity of Trichoscopy for Eyebrow Involvement in Lichen Planopilaris and Frontal Fibrosing Alopecia: A Case-Control Study

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ABSTRACT **Introduction:** Few publications are available on eyebrow trichoscopy in patients with alopecia areata and frontal fibrosing alopecia (FFA).

Objective: To investigate the validity of using trichoscopy to examine eyebrow involvement in patients with lichen planopilaris (LPP) and FFA.

Methods: In this case-control study, 109 patients with eyebrow involvement in LPP and FFA (cases) and with acquired hair disorders of the eyebrows (controls) were included.

Results: Trichoscopy was highly specific and sensitive for the diagnosis of LPP and FFA. Trichoscopic features significantly associated with LPP were peripilar scaling, peripilar pigmentation, broken hairs, peripilar white halos, diffuse empty follicles, and vellus hair. Localized peripilar erythema and empty follicles were significantly associated with the diffuse form of LPP and the zigzag type of FFA. Yellow dots, dystrophic hairs, hair regrowth in different directions, and diffuse empty follicles were associated with LPP activity and FFA severity.

Limitations: The retrospective nature of the statistical analysis.

Conclusions: Trichoscopy is a valid tool for evaluating eyebrow involvement in LPP and FFA. Thus, it could help increase the diagnostic accuracy and predict the prognosis of eyebrow hair loss at an early stage.

Introduction

Eyebrows are short terminal hairs that serve important biological and social functions, especially eye protection, non-verbal expression, and gender definition, in addition to their crucial role in facial aesthetics [1]. Therefore, hair disorders at this location may have functional and psychological effects.

Hair loss is the most frequent eyebrow disorder. It can be classified as scarring or non-scarring alopecia and may present as an isolated finding or as the presenting manifestation of an underlying systemic or hair disease. Thus, its etiologies are varied, including autoimmune (alopecia areata [AA] and frontal fibrosing alopecia [FFA]), infectious (leprosy, cutaneous syphilis, and tinea), neoplastic (hematologic malignancies), nutritional (zinc deficiency), traumatic (trichotillomania), endocrinologic (hypothyroidism), and genetic (keratosis follicularis spinulosa decalvans) conditions [2].

Given the extensive breadth of etiology and the importance of the eyebrows in many functional and cosmetic roles, a prompt, early, accurate diagnosis is mandatory as the first step in clinical and therapeutic management [2]. Unfortunately, few studies have focused on the diagnosis and management of eyebrow disorders.

In the literature, most hair disorders affecting the eyebrows, especially those causing hair loss, first affect the lateral third (tail), which may be explained by the thinner nature and lower density of the hairs (shortest anagen and lowest follicular stem cell proliferation level) in comparison with those of other eyebrow hairs [1,3]. Hair loss in this segment may result from repeated itching and rubbing in inflammatory dermatoses, such as atopic dermatitis, which is known as Hertoghe's sign [4]. Involvement of the other segments of the eyebrows has also been reported in AA, FFA, and trichotillomania [4].

Trichoscopy is not only a good noninvasive tool for scalp alopecia and hair disorders but can also be of great help in diagnosing hair loss or hair diseases of the eyebrows at an early stage. However, studies using this tool in this context are rare, and its use has only been reported for FFA, AA, and trichotillomania.

In this study we aimed to describe clinical and trichoscopic patterns of hair disorders of the eyebrows and eyebrow involvement in lichen planopilaris (LPP) and FFA, to correlate trichoscopic findings with the epidemiological and clinical characteristics of LPP patients, and to investigate the validity of using trichoscopy to evaluate these acquired eyebrows disorders.

Methods

This study was approved by the ethics committee of the Mohammed VI University of Health Sciences of Casablanca.

We collected dermoscopic images of the eyebrows of 109 patients with acquired hair disorders of the eyebrows, either in isolation or associated with hair disorders affecting the scalp, during dermatology consultations between September 2022 and November 2023.

Cases were patients who had eyebrow involvement in LPP and FFA, while controls were patients with other acquired hair disorders of the eyebrows.

Clinical and paraclinical sociodemographic data were retrospectively extracted from medical records. Eyebrow trichoscopic analysis was performed in patients with hair loss regardless of whether the eyebrow was clinically affected or in patients with visible eyebrow disorders (hair loss, erythema, or scaling).

To analyze the entire eyebrow on each side, we divided the eyebrow into three segments (the head, body, and tail) using lines running perpendicular to the medial and lateral canthi [1,3].

The severity of eyebrow hair involvement was assessed based on the percentage of the area depilated per dermoscopic field (<50% or ≥50%), the areas of the eyebrows affected, and the extent of hair damage based on the clinician-reported outcome (ClinRO) for eyebrow loss which was describe for AA [5]. The ClinRO was rated on a scale of 0 (no involvement) to 3 (complete loss).

Diagnoses of non-cicatricial alopecia (AA or trichotillomania) were established based on detailed medical history, clinical examination, and scalp trichoscopy. Cicatricial alopecia was confirmed based on histopathological analysis of the scalp. Biopsy of the eyebrows was not performed. Ambiguous cases were excluded from the study.

Patients with a history of recent eyebrow plucking were advised to return for a trichoscopic examination within one month.

For LPP, disease activity assessment (scalp involvement) was performed using the LPP activity index (LPPAI) [6]. For FFA, we used the severity grade (the V-grade classification) described by Vañó et al. and categorized patients as having either mild (I-II) or severe (III-V) FFA [7].

In every case, dry trichoscopy with or without trichoscopy with immersion fluid from the eyebrow area was performed using a DermoLite 4 or HeineDelta 30 digital dermoscope. All trichoscopic images were blindly analyzed by two independent evaluators for the presence of specific abnormalities in the hair shaft structure and skin surface.

Data extraction was performed using Excel. Data were analyzed using IBM SPSS Statistics version 25 software. Descriptive statistics are expressed as means and percentages. Differences in the incidence rates of various trichoscopic features according to the epidemiological and clinical characteristics of the patients were examined using the chi-square test. The results were considered statistically significant if the p-value was <0.05.

Results

Clinical Characteristics

A total of 109 patients were examined, and 1,408 images were evaluated. The average patient age was 42.92 ± 17.47 years, patients aged 31–45 years were the most prevalent (27.52%), and females were predominant (66.97%).

LPP and FFA (cases) represented 52.3% of all the cases (57 patients), including the diffuse clinical form (39 patients) and 11 patients with FFA. Scalp involvement was noted in all patients, and beard involvement occurred in 10 male patients. Apart from patients with FFA, Grade I hair line recession was noted in 29 patients with LPP (63%).

The control group included other causes of hair loss, such as AA in five patients (4.9%), folliculitis decalvans (FD), trichotillomania, and anagen effluvium after chemotherapy in three patients each (2.75%), and infiltrative basal cell carcinoma in one patient, and eyebrow disorders without hair loss such as seborrheic dermatitis (SD; 11 patients, 10.09%), psoriasis (seven patients, 6.42%), chronic eczema (five patients, 4.59%), rosacea (five patients, 4.59%), lupus discoid (four patients, 3.67%), demodicidosis (three patients, 2.75%), and sarcoidosis (two patients, 1.8%).

Female sex was significantly associated with the diagnosis of LPP and FFA, lupus and AA ($P < 0.001$).

Alopecia of the eyebrows was not clinically visible in the majority of patients (66 patients). Clinical visibility of eyebrow disorders was significantly associated with FFA diagnosis, active LPP (tail involvement), and SD ($P = 0.005$).

Trichoscopic Findings of the Eyebrows (all diagnoses included) (Figures 1-2)

Peripilar erythema was the most frequent trichoscopic sign, with 93 patients having localized peripilar erythema (<50%) and only six patients having diffuse peripilar erythema; for ten patients, erythema was replaced by peripilar pigmentation, including all eight patients (7.34%) with a dark phototype (V–VI) (Table 1).

Vellus hair and empty follicles were observed in all patients with AA, while yellow dots were found three patients and exclamation marks and circular pigtail hairs in one patient.

Trichoscopy of eyebrow hairs involved in lupus discoid identified localized peripilar scaling and peripilar white halos in all patients, localized peripilar erythema in 75% of patients.

Correlations of Trichoscopy in Cases and Controls

Trichoscopic features significantly associated with LPP were peripilar scaling ($P < 0.001$), peripilar pigmentation ($P = 0.003$), broken hairs ($P < 0.001$), peripilar white halos ($P = 0.011$), diffuse empty follicles ($P = 0.038$), and vellus hair ($P = 0.048$).

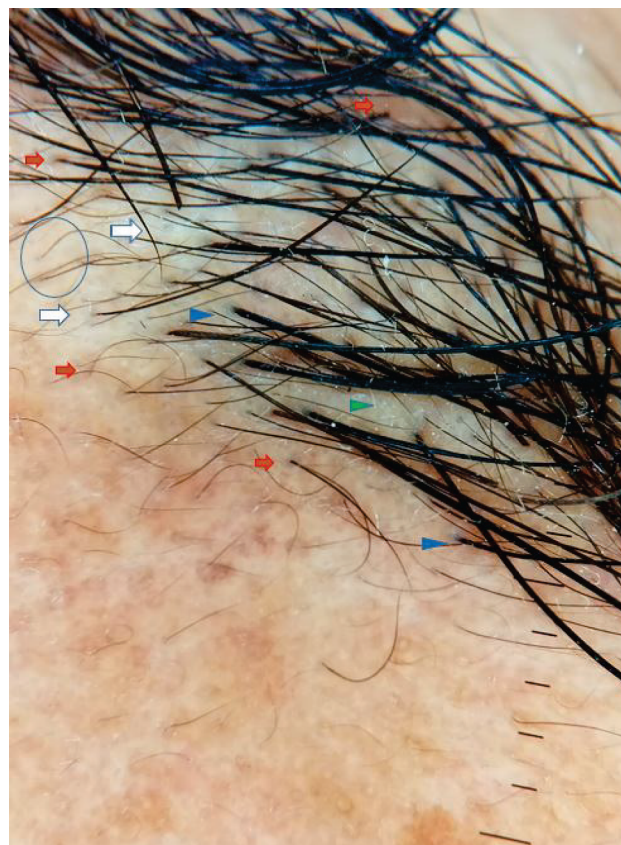


Figure 1. Trichoscopic image of the body (A) of the eyebrow of a dark-skinned patient with LPP. Peripilar pigmentation (orange arrow), peripilar scaling (blue arrow), vellus hair (blue circle), peripilar white halos (white arrow), and empty follicles (green arrow).



Figure 2. Trichoscopic image of the head of the eyebrow of a patient with diffuse LPP. Peripilar erythema (red arrow), peripilar scaling (blue arrow), vellus hair (blue circle), peripilar white halos (white arrow), and empty follicles (green arrow).

Table 1. Analysis of the Trichoscopic Findings of the Eyebrows of Cases and Controls.

Trichoscopic signs	Number	Percentage	Significant association with a diagnosis	p-value
Peripilar erythema	99	90.8%		
Diffuse erythema ($\geq 50\%$)	6	5.50%	Psoriasis	0.017
Localized erythema ($< 50\%$)	93	85.32%		
Peripilar pigmentation	8	7.3%	Lupus and LPP	0.033
Peripilar scaling (PPS)	101	92.7%		
Diffuse PPS ($\geq 50\%$)	2	1.83%	Psoriasis	0.001
Localized PPS ($< 50\%$)	99	90.83%	LPP/FFA	< 0.001
Vellus hair	89	81.65%	LPP/FFA	0.048
Peripilar white halo	83	76.15%	LPP/AFF	0.011
Empty follicles	81	74.3%	LPP/FFA	0.038
Eyebrow regrowth in different directions	71	65.14%	Eczema	0.030
Dystrophic hairs	56	51.38%	Eczema	0.019
Yellow dots	32	29.36%		
Red dots	26	23.85%		
Broken hairs	28	25.69%	Trichotillomania (broken at different lengths)	< 0.001
Diffuse	25	22.9%		
Localized	3	2.7%	LPP	

Concerning chronic eczema, significant associations were observed for certain features, including dystrophic hairs ($P=0.019$), Focal hair regrowth in different directions ($P=0.030$), and other trichoscopic signs ($P=0.000$), such as crusts, pustules, and erosions.

Diffuse peripilar erythema ($P=0.017$) was the only sign significantly associated with psoriasis.

No significant associations were found between trichoscopy and other diagnoses, particularly SD, lupus, and rosacea.

Trichoscopy of the Eyebrows in Patients with LPP and its Variants (Table 2)

The majority of patients with LPP had affected hairs in the tail (41), with isolated tail involvement in 11 patients. Eyebrow examination was not the reason patients sought consultations, and the majority of patients ignored eyebrow involvement; thus, we were unable to determine whether eyebrow loss was an initial clinical manifestation of the disease.

The area affected by the eyebrows was $< 30\%$ in 47 patients (82.4%). Localized peripilar erythema, peripilar pigmentation, empty follicles, localization to the tail, and diffuse eyebrow involvement with an area of $< 30\%$ were significantly associated with the diffuse clinical form of LPP ($P=0.028$, $P=0.04$, $P<0.001$, $P=0.016$, and $P=0.001$, respectively). Localized peripilar erythema and empty follicles were also associated with the zigzag variant of FFA ($P=0.028$ and $P<0.001$, respectively).

The disease activity of LPP and FFA severity were significantly associated with clinically visible eyebrow involvement ($P=0.012$), an affected area of $> 50\%$ ($P<0.001$), and trichoscopic features, such as yellow dots ($P=0.024$), dystrophic hairs ($P=0.015$), diffuse pattern of regrowth in different directions ($P=0.011$), and diffuse empty follicles ($P=0.002$).

Peripilar erythema and red dots were associated with phototypes III and IV ($P<0.001$ and $P=0.027$, respectively), whereas peripilar pigmentation was associated with very dark phototypes (V and VI; $P<0.001$).

Vellus hair and empty follicles were significantly associated with clinically visible eyebrow loss ($P=0.021$ and $P<0.001$, respectively).

Facial involvement in FFA (facial papules) was associated with trichoscopic findings in the eyebrows: yellow dots ($P=0.006$), red dots ($P<0.001$), and broken hairs ($P=0.019$).

Trichoscopy was highly specific and sensitive for diagnosing LPP and its variants, including FFA (Table 3).

Discussion

Available data concerning trichoscopy of the eyebrows are rare; few publications have been reported on FFA and AA, and no data are available concerning LPP. In addition, the distinction between LPP and FFA has been described in different body regions, especially the scalp, beard, and body hair [8]; however, no comparison has been performed in the eyebrows. In this study, no comparison between the two diagnoses was performed for the following reasons: FFA is

Table 2. Descriptive Analysis of Trichoscopy of the Eyebrows in Cases and Controls.

	Cases: LPP/AFF (57)		Controls (other diagnoses: 52)	
Mean age	39.1+/-17.2		46.1+/-18.3	
Qualitative variables	Number	Percentages	Number	Percentages
Sex	F: 41 M: 15	73.2 26.8	F: 32 M: 20	61.5 38.4
Family history of the disease	3	5.2		
Facial involvement	6 FFA	11.1	2	3.8
Clinically visible	11	19.3	32	61.5
Tail	8	72	14	26.9
Diffuse	3	27.3	18	34.6
Peripilar erythema	53	92.9	49	94.2
Localized	49	85.9	47	90.3
Diffuse	4	7	2	3.8
Peripilar pigmentation	3	5.2	5	9.6
Peripilar scaling	56	98.2	47	90.3
Localized	55	96.5	46	88.4
Diffuse	2	3.5	1	1.9
Peripilar white halo	47	82.5	22	42.3
Localized	4	7	20	38.4
Diffuse	43	75.4	2	3.8
Vellus hair	51	89.5	41	78.8
Yellow dots	17	29.8	12	23
Red dots	10	17.5	12	23
Broken hairs	11	19.3	13	25
Dystrophic hairs	28	49	26	50
Regrowth in different direction (RDD)	33	57.9	33	63.4
Diffuse RDD	8 FFA	14	0	0
Focal RDD	25	43.8	33	63.4
Empty follicles	47	82.5	30	57.6
Localized	43	75.4		
Diffuse	4	7		

Table 3. Validity of Trichoscopy in the Evaluation of Eyebrow Involvement in LPP and its Variants.

Diagnosis	Sensibility	Specificity	Positive Predictive Value	Negative Predictive Value
Cases (LPP and variants)	87.5%	98.08%	87.5%	98.08%
Controls	44.74%	70.97%	48.57%	67.69%

considered a clinical variant of LPP in many publications [9], LPP is more prevalent than FFA, FFA grade I is associated with the diffuse forms of LPP in many patients, and trichoscopic features were similar according to our evaluators. We therefore considered both diagnoses in the same group of cases.

Although eyebrow hair loss was not clinically visible in most our patients, trichoscopy was a specific and sensitive tool that increased the diagnostic accuracy of eyebrow LPP and FFA.

Trichoscopic features of autoimmune diseases of the eyebrows are often subtle at the beginning. Eyebrow

involvement in LPP was clinically invisible in the majority of our patients and was more frequent in the tail of the eyebrows; it was significantly associated with trichoscopic features such as peripilar scaling, peripilar pigmentation in the dark phototype, broken hairs, peripilar white halos, vellus hair, and diffuse empty follicles.

Trichoscopy was also correlated to the clinical variants of LPP; the recently described diffuse clinical variant of LPP [10] has been significantly associated with trichoscopic findings, such as localized peripilar erythema and empty follicles, which were also significantly linked to the zigzag variant of FFA. This is an additional important result for an early

diagnosis of these underdiagnosed clinical subtypes of LPP and FFA.

Another interesting finding of this study was that clinical visibility of the eyebrows involvement was significantly linked to advanced active disease with an affected area of >50% ($P < 0.001$), which confirms the crucial role of an early diagnosis based on trichoscopy, since in reported studies of FFA, trichoscopic analysis was rather performed in clinically visible madarosis, with bilateral partial or complete eyebrow involvement [4,11], or in isolated forms of FFA [12].

Affected eyebrows in FFA often appear to be non-inflammatory and non-scarring clinically [13] and demonstrate non-scarring features on trichoscopy. Similarly, a cohort of 151 patients with FFA had findings of non-cicatricial alopecia including short vellus hairs, hair growing in different directions, tapered and broken hairs, dystrophic hairs, black dots, red dots, yellow dots, and multiple pinpoint dots [2]. This fact explains the reversibility of some eyebrow loss in FFA [2,14]. Also, signs of cicatricial hair loss including white cicatricial areas, white dots, pili torti, and visualization of hair bulbs that reflect skin atrophy in advanced FFA have been described [8,11,14]. Signs like dystrophic hairs and hairs growing in different directions were considered more specific trichoscopic findings of eyebrow FFA, which can be useful in diagnosing patients with isolated eyebrow loss [11,12]. However, the lack of a control group in these studies makes it difficult to draw conclusions, a better trichoscopic characterization is then mandatory as we have found that focal regrowth in different directions was also noticed in the control group of inflammatory acquired eyebrow disorders.

Diffuse hair growth in different directions was significantly associated with severe and active LPP and FFA in our study, which has also been described in the literature, in addition to pili torti as early markers of fibrosis; and an indicator of a worse prognosis and a poor response to treatment (11,15). In contrast, the presence of red dots may be a favorable prognostic factor for eyebrow regrowth [2].

Diffuse erythema has been reported as a nonspecific trichoscopic feature in patients with AA and FFA [11]. This was identified in different diagnosis cases and controls in this study and was significantly related to eyebrow psoriasis.

Study Limitations

The limitations of this study were the retrospective nature of the statistical analysis and the small number of patients with each diagnosis in the control group. In addition, the controls were not matched for age or sex.

Conclusions

In this pilot study, trichoscopy was a valid tool for evaluating eyebrow involvement in LPP and FFA. Thus, it could be of great help in increasing the diagnostic accuracy and predicting the prognosis of eyebrow hair loss at an early stage. Early diagnosis may be performed by examining the tail of the eyebrows in LPP patients, which contains trichoscopic features such as peripilar scaling, peripilar erythema, broken hairs, peripilar white halos, diffuse empty follicles, and vellus hair. Yellow dots, dystrophic hairs, diffuse regrowth in different directions, and diffuse empty follicles were significantly associated with active and severe forms of LPP and FFA.

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