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Quantification of dandruff adherence to hair

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Summary

Dandruff adherence to hair shafts is a visible annoying phenomenon. The aspect can be recorded by different means including the ultraviolet light-enhanced visualization (ULEV) method and microscopy. We present another quantitative method. Hairs were clipped from the parietal scalp area of 25 volunteers complaining of dandruff. They were firmly applied onto cyanoacrylate-coated microscopic slides. Hairs were lifted up after 15–20 s leaving a cast in the adhesive coat. Dandruff were thus harvested from the hair shafts and remained attached to the cyanoacrylate coat. After staining, the material was submitted to image analysis to derive the dandruff density per unit length of hairs. In 11/25 subjects, a correlation was found between the width of the hair casts and the dandruff density. This method does not collect all dandruff along hair shafts, but data are likely representative of the whole corneocyte load.

Synopsis

L'adhérence de pellicules aux cheveux est une situation visible et ennuyeuse. Cet aspect peut être observé par plusieurs moyens incluant la méthode ultraviolet light-enhanced visualization (ULEV) et la microscopie. Nous présentons une nouvelle méthode quantitative. Les cheveux furent coupés sur la région pariétale chez 25 volontaires se plaignant de pellicules. Ils furent appliqués fermement sur des lames microscopiques couvertes de cyanoacrylate. Les cheveux furent enlevés après 15 à 20 s laissant leur empreinte dans l'adhesif. Les pellicules étaient ainsi détachées des cheveux et accrochées au film de cyanoacrylate. Après coloration, le matériel a été examiné par analyse informatisée d'images afin de quantifier la densité de pellicules par unité de longueur des cheveux. Chez 11/25 sujets, une corrélation fut retrouvée entre la largeur de l'empreinte des cheveux et la densité pelliculaire. Cette méthode ne collecte pas la totalité des pellicules, mais les resultats en sont vraisemblablement un reflet représentatif.

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Introduction

Dandruff can adhere to hair shafts. This situation makes dandruff more visible and annoying. Quantification of this condition is quite difficult unless objective assessments are performed.

The squamometry X method can be used for that purpose although it is better suited for assessing dandruff on the scalp rather than on hair [1–4]. Indeed, the sampling area is small, and the precise relationship between the hair shafts and dandruff cannot be evaluated. Thus, there is a need for improving the collection of information relative to dandruff and hair shafts.

The aim of this work was to compare the value of three methods for the visualization and quantification of dandruff adhering to hair. Dry dermoscopy was the reference method [1]. We also used the ultraviolet light-enhanced visualization (ULEV) method [5–9], the microscopic method under polarized light and a novel cyanoacrylate-harvesting method combined with computerized analytical assessment.

Materials and methods

Hair was examined in subjects complaining of dandruff using dry dermoscopy. The photographic method was the same as the one used to record scaly conditions [1]. A Dermaphot® (Heine Delta 10, Pabish, Germany) was firmly applied onto hair without interposition of oil or water. The system provides a controlled 2.5× magnification.

The ULEV method relies on recording a target area using a CCD camera equipped with an internal ultraviolet light-emitting unit (Visioscan® VC98, C+K electronic, Cologne, Germany). The method has been previously described in detail for the assessment of subclinical melanoderma and xerotic conditions [5–9]. In the present study, the camera was firmly applied to hair.

A dozen hairs coated by discrete dandruff were clipped from the parietal area in 25 volunteers.

Figure 1 Ultraviolet light-enhanced visualization of dandruff-coated hairs.

Some hair shafts were placed on microscopic slides before examination under polarized light. The other hair shafts were firmly applied onto cyanoacrylate-coated slides. After 15–20 s, hairs were lifted up. Dandruff were transferred by this means from hairs to the cyanoacrylate coat. A drop of toluidine blue-basic fuschin in 30% hydro-alcoholic solution was deposited in order to stain dandruff. After 1 min, the material was gently dipped into water before microscopic examination. Computer image analysis was performed in order to measure the width of the hair shaft casts, the dandruff size, and the density of dandruff per unit of length of the hair shafts. Examinations were performed on a series of microscopic fields showing a total of 1.25 cm of the proximal portion of the hairs.

In each subject, the mean and median numbers of dandruff and standard deviation were calculated per mm length of hair. The Spearman correlation test was performed searching for any correlation between the width of hair shaft casts and dandruff density.

Results

Dry dermoscopy conveniently showed dandruff bound to hair. Scoring the severity was possible, but precise quantitative assessments were not possible.

The ULEV method also revealed dandruff which appeared as bright objects along the hair shafts (Fig. 1). It was, however, impossible to make quantifications because some hair shafts appeared

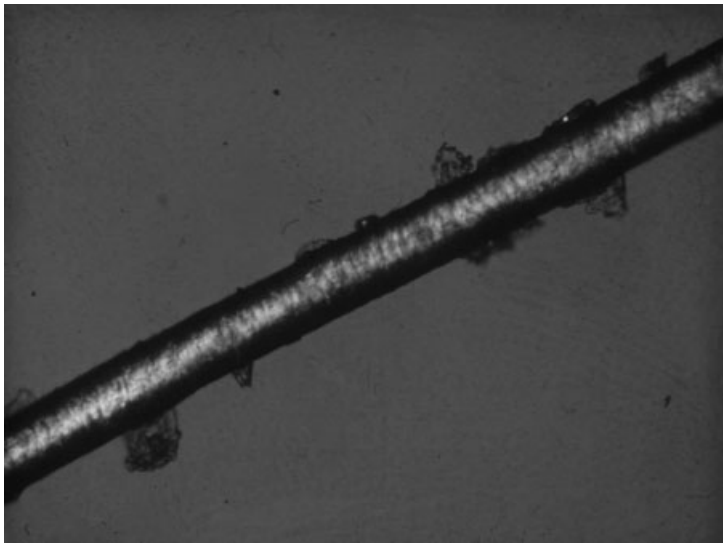

Figure 2 Polarized light microscopy of dandruff adhering to a hair shaft.

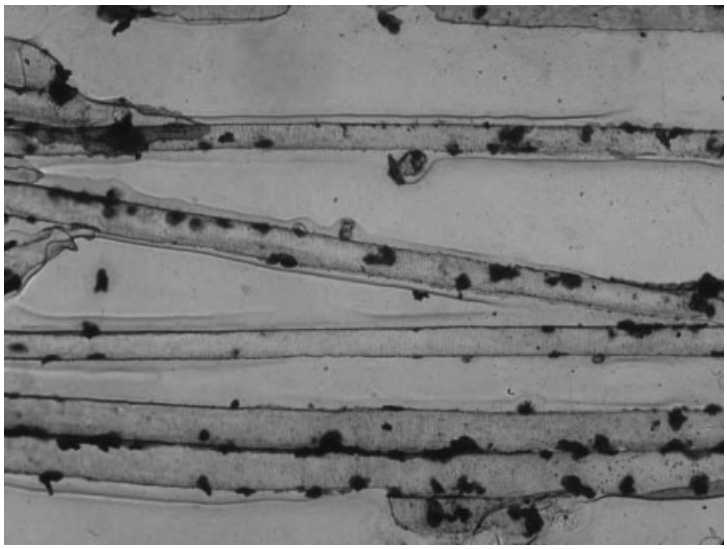

Figure 3 Hair casts and dandruff on a cyanoacrylate-coated microscopic slide.

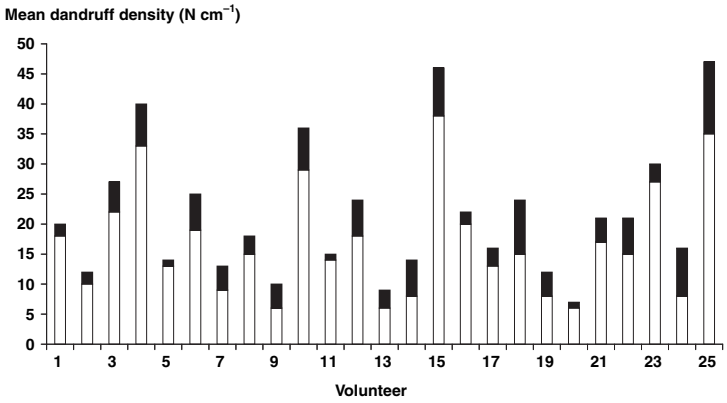

Figure 4 Mean and SD of dandruff density per cm of hair in 25 subjects.

as bright as dandruff. Indeed, the ULEV assessment shows hairs of different levels of brightness somewhat but not completely related to canitia.

As seen under the microscope, small size dandruff were present along the hair shafts (Fig. 2). In most specimens, the corneocyte clumps appeared to adhere to the hair cuticle by only a small part of their surfaces. The rest of these dandruff was lifted up. Quantification of dandruff was quite difficult on these samplings.

The cast of dandruff-coated hairs on the cyanoacrylate film is shown in Fig. 3. Dandruff appeared as dark objects often of similar size and distributed quite uniformly along the hair shaft casts. Rare free dandruff were found unbound to hairs. This material was suitable for computerized analysis. Inter-individual comparisons showed large variations in dandruff density along the hair shafts (Fig. 4). Overall, the long axis of individual dandruff ranged from 15 to 853 μm (mean: 233 μm). In 11/25 subjects, a correlation was found

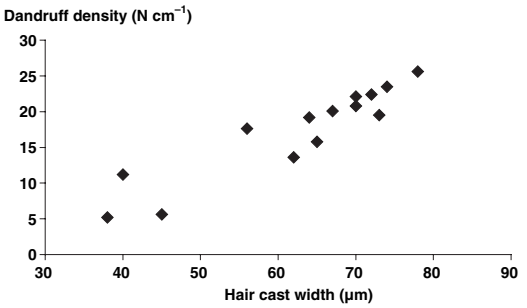

Figure 5 Example of a linear correlation found between the dandruff density and the hair cast width of 14 hairs collected in a single volunteer and placed on a cyanoacrylate-coated microscopic slide.

between the width of the hair shaft casts and the dandruff density (Fig. 5).

Discussion

Dry dermoscopy, the ULEV method and the microscopic examination of hairs covered by dandruff were convenient means for illustrating the condition. Subjective ratings were possible, but objective quantification was nearly impossible.

Our study shows that the dandruff-harvesting method on sticky slides allows us to clearly examine the distribution of dandruff along the hair shaft and to assess the size of dandruff. In the presently examined samples, the number of dandruff appeared correlated with the diameter of hairs. This is in part due to the fact that thicker hairs have a larger contact area with the cyanoacrylate coat, thus increasing the possibility to harvest more dandruff. The presently described method has the advantage to provide a sharply defined cast of the hair shafts. However, the width of the hair cast is related to, but is not equal to the hair shaft diameter. Indeed, it depends on the contact area between hairs and the cyanoacrylate coat, thus depending on the actual hair shaft diameter and curvature, and also on the thickness of the adhesive coating. The number of harvested dandruff depends on the contact area between the sample and the cyanoacrylate coating. Thus, data cannot be taken at face value, and only represents a part of all scales covering the whole hair shaft surface. In order to collect all dandruff, single hairs should be assessed on sticky slides after exerting a rolling motion to secure a contact with the whole hair surface.

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