

# TRICHOSCOPY: A NEW METHOD FOR DIAGNOSING HAIR LOSS

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## Abstract

Videodermoscopy of hair and scalp (trichoscopy) is gaining popularity as a valuable tool in differential diagnosis of hair loss. This method allows viewing of the hair and scalp at X20 to X160 magnifications. Structures which may be visualized by trichoscopy include hair shafts of different types: vellus, terminal, micro-exclamation mark type, monilethrix, Netherton type, and pili annulati hairs. The number of hairs in one pilosebaceous unit may be assessed. It may be distinguished whether hair follicles are normal, empty, fibrotic ("white dots"), filled with hyperkeratotic plugs ("yellow dots") or containing cadaverized hair ("black dots"). Abnormalities of scalp skin color or structure which may be visualized by trichoscopy include honeycomb-type hyperpigmentation, perifollicular discoloration (hyperpigmentation), and scaling.

## Introduction

Videodermoscopy is an established method in early melanoma detection and differential diagnosis of pigmented skin lesions.<sup>1,2</sup> Videodermoscopes allow also visualization of hair and hair follicles at high magnification and measurement of relevant trichologic structures. The number of hairs in a pilosebaceous unit may be assessed, as well as distinguishing whether hair follicles are normal, empty, fibrotic ("white dots"), filled with hyperkeratotic plugs ("yellow dots") or containing cadaverized hair ("black dots"). Thus, videodermoscopy of hair, scalp, eyebrows, and eyelashes (trichoscopy) is now gaining popularity in practical dermatology.

In androgenic alopecia, trichoscopy shows increased hair shaft thickness heterogeneity, decreased terminal to vellus hair ratio, predominance of hair follicle units with single hairs, presence of hyperkeratotic plugs and perifollicular hyperpigmentation. Alopecia areata is characterized by regularly distributed yellow dots, black dots, micro-exclamation mark hairs, dystrophic, and regrowing hairs. Trichoscopy allows also distinguishing cicatricial alopecia from noncicatricial alopecia. It also may serve as a research tool in evaluation of treatment efficacy in various diseases with hair loss.

In some cases a handheld dermoscope may give easy and quick insight into the trichological diagnosis. Videodermoscopes, however, have the benefit of larger magnification and more precise measurement.

## Background

Despite many years of experience with dermoscopy, the method was not used to visualize hair related structures until 1993, when Kossard and Zagarella published a case of cicatricial alopecia in a 42-year-old black woman in which dermoscopy allowed visualization of follicular fibrosis.<sup>3</sup> In this patient, dermoscopy with oil revealed uniform pale dots associated with a radiating pigment network. According to histopathology findings, the pale dots corresponded to focal decrease in epidermal melanin pigment overlying the site of the fibrous tracts and may have provided a dermoscopic clue

of cicatricial alopecia.<sup>3</sup> More than 10 years later, Lacrubba et al<sup>4</sup> first described videodermoscopic features of alopecia areata. In 2005, videodermoscopy was used for evaluation of disease severity in androgenic alopecia and monitoring treatment efficacy.<sup>5</sup> In the next year, Ross et al<sup>6</sup> specified videodermoscopy features of different acquired hair and scalp diseases. Also in 2006, "trichoscopy" became the known term for videodermoscopy of hair, scalp, eyebrows, and eyelashes.<sup>7</sup> In 2007, Rakowska et al showed, that trichoscopy may easily replace microscopic evaluation of pulled hairs in genetic hair shaft abnormalities, such as monilethrix.<sup>8</sup> The first atlas of dermoscopy of hair and scalp was published by Tosti<sup>9</sup> in 2008.

## Equipment

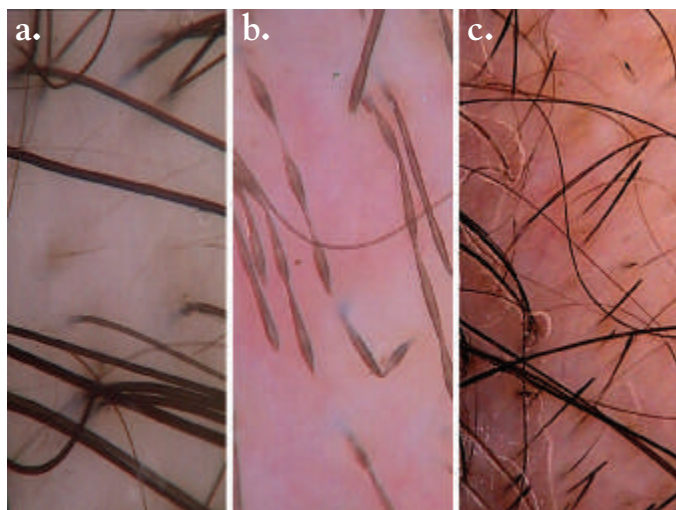
Any videodermoscope may be used for trichoscopy. The usual working magnifications are X20 and X70. It is beneficial to be equipped with software, which enables measurement of visualized structures and conversion of measurement results into a data sheet. Some hair abnormalities may be seen with a handheld dermoscope, but this device is not sufficient for precise hair evaluation in many diseases.

## Performing Trichoscopy

A regular trichoscopy screening should include evaluation of hair and scalp in the frontal, occipital, and parietal areas. In selected cases other locations are chosen for trichoscopy; these may include the eyebrows for Netherton syndrome, eyelashes for isolated eyelash alopecia, or involved scalp skin in alopecia areata or fibrosing alopecia.<sup>10</sup>

The choice of immersion fluid is a matter of individual preference. In a recent study, the usefulness of different dermoscopy immersion fluids was assessed.<sup>11</sup> Gewirtzman et al<sup>11</sup> compared aqueous, gel, alcoholic, and oily immersion fluids in regard to image clarity and tendency to form air inclusions (bubbles). Results demonstrated that dermoscopic structures were equally clear with alcohols and liquid paraffin, but slightly blurry with ultrasound gel or water. Application of alcoholic immersion fluids (70% ethanol, 90% isopropanol,

**Figure 1.** Different hairs in trichoscopy: a) terminal and vellus hairs; b) hair with nodes and internodal thinning in monilethrix; c) micro-exclamation mark hairs.



and alcoholic disinfectant) resulted in the least amount of air bubble inclusions, while liquid paraffin resulted in the most air bubbles. Taken into consideration, these results suggest using 70% ethanol for dermoscopy, because of the advantage of being odorless, not staining clothes and not crystallizing on the dermoscope. Also ethanol disinfects, evaporates immediately, and does not require wiping off.<sup>11</sup> Direct clinical experience confirms these observations. An exception is videodermoscopy of the eyebrows and eyelashes. One would not use the ethanol for localizations close to eyes. In the case of eyebrows, ultrasound gel works best, and for eyelashes sterile 0.9% sodium (sodium) chloride solution is used. Immersion fluid may be placed to the investigated skin area by either an eyedropper or spray.

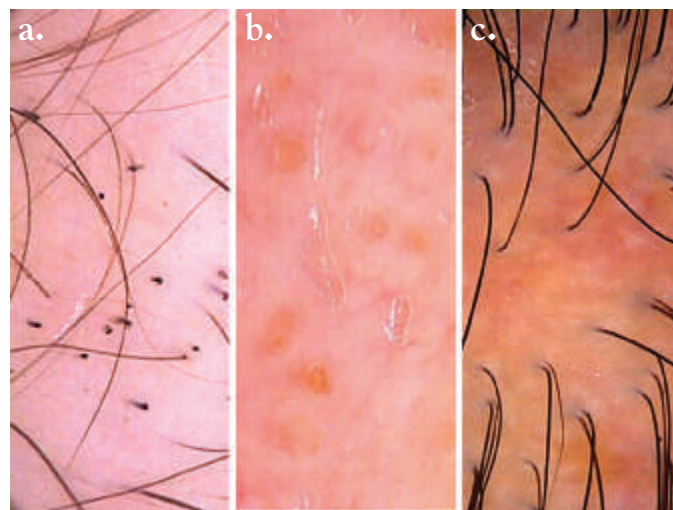
In some cases, dry trichoscopy may be of benefit. This is the case in minor or perifollicular scaling, which may pass unnoticed in trichoscopy with immersion fluid. Dry dermoscopy was used to analyze progress in alopecia areata therapy.<sup>12</sup>

### Trichoscopy Structures

Structures which may be visualized by trichoscopy include hair shafts, hair follicle openings, the perifollicular epidermis, and cutaneous microvasculature. Trichoscopy allows distinguishing between normal terminal hairs and vellus (or vellus-like) hairs, which by definition are 0.03 mm or less in thickness.<sup>13</sup> The method enables visualization of micro-exclamation mark hairs which may be 1 to 2 mm or less in length. Structural hair shaft abnormalities may be visualized by trichoscopy.<sup>10</sup>

Abnormalities of scalp skin color/structure which may be visualized by trichoscopy include honeycomb-type hyperpigmentation, perifollicular discoloration (hyperpigmentation) predominant in androgenic alopecia, and perifollicular fibrosis, characteristic for some forms of fibrosing alopecia.<sup>6</sup>

**Figure 2.** “Dots” in trichoscopy: a) black dots corresponding to calcified hairs; b) yellow dots corresponding to hyperkeratotic plugs in hair follicle openings; c) white dots corresponding to follicular fibrosis.



Cutaneous microvasculature often may be seen in scalp skin. Additionally scaling intensity may be evaluated. Most clinicians use a 5-point intensity scale (0=no scaling and 4=severe scaling).

### Genetic Hair Shaft Abnormalities

#### Monilethrix

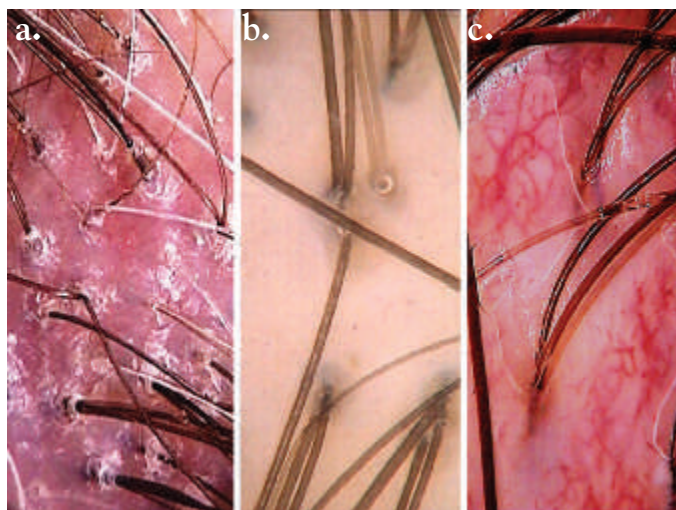
Monilethrix is a rare autosomal dominant disease of the hair shaft. Most commonly the disease is related to a mutation in human hair keratin *hHb6* gene.<sup>14</sup> Structure abnormalities of hair cortex are in particular multiple constrictions of hair shaft, which alternate with elliptical nodosities, giving the microscopical picture of a pearl necklace. The internodes exhibit a high tendency to fracture, giving hair a stubble-like appearance. Hair in patients with monilethrix is seldom thick or longer than 5 to 8 cm.<sup>15</sup> The effect of disease on hair is variable and, even within families, may range from close to normal or mild occipital hair loss to near total alopecia.<sup>15</sup> Trichoscopy in such cases demonstrates an unusual picture of hair shafts bended regularly in multiple places and curving in different directions, referred to as the “regularly bended ribbon sign.”<sup>18</sup>

#### Netherton Syndrome

Netherton syndrome is a rare autosomal recessive disorder associated with mutations in the *SPINK5* gene encoding LEKTI (lympho-epithelial Kazal-type related inhibitor).<sup>16</sup> The disease is characterized by an ichthyosiform erythroderma, atopic manifestations, and hair shaft abnormalities. The basis for diagnosis of Netherton syndrome remains microscopically confirmed trichorrhexis invaginata. A single hair with characteristic invagination is sufficient to establish diagnosis, but hairs with pathognomic features are often difficult to spot.<sup>17</sup>

Clinically hair appears sparse, dull, brittle and short. The hair abnormality, called “bamboo hair” or trichorrhexis invaginata, is microscopically characterized by a characteristic

**Figure 3.** Abnormalities in the perifollicular and interfollicular scalp areas: a) perifollicular hyperkeratosis; b) perifollicular hyperpigmentation; c) enlarged blood vessels.



invagination of the distal portion of the hair shaft into its proximal portion forming a “ball in cup” appearance. This ball and socket structure is being called “golf-tee type” of appearance by some authors and represents a unique form of hair fiber fracture.<sup>17</sup>

Trichoscopy allows screening and detection of hair shaft invaginations characteristic of trichorrhexis invaginata without the need of hair sampling for *ex vivo* evaluation. Characteristic hair shaft abnormalities may be observed in scalp hair and eyebrows by both videodermoscopy and handheld dermoscope.<sup>10</sup> Videodermoscopy however, has the benefit of significantly larger magnification and better visualization, as well as simplicity in recording visualized abnormalities for future reference.

#### Pili Annulati

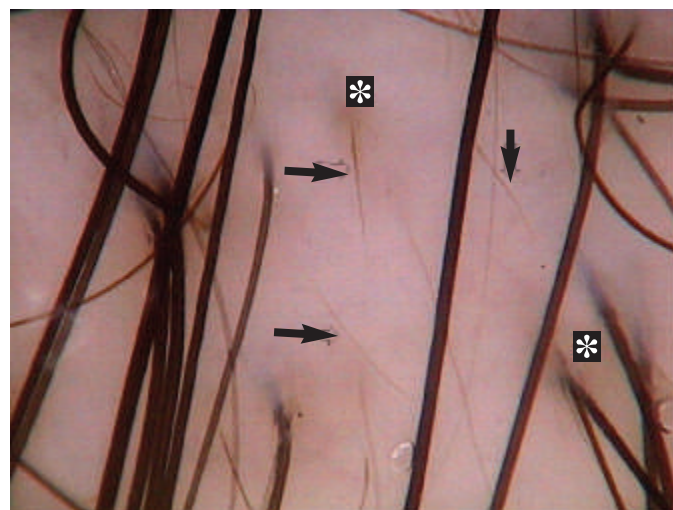
Pili annulati is a rare hair shaft disorder inherited in an autosomal dominant manner with variable penetrance. The disease is characterized by the appearance of alternating light and dark bands as seen with the unaided eye. The light bands are abnormal areas due to cavities within the cortex.<sup>18</sup> Scalp hair involvement has been described as the most commonly affected site, but axillary, beard, and pubic hair involvement have also been described.<sup>18</sup> The cavities appear as whitish areas within a darker hair shaft, unlike light microscopy of pulled hair where cavities within the cortex appear darker compared to the hair cortex.<sup>10</sup>

#### Acquired Hair Diseases

##### Androgenic Alopecia

In androgenic alopecia, trichoscopy allows visualization of abnormalities which are known from research performed with invasive and semi-invasive techniques. One of most characteristic features of androgenic alopecia is heterogeneity of hair shaft diameter. According to Lacharriere et al<sup>19</sup> diversity in hair diameter is the main and most accurate clinical parameter linked to follicle miniaturization. Olszewska et al

**Figure 4.** Androgenic alopecia in trichoscopy. High hair thickness diversity, multiple vellus hairs (arrows), perifollicular hyperpigmentation (\*).



have shown that trichoscopy allows to perform precise measurement and monitoring of hair shaft thickness in androgenic alopecia.<sup>5,20</sup> Accordingly identifying and counting vellus hairs (thin hairs of less than 0.03 mm in width) is possible. Without the need to perform multiple scalp biopsies,<sup>13,21</sup> the terminal to vellus hair ratio may be calculated.

Via trichoscopy, androgenic alopecia has been characterized by an increased percentage of thin hairs, decreased average hair diameter, predominance of hair follicle units with single hairs, presence of yellow dots, and perifollicular hyperpigmentation.<sup>5,6,7,21</sup>

A case report of identifying lipedematous scalp by videodermoscopy in 2 male patients with androgenic alopecia was published recently.<sup>22</sup> Direct clinical experience of the authors' confirms the value of trichoscopy in diagnosing lipedematous alopecia, regardless of coexisting androgenic alopecia.

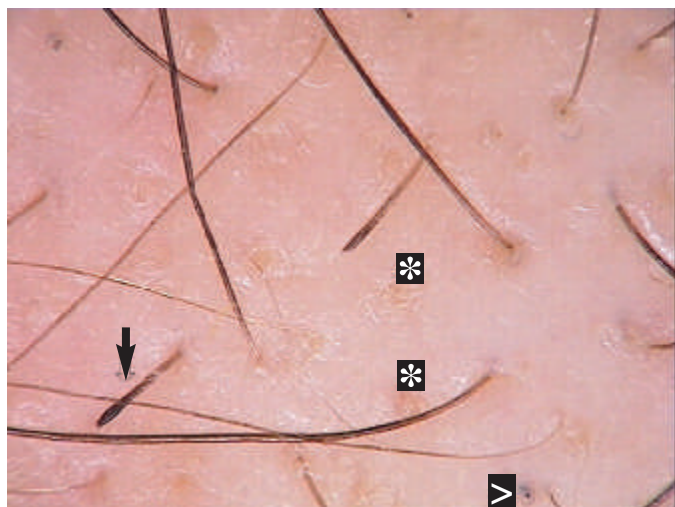
##### Alopecia Areata

Trichoscopy is particularly useful in diagnosing alopecia areata with atypical course of disease, where the diagnosis may not be established solely on basis of clinical appearance. Most characteristic features include regularly distributed hyperkeratotic plugs in hair follicles (yellow dots), cadaverized hairs (black dots), micro-exclamation mark hairs (visible when 1 mm or less in length), dystrophic and regrowing hairs. Some vellus hairs may also be present. The average hair thickness is not significantly decreased and features of fibrosis (white dots) may be seen in long-lasting alopecia areata.<sup>6,23</sup>

##### Cicatricial Alopecia

Cicatricial alopecias (scarring alopecias) are of diverse etiology and pathogenesis,<sup>24,25</sup> and represent a diverse group of diseases characterized by a lack of follicular ostia and irreversible alopecia. In trichoscopy, fibrosis of follicular ostia is visible in the form of white dots.<sup>3,6</sup> In more advanced stages of these white dots coalesce to form a cohesive area lacking follicular ostia. This characteristic image allows unproblematic

**Figure 5.** Alopecia areata in trichoscopy. Micro-exclamation mark hairs (arrow), yellow dots (\*), black dot (>).



differentiating between scarring and nonscarring alopecia. At present, a precise distinction of cicatricial alopecias of different origin is not possible by trichoscopy.

### Research and Cosmetology

In a 2005 study, trichoscopy was used to monitor the impact of dutasteride therapy on hair thickness and hair shaft heterogeneity in androgenic alopecia.<sup>5</sup> It has been shown that the method may be used as a research tool to evaluate the effect of different therapeutic agents or cosmetic products on hair and scalp condition.<sup>20</sup> Trichoscopy has the advantage of being noninvasive and allowing precise measurement of visualized structures. This makes trichoscopy a valuable research tool, especially in frequent and long-term monitoring.

### Conclusion

Trichoscopy is a newly developed method of considerable potential in dermatological practice. It is gaining popularity as an accessory tool in differential diagnosis of hair loss. However, additional research is clearly needed to further characterize structures which may be visualized by trichoscopy and to examine the sensitivity and specificity of trichoscopy in diagnosing different hair diseases.

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