

## Review of the Trends in Diagnosing Alopecia with Scalp Biopsy and Trichoscopy

Annyella Douglas<sup>1</sup>, Think Q. Nguyen<sup>2</sup>, Jayson Suriano<sup>2</sup>, Neda Nikbakht<sup>2\*</sup>

<sup>1</sup>Department of Advanced Dermatology and Cosmetic Surgery, Thomas Jefferson University Hospital, Pembroke Pines, USA; <sup>2</sup>Department of Dermatology and Cutaneous Biology, Thomas Jefferson University, Philadelphia, USA

### ABSTRACT

**Background:** Hair loss is a common problem among patients who present to their dermatologist and diagnosis in the hair clinic often includes a thorough history, clinical examination with trichoscopy and a potential scalp biopsy.

**Objective:** To assess the trends and development of trichoscopy and the utilization of scalp biopsy in dermatologic practice.

**Methods:** Literature search using keywords “Trichoscopy”, “alopecia”, “scalp biopsy”, “hair loss” was done in Pubmed, Ovid MEDLINE, and Cochrane. The search yielded 138 articles after title, abstract, in-text review and removing duplicates, 53 articles were included.

**Results:** The literature search demonstrated a trend in the relationship between scalp biopsy and trichoscopy in diagnosing scalp disorders, especially alopecia, from late 1950s to present. From the late 1950s-mid 2000s, scalp biopsy was the gold standard for scalp disorders/alopecia diagnosis. From the mid 2000s-mid 2010s, trichoscopy became popular and was speculated to replace scalp biopsy. From 2016 until now, scalp biopsy is reinforced as the ultimate diagnostic tool, and trichoscopy is valuable in aiding diagnosis.

**Conclusion:** Scalp biopsy and trichoscopy are both essential diagnostic aids. Dermatologists and pathologists in training should be competent in performing both techniques and interpreting the results of both tests.

**Keywords:** Alopecia; Trichoscopy; Biopsy; Hair loss; Scarring; Non-scarring; Diagnosis; Dermoscopy; Scalp; Videodermoscopy; Dermatoscope

### INTRODUCTION

Alopecia is one of the most common reasons patients seek dermatologic care. Alopecia is divided into two major categories: Primarily non scarring and scarring alopecia. Scarring alopecia often signifies that hair follicles have been destroyed although late stages of non-scarring alopecia can also present as scarring alopecia. Prompt and accurate diagnosis of hair disorders is imperative.

Diagnosis often includes a thorough history, clinical examination and sometimes laboratory evaluations. A thorough history entails components related to the duration, pattern, and thinning of hair loss in addition to relevant symptoms, medications, surgeries, nutrition, and psychosocial aspects. A complete clinical examination of the scalp may incorporate techniques such as the hair card, pull test or tug test and often includes a scalp exam using trichoscopy and/or scalp biopsy [1].

Trichoscopy and scalp biopsy remain two of the most popular diagnostic aids in alopecia. Trichoscopy or ‘scalp dermoscopy’ is a non-invasive technique which allows for magnified visualization

of the hair and scalp skin. It may be performed with a manual dermoscope (up to × 10 magnification) or a videodermoscope (up to × 1,000 magnification) [2]. A scalp biopsy is commonly performed with a 4 mm punch biopsy in which a sample of scalp tissue is sent to a pathologist for histologic diagnosis. There has been much debate about the reliability of one technique over the other. This manuscript will review the existing literature to investigate the past and current expert opinions on the role of trichoscopy *versus* scalp biopsy in the diagnosis of alopecia.

### LITERATURE REVIEW

A broad review was conducted using a comprehensive list of keywords including “Trichoscopy”, “alopecia”, “scalp biopsy”, “hair loss” on PubMed, OVID MEDLINE, and Cochrane databases published from inception to June 2024. Inclusion criteria included English language, human studies, and the use of trichoscopy and/or scalp biopsy in diagnosing scalp alopecia. The result yielded a total of 138 articles, 21 publications were removed as duplicates and 53 met the inclusion criteria. The included articles report on

**Correspondence to:** Neda Nikbakht, Department of Dermatology and Cutaneous Biology, Thomas Jefferson University, Philadelphia, USA, E-mail: neda.nikbakht@jefferson.edu

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the role of either trichoscopy or scalp biopsy used independently or in conjunction with one another in treating various types of alopecia as shown in Supplementary Table 1.

The earliest literature of scalp biopsy was written in 1958. The histological specimen of a scalp biopsy was studied to understand the differences in the matrix of the hair bulb and its dermal papilla in an alopecic scalp *versus* a normal scalp [3]. This study demonstrated the utility of using 6 mm punch biopsy specimens to study hair disorders. A study by Crounse et al., explored the correlation between the toxicity of different chemotherapeutic agents and the shape of a patient's hair roots compared to that of a standard control [4]. By carefully examining the root of individual hair epilated by forceps, the study identified the effects of chemotherapy on growing hair and resting hair. Nevertheless, the study acknowledged that their approach was insufficient to determine the specific damage caused by each chemotherapeutic drug unless it was done by investigating scalp biopsy specimens [4].

As scalp biopsy further gained an important role in hair disease diagnosis, it became essential to collect scalp tissue appropriately. Scalp biopsy techniques and proper parameters gradually developed and continuously refined to ensure the acquirement of comprehensive hair follicle structures. Current guidelines include selecting a biopsy site with active disease, notably avoiding bald spots in cicatricial alopecia. It is advised to use a 4 mm punch biopsy, oriented in the direction of hair growth which would then be sectioned horizontally. Biopsies performed at multiple sites of the scalp are ideal if there is concern for multifactorial alopecia [5].

In the mid to late 2000s, the seemingly irreplaceable role of scalp biopsy in diagnosing various hair disorders was challenged by the rising popularity of another diagnostic tool: Trichoscopy. Kossard et al., were the first to describe the use of a dermatoscope to identify follicular fibrosis in cicatricial alopecia [6]. Ross et al., identified that yellow dots can be seen with videodermoscopy in cases of alopecia areata and advanced androgenetic alopecia [7]. It was concluded that information revealed by videodermoscopy may obviate the need for biopsy, especially because scalp biopsy was not often diagnostically determinative. Also, Rudnicka et al., introduced the term "trichoscopy" to the medical literature, defined as videodermoscopy of the hair and scalp, which allowed the hair and scalp to be visualized at 20x to 160x magnifications [8,9]. The tool started to gain traction and became popular due to its advances in identifying scalp characteristics specific to various alopecia subtypes. By 2010, the term "trichoscopy" described the examination of the hair and scalp with either videodermoscopy or dermoscopy [10]. Today, trichoscopy is usually performed *via* a dermatoscope, with alcohol as the interface solution in the average dermatology clinic. Additionally, videodermoscopy magnification has now advanced past 160x magnification.

Multiple studies from the late 2000s to mid-2010s suggested that trichoscopy can completely replace scalp biopsy in certain types of alopecia due to its non-invasive approach [2,7,9,11-19]. For example, Rudnicka et al., concluded that it is possible to diagnose most genetic hair shaft defects with trichoscopy [16,17]. As research on trichoscopy started to bloom during this same period, different opinions on the scope of trichoscopy as a diagnostic tool emerged. Many challenged the concept of trichoscopy as the sole diagnostic tool as new research pointed out both unique and shared trichoscopic characteristics of alopecia subtypes [1,16-19]. For example, in 2012, it was realized that black dots seen under trichoscopy were not specific to alopecia areata [19]. Miteva et al.,

published that flame hair is not a specific trichoscopic characteristic to trichotillomania as previously believed [20]. However, Kowalska-Oledzka et al., identified that trichoscopy had high sensitivity and specificity and can be considered as a reference test for diagnosis [21]. Moreover, research started to adopt the notion that trichoscopy should be used as an auxiliary diagnostic tool in uncertain diagnostic presentations, as a guide for optimal biopsy sites, or as an assessment of treatment response at follow-up visits [9,21,22-24]. It was indeed an exciting era for trichoscopy as a tool in the world of dermatology [25-32].

As the late 2010s and early 2020s approached, the opinion on the role of trichoscopy as an auxiliary diagnostic tool started to solidify [33-40]. Most literature in this period supported that trichoscopy should complement scalp biopsy, especially in cases with unclear definite diagnoses [4,43-47]. Starace et al., reviewed a variant of alopecia areata which mimicked other alopecia subtypes, necessitating a scalp biopsy for diagnosis and in 2020 advocated for trichoscopy-guided biopsy for patients with diffuse hair thinning [27,36]. Herein, scalp biopsy returns to its original placement as the most reliable tool for diagnosing alopecia. While pathologists should be trained in evaluating hair histopathology, dermatologists need to be trained extensively on how to perform a proper scalp biopsy and how to appropriately utilize trichoscopy to obtain optimal biopsy samples. A recent study pointed out up to 70% discrepancy in pre and post-biopsy alopecia diagnosis, further advocating for a comprehensive diagnostic approach (medical history, trichoscopy, and biopsy) and well-rounded training of dermatologists and pathologists who specialize in hair conditions [48].

## DISCUSSION

Scalp biopsy was among the first and most reliable diagnostic tools for various hair and scalp disorders, dating back to the 1950s. As scalp biopsy became more common and utilized more frequently in clinics, guidelines and recommendations for this procedure constantly developed, resulting in a standard of practice. Scalp biopsy remained the most reliable diagnostic tool until trichoscopy emerged in popularity in 2004-2006. Marveled by its novelty and non-invasive approach, many researchers speculated the replacement of scalp biopsy by trichoscopy, as evidenced by the rising body of literature from 2008-2016. However, as more research and data amassed after this period and until now, scalp biopsy remains as an imperative diagnostic approach. At the same time, trichoscopy solidifies its purpose as a valuable tool in diagnosing hair disorders [49-51].

Much research has pointed out the tremendous benefit of trichoscopy to guide in diagnosis, biopsy sites, assess treatment responses, and follow hair disease progression, making it an asset in the clinic. However, when diagnosis is in question, a scalp biopsy is often still needed, with a trichoscopy guided biopsy yielding best results. As a result, dermatologists need to be well-versed in trichoscopy and skilled in obtaining proper scalp biopsy specimens. Besides fine trichoscopy and biopsy techniques, dermatologists should be comfortable obtaining a comprehensive history and differential diagnoses, as this clinical information can provide important clues for pathologists in making the appropriate clinicopathological correlation [52,53]. Hair pathologists need to be well-trained in hair histopathology and proficient in interpreting horizontal tissue sections. It is also essential for the laboratory processing scalp histology samples to be adept at handling scalp tissue and horizontal sections, as these techniques are uncommon

in general laboratories. Indeed, a well-communicated network of dermatologists performing scalp biopsies, a dermatopathology laboratory processing scalp sample, and a pathologist well-trained in hair histopathology will increase optimal diagnostic yield for alopecia [54,55].

## CONCLUSION

The literature enforces that the scalp biopsy and trichoscopy are both essential diagnostic aids for alopecia. The trichoscopy is helpful in many roles as it is a guide in diagnosis, biopsy sites, treatment response, and disease progression. For some time, it was thought that a scalp biopsy may be replaceable. However, the literature favors that a trichoscopy guided biopsy yields the best results when the diagnosis is ambiguous. Dermatologists should be competent in both techniques and should work alongside pathologists well-trained in hair histopathology.

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