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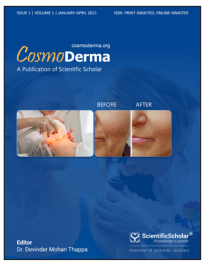

Original Article

Utility of trichoscopy in comparison to the standard methods for assessing the disease activity, severity, and therapeutic response in alopecia areata

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ABSTRACT

Objectives: Alopecia areata (AA) is a common autoimmune hair disorder with variable disease activity and severity. Conventionally, hair pull test (HPT) and off late trichoscopy are used to diagnose and monitor disease course in AA. The aim of the study was to evaluate the use of trichoscope in monitoring the disease activity, severity, and therapeutic response in AA.

Material and Methods: This was a hospital-based and longitudinal study. Consecutive patients with AA between March 2018 and February 2019 were included in the study. Baseline clinical examination, HPT, and trichoscopy of patients was done at baseline and adequate treatment initiated. Monthly follow-up for next 3 months was done to study response to treatment.

Results: Black dots (BDs) (100%) were commonest trichoscopic feature followed by yellow dots (YDs) (93.5%). BDs, broken hairs (BHs), and short vellus hairs (SVH) had significant correlation with disease activity while all trichoscopic markers significantly correlated with disease severity. With each follow-up, mean values for YDs, BDs, and BHs were declining, while SVH was increasing steadily. The abatement of trichoscopic activity markers preceded the disappearance of a positive HPT.

Conclusion: The abatement of trichoscopic markers of disease activity in AA preceded a negative HPT, highlighting the role of trichoscopy as a useful tool in monitoring therapeutic response.

Keywords: Alopecia areata, Trichoscopy, Hair pull test, Yellow dots, Black dots, Exclamation mark hairs, Short vellus hairs

INTRODUCTION

Alopecia areata (AA) is a common autoimmune hair disorder, presenting as non-scarring, patchy, hair loss that can affect any hair-bearing area, across both genders and age group[1,2] Worldwide disease prevalence is around 0.2% with a prevalence of about 0.7% in India.[3-5] It accounts for 25% of all alopecia cases. Diagnosis of AA is usually clinical.[6] The hair pull test (HPT) can help assess disease activity and progression of AA.[7]

Trichoscopy (scalp dermoscopy) is a non-invasive diagnostic procedure that allows *in vivo* visualization of the epidermal portion of hair follicles, perifollicular epidermis, and hair shafts and even perform

measurements, such as hair shaft thickness, alleviating the need of removing hair for diagnostic purposes.[1] Trichoscopy is an excellent complimentary aid to clinical examination and at times, undo the need of a scalp biopsy. Characteristic trichoscopic findings of AA include cadaverized hairs or black dots (BDs), exclamation mark hairs (EMH) or tapering hairs (THs), broken hairs (BHs), yellow dots (YDs), and clustered short vellus hairs (SVH).[6] SVH and YDs are considered as sensitive markers while BDs, THs, and BHs are reported as specific markers for diagnosing AA.[8] Trichoscopy have been used to assess treatment response in AA.[6] Seo *et al*. reported subsidence of trichoscopic markers of disease activity in AA to preceed negative HPT after intralesional steroid treatment.[7]

With this background, this study was conducted to evaluate the use of trichoscope in monitoring the AA disease activity, severity, and therapeutic response.

MATERIAL AND METHODS

This was a hospital-based and longitudinal study done in a tertiary care hospital in North India from March 2018 to February 2019. Institutional Ethics committee clearance obtained before initiating the study. Consecutive patients with AA of all age groups and both genders were included in the study after written informed consent. While pregnant and lactating mothers were excluded from the study. In case of minors, consent was obtained from guardians. AA was defined as non-scarring and well-demarcated patches of hair loss over the scalp and/or body. Detailed history and clinical examination of enrolled patients were filled in a standard proforma. Photographs were taken after a separate consent for photography. At baseline, severity and activity of AA were assessed as follows

Severity of AA by "Alopecia Grading Scale" (AGS)[9] graded as

S0 –No hair loss, S1 –<25% hair loss, S2 – 26–50% hair loss, S3 – 51–75% hair loss, S4 – 76–99% hair loss, and S5 – 100% hair loss; where S stands for scalp

B0 – No body hair loss, B1 – Some body hair loss, and B2 – 100% body (excluding scalp) hair loss; B stands for body

N0 – No nail involvement and N1 – Some nail involvement, N stands for nails

HPT: It was performed by gentle and light pulls from all four sides of a patch and noted as positive (if >10% hairs or >6 hairs pulled out) or negative.

Trichoscopy (Dermlite DL4, third-generation Polarized Dermoscope, ×10 magnification) was done on 4 points on margin and 1 point on center of the patch and also perilesional scalp.

Trichoscopic activity of AA was calculated by the ratio of the sum of pathognomonic findings of AA (YDs, BDs, BHs, and EMH) and SVH (marker of hair regrowth).

$$\textit{Trichoscopic activity of AA } (\alpha) = \frac{\textit{YDs + BDs + BHs + EMH}}{\textit{No. of SVH}}$$

Value of $\alpha \geq 1$ was indicative of active disease, while a value <1 suggested that the hair regrowth was significant.

Thereafter patients received either one of the following treatments according to the British Association of Dermatologists' guidelines,[10] which includes: topical steroid twice daily or intralesional triamcinolone acetonide 5 mg/mL injection every 4 weeks, or oral steroid mini pulse with tablet betamethasone 5 mg for 2 consecutive days every week depending on the clinical extent and severity. No randomization of treatment protocol was done.

Patients were followed up at 4 weekly intervals until 12 weeks. At each follow-up visit, the AGS score, HPT, and trichoscopy were checked along with hair regrowth assessment by "The Hair Re-growth Grade" scale[5] given as, Scale I: 0–25%, Scale II: 26–50%, Scale III: 51–75%, and Scale IV: 76–100%.

Positive outcome was defined as subsidence of trichoscopic markers of disease activity (YDs, BDs, BHs, and EMH) preceding a negative HPT following standard treatment.

The outcome variables (clinical response and dermoscopic parameters) were assessed and quantified every 4 weeks for a maximum follow-up period of 12 weeks).

Statistical analysis

Correlations between the incidence of each dermoscopic finding and the disease activity or severity were analyzed using the Spearman rank-order correlation coefficient test. All statistical analyses were carried out at 95% confidence interval and $P < 0.05$ was considered as significant.

RESULTS

A total of 50 patients were enrolled, of which 8% were lost to follow-up and the remaining 46 patients were analyzed. Mean age was 28.02 ± 11.66 years. Male to female ratio was 1.3:1 (M = 26, F = 20). Average duration of disease was 10.38 ± 27.42 months. The most common type of AA was the alopecia focalis (86.9%, n = 40) followed by alopecia universalis (8.7%, n = 4). About 28.3% patients (n = 13) had symptomatic lesions, itching being the most common. Scalp involvement was most common (71.7%, n = 33) followed by beard area (15.2%, n = 7). Personal history of atopy was present in 45.7% (n = 21). Family history of AA was found in 13% (n = 6). Nail involvement was found in 37% (n = 17), most common finding being leukonychia in 22% (n = 10). Clinicodemographic characteristics of the study population are described in [Table 1].

Table 1: Summary of the demographic and clinical characteristics of study population.

Characteristics	*n* (%)
Males	26 (56.5)
Females	20 (43.5)
Age distribution (%)	
1–10 years	8.7
11–20 years	13
21–30 years	37
31–40 years	26.1
41–50 years	13
51–60 years	2.2
Sites affected	
Scalp only	33 (71.7)
Beard only	7 (15.2)
Scalp and Beard	1 (2.2)
Scalp and eyebrow	1 (2.2)
Scalp and body	4 (8.7)
Clinical patterns	
AA focalis	40 (86.9)
AA universalis	4 (8.7)
Ophiasis	1 (2.2)
Sisaipho	1 (2.2)
Positive family history, %	13 (6/46)
Association with atopy, %	45.7
Associated thyroid disease, %	2.2 (1/46)
Associated diabetes mellitus, %	2.2 (1/46)

SD: Standard deviation, AA: Alopecia areata

Disease activity at baseline

HPT was positive in 94.7% ($n = 44$). On trichoscopy, BDs were seen in 100% cases, YDs in 93.5% ($n = 43$), BHs in 97.8% ($n = 45$), EMH in 47.8% ($n = 22$), and SVH in 100% cases. Other reported trichoscopic findings such as coudability hairs, cumulus-like clustered white dots (CWD), coiled hairs, flame hairs, monilethrix-like hairs, pigtail hairs, white dots (WDs), and Pohl-Pinkus constrictions, each were seen in <5 cases. Statistically significant association was observed between BDs, BHs, SVH, and disease activity (HPT) at baseline.

Disease severity at baseline

Using the AGS score, up to 6.5% ($n = 3$) had severe disease (100% scalp hair loss and body hair involvement). A statistically significant correlation between disease severity and all the trichoscopic features (YD, BD, BH, EMH, and SVH) were seen.

Follow-up assessment (at each visit)

About 87% ($n = 40$) of them had 25% regrowth at first follow-up visit. About 65.2% ($n = 30$) had 50% regrowth at second follow-up visit and up to 45.7% ($n = 21$) had >50% regrowth at third follow-up visit. Disease activity assessed by HPT demonstrated that only 8.7% ($n = 4$) of them had a negative HPT at the end of 12 weeks. Disease severity by AGS score showed 10.8% ($n = 5$) of them with >25% reduction in severity of AA at the end of 12 weeks.

[Table 2] shows the mean values of trichoscopic features and [Figure 1] shows the trend of trichoscopic features –YD, BD, BH, and SVH over the study period.

Relation between trichoscopic features and disease activity assessed by HPT

At third follow-up visit (12 weeks) statistically significant association was observed only between BHs and HPT [Table 3]. It was observed that YDs, BDs, and EMH were more indicative of early active disease and early to abate with therapy [Figures 2 and 3].

Relation between trichoscopic features and disease severity assessed by AGS score

At last follow-up visit (12 weeks) statistically significant association was observed between disease severity and YDs, BDs, BHs, and SVH while, the association between disease severity and EMH was not statistically significant [Table 4].

Relation between trichoscopic AA disease activity (α) and disease activity assessed by HPT

At third follow-up visit (12 weeks), 95.7% of patients with trichoscopic AA disease activity (α) <1, indicating hair regrowth, did not have negative HPT. The abatement of trichoscopic activity markers preceded the disappearance of a positive HPT. It was seen that the change in the HPT results was not significant even at the end of the third follow-up visit indicating that the HPT is a poor parameter to assess the disease activity. [Table 5] shows the comparison (*P*-values) of the trichoscopic features at each visit with that of the baseline.

DISCUSSION

AA presents with non-cicatricial patchy hair loss.[11] Our findings of male preponderance (56.5%), prevalence in 3rd decade, mean disease duration of 11 months, alopecia focalis as commonest clinical type, and scalp as most common site involved are similar to existing literature[5,6,12,13] Up to 45.7% of our patients had personal history of atopy while existing literature reports this association to be around 10–22%.[14] Thyroiditis, diabetes mellitus, and Down's syndrome were found in 2.2% of the patients each. Sharma *et al*.[3] reported association of AA with autoimmune thyroiditis in 1% cases. Nail changes are reported in 29% of adults of AA. In the present study, this was seen in 37% of patients. The presence of nail involvement denotes severe AA.[15-17] Geometric pitting is typical of AA.

Table 2: Visit-wise change in the mean value of trichoscopic features.

Trichoscopic features	Mean value (SD) at baseline	Mean value (SD) at 1st Follow-up (FU)	Mean value (SD) at 2nd FU	Mean value (SD) at 3rd FU
YD	64.96±66.96	36.41±35.6	22.45±24.25	13.83±17.60
BD	40.15±48.01	26.22±27.76	17.5±20.03	9.43±10.12
BH	34.39±58.57	17.41±25.29	12.43±19.44	7.369±12.99
EMH	1.87±2.49	1.09±2.02	0.30±0.76	0.70±0.33
SVH	36.87±35.59	98.15±76.01	139.48±97.04	161.57±102.09

YD: Yellow dot, BD: Black dot, BH: Broken hair, EMH: Exclamatory mark hair, SVH: Short vellus hair, SD: Standard deviation. It is shown that the mean values for each trichoscopic features at each visit. It is evident that the values are declining for the pathognomonic hairs (YDs, BDs, BHs, and EMH) while the values are tremendously rising for SVH indicative of the treatment response

Table 3: Correlation of disease activity with trichoscopic features at third follow-up visit.

Disease activity (HPT)	YD	BD	BH	EMH	SVH
Present (42)	35	34	33	2	42
Absent (4)	3	2	1	0	4
Total (46)	38	36	34	2	46
Correlation coefficient (Fischer's exact test)	0.5477	0.2015	0.0044	1	1
P-value	>0.05 (NS)	>0.05 (NS)	<0.05 (S)*	>0.05 (NS)	>0.05 (NS)

HPT: Hair pull test, YD: Yellow dot, BD: Black dot, BH: Broken hair, EMH: Exclamatory mark hair, SVH: Short vellus hair. S: Significant, NS: Not significant

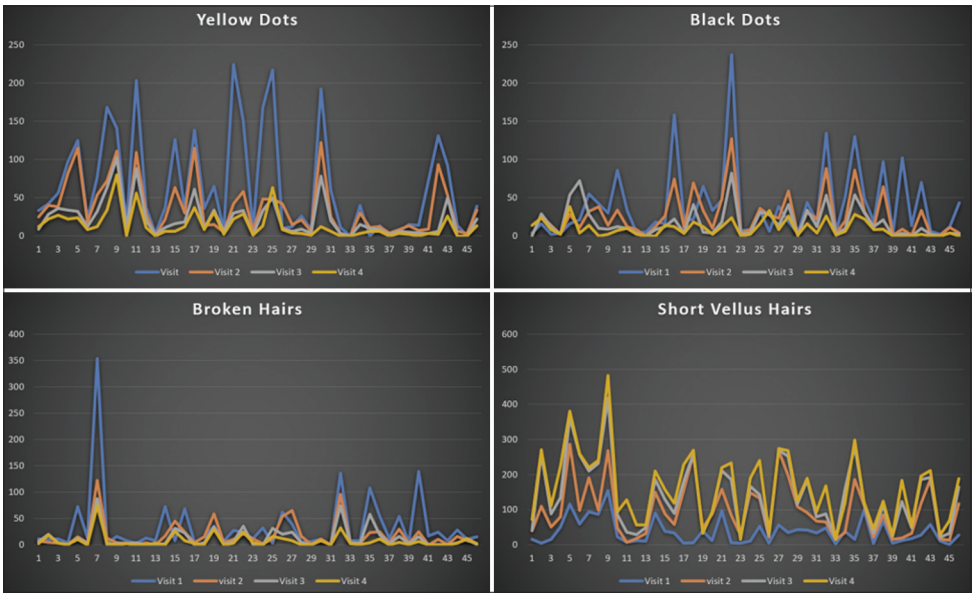

Figure 1: Trends in trichoscopic features over 3 months period (Baseline to third follow-up visit).

YDs represent the follicular infundibular orifice clogged with yellowish sebum and/or keratotic material. YDs were initially proposed by Ross *et al.*[18] and regarded as the most sensitive trichoscopic feature of AA.[19] However, they are not specific for AA. YDs are also seen in androgenetic alopecia (predominantly on the frontal area), dissecting cellulitis of the scalp (YD as huge three-dimensional soap bubbles), discoid lupus erythematosus (large dark YDs), trichotillomania, and AA incognito. Their relatively regular distribution in AA is characteristic in nature. YDs tend to correlate with disease severity and usually predominates in long-lasting and inactive disease.[20] In this study, YDs were observed as regular, round, and yellowish structures around the ostia and were present in 93.5% of the patients. Existing studies showed incidence of YDs ranging from 6% to 100%.[5,6,8,13,18,21-25] This variation is attributed to various factors such as skin phototypes, type of dermoscope, and shampooing

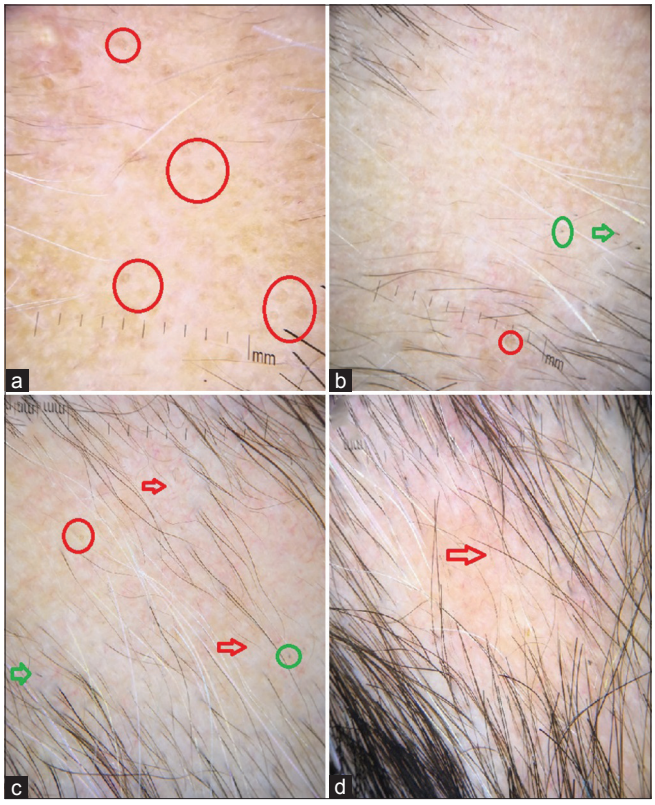

Figure 2: The declining trend in yellow dots (red circle) and rising trend in short vellus hairs (red arrow) as seen by trichoscopy at each visit. Few black dots (green circle) and broken hairs (green arrow) seen at first follow-up visit also disappeared in subsequent visits. (a) baseline, (b) first follow-up visit, (c) second follow-up, and (d) third follow-up visit.

habits. Studies on Indian population show a higher incidence of YDs, probably be due to the Indian practice of oiling hair.[25] In this study, the mean value of YDs showed a reduction rate of 44% at 4 weeks, 65.4% at 8 weeks, and 78.7% at 12 weeks from baseline. This declining trend was statistically significant from the first follow-up visit. Bapu *et al*.[25] observed that the number of YDs per field of vision corresponded to the severity of AA. In this study, YDs correlated significantly with disease severity but not with the disease activity measured by HPT.

BDs, also known as cadaverized hairs, are remnants of the BH and EMH. BD represents pigmented hairs, broken or destroyed, at level of scalp.[8] BDs preponderate in acute AA with active loss of hair.[5,15,21] They are also frequently observed in tinea capitis and trichotillomania.[20,26,27] However, these can be distinguished from BDs present in AA by high variability in diameter and shape in individual patients.[27] BDs are known to be the characteristic marker of AA.[8] In this study, BDs were the most predominant trichoscopic feature seen as multiple pin-point round BDs, (100% cases) similar to the study by Peter *et al*.[28] where it was noted in 75% cases. The previous literature[5,6,8,23-25] shows a wide range in

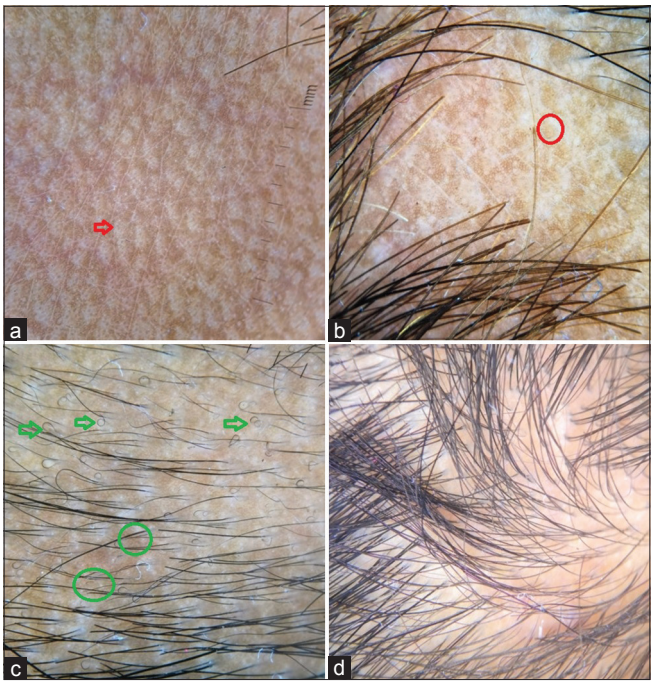

Figure 3: Trichoscopic images of alopecia areata in one of our patients (a) at baseline showing cumulus-like white dots (red arrow), (b) at first follow-up visit showing few yellow dots (YDs) (red circle), (c) at second follow-up visit showing very few YDs while multiple pigtail hairs (green arrow) and short vellus hairs. (green circle), and (d) at third follow-up visit showing adequate regrowth.

incidence of BDs in AA (0–84%) and this variation results from a difference in hair color and cuticle resistance. Higher incidence noted in our study could be because BDs are easily appreciated against a yellowish scalp in Indian skin. At follow-up, BDs (mean value) showed a decreasing trend and this was statistically significant from second follow-up visit at 8 weeks. Srivastava *et al*. reported a declining mean value of BD only after the fourth follow-up visit.[13]

BHs result from an uneven horizontal fracture of the terminal hair shaft enfeebled by active inflammation or by rapid regrowth of incompletely damaged hair that had earlier formed BDs.[5] They are also predominantly seen in acute AA with active hair loss.[8] These are seen in trichotillomania as well, where it has different lengths. The incidence of BHs in AA in the present study was 97.8%, higher than that in other studies.[5,6] Furthermore, in this study, BHs positively correlated with disease activity and severity. The trend in decline of BHs noted in this study was statistically significant after the second follow-up visit as against that was seen from first follow-up visit in by Srivastava *et al*.[13]

In this study, EMH were noted in 47.8% of cases. Prevalence of EMH in previous literature ranged from 12% to 71%.[5,6,8,20,23-25,28] This study observed that EMH correlated positively with disease severity and not with disease activity, in spite of it being

Table 4: Correlation of disease severity with trichoscopic features (end of 3rd follow-up visit).

Disease severity-AGS (no. of patients)	YD	BD	BH	EMH	SVH
S1 (26)	22	19	16	0	26
S2 (1)	1	1	1	1	1
S4B1N1 (3)	2	3	3	0	3
S2B0N1 (1)	1	1	0	0	1
S2B2N1 (1)	1	1	1	0	1
S1B1N0 (3)	2	2	2	0	3
S1B0N1 (4)	3	4	4	0	4
B1 (7)	4	6	7	1	7
Correlation coefficient (Spearman rank test)	1	0.99373	0.97561	0	1
P-value	0 (S)*	0 (S)*	0 (S)*	1 (NS)	0 (S)*

YD: Yellow dot, BD: Black dot, BH: Broken hair, EMH: Exclamatory mark hair, SVH: Short vellus hair. S: Significant, NS: Not significant

Table 5: Comparison of qualitative changes in trichoscopic findings at each FU with the baseline.

Trichoscopic features	Baseline versus 1st FU P value	Baseline versus 2nd FU P value	Baseline versus 3rd FU P value
YD	0.011 (S)*	0.0001 (S)*	<0.0001 (S)*
BD	0.0903 (NS)	0.0051 (S)*	<0.0001 (S)*
BH	0.07 (NS)	0.0176 (S)*	0.0030 (S)*
EMH	0.1 (NS)	0.0001 (S)*	<0.0001 (S)*
SVH	< 0.0001 (S)*	< 0.0001 (S)*	<0.0001 (S)*

YD: Yellow dot, BD: Black dot, BH: Broken hair, EMH: Exclamatory mark hair, SVH: Short vellus hair, S: Significant, NS: Not significant, FU: Follow-up

Table 6: Literature review of the correlation of trichoscopic markers with disease activity and severity.

Author of the study (year)	Disease activity		Disease severity	
	Positive correlation	Negative correlation	Positive correlation	Negative correlation
Lacarrubba *et al.* (2004)	BHs, EMH	-	-	-
Inui *et al.* (2008)	BDs, BHs, EMH	SVH	BDs, YDs	SVH
Mane *et al.* (2011)	-	-	-	-
Ganjoo and Thappa (2013)	EMH, BHs, BDs	-	-	-
Peter *et al.* (2013)	-	-	-	-
Bapu *et al.* (2014)	-	-	-	-
Kibar *et al.* (2015)	EMH	WDs	WDs, CWDs, HCPP	EMH
Guttikonda *et al.* (2016)	BDs, BHs, EMH	SVH	-	-
Mahmoudi *et al.* (2018)[33]	-	SVH	YDs	SVH, BHs, EMH
This study	BDs, BHs, SVH	-	YDs, BDs, BHs, EMH, SVH	-

YDs: Yellow dots, BDs: Black dots, BHs: Broken hairs, EMH: Exclamatory mark hairs, SVH: Short vellus hair

regarded as a marker of active disease. The decline in EMH with treatment was statistically significant after the second follow-up visit at 8 weeks, unlike that reported by Srivastava *et al.*[13] who noted the decline at the first follow-up visit.

SVH is lightly pigmented or non-pigmented hairs of length <10 mm. These constitute roughly around 10% of normal human scalp hair.[20,29] It is a sensitive indicator of AA and the most common finding in chronic and remitting stage,[21,29,30] as it indicates hair regrowth. In this study, 100% of patients at baseline had SVH. Proportion of SVH in AA varies from 34% to 100%.[5,6,8,20,23,24] The higher incidence in this study could be explained by the fact that SVH is more visible in darker skin.[8] SVH did not correlate with the disease activity and severity noted in this study. Interestingly, the number of SVH steadily increased with each visit, reaching up to 4.4 times at the end of third follow-up visit compared to baseline, indicating therapeutic response in our patients.

Pigtail hairs are short, regrowing, and evenly coiled hairs with tapered ends.[30] They depict hair regrowth and disappear after a few weeks.[20,21] Apart from AA, these are also found in chemotherapy-induced alopecia,[31] tineacapitis, trichotillomania, and triangular temporal alopecia.[32] The

incidence of pigtail hairs in AA ranges from 4% to 61%[5,20,25,28] In the present study, pigtail hairs were observed in 0.06% of patients. They mark the areas of decreased hair thickness within the hair shaft. This occurs due to rapid and repeated repression of metabolic and mitotic activity of the follicle. Very few studies have observed Pohl-Pinkus constrictions in AA with the incidence rate ranging from 2% to 10%.[5,6,20] However, in this study, this was observed in 0.04% patients. Kibar *et al*.[23] first described the "Cumulus-like clustered white dots" (CWD) for a combination of big and pinpoint WDs. This finding was observed in 0.06% of our patients. Coudability hairs were present in 0.06% patients in this study which was quite contrasting with the finding by Guttikonda *et al*.[5] where it was seen in 14% of cases. Coudability hairs are thought to precede BDs and EMH.

Correlation between various trichoscopic findings and disease activity

In this study, BDs and BHs had a significant positive correlation with disease activity while, SVH had a negative correlation with disease activity. Kibar *et al*.[23] reported only EMH to correlate positively with disease activity, while WDs showed a negative correlation. Other studies showed no correlation of trichoscopic findings with disease activity.[25,28]

Correlation between various trichoscopic findings and disease severity

In this study, YDs, BDs, and BHs significantly correlated with the disease severity. SVH negatively correlated with disease severity similar to that noted by Inui *et al*.[8] Other studies found no correlation between trichoscopic findings and disease severity.[20,25,28] The limiting factor was the SALT score used in those studies to assess disease severity while in this study, we used AGS score (to include scalp, body, and nail involvement). Varying scales used to measure disease activity and severity in AA may be the cause for difference in findings in comparison to many other studies. Table 6 shows the correlation of trichoscopic markers with disease activity and severity seen in previously published literature.

CONCLUSION

Trichoscopy is an excellent aid for accurate and quick diagnosis of AA, to assess disease activity and severity and to define therapeutic endpoints. This study also observed that the abatement of trichoscopic markers of disease activity in AA preceded a negative HPT, highlighting the role of trichoscopy as a useful tool in monitoring therapeutic response. This can avoid unduly prolonged treatments and their side effects, especially with corticosteroids. Furthermore, trichoscopic images can serve as an objective tool to counsel, reassure, and satisfy anxious patients. Thus, trichoscopy is a better tool for the diagnosis, assessment of disease activity and severity, and therapeutic response monitoring in AA.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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