ORIGINAL ARTICLE **DERMATOLOGY**

Journal of Contemporary Medicine and Dentistry
www.jcmad.com

ISSN [P-2347-4513]
ISSN [O-2349-0799]
Year: 2021, Volume: 9
Issue: 1, p: 71 - 76

A Study of Utility of Folliscope and Trichoscan in Diffuse Hair Loss Disorders

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Abstract

***Background**: There are various methods of evaluation for hair loss disorders. **Aim**: The study aims at utilizing folliscope and trichoscan in the evaluation of diffuse hair loss. M**ethods**: Patients attending the outpatient department of Dermatology, Venereology and Leprosy at a tertiary care centre with complaint of hair loss disorders were enrolled. Detailed history and examination were done. Accordingly, blood investigations and skin biopsy were advised for further evaluation. Patients with diffuse hair loss were studied using folliscope and trichoscan and results noted. **Results**: Trichoscan findings in AGA were significant as compared to controls while telogen effluvium showed no difference in trichoscan findings as compared to controls. Folliscope showed reduced thickness and density of hair in AGA while in telogen effluvium it showed reduction in hair density. **Conclusion**: Folliscope can be used to assess the thickness of hair as well as density of hair sequentially over a period. Trichoscan is promoted as a validated and precise tool for measurement of hair growth parameters. These two methods can be used in routine evaluation of hair loss as well as for research purpose.*

***Keywords**: Diffuse hair loss disorders, folliscope, trichoscan*

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Date of Acceptance: 19/04/2021

Introduction

Various methods are available for evaluation (for diagnosis and/or quantification) of a patient presenting with hair loss. Hair evaluation methods are grouped into three main categories: Noninvasive methods (e.g., questionnaire, daily hair counts, standardized wash test, 60-s hair count, global photographs, dermoscopy, hair weight, contrasting felt examination, phototrichogram, TrichoScan and polarizing and surface electron microscopy), semi-invasive methods (e.g., trichogram and unit area trichogram) and invasive methods (e.g., scalp biopsy) [1]. However, most methods, when interpreted with caution, provide valuable insights into patient diagnosis and monitoring. The three-step approach to patient assessment includes a detailed history, clinical examination and investigations [2]. Thus, we would like to study the utility of folliscope and trichoscan in the evaluation of diffuse hair loss.

Materials and Methods

The aims and objectives of this study are to study the use of Folliscope (hair density analyser) in various disorders of diffuse hair loss and also to study the use of epiluminescence microscopy with automatic digital image analysis (trichoscan) in diffuse hair loss. The patients attending the skin OPD at a tertiary care centre and presenting with a complaint of hair loss i.e. alopecia was included in the study. Demographic details in the form of age, sex, address, occupation and marital status were noted. Detail history of the patient was noted.

Trichoscan (Figure 1) was used in patients with diffuse hair loss. Its principle depends on the software which measures the length of all hairs and by statistical analysis will discriminate between growing versus non-growing hairs. Telogen hair will not grow whereas anagen hair will at approximately 0.03mm/day. A default cut off 0.65mm is used to distinguish growing and non-growing hair. Trichoscan identifies growing hairs as anagen hair (green) and non-growing hairs as telogen hair (red). Procedure: The procedure was carried out as per the TrichoScan user manual. Selection of the optimal measurement site for trichoscan: Representative area of the scalp was prepared for the procedure. Female: The site for females was taken as mid scalp region, 1 cm lateral to the midline hair partition between highest points of pinnae of both ears, so that the hair in close vicinity can be combed over the clipped area. Males: The site was an area 1 cm behind the frontal hairline in temporal region. Clipping of hair on day 1: The hair exposed through the template was cut close to the scalp surface with a pair of scirrors. Thereafter, Moser-Trichoscan edition hair clipper was used to clip the hair evenly and completely to leave a small, neat spot where short hair shafts were still visible. Photographs were taken on day 1 to ensure uniform clipping. The patients were advised to follow up on the third day and suitable images were taken using digital camera, image recording, and analysis done. Folliscope or Hair density analyser system (SIF-1) (Figure 2) gives high resolution viewing at higher magnification. It was also used in patients with alopecia. It gives magnification of 50x and 300x, so that the hair characteristic can be assessed with the use of computer equipped with high definition colour video microscopic camera and Folliscope software. Procedure: No patient preparation is required for this method. A questionnaire of about 13 questions for males and 15 questions for females about loss of hair, symptoms and progression, is given to the patient and by using 50x handy scope and 300x handy scope, scalp condition, hair inspection, hair diameter, hair density and pattern of hair loss can be detected by the software.

Results

Trichoscan: Of the total 40 patients of diffuse hair loss, 8 patients were males and 32 patients were females. 10 normal healthy volunteers were taken as controls. Males were in the age range of 25-43 years while females were in the age range of 17-45 years. Trichoscan was run in these patients. The trichoscan findings in the form of total hair count (THC), hair density (HD), anagen telogen ratio (A/T), density vellus hair (DVH), density terminal hair (DTH), Ratio vellus hair (RVH) and ratio terminal hair (RTH) in AGA and telogen effluvium is given in tables 1, 2 and 3 respectively. The trichoscan findings of control patients are given in table 4. Thus when comparing the trichoscan findings of MPB with that of control, it was found that there was significant difference in the total hair count ($p=0.001877$), density ($p=0.001886$), anagen telogen ratio ($p=0.025912$) as well as ratio vellus hair ($p=0.004833$) and ratio terminal hair ($p=0.004833$). While in patients with FPHL, there was significant difference found in anagen telogen ratio ($p=0.027061$), ratio vellus hair ($p=0.024441$) and ratio terminal hair ($p=0.024441$). While it was observed that there was not much difference in the values of total hair count, density, anagen telogen ratio and terminal to vellus hair ratio in patients of TE to that of controls ($p>0.05$).

Table1: **Trichoscan findings in MPA**

	THC3	HD3	A/T3	DVH3	DTH3	RVH3	RTH3
	269.5	176.9	1.61	33.5	143.4	18.9	81.1
	169	110.9	1.38	14.1	96.8	12.7	87.3
	276	181.2	0.821	29.2	152	16.1	83.9
	250	164	1.506	24	140.2	14.6	85.4
	233.5	153.3	1.45	27.9	125.4	18.2	81.8
	432	283.6	1.881	47.6	236	16.8	83.2
	510	335.1	1.409	37.1	298	11.1	88.9
	276	181.2	0.821	29.2	152	16.1	83.9
AVG	302	198.275	1.359	30.325	167.96	15.56	84.44

Table 2: Trichoscan findings inFPHL

	THC3	HD3	A/T3	DVH 3	DTH 3	RVH 3	RTH 3
	361.5	273.3	1.525	51.9	185.5	21.9	78.1
	233.5	153.3	1.45	27.9	125.4	18.2	81.8
	351	230.8	1.985	34.5	196.3	14.9	85.1
	309	203.2	1.71	28.6	174.6	14.1	85.9
	573	441.8	1.271	82.4	359.4	18.6	81.4
	673	441.8	1.217	82.4	359.4	18.6	81.4
	660.5	433.6	0.834	55.5	378.1	12.8	87.2
	641	375.5	0.828	45.6	375.5	10.8	89.2
AVG	475.3125	319.1625	1.3525	51.1	269.275	16.2375	83.7625

Table 3: Trichoscan findings in Telogen effluvium

	THC 3	HD3	A/T 3	DVH 3	DTH 3	RVH 3	RTH 3
	384.5	383.7	1.237	57.8	325.9	15.1	84.9
	419	275	1.257	67.6	207	24.6	75.4
	361.5	237.3	1.525	51.9	185.5	21.9	78.1
	339	222.5	2.105	32.2	190.4	14.5	85.5
	378	248.5	2.021	61.7	186	24.8	75.2
	445	292.1	1.38	56.1	236	19.2	80.8
	555	364	1.109	64.3	300	17.7	82.3
	361.5	237.3	1.525	51.9	185.5	21.9	78.1
	583	382.7	1.59	45.3	337.4	11.8	88.2
	238.5	156.6	2.636	35.1	121.5	22.4	77.6
	593	354	1.288	83.7	371.2	56.3	43.7
	685.5	450	1.347	67	383	14.9	85.1
	583	382.7	1.59	45.3	337.4	11.8	88.2
	685.5	450	1.347	67	383	14.9	85.1
	583	382.7	1.59	45.3	337.4	11.8	88.2
	279.5	183.5	1.923	31.2	152.3	17	83
	538	353.2	1.136	47.9	305.3	13.6	86.4
	283	185.8	2.194	36.4	149.4	19.6	80.4
	319.5	209.7	5.25	36.4	173.3	17.4	82.6
	365	239.6	1.958	57.1	182.5	23.8	76.2
	810.5	532.1	1.444	114.6	417.5	21.5	78.5
	538	353.2	1.136	47.9	305.3	13.6	86.4
	361.5	273.3	1.525	51.9	185.5	21.9	78.1
	339	222.5	2.105	32.2	190.4	14.5	85.5
AVG	459.5417	307.1667	1.759083	53.65833	256.1958	19.4375	80.5625

Table 4: Trichoscan findings of controls

	THC	HD	A/T	DVH	DTH	RVH	RTH
AVG	493.85	324.21	1.869	65.78	258.42	20	80

Table 5: Findings of Folliscope (hair density analyser system) in various hair loss disorders

SCALP	HT	HD	Type	DIAGNOSIS
N	0.08	11	M-1	AGA
N	0.08	10	M-2	AGA
N	0.07	10	M-2	AGA
N	0.07	8	M-1	AGA
N	0.11	5	M-1	AGA
N	0.09	7	O-1	AGA
N	0.07	5	O-2	AGA
N	0.9	8	O-2	AGA
N	0.08	6	I-4	FPHL
DRY SCALP	0.07	10	O-2	AGA
N	0.08	11	M-1	AGA
SEBORRHEIC SCALP	0.07	11	M-1	AGA
N	0.07	12	M-2	AGA
N	0.08	12	O-1	AGA
N	0.07	6	I-4	FPHL
N	0.08	4	No hair loss	TE
N	0.08	10	No hair loss	TE
N	0.09	7	No hair loss	TE
N	0.11	8	No hair loss	TE
N	0.07	5	No hair loss	TE
N	0.9	6	No hair loss	TE
N	1.4	9	No hair loss	TE
N	0.11	9	No hair loss	TE
N	0.07	8	II-1	FPHL
N	0.06	8	II-2	FPHL
OILY	0.07	10	II-2	FPHL
N	0.08	11	II-1	FPHL
DRY SCALP	0.07	11	II-1	FPHL
N	0.11	5	I-4	FPHL
N	0.09	7	II-2	FPHL

While comparing the clinical diagnosis of AGA and TE with that of the parameters of trichoscan, it is found that of the total 40 patients, 30 patients had reduced anagen telogen ratio and normal terminal to vellus hair ratio (TE) while 10 patients had reduced anagen telogen ratio as well as terminal to vellus hair ratio (AGA with TE). This was done considering the normal anagen telogen ratio of 9:1 and terminal vellus ratio of 8:1. Thus trichoscan can detect the coexistence of telogen effluvium with androgenetic alopecia. Folliscope (hair density analyser system) table 5: Folliscope or hair density analyzer system was used in 30 patients. Of the 30 patients, 2 patients had dry scalp (6.67%), one patient had oily scalp (3.33%), 1 patient had seborrhiec scalp (3.33%) and 26 had normal scalp (86.67%). Of the total patients, 13 patients (43.33%) had hair thinning as against the normal value of 0.08-0.1mm given in the system while 17 patients (56.67%) had normal thickness. Of the 30 patients, 28 patients (93.33%) had low hair density as against the normal hair density of 12-14/cm2 given in the system.

Discussion

This study was conducted at a tertiary care centre over a period of about 12 months where patients with diffuse hair loss were enrolled after consent.

Folliscope

Folliscope is hair analysis system which gives high resolution viewing at higher magnification. The magnification enhances the images of scalp and hair and detects the hair shaft in the follicle (if present) and its length, diameter, and possible anomalies. The software also calculates hair density as well as thickness of hair. Of the 30 patients, 2 patients had dry scalp (6.67%), one patient had oily scalp (3.33%), 1 patient had seborrhiec scalp (3.33%) and 26 had normal scalp (86.67%). In this study, out of 22 patients of AGA diagnosed clinically, 11 patients have reduced hair thickness (50%) while 20 patients

have reduced hair density (90.9%). Out of the 8 patients of telogen effluvium, 1 patient has reduced hair thickness (12.5%) while 100% patients have reduced hair density. It helps in grading of androgenetic alopecia by taking vertex photography followed by matching the photograph with the graded scale lines like the clinical grading. Thus in 13 patients of clinically diagnosed as MPB, as per software comparison, 5 patients had M-1 pattern, 3 patients had M-2, 2 patients had O-1 pattern while 3 patients had O-3 pattern. Likewise, in 9 patients of clinically diagnosed FPHL, 3 patients had I-4 pattern, 3 patients had II-1 pattern and 3 patients had II-2 pattern. Thus, it also gives the type or grading of androgenetic alopecia. However, this needs standardization for the procedure for taking the vertex photography. Thus, using Folliscope, the condition of the scalp and its characteristics can be evaluated. It also gives hair thickness so that the progressive miniaturization of hair can be detected sequentially. The hair density count should be done sequentially so as to look for progressive hair loss as well as improvement of hair loss while on treatment. Hence it was expected to give help with scalp surface characteristics and hair follicle condition whereby structure and condition of scalp and hair shaft can determine. In view of magnified images given by Folliscope, it is expected in enhancing clinical skills with which scalp surface, hair shaft defects can be picked up.

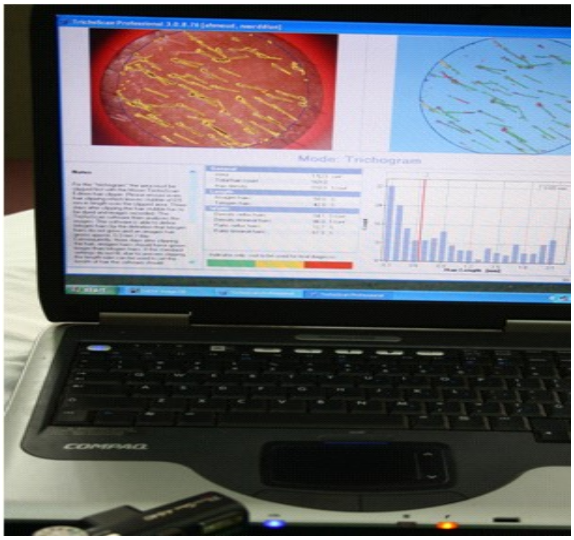

Figure 1: **TRICHOSCAN**

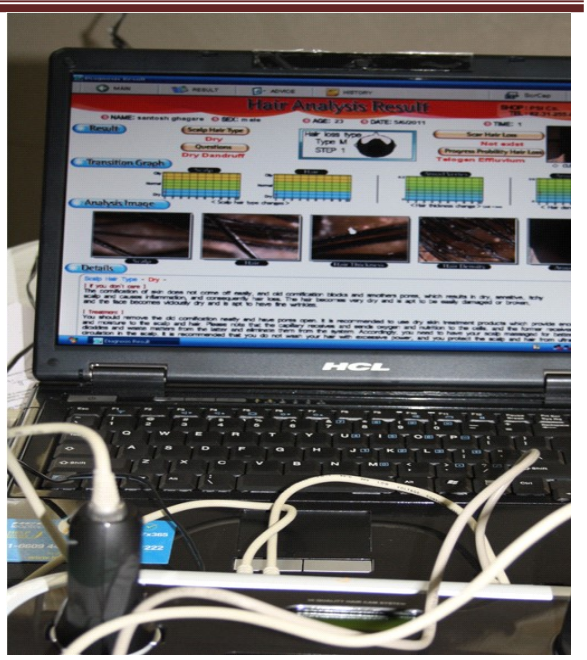

Figure 2: Folliscope (hair density analyser)

Trichoscan

Numerous hair diseases such as the scarring alopecias, alopecia areata, or trichotillomania are mostly diagnosed on clinical basis, usually do not need a quantitative method to evaluate the amount of hair shedding. Androgenetic effluvium, however, the most common form of hair loss, is typically difficult to quantify and at present simple but reliable tool analytical procedures have not been developed. Although scalp biopsy can be done, this procedure is invasive and not suitable for monitoring patients of hair loss. Therefore, an operator friendly and patient-friendly, inexpensive, validated, and reliable method is a rational need which is trichoscan. It is able to analyze the biologic parameters of hair growth, which are: (i) hair density (n per cm^2); (ii) hair diameter (mm); (iii) hair growth rate (mm per day); and (iv) anagen/telogen ratio [3]. In this study, the patients which are diagnosed clinically as MPB showed significant difference in the trichoscan parameters as compare to controls. Even parameters like ratio vellus hair, ratio terminal hair and anagen telogen ratio in patients with FPHL showed significant difference as compared to controls. While patients of TE did not show any significant difference as compared to controls. Thus, it is difficult to diagnose AGA and TE on the trichoscan findings. Also, the anagen telogen ratio is reduced in all patients, this may be due to increase counting of telogen

hair by trichoscan. In a study by Saraogi P et al in 2010 summarized that TrichoScan-analyzed telogen hair percentage is falsely elevated. TrichoScan-analyzed total hair count and thereby THD measurements are faulty. Anagen and telogen hair detection is not optimal [4]. In this study, it is also seen that there is coexistence of TE in patients of AGA. This can be explained by maintenance of terminal hair to vellus hair ratio in each patient. Thus, trichoscan can be helpful in finding coexisting TE which cannot be detected clinically. However, in a study by UceÖzkol H et al concluded the use of TrichoScan was very successful in the differentiation between AGA and TE [5]. But in a study by Guarrera M et al concluded that TrichoScan(®) is less useful and may be even misleading in TE [6]. While in previous study by Isabella Urysiak-Crested tit et al in 2010 stated that Trichoscan Professional V3.0.8.76 is not useful in percentage examination of anagen, telogen, terminal and vellus hair [7]. Similarly, in a study by Saraogi P et al in 2010 concluded that TrichoScan-analyzed anagen/telogen hair detection is not optimal; moreover, there is overestimation of THD and the vellus hair percentage does not correlate with clinical severity of alopecia [4].

Conclusion

Folliscope can be used to assess the thickness of hair as well as density of hair sequentially over a period of time. It also helps in assessing the condition of scalp and hair examination. Trichoscan technique can be used for clinical studies to compare placebo vs treatment or to compare different capacities of different hair growth promoting substances. This technique can be used to study AGA or other forms of diffuse hair loss. Trichoscan is promoted as a validated and precise tool for measurement of hair growth parameters. Because of the many controversies associated with the use of this diagnostic method, it seems necessary to conduct further research objective.

Conflict of Interest: *None declared*
Source of Support: *Nil*
Ethical Permission: *Obtained*

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