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Clinical and Trichoscopic Evaluations of Topical Finasteride 1%, Topical Spironolactone 5%, and Minoxidil 5% in Female Pattern Hair Loss Treatment

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ABSTRACT

Introduction: Female pattern hair loss (FPHL) is one of the most common forms of diffuse alopecia in females. Despite the availability of multiple treatment options, FPHL management poses challenges for the dermatologist.

Objectives: We aimed to compare the efficacy and safety of topical finasteride 1% solution and spironolactone 5% solution to minoxidil 5% solution in the treatment of FPHL clinically and trichoscopically.

Methods: Forty-five adult female patients diagnosed with FPHL were divided into three groups of 15 each. Group A was treated with topical finasteride 1%, group B used topical spironolactone 5%, and group C was treated with topical minoxidil solution 5 %, all groups were treated for 16 weeks.

Results: By the end of 16th week, significant improvement on the Sinclair scale was observed in groups A and C, but the difference between the three groups was statistically insignificant. Trichoscopically, hair density significantly increased in groups A and C. There was a significant reduction in the number of patients with yellow dots, peripilar sign, and single hair follicular units (FU) in group A. In group C, a significant reduction in the number of patients with yellow dots and single hair FU was documented. No trichoscopic changes were detected in group B.

Conclusions: Topical finasteride is as safe and effective as topical minoxidil in FPHL. Both treatments showed greater effectiveness clinically and trichoscopically than topical spironolactone. The use of topical finasteride may be another solution for the treatment of FPHL in minoxidil non-responders or in the presence of intolerable side effects.

Introduction

Female pattern hair loss (FPHL) is a common hair disorder that has a negative psychological impact on female patients. It is distinguished from other hair disorders by progressive miniaturization of the hair follicle (HF) with transformation of terminal hair into vellus hair [1]. Hair shaft diversity, yellow dots and peripilar pigmentations are known trichoscopic features of FPHL [2]. Androgenic and nonandrogenic factors, including genetic predisposition, are suggested in the pathogenesis of FPHL. However, the relation to androgens is not completely understood [3,4]. Topical and systemic treatment options are available, yet incomplete satisfactory results are obtained. Topical minoxidil 2% solution or 5% foam are the only FDA-approved therapeutic options for FPHL. Increased angiogenesis and prostaglandin synthase-1 are suggested mechanisms of action [5]. Reports on the efficacy of oral finasteride as a selective 5α-reductase type II enzyme inhibitor in FPHL are conflicting; additionally, its teratogenic effect limits its use. To overcome this issue, topical formulation has been proposed [6]. Spironolactone, another antiandrogen drug, has been used as an off-label indication for FPHL. Topical spironolactone may maximize its absorption with the advantage of minimizing oral side effects [7]. Because of the paucity of clinical studies addressing the efficacy and safety of topical formulations in the treatment of FPHL, the selection of the treatment is challenging for physicians.

Objectives

The present study aimed to evaluate the efficacy and safety of topical formulation of finasteride 1% solution and spironolactone 5% solution compared to minoxidil 5% solution in the treatment of FPHL, both clinically and trichoscopically.

Methods

The current prospective randomized study was conducted in the Hair Outpatient Clinic, Dermatology Department, Faculty of Medicine, Alexandria University. Study approval of the local medical research ethics committee was obtained, in addition to written informed consent from all patients (IRB NO: 00012098-FWA NO: 00018699).

Study Participants and Treatment Protocol

Forty-five adult female patients aged >18 years participated in the present study. They were diagnosed as FPHL according to history and clinical and dermoscopic evaluation [8].

Exclusion criteria: hair growth-promoting drugs in the preceding three months, any systemic disease, including hyperandrogenism, or local scalp diseases. Pregnant or lactating females were also excluded.

The participants were randomly divided into three equal groups using the sealed envelope method. Group A applied finasteride 1% solution, group B applied 5% spironolactone solution, and group C applied 5% minoxidil solution, all for four months. Solutions were dispensed in identical 60 ml dropper bottles. Patients were asked to apply one dropper (1ml) of the prepared solution on a dry clean scalp, followed by gentle massage for the frontal and vertex area. The solutions were applied twice per day for 16 weeks. The patients were asked to return empty bottles every four weeks to ensure their compliance to treatment.

Patient Evaluation

Clinical Assessment

Participants were graded from 1–5 on the Sinclair scale. Global photography of vertex and frontal views, with hair parted in the center, were taken at baseline and at the end of the treatment period. The photos were evaluated by two independent blinded investigators. Quartile grading scale of improvement was used at the end of the study as follows; (0–24%) poor improvement, (25–50%) mild improvement, (51–75%) moderate improvement, and (76–100%) great improvement. The degree of patient satisfaction was reported as dissatisfied, slightly satisfied, moderately satisfied, and highly satisfied.

Trichoscopic Assessment

For uniformity of assessment, a fixed target area of 1 cm^2 was selected on the frontal area, and the site was maintained by measuring 9 cm from the glabella. Trichoscopic examination was performed with a handheld DermLiteaVIdermatoscope (3Gen) at a 10-fold magnification. Hair diversity >20% was a preliminary diagnostic criterion for FPHL. Dermoscopic images were assessed by an independent investigator before and after treatment for hair density, yellow dots, peripilar sign, honeycomb hyperpigmentation, and percentage of single hair follicular units (FU). For better assessment of the single hair FU, it was further subdivided into (25%–50%), (51–75%), and (>75%) involvement of the scalp.

Safety Assessment

No side effects were reported.

Statistical Analysis of the Data

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0. (IBM Corp). Significance of the obtained results was judged at the 5% level [9].

Results

The present study included 45 adult female patients with FPHL, with an age range of 23 to 43 years. FPHL was graded according to the Sinclair scale. The patients were randomly

Table 1. Comparison between the Three StudyGroups according to Demographic Data.

Demographic data	Group A (n=15)	Group B (n=15)	Group C (n=15)	Test of sig.	p
Age (years)					
Median (Min. – Max.)	35 (24–42)	34 (25–43)	34 (23–43)	F = 0.053	0.948
Mean ± SD.	32.87 ± 5.88	33.27 ± 6.35	32.53 ± 6.23		
Family history					
Negative	5 (33.3%)	5 (33.3%)	4 (26.7%)	χ^2 = 0.301	^{MC}p = 1.000
Positive	10 (66.7%)	10 (66.7%)	11 (73.3%)		
Duration (years)					
Median (Min. – Max.)	5 (2–10)	5 (1–10)	5 (1.5–10)	F = 0.120	0.887
Mean ± SD.	5.13 ± 2.50	5 ± 2.59	4.70 ± 2.33		

Abbreviations: SD: Standard deviation; χ^2: Chi squared test; MC: Monte Carlo; F: F for One way ANOVA test; p: p-value for comparing between the three studygroups.

Table 2. Comparison between the Three StudyGroups according to the Sinclair Scale.

Sinclair Scale	Group A (n=15)	Group B (n=15)	Group C (n=15)	χ^2	^{MC}p
Stages before treatment					
1	0 (0%)	0 (0%)	0 (0%)	1.574	0.894
2	2 (13.3%)	1 (6.7%)	3 (20%)		
3	8 (53.3%)	10 (66.7%)	8 (53.3%)		
4	5 (33.3%)	4 (26.7%)	4 (26.7%)		
Stages after treatment					
1	0 (0%)	0 (0%)	0 (0%)	5.564	0.244
2	2 (13.3%)	2 (13.3%)	4 (26.7%)		
3	12 (80%)	9 (60%)	11 (73.3%)		
4	1 (6.7%)	4 (26.7%)	0 (0.0%)		
MH (p_0)	14.0*(0.046*)	2.500(0.317)	16.500*(0.025*)		

χ^2: Chi squared test. Abbreviation: MC: Monte Carlo; MH: Marginal Homogeneity Test.
p: p-value for comparing between the three studied groups
p_0: p-value for comparing between before and after treatment in each group
*: Statistically significant at $P \leq 0.05$

divided into three equal groups (n=15 each). No significant differences among groups regarding demographic and clinical data were detected (Tables 1 and 2).

Clinical Evaluation

Although there was improvement on the Sinclair scale by the end of 16th week, the difference between the three groups was statistically insignificant (P =0.244). Nonetheless, according to the evaluation of each group separately, a significant improvement on the Sinclair scale was documented in both groups A and C over the treatment period (P =0.046 and P = 0.025, respectively) (Table 2).

Trichoscopic Evaluation

Before the start of the treatment, concerning yellow dots, peripilar sign, honeycomb hyperpigmentation and single hair FU%, no significant differences were observed between the threegroups, nor at the end of the treatment. However, some changes in the trichoscopic features were noticed in each separate group by the end of the study (Tables 3 and 4).

Table 3. Distribution of all Studied Cases according to Trichoscopic Findings.

Before treatment	No.	%
Yellow dots	26	57.8
Peripilar sign	28	62.2
Honeycomb pigmentation	11	24.4
Single hair FU		
25–50%	8	17.8
50–75%	13	28.9
>75%	24	53.3

Table 4. Comparison between the Three StudyGroups according to TrichoscopicFindings.

	Group A (n=15)	Group B (n=15)	Group C (n=15)	χ^2	p
Yellow dots					
Before treatment					
No	7 (46.7%)	8 (53.3%)	4 (26.7%)	2.368	0.306
Yes	8 (53.3%)	7 (46.7%)	11 (73.3%)		
After treatment					
No	14 (93.3%)	11 (73.3%)	11 (73.3%)	2.585	$^{MC}p = 0.339$
Yes	1 (6.7%)	4 (26.7%)	4 (26.7%)		
$^{McN}p_0$	**0.016***	**0.250**	**0.016***		
Peripilar sign					
Before treatment					
No	3 (20%)	7 (46.7%)	7 (46.7%)	3.025	0.220
Yes	12 (80%)	8 (53.3%)	8 (53.3%)		
After treatment				1.800	0.407
No	9 (60%)	9 (60%)	12 (80%)		
Yes	6 (40%)	6 (40%)	3 (20%)		
$^{McN}p_0$	**0.031***	**0.500**	**0.063**		
Honeycomb pigmentation					
Before treatment					
No	12 (80%)	11 (73.3%)	11 (73.3%)	0.350	$^{MC}p = 1.000$
Yes	3 (20%)	4 (26.7%)	4 (26.7%)		
After treatment					
No	13 (86.7%)	11 (73.3%)	13 (86.7%)	1.176	$^{MC}p = 0.700$
Yes	2(13.3%)	4 (26.7%)	2 (13.3%)		
$^{McN}p_0$	**1.000**	**1.000**	**0.500**		
Single hair FU					
Before treatment					
25–50%	2 (13.3%)	3 (20.0%)	3 (20.0%)	0.882	^{MC}**p = 0.975**
50–75%	4 (26.7%)	5 (33.3%)	4 (26.7%)		
>75%	9 (60.0%)	7 (46.7%)	8 (53.3%)		
After treatment					
25–50%	3 (20.0%)	4 (26.7%)	5 (33.3%)	4.155	$^{MC}p = 0.386$
50–75%	9 (60.0%)	4 (26.7%)	6 (40.0%)		
>75%	3 (20.0%)	7 (46.7%)	4 (26.7%)		
$^{MH}p_0$	**0.008***	**0.317**	**0.014***		

χ^2: Chi squared test. Abbreviation: MC: Monte Carlo; MH: Marginal Homogeneity Test; McN: McNemar test.
p: p-value for comparing between the three studied groups
p_0: p-value for comparing between before and after treatment in each group
*: Statistically significant at $P \leq 0.05$

In group A, a significant reduction in the number of patients with yellow dots and peripilar sign as well as single hair FU% was noted. In group C, a significant reduction in the number of patients with yellow dots and single hair FU% was documented. Nevertheless, no changes were detected in group B regarding the four trichoscopic features. Additionally, there were no noticeable changes concerning honeycomb pigmentation among the three studied groups. Before the start of the treatment, the mean hair density showed no significant difference between the three groups (P =0.404). Nevertheless, a significant difference was reported between the groups by the end of the treatment (P < 0.001). In detail, at the end of the study, hair density was significantly higher in group A than in group B (p<0.001) and in group C than in group B (p<0.001). Nonetheless, both group A and C showed comparable results (p=0.915). Regarding hair

Table 5. Comparison between the Three StudyGroups according to Hair Density.

Hair density	Group A (n=15)	Group B (n=15)	Group C (n=15)	F	p
Before treatment					
Median (Min. – Max.)	95 (80 – 110)	93 (80 –110)	95 (83 – 115)	0.927	0.404
Mean ± SD.	92.6 ± 8.98	92.40 ± 7.26	96.13 ± 8.98)		
After treatment				24.687*	<0.001*
Median (Min. – Max.)	135 (100 – 165)	98 (80 – 110)	130 (95 – 160)		
Mean ± SD.	134 ± 18.82	97.67 ± 8.07	131.67 ± 18.29		
Significance between groups	p_1<0.001*, p_2=0.915, p_3<0.001*				
t (p_0)	**6.908*(<0.001*)**	**2.134(0.051)**	**6.086*(<0.001*)**		

Abbreviations: SD: Standard deviation: Paired t-test; F: F for One way ANOVA test, Pairwise comparison between each 2 groups was done using post-hoc test (Tukey).
p_0: p-value for comparing between before and after treatment in each group
p: p-value for comparing between the three studied groups
p_1: p-value for comparing between group Aand group B
p_2: p-value for comparing between group Aand group C
p_3: p-value for comparing between group Band group C
*: Statistically significant at $P \leq 0.05$

Table 6. Comparison between the Three StudyGroups according to Degree of Improvement and Patient Satisfaction

	Group A (n=15)	Group B (n=15)	Group C (n=15)	χ^2	p
Degree of improvement					
Poor	1 (6.7%)	11 (73.3%)	2 (13.3%)	22.418*	$^{MC}p < 0.001$*
Mild	5 (33.3%)	4 (26.7%)	5 (33.3%)		
Moderate	9 (60%)	0 (0%)	8 (53.3%)		
Significance between groups	$^{MC}p_1$<0.001*, $^{MC}p_2$=1.000, $^{MC}p_3$<0.001*				
Patient satisfaction					
Dissatisfied	2 (13.3%)	11 (73.3%)	2 (13.3%)	18.800*	0.001*
Slight	5 (33.3%)	4 (26.7%)	6 (40%)		
Moderate	8 (53.3%)	0 (0%)	7 (46.7%)		
Significance between groups	$^{MC}p_1$<0.001*, $^{MC}p_2$=1.000, $^{MC}p_3$=0.001*				

χ^2: Chi square test. Abbreviation: MC: Monte Carlo.
p: p-value for comparing between the three studied groups
p_1: p -value for Chi square test for comparing between group Aand group B
p_2: p-value for Chi square testfor comparing between group Aand group C
p_3: p-value for Chi squaredtestfor comparing between group Band group C
*: Statistically significant at $P \leq 0.05$

density in each group separately, significant increase in the hair density was detected in groups A and C at the end of the treatment (p_0<0.001 for each), while group B lacked this finding (p_0=0.051) (Table 5).

Photographic Evaluation

A significant difference in the degree of improvement between the three groups was observed at the end of the study. The degree of improvement was significant in groups A and C in comparison to group B, while no significant difference was detected between groups A and C (Table 6).

Patient Satisfaction

A significant difference was observed between the three groups regarding patient satisfaction level (P = 0.001), with a higher degree of satisfaction in both groups A and C (moderate degree in 53.3% and 46.7%, respectively) (Table 6).

Figure 1. (A) A 31-year-old femalein group A: pre-treatment (Sinclair 3); (B) Post-treatment (Sinclair 2: moderate improvement); (C) Dermoscopic findings at baseline (10X) showed peripilar pigmentation (red circle), yellow dot (blue circle), hair shaft diversity, and single hair/follicular unit (FU); (D) Dermoscopic findings after four months of treatment showed increased hair density and decreased single hair FU.

Safety Assessment

No side effect was detected in any groups, except for mild temporary scalp irritation in two patients in group C. Figures 1–3 present pre- and post-treatment of FPHL.

Discussion

The efficacy and safety of topical finasteride and spironolactone and minoxidil solutions in the treatment of FPHL were evaluated in the present study clinically and dermoscopically, with a superior effect of finasteride and minoxidil over spironolactone. The baseline data between the groups did not differ significantly, as previously reported [10-12]. The concept of applying topical finasteride is highly supported due to its limited systemic absorption, hence fewer side effects, than its oral from. Its efficacy was investigated in previous studies on male androgenetic alopecia, while there is a paucity of studies concerning its efficacy and safety in FPHL [13].

In the present work, group A received topical finasteride 1% twice per day for 16 weeks and showed significant improvement clinically on the Sinclair scale as well as trichoscopically. Moderate improvement was detected in 60% of patients, and moderate satisfaction in 53.3% was also reported. Mazzarella et al. used 0.005% finasteride solution twice daily versus placebo for 16 months in 52 patients, including 24 premenopausal women. A reduction in hair shedding with increased hair density was demonstrated [14]. Recent data have confirmed the efficacy of topical finasteride versus placebo in improving hair count at 24 weeks even more; the clinical improvement by topical finasteride

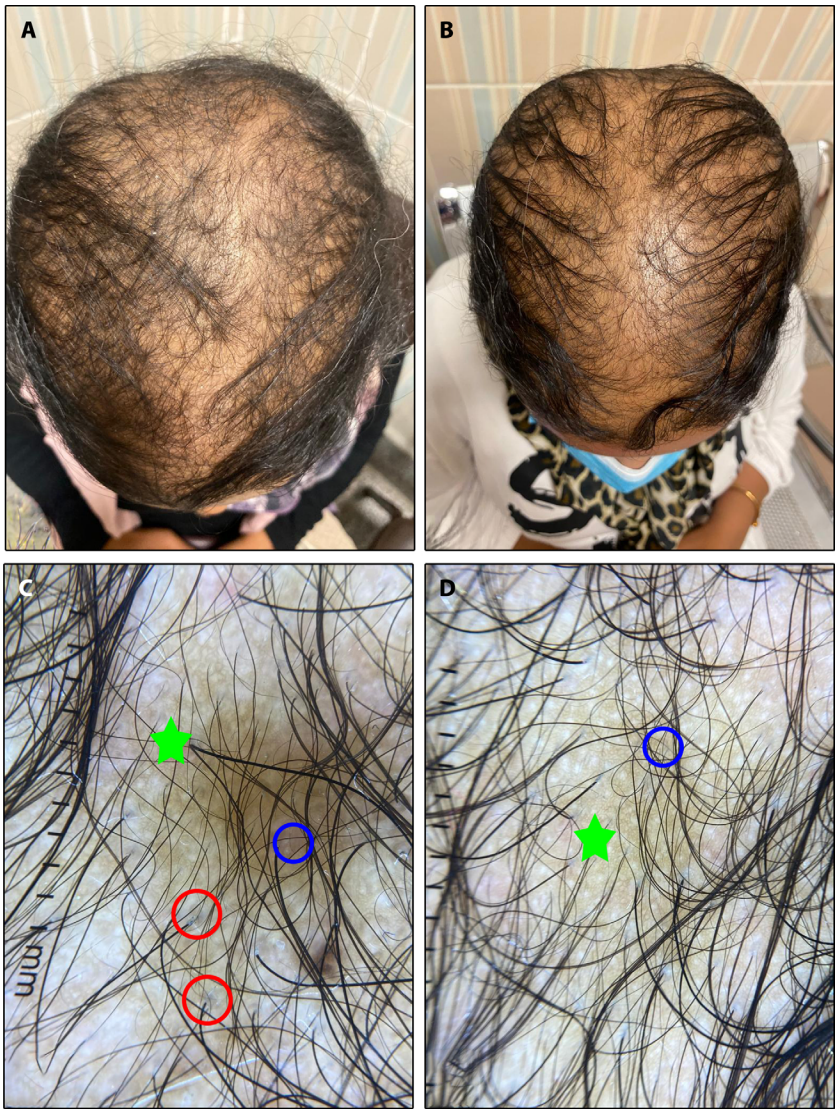

Figure 2. (A) A 35-year-old female patient in group B: pre-treatment (Sinclair 4); (B) Post-treatment (Sinclair 4: poor improvement); (C) Dermoscopic findings at baseline (10X magnification) showed peripilar pigmentation (red circle), yellow dot (blue circle), honeycomb pigmentation (green stars); (D) Dermoscopic findings after four months of treatment showed no improvement in hair density with single hairFU and honeycomb pigmentation.

was comparable to oral 1mg finasteride. However, trichoscopic findings were not assessed, as they were in the present work [15].

In the present study, topical finasteride was used in a relatively higher concentration (1%) than previously reported. Nonetheless, there is no agreement on theoptimum concentration, vehicle type, and/or amount and frequency of application, which necessitate further standardization [16].

In the group B, 73.3% of the patients showed poor improvement and reported being dissatisfied, besides not showing clinical improvement on the Sinclair scale. Their trichoscopic findings did not demonstrate any significant changes at the end of the treatment. Ammar et al. reported a significant decrease in vellus hair, hair shaft diversity, and increased upright hair after three months of 5% topical spironolactone [7]. Similarly, Abdel-Raouf et al. found that on applying spironolactone 1% gel for 12 months, anagen hair increased significantly, with a reduction intelogen and vellus hairs [10]. Conversely, Berardesca et al. mentioned that topical spironolactone has a slow onset of action, which might need more than 12 weeks to give significant effect [17]. The difference between the current study and the previous results may be due to the larger sample size or the longer duration of treatment. In addition, specific dermoscopic features (yellow dots, peripilar sign, and honeycomb pigmentation) were not evaluated in the previous studies, unlike the current work.

In the present study, group C, who received topical minoxidil, showed moderate improvement in 53.3% of patients and moderate degree of satisfaction in 46.7 % by the end of the treatment, with clinical improvement on the Sinclair scale.

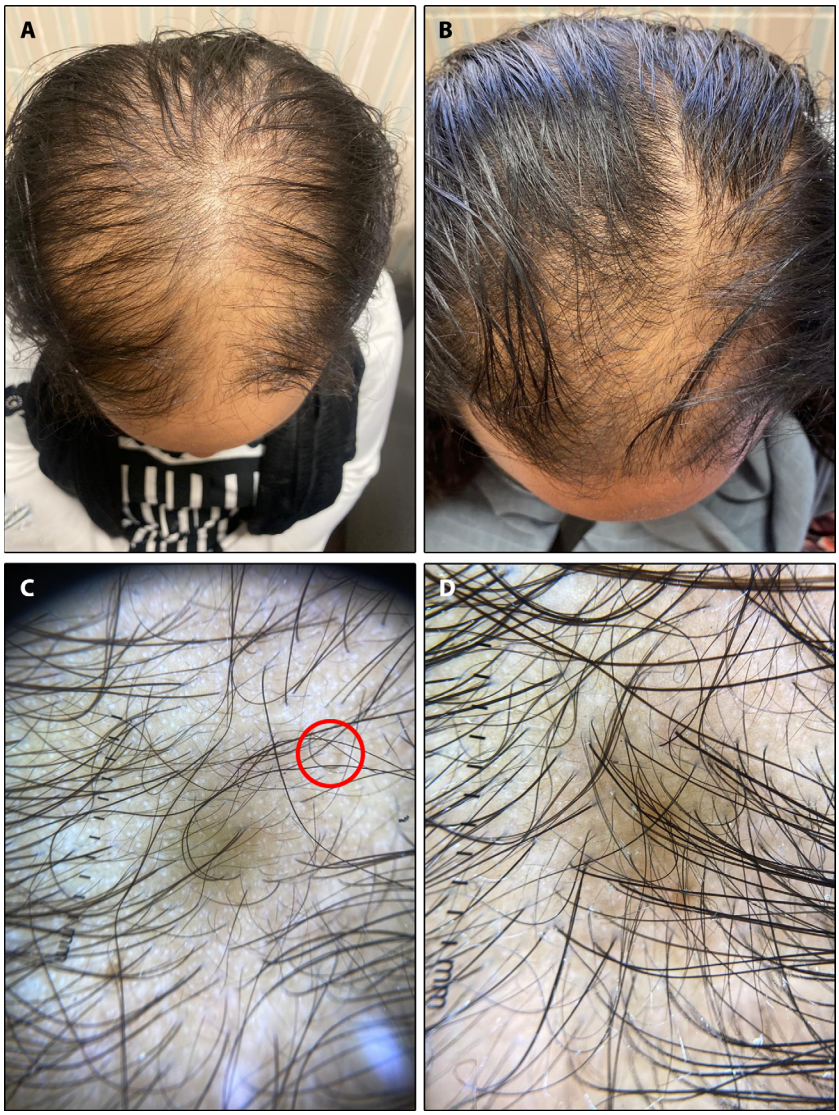

Figure 3. (A) A 29-year-old female patient in group C: pre-treatment (Sinclair 4); (B) Post-treatment (Sinclair 3: moderate improvement); (C) Dermoscopic findings at baseline (10X magnification)showed yellow dot (blue circle), hair shaft diversity, and single hair FU; (D) Dermoscopic findings after fourmonths of treatment showed increased hair density and decreased single hair FU.

Increased hair density was dermoscopically observed in the current work. This was in agreement with Esmat et al., who reported that the number of hair follicles increased after a 4-month period in a group that received 5% topical minoxidil. They reported 80% improvement and 90% patient satisfaction [18], in accordance with Oslen et al., who demonstrated hair regrowth by the end of 16 weeks [19]. A longer period of follow-up than ours (48 weeks) was assessed by Lucky et al., with superior effect of minoxidil 5% over minoxidil 2% in FPHL [20].

The difference in response to topical minoxidil among patients in different studies may be explained by defective sulfotransferase enzyme. Differences in sample size, duration of treatment, or vehicle may be other explanations [21].

Trichoscopy offers a wide range of add-on findings to emphasize the clinical assessment of hair disorders. In a healthy person, 2–4 terminal hairs are detected in each follicle [22], while the predominance of single hair per FU in the frontal area was documented as a principal feature of FPHL [23]; 53.3% of patients in the current work presented with single hair FU at baseline (>75% involvement), which indicates the process of miniaturization targeting the terminal hair in FPHL. Yellow dots represent hair follicles lacking hair. This may reflect the presence of large active sebaceous lobules in relation to miniaturized hair follicle, developing intraepidermal sebum lacunae [24]. In the current study, 57% of all patients had yellow dots, compared to a wide range of incidence in other studies [23,25-29]. Different genetic

background, frequency of washing the scalp, and previous treatments may explain these differences. Kaur et al. recorded more yellow dots in males than in females, with Inui et al.reporting similar results [30,31]. They explained that yellow dots predominantly consist of sebum and sebaceous hypertrophy, considering the higher androgen levels in males.

Perifollicular darkening or "peripilar sign" is described by Deloche, reflecting perifollicular lymphocytic infiltration in early androgenetic alopecia [32]. This sign was recorded in previous studies as well as in the present study (62% of patients) [23,25,31,33].

In the present work,24.4% of patients presented with honeycomb pigmentation, in accordance with Ross et al. (12/46) [34], while lower percentages were documented in other results [25,26,33] and higher percentages were reported by Kaur et al. (43%) [30], agreeing with Hu Ruiming et al. (44.5%) [35]. It was previously explained by the melanocytic proliferation on sun exposure and skin type [28], which are incapable of explaining the present findings as our female patients were veiled.

Concerning the trichoscopic changes after utilization of three different treatments in the current work, some explanations should be mentioned. Significant comparable increase in hair density was more noted in groups A and C than in group B, which was associated with significant decrease in the percentage of single hair FU in groups A and C. Both finasteride and spironolactone have an antiandrogenic effect [6,7], which can explain their ability to prevent the transformation of terminal hair into vellus hair, but this was not the case in our patients who used topical spironolactone. This means that spironolactone may need a longer duration or is used more appropriately in mixed formulations to produce significant results. A systematic review on seven previous studies elucidated the efficacy of topical finasteride in increasing the total hair and terminal counts in androgenetic alopecia, supporting the current data [16].

Moreover, the efficacy of minoxidil has been previously highlighted in the improvement of androgenetic alopecia [36]. Enhanced cellular proliferation, DNA synthesis, increased blood flow, and stimulation of growth factors, including vascular endothelial growth factor in dermal papilla, are suggested factors for minoxidil efficacy [37].

In the present results, it was found that both topical finasteride 1% and minoxidil 5% cause significant reduction in the number of patients with yellow dots. This is in line with El-Garf et al., who reported a significant decrease in the yellow dots in addition to other trichoscopic findings, including peripilar sign and hair shaft heterogenicity, among their patients [38]. Finasteride works through inhibition of 5α-reductase II enzyme, thus affecting local scalp androgen level and hence sebum production, while the direct action of minoxidil on sebum lagoons of yellow dots is still unexplained. Furthermore, a significant reduction in the patients with peripilar pigmentation was only noted in group A, receiving Finasteride, which raised the question of whether it has an anti-inflammatory effect on hair follicles.

The comparison between the three treatments modalities needs further studies. Few studies have reported the comparison of two forms of treatment or the efficacy of a combination of only two modalities. Suchonwanit et al. compared 0.25% finasteride with 3% minoxidil versus minoxidil alone for the treatment of postmenopausal FPHL. The combination group showed superior efficacy than did monotherapy in increasing hair shaft diameter at the 24th week, while hair density increased in both groups similarly. Clinical improvement was revealed in 93% of patients in the combination group and did not differ from minoxidil group [6].

A prospective study was conducted on 30 postmenopausal women with FPHL. The authors suggested that adding topical finasteride (0.25%) to minoxidil (3%) significantly enhanced the efficacy of the latter, in which improvement of hair diameter without significant improvement in the hair density was observed in the combination group compared to topical minoxidil alone [39]. Rossi et al. demonstrated that topical finasteride combined with minoxidil 2% had greater efficacy than did topical 17α-estradiol with minoxidil 2%. However, they included only postmenopausal females and did not assess the trichoscopic findings [4]. Similarly, superior results were documented by Gowda et al. using a combination of topical finasteride and minoxidil over topical minoxidil in increasing both hair count and terminal hair in male AGA [40]. Unlike the current results, Abdel-Raouf et al. compared topical spironolactone versus topical minoxidil, with no significant difference in the clinical response after 12 months. However, their combination showed superior significant clinical and histopathological response [10].

In a study by Mohamed et al. [41], 5% minoxidil group and 5% spironolactone group did not show a reduction in peripilar sign, yellow dots, or honeycomb pigmentation among AGA patients, and no difference was reported between groups except in vellus hair reduction, in agreement with Ammar et al. [7]. These data were confirmed by the present results regarding spironolactone group but not in accordance with the minoxidil group. Both studies confirmed that the combination of topical minoxidil and spironolactone can boost the potency of topical treatment in androgenetic alopecia in males and females [7,41].

The previous studies suggested that combination treatment may give superior results than monotherapy.

The present study was designed to compare the three lines of treatment. All patients were diagnosed using trichoscopy and Sinclair scale. The degree of improvement and the degree of patients' satisfaction were superior in both groups A and C in relation to group B; nevertheless, both

groups A and C did not differ significantly except for the effect of finasteride treatment on the reduction in the peripilar sign.

No serious adverse effects were reported in the present work; only two patients (13%) ingroup C experienced mild skin irritation that lasted for a few hours at the beginning of application of topical minoxidil, in agreement with previous data [10,18,41]. Instead, Blume-Peytavi et al. reported facial hypertrichosis in 6.11% of patients [42].

Tolerable pruritus and irritation were reported in patients applying topical finasteride by Mazzarella et al. and by Lee et al. which was not detected in the current work. In the systematic review by Lee et al., they documented other side effects such as elevated liver enzymes, headache, testicular pain and oropharyngeal pain [6,14,16].

As the efficacy of finasteride in androgenic alopecia is mainly attributed to its inhibitory effect on the 5α-reductase enzyme, consequently blocking the production of dihydrotestosterone (DHT), there is a concern about its systemic effect on serum androgen levels even with its topical use. The pharmacodynamic data from the study by Mazerella et al. revealed no significant change in plasma level of DHT after 16 months of topical finasteride [16].

On the contrary, Piraccini et al. [15] did not exclude the possibility of systemic side effects related to decreased level of serum DHT after topical finasteride application, even with plasma concentration 100-fold less than the oral form. Similarly, Suchonwanit et al. noted a decrease in dihydrotestosterone level from baseline level in postmenopausal women who received topical finasteride, which might indicate its percutaneous absorption [6]. Abdel-Raouf et al. [10] reported minimal side effects in patients receiving spironolactone, in agreement with Ammar et al. [7], while no side effect was detected in the present work.

Conclusion

Taking the current results into account, topical finasteride is as safe and effective a treatment as topical minoxidil in FPHL. Both treatments showed greater effectiveness both clinically and trichoscopically, than topical spironolactone. Thus, the use of topical finasteride may be another option for FPHL in minoxidil non-responders or in the presence of intolerable side effects. Because of the limited available data, further studies with larger sample sizes and long-term follow-up are needed. Additionally, combination therapy of topical treatments should be further evaluated and compared to the available data. Studies conducted on females with different age groups are required, as most studies have been conducted on postmenopausal females. There is still uncertainty about the safety of using topical finasteride in premenopausal females or in females with a history of estrogen-dependent tumors. However, it is not recommended to give topical finasteride to patients with tumors for fear of systemic absorption.

In the present work, serum DHT and serum androgens were not measured, which is considered a limitation of this work. The small sample size and the short duration of treatment are other limitations.

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