ORIGINAL ARTICLE

Comparative study between the Efficacy of Topical Sildenafil 2% and Topical Minoxidil 5% in the Treatment of Male Androgenic Alopecia

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Abstract

Background: ***In genetically predisposed people, androgen-induced hair thinning is known as androgenic alopecia(AGA). It has a hereditary tendency and is a multifactorial and polygenetic disorder.***

Aims and objectives: ***To contrast topical minoxidil 5% and topical sildenafil 2% in terms of their effectiveness in treating male androgenic hair loss.***

Subjects and methods: ***Fifty patients with androgenic alopecia were included in the present investigation according to their clinical and dermoscopic diagnoses. Two groups of twenty-five patients each were formed from the patients. For six months, Group A was administered topical sildenafil 2% twice a day. Similarly, Group B was administered topical minoxidil 5% twice a day.***

Result: ***Age and vertex hair thickness showed a strong positive association, according to the topical Minoxidil 5% group. However, there was no discernible relationship between the others. VH responses at the frontal region and patient satisfaction showed a significant positive association, based on the topical Sildenafil 2% group. Age and the length of AGA were significantly and negatively correlated with the VH activity in the vertex region. Age and the length of AGA were significantly and negatively correlated with frontal area hair thickness. Age and the duration of AGA were significantly positively correlated with hair density at the frontal and vertex regions.***

Conclusion: ***The research found that while topical minoxidil 5% is currently the most common treatment for treating AGA due to its great tolerability and patient satisfaction, topical sildenafil 2% therapy is a promising alternative.***

Keywords: Androgenic; Alopecia; Topical Sildenafil 2%; Topical minoxidil 5%

1. Introduction

The most prevalent form of non-scarring hair loss affecting the scalp is called androgenetic alopecia (AGA). It is caused by inherited end-organ sensitivity to androgens, and it is characterised by hair follicle miniaturisation. About half of the population is affected before the age of fifty, and it typically starts in both males and females between the ages of twelve and forty.[1]

Dihydrotestosterone, or DHT, is widely believed to be the cause of AGA. DHT causes hair follicles to shrink through a number of methods, including quickening the hair cycle, accelerating the matrix's mitotic rates, boosting telogen shedding, and lengthening the catagen or lag phase.[2]

Dermatologists are constantly confronted with individuals who do not respond well to therapy, despite the fact that there are numerous therapeutic choices for treating AGA. Thus, it is crucial to develop novel treatments for this illness and increase the efficacy of those that already exist.[3]

Laser therapy for hair loss has gained a lot of popularity lately. Because some wavelengths of laser light have been shown to encourage hair growth, it has also been recommended as a prophylactic step against AGA.[4]

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When used in the right conditions, a fractional laser can promote hair growth. While the exact mechanisms by which certain fractional lasers affect hair regeneration remain poorly understood, they most likely stem from trauma-stimulated wound repair. The progeny of hair follicle stem cells migrate to the epidermal deficiency and encourage re-epithelialization. The anagen stage of skin wound healing speeds up the process considerably, and following tissue damage, more hair follicles regenerate.[5]

LAD, or laser-assisted drug delivery, is a developing technique with a wide range of possible clinical uses. The skin's barrier is broken down by heat and physical trauma, which facilitates the administration of drugs through these laser channels.6

An autologous manufacturing process for enriched platelets in plasma is called platelet-rich plasma(PRP). Its function in wound healing has been studied in a number of medical specialties, including orthopaedics and dentistry.[7]

After attaching to their corresponding receptors on stem cells, growth hormones seem to work in the bulge region of the follicle. In order to create new follicular units, they trigger the stem cells' development and growth phases. In light of this, PRP may be used to treat AGA.[8]

The current study aims to contrast topical minoxidil 5% and topical sildenafil 2% in terms of their effectiveness in treating male androgenic hair loss.

2. Patients and methods

This was a comparative study conducted on 50 patients diagnosed clinically and dermoscopically as androgenic alopecia at Tiba hospital in Esna, luxor Governorate from 30/3/2022 to 12/12/2023.

Inclusion criteria:

Men between the ages of 18 and 45 who were clinically and dermoscopically classified as AGA and who agreed to submit their photos and participate in the follow-up evaluation.

Exclusion criteria:

Individuals with various forms of alopecia, as well as those who have undergone systemic or topical therapy for AGA in the past six months. Individuals with any autoimmune disorder, chronic debilitating illness (cancer patients, hepatic patients, congestive heart failure, and chronic renal failure), anaemia, thyroid disorders, and vitamin D insufficiency were not allowed to participate in the research. Every patient underwent a comprehensive physical examination, as well as dermatological and general evaluations.

Dermatological Examination:

Scalp and hair examination.

The overall aesthetic of the hair was evaluated. The whole scalp was examined in a methodical manner, beginning from the front of the head and progressing towards the back and sides. The presence of vellus (fine, non-pigmented) and terminal (thicker, pigmented) hairs were observed. Gentle pull test to assess hair shedding was performed. The scalp was delicately examined by using light pressure to detect any sensitivity, masses, or abnormalities.

Scalp biopsy:

Under local anesthesia, lignocaine with a 1:100,000 adrenaline mixture and a skin biopsy punch with a minimum size of 4 mm were used for the biopsy operation. The biopsy sample was divided in half at a point one millimeter under the dermoepidermal junction. This point corresponds anatomically to the point where sebaceous gland ducts flow into follicles, where the highest concentration of vellus hair is found.

Digital Photography:

For precise color representation and no shadows, consistent lighting was essential. For detailed close-up photographs, a high-resolution camera was used with manual focus. To protect patient privacy and ethical standards while documenting or publishing these photos, informed consent was required.

Methods of preparation of topical sildenafil:

Standard 2 g of sildenafil dissolved in 100 ml of ethanol solution to prepare 2% lotion. 40 gm standard pure sildenafil imported by (E. Merck) for chemical trade was dissolved in ethyl alcohol (Algomhoria Chemical, Egypt, for chemical export), 95% concentration.

Outcome Measurements and Follow-up

Patients were graded based on how much their Hamilton-Norwood grade had improved. The trichoscopic images taken before and after therapy were compared to determine the degree of progress in terms of hair density, the number of terminal hairs(TH), and vellus hair(VH). Additionally, notes regarding the patient's pleasure and potential complications were made.

Ethical Consideration:

The information collected from those who participate is private. No report or publication pertaining to this study included the names of the study subjects. The goal, design, and risk-benefit analysis of the research were all presented to the subjects prior to their admittance. An informed consent was acquired.

Statistical Analysis:

All statistical calculations were done using computer programs Microsoft Excel version 7 (Microsoft Corporation, NY, USA) and SPSS version for Windows. SPSS(Statistical Package for the Social Sciences; SPSS Inc., Chicago, IL, USA).

Descriptive statistics: Mean, Standard deviation(±SD), and range for parametric numerical data, while Median and Interquartile range(IQR) for non-parametric numerical data. Frequency and percentage of non-numerical data.

Analytical statistics: Student's t-test was used to assess the statistical significance of the difference between the means of the two study groups. Paired T-test was used to assess the statistical significance of the difference between two means measured twice for the same study group. For comparing categorical data, the chi-square (x2) test, the likelihood ratio, Fisher's exact test, continuity correction, and linear-by-linear association were performed. P-value: level of significance, P>0.05:Non-significant(NS), P<0.05:Significant(S), and P<0.01:Highly significant(HS).

3. Results

Table 1. Comparison of the studied cases and controls as regard age and duration of AGA.

	TOPICAL MINOXIDIL 5% GROUP (NO.=25)	TOPICAL SILDENAFIL 2% GROUP (NO.=25)	TEST OF SIGNIFICANCE (P)
AGE(YEARS)			t= 0.7, p=0.48
MEAN±SD	30.6±4.37	29.68±4.79	
MEDIAN (MIN.-MAX.)	31.0(23.0-41.0)	30.0(19.0-37.0)	
DURATION OF AGA(YEARS)			t= -0.56, p=0.6
MEAN±SD	6.68±1.18	7±2.44	
MEDIAN (MIN.-MAX.)	7(4-9)	6(4-12)	

T:Independent t-test; SD:Standard Deviation

Table (1) shows the socio demographic characterstics of the studied groups. There was no significance difference between topical minoxidil 5% group and topical sildenafil 2% group regarding age and duration of AGA (p=0.48 and 0.6 respectively).

Table 2. Correlation of TH & VH& hair thickness& density with demographic, clinical characteristics and satisfaction of patient's treated with topical minoxidil 5% group

	TH response at the frontal region		TH response at the vertex		VH response at the frontal region		VH response at the vertex		Hair thickness at the frontal region		Hair thickness at the vertex region		Hair density at the frontal region		Hair density at the vertex region	
Topical Minoxidil 5% group	R	P	r	P	R	P	r	P	R	P	R	P	R	P	r	P
Age(Year)	-0.08	0.72	-0.28	0.18	-0.15	0.46	0.07	0.74	0.24	0.25	0.6	0.003*	0.09	0.6	0.189	0.4
Duration of AGA (Years)	-0.07	0.73	-0.23	0.27	-0.04	0.8	0.33	0.1	-0.12	0.5	0.19	0.35	0.18	0.4	-0.12	0.6
Patient's satisfaction	-0.15	0.47	-0.25	0.22	0.06	0.76	0.06	0.78	0.37	0.07	0.28	0.16	0.09	0.7	0.17	0.4

r;Spearman's correlation

Table 2 shows that, according to topical minoxidil 5% treated group, there was a significant positive correlation between hair thickness at the vertex region and age (r=0.6, p=0.003).

Table 3. Correlation of TH & VH& hair thickness & density with demographic, clinical characteristics and Patient's satisfaction at topical Sildenafil 2% group

	TH response at the frontal region		TH response at the vertex		VH response at the frontal region		VH response at the vertex		Hair thickness at the frontal region		Hair thickness at the vertex region		Hair density at the frontal region		Hair density at the vertex region	
Topical Sildenafil 2% group	R	P	r	P	R	P	r	P	R	P	R	P	R	P	r	P
Age (Years)	0.19	.35	-.03	.8	.37	.06	-.39	.049*	-.46	.02*	-.014	.94	.7	<.001*	.54	.005*

Duration of AGA (Years)	.32	.12	.037	.86	.34	.09	-.44	.03*	-.6	.002*	.005	.9	.8	<.001*	.6	.001*
Patient's satisfaction	.17	.43	-.2	.3	.45	.024*	-.28	.17	-.211	.3	.16	.45	.2	.4	.146	.48

Table 3 shows that, among patients treated with topical sildenafil 2%, there were negative significant correlations between age and VH response at the vertex (r=-0.39, p=0.049), and age and hair thickness at the frontal region (r=-0.46, p=0.02). The same group showed a positive significant correlations between age and hair density at frontal region (r=0.7, p<0.001), and age and hair density at the vertex region (r=0.54, p=0.005). Duration of AGA correlatied negatively with VH response at the frontal region (r=-0.44, p=0.03) and with hair thickness at frontal region (r=-0.6, p=0.002). Duration of AGA correlated positively with hair density at the frontal region (r=0.8, p<0.001) and with hair density at the vertex region (r=0.6, p=0.001). Patients' satisfaction correlated positively with VH response at the frontal region (r=0.45, p=0.024).

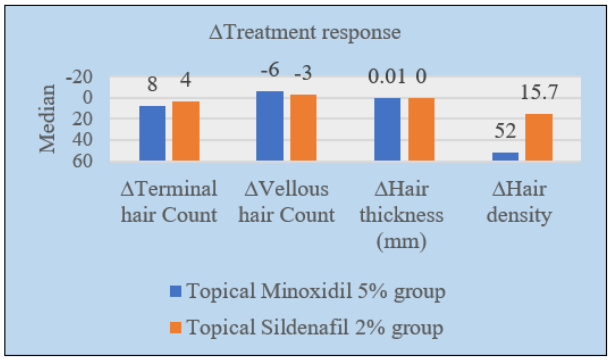

Figure 1. Comparison of treatment response change at the frontal region between the 2 groups.

Figure 1 demonstrates that, as for the frontal region treatment response, patients treated with topical minoxidil 5% had higher terminal hair count (7.88±4.35) than patients treated with topical sildenafil 2%(3.3±4.1) with a statistically significant difference (p<0.001). Vellous hair count was lower among patients treated with topical minoxidil 5%(-6.2±6.24) than those treated with topical sildenafil 2%(-4.2±6.5) with a statistically significant difference (p=0.044). Moreover, hair was thicker among patients treated with topical minoxidil 5%(.0093±.007 mm) than those treated with topical sildenafil 2% with a statistically significant difference (p<0.001). Hair density was higher among patients treated with minoxidil 5%(62.2±87.5) than those treated with topical sildenafil 2%(24.7±39.34) with a statistically significant difference (p=0.01).

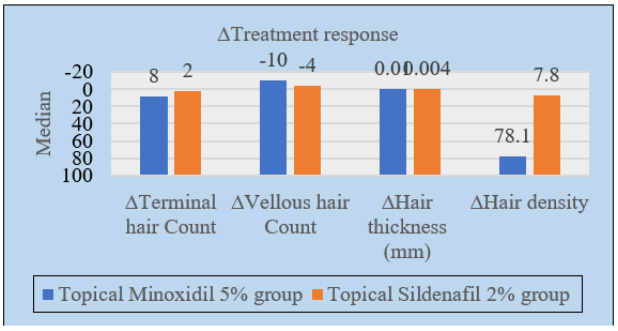

Figure 2. Comparison of treatment response change at the vertex region between the 2 groups.

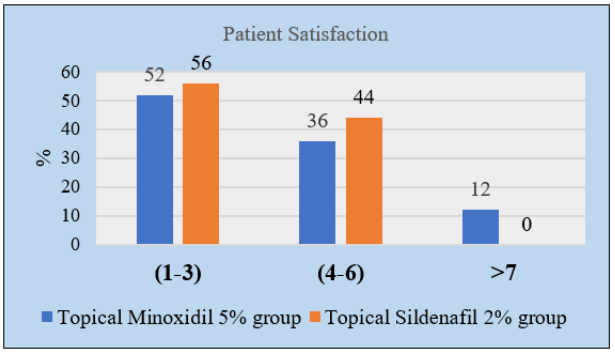

Figure 3. Comparison of Patient satisfaction between the 2 groups.

Figures 2 and 3 demonstrate that, at the vertex region, terminal hair count was higher among patients treated with topical minoxidil 5%(7.8±6.13) than those treated with topical sildenafil 2%(1.56±3.2) with a statistically significant difference (p<0.001). Vellous hair decreased among patients treated with topical sildenafil 2%(-5.64±6.4) than those treated with topical minoxidil 5% group with no statistically significant difference (p=0.07).

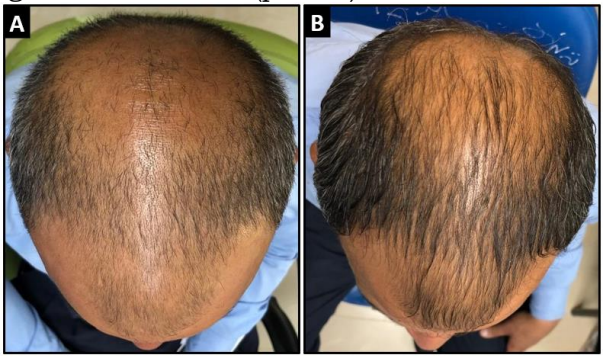

Figure 4. Clinical picture of one patient aged 35 years with grade IV AGA: (A) before treatment (B) at 6 months after beginning of treatment

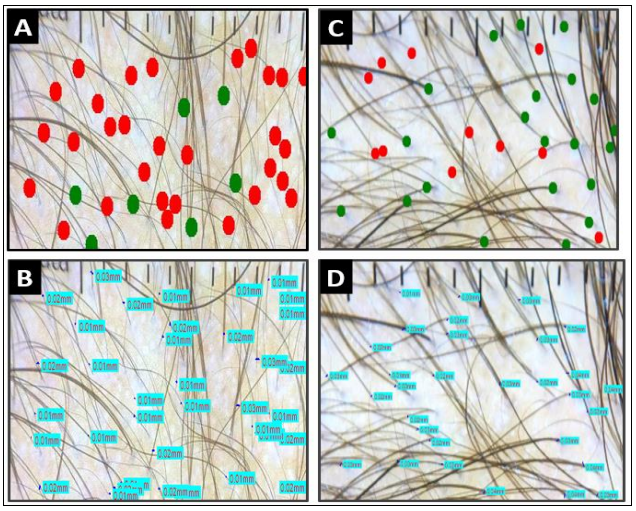

Figure 5. Trichoscopic assessment at the frontal region:(A,B) before treatment (C,D) at 6 months after beginning of treatment.

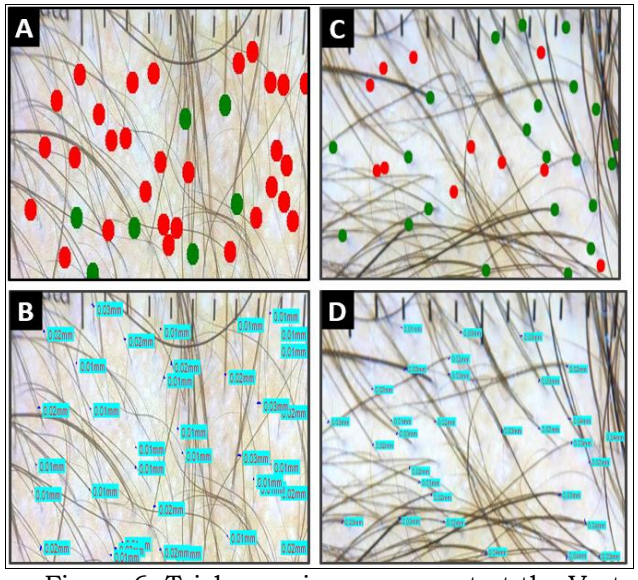

Figure 6. Trichoscopic assessment at the Vertex region:(A,B) before treatment (C,D) at 6 months after beginning of treatment.

Figures 4-6 show the clinical photographs of a 35-year-old male patient from group I with AGA 5 years ago, grade V on Hamilton grading before and after treatment, patient was completely satisfied.

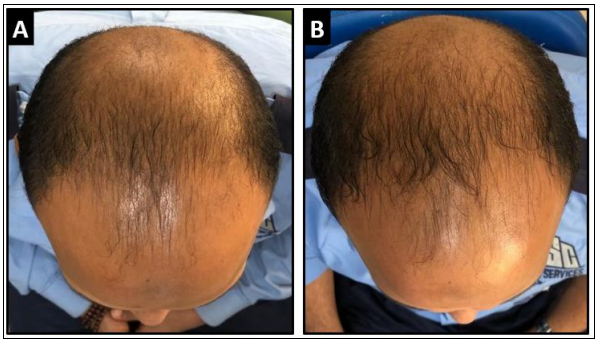

Figure 7. Clinical picture of one patient aged 27 years with grade IV AGA:(A) before treatment (B) at 6 months after beginning of treatment

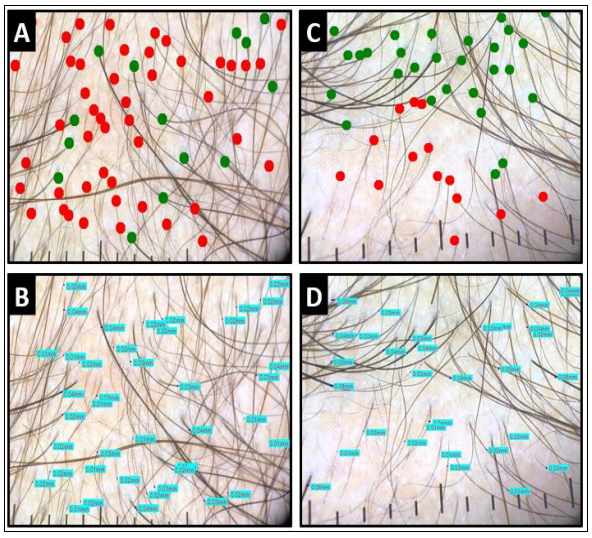

Figure 8. Trichoscopic assessment at the frontal region:(A,B) before treatment (C,D)at 6 months after beginning of treatment.

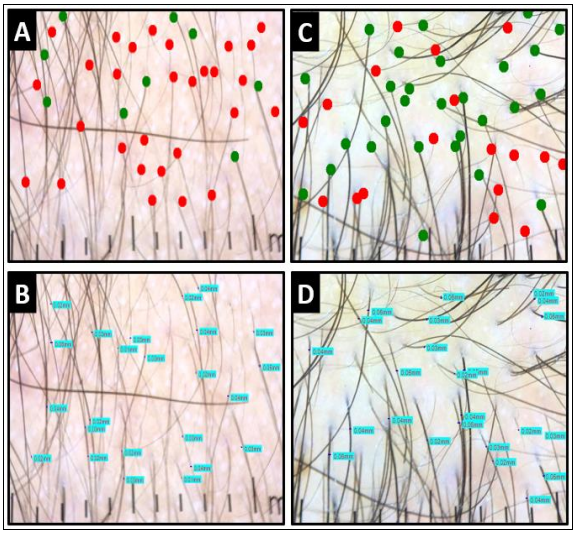

Figure 9. Trichoscopic assessment at the vertex region:(A,B) before treatment (C,D)at 6 months after beginning of treatment.

Figures 7-9 show the clinical photographs of a 27-year-old male patient from group II with AGA 6 years duration, grade VI on Hamilton grading before and after treatment, patient was completely satisfied.

4. Discussion

AGA in males is the most prevalent kind of hair loss, impacting as many as 80% of males and 40% of females. Alopecia patients experience extreme discomfort as a result of their changed look, which has a substantial impact on their day-to-day activities and may exacerbate signs of worry and sadness. AGA patients continue to have difficult treatment options, and none of them are fully preventative or curative.[9]

The primary objective of this investigation was to evaluate the effectiveness of topical minoxidil 5% and topical sildenafil 2% in the management

of male androgenic alopecia.

The current study revealed that, as for the frontal region treatment response, topical minoxidil 5% showed higher terminal hair count and density, thicker hair, and lower vellous hair count among patients treated with topical minoxidil 5% than those treated with topical sildenafil 2%.

At the vertex region, terminal hair count, hair thickness, and density were higher among patients treated with topical minoxidil 5% than those treated with topical sildenafil 2%. Vellous hair decreased among patients treated with topical sildenafil 2% compared to those treated with topical minoxidil 5% group.

The outcomes of the present investigation were consistent with those of Mostafa et al.'s study from 2022, which discovered that minoxidil outperformed sildenafil in terms of increased terminal hair count, thicker hair diameter, and fewer vellus hairs. Less noticeable effects were observed in the vertex and more in the frontal and temporal regions.[10]

The capacity of minoxidil to enhance dermal papilla cutaneous blood circulation, activate vascular endothelial growth factor, and promote other hair improvement boosters may be the cause of its effectiveness.[11]

Moreover, it promotes DNA synthesis, angiogenesis, and the growth of cells.12

Additionally, it may promote hair development by stimulating prostaglandin endoperoxidesynthase-1, which in turn increases the formation of prostaglandin E2(PGE2).[13]

In the current study, according to patients treated with topical minoxidil 5% at the frontal region as well as the vertex region, terminal hair count, hair thickness, and hair density increased significantly after six months of treatment. On the other hand, vellous hair count decreased significantly after 6 months of treatment compared to before treatment.

In agreement with the current study, Bassiouny et al. reported that the topical minoxidil 5% therapy group showed a substantial rise in terminal hair number in both the vertex and frontal regions after twenty-four weeks of therapy, nevertheless, the research refuted the present results and reported that the topical minoxidil 5% therapy group's vellus hair density rose in both the vertex and frontal regions.[14]

Following six months of therapy, the number of vellous hairs considerably dropped in accordance with the frontal area response of patients receiving topical sildenafil 2% in the present research. Hair thickness did not significantly increase after 6 months of treatment. On vertex region, terminal hair count and density increased significantly after six months of treatment with a statistically significant difference. Vellous hair count decreased significantly after 6 months. Hair thickness decreased after treatment, with no statistically significant difference.

Displeased with the present findings, Mostafa et al. discovered a statistically noteworthy rise in the number of vellus hairs in the frontal area, vertex, and temporal side in the group that received topical sildenafil 1% following therapy as opposed to pre-treatment.[15]

According to the current study, there was no statistically significant difference between the topical minoxidil group (5%) and the topical sildenafil group (2%) in terms of patient satisfaction.

The researchers of the research by Bassiouny et al. agreed with the present results and discovered that after the 24th week, group 1 had substantially greater ratings for improved clinical outcomes in all variables, with the exception of the hair loss variable, which was not significantly different between groups at any point in time due to minoxidil's ability to reduce hair fall. From the standpoint of the patients, cetirizine could help in the growth of new newborn hairs because the group 1 variable of the appearance of new hairs at the 12 and 18-week marks was considerably superior.[14]

In the current study, according to topical minoxidil 5% treated group, there was a significant positive correlation between hair thickness at the vertex region and age. among patients treated with topical sildenafil 2%, there were negative significant correlations between age and VH response at the vertex ($r=-0.39$, $p=0.049$), and age and hair thickness at the frontal region ($r=-0.46$, $p=0.02$).

Our findings of the minoxidil group were in conflict with those of Al-Shabkhon et al., who claimed that there was no meaningful relationship between the hair thickness responses in the frontal and vertex regions and the demographic and medical records. Although no additional significant connections were discovered, there was a substantial negative link between the VH response at the vertex and the AGA degree.[16]

Recommendations: Data collection using standardized tools and protocols, at regular intervals postoperatively. The sample size of future studies should be large enough to provide meaningful conclusions and to control for confounding factors. To accurately assess long-term outcomes, studies should have a longer follow-up period.

4. Conclusion

Patients treated with topical minoxidil 5% had a

significantly higher terminal hair count, a lower vellous hair count, thicker hair, and higher hair density than those treated with topical sildenafil 2%.

Disclosure

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Authorship

All authors have a substantial contribution to the article

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Conflicts of interest

There are no conflicts of interest.

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