Al-Azhar International Medical Journal

Volume 4 | Issue 11 Article 10

2023
Section: Dermatology

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How to Cite This Article

IM, Abdel Kareem; MK, Ibrahim; and Sherif, Mahmoud E. (2023) "Evaluation of efficacy and safety of scalp threading with polydioxanone (PDO) monofilament threads in the treatment of male androgenetic alopecia," *Al-Azhar International Medical Journal*: Vol. 4: Iss. 11, Article 10.
DOI: https://doi.org/10.58675/2682-339X.2093

ORIGINAL ARTICLE

Evaluation of Efficacy and Safety of Scalp Threading with Polydioxanone (PDO) Monofilament Threads in the Treatment of Male Androgenetic Alopecia

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Abstract

Background: **Male pattern baldness, known as androgenetic alopecia (AGA), is progressive hair loss. The degree of severity, age at onset, and location of hair loss of this polygenetic condition were varied. Polydioxanone (PDO) threads were used for facial rejuvenation, and this procedure is becoming increasingly popular in promoting hair growth.**

Aim: **To determine whether polydioxanone monofilamet threads for male patients with crown baldness (vertex androgenetic alopecia) are safe and effective.**

Subject and material: **In this pilot study, seven male AGA patients experienced crown hair (stage III vertex androgenetic alopecia by the Norwood-Hamilton scale). Polydioxanone monofilament threads were inserted into the dermal layer of the crown, or vertex, of the scalp. The result was evaluated after a half year by clinical assessment, computerized photography, and trichoscopy examination.**

Results: **There was significant difference in hair regrowth and an increase in hair density after 6 months in the targeted area compared with the baseline of trichoscopy. The clinical result was favorable thanks to PDO threads.**

Conclusion: **Scalp stringing with PDO monofilament strings is straightforward, possible, and with quicker reassuring outcomes in male patients with crown sparseness (vertex androgenetic alopecia) with apparent expansion in hair thickness and thickness.**

Keywords: Androgenetic alopecia, Crown baldness, Polydioxanone, Polydioxanone monofilament threads, Scalp threading

1. Introduction

Male androgenetic alopecia (MAA) is the most popular type of alopecia among men, influencing 30–50 % of men by the age of 50 years.[1] The predominance is high in old patients. However, androgenetic alopecia (AGA) could begin during puberty.[2] It is characterized by the progressive loss of terminal scalp hair at any time after puberty, with a particular distribution in males and females. The vertex and frontotemporal regions experience the greatest amount of hair loss in males.[3] The highest point is referred to as the vertex. Hair is organized there as a whorl or whirl, beginning from 1 or 2 focuses.[4] Thread-embedding therapy (TET) is a type of dermal needling treatment in which threads are inserted into skin lesions to extend the therapeutic effect.[4] Polydioxanone (PDO) threads are dissolvable sutures used as a cosmetic procedure for rejuvenating and lifting sagging skin. Lately, PDO threads were used in hair loss, especially for both males and females with androgenetic alopecia. Therefore, scalp threading clinically proved that stimulation for hair growth proved good to those who failed to respond to FDA-approved treatments (minoxidil or finasteride). Currently, guidelines

Accepted 12 July 2023.
Available online 22 January 2024

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https://doi.org/10.58675/2682-339X.2093

observed that PDO threads can stimulate neo-collagenesis, mechano-transduction (mechanical upgrades prompted fibroblastic reaction), guideline of quality articulation, and further developed microcirculation appear to be the conceivable components.[5] This polymer is thought to be nonantigenic and nonpyrogenic, and previous literature provided with existing PDO products indicates that it causes little tissue reaction during absorption after implantation.[6]

Therefore; this study aims to determine whether polydioxanone monofilament (PDO) threads for male patients with crown baldness (vertex androgenetic alopecia) are safe and effective.

2. Patients and methods

In this pilot study, seven male AGA patients were clinically determined and by trichoscopy to obtain the degree of androgenetic alopecia, who underwent scalp threading for the treatment of male androgenic alopecia between January 2021 and January 2022 with a 0 and 6 months follow-up conducted in the outpatient clinic of Dermatology and Venereology Department at Al-Azhar University served as the setting for the study.

Written informed consent was provided by each participant. Institutional ethics endorsement was acquired before the beginning of the review.

Male patients with or without frontal vertex androgenetic alopecia up to grade 4, patients over the age of 18 years, and those who had not received treatment in at least 3 months were included. Systemic therapy for androgenetic alopecia in the last 3 months and topical treatment in the last 3 months, severe irritation, and highly inflamed scalp skin were excluded.

Clinical diagnosis with a gradual onset that began after puberty and frequently, but not always, a family history of baldness, depression, or mental illness. It is important to look over the patient's medication list, past medical history, and systemic or topical courses to make sure that the androgenetic alopecia is not being unmasked by other means. The use of thyroid studies, a complete blood count, a screening for iron deficiency using iron, total iron-binding capacity, and ferritin was made.

The conclusion of crown sparseness (vertex AGA) depended on an individual history of moderate loss of vertex hair and on trichoscopic discoveries, for example, the reversal of rates of anagen and telogen hairs and a reduction in hair thickness.

After significant history, appropriate patient choice, taking an educated assent, and under all aseptic insurances PDO monofilament strings are embedded at a point as intense to the scalp as could be expected, along the course of hair development. PDO monofilament strings of 27 G, 50 mm were used. While embedding the string with one hand, the fingers of the other hand assist with balancing out the scalp surface. The thread can be easily inserted in the desired plane (the dermal layer at the vertex of the scalp) with this method. A small amount of anesthetic solution containing lignocaine is injected at the entry point to alleviate pain. Each string is embedded 3–5 cm separated, and the ideal number of strings to be embedded would rely on the area of crown hair loss.

Dermatological assessment shows scaled-down hair and brown perihilar projects, which can help separate from diffuse alopecia areata that impersonates male example sparseness.

2.1. Evaluation trichoscopically

At least four images from the parietal, frontal, occipital, and lesional areas were taken at a magnification of 100 to better understand the vascular patterns and prevent nosocomial infections. Dermoscopic criteria for the diagnosis of AGA are two major criteria or one major criterion and two minor criteria indicate the diagnosis with 98 % specificity.

Trichoscopic evaluation and assessment were used with a power of 10× magnifications connected to a laptop with software, the ability to take measurements, and drawing features. After 6 months, follow-up and trichoscopy evaluation were carried out during the 6-month study period. The patient was instructed to come in for a trichoscopy examination every 6 months. Negative effects (such as erythema, erosion, edema, seborrheic dermatitis, dryness, and pruritus) were examined every 0 and 6 months.

SPSS factual bundle (SPSS v22.0) was used for measurable investigations. The *t*-test was used to compare changes in hair density and diameter before and after treatment, and the ANOVA extended the *t*-test. For *P* values of less than 0.05., statistical significance was accepted (Fig. 1, Table 1).

3. Results

Instrumental evaluation using trichoscopy analysis for the identification of hair density before and after PDO with significant differences (Figs. 2–15, Table 2).

No improvement or further hair loss, fair response: less than 25 % improvement, good

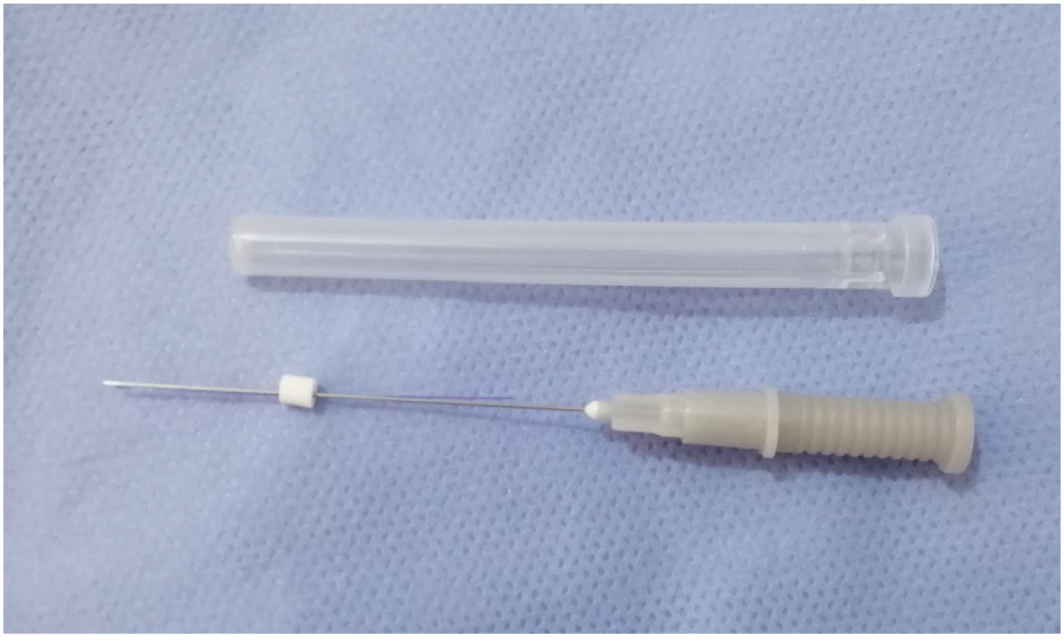

Fig. 1. 27 G, 50 mm Polydioxanone monofilament thread.

Table 1. Patient characteristics.

Patient	Sex	Age	Norwood–Hamilton degree	Targeted area	Number of threads
1	Male	29	III Vertex	Crown (vertex)	5 threads
2	Male	28	III Vertex	Crown (vertex)	5 threads
3	Male	28	III Vertex	Crown (vertex)	9 threads
4	Male	30	III Vertex	Crown (vertex)	5 threads
5	Male	28	III Vertex	Crown (vertex)	6 threads
6	Male	30	III Vertex	Crown (vertex)	5 threads
7	Male	23	III Vertex	Crown (vertex)	5 threads

Fig. 2. Patient 1. Male patient with vertex androgenetic alopecia treated with polydioxanone monofilament threads. (Left) Preoperative view of the scalp of a 29-year-old male patient affected by AGA III vertex according to Norwood–Hamilton scale. (Right) A view at 6 months after scalp threading with polydioxanone monofilaments.

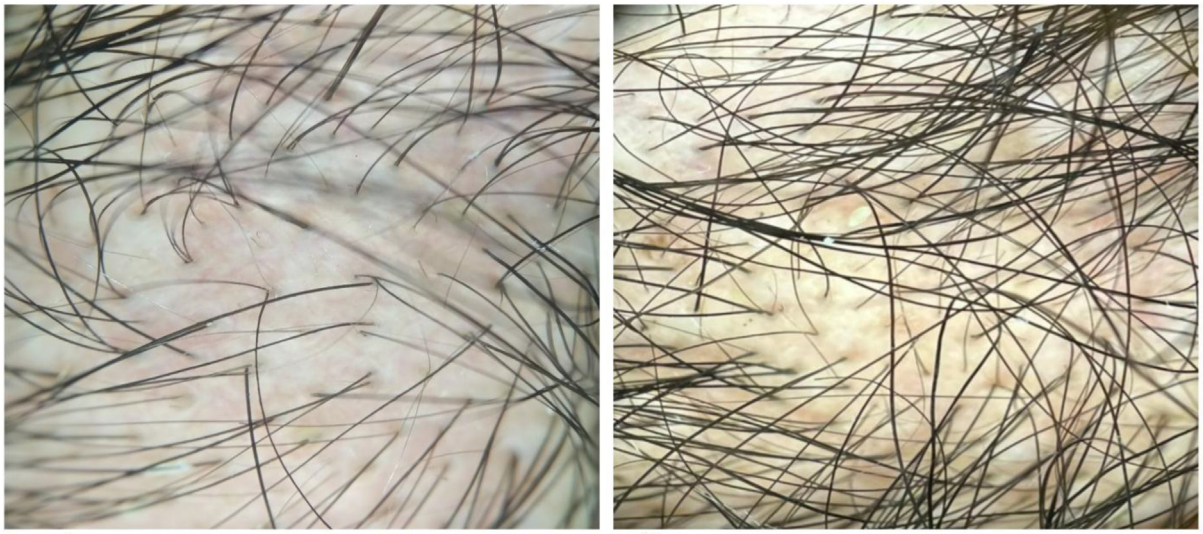

Fig. 3. Patient 1. Trichoscopic picture of the patient in Fig. 5 (A) Before scalp threading hair density was 44 ± 2 hairs/cm^2. (B) At 6 months after scalp threading the hair density was 56 ± 2 hairs/cm^2.

response: 25%–50 % improvement, very good response: greater than 50%–75 % improvement, and excellent response: greater than 75 % improvement. Patient Satisfaction regarding crown (vertex) coverage included: excellent, good, fair, poor, and unsatisfactory (Table 3).

Side effects included: pain after threading, itching, tingling, infection, and extrusion of threads. There was no tingling, infection, or extrusion of threads in all patients; however, itching were slightly observed after 2–3 h in only one patient. Pain was observed among all the included patients starting from 4 h and not exceeding 12 h (Table 4).

4. Discussion

Minoxidil and finasteride were FDA-approved treatments, and have traditionally been combined to treat male androgenetic alopecia. However, platelet-rich plasma (PRP), miniature needling, and low-level laser light treatment (LLLT) have likewise been attempted with variable outcomes.[6]

Fig. 4. Patient 2 digital photographs: (A) Before scalp threading and (B) At 6 months after scalp threading.

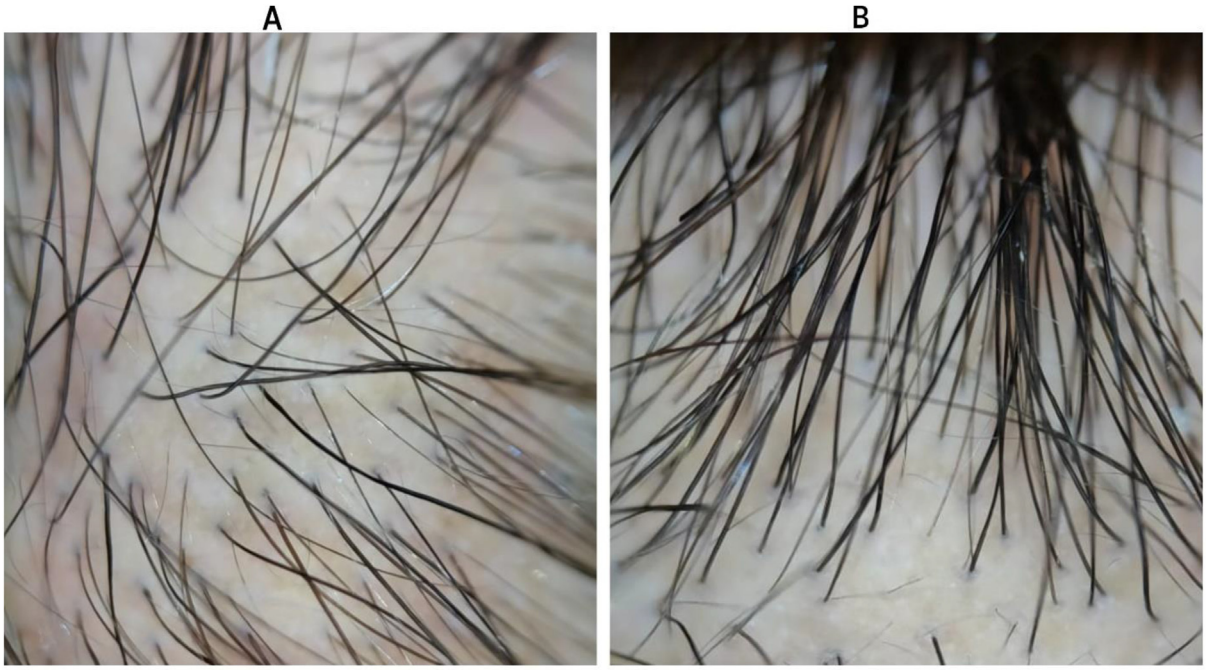

Fig. 5. Patient 2 Dermoscopy: (A) Before scalp threading and (B) At 6 months after scalp threading.

PDO strings are adaptable, nonhypersensitive, and engineered having high maintenance, and slow assimilation rate, and have been used in cardiovascular medical procedures for long. In recent times, face sculpting and lifting procedures were used. The regenerative potential of threads on the connective tissue could also affect the hair growth cycle through the following mechanisms, the effect of threads on hair development, stimulation of the formation of new collagen, stimulation of the production of growth factors (PDGF, VEGF), direct stimulation of stem cells of the hair follicle, and enhancement of the microvascular supply to the hair follicle.[7]

This study compared other forms of conventional treatment, such as microneedling, which requires 8–10 sessions every month, and threads only require one or two sessions spaced 6–8 months

Fig. 6. Patient 3 Digital photographs: (A) Before scalp threading and (B) At 6 months after scalp threading.

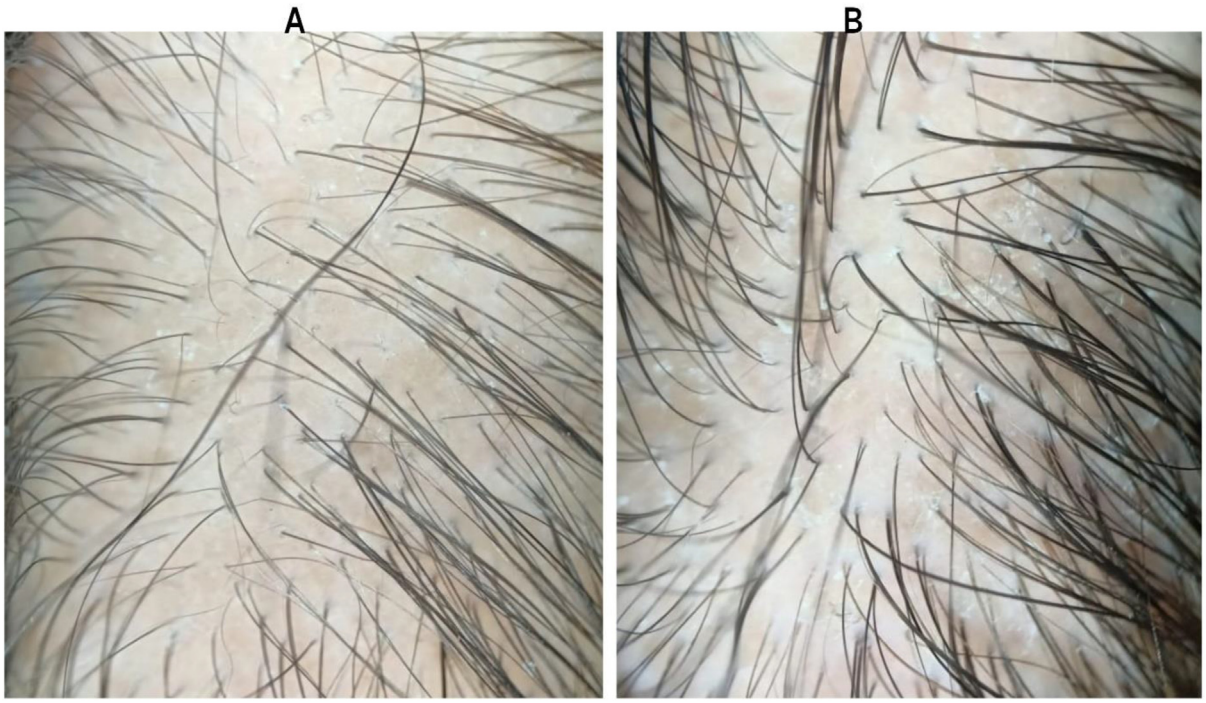

Fig. 7. Patient 3 Dermoscopy: (A) Before scalp threading and (B) at 6 months after scalp threading.

apart. This aids in the aversion of rehashed injury to the scalp and consequently expands consistency among the patients.

In addition Lattanand and Johnson[8] observed that the papillary loop, lesser extent, vessels of the dermal and subdermal plexuses perfuse normal, and healthy terminal scalp hair follicles. The ascending arterioles and extensive surrounding microvasculature are connected by smaller-caliber cross shunts.

More specifically according to Hunt and Pai,[9] when tissue PO2 falls below 40 mmHg, collagen synthesis by fibroblasts and dermal papillae is significantly impaired.[9]

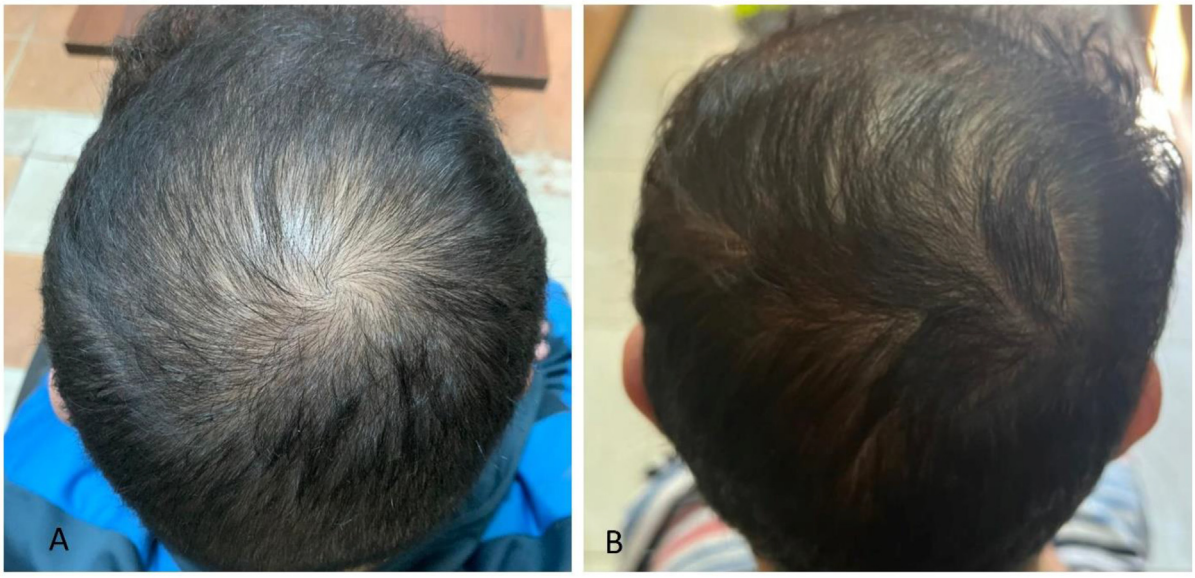

Fig. 8. Patient 4 Digital photographs: (A) before scalp threading and (B) at 6 months after scalp threading.

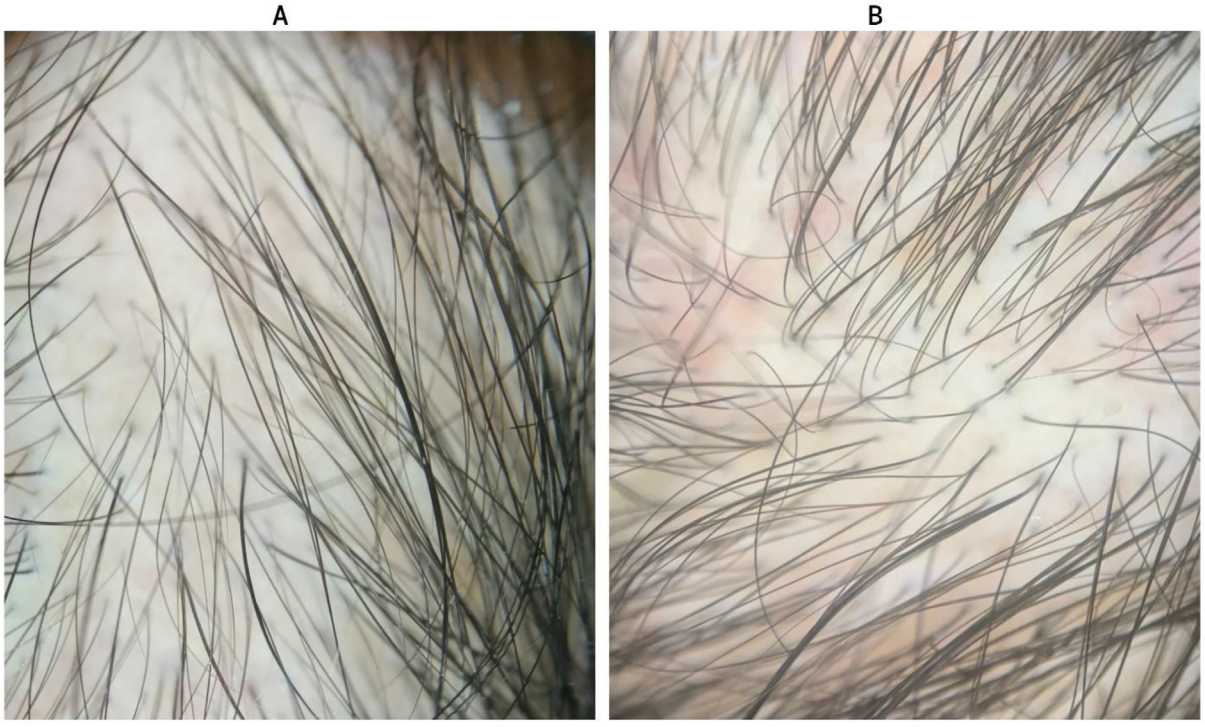

Fig. 9. Patient 4 Dermoscopy: (A) before scalp threading and (B) at 6 months after scalp threading.

Since transcutaneous PO2 in bald areas is less than 40 mmHg, hair follicle cell keratin production may also be affected. Goldman et al.[10] indicate that the AGA-affected areas have a relative, subclinical, microvascular pseudo-insufficiency at levels below those required for hair growth.

According to Yano et al.,[11] vascular endothelial growth factor (VEGF) has been identified as a major

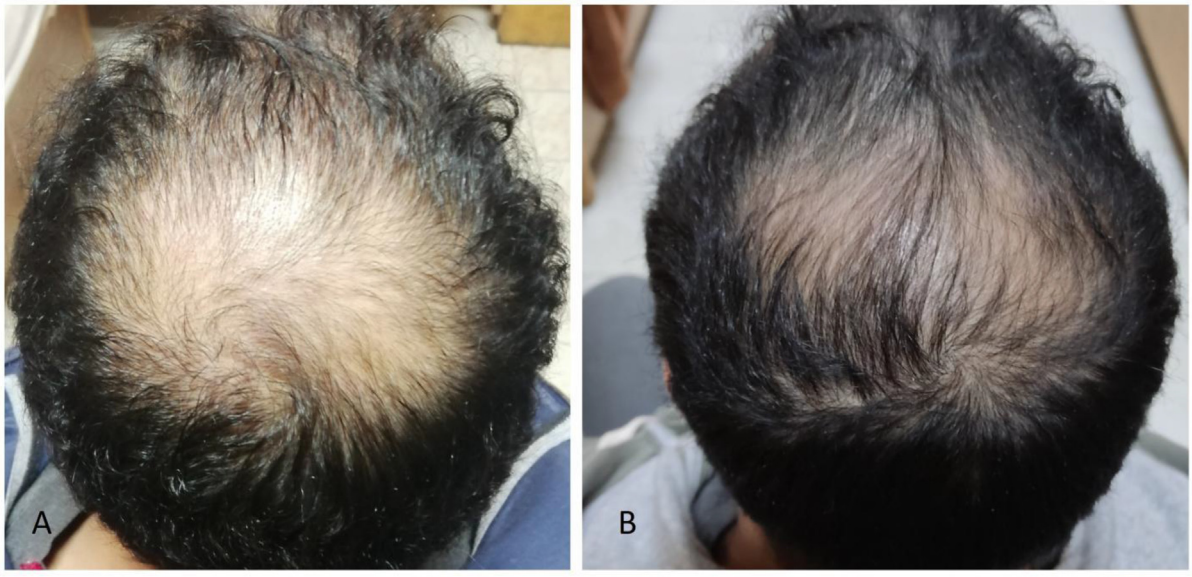

Fig. 10. Patient 5 Digital photographs: (A) before scalp threading and (B) at 6 months after scalp threading.

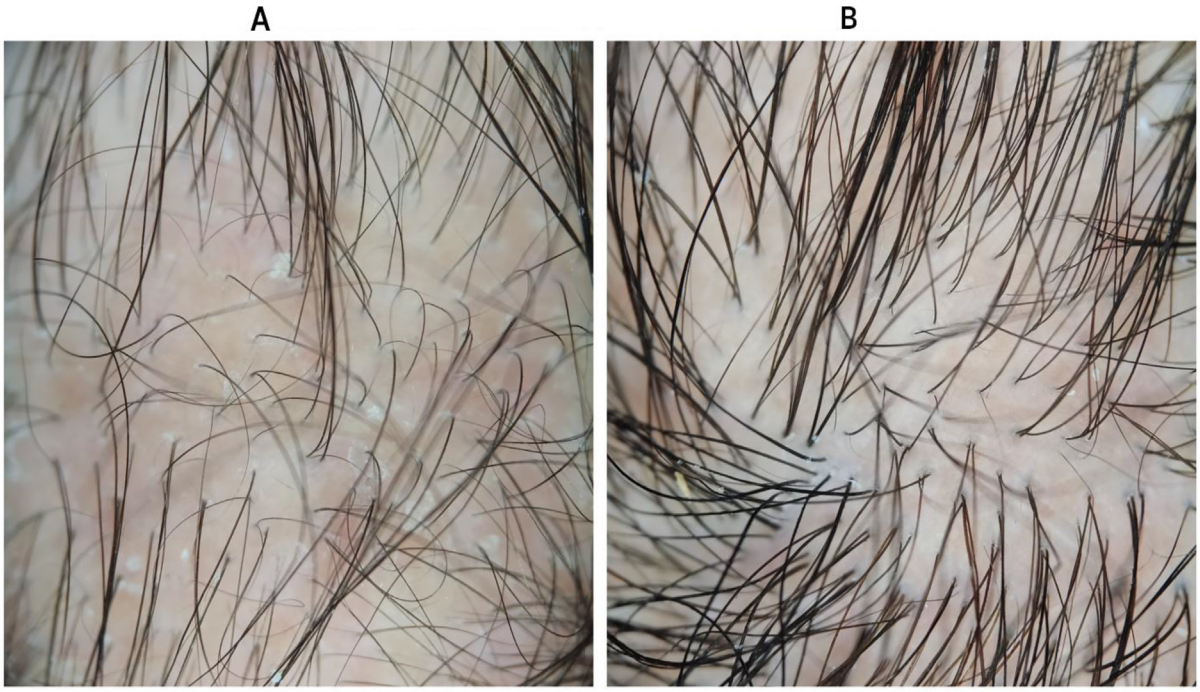

Fig. 11. Patient 5 Dermoscopy: (A) before scalp threading and (B) at 6 months after scalp threading.

mediator of hair follicle growth and cycling and has been identified as an endothelial cell-specific mitogen. Moreover, Jeong et al.,[12] the precise mechanism of action of hair growth stimulation by PDO remains theoretical.

However, according to Kim et al.,[13] it is anticipated that similar to microneedling, it likely involves the direct stimulation of stem cells in the hair bulge area and the release of growth factors such as PDGF.

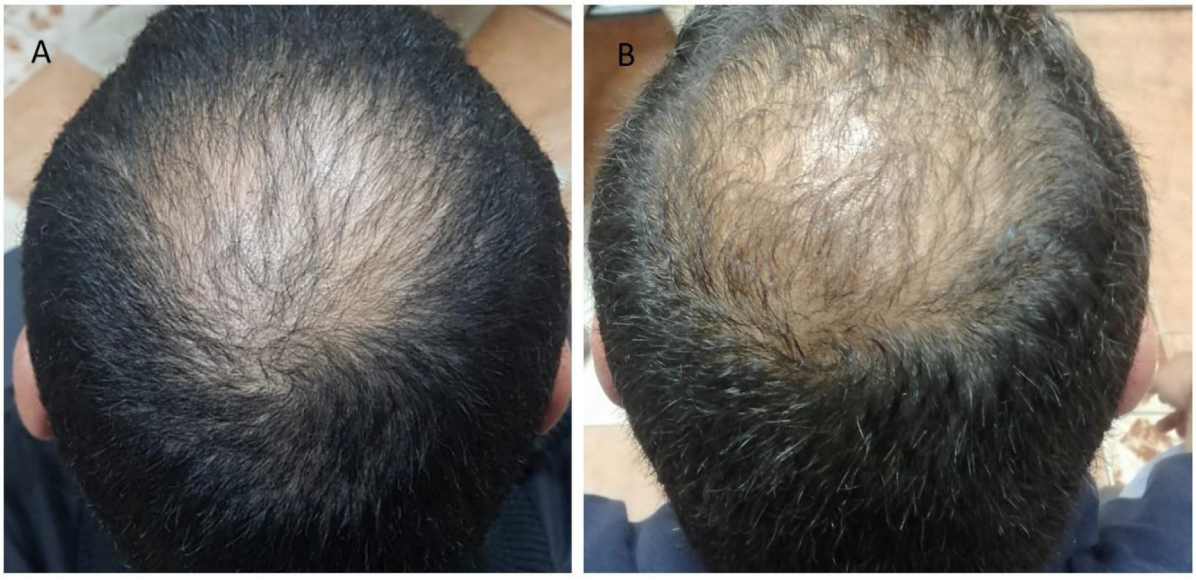

Fig. 12. Patient 6, digital photographs: (A) before scalp threading and (B) at 6 months after scalp threading.

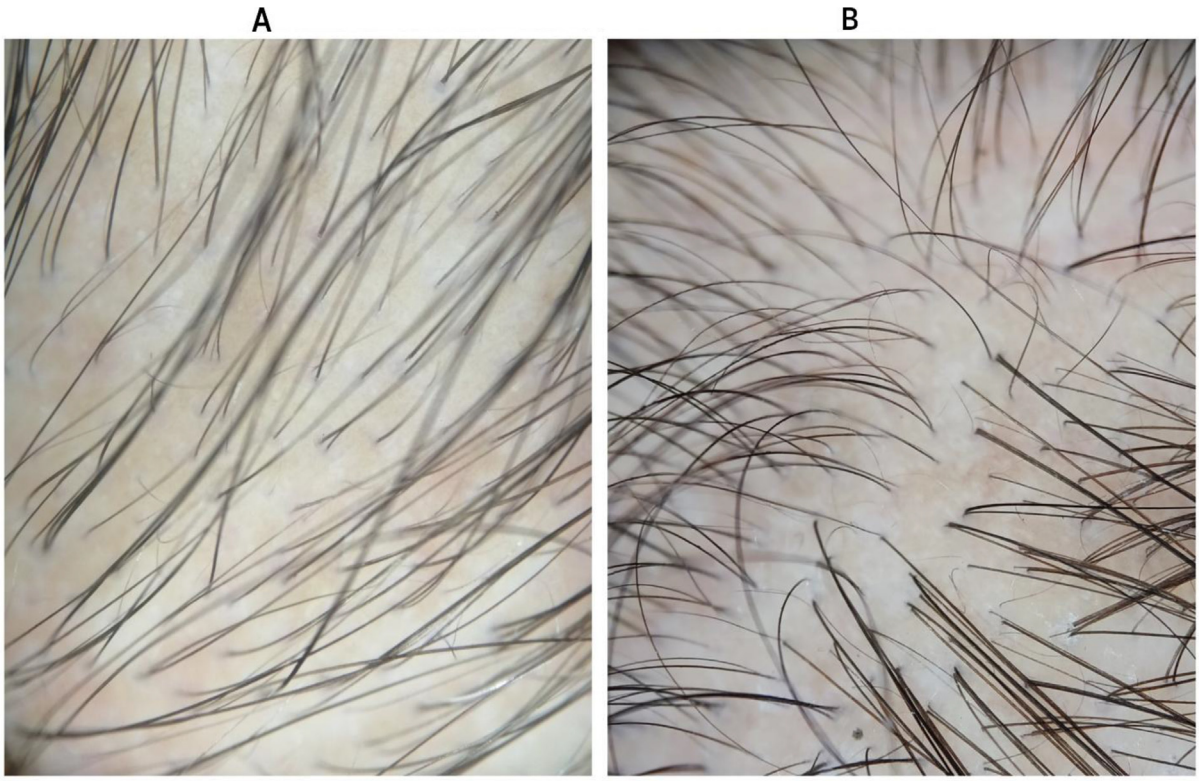

Fig. 13. Patient 6 Dermoscopy: (A) before scalp threading and (B) at 6 months after scalp threading.

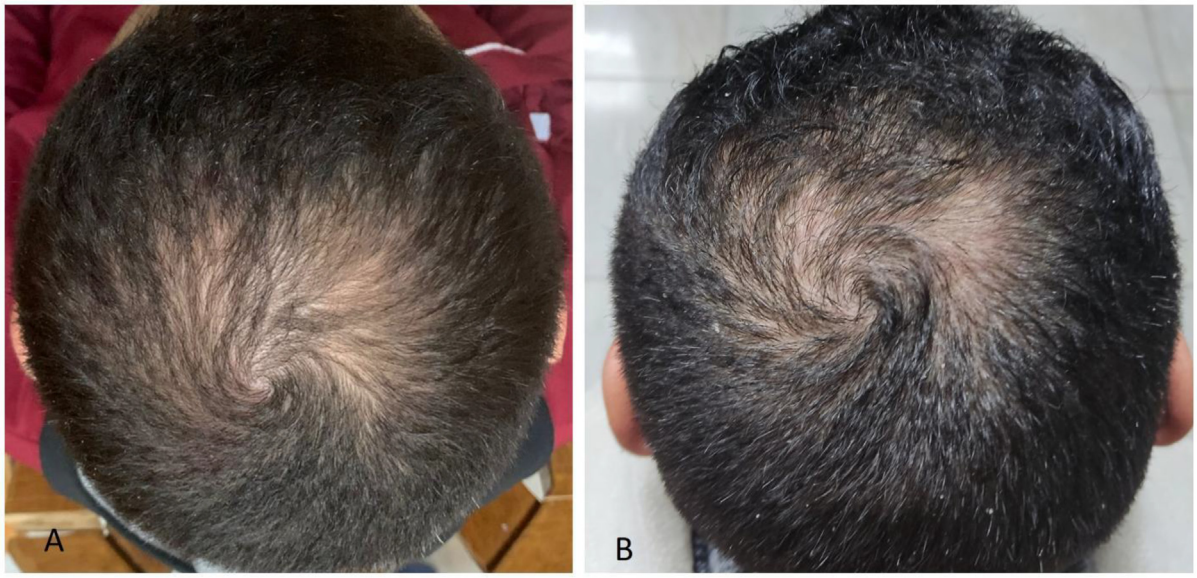

Fig. 14. Patient 7 digital photographs: (A) before scalp threading and (B) at 6 months after scalp threading.

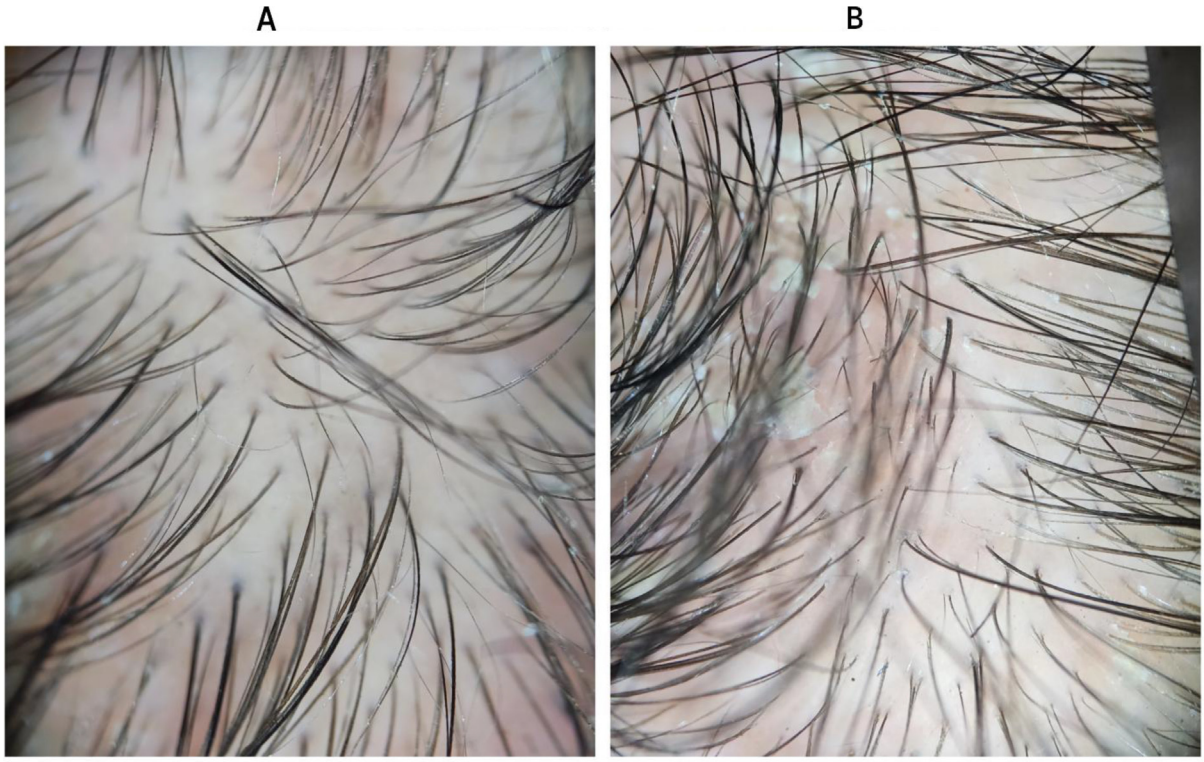

Fig. 15. Patient 7 Dermoscopy: (A) before scalp threading and (B) at 6 months after scalp threading.

Table 2. Trichoscopic evaluation in terms of hair density (HD) (hairs/cm^2).

Patient	Hair density (HD) before crown threading	Hair density (HD) 6 months after crown threading
1	41 ± 2 hairs/cm^2	56 ± 2 hairs/cm^2
2	51 ± 2 hairs/cm^2	62 ± 2 hairs/cm^2
3	46 ± 2 hairs/cm^2	53 ± 2 hairs/cm^2
4	42 ± 2 hairs/cm^2	55 ± 2 hairs/cm^2
5	48 ± 2 hairs/cm^2	60 ± 2 hairs/cm^2
6	44 ± 2 hairs/cm^2	54 ± 2 hairs/cm^2
7	45 ± 2 hairs/cm^2	52 ± 2 hairs/cm^2

Table 3. Clinical evaluation.

Patient	Investigator evaluation	Patient satisfaction regarding crown (vertex) coverage
1	Excellent response	Excellent
2	Good response	Good
3	Good response	Fair
4	Very good response	Good
5	Good response	Very Good
6	Good response	Fair
7	Good response	Good

Table 4. Sides effects for each patient in the first week after threading (x) = absent.

Side effect Patient	Pain (after threading)	Itching	Tingling	Infection	Extrusion of threads
1	Only on pressure for 8 h	Slight for 2–3 h	x	x	x
2	Only on pressure for 6 h	x	x	x	x
3	Only on pressure for 24 h	x	x	x	x
4	Only on pressure for 4 h	x	x	x	x
5	Only on pressure for 12 h	x	x	x	x
6	Only on pressure for 18 h	x	x	x	x
7	Only on pressure for 12 h	x	x	x	x

4.1. Conclusion

The efficacy of PDO monofilament threads in the treatment of crown baldness (AGA III vertex) in male AGA through clinical and trichoscopy investigations has no secondary effects. Scalp threading with PDO monofilament threads is simple, possible, and has faster encouraging results in male patients with crown baldness (vertex androgenetic alopecia). Every patient who tried this procedure has efficient results including; an increase in hair thickness and density.

4.2. Limitations

Scalp threading using PDO thread lifting is not recommended for severe or premature aging, or sagged skin, in pregnant, or breastfeeding women.

Conflicts of interest

There is no any conflict of any interest.

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