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Preliminary results of the use of scalp microneedling in different types of alopecia

Michela Starace MD | Aurora Alessandrini MD | Nicolò Brandi MD | Bianca Maria Piraccini MD, Ph

Department of Experimental, Diagnostic and Specialty Medicine-Division of Dermatology, University of Bologna, Bologna, Italy

Correspondence
Nicolò Brandi, Department of Experimental, Diagnostic and Specialty Medicine- Division of Dermatology, University of Bologna, Via Massarenti, 1, 40138 Bologna, Italy.
Email: nicolo.brandi@studio.unibo.it

Abstract

Background: Androgenetic alopecia (AGA) is the result of progressive patterned hair density reduction and sometimes can be associated with telogen effluvium (TE). The efficacy of conventional therapy is variable, and therefore, there is a need for adjuvant and newer modalities of treatment in order to give faster and better outcomes. Microneedling has been reported to be a promising, effective, and safe new technique in the treatment of AGA.

Objective: The aim of this study was to prove that microneedling procedure should be offered to patients with AGA and TE along with the existing therapeutic modalities, in order to obtain faster hair regrowth and, therefore, a better patient compliance.

Patients and methods: We collected data of 36 females, 29 with AGA, and 7 with TE, and 14 males with AGA between January 2017 and December 2018 and then treated with 3 session of microneedling over a total period of 6 months.

Results: No serious adverse side effects were reported. All the patients reported a partial or complete reduction in hair loss, associated to the perception of improvement of hair density and thickening of the hair shaft diameter, results confirmed by clinical iconography and trichoscopy.

Conclusions: Scalp areas typical affected by AGA, that is, the vertex in males and the frontal area in females, are the ones that showed the greater percentage of improvement. Moreover, microneedling can have a role also in TE, especially when cosmetic procedures do not give enough results, because it induces a rapid arresting of the hair loss.

KEYWORDS

androgenetic alopecia, hair density, hair loss, microneedling, telogen effluvium

1 | INTRODUCTION

Androgenetic alopecia (AGA) is the most common type of alopecia and is the result of progressive patterned hair loss that occurs when genetically predisposed individuals are exposed to androgens.[1] Telogen effluvium (TE) can be associated in patients affected by AGA, especially in females, and can be a possible trigger factor that induces the onset of AGA in predisposed persons.[2] By far, the most promising approaches approved by FDA for the treatment of AGA are drug therapies, such as local minoxidil and oral finasteride.[3] However, these may not always be effective and take a long time to show results. In fact, the European guidelines report data on finasteride and minoxidil efficacy in terms of arresting of ongoing hair loss and new hair regrowth varying between 40% and 60%.[4] Therefore, a large

proportion of patients with AGA remain unsatisfied and a significant number of them still go bald despite therapy. Hence, there is a need for adjuvant and newer modalities of treatment in order to give faster and better outcomes, especially for those patients who have not obtained results or want to improve what they have already achieved.

The last European guideline summarizes evidence-based treatment for androgenetic alopecia, associating them with expert-based recommendations and describing the most frequently prescribed options.[4] In this review, they underline the importance adding adjuvant physical or surgical therapies, such as PRP (Platelet-Rich Plasma), when standard treatments do not give enough results.

Recently, the use of microneedling has been investigated as potential therapeutic options for the treatment of hair disorders due to its capacity to enhance growth factor production, facilitate hair follicle development and cycling, amplify collagen and elastin production and create microchannels that allow transdermal delivery of drugs through the stratum corneum.[5]

Even though puncturing with microneedles does not cause a deep injury—and therefore it does not lead to scar formation—this procedure is sufficient to induce skin irritation and trigger skin repair functions (as measured by induction of TGF-beta, TGF-alpha, FGF 7, PDGF), ultimately resulting in collagen deposition by fibroblasts.[6,7]

The aim of this study was to prove that microneedling procedure should be offered to patients with AGA and TE along with the existing therapeutic modalities, in order to obtain faster hair regrowth and, therefore, a better patient satisfaction.

2 | MATERIALS AND METHODS

A pilot study, open-label, not randomized, single-group, and single-center were performed. The study was divided into a phase of screening/inclusion and a phase of follow-up of 6 months.

After obtaining informed consent, we enrolled a total of 50 patients, 36 females (29 with AGA and 7 with TE) and 14 males (with AGA) between January 2017 and December 2018. All the patients were taking topical or systemic treatments for AGA or TE lasting for at least 1 year.

We performed three treatments of microneedling at an interval of 4 weeks, over a total period of 6 months. For the procedure, the patients were anaesthetized with local mixture of lidocaine and prilocaine/tetracaine cream 1 hour before the procedure and the scalp was prepared with betadine and normal saline solutions. Rolling was done with dermaroller with needle length 1.5 mm over affected areas in longitudinal, vertical, and diagonal directions, eight times in each direction or until mild erythema and pin point bleeding was noted, which was considered as the end point (Figure 1). Each procedure lasted for about 20-25 minutes. After rolling, the scalp was cleaned with antiseptic solution and antibiotic cream was applied to the treated area. Patients were recommended not to wash the scalp for 24 hours. All patients were instructed not to apply minoxidil the day of procedure and to resume its application only 24 hours after the microneedling treatment. Patients were instructed not to alter their hairstyle or dye their hair during the entire study.

We evaluated the efficacy and tolerability of microneedling before starting the treatment and after 6 months through pull test, clinical iconography, and trichoscopy; digital images were obtained at 20×, 40×, and 70× magnifications at the vertex and central hairline of the scalp and both the number and the diameter of the hairs were measured with Trichoscan® software. We used a standardized grid located on the scalp at every session in order to correctly locate the same frontal and vertex scalp area during the treatment, using as primary reference the Kang's point or "V" point. The "V" point is calculated by the intersection of the mid-sagittal line, and the coronal line connecting both tips of the tragus of the patient.

Furthermore, we questioned all patients about local adverse effects or increase in hair loss, as well as their perception of hair growth.

3 | RESULTS

We collected data of 36 females, 29 with AGA, and 7 with TE, and 14 males with AGA between January 2017 and December 2018, all treated with 3 sessions of microneedling at an interval of 4 weeks, over a total period of 6 months. All the patients were Caucasian, and the mean age at diagnosis was 38.6 (range 25-62). Scalp dermoscopy revealed the typical aspect of AGA with the presence of diameter variability, peripilar signs, and empty follicles in all patients; the seven patients with TE showed short hairs in regrowth at trichoscopy and a positive pull test with telogen hair roots.

No serious adverse side effects were encountered during the treatment term that induce the patients to stop the procedures. Pain during the microneedling treatment was well tolerated by all

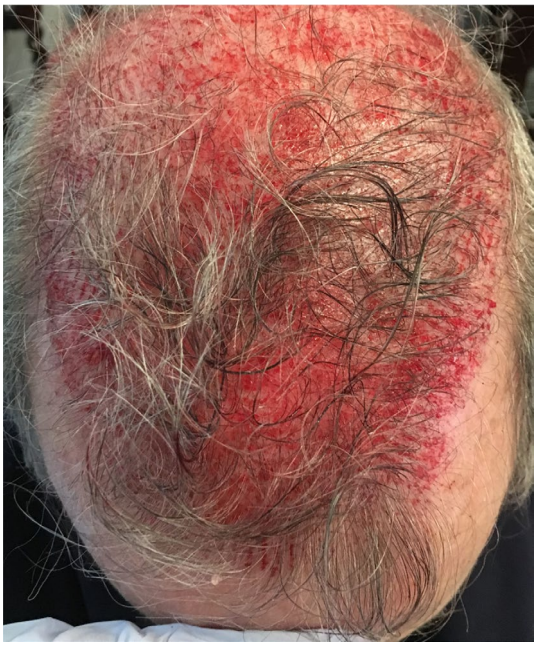

FIGURE 1 Significant erythema and pin point bleeding at the end of dermaroller treatment in a male patient with AGA

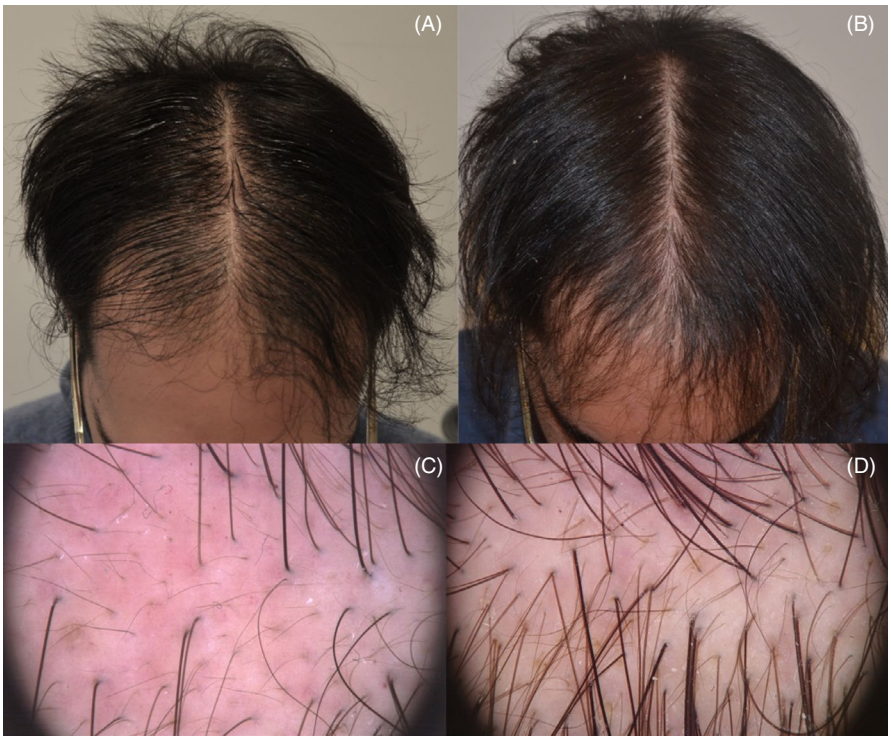

FIGURE 2 Androgenetic alopecia in a 33-y-old male. Clinical picture (A) and corresponding dermoscopic image (C) at baseline before dermaroller treatment and clinical picture (B) and corresponding dermoscopic image (D) with increased of hair density after 6 mo

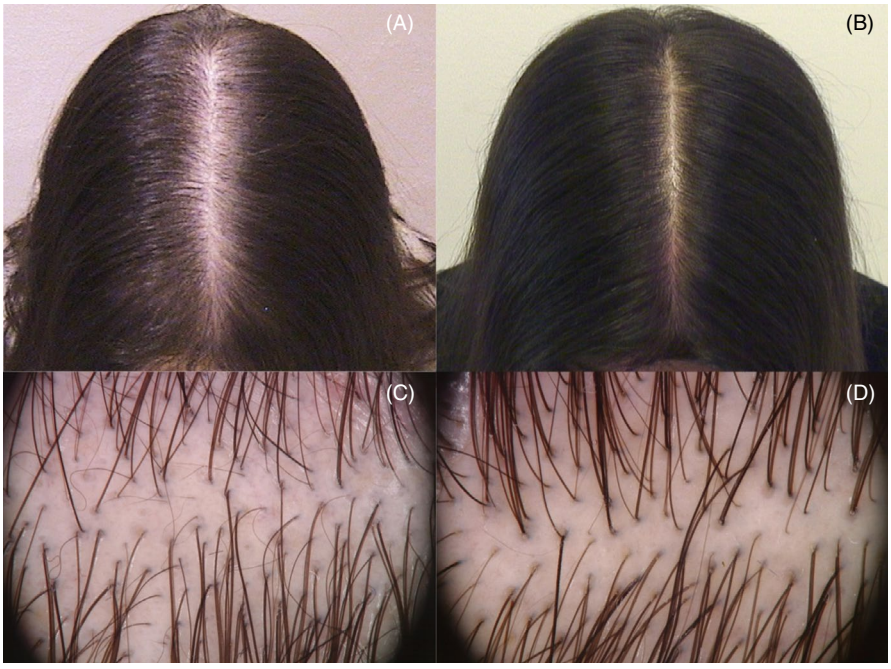

FIGURE 3 Androgenetic alopecia in a 28-y-old female. Clinical picture (A) and corresponding dermoscopic image (C) at baseline before dermaroller treatment and clinical picture (B) and corresponding dermoscopic image (D) with increased of hair density after 6 mo

patients. Transient pinpoint bleeding was observed during dermaroller treatment. A mild erythema occurred in the treated site, resolving within 24 hours, as well as the enlargement of the lateral cervical lymph nodes reported by eight patients. No erosion or breakage of hair shaft was noted on the affected areas.

After the 6 months treatment, all the patients reported a partial or complete reduction in hair loss, confirmed by a negative pull test, associated to the perception of a hair density improvement and a hair shaft diameter thickening.

Based on trichoscopical examination, all patients showed an increased frontal and vertex median density over time, respectively, of 36.64% and 35.10%, corresponding to a clinical visible improvement (Figure 2). The vellus relative change showed a decrease since the beginning of the procedure in both areas, −9.54% in the frontal area and −9.96% in the central area. The measurements of the medium hair diameter in frontal and vertex area showed important increase after 6 months, with a gain of 9.75% (from 0.057 to 0.062 mm) in the front and 9.08% (from 0.064 to

0.069 mm) at the vertex. This data were confirmed by clinical and trichoscopic improvement.

Specifically analyzing the data relating to the different groups, it emerged that hair density significantly improved in the seven patients with TE, with an increasing of 52.4% in the frontal area and of 51.97% at the vertex. However, even to a lesser extent, also the patients with AGA showed an appreciable increase in hair diameter, with percentages of increase equal to 25.16% at the frontal area and 17.45% at the vertex for males and to 32.35% at the frontal area and 35.88% at the vertex for females (Figure 3).

The number of vellus hair critically decreased in both sexes affected by AGA, as showed in Table 1. In patients affected by TE a minimum reduction in vellus hair in both areas was evident.

Male patients showed a major increase in hair diameter mostly in the vertex area (from 0.057 to 0.062 mm), commonly the most affected site by androgen hormones, while the frontal hair diameter mainly improved in female patients (from 0.051 to 0.054).

All patients judged the procedure effective and appreciated its cosmetic benefits. After the end of the study, all patients declared satisfaction with the results and their willingness to undergo such treatment again in case of need.

TABLE 1 Data of patients before (T0) and after the treatment (T6), regarding frontal and vertex density, frontal and vertex vellus density, frontal and vertex diameter

	T0	T6	T0-T6 difference (%)
Males with AGA			
Frontal density/cm^2	82.11	99.28	25.16
Vertex density/cm^2	80.43	91.99	17.45
Frontal vellus/cm^2	33.85	29.90	−13.16
Vertex vellus/cm^2	36.05	30.87	−15.38
Frontal mean diameter	0.056	0.057	3.63
Vertex mean diameter	0.057	0.062	11.80
Females with AGA			
Frontal density/cm^2	69.25	88.82	32.35
Vertex density/cm^2	65.04	85.93	35.88
Frontal vellus/cm^2	44.95	37.48	−13.24
Vertex vellus/cm^2	34.19	29.72	−8.66
Frontal mean diameter	0.051	0.054	9.54
Vertex mean diameter	0.058	0.060	5.29
Females with TE			
Frontal density/cm^2	70.20	107.03	52.40
Vertex density/cm^2	66.70	94.97	51.97
Frontal vellus/cm^2	32.36	24.14	−2.21
Vertex vellus/cm^2	21.61	19.73	−5.94
Frontal mean diameter	0.065	0.074	16.07
Vertex mean diameter	0.076	0.084	10.16
All patients			
Frontal density/cm^2	73.85	98.38	36.64
Vertex density/cm^2	70.72	90.96	35.10
Frontal vellus/cm^2	37.05	30.51	−9.54
Vertex vellus/cm^2	30.62	26.77	−9.96
Frontal mean diameter	0.057	0.062	9.75
Vertex mean diameter	0.064	0.069	9.08

4 | DISCUSSION

Microneedling works by increasing blood flow to hair follicle, stimulating the stem cells and inducing activation of growth factors by neovascularization and neocollagenesis. Moreover, this procedure creates multiple microchannels and increases transdermal penetration of drugs, bypassing the stratum corneum and achieving higher concentration directly in the vascularized dermis.[8,9]

Microneedling therapy is becoming popular in management of acne scars and for facial rejuvenations,[10] but it has recently been demonstrated to improve hair growth through stimulation of dermal papilla and stem cells and an increase in hair follicles blood supply. In addition, it has also been hypothesized that the microinjury produced by microneedling could help the recruiting growth factors, such as platelet-derived growth factor, epidermal growth factors, vascular endothelial growth factor, B catenin, Wnt3a, and Wnt10 b.[11-13] Kim et al[12] noted an earlier and faster hair regrowth with more shiny texture of the hair in microneedle-treated group than the untreated mice group. The authors also suggested that micro needle roller could be useful to treat hair loss refractory to minoxidil therapy. There are already several evidences that this technique may be effective in AGA, based on the results of a 12-week randomized, evaluator-blinded study published in 2013 on 100 patients with AGA.[13] These results were confirmed by more recent studies and reviews, suggesting the effectiveness of microneedling in combination with other established treatments of AGA and, in particular, with topical minoxidil.[14]

Our experience confirms an improvement after the use of microneedling in two different types of patients: those who want to have a quick response to therapy and those who had not obtained a satisfactory result with previous treatments. The results are confirmed by trichoscopy, a validate and objective method, which has shown how the typical androgenetic affected area, the vertex in males and the frontal area in females, are the ones that have the most of improvement with microneedling technique.

Moreover, our preliminary study underlines also a possible role of microneedling in TE, especially when cosmetic procedures do not give enough results or when patients do not feel comfortable with starting a local treatment with minoxidil solution for a long time. In fact, as seen in our case series, when hair shedding stops, the hair progressively regrows over time, resulting in a corresponding increase in hair density all over the scalp. Hence, this result, associated with the evidence of a negative pull test in follow-up visit, demonstrated a partial or complete resolution of the hair loss after the procedure. Finally, as shown by collected data, it is important to note that vellus relative change in TE patients is not significantly reduced

due to the fact that vellus hairs are not a characteristic sign of this disease, contrary to AGA.

5 | CONCLUSION

The pathogenesis of AGA is multifactorial and is still not clear and the efficacy of the conventional therapies is often unsatisfactory. During the last 10 years, many new innovations have been made and microneedling is a relatively new minimally invasive procedure involving superficial and controlled puncturing of the skin by rolling with miniature fine needles that demonstrated several proprieties in inducing hair regrowth.

Potentially, the dermaroller activates stem cells in the hair bulge area under wound-healing conditions, inducing a new hair cycle and resulting in growth of new hair[15] and facilitating penetration of first-line medications.[16] Over a short period of time, it has gained mass popularity and acceptance due to its simplicity, affordability, and safety, in addition to the minimal training needed.

The present case series confirms the role of microneedling procedure in increasing hair regrowth and hair diameter, even in patients that have obtained poor results with conventional therapy, and it possibly contributes to stoping hair shedding even in TE. The results of our experience show that microneedling is a safe and a promising tool in hair stimulation both for severe male and female AGA in patients who want a quick improvement and also in cases of hair loss refractory to local minoxidil or oral finasteride therapy. As microneedling targets multiple pathogenetic factors of AGA, we claim that this procedure should be offered to patients with AGA for new and faster hair follicle stimulation. Moreover, microneedling offers a simple and cost-effective therapeutic modality with minimal adverse effects and a promising safety profile.

However, the total number and frequency of sessions and long-term sustainability of the response to microneedling need to be evaluated within a larger population. In this sense, it is important to keep in mind that most comparative studies on microneedling have been only single case reports, case series, or small randomized controlled trials. Future large controlled clinical trials exploring the utility of microneedling are imperative to prove its validation as an evidence-based therapeutic option for patients with a variety of hair disorders, thus confirming its role as more than a cosmeceutical treatment.

Finally, this report underlines how TE can be added as another hair disease that can be treated with microneedling, inducing an evident arresting of the hair loss immediately from the first month after the procedure. It will be interesting also to observe whether this significant improvement will persist over time or deteriorate again once the treatments stop.

CONFLICT OF INTEREST

The authors do not have any conflict of interest to declare.

AUTHOR CONTRIBUTION

All authors contribute to design, data acquirement, study writing, editing.

ORCID

Nicolò Brandi https://orcid.org/0000-0003-0574-3455

REFERENCES

1. Sinclair RD. Disorders of hair. In: Burns T, Breathnach S, Cox N, Griffiths C, eds. *Rook's Textbook of Dermatology*. 8th ed. Vol. 4. UK: Blackwell Publishing Ltd; 2010:66.16-66.31.
2. Piraccini BM, Alessandrini A. Androgenetic alopecia. *G Ital Dermatol Venereol*. 2014;149(1):15-24.
3. Atanaskova Mesinkovska N, Bergfeld WF. Hair: what is new in diagnosis and management. Female pattern hair loss update: diagnosis and treatment. *Dermatol Clin*. 2013;31:119-127.
4. Kanti V, Messenger A, Dobos G, et al. Evidence-based (S3) guideline for the treatment of androgenetic alopecia in women and in men - short version. *J Eur Acad Dermatol Venereol*. 2018;32(1):11-22.
5. Arora S, Gupta PB. Automated microneedling device—a new tool in dermatologist's kit—a review. *J Pak Med Assoc*. 2012;22:354e7.
6. Singh A, Yadav S. Yadav microneedling: advances and widening horizons Indian. *Dermatol Online J*. 2016;7(4):244-254.
7. Iriarte C, Awosika O, Rengifo-Pardo M, Ehrlich A. Review of applications of microneedling in dermatology. *Clin Cosmet Investig Dermatol*. 2017;10:289-298.
8. Vedamurthy M. Mesotherapy. *Indian J Dermatol Venereol Leprol*. 2007;73:60-62.
9. Escobar-Chávez JJ, Bonilla-Martínez D, Angélica M, et al. Microneedles: A valuable physical enhancer to increase transdermal drug delivery. *J Clin Pharmacol*. 2011;51:964-977.
10. Hou A, Cohen B, Haimovic A, Elbuluk N. Microneedling: A Comprehensive Review. *Dermatol Surg* 2017; 43: 321-339.
11. Jeong K, Lee YJ, Kim JE, Park YM, Kim BJ, Kang H. Repeated microneedle stimulation induce the enhanced expression of hair-growth-related genes. *Int J Trichology*. 2012;4:117.
12. Kim BJ, Lim YY, Kim HM, et al. Hair follicle regeneration in mice after wounding by microneedle roller. *Int J Trichology*. 2012;4:117.
13. Dhurat R, Sukesh M, Avhad G, Dandale A, Pal A, Pund P. A randomized evaluator blinded study of effect of microneedling in androgenetic alopecia: a pilot study. *Int J Trichology*. 2013;5(1):6-11.
14. Fertig RM, Gamret AC, Cervantes J, Tosti A. Microneedling for the treatment of hair loss? *JEADV*. 2018;32:564-569.
15. Liebl H, Kloth LC. Skin cell proliferation stimulated by microneedles. *J Am Coll Clin Wound Spec*. 2012;4:2-6.
16. Jha AK, Udayan UK, Roy PK, Jha Amar AK, Chaudhary R. Platelet-rich plasma with microneedling in androgenetic alopecia along with dermoscopic pre- and post- treatment evaluation. *J Cosmet Dermatol*. 2018;17:313-318.

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