

## Original Research Article

# Does microneedling with 5% minoxidil offer added advantage for treatment of androgenetic alopecia in comparison to use of topical 5% minoxidil alone?

Karan Malhotra\*, Kallappa C. Herakal

Department of Dermatology, Venereology and Leprosy, Navodaya Medical College, Hospital and Research Centre, Raichur, Karnataka, India

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**\*Correspondence:**

Dr. Karan Malhotra,

E-mail: [dr.karan2015@gmail.com](mailto:dr.karan2015@gmail.com)

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### ABSTRACT

**Background:** Androgenetic alopecia is the most common cause of chronic hair loss. The FDA approved treatment for male androgenetic alopecia are Finasteride and Minoxidil. But many patients do not respond to these medications. Microneedling is a recent modality that releases several growth factors and enhances penetration of minoxidil, thereby promoting hair growth.

**Methods:** 60 patients, aged 21-40 years, with androgenetic alopecia were divided into 2 groups. In group A, patients were subjected to microneedling twice monthly, immediately followed by application of topical 5% minoxidil solution over the scalp and then 1 ml twice daily. In group B, patients were treated with application of 1ml of topical 5% minoxidil solution over the scalp twice daily. The results were evaluated based on patient's and physician's assessment based on the standardized 7-point evaluation scale.

**Results:** Patients in group A showed statistically significant improvement (p value<0.05) compared to group B. Headache and erythema were the most common side effects encountered in both the groups.

**Conclusions:** Microneedling with 5% minoxidil is a safe, simple and cost-effective modality and is a promising treatment option for patients with androgenetic alopecia. It showed much better results when compared to use of topical 5% minoxidil solution alone.

**Keywords:** Androgenetic alopecia, Male pattern baldness, Microneedling, Minoxidil

### INTRODUCTION

Androgenetic Alopecia (AGA) is a common cause of chronic hair loss. It affects both sexes. It affects up to 80% Caucasian men and 40% women. Its frequency increases with age, but it may start at puberty.<sup>1</sup>

Miniaturization of the hair follicle is the hallmark of androgenetic alopecia. It occurs between the late catagen or early anagen phase, affecting the dermal papilla and the dermal sheath, resulting in a smaller follicle and a reduced anagen phase.<sup>2</sup>

Topical minoxidil and oral finasteride are the only two currently approved drugs by the United States Food and Drug Administration for the treatment of AGA in men. Topical minoxidil 5% solution (1 mL) applied twice daily is effective in preventing progression and improving AGA in men.<sup>3</sup>

But majority of the patients show poor response to these drugs, hence the need arose to search for newer modalities of treatment. Microneedling is a new minimally invasive procedure where superficial and controlled puncturing of the skin is done by rolling with miniature fine needles. Micro

punctures are created using microneedles and they produce a controlled skin injury without damaging the epidermis. These microinjuries lead to minimal superficial bleeding and set up a wound healing cascade with release of various growth factors such as platelet derived growth factor (PGF), transforming growth factor alpha and beta (TGF- $\alpha$  and TGF- $\beta$ ), connective tissue growth factor, connective tissue activating protein and fibroblast growth factor (FGF).<sup>4</sup>

Microneedling also facilitates penetration of first-line medications (like minoxidil), and this is one mechanism by which it promotes hair growth.

**METHODS**

This prospective study was aimed at comparing the clinical efficacy of microneedling with 5% minoxidil versus topical minoxidil 5% alone for the treatment of AGA patients

**Inclusion criteria**

- The study included patients who agreed to participate in the study. Age matched patients between the age of 21 to 40 years with Stage III–IV Androgenetic alopecia according to Norwood-Hamilton grading scale, and those who did not taken any treatment in the past 1 year were enrolled in the study.

**Exclusion criteria**

- Patients with abnormal coagulation profile, with any dermatological disease over the scalp and those uncooperative and unwilling for the procedure were excluded.

60 age-matched male patients with AGA were randomly divided into two groups of 30 patients each. In the first group (A), patients were subjected micro needling twice monthly, immediately followed by application of topical 5% minoxidil solution over the scalp and then 1ml twice daily. Whereas in the second group (B), patients applied 1ml of topical 5% minoxidil solution over the scalp twice daily.

Patients who could come for regular follow-up were selected and included in the study. After taking the written and informed consent, patients were included in the study and procedure was started.

All participants were subjected to:

- Fitness assessment: Complete history taking and general examination.
- Local scalp examination for establishment of the diagnosis
- Grading of AGA was done using the Hamilton–Norwood classification of male pattern baldness in males.

- Photographic documentation and patient’s data were recorded prior to onset of treatment.

Scalp was cleansed with topical antiseptic. Then topical anesthesia was applied. Microneedling was done with derma roller with needle length 1.5 mm over affected areas in longitudinal, vertical, and diagonal directions until mild erythema was noted which was considered as the end point. This activation of scalp with microneedling was followed by application of 1 ml of 5% minoxidil on the affected site.

**Duration of study**

The procedure was repeated every 15 days for duration of 6 months.

The patients were followed up for 6 months to assess the sustainability.

Patients were assessed before starting the treatment and at the end of 6 months on the basis of:

Patient’s self-assessment based on standardized seven-point scale compared with baseline which is shown in Table 1. Physician’s assessment based on standardized seven-point scale of hair growth compared with baseline which is shown in Table 2.

**Table 1: Patient's assessment of improvement on 7-point scale.**

-3	Severe hair fall
-2	Moderate hair fall
-1	Mild hair fall
0	No change
+1	Mild Improvement
+2	Moderate Improvement
+3	Excellent Improvement

**Table 2: Physician's assessment of improvement on 7-point scale.**

-3	Severe worsening
-2	Moderate worsening
-1	Mild worsening
0	No change
+1	Mild Improvement
+2	Moderate Improvement
+3	Excellent Improvement

**Statistical analysis**

Calculated Mean, Standard Deviation, percentage, p value and Chi square value were analysed by using SPSS V 16.0 software.

**RESULTS**

In the current study, the two groups of patients were statistically matched regarding age (p=0.793), duration of hair fall (p=0.711), and disease severity (p=0.855).

56.7% (n=17) patients in Group A and 60% (n=18) patients in Group B were in age group 21-30 years whereas 43.3% (n=13) patients in Group A and 40% (n=12) patients in Group B were in age group 31-40 years. Average age in Group A and B were 28.6 and 29.2

years respectively, which were comparable, and difference was not statistically significant (p=0.793).

62% (n=31) patients had hair loss duration of 1-5 years. Maximum duration of hair loss was of 15 years, for three patients seeking advice. There was not much difference in duration of hair loss of the patients in both the groups.

In the study of total sixty male patients, 37 (61.7%) patients had Grade III alopecia, and 17 (28.3%) patients had Grade IV alopecia. Maximum patients were of Grade III alopecia (Table 3).

**Table 3: Comparison of clinico-demographic data of patients in both groups.**

	Parameter	Microneedling with 5% minoxidil (n=30)	5% minoxidil only (n=30)	Test of significance
Age (years)	21-30 years	17	18	$\chi^2=0.0686$ , p=0.793 Difference is statistically not significant
	31-40 years	13	12	
	Mean±sd	28.6±6.32	29.2±7.04	
Duration of hair fall (months)	< 12	7	5	$\chi^2=0.6825$ , p=0.711 Difference is statistically not significant
	12-60	14	17	
	>60	9	8	
	Mean±sd	28.36±16.85	33.7±19.18	
Severity of alopecia	Mild (grade ii)	3 (10%)	4 (13.3%)	$\chi^2=0.3128$ , p=0.855 Difference is statistically not significant
	Moderate (grade iii)	19 (63.3%)	17 (56.7%)	
	Severe (grade iv)	8 (26.7%)	9 (30%)	

**Table 4: Comparison of patients’ assessment at the end of 6 months between two Groups A and B using Chi-square test.**

Patients’ assessment at 6 months	Group A (n=30), n (%)	Group B (n=30), n (%)	p value	Chi-square value ( $\chi^2$ )
No change	4(13.3%)	11(36.7%)	0.037	8.455
Mild improvement	6(20%)	10 (33.3%)		
Moderate improvement	16 (53.3%)	7(23.3%)		
Excellent improvement	4 (13.3%)	2 (6.7%)		

**Table 5: Comparison of investigator assessment at the end of 6 months between two Groups A and B using Chi-square test.**

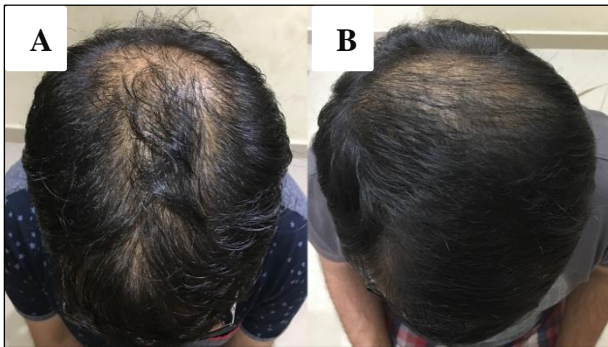
Physician’s assessment at 6 months	Group A (n=30), n (%)	Group B (n=30), n (%)	p value	Chi-square value ( $\chi^2$ )
No change	3 (10%)	9 (30%)	0.036	8.5105
Mild improvement	7 (23.3%)	12 (40%)		
Moderate improvement	15 (50%)	7 (23.3%)		
Excellent improvement	5 (16.7%)	2 (6.7%)		

As shown in Table 4, there is a statistically significant improvement (p<0.05) in patients’ assessment in Group A as compared to Group B at the end of 6 months. As shown in Table 5, there is a statistically significant improvement (p<0.05) in physician’s assessment in Group A as compared to Group B at the end of 6 months.

The results of group A are shown in Figures 1A-1B and the results of group B are shown in Figures 2A-2B which shows that there is significant improvement in group A patients when compared to group B patients. The side effects encountered in Group A and Group B are shown in Table 6.

**Table 6: Comparison of side effects encountered between group A and group B.**

Side effects	Microneedling with 5% minoxidil	5% minoxidil alone
Headache	4	3
Erythema	6	2
Discomfort over scalp	3	1
Contact dermatitis	1	1
Hypertrichosis	1	1



**Figure 1: A) Pre-treatment (group A), B) Post-treatment (group A).**



**Figure 2: A) Pre-treatment (group B), B) Post-treatment (group B).**

**DISCUSSION**

Hair loss causes a significant psychological distress and is often associated with low self-esteem and depression. Male-Pattern Hair Loss (MPHL) is a very common problem among majority of males. It may occur as early as puberty and increases with age.<sup>5</sup>

Hair cycle alteration, miniaturization of follicles, and inflammation are the key characteristic features of AGA. The duration of anagen phase decreases with each cycle, and the length of telogen remains constant or is prolonged in patients with AGA. The duration of anagen becomes so short that the growing hair does not achieve sufficient length to reach the surface of the skin, leaving an empty follicular pore.<sup>6</sup>

Minoxidil is a pyrimidine derivative which has a chemical structure 2,4-diamino-6-piperidinopyrimidine-3-oxide. The history on how it was introduced as a treatment for AGA is very interesting. Initially minoxidil was introduced in the early 1970's as an anti-hypertensive agent to treat hypertension. It is a direct-acting arteriolar vasodilator, which acts specifically to open the potassium-channels. Minoxidil exerts its effect after transforming into its active metabolite, minoxidil sulphate. The enzyme called sulfotransferase, which is found in the scalp, causes this conversion. Minoxidil converts to its sulphate form most likely at the lower outer root sheath.<sup>7</sup>

The exact mechanism of minoxidil stimulating the anagen phase and promoting hair growth is not fully known. In the late telogen phase of the hair follicle growth cycle, stem cells located in the bulge region differentiate and re-enter anagen phase, a period of growth lasting 2-6 years. Studies demonstrate that minoxidil increases the amount of intracellular Ca<sup>2+</sup>, which in turn up-regulates the enzyme adenosine triphosphate (ATP) synthase. A recent study demonstrated that ATP synthase promotes stem cell differentiation. Thus, minoxidil induced Ca<sup>2+</sup> influx increases stem cell differentiation and therefore plays a key role in the facilitation of hair growth.<sup>8</sup>

Microneedling is a minimally invasive dermatological procedure. Fine needles are rolled over the skin to puncture the stratum corneum. This therapy induces collagen formation, neovascularization and growth factor production of treated areas. It has been used in a wide range of dermatologic conditions, including Androgenetic Alopecia (AGA) and alopecia areata, among others.<sup>9</sup>

Mechanisms of hair re-growth induced by Microneedling include:<sup>10</sup>

- Increased release of platelet derived growth factor, epidermal growth factors by platelet activation and skin wound regeneration.
- The stem cells in the hair bulge area are activated under wound healing conditions.
- Overexpression of hair growth related genes, vascular endothelial growth factor, B catenin, Wnt3a, and Wnt10 b.

In this study, the side effects were slightly more among patients on microneedling with 5% minoxidil than on topical 5% minoxidil alone. Headache and erythema were the most common side effects encountered. NSAIDs were given for headache and erythema subsided gradually within 2-3 days.

**CONCLUSION**

Microneedling with 5% minoxidil is a safe, simple and cost-effective modality and is a promising treatment option for patients with androgenetic alopecia. In this

study, patients who underwent microneedling with 5% minoxidil showed better results than those treated with topical 5% minoxidil alone and the difference was found to be statistically significant. Patient satisfaction rate was high. Authors opine that Microneedling procedure should be offered to patients with AGA along with the existing therapeutic modalities like minoxidil for faster hair regrowth and better patient compliance.

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## REFERENCES

1. Gkini MA, Kouskoukis AE, Tripsianis G, Rigopoulos D, Kouskoukis K. Study of platelet-rich plasma injections in the treatment of androgenetic alopecia through an one-year period. *J Cutan Aesth Surg.* 2014 Oct;7(4):213-9.
2. Martinez-Jacobo L, Villarreal-Villarreal CD, Ortiz-López R, Ocampo-Candiani J, Rojas-Martínez A. Genetic and molecular aspects of androgenetic alopecia. *Ind J Dermatol Venereol Leprol.* 2018 May 1;84(3):263-8.
3. Kumar MK, Inamadar AC, Palit A. A randomized controlled, single-observer blinded study to determine the efficacy of topical minoxidil plus microneedling versus topical minoxidil alone in the treatment of androgenetic alopecia. *J Cutan Aesth Surg.* 2018 Oct;11(4):211.
4. Singh A, Yadav S. Microneedling: advances and widening horizons. *Ind Dermatol Onli J.* 2016 Jul;7(4):244-54.
5. Wirya CT, Wu W, Wu K. Classification of male-pattern hair loss. *Intern J Trichol.* 2017 Jul;9(3):95-100.
6. Tanaka Y, Aso T, Ono J, Hosoi R, Kaneko T. Androgenetic alopecia treatment in asian men. *J Clin Aesth Dermatol.* 2018 Jul;11(7):32-5.
7. Palanisamy T. Minoxidil to treat androgenetic alopecia in men and women: what is it & how does it work. *Am J Med Med Sci.* 2014;4(6):262-5.
8. Goren A, Naccarato T, Situm M, Kovacevic M, Lotti T, McCoy J. Mechanism of action of minoxidil in the treatment of androgenetic alopecia is likely mediated by mitochondrial adenosine triphosphate synthase-induced stem cell differentiation. *J Biolog Regul Homeo Age.* 2017;31(4):1049-53.
9. Fertig RM, Gamret AC, Cervantes J, Tosti A. Microneedling for the treatment of hair loss?. *J Eur Acad Dermatol Venereol.* 2018 Apr;32(4):564-9.
10. Dhurat R, Sukesh MS, Avhad G, Dandale A, Pal A, Pund P. A randomized evaluator blinded study of effect of microneedling in androgenetic alopecia: a pilot study. *Intern J Trichol.* 2013 Jan;5(1):6.

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