RESEARCH PAPER

Comparative Evaluation of Microneedling Technique with Vitamin C Application versus Scalpel Technique for Gingival Depigmentation: A Split Mouth Study

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Abstract

Introduction: Gingival esthetics plays a vital role in an attractive smile, with healthy, well contoured gingiva contributing significantly to overall appearance. Various factors, including genetic predisposition, environmental influences such as smoking, and systemic conditions, contribute to its occurrence. Gingival depigmentation procedures aim to reduce pigmentation and improve esthetics using surgical and non-surgical techniques. Among these, newer minimally invasive approaches like microneedling with vitamin C and conventional methods such as the scalpel technique have gained clinical importance for effective management. **Objectives:** To evaluate and compare the clinical outcomes of gingival depigmentation in the anterior esthetic zone using two techniques namely: Microneedling combined with topical application of Vitamin C and the scalpel technique. **Method**: 20 patients with melanin pigmentation, who met the inclusion and exclusion criteria of the study and aged 18 to 35 years, were selected for the study and divided into two groups. Group A involved Gingival depigmentation with microneedling technique with application of vitamin C in anterior esthetic zone (n- 20) and Group-B involved Gingival depigmentation with scalpel technique in anterior esthetic zone (n-20). Plaque index, Modified gingival index, Dummett index, Hedin index for group A and group B at baseline, 1 month,3 months and 6 months in both groups. Wound healing index, Visual analogue scale (Pain and Esthetic) for Group A and Group B at baseline,7days,1 month, 3 months and 6 months.**Results:** Mean, paired t test and unpaired t test calculated and analyzed that which was done at baseline, at 1 month, 3 months, 6 months. The p-value ($p \geq 0.05$) which was obtained showed that no statically significant was seen in both groups. During the follow up period, no side effects were seen for both the techniques, healing is better in Group B and repigmentation rate in more in group B at 6 months and Visual analogue scale (Pain) is less in group B. **Conclusion**: The result of this study indicated that both microneedling with vitamin C application and scalpel technique were efficient in depigmentation of the gingiva. Both the procedures did not result in any postoperative complication, and the healing was uneventful.

Keywords: Melanin; Pigmentation; Microneedling, Vitamin C, Scalpel technique

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Introduction

Gingival hyperpigmentation, characterized by darker-than-normal gingival coloration, is often

considered unaesthetic and may negatively affect patients, especially those with excessive gingival display. The most common cause of gingival pigmentation is melanin, produced by melanocytes in the basal layer of the epithelium. Pigmentation can be influenced by genetic factors, skin complexion, smoking, medications, endocrine disorders, heavy metal exposure, and certain pathological conditions.[1] It is most commonly observed in the anterior labial gingiva. Gingival depigmentation aims to reduce or eliminate excess melanin, improving smile esthetics. Various techniques are available, including surgical methods such as scalpel surgery, lasers, electrosurgery, and grafting procedures, as well as non-surgical approaches using depigmenting agents like vitamin C. Microneedling is a minimally invasive procedure that creates controlled micro-injuries in the gingiva, enhancing wound healing, collagen production, and the absorption of topical agents.[2] Vitamin C (ascorbic acid) acts as an antioxidant and inhibits tyrosinase activity, thereby reducing melanin synthesis. The scalpel technique remains a widely used and cost-effective method for gingival depigmentation, involving the removal of pigmented epithelium and superficial connective tissue, followed by healing with the formation of new, less-pigmented tissue.[3]

Aim: The aim of this study is to clinically evaluate and compare the effect of microneedling technique with application of vitamin C vs scalpel technique for gingival depigmentation. **Objectives:**

1.To evaluate and compare following ancillary parameters at baseline, 1 month, 3 months and 6 months in depigmentation with microneedling technique with application of vitamin C group and depigmentation with scalpel technique group.

● Plaque Index (Turesky- Gilmore- Glickman modification of the Quigley- Hein plaque index) ● Modified Gingival Index (Lobene et al, 1986)

2.To evaluate and compare following clinical parameters at baseline, 1 month, 3 months and 6 months in depigmentation with microneedling technique with application of Vitamin C group and depigmentation with scalpel technique group.

● Dumett Pigmentation Index

● Hedin Pigmentation Index

3. To evaluate and compare following clinical parameters at 7 days, 1 month, 3 months and 6 months in depigmentation with microneedling technique with application of Vitamin C group and depigmentation with scalpel technique group.

● Visual Analogue Scale (Esthetic and Pain)

● Wound Healing Index (Huang et al 2005)

Material and Method

This was a comparative, prospective, split mouth, randomized clinical study of the management of melanin pigmented gingiva using microneedling with vitamin C in one quadrant and scalpel technique in another quadrant. Twenty subjects having complain of “black gums” (melanin hyperpigmentation) were examined under inclusion and exclusion criteria and were selected for the study. Subjects who agreed to participate in the study and gave consent in front of witness, were asked to sign (thumb impression in the case of illiterate subject) the written consent form along with the signature of the witness.

Inclusion Criteria:

♣ Systemically healthy patients. ♣ Patients aged between 18 to 35 years of age. ♣ Patients with melanin hyperpigmentation.♣ Patients with clinically healthy gingiva. ♣ Patients were willing to give the informed consent and willing to comply with the study were selected.

Exclusion Criteria:

♣ Systemic conditions known to cause oral pigmentation. ♣ Subjects who had underwent periodontal therapy within last 6 month. ♣ Pregnant women and lactating mothers. ♣ Medically compromised patients. ♣ Tobacco consumption in any form. ♣ Subjects who had oral mucosal lesions. ♣ Chemicals or Drugs with potential to cause oral pigmentation.

Group-A: Gingival depigmentation with microneedling technique with application of vitamin C in anterior esthetic zone

Group-B: Gingival depigmentation with scalpel technique in anterior esthetic zone. [Control Group]

Surgical Procedure :

Initial therapy including oral hygiene instructions, scaling and root planing was performed for both the groups. Following evaluation, the surgical sites were randomly divided into two groups. For depigmentation, in group A, after administration of local anaesthesia (2% lignocaine with adrenaline 1:80,000 solution), the pigmented gingival epithelium from one side of anterior aesthetic zone was receiving microneedling using Dermapen with needles of 1.5 mm depth. After ensuring the observation of the bleeding points on all affected gingiva, topical AA powder (1000 mg/ml) mixed with saline was applied to the gingival mucosa for 10 minutes. The treated area was left without dressing. For depigmentation, in group B, after administration of infiltration anesthesia (2% lignocaine with adrenaline 1:80,000 solution), Bard Parker handle with No. 15 surgical blade was used to extirpate the gingival epithelium of pigmented area extending from other side of anterior esthetic zone. The epithelium was completely removed extending from marginal gingiva to mucogingival junction, placing the blade approximately parallel to long axis of teeth. The exposed connective tissue surface was carefully examined and any residual tissue tags excised using surgical scissors. A saline pressure pack applied to control the bleeding. After hemostasis was attained the periodontal dressing applied over wound for a week.

Post operative instructions:
The patients were instructed to refrain from drinking acidic or hot beverages for 24 hours and not brush for one day to avoid any mechanical trauma to the gingiva. It was not necessary to prescribe mouthwash. Analgesics prescribed as per patients need.

Results
A comparative, randomized prospective study was conducted to evaluate and compare the management of melanin pigmented gingiva. The study included twenty subjects with melanin hyperpigmentation having age group of 18-35 years.
Plaque index, Gingival index, Dummett index for melanin hyperpigmentation, Visual analogue scale and Patient comfort score was done at baseline ,1 month, 2 months and 3 months, 6 months.

Table 1: Intergroup comparison of Plaque Index (PI).

Parameter	Duration	N	Group A		Group B		P value
			Mean	SD	Mean	SD	
Plaque index	Baseline	20	2.5	0.513	2.5	0.513	0.165**
	1 month	20	1.05	0.224	0.95	0.224	0.165**
	3 months	20	0.35	0.489	0.45	0.489	0.531**
	6 months	20	0.35	0.489	0.45	0.489	0.531**

Level of Significance: ≤ 0.05, Statistically Significant *, Statistically Non -Significant **
Statistically, No significant difference in Plaque index score was seen between both the groups at baseline, 3 weeks and at 6 weeks (p≥ 0.05**).

Table 2: Intergroup comparison of Gingival Index (GI)

		N	Group A		Group B		
Parameter	Duration		Mean	SD	Mean	SD	P value
Gingival Index	Baseline	20	2.25	0.639	2.25	0.639	1.000**
	1 month	20	1.25	0.444	1.30	0.470	0.731**
	3 months	20	0.35	0.489	0.45	0.510	0.531**
	6 months	20	0.35	0.489	0.45	0.510	0.531**

Level of Significance: ≤ 0.05, Statistically Significant *, Statistically Non -Significant **
Statistically, No significant difference in Gingival index score was seen between both the groups at baseline, 1 month, 3 months and at 6 months (p≥ 0.05**)

Table 3: Intergroup comparison of Dummett Pigmentation.

Parameter	Duration	N	Group A		Group B		P value
			Mean	SD	Mean	SD	
Dummet Pigme	Baseline	20	2.45	0.510	2.45	0.510	1.00**

Case No : 2

ntation	1 month	20	0.00	0.000[a]	0.00	0.000[a]	1.000**
	3 months	20	0.00	0.000[a]	0.00	0.000[a]	1.000**
	6 months	20	0.25	0.444	0.10	0.308	0.223**

Level of Significance: ≤ 0.05, Statistically Significant *, Statistically Non -Significant **
Statistically, No significant difference in Dummet Pigmentation was seen between both the groups at baseline, 1 month, 3 months and at 6 months (p≥ 0.05**).

Table 4: Intergroup comparison of Hedin Pigmentation.

Parameter	Duration	N	Group A		Group B		P value
			Mean	SD	Mean	SD	
Hedin Pigmentation	Baseline	20	3.05	0.686	3.05	0.686	1.000**
	1 month	20	0.00	0.000[a]	0.00	0.000[a]	1.000**
	3 months	20	0.00	0.000[a]	0.00	0.000[a]	1.000**
	6 months	20	0.25	0.550	0.15	0.366	0.503**

Statistically, No significant difference in Hedin Pigmentation was seen between both the groups at baseline, 1 month, 3 months and at 6 months (p≥ 0.05**).

Table 5: Intergroup comparison of Wound healing.

Parameter	Duration		Mean	SD	Mean	SD	P value
Wound Healing	7 Days	20	1.35	0.489	2.00	0.000	0.001*
	1 month	20	1.10	0.308	1.10	0.308	1.000**
	3 months	20	1.00	0.000	1.00	0.000	1.000**
	6 months	20	1.00	0.000	1.00	0.000	1.000**

Level of Significance: ≤ 0.05, Statistically Significant *, Statistically Non -Significant **
Statistically, significant difference in Wound healing was seen between the groups at 7 Days (p≤ 0.05*).
Statistically, No significant difference in Wound healing was seen between the groups at 7 Days, 1 month, 3 months and 6 months (p> 0.05**).

Table 6: Intergroup comparison of Visual Analogue Scale (VAS) (Pain).

Parameter	Duration	N	Group A		Group B		P value
			Mean	SD	Mean	SD	
VAS	7 Days	20	5.00	0.444	4.00	0.444	0.001*
	1 month	20	0.00	0.605	0.00	0.605	1.000**
	3 months	20	0.00	0.605	0.00	0.605	1.000**
	6 months	20	0.00	0.605	0.00	0.605	1.000**

Independent t-test applied, Level of Significance: ≤ 0.05, Statistically Significant *, Statistically Non - Significant **

Statistically, significant difference in Visual Analogue Scale (VAS) (Pain) was seen between the groups at 7 Days (p≤ 0.05*). No significant difference in Visual Analogue Scale (VAS) (Esthetic) was seen between the groups at 1 month, 3 months and 6 months respectively (p> 0.05**).

Table 7: Intergroup comparison of Visual Analogue Scale (VAS) (Esthetic).

Parameter	Duration	N	Group A		Group B		P value
			Mean	SD	Mean	SD	
VAS	7 Days	20	7.50	0.444	8.05	0.444	0.001*
	1 month	20	8.50	0.605	9.50	0.605	0.001*
	3 months	20	8.50	0.605	8.50	0.605	1.00**
	6 months	20	8.05	0.605	7.50	0.605	0.001*

Independent t-test applied, Level of Significance: ≤ 0.05, Statistically Significant *, Statistically Non - Significant **

Statistically, significant difference in Visual Analogue Scale (VAS) (Esthetic) was seen between the groups at 7 Days, 1 month & 6 months (p≤ 0.05*). No significant difference in Visual Analogue Scale (VAS) (Esthetic) was seen between the groups at 3 months (p> 0.05**).

Discussion

The present study compared microneedling with vitamin C and the conventional scalpel technique for gingival depigmentation. Both techniques demonstrated significant improvement in plaque control, gingival health, pigmentation scores, wound healing, pain, and esthetic outcomes.

No significant differences were observed between the groups with respect to plaque index and gingival index. Similar findings were reported by **Biswas et al., Alasmari et al., Lin YH et al., and Patil KP et al.**, suggesting that depigmentation procedures do not significantly affect periodontal health when adequate oral hygiene is maintained.[4]

102 Both groups showed complete depigmentation at 1 and 3 months, followed by slight repigmentation at 6 months. These observations are in agreement with **Chandrashekhar et al.** and **Suragimath et al.**, who reported comparable pigmentation reduction among different depigmentation techniques. Repigmentation observed at 6 months may be explained by the melanocyte migration theory.[5] Microneedling with vitamin C demonstrated better early wound healing and lower postoperative pain. Similar findings have been reported by **Desmond Fernandes**, **Kolimi et al.**, and **Ghezzi and Donghi**, who attributed these advantages to reduced tissue trauma and enhanced collagen formation.[6,7]

Regarding esthetic outcomes, Group A showed superior early esthetic satisfaction, whereas Group B demonstrated better long-term stability. Similar trends have been reported by **Riachi et al.** [8]

Overall, both techniques proved to be effective and predictable for gingival depigmentation. Microneedling with vitamin C offered improved early healing and patient comfort, whereas the scalpel technique provided slightly better long-term esthetic outcomes. Further studies with larger sample sizes and longer follow-up periods are recommended to validate these findings.

Conclusion

he present randomized prospective study compared microneedling with vitamin C and the conventional scalpel technique for the management of gingival melanin pigmentation. Twenty patients were evaluated over a period of 6 months using clinical parameters including plaque index, modified gingival index, pigmentation indices, wound healing, pain, and esthetic scores.

Both treatment modalities demonstrated significant improvement in clinical parameters with no statistically significant intergroup differences. Microneedling with vitamin C was associated with reduced postoperative discomfort and improved patient comfort, whereas the scalpel technique provided satisfactory wound healing and better long-term esthetic outcomes. Mild repigmentation was observed in a few cases after 6 months.

Within the limitations of the present study, both techniques proved to be safe and effective methods for gingival depigmentation. However, studies with larger sample sizes and longer follow-up periods along with histopathological evaluation are recommended to assess the long-term stability of treatment outcomes.

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