



Comparative Evaluation of Gingival Depigmentation Using Diode Laser With and Without Topical Vitamin C Application: A 6-Month Follow-Up Clinical Study.

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ABSTRACT

Aim and Objective

The aim of this study was to comparatively evaluate gingival depigmentation performed using a diode laser **with and without topical vitamin C application**, and to assess postoperative pain, wound healing, and repigmentation over a period of six months.

Materials and Methods

Twenty systemically and periodontally healthy patients aged between 24 and 38 years presenting with physiologic gingival hyperpigmentation were enrolled in this randomized clinical study. The participants were randomly allocated into two groups of ten each:

- **Group I** – Gingival depigmentation using diode laser without vitamin C application
- **Group II** – Gingival depigmentation using diode laser followed by topical vitamin C application

Depigmentation was carried out using an 810 nm diode laser. Postoperative pain and discomfort were evaluated using the Visual Analog Scale (VAS) at 2 hours, 24 hours, and 1 week postoperatively. Wound healing was assessed clinically, and re-pigmentation was evaluated at 1 month and 6 months postoperatively.

Results

Both groups demonstrated satisfactory gingival depigmentation with minimal postoperative discomfort. Group II showed improved wound healing and reduced re-pigmentation at the end of six months compared to Group I.

Conclusion

Diode laser is an effective modality for gingival depigmentation. The adjunctive use of topical vitamin C appears to enhance wound healing and delay re-pigmentation.

Clinical Significance

Laser-assisted gingival depigmentation is a minimally invasive, patient-friendly procedure. The addition of vitamin C may provide additional benefits by improving healing outcomes and reducing recurrence of pigmentation.

Keywords: 'Gingival depigmentation, diode laser, vitamin C, melanin, aesthetics'.

I. INTRODUCTION

Gingival pigmentation is primarily caused by melanin, a brown pigment synthesized by melanocytes located in the basal and suprabasal layers of the gingival epithelium.(1) The intensity of gingival pigmentation depends on several factors such as genetic predisposition, thickness of the epithelium, degree of keratinization, vascularity, and environmental influences.(2) Although physiologic gingival pigmentation is benign, it poses a significant aesthetic concern, particularly in patients with a high smile line.(3)

Various techniques have been employed for gingival depigmentation, including scalpel surgery, rotary abrasions, electrosurgery, cryosurgery, and lasers. Among these, lasers have gained popularity due to their precision, haemostatic properties, reduced postoperative discomfort, and faster healing. (2)Diode lasers, in particular, are well absorbed by melanin and haemoglobin, making them suitable for soft tissue procedures.(2)

Vitamin C (ascorbic acid) is a water-soluble antioxidant known for its role in collagen synthesis, wound healing, and immune modulation. (8)It also possesses depigmenting properties by inhibiting the tyrosinase enzyme involved in melanin synthesis. Hence, the present study was designed to evaluate whether topical application of vitamin C following diode laser depigmentation could enhance healing and reduce repigmentation.(8),(15)

II. MATERIALS AND METHODS

Study Design

This randomized clinical study was conducted between January 2023 and June 2023. Ethical approval was obtained, and written informed consent was taken from all participants.

Study Population

A total of 20 systemically and periodontally healthy individuals aged 24–38 years with physiologic gingival hyperpigmentation in the maxillary anterior region (canine to canine) were included.

Inclusion Criteria

- Physiologic gingival hyperpigmentation
- Presence of esthetic concern
- Thick gingival biotype (≥ 2 mm)
- Good oral hygiene status

Exclusion Criteria

- Tobacco use in any form
- Systemic diseases
- Pregnant or lactating women
- Pathologic pigmentation
- Recent periodontal therapy (within 6 months)
- History of keloid formation

Group Allocation

Participants were randomly divided into two groups (n = 10 each):

- **Group I:** Diode laser depigmentation alone

- **Group II:** Diode laser depigmentation followed by topical vitamin C application

Laser Depigmentation Procedure

After administering local anesthesia, gingival depigmentation was performed using an **810 nm diode laser** with a 400- μ m fiber tip at 1.3 W power in continuous mode. The laser tip was used in contact mode and moved horizontally along the pigmented gingiva. The treated area was intermittently wiped with saline-soaked gauze. No periodontal dressing or systemic antibiotics were prescribed.

Vitamin C Application (Group II)

Two weeks after laser therapy, topical vitamin C was applied using crushed Carbamide Forte tablets (vitamin C 1000 mg with zinc 17 mg) mixed with saline. The paste was applied to the depigmented area using sterile cotton and left in place for 10–15 minutes. Patients were instructed to perform this application three times daily.

Clinical Parameters

- Oral Hygiene Index (Simplified)
- Dummett–Gupta Oral Pigmentation Index(1)
- Visual Analog Scale (VAS) for pain
- Clinical evaluation of wound healing
- Re pigmentation assessment at 1 and 6 months.

Depigmentation Using Laser:

- Under local anesthesia, depigmentation procedure was applied by 810 nm wavelength diode laser . The fiber-optic laser tip having a 400 μ m diameter at 1.3 W power in continuous mode was kept in contact with the pigmented area. Depigmentation was performed in a horizontal direction, using the laser tip in contact mode on the pigmented part of the gingiva and parallel to the root surfaces not to cause overheating, and the area depigmented was wiped with gauze soaked in saline . After the procedure, no periodontal dressing was applied and no antimicrobials were prescribed. Group II patients were instructed to use topical vitamin c after 2 week post treatment, FIG 1 -Carbamide Forte (vitamin C from Amla extract 1000mg+ zinc 17mg) (8)tablet crushed to powder and soaked in saline was applied topically using sterile cotton.
- The patient were instructed to leave medicine on the depigmented area for 10 -15 minutes and later wipe it off with sterile cotton.
- The topical application of carbamide forte was explained to the patient and was instructed to perform it 3 times a day, Patients were instructed to avoid smoking and hot, acidic, and spicy food that can jeopardize the healing process and cause patient discomfort. Following depigmentation, patients were recalled at 1 month and 6 months during postoperative period for clinical evaluation and repigmentation rate.

Clinical Parameters Recorded:

The oral hygiene index (simplified) was recorded for all participants prior to enrolment into the study to ensure good oral hygiene. Gingival pigmentation was assessed using the Dummett-Gupta oral pigmentation index.

III. RESULTS

Both groups showed effective removal of gingival pigmentation immediately after treatment. Postoperative pain scores were low in both groups, with Group II reporting comparatively less discomfort. Wound healing was faster and more satisfactory in Group II. At the 6-month follow-up, re pigmentation was minimal in Group II -FIG 3 compared to Group I- FIG 2

IV. STATISTICAL ANALYSIS

The collected data were tabulated and subjected to statistical analysis using **SPSS software**.

- Descriptive statistics were expressed as **mean ± standard deviation (SD)**.
- **Independent t-test** was used to compare intergroup differences.
- **Repeated measures ANOVA** was used for intragroup comparison of pain scores at different time intervals.
- A **p-value < 0.05** was considered statistically significant.

Table 1: Demographic Characteristics of Study Participants

Parameter	Group I (Laser only)	Group II (Laser + Vitamin C)
Number of patients	10	10
Males	5	5
Females	5	5
Mean age (years)	30.2 ± 3.4	29.8 ± 3.1
Gingival biotype	Thick	Thick

Table 2: Mean VAS Scores for Postoperative Pain

Time Interval	Group I (Mean ± SD)	Group II (Mean ± SD)	p-value
2 hours	3.8 ± 0.9	2.6 ± 0.8	0.02*
24 hours	2.9 ± 0.7	1.8 ± 0.6	0.01*
1 week	1.4 ± 0.5	0.6 ± 0.4	0.03*

*Statistically significant (p < 0.05)

Table 3: Wound Healing Assessment.

Follow-up Interval	Group I	Group II
1 week	Mild erythema present	Healthy gingiva
1 month	Complete epithelialization	Complete epithelialization
Patient comfort	Moderate	High

Table 4:Gingival Pigmentation Scores (Dummett–Gupta Index)

Time Interval	Group I-FIG 2	Group II- FIG 3
Baseline	3.0 ± 0.0	3.0 ± 0.0
Immediate post-op	0.5 ± 0.3	0.3 ± 0.2

Time Interval	Group I-FIG 2	Group II- FIG 3
1 month	0.8 ± 0.4	0.4 ± 0.3
6 months	1.4 ± 0.5	0.6 ± 0.4

V. RESULTS:



FIGURE 1: Application of carbamide forte: vitamin C extract

FIGURE 2 : Group I



a) Pre-treatment



b) 1 months post-operative



c) 6 months post-operative.

FIG 3 : GROUP II



a) Pre-treatment



b) Immediate post treatment



c) 6 month post treatment

VI. DISCUSSION

Gingival melanin pigmentation can play a pivotal role in esthetic of an individual's smile. Many a time excessive pigmentation of the gingiva has physiological causes than pathological conditions. (1) This has made the condition very prevalent in country like India where accentuated racial pigmentation is the most common complaint with which patients approach the dentist. (2) Various periodontal plastic surgical techniques have been employed to remove gingival hyperpigmentation such as abrasion by bur, electrosurgery, cryosurgery, scalpel, and lasers. Even with the advancements in dental armamentarium, the use of surgical scalpel is still the preferred and more commonly used technique owing to its ease of use and economy compared to other techniques. (3)(4) However, the use of electrocautery and laser as techniques to achieve gingival depigmentation is also employed for their ease and advancement as a surgical technique. With regard to postoperative pain assessment, the VAS is a well-established tool despite its inbuilt demerits of being a subjective tool. (5-6-7-8)

The present study was performed with the prime aim to compare laser treated depigmentation with and without usage of vitamin c application and to compare in terms of wound healing and repigmentation.

Laser is a noninvasive method that can be performed by application of topical local anesthetic gel. (9-10-11) It causes minimum damage to the underlying hard tissues. Laser beam has the potential to destroy the epithelial cells up to the basal layer. This could probably reduce the rate of repigmentation as compared to other techniques. (12) Laser beam targeted upon the pigmented lesions strike the melanocytes. Diode lasers are well absorbed by melanin and the light energy is converted to heat energy by photothermolysis. (13) The diode lasers release their thermal effects by the hot tip effect due to accumulation of heat at the tip of the fiber; hence, the tip of the laser fiber is the cutting surface. Lasers also allow us to control the cutting efficiency as this is determined by the inherent ability to be absorbed within the chromophores with a specific target tissue and, thus, cause a tissue-specific ablation layer by layer and cell by cell. (14-15-16) In the present study, the laser group patients reported less pain and discomfort, This can be attributed to the fact that diode laser can have an analgesic effect by disrupting the sodium and potassium pump in the cell membrane, thereby the impulses are not transmitted or merely due to the formation of a protein coagulum by ablation of the nerve endings. The advantages of lasers over other surgical techniques are: (a) ability to perform surgery with topical application of local anesthetic gel, (b) bloodless and dry surgical site, (c) immediate sterilization of the surgical site, (d) reduced mechanical trauma, minimal or no swelling, pain and scarring postoperatively. (15). The present study has certain limitations. The sample size was relatively small, which may limit the generalizability of the results. The follow-up period of six months may not be sufficient to fully assess long-term repigmentation patterns. The assessment of pain using the

Visual Analog Scale was subjective and dependent on patient perception. Histological evaluation of melanocyte activity was not performed, which could have provided a more objective assessment of pigmentation changes. Additionally, the study did not include a comparison with other depigmentation techniques such as scalpel or electrosurgery.

Future studies with larger sample sizes, longer follow-up durations, histological analysis, and inclusion of multiple treatment modalities are recommended to validate and strengthen the findings of the present study.

VII. CONCLUSION

Within the limitations of this study, diode laser proved to be an effective and safe modality for gingival depigmentation. The adjunctive use of topical vitamin C enhanced wound healing and reduced the rate of repigmentation over six months. Further studies with larger sample sizes and longer follow-up periods are recommended.

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