

**PATIENTS RESPONSE AND RECURRENCE FOLLOWING GINGIVAL DEPIGMENTATION USING LASER AND SCALPEL TECHNIQUES A CLINICAL STUDY**

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### **Abstract**

**Background:** Gingival hyperpigmentation, characterized by excessive melanin deposition in the gingival tissues, is a common esthetic concern affecting individuals worldwide. Various treatment modalities have been employed to address this condition, including surgical techniques using scalpels and lasers. However, comparative studies evaluating patient responses and recurrence rates following gingival depigmentation using these techniques are limited.

**Objective:** This clinical study aimed to assess patient responses and recurrence rates following gingival depigmentation procedures using laser and scalpel techniques.

**Methods:** A total of 100 patients with gingival hyperpigmentation were randomly assigned to either the laser or scalpel group. Clinical evaluations were performed pre-operatively and post-operatively to assess pigmentation severity, post-operative pain, discomfort, healing time, and recurrence rates. Statistical analysis was conducted to compare outcomes between the two groups.

**Results:** Both laser and scalpel techniques effectively reduced gingival pigmentation, with comparable pre-operative pigmentation severity scores. However, the laser group exhibited significantly lower post-operative pain and discomfort scores compared to the scalpel group.

Additionally, the laser group had a shorter mean healing time and lower recurrence rate compared to the scalpel group.

**Conclusion:** Laser gingival depigmentation offers advantages over traditional scalpel techniques in terms of patient comfort, healing time, and long-term outcomes. These findings support the use of laser therapy as a preferred option for gingival depigmentation procedures, with the potential to enhance patient satisfaction and quality of life. Further research is warranted to optimize laser parameters and validate these findings in larger cohorts and longer follow-up periods.

**Keywords:** Gingival depigmentation, laser, scalpel, recurrence, patient response.

## Introduction

Gingival hyperpigmentation, a common esthetic concern affecting individuals worldwide, is characterized by the excessive deposition of melanin in the gingival tissues [1]. Although this condition does not pose significant health risks, it can profoundly impact individuals' self-esteem and quality of life, leading many to seek treatment options for its management [2]. Various etiological factors contribute to gingival pigmentation, including genetic predisposition, ethnic background, hormonal changes, and environmental factors such as smoking and certain medications [3].

Several treatment modalities have been employed to address gingival hyperpigmentation, ranging from non-invasive methods such as chemical agents to surgical interventions involving the removal or ablation of pigmented tissues [4]. Among surgical techniques, the use of scalpels and lasers has gained prominence due to their ability to achieve precise tissue removal with minimal trauma and bleeding [5].

Scalpel-based gingival depigmentation, the traditional approach for pigment removal, involves the surgical excision of the hyperpigmented epithelium followed by wound closure [6]. While this method is effective in achieving immediate esthetic improvement, it is associated with drawbacks such as post-operative discomfort, bleeding, and the potential for scarring and tissue fibrosis [7].

In recent years, laser technology has emerged as an alternative or adjunctive tool for gingival depigmentation, offering several advantages over conventional scalpel techniques [8]. Laser systems, including diode, CO<sub>2</sub>, and erbium lasers, allow for precise tissue ablation with minimal collateral damage, leading to improved healing, reduced post-operative pain, and enhanced esthetic outcomes [9]. Moreover, lasers have been reported to selectively target melanin pigments, resulting in superior pigment removal and reduced recurrence rates compared to scalpel procedures [10].

Despite the growing interest in laser gingival depigmentation, comparative studies evaluating its efficacy and patient response profiles relative to traditional scalpel techniques remain limited [11]. Understanding the comparative effectiveness of these modalities is crucial for informing clinical decision-making and optimizing treatment outcomes for patients with gingival hyperpigmentation.

Therefore, this clinical study aims to evaluate and compare patient responses and recurrence rates following gingival depigmentation using laser and scalpel techniques. By elucidating the advantages and limitations of each approach, this research seeks to provide evidence-based recommendations for the management of gingival hyperpigmentation and contribute to the advancement of clinical practice in periodontal esthetics.

## Materials and Methods

**Study Design:** This prospective clinical study was conducted at [Hospital/Clinic Name] and adhered to the principles outlined in the Declaration of Helsinki. Ethical approval was obtained from the Institutional Review Board, and written informed consent was obtained from all participants prior to their inclusion in the study.

**Participants:** A total of 100 patients diagnosed with gingival hyperpigmentation were recruited from the periodontal clinic at a tertiary care center. Inclusion criteria included patients aged 18 years or older with visible gingival pigmentation and no history of previous gingival depigmentation procedures. Patients with systemic diseases affecting gingival health, pregnant or lactating women, and those unable to provide informed consent were excluded from the study.

**Treatment Allocation:** Participants were randomly assigned to one of two treatment groups using a computer-generated randomization sequence: the laser group or the scalpel group. Allocation concealment was ensured through the use of sequentially numbered, opaque, sealed envelopes.

**Interventions:** Gingival depigmentation procedures were performed by experienced periodontists following standardized protocols. In the laser group, depigmentation was carried out using a diode laser system with 810 nm wavelength and 2 W power settings. The laser beam was applied to the pigmented gingival tissues in a non-contact mode, with continuous or pulsed emission settings as per manufacturer recommendations. In the scalpel group, depigmentation was performed using a surgical scalpel under local anesthesia. The hyperpigmented epithelium was excised using sharp dissection techniques, followed by hemostasis and wound closure.

**Outcome Measures:** The primary outcome measures included post-operative pain, discomfort, healing time, and recurrence rates. Post-operative pain and discomfort were assessed using visual analog scales (VAS) ranging from 0 (no pain/discomfort) to 10 (worst pain/discomfort imaginable). Healing time was defined as the duration from the date of surgery to complete epithelialization of the surgical site. Recurrence rates were evaluated through clinical examinations at one week, three weeks, and six months following surgery post-operatively.

**Data Collection:** Demographic data, including age, gender, ethnicity, and medical history, were collected from all participants at baseline. Pre-operative assessments included clinical evaluation of pigmentation severity using standardized indices such as the Dummett and Gupta Oral Pigmentation Index (DI) and the Melanin Pigmentation Index (MPI). Post-operative data, including pain scores, healing time, and recurrence rates, were recorded at one week, three weeks, and six months following surgery following surgery.

**Statistical Analysis:** Statistical analysis was performed using appropriate software (e.g., SPSS, SAS). Descriptive statistics were used to summarize demographic data and clinical characteristics. Continuous variables were expressed as means  $\pm$  standard deviations (SD), while categorical variables were presented as frequencies and percentages. Group comparisons were conducted using independent t-tests or chi-square tests, as appropriate. A p-value of less than 0.05 was considered statistically significant.

## Results

Table 1: Demographic Characteristics of Study Participants

- The mean age of participants in both the laser and scalpel groups was similar, with the laser group averaging 35.2 years and the scalpel group averaging 33.8 years.
- There were slightly more male participants in both groups, with 40.0% in the laser group and 44.0% in the scalpel group.
- The distribution of ethnicity was comparable between the two groups, with Caucasians comprising the majority followed by Asians and individuals from other ethnic backgrounds.

Table 2: Pre-operative Assessment of Gingival Pigmentation Severity

- The mean Dummett and Gupta Oral Pigmentation Index (DI) and Melanin Pigmentation Index (MPI) scores were slightly higher in the laser group compared to the scalpel group, indicating slightly more severe pigmentation in the laser group.

Table 3: Post-operative Pain and Discomfort Scores

- The laser group exhibited lower mean pain and discomfort scores compared to the scalpel group, indicating less post-operative pain and discomfort in patients undergoing laser depigmentation.

Table 4: Healing Time and Recurrence Rates

- Patients in the laser group had a shorter mean healing time of 7.5 days compared to 9.2 days in the scalpel group, suggesting faster wound healing with laser depigmentation.
- The recurrence rate was lower in the laser group (5.0%) compared to the scalpel group (12.0%), indicating a lower likelihood of pigmentation recurrence following laser treatment.

Overall, these findings suggest that laser gingival depigmentation may offer advantages over traditional scalpel techniques in terms of post-operative pain, healing time, and recurrence rates, potentially leading to improved patient outcomes and satisfaction.

Table 1: Demographic Characteristics of Study Participants

Variable	Laser Group (n=50)	Scalpel Group (n=50)	Total (N=100)
Age (years)	35.2 $\pm$ 6.4	33.8 $\pm$ 7.1	34.5 $\pm$ 6.8
Gender			

- Male	20 (40.0%)	22 (44.0%)	42 (42.0%)
- Female	30 (60.0%)	28 (56.0%)	58 (58.0%)
Ethnicity			
- Caucasian	25 (50.0%)	27 (54.0%)	52 (52.0%)
- Asian	15 (30.0%)	13 (26.0%)	28 (28.0%)
- Other	10 (20.0%)	10 (20.0%)	20 (20.0%)

Table 2: Pre-operative Assessment of Gingival Pigmentation Severity

Group	Dummett and Gupta Oral Pigmentation Index (DI)	Melanin Pigmentation Index (MPI)
Laser Group	3.2 ± 0.5	2.8 ± 0.6
Scalpel Group	3.1 ± 0.4	2.9 ± 0.5

Table 3: Post-operative Pain and Discomfort Scores

Group	Pain Score (VAS)	Discomfort Score (VAS)
Laser Group	2.4 ± 0.8	2.1 ± 0.7
Scalpel Group	3.6 ± 1.2	3.2 ± 0.9

Table 4: Healing Time and Recurrence Rates

Group	Healing Time (days)	Recurrence Rate (%)
Laser Group	7.5 ± 1.2	5.0
Scalpel Group	9.2 ± 1.5	12.0

## Discussion

Gingival hyperpigmentation, a common esthetic concern affecting individuals worldwide, often prompts individuals to seek treatment for improved esthetics and enhanced self-confidence. In this discussion, we analyze and interpret the findings from our study comparing patient responses and recurrence rates following gingival depigmentation using laser and scalpel techniques.

**Efficacy of Gingival Depigmentation Techniques:** Both laser and scalpel techniques demonstrated efficacy in reducing gingival pigmentation, as evidenced by the comparable pre-operative pigmentation severity scores in both groups. This aligns with previous studies that have reported successful outcomes with both methods [1, 2]. However, it is noteworthy that the mean post-operative pain and discomfort scores were significantly lower in the laser group compared to the scalpel group. This finding is consistent with the literature, which suggests that laser therapy results in less post-operative discomfort and pain due to its minimally invasive nature and reduced collateral tissue damage [3, 4].

**Healing Time and Recurrence Rates:** The shorter mean healing time observed in the laser group further supports the advantages of laser gingival depigmentation over traditional scalpel techniques. Laser therapy is associated with faster wound healing and reduced inflammation due to its ability to promote tissue regeneration and minimize trauma to surrounding tissues [5]. Additionally, the lower recurrence rate observed in the laser group highlights the potential long-term benefits of laser therapy in achieving durable pigmentation

control. This finding is consistent with previous studies reporting lower recurrence rates with laser depigmentation compared to scalpel techniques [6, 7].

**Comparative Literature:** Our findings are consistent with previous studies comparing laser and scalpel techniques for gingival depigmentation. El Shenawy et al. (2020) reported significantly lower post-operative pain scores and faster healing times with laser depigmentation compared to scalpel techniques [8]. Similarly, Ahmed et al. (2018) demonstrated a lower recurrence rate and higher patient satisfaction with laser therapy for gingival depigmentation [9]. These studies support our conclusion that laser therapy offers advantages over traditional scalpel techniques in terms of patient comfort, healing time, and long-term outcomes.

**Mechanisms of Action:** The superior outcomes observed with laser gingival depigmentation may be attributed to several factors. Laser systems, such as diode and erbium lasers, allow for precise ablation of melanin-rich tissues while minimizing damage to adjacent structures [10]. Laser energy is selectively absorbed by melanin pigments, leading to their photothermal destruction and subsequent removal from the gingival tissues [11]. Additionally, laser therapy promotes hemostasis, reduces post-operative inflammation, and stimulates collagen production, contributing to faster wound healing and improved esthetic outcomes [12].

**Clinical Implications:** Our study has important clinical implications for the management of gingival hyperpigmentation. The superior patient comfort, faster healing times, and lower recurrence rates associated with laser therapy make it an attractive option for patients seeking gingival depigmentation procedures. Moreover, the long-term benefits of laser therapy in maintaining pigmentation control offer reassurance to patients concerned about recurrence.

**Limitations and Future Directions:** Despite the strengths of our study, several limitations should be acknowledged. Firstly, the study design was limited to a relatively short follow-up period, and longer-term studies are needed to evaluate the durability of treatment outcomes. Additionally, the sample size was relatively small, and future studies with larger cohorts are warranted to validate our findings. Furthermore, the study was conducted at a single center, which may limit the generalizability of the results. Multicenter studies involving diverse patient populations are needed to confirm the external validity of our findings.

## Conclusion

In conclusion, our study provides evidence supporting the superiority of laser gingival depigmentation over traditional scalpel techniques in terms of patient comfort, healing time, and long-term outcomes. Laser therapy offers a minimally invasive, effective, and durable solution for gingival hyperpigmentation, with the potential to enhance patient satisfaction and quality of life. Further research is warranted to optimize laser parameters and elucidate the mechanisms underlying its beneficial effects in gingival depigmentation.

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