



Gingival Melanin Pigmentation by Surgical Scalpel and Diode Laser - A Comparative Clinical Study

Sridevi Shetty KS* and Eric Mario Shailander A

Department of Periodontology and Implantology, Rajiv Gandhi University of Health Sciences, India

*Corresponding Author: Sridevi Shetty KS, Department of Periodontology and Implantology, Rajiv Gandhi University of Health Sciences, India.

Received: July 25, 2022

Published: August 18, 2022

© All rights are reserved by Sridevi Shetty KS and Eric Mario Shailander A.

Abstract

Aims and Objectives: The purpose of the present study was to evaluate and compare the effectiveness, extent of repigmentation of the gingiva, time taken for the procedure, subject's response and preferences after surgical scalpel and diode laser as a treatment of gingival hyperpigmentation.

Materials and Methods: A randomized controlled clinical study with 17 periodontally healthy subjects, having esthetic complaints of excessive gingival melanin pigmentation on maxillary and mandibular labial gingiva was included. The maxillary and mandibular anterior regions were treated alternatively by surgical scalpel technique or Diode laser irradiation. Clinical measurements like plaque index, gingival bleeding index, DOPI and gingival shade guide assessment were evaluated at baseline (at the day of surgery), 3 months and 6 months after surgery. All subjects answered a VAS questionnaire (pain, bleeding, swelling of mucosa and mean number of analgesics taken post-operatively) at each day following surgery till one week, to evaluate post-operative symptoms as well as subject's preference.

Statistical analysis was performed by using Descriptive statistics, Wilcoxon signed-rank test and Fisher exact test.

Results: The plaque index and gingival bleeding index at 3 and 6 months showed gradual rise but was not of statistical significance. The DOPI score at the end of 6 months showed no difference in the repigmentation and thus no statistically significant variation was found in both the study groups. The gingival shade guide score also recorded repigmentation at the end of 6 month with lesser intensity of pigmentation in the control group and this was statistically significant when compared to the test group.

It was also noted that there was no difference in the VAS score which was recorded in relation to post-operative pain, swelling, bleeding and number of analgesics taken in both the treatment groups. However, subjects preferred Diode laser as a treatment option when compared to surgical scalpel, as the intra-operative time taken for the treatment procedure was less which was statistically significant.

Conclusion: Therefore, both the techniques evaluated are an effective treatment option for the management of gingival hyperpigmentation. Thus, the option of treatment technique is entirely practitioner's prerogative.

Keywords: Gingival Depigmentation; Diode Laser; Surgical Scalpel; Pigmentation; Esthetics; Smile

Introduction

Esthetics is the knowledge of exquisiteness that is focused on the detailing of an animate or an inanimate entity. Dental esthet-

ics is integral to facial esthetics and its demand has significantly increased over the years. Dental esthetics has a tremendous psychological impact on the well-being of the patient besides being

critical in improving function in certain scenarios. This increases self-confidence and appeal [1].

Similar to teeth, gingival health and appearance are also a crucial component of a beautiful smile [2]. Gingival hyperpigmentation may be physiological or pathological and can present in varying colors and shades. However, it is observed that pink gingiva is most preferred and favored in comparison to brown, bluish-black, or mixed colorations [3].

The color of the attached and marginal gingiva is determined by the number and the size of the underlying blood vessels, overlying epithelial thickness, quantity of keratinization, and the pigments present within the epithelium.⁴ Over the years, many techniques have been used to remove the gingival melanin pigmentation including chemical ablations, abrasions with diamond burs, surgical excision by gingivectomies, soft tissue autografts, partial-thickness flaps, cryosurgeries, and laser ablations. However, variable results and uncertain outcomes continue to drive the search for a technique that can guarantee the expected results [4,5].

The successful and effective use of the conventional surgical blade for gingival depigmentation has resulted in excellent clinical outcomes through the test of time.⁵ Some of the disadvantages and inadequacies of using the surgical blade has spawned a keen interest in the use of lasers for gingival depigmentation.

Lasers have gained popularity in multiple specialties. The unique ability of lasers to provide a bleeding-free working field gives them a superior advantage. Numerous lasers, including Nd:YAG (neodymium-yttrium-aluminum-garnet), Diode, Carbon dioxide, Argon, and Ruby lasers, have been tried for gingival depigmentation [6].

In this study, we compare the clinical efficacy of diode laser irradiation and excision with the surgical blade for gingival melanin depigmentation. We also assessed the perceptions and preferences of the patients towards both the treatment procedures.

Aims and Objectives

- To compare the clinical outcome between surgical blade and diode laser in the management of gingival melanin pigmentation.

- To evaluate patients comfort and preference following these two procedures using a Visual Analog Scale (VAS) Questionnaire.
- To evaluate and compare the time taken for the completion of the surgical procedure.

Materials and Methods

A randomized, single-blind, case-control study with 15 patients having esthetic complaints of gingival melanin pigmentation from the Oxford Dental College, Bangalore were recruited from the study. The maxillary and mandibular anterior regions were treated alternatively by surgical scalpel (blade no 15) technique or diode laser irradiation. The entire study was completed within a span of one year including the follow up.

Inclusion criteria

- Age group between ≥ 18 -50 years
- Systemically healthy subjects
- Subjects without periodontitis
- Subjects having bi-maxillary melanin pigmentation in the anterior regions will be evaluated as either moderate or heavy clinical pigmentation according to the criteria given by Dummett Co.
- Patients with high and medium lip lines

Exclusion criteria

- Smokers
- Low lip line
- Thin gingival biotype
- Pregnant and lactating women
- Medically compromised patients

Comprehensive medical and dental history was recorded. Supra and subgingival scaling was done and further periodontal evaluation was performed 2 weeks after Phase I therapy for site selection for the depigmentation procedure.

Clinical measurements like Plaque Index, Gingival Bleeding Index, Dummett - Gupta Oral Pigmentation Index (DOPI) were evaluated at baseline (at the day of surgery before the procedure), 3 months, and 6 months after the procedure. Clinical pre- and post-operative photographs were taken using white spot contrast. Assessment of re-pigmentation was done using the gingival shade guide. It was carried out by a blinded examiner at 3 and 6 months during the follow-up period in natural light.

The maxillary and mandibular anterior regions were treated alternatively with surgical scalpel or by diode laser irradiation. The extent of the maxillary surgical site was determined by the extent of the patient's smile window, and the mandibular surgical site extended to the distal papillae of the canines on both sides. The two procedures were spaced 7-10 days apart.

In our study, Gallium-Aluminum-Arsenide (Ga-Al-As) diode laser device with a wavelength of 810 nm at 1.5 to 1.75-Watt power was used.

The time taken and the VAS [7] score were recorded to evaluate post-operative symptoms.

Statistical analysis was carried out and described in the form descriptive and non-descriptive statistics (Fisher exact and Wilcoxon signed rank test) with SPSS 15.0, Stata 10.1, MedCalc 9.0.1, Systat 12.0 and R environment ver.2.11.1 software.

Results

All 15 patients completed the study and had undergone gingival depigmentation using laser (Group 1) and scalpel (Group 2). The mean age of the patients was 23.53 ± 2.58 years, and 26.7% were male and 73.3% were female.

Time taken for the depigmentation procedure using the laser (997 seconds) was lesser than the time taken with the scalpel (6412 seconds) and was statistically significant ($p = 0.001$).

Gingival pigmentation was recorded using DOPI. At baseline, the maximum score recorded was 3 and the minimum score was 1 (range, 2.45 ± 0.6). DOPI recorded at 3 months was similar with respect to both test and control groups (range, 0.07 ± 0.25 ; $p = 1.000$), whereas test scores at 6 months were slightly higher than the control group (0.53 ± 0.5 vs. 0.2 ± 0.41). However, they were not statistically significant ($p > 0.05$).

Additionally, a customized gingival shade guide was used to assess the gingival pigmentation. The baseline recording was higher in both the laser and control groups (range, 2.1 ± 0.83). At 3 months, both test and control groups showed minimal to no signs of re-pigmentation (8.4 ± 0.9 vs. 8.8 ± 0.63 ; $p > 0.05$). However, at 6 months, the control sites showed less re-pigmentation when compared to the laser group ($p < 0.05$). The results were found to be statistically significant.

As far as the comparative evaluation of Mean VAS score of subjects were concerned, there were no statistically suggestive differences between both the groups with respect to pain and the mean number of analgesics taken. No post-operative bleeding and swelling in the mucosa was recorded for both the groups.

Discussion

Intraoral esthetics forms an integral aspect of dentistry with both, the hard tissue and the soft tissue, playing equally important roles. The demand for cosmetic correction is more common in fair individuals, especially with a high smile line (also known as the gummy smile) [8]. Although the pigmentation is harmless, it is the esthetic concern which brings the individual to the dentist.

In our study, most patients were women (73.3%), with a mean age of 23.53 years. It was observed that younger women were more esthetically conscious than younger men. This was in accordance with the study which surveyed the attitudes of different groups of subjects towards dental aesthetics [9].

We observed in our study that the duration of the laser depigmentation procedure (997 seconds) was significantly lesser in comparison to the depigmentation procedure using a surgical scalpel (6412 seconds). Azzeh M and Robert M Pick, from their studies, also observed minimal surgical time with lasers than with the conventional scalpel technique [10-12]. Unpleasant bleeding during, and after, the surgery has always been a downside to the conventional scalpel technique [6,13,14].

However, it was reported that the healing period following depigmentation with a scalpel was shorter than that following treatment with a diode laser. This may be due to the presence of coagulated and charred tissue with the latter [11,15,16]. In contrast, in the present study, no difference in the healing period was observed among the two techniques.

Another advantage of the scalpel over the laser was the surgeon's control over the depth and extent of the incision and the lack of any untoward effects on the underlying bone and periosteum. The estimated depth of diode laser penetration varies between 0.5-3.0 mm [11,15,16]. However, there are insufficient clinical and histological studies to support these claims and therefore, the control on the depth of penetration still remains elusive [11,15,16].

The diode laser causes ablation or disintegration of biological materials by photochemical-, thermal-, or plasma-mediated mechanisms. Thermal ablation occurs when the energy delivered by the laser interacts with irradiated material by an absorption process causing a rise in temperature at the site. As the temperature rises at the surgical site, the soft tissues are subject to heating (37-60°C), protein denaturation, coagulation (> 60°C), welding (70-90°C), vaporization (100-150°C), and carbonization (> 200°C). The rapid rises in intracellular temperature and pressure leads to cellular rupture with release of vapor and cellular debris, termed as laser plume [10]. In our study, we had 3 patients who complained of an unpleasant/revolting, offensive odor while cutting the tissues with the laser.

The patient comfort with the techniques was evaluated and compared using the mean VAS score of subjects and found that there were no differences between the groups with regards to pain, mucosal swelling, and the mean number of analgesics taken.

The treated sites were observed periodically for signs of re-pigmentation, which begins with the "migration" of the melanocytes from the adjacent free gingiva on to the surgical site. It also depends on the tyrosinase enzyme activity of the melanocytes [17,18].

According to the Migration Theory, active melanocytes from adjacent pigmented tissues migrate to treated areas causing re-pigmentation. Perlmutter and Tal described re-pigmentation after 7-8 years. 40,85 Similarly, a study by Oswald, *et al.* (1993) showed that gingival surgical procedures performed solely for cosmetic reasons offer no permanent results. Recurrence of gingival pigmentation has been documented to occur anytime between 24 days and 8 years following surgery. Re-pigmentation can also be partially accredited to the epidermal melanocyte unit [17,18].

To prevent rapid recurrence of gingival pigmentation, the gingival tissues should be cleared of melanin entirely, including the free gingiva, interdental papillae, and the margins of the treated ar-

reas. It may be difficult to treat the papillary and marginal gingival tissues with complete accuracy without damage, especially with a laser [17,18].

In this study, the re-pigmentation was assessed in terms of change in DOPI. Clinical photographs were taken with a white dot contrast on the depigmented sites and using a gingival shade guide from baseline, 3, and 6 months post-operatively by a blinded examiner.

Further, due to the reduced intra-operative time and ease, greater compliance was observed among patients. Hence, most of the patients were content to get depigmentation done using a diode laser in case of re-pigmentation.

A steady fall in the area of pigmentation from baseline to 6 months in both the treatment groups was recorded in our study, which is in agreement with studies done by TMS Ginwalla, BC Gomes, and BRR Verma (1966), Tal H and Kozlovsky A (1987), Ozbayrak S., *et al.* (2000), Esen E., *et al.* (2004), Stuart Coleton., *et al.* (2004), Tal H., *et al.* (2003), Rosa D., *et al.* (2007), and Azzeh MM (2007) [11,19-24].

The re-pigmentation appeared in the form of small diffuse patches in the interdental areas and on the attached gingiva. Both treatment groups showed re-pigmentation at the end of 6 months. However, 1 of 15 subjects showed re-pigmentation at the end of 3 months in the laser group in the form of distinct patches on the interdental papilla and attached gingiva.

The pigmentation that appeared in any form was too less compared to the pre-treatment pigmentation in density, extent, and distribution. Therefore, this did not pose any esthetic concerns. The intensity may increase with time and reach pre-treatment levels as melanocytes are a reproductive, self-maintaining system of cells. Thus, when depleted, they repopulate keratinocyte-derived growth factor, fibroblast growth factor- β (FGF- β), evolve as mitogens. Thus the depigmentation procedure is not permanent. This was in agreement with Perlmutter and Tal's study (1986) and Kon's Electron Microscopic study which demonstrated that permanent results cannot be obtained when depigmentation procedures are performed [17,25].

In this study, DOPI results of the two groups were not statistically significant even though re-pigmentation was more in the laser

site than in the control site, as evident in the clinical photographs. However, due to a wider range of scoring and greater sensitivity to the intensity of re-pigmentation, outcomes measured with the Gingival Shade Guide were better in the control sites.

Over the years many techniques like gingivectomy, free gingival autografts, electrosurgery, cryosurgery, the use of chemical agents such as 90% phenol, and 95% alcohol, abrasion with a diamond bur, and surgical stripping have been tried to reduce or eliminate gingival hyperpigmentation. Limited control over depth, latent heat production, tissue damage, patient discomfort, and improper color-match has driven the quest for newer techniques like lasers [14,18,26-28].

Lasers have gained popularity in various fields, but challenges like having an uncontrolled depth of action, being expensive, and being very technique-sensitive, have restricted their use. The scalpel, on the other hand, has been popular among the surgeons for a very long time [11,12,15,16].

In our study we had followed all set protocols to ensure standardization and elimination of any flaws which may directly or indirectly hamper the treatment outcome and the prognosis. However, any unknown circumstances arising from the patients neglect to follow the same cannot be overruled. All 15 patients were followed up with at regular time intervals to ensure adherence to protocol.

A small sample size is one of the limitations of our study. Studies with larger sample sizes are warranted to draw more conclusive evidence about the best technique to be used for gingival depigmentation procedure to congregate our findings.

Grade	Color	Description
I	Pink gingiva	No clinical pigmentation
II	Mild light brown color	Mild clinical pigmentation
III	Medium brown or mixed pink and brown	Moderate clinical pigmentation
IV	Deep brown or bluish black	Heavy clinical pigmentation

Table 1: Dummett-Gupta Oral Pigmentation Index (DOPI): (Dummett 1971).

DOPI	N		Mean	Median	Std. Deviation	Minimum	Maximum
	Valid	Missing					
Group 1 Baseline	15	0	2.47	3.0	0.6	1	3
3months	15	0	0.07	0.0	0.2	0	1
6months	15	0	0.53	1.0	0.5	0	1
Group 2 Baseline	15	0	2.47	2.0	0.5	2	3
3months	15	0	0.07	0.0	0.2	0	1
6months	15	0	0.20	0.0	0.4	0	1

Table 2

Duration of the procedure (seconds)	N	Mean	Median	Std. Deviation	Minimum	Maximum
Group 1	15	588.3	512.0	156.59	392.0	997.0
Group 2	15	2217.06	1652.0	1359.46	1220.0	6412.0

Table 3: Comparative evaluation of Time duration in seconds in two study groups.

Pain (Each day of the week)	Groups (No. of subjects)		
	1	2	
Day 1	0	5	1
	1	8	14
	2	2	0
	3	0	0
Day 2	0	10	11
	1	5	4
	2	0	0
	3	0	0
Day 3	0	13	15
	1	2	0
	2	0	0
	3	0	0
Day 4	0	15	15
Day 5	0	15	15
Day 6	0	15	15
Day 7	0	15	15

Table 4: Comparative evaluation of Mean VAS score of Pain studied in two study groups.

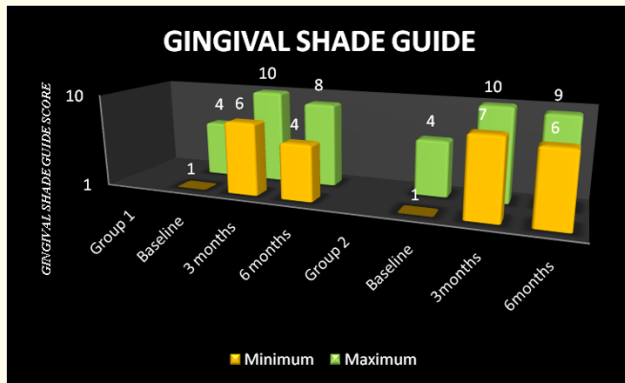


Figure 1: Comparative evaluation of Gingival Shade Guide in two study groups.



Figure 2

Conclusion

Lasers are highly preferred for over the surgical scalpel because of the clean surgical field, which can significantly impact surgical outcomes. However, here we found that the surgical scalpel technique showed reduced density of re-pigmentation in comparison to the diode laser.

Lasers are an integral part of the surgeon’s arsenal in the current era, having with its own set of advantages and disadvantages. The surgeon’s expertise and experience are the best determinant to choose the appropriate technique for each procedure. Hence, we would suggest that the choice of use of the laser and the surgical scalpel be left to the discretion of the treating surgeon.

Bibliography

1. Hessam Nowzari. “Esthetic periodontal therapy”. *Periodontology 2000* 27 (2002): 7.
2. Kanakamedala AK., et al. “Management of Gingival Hyperpigmentation by the Surgical Scalpel Technique- Report of Three Cases”. *Journal of Clinical and Diagnostic Research* 4 (2010): 2341-2346.
3. Dummett CO., et al. “Attitudes towards normal pigmentation of the oral mucosa”. *Quintessence International* 10 (1981): 115-1122.
4. Kaur H., et al. “Duration of reappearance of gingival melanin pigmentation after surgical removal- A clinical study”. *Journal of Indian Society of Periodontology* 14.2 (2010): 101-105.
5. Lagdive S., et al. “Management of gingival hyperpigmentation using surgical blade and diode laser therapy: A comparative study”. *The Journal of Oral Laser Applications* 9 (2009): 41-47.
6. Stabholz A., et al. “The use of lasers in dentistry: Principles of operation and clinical applications”. *Compendium of Continuing Education in Dentistry* 24 (2003): 935-948.
7. Hagenaaers S., et al. “Soft tissue wound healing following periodontal surgery and EMDOGAIN application”. *Journal of Clinical Periodontology* 31 (2004): 850-856.
8. Dummett CO., et al. “The relationship of facial skin complexion to oral mucosa pigmentation and tooth color”. *Journal of Prosthetic Dentistry* 43 (1980): 392-396.
9. Vallittu PK., et al. “Dental aesthetics- A survey of attitudes in different groups of patients”. *Journal of Dentistry* 24.5 (1996): 335-338.
10. Shah S., et al. “Management of gingival hyperpigmentation using surgical blade and diode laser therapy: A case report”. *Advances in Human Biology* 2.3 (2012): 30-34.

11. Azzeh MM. "Treatment of gingival hyperpigmentation by Erbium-Doped: Yttrium, Aluminium, and Garnet laser for esthetic purposes". *Journal of Periodontology* 78.1 (2007): 177-184.
12. Pick RM and Colvard MD. "Current Status of Lasers in Soft Tissue Dental Surgery". *Journal of Periodontology* 64.7 (1993): 589-602.
13. Thangavelu A., et al. "Pink esthetics in periodontics - Gingival depigmentation: A case series". *Journal of Pharmacy and Biomedical Sciences* 4.2 (2012): 186-190.
14. Gupta G. "Management of gingival hyperpigmentation by semiconductor diode laser". *Journal of Cutaneous and Aesthetic Surgery* 4.3 (2011): 208-210.
15. Hale GM and Query MR. "Optical constants of water in the 200nm to 200µm wavelength region". *Applied Optics* 12 (1973): 555-563.
16. Baxter GD. "Therapeutic Lasers: Theory and practice". New York: Churchill Livingstone (1994): 80.
17. Perlmutter S and Tal H. "Repigmentation of the gingiva following surgical injury". *Journal of Periodontology* 57.1 (1986): 48-50.
18. Shah SS. "Surgical esthetic correction for gingival pigmentation". *Journal of Interdisciplinary Dentistry* 2.3 (2012): 195-200.
19. Ozbayrak S., et al. "The treatment of melanin pigmented gingival and oral mucosa with CO2 laser". *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology* 90.1 (2000): 14-15.
20. Ginwalla TM., et al. "Surgical removal of gingival pigmentation: A preliminary study". *Journal of Indian Dental Association* 38 (1966): 147-150.
21. Tal H., et al. "Cryosurgical depigmentation of the gingival. A case report". *Journal of Clinical Periodontology* 14 (1987): 614-617.
22. Coletan S. "Lasers in surgical Periodontics and Oral Medicine". *Dental Clinics of North America* 48 (2004): 937-962.
23. Esen E., et al. "Gingival melanin pigmentation and its treatment with the CO₂ laser". *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology* 98.5 (2004): 522-527.
24. Tal H., et al. "Gingival depigmentation by Erbium: YAG laser: Clinical observation and patient responses". *Journal of Periodontology* 74 (2003): 1660-1667.
25. Bergamaschi O., et al. "Melanin repigmentation after gingivectomy: A 5 year clinical and transmission electron microscopic study in humans". *International Journal of Periodontics and Restorative Dentistry* 13 (1993): 85-92.
26. Prasad D., et al. "Treatment of gingival pigmentation: A case series". *Indian Journal of Dental Research* 16 (2005): 171-176.
27. Atsawasuan P., et al. "Treatment of gingival hyperpigmentation for esthetic purposes by Nd: YAG laser: Report of 4 cases". *Journal of Periodontology* 71 (2000): 315-321.
28. Janam P., et al. "Gingival depigmentation by laser: A case series". *Journal of Indian Society of Periodontology* 4 (2010): 5-7.

Volume 6 Issue 9 September 2022

© All rights are reserved by Sridevi Shetty KS and Eric Mario Shailander A.