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ORIGINAL ARTICLE

Comparison of Diode Laser and Scalpel Techniques in the Treatment of Gingival Melanin Hyperpigmentation

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ABSTRACT

Introduction: Although clinical melanin pigmentation does not present itself as a medical problem or a disease entity, "black gums" is a major esthetic complaint for many people, who often request cosmetic corrections. Depigmentation of melanin hyperpigmented gingiva can be carried out using many procedures, of which lasers are a new addition. This study was undertaken to evaluate and compare the effectiveness of conventional scalpel scraping and diode laser for the treatment of gingival melanin hyperpigmentation.

Materials and methods: A total of 14 patients in the age group between 15 and 30 years were selected for a randomized split mouth depigmentation procedure using scalpel scraping (group I) and diode laser (group II). Parameters evaluated were recurrence of pigmentation using Dummett index 1964, and plaque index and gingival index at 1 week, and 1, 3, and 6 months. Mann–Whitney U test was used to analyze statistical significance between different variables.

Results: There was no statistical significance in plaque and gingival index in both the groups. At 6 months in group I, repigmentation was seen in 10 patients and in group II, repigmentation was seen in 8 patients.

Conclusion: Although both treatment modalities are highly effective depigmentation procedures, giving excellent esthetics results, scalpel remains the gold standard because of its convenience and cost-effectiveness. However, by adhering to safety measures, the diode laser can also be used to remove gingival pigmentation efficiently.

Keywords: Gingival depigmentation, Laser, Scalpel.

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INTRODUCTION

A smile can reflect self-confidence and kindness. It is an expression of the feelings of joy and harmony. A beautiful smile is not only determined by the color, position, and shape of the teeth, but also by gingival tissues.[1] Color of the gingiva depends on the number and size of blood vessels, epithelial thickness, quantity of keratinization, and pigments within epithelium like melanin, carotene, reduced hemoglobin, and oxyhemoglobin. Melanin is derived from the Greek word "melas," which means black. It is produced in the basal and suprabasal layers of the epithelium by the melanocytes and is an endogenous pigment. Melanin is the most common natural pigment contributing to the color of the gums.[2]

This pigmentation may be seen across all the races[3] and at any age[4] and is without gender predilection.[5] Gingival melanin hyperpigmentation is neither a medical problem nor a disease entity, but black gums is a common complaint and patients frequently request for cosmetic correction. Different treatment modalities, which have been reported, include bur abrasion, scraping, partial thickness flap, cryotherapy, electrosurgery, gingivectomy, gingivectomy with free gingival autografting, chemical agents, such as 90% phenol and 95% alcohol, and use of lasers.[6] Scalpel surgery for depigmentation is a time-tested technique and remains the gold standard.[7]

Lasers have been used in dentistry since the beginning of the 1980s. Recently, lasers have become the treatment of choice as they improve hemostasis and causes less postoperative discomfort compared with scalpel surgery. Different lasers, such as carbon dioxide (CO_2) laser, neodymium-doped yttrium aluminum garnet (Nd:YAG) laser, argon laser, diode laser, erbium-doped YAG (Er:YAG) laser, and erbium, chromium-doped yttrium, scandium, gallium, and garnet laser have been used for depigmentation. Among all lasers, diode laser has gained increasing importance and interest as it has energy and wavelength characteristics that specifically target the soft tissues. Also, it has affinity for hemoglobin and melanin and, therefore, is more efficient and better equipped to address soft tissue problems.[8] Semiconductor diode laser has been used for gingivectomy, frenectomy, incisional and excisional biopsy, and depigmentation procedures.[9]

In order to find a better approach for gingival depigmentation, the present study aims to describe two simple depigmentation techniques and their effectiveness in fulfilling the patient's needs. The two techniques used are the scalpel scraping technique and the semiconductor diode laser technique.

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Fig. 1: Preoperative



Fig. 2: Scalpel scraping

MATERIALS AND METHODS

Subjects for this study were selected from the outpatient department of Periodontics, College of Dental Sciences, Davangere, Karnataka, India. The study obtained ethical clearance from the Institutional Review Board. In this study, a total of 14 patients having uniformly dense band of bilateral physiologic gingival hyperpigmentation on the facial aspect of the maxillary gingiva were included using the sample size determination formula $n = z^2pq/e^2$.

A total of 28 sites extending from distal of the right canine to the midline (14 sites) and distal of the left canine to the midline (14 sites) were selected randomly by the coin toss method for treatment either by diode laser or scalpel scraping techniques.

The study was a split-mouth, 6-month follow-up study. Each patient underwent initial phase therapy (oral hygiene instructions, scaling and root planing) 1 week before the depigmentation procedure. Patients were made aware of the procedure and the purpose of the study and prior informed consent was obtained. Inclusion criteria in this study were subjects with age between 15 and 35 years, systemically and periodontally healthy subjects with bimaxillary melanin hyperpigmentation in the facial aspects of anterior regions, and those evaluated as having either moderate or heavy clinical pigmentation according to the criteria given by Dummett and Gupta.[10] Exclusion criteria were subjects with thin gingival biotype, pregnant and lactating women, medically compromised patients, those using drugs and chemicals with a potential to cause oral pigmentation like antimalarials, minocycline, oral contraceptives etc., patients under any medication or condition that will interfere with bleeding or wound healing, and smokers.

Procedural Steps

The randomly selected patients were divided into two groups:



Fig. 3: Laser

Group I (Control) Scalpel Scraping Technique

After achieving adequate local anesthesia, the surgical scalpel blade No. 15 was used to scrape the entire epithelium and a layer of connective tissue until all the visible pigmentation was removed from margin to the mucogingival junction. Bleeding was controlled by pressure pack and periodontal dressing was placed[9] (Figs 1 and 2).

Group II (Experimental) Laser Technique

Topical or local anesthesia was given to the patient, if required. Melanin-pigmented gingiva was ablated by diode laser device having a wavelength 810 nm at 1.5 to 2 watt power in a continuous wave mode with a flexible fiber-optic delivery system. The procedure was performed in the contact mode of laser tip to the tissues. The tip was held in light contact with the target tissue and procedure was performed with light sweeping brush strokes until blister formation occurred in the target tissues. Blistered gingiva was scraped off with wet, saline moistened gauze to remove the epithelium containing melanin pigmentation. The procedure was performed from a cervicoapical direction in all pigmented areas[8,9] (Figs 3 to 5).

Clinical parameters assessed were (i) plaque index,[11] (ii) gingival index,[12] and (iii) gingival repigmentation:



Fig. 4: Immediate postoperative



Fig. 5: Periodontal dressing placed



Fig. 6: One week postoperative



Fig. 7: One month postoperative



Fig. 8: Three months postoperative



Fig. 9: Six months postoperative

Preoperative and postoperative observations about the gingival pigmentation were made according to Dummett and Gupta.[10]

- 0—no clinical pigmentation (pink gingiva).
- 1—mild clinical pigmentation (mild light brown color).
- 2—moderate clinical pigmentation (medium brown or mixed pink and brown color).
- 3—heavy clinical pigmentation (deep brown or bluish black color).

After treatment, recall visits were scheduled at 1 week, and 1, 3, and 6 months postoperatively. Plaque index and gingival index were taken at baseline and at all recall visits. Sites were examined for clinical repigmentation using the Dummett Oral Pigmentation Index at 1 week, and 1, 3, and 6 months postoperatively by a single calibrated examiner throughout the study (single blinding) (Figs 6 to 9). The collected data were subjected to statistical analysis. For quantitative data, unpaired t-test was used for groupwise comparison. Categorical data were analyzed by Mann–Whitney U test.

RESULTS

In the present study, out of the total 14 patients treated (age group 15–30 years), 8 were males and 6 were females.

Table 1: Comparison of plaque index between scalpel scraping group and diode laser groups

	Plaque index			
	Scalpel scraping	*Diode laser*	*t-value**	*p-value*
Baseline	1.39 ± 0.46	1.41 ± 0.012	0.65	0.53 NS
1 week	1.21 ± 0.025	1.22 ± 0.04	0.02	0.95 NS
1 month	1.23 ± 0.023	1.21 ± 0.015	0.81	0.44 NS
3 months	1.24 ± 0.19	1.26 ± 0.02	0.47	0.64 NS
6 months	1.31 ± 0.15	1.30 ± 0.18	0.07	0.96 NS

NS: Nonsignificant, p > 0.05

Table 2: Comparison of gingival index between scalpel scraping group and diode laser groups

	Gingival index			
	Scalpel scraping	*Diode laser*	*t-value**	*p-value*
Baseline	1.31 ± 0.24	1.32 ± 0.38	0.19	0.84 NS
1 week	1.18 ± 0.19	1.16 ± 0.23	0.21	0.96 NS
1 month	1.20 ± 0.33	1.21 ± 0.29	0.30	0.77 NS
3 months	1.21 ± 0.36	1.23 ± 0.31	0.43	0.68 NS
6 months	1.24 ± 0.15	1.25 ± 0.17	0.51	0.46 NS

NS: Nonsignificant, p > 0.05

Table 3: Comparison of recurrence of pigmentation (Dummett index 1964)

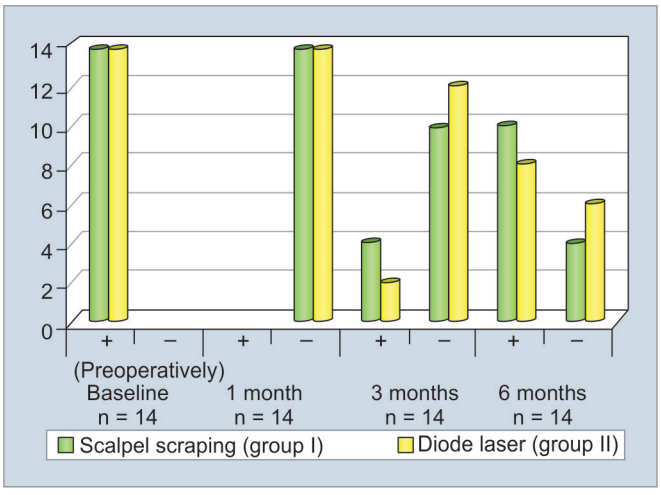
	Baseline (n = 14) (preoperatively)		*1 month (n = 14)*		*3 months (n = 14)*		*6 months (n = 14)*	
	+	–	+	–	+	–	+	–
Scalpel scraping (group I)	14			14 (100%)	4 (28.5%)	10 (71.5%)	10 (71.5%)	4 (28.5%)
Diode laser (group II)	14			14 (100%)	2 (14.3%)	12 (87.7%)	8 (57.15%)	6 (42.85%)
Man—Whitney U-test	98		98		84		84	
p-value	p = 1.00, p > 0.01 NS		p = 1, p > 0.01 NS		p = 0.541, p > 0.01 NS		p = 0.541, p > 0.01 NS	

+: Present; –: Absent; NS: Nonsignificant

Study results were presented for the amount of repigmentation for a period of 6 months postoperatively.

The mean plaque index and gingival index scores were low at 6 months when compared with baseline as shown in Tables 1 and 2. There was no statistically significant difference in plaque index and gingival index between both the groups at all intervals (p > 0.05).

At recall intervals of 1 week and 1 month, there was no recurrence of pigmentation in both groups. At 3 months, in 28.5% of sites treated by scalpel scraping and 14.2% sites treated by diode laser, it showed the recurrence of pigmentation. This was not significant between both the groups (p > 0.05). At 6 months, recurrence was seen in 71.5% of sites treated by scalpel scraping and 57.15% of laser-treated sites. The laser-treated sites showed lower repigmentation than scalpel scraping technique, which was not significant (p > 0.05; Table 3 and Graph 1).



Graph 1: Comparison of repigmentation (Dummett index 1964) between the groups

DISCUSSION

Pigmented gingival tissue, many a time, forces the patients to seek cosmetic treatment. Although several techniques are currently in use, the scalpel technique is still the most widely employed as it is most economical compared with other techniques, which require more advanced armamentarium. Therefore, the scalpel technique is highly recommended in consideration of the equipment constraints in developing countries.[13]

The present study has a split-mouth design, which is an excellent method to determine the clinical relevance for comparison of the two different depigmentation techniques to remove gingival melanin hyperpigmentation. By comparing the techniques within a subject, it minimizes the influence of numerous intersubject factors, such as age, facial complexion, etc.

In the present study, the oral hygiene of the patients in both groups was satisfactory as measured by plaque and gingival scores. At 6 months, recurrence was seen in 71.5% of sites treated by scalpel scraping and 57.15% of laser-treated sites.

The results in our study were in accordance with following studies: Ginwalla reported repigmentation in 50% of their cases between 24 and 55 days.[14] Gingivectomy procedure was used by Dummett and Bolden[15] to operate on pigmented gingiva in nine cases, and as early as 33 days after surgical removal, recurrence of pigmentation occurred in 67% of the areas. Singh et al[16] described a case in which diode laser and cryosurgery were used and they reported that there was recurrence of pigmentation after 18 months in 1 patient out of 20 patients.

The results of the present study were not in accordance with the following studies: Nakamura et al[17] used CO_2

laser for depigmentation in 10 patients and observed that repigmentation was not seen in the first year, but at 24 months, 4 patients showed repigmentation. Tal et al[18] observed no repigmentation occurring in any of the patients with Er:YAG laser after 6 months. Kumara Ajeya et al[19] described a case in which diode laser and surgical scalpel were used and they reported that no recurrence of pigmentation was seen after 12 months.

The large variation in the time of occurrence of repigmentation may be related to the race of the patient and type of the technique used in treating depigmentation. The mechanism of repigmentation is not understood and there is little information on the behavior of melanocytes after surgical injury. According to the migration theory, active melanocytes migrate from the adjacent pigmented tissues to operated areas, causing repigmentation.[20] Repigmentation may also be attributed to the melanocytes that are left during surgery as stated by Ginwalla et al.[14] These may become activated and start synthesizing melanin. Ginwalla reported repigmentation in 50% of their cases between 24 and 55 days. Dummett and Bolden[15] reported repigmentation in 67% of the areas, as early as 33 days after gingivectomy procedure. Perlmutter and Tal[20] have observed repigmentation of gingiva 7 years after removal of gingival-pigmented tissue in one patient. Repigmentation was not seen in any of the four patients treated by Atsawasuwan et al[21] at 11 to 13 months after gingival depigmentation using Nd:YAG laser. Tal et al[18] used Er:YAG laser for depigmentation and observed no recurrence of pigmentation in any of the patients after 6 months.

The advantage of the diode laser is the maintenance of a relatively bloodless surgical and postsurgical course. The mechanisms by which the diode laser leads to ablation or decomposition of biological materials are photochemical-, thermal-, or plasma-mediated. Thermal ablation means that the energy delivered by the laser is coupled into irradiated material by an absorption process, yielding a temperature rise in that tissue.[22] As the temperature increases at the surgical site, the soft tissues are subjected to warming (37–60°C), protein denaturation, coagulation (>60°C), welding (70–900°C), vaporization (100–150°C), and carbonization (>200°C). The rapid rise in intracellular temperature and pressure leads to cellular rupture, as well as release of vapor and cellular debris, termed the laser plume.[23] Moritz et al in an *in vitro* and *in vivo* study showed a bactericidal effect of diode laser.[24] They found an extraordinarily high reduction of bacteria.

CONCLUSION

The need and demand for esthetics in helping to create a pleasant and confident smile require the removal of unsightly pigmented gingival areas, which altogether alter the personality of an individual. The methods used here produced desired results and above all, the patient was satisfied with the outcome, which is the ultimate goal of any therapy, i.e., carried out. However, a larger series of patients are needed to offer conclusive evidence of the efficacy of both the procedures. The scalpel remains the gold standard because of its convenience and cost-effectiveness, but with proper adhesion to safety measures, the diode laser can also be used to remove gingival pigmentation efficiently.

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