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Gingival Depigmentation Using Microneedling and Diode Laser: A Randomized Clinical Trail

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Abstract

Introduction: "Black gums" is a common aesthetic concern for many people, who frequently seek cosmetic adjustments, despite the fact that clinical melanin pigmentation does not manifest as a disease entity or medical issue. There are numerous methods available for depigmenting melanin hyperpigmented gingiva, with microneedling being a recent addition. This investigation was conducted to assess and contrast diode laser and microneedling as treatments for gingival melanin hyperpigmentation.

Materials and methods: A total of 40 patients in the age group between 15 and 30 years were selected for a microneedling group (I) and diode laser (group II). Parameters evaluated were recurrence of pigmentation using Pigmentation intensity scores (PIS) Dummett index 1964, Pigmentation extension scores (PES) were assessed by the Hedin melanin index (HMI) and plaque index and gingival index at 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. By adhering to safety measures, and long duration of gingival repigmentation by diode laser as compared to microneedling. However microneedling also can be used to remove gingival pigmentation efficiently.

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Introduction

A smile can convey warmth and confidence. It is an outward manifestation of happiness and harmony. Gingival tissues also play a role in determining an attractive smile in addition to tooth color, location, and shape ^[1]. The amount and size of blood vessels, the thickness of the epithelium, the degree of keratinization, and pigments such as melanin, carotene, decreased hemoglobin, and oxyhemoglobin within the epithelium all affect gingiva color. The word "melas," which meaning "black," is the Greek root of the word melanin. It is an endogenous pigment made by melanocytes in the basal and suprabasal layers of the epithelium.

The most prevalent natural pigment that affects gum color is melanin. There is no gender predilection^[5] to this pigmentation, and it can be seen in people of all races³ at any age^[4]. Although dark gums are a common complaint and patients often want cosmetic treatment, gingival melanin hyperpigmentation is neither a medical condition nor a disease entity. Since the early 1980s, lasers have been utilized in dentistry. Compared to knife surgery, lasers cause less postoperative discomfort and better hemostasis, making them the preferred therapeutic option in recent times. Several types of lasers have been used for depigmentation, including erbium, chromium, and garnet lasers, carbon dioxide (CO₂) lasers, argon lasers, diode lasers, neodymium-doped yttrium aluminum garnet (Nd:YAG) lasers, and erbium, chromium-doped yttrium, scandium, and gallium lasers. The diode laser, out of all the lasers, has drawn more attention and significance because of its energy and wavelength properties that enable it to target soft tissues specifically. Additionally, because of its affinity for melanin and hemoglobin, it is more effective and well-suited to deal with soft tissue issues.⁸ Gingivectomy, frenectomy, incisional and excisional biopsies, and depigmentation operations have all been performed using semiconductor diode lasers^[9]. The current study is to detail two straightforward depigmentation approaches and their efficacy in meeting the patient's needs in order to discover a better gingival depigmentation strategy. The semiconductor diode laser technology and the scalpel scraping technique are the two methods employed.

Materials and Methods

Subjects for this study were selected from the outpatient department of Periodontics, College of k.d dental college and hospital Mathura, Uttar Pradesh India. The study obtained ethical clearance from the Institutional Review Board. In this study, a total of 40 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 $n = z^2 pq/e^2$. A total of 40 sites extending from distal of the right canine to the canine (20) and distal of the left canine to the canine (20 sites) were selected randomly by the coin toss method for treatment either by diode laser and microneedling techniques. The study was a Randomized clinical trial, 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 Step

The randomly selected patients were divided into two groups Group I (Control) Microneedling technique.

After achieving adequate local anesthesia, microneedling is done by using Dermapen 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.



Fig 1: Pre-operative



Fig 2: Microneedling scraping



Fig 3: Immediate post-operative



Fig 4: One month follow up



Fig 5: Three months follow up



Fig 6: Six months follow up



Fig 4: One months follow up

Group -2 (Experimental) Laser group

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.



Fig 5: Three months follow up



Fig 1: Pre-operative



Fig 6: Six months follow up



Fig 2: Laser scapping



Fig 3: Immediate post-operative

Clinical parameters assessed were (i) plaque index,¹¹ (ii) gingival index,¹² and (iii) gingival repigmentation: 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, Pigmentation extension scores (PES) were assessed by the Hedin melanin index (HMI), where scores were recorded from 0 to four: 0 for no clinically evident pigmentation; one for one or two solitary pigmented units in the interdental papillae; two for three or more pigmentation units in the papillary gingival without a continuous ribbon pattern; three for more than or equal to one short continuous ribbon of pigmentation; and four for a continuous ribbon pattern involving the area between canines.

After treatment, recall visits were scheduled at 1 month 3 month 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

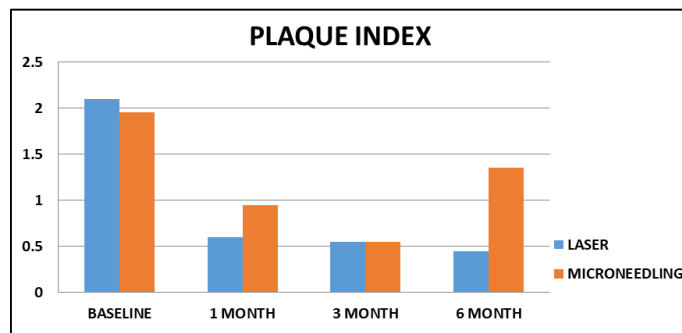
comparison. Categorical data were analyzed by Mann-Whitney U test.

Results

Table 1: Comparison of Plaque Index in Between Laser and Microneedling at Different Time Interval

Time interval	Group	Mean	Std. Deviation	Mean diff	T value	pvalue
Baseline	Laser	2.10	.718	.150	.588	.56
	Microneedling	1.95	.887			
1 Month	Laser	.60	.598	-.350	-1.619	.11
	Microneedling	.95	.759			
3 Month	Laser	.55	.510	.00	.000	1
	Microneedling	.55	.510			
6 Month	Laser	.45	.510	-.900	- 4.456	<0.001**
	Microneedling	1.35	.745			

Test used- independent t test, p<0.001** very highly significant, p>0.05 insignificant



Mean ±SD of plaque index of laser and micro needling group at baseline was 2.10± .718 and 1.95±.887 respectively. Results were found to be insignificant on comparing plaque index at baseline in laser and micro needling group.

Mean ±SD of plaque index of laser and micro needling group at 1 month was .60± .598 and .95±.759 respectively. Results were found to be insignificant on comparing plaque index at 1 month in laser and micro needling group.

Mean ±SD of plaque index of laser and micro needling group at 3 month was .55± .510 and .55±.510 respectively. Results were found to be insignificant on comparing plaque index at

3 month in laser and micro needling group.

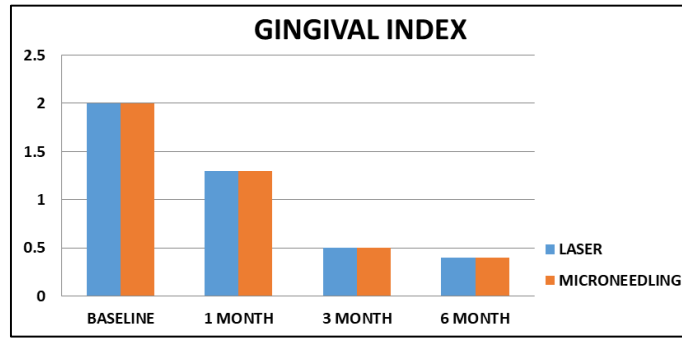
Mean ±SD of plaque index of laser and micro needling group at 6 month was .45± .510 and 1.35±.745 respectively. Results were found to be highly significant on comparing plaque index at 6 month in laser and micro needling group.

It was clear in graph that plaque index was more in laser group at baseline after that at 1 month plaque index was more in micro needling group, plaque index same in both group at 3 months and at 6 month plaque index was maximum in micro needling group in compare to laser group.

Table 2: Comparison of Gingival Index in Between Laser and Microneedling at Different Time Interval

Time Interval	Group	Mean	Std. Deviation	Mean diff	T value	pvalue
Baseline	Laser	2.00	.858	.00	.00	1
	Microneedling	2.00	.858			
1 Month	Laser	1.30	1.129	.00	.00	1
	Microneedling	1.30	1.129			
3 Month	Laser	.50	.761	.00	.00	1
	Microneedling	.50	.761			
6 Month	Laser	.40	.503	.00	.00	1
	Microneedling	.40	.503			

Test used- independent t test, p>0.05 insignificant



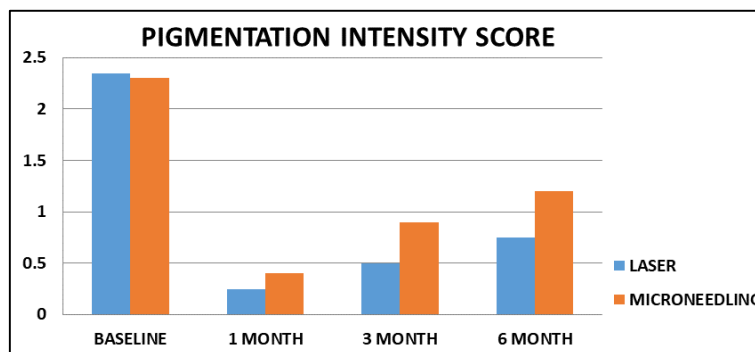
Mean ±SD of gingival index of laser and micro needling group at baseline was 2.00± .858 and 2.00±.858 respectively. Results were found to be insignificant on comparing gingival index at baseline in laser and micro needling group. Mean ±SD of gingival index of laser and micro needling group at 1 month was 1.30± 1.129 and 1.30±1.129 respectively. Results were found to be insignificant on comparing gingival index at 1 month in laser and micro needling group. Mean ±SD of gingival index of laser and micro needling

group at 3 month was .50± .761 and .50±.761 respectively. Results were found to be insignificant on comparing gingival index at 3 month in laser and micro needling group. Mean ±SD of gingival index of laser and micro needling group at 6 month was .40± .503 and .40±.503 respectively. Results were found to be insignificant on comparing gingival index at 6 month in laser and micro needling group. It was clear in graph that gingival index remains same at every time interval in laser and micro needling group.

Table 3: Comparison of Pigmentation Intensity Score (PIS) in Between Laser and Microneedling at Different Time Interval

Time interval	Group	Mean	Std. Deviation	Mean diff	T value	Pvalue
Baseline	Laser	2.35	.671	.050	.225	.82
	Microneedling	2.30	.733			
1 Month	Laser	.25	.444	-.150	-1.000	.32
	Microneedling	.40	.503			
3 Month	Laser	.50	.607	-.400	-1.798	.08
	Microneedling	.90	.788			
6 Month	Laser	.75	.967	-.450	- 1.528	.13
	Microneedling	1.20	.894			

Test used- independent t test, p>0.05 insignificant



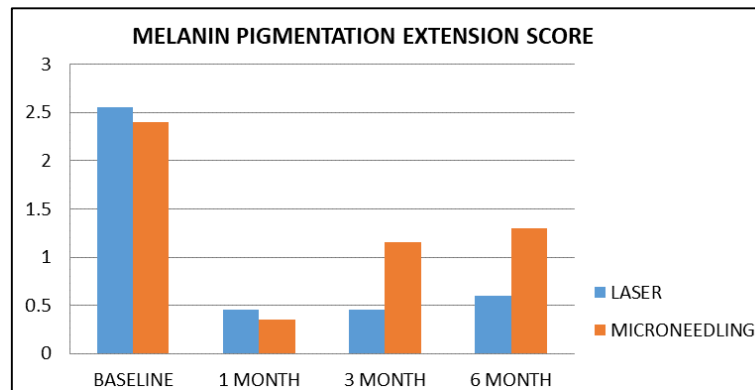
Mean ±SD of pigmentation intensity score of laser and micro needling group at baseline was 2.35± .671 and 2.30±.733 respectively. Results were found to be insignificant on comparing PIS at baseline in laser and micro needling group. Mean ±SD of PIS of laser and micro needling group at 1 month was .25± .444 and .40±.503 respectively. Results were found to be insignificant on comparing PIS at 1 month in laser and micro needling group. Mean ±SD of PIS of laser and micro needling group at 3 month was .50± .607 and .90±.788 respectively. Results were

found to be insignificant on comparing PIS at 3 month in laser and micro needling group. Mean ±SD of PIS of laser and micro needling group at 6 month was .75± .967 and 1.20±.894 respectively. Results were found to be insignificant on comparing PIS at 6 month in laser and micro needling group. It was clear in graph that PIS was more in laser group at baseline after that PIS was more in micro needling group at 1 month, 3 month and 6 month in comparison to laser group.

Table 4: Comparison of Melanin pigmentation Extension (HES) Score in Between Laser and Microneedling at Different Time Interval

Time interval	Group	Mean	Std. Deviation	Mean diff	T value	pvalue
BASELINE	Laser	2.55	.999	.150	.489	.62
	Microneedling	2.40	.940			
1 MONTH	Laser	.45	.686	.10	.531	.59
	Microneedling	.35	.489			
3 MONTH	Laser	.45	.686	-.700	-3.714	.001**
	Microneedling	1.15	.489			
6 MONTH	Laser	.60	.754	-.700	-3.310	0.002**
	Microneedling	1.30	.571			

Test used- independent t test, $p < 0.05$ ** highly significant, $p > 0.05$ insignificant



Mean \pm SD of pigmentation extension score (HES) of laser and micro needling group at baseline was $2.55 \pm .999$ and $2.40 \pm .940$ respectively. Results were found to be insignificant on comparing HES at baseline in laser and micro needling group.

Mean \pm SD of HES of laser and micro needling group at 1 month was $.45 \pm .686$ and $.35 \pm .489$ respectively. Results were found to be insignificant on comparing HES at 1 month in laser and micro needling group.

Mean \pm SD of HES of laser and micro needling group at 3 month was $.45 \pm .686$ and $1.15 \pm .489$ respectively. Results were found to be highly significant on comparing HES at 3 month in laser and micro needling group.

Mean \pm SD of HES of laser and micro needling group at 6 month was $.60 \pm .754$ and $1.30 \pm .571$ respectively. Results were found to be highly significant on comparing HES at 6 month in laser and micro needling group.

It was clear in graph that HES was more in laser group at baseline and 1 month after that HES was more in micro needling group at 3 month and 6 month in comparison to laser group.

Discussion

Patients with pigmented gingival tissue are frequently compelled to seek out cosmetic procedures. Even though there are a number of ways currently in use, the scalpel approach is still the most popular because it is less expensive than other techniques that call for more sophisticated equipment. Because of the limited equipment available in developing nations, the scalpel approach is therefore strongly advised. This study's methodology is a great way to assess the clinical applicability of contrasting the two distinct depigmentation approaches used to treat gingival melanin hyperpigmentation. Through technique comparison within a subject, many inter-subject factors—like age and complexion—are reduced in impact. According to plaque and gingival scores, the dental hygiene of the patients in both groups in the current investigation was adequate. Recurrence

was observed at 6 months in 57.15% of laser-treated sites and 71.5% of microneedling-treated sites.

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