

## Gingival Melanin Depigmentation by Diode Laser 980 nm with Minimal Power Parameters

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### Abstract:

**Background:** Laser gingival depigmentation is the easiest and least painful treatment option and does not require periodontal dressing. In most studies, gingival depigmentation by diode laser was performed using power parameters higher than 1 Watt; which is commonly associated with post-operative pain.

**Materials and Methods:** In this retrospective descriptive study, 10 patients, 4 males and 6 females, with age range from 16 to 29 years, having moderate to severe melanin physiologic pigmentation of gingiva were treated by diode laser 980 nm, with lowered power parameters to reduce post-operative pain and to allow faster healing of the gingiva. Post-operative assessment included procedure time, pain, clinical response, and patient satisfaction

**Results:** The mean procedure time was 26 minutes. Six patients reported no post-operative pain, and 4 patients reported slight pain on the first day only. Two patients only required a second session of Laser depigmentation. Eight patients were very satisfied and 2 patients were satisfied, with the painless procedure and esthetic results. After 12 months, there was no recurrence.

**Conclusion:** Lowered power Diode Laser 980 nm is a painless effective treatment for gingival melanin depigmentation.

**Key Word:** Gingiva, depigmentation, Diode 980 nm, power, parameters

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### I. Introduction

Gingival tissue plays an important part of dento-facial esthetics along with face, lip, and teeth. A beautiful smile mainly depends on the appearance of teeth and gingiva. The shape, level, and color of gingival play an essential role in smile harmony.<sup>1</sup> Melanin pigmentation of gingiva causes esthetic problems, social embarrassment, and it may have psychological problems; especially when the pigmentations are visible during speech and smiling. This impact is more obvious in patients with “gummy smile” or excessive gingival display while smiling (high lip line). The color of gingiva is determined by number and size of blood vessels, thickness of epithelium and its keratinization degree, and melanin pigments present in epithelium. Melanin, which plays a main role for pigmentation of gingiva, is a brown pigment, produced by Melanocytes, located in the basal and suprabasal layers of gingival epithelium.<sup>2</sup>

Gingival hyperpigmentation can be defined as a darker gingival color beyond what is normally expected. This hyperpigmentation can be seen in all the races, but it is more common in black individuals.<sup>3</sup> Gingival hyperpigmentation results from physiologic melanin pigments, or other environmental risk factors; such as, tobacco smoking, ultraviolet radiation, drug induced (anti-malarial agents & tricyclic anti-depressant agents), occupational exposure to heavy metals contribute to the gingival hyperpigmentation. Ethnicity and age also can influence the color of gingiva, and there is no gender predilection. Treatment modalities for depigmentation of gingiva different have been reported like chemical agents (alcohols\ phenols\ ascorbic acid), scalpel surgical scraping, partial thickness flap, bur abrasion, electrosurgery, cryosurgery, and laser.<sup>4</sup>

The first and most popular technique used is the scalpel surgical removal of melanin pigmentation of gingiva. However, periodontal dressing is mandatory for at least a week; in addition, repigmentation of melanin pigment after surgical procedure has been reported in a high percentage.<sup>5</sup> Electrosurgery is always associated with more pain and clinically delayed healing when compared to scalpel surgery.<sup>6</sup>

One step laser treatment is now the easiest and the least painful treatment option to eliminate the pigmented areas of gingiva and does not require periodontal dressing. Laser has the advantages of easy handling, short treatment time, hemostasis, decontamination effects, and it does not require a periodontal dressing.<sup>7</sup>

Many types of lasers can be used for depigmentation of gingiva; such as, Nd YAG laser, Er YAG laser, CO2 laser, and diode laser. Diode laser 980 nm has a high affinity to penetrate into melanin pigments, which makes it the preferred laser type for depigmentation of gingiva. Also, diode laser does not cause damage to the periosteum and bone beneath the gingiva. In addition, diode laser has smaller size equipment, as well as, the lower cost than other types of lasers.<sup>8</sup>

In most studies, gingival depigmentation by diode 980 nm laser was performed using power parameters higher than 1 Watt; which has been commonly associated with post-operative pain\discomfort, and slow gingival healing, caused by heat generation. In this study, we present our experience with diode laser 980 nm depigmentation of gingiva, using lowered power parameters of 0.7 - 1 Watt in to reduce heat generation and post-operative pain or discomfort; and to allow faster healing of gingiva, evaluating procedure time, clinical outcome, pain and patient satisfaction.

## **II. Material And Methods**

This retrospective study was carried out on patients of Laser clinic from June 2020 to June 2021. Total 10 adult subjects (both male and females) of aged  $\geq 18$ , years were for in this study.

**Study Design:** Retrospective Study

**Study Location:** Laser clinic in Faculty of Dentistry, Misr University for Science and Technology in Egypt

**Study Duration:** June 2020 to June2021.

**Sample size:** 10 patients.

**Subjects & selection method:** The study population was drawn from patients who presented Laser clinic in Faculty of Dentistry, Misr University for Science and Technology in Egypt, study started in June 2020, and to June 2021 (follow up for 12 month).

### **Inclusion criteria:**

1. Aged  $\geq 15$  years
2. Either sex
3. Patients with moderate to severe melanin physiologic gingiva pigmentation according to Dummett-Gupta Oral Pigmentation Index:<sup>9</sup>
  - 0 - No clinical pigmentation (ping 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).

**Exclusion criteria:** as suggested by Dummett Gupta<sup>10</sup>

1. Pregnant women
2. Smoking
3. Patients with autoimmune diseases
4. Patients with Diabetes Mellitus
5. Patients with bad oral hygiene
6. Patients with periodontitis

### **Procedure methodology**

All details of the treatment procedure, its benefits and potential risks were explained in a simple clear language, and a written informed consent was obtained from each patient. Confidentiality of Data was assured for all participating patients; the participant's names and personal data will never be mentioned.

A standardized set of data for each patient was recorded in a sheet and kept in each patient file; including: age, sex, clinical history, laser parameters, pre-operative and post-operative photographs, clinical response, and follow up visits.

Standardized digital colored photographs (standard 16-megapixel digital camera, standard magnification and at standard distance of 30 cm) were taken for each patient on the first visit, immediate post-operative, and after 1 month, 6 months, and 12 months.

Treatment protocol included: local anesthesia; topical gel (10% Lidocaine), then infiltration anesthesia: Mepivacaine Hcl 3% 1:30,000 conc. (Alexandria Co for pharmaceuticals and chemicals Ind., Egypt).

Then, gingival depigmentation procedure was done using Diode Laser 980 nm wave-length (doctor smile ®), fiber- optic tip 400  $\mu$ m diameter, with power parameters of 0.7 – 1 Watt (starting with 0.7 Watt; and

increased up to 1 watt, according to the degree of melanin pigmentation). Depigmentation procedure was done using continuous wave mode, contact mode (in contact with pigmented areas of gingiva). The laser tip was initiated (Fig.1), then, used in horizontal direction and parallel to the root surfaces to remove melanin pigmentation (Fig.3). The area depigmented was wiped with gauze soaked in saline to reduce the thermal effect of laser on tissues, and to work in a clean operating field. This procedure was repeated until all pigments removed. No periodontal dressing was used after depigmentation.

Post-operative Ibuprofen 600 mg (BRUFEN® granules \ Abbott) analgesic was prescribed only the day of Laser depigmentation. Patients were instructed to avoid hot, acidic, and spicy food during the first week, as it can jeopardize the healing process and cause patient pain \ discomfort.

Level pain was evaluated (post-operative 1<sup>st</sup> day, 1<sup>st</sup> week), using the visual analog scale (VAS) score:<sup>11</sup>

- Score 0: 0 mm: no pain
- Score 1: 1 to 30 mm: slight pain
- Score 2: 31 to 60 mm: moderate pain
- Score 3: 61 to 100 mm: severe pain.

Follow-up visits were after 4 weeks, 6 months, and after 12 months. Clinical outcome was evaluated according to the following criteria: complete response (complete disappearance of pigments), marked improvement (>70% disappearance of pigments), moderate improvement (40–70% of pigments), slight improvement (<40% disappearance of pigments), and no response.

Patient satisfaction was documented based on patient's opinion, measured on a five-point scale [12], after 6 months of diode laser depigmentation procedure:

- 0: very dissatisfied
- 1: dissatisfied
- 2: neither satisfied nor dissatisfied
- 3: satisfied
- 4: very satisfied

### III. Results

The present study included 10 patients; 4 males and 6 females; the mean age was 23.1 years (range: 16 to 29 years old). Regarding pigmentation, 7 patients had heavy clinical pigmentation and 3 patients had moderate clinical pigmentation. The mean procedure time was 26 minutes (range: 20 to 30 minutes), depending on the extent of pigmentation.

Regarding pain, 6 patients reported no pain on first post-operative day and throughout the first week (score 0), and 4 patients reported slight pain (score 1) on the first day only.

Complete healing of gingiva occurred after 2 weeks. Eight Patients had complete response (complete disappearance of gingival pigments) in one session. Only 2 patients out of 10 had marked improvement (>70% disappearance of pigments); and required a second session for depigmentation after 4 weeks, then, complete response was achieved.

Regarding patient satisfaction, 8 patients were very satisfied (4 point scale) with painless quick procedure and good esthetic results, and only 2 patients were satisfied (3 point scale). Patients were followed up for one year and there was no repigmentation in any case. Fig. 2, 3, 4, 5 showing case I: a 27 years old male patient, and Fig. 6, 7, 8 showing case II: a 21 years old female patient. Table 1 summarizes patients' demographics and clinical responses.



**Fig.1:** Initiation of fiber-optic laser tip



**Fig.2:** Pre-operative view of a 27 years old male patient – Case I



**Fig.3:** Laser Depigmentation procedure of maxillary gingiva



**Fig.4:** Immediate post-operative view  
Procedure time: 20 minutes



**Fig.5:** Follow-up view after 12 months  
NNO recurrence



**Fig.6:** Pre-operative view of a 21 years old female patient



**Fig.7:** Immediate post-operative view  
Procedure time: 20 minutes



Fig.8: Follow-up view after 12 months

Fig.3: Case II: Gingival Depigmentation of a 21 years old female patient

Table no 1: Shows patients demographics and clinical responses

Case no.	Age (yrs)	Sex	Pigmentation	Procedure Time	Pain VAS Index	No. Of sessions	Clinical Outcome	Satisfaction	Recurrence
1	27	M	Severe	30 min	Score 0	2	Complete Response	Very Satisfied	NO
2	29	M	Severe	30 min	Score 1	2	Marked Response	Satisfied	NO
3	28	M	Severe	29 min	Score 0	1	Marked Improvement	Satisfied	NO
4	19	M	Severe	27 min	Score 0	1	Complete Response	Very Satisfied	NO
5	21	F	Moderate	25 min	Score 0	1	Complete Response	Very Satisfied	NO
6	16	F	Moderate	20 min	Score 0	1	Complete Response	Very Satisfied	NO
7	18	F	Moderate	25 min	Score 0	1	Complete Response	Very Satisfied	NO
8	25	F	Severe	20 min	Score 1	1	Complete Response	Very Satisfied	NO
9	22	F	Severe	26 min	Score 1	1	Complete Response	Very Satisfied	NO
10	26	F	Severe	28 min	Score 1	1	Complete Response	Very Satisfied	NO

**Abbreviations:** F (female), M (male), min (minutes), VAS (visual analog scale)  
**Pain VAS Index:** Score 0 (no pain), Score 1 (slight pain)  
**Clinical Outcome:** complete response (complete disappearance of pigments), marked improvement (>70% disappearance of pigments)

#### IV. Discussion

Gingival melanin pigmentation causes esthetic concerns for many patients. Different techniques have been used for depigmentation procedure; such as, scalpel surgery, cauterization, cryotherapy, diamond burs, and lasers, the laser being the most recent and reliable one.<sup>13</sup>

In 2018, Alasmari searched the MEDLINE and Cochrane databases of systematic reviews of different gingival depigmentation techniques. The authors concluded that cryosurgery, followed by lasers, are the most superior techniques with better esthetic results and low rate of recurrence.<sup>14</sup>

Spontaneous repigmentation is very common after scalpel surgical and electrosurgical removal of melanin pigmentation of gingiva. The mechanism suggested of repigmentation is that the active melanocytes from in the basal layers of oral epithelium proliferate and migrate into the depigmented areas. Most of the authors concluded that melanin granules are synthesized by melanocytes in deep layers, and transferred to the

superficial layers of gingiva where pigmented areas are seen. These melanocytes become activated by surgery and start synthesizing melanin again. The recurrence rate of gingival pigmentation is less with lasers when compared with surgery and electro-cautery; this is due to the effect of laser on melanocytes in deeper layers of gingiva.<sup>15, 16</sup>

The use of lasers for depigmentation has several advantages than other techniques, such as, easy handling, good hemostasis, good visibility, and accessibility to the surgical site (e.g. interdental papilla), no need to place a periodontal dressing, short treatment time, short healing period, no or very slight operative and post-operative pain, decontamination and sterilization effects, and low rate of recurrence compared to other depigmentation techniques. The only disadvantage of laser therapy is the high cost of the laser equipment.<sup>17</sup>

In this study, we used Diode 980 nm Laser, we started with 0.7 Watt power, then the power was increased if needed up to 1 Watt only, using contact mode, with continuous wave mode, followed by using gauze soaked in saline. In most studies, depigmentation of gingiva by diode laser 980 nm was done with parameters ranging from 1 to 3 Watt power, with continuous wave mode.<sup>18</sup> The reduction in laser parameters in our study has resulted in less pain and better healing. Our findings in the current study were similar to Giannelli et al; the authors reported that lowering power parameters of diode laser reduces the thermal damage to tissues; thereby reducing post-operative pain and resulted in faster and better healing of gingival tissues. In addition, using gauze with saline has a cooling effect, reducing thermal effect of laser on tissue, which results in faster and better healing of irradiated tissues.<sup>19</sup>

The procedure time ranged from 20 to 30 minutes, depending on the extent of pigmentation. This reduction in treatment time reduced patient discomfort and increased patient satisfaction. All patients felt no pain during treatment and there was no post-operative pain; which also increased patient satisfaction. Complete healing of gingiva occurred after 2- 3 weeks.

Only 2 patients out of 10 required a second session for laser depigmentation to achieve the best esthetic results. All patients were satisfied with the quick painless procedure for depigmentation of gingiva, and the good esthetic results

## V. Conclusion

Within the limitations of this study, Diode 980 nm Laser, with lower power parameters 0.7 - 1 Watt, is a safe, painless, and effective treatment modality for melanin pigmentation of gingiva. Future studies with larger number of patients are recommended.

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