Case Report

Brightening smiles: diode laser assisted gingival depigmentation

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Abstract

Clinical melanin pigmentation, though not a medical issue or disease, often causes aesthetic concerns for individuals, particularly those with 'black gums' who frequently seek cosmetic correction. Gingival depigmentation a type of perio-plastic surgery is a procedure designed to lighten the colour of the gums by removing the pigmented tissue. The objective of this study was to evaluate the efficacy of diode LASER for depigmentation procedure.A 24-year-old female reported to the outpatient Department of Periodontology, Kothiwal Dental college and Research Centre, Moradabad, with a chief complaint of unaesthetic dark gums on her upper front region of the jaw while smiling since many years and wanted the treatment for the same Depigmentation with diode laser showed satisfactory results Diode lasers are a safe and effective treatment option for gingival hyperpigmentation. It provides optimal aesthetics with reduced discomfort to patients

KEYWORDS: gingival depigmentation, laser, diode, melanocytes

Introduction

An attractive smile holds great significance as it is a reflection of beauty sophistication and confidence. The harmony of smile is influenced not only by the shape, alignment and color of teeth but also by the position and colour of gums.

The colour of the gingiva is influenced by several factors, including the number and size of blood vessels, the thickness of the epithelium, the degree of keratinization, and the presence of pigments within the epithelium, such as melanin, carotene, reduced hemoglobin, and oxyhemoglobin.[1]

Melanin, whose name originates from the Greek word "melas," meaning "black," is a natural pigment produced by melanocytes in the basal and suprabasal layers of the epithelium. It is the primary pigment responsible for the natural coloration of the gums.[2]

Systemic hormonal imbalances, certain medications, and external factors like heavy metals (e.g., mercury, bismuth, lead, and iron) can contribute to gingival hyperpigmentation. Hirschfeld once linked oral pigmentation to Addison's disease, introducing the term "melanoplakia."[3]

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Several scoring systems have been developed to evaluate pigmentation, including the Dummett–Gupta Oral Pigmentation Index and Takashi's classification.

Table 1: Dummett–Gupta Oral Pigmentation Index.[4]

Score	Scale of Pigmentation Degree
Degree 1	Isolated—only 1 or 2 pigmented interdental papillae
Degree 2	Numerous pigmented interdental papillae
Degree 3	Short continuous ribbons
Degree 4	Long continuous ribbon

Table- 2: Takashi classification for gingival pigmentation.[5]

Score	Scale of pigmentation
SCORE O	No pigmentation
SCORE 1	Solitary unit(s) of pigmentation in papillary gingiva without extension between neighbouring solitary units.
SCORE 2	Formation of continuous ribbon extending from neighbouring solitary units

Various methods have been used for this procedure with different degrees of success:

Roshni & Nandakumar[6] in 2005 classified different gingival depigmentation methods as:

Methods used to remove the gingival pigmentation:

A. Surgical methods:
   i. Scalpel surgical technique
   ii. Bur abrasion method
   iii. Electro-surgery
   iv. Cryosurgery,
   v. Lasers,
   vi. Radiosurgery.

B. Chemical methods

Methods used to mask the gingival pigmentation:

i. Free gingival graft.
ii. Acellular dermal matrix allograft.

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 (CO2) 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. The diode laser has become increasingly significant and widely used due to its energy and wavelength properties that specifically target soft tissues. Its affinity for hemoglobin and melanin enhances its efficiency, making it particularly well-suited for addressing soft tissue issues.[7] Semiconductor diode laser has been used for gingivectomy, frenectomy, incisional and excisional biopsy, and depigmentation procedures.[8]

Case report

A 24-year-old female patient reported to the outpatient Department of Periodontology, Kothiwal Dental college and Research Centre, Moradabad, with a chief complaint of unaesthetic dark gums. The patient was systemically healthy and not under any medication. The oral hygiene of the patient was good with no history of smoking. On intraoral examination, the periodontal tissues were healthy, but bilateral melanin pigmentation was present in the maxilla. Takashi classification for gingival pigmentation index was used to determine the level of depigmentation, and the score was diagnosed as "2". (Figure- 1)

Based on the patient's history and clinical findings, a final diagnosis of physiologic gingival hyperpigmentation was made**.**

Case management

The patient was subjected to routine hematological investigations prior to the treatment. Following which phase I therapy was carried out in which complete supra and sub-gingival scaling was done and proper oral hygiene instructions were given. A week after scaling and root planing, gingival depigmentation procedure was performed in relation to maxilla with diode laser.

After attaining adequate local anaesthesia, melanin-pigmented gingiva was ablated with 970 nm diode laser (Fona^{TM}, Sirona Dental System, Germany) at 2 watts in continuous wave mode using a flexible fiber-optic system. The laser tip was lightly applied in contact mode with sweeping strokes until blisters formed and the blistered tissue was removed with saline-moistened gauze [Figure-2]. Laser ablation was started from the mucogingival junction towards the free gingival margin, including papilla. The procedure was performed targeting all pigmented areas in a cervico-apical direction. [Figure-3]. After the procedure, periodontal dressing was applied [Figure 4]

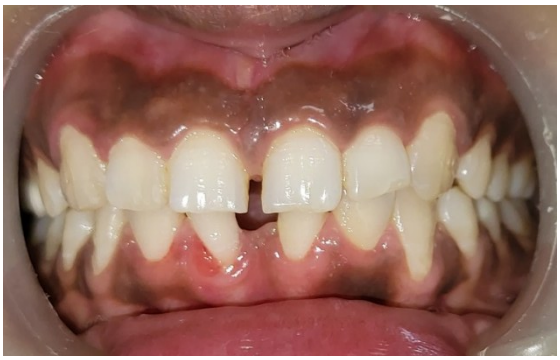

Figure 1 -Preoperative intraoral view

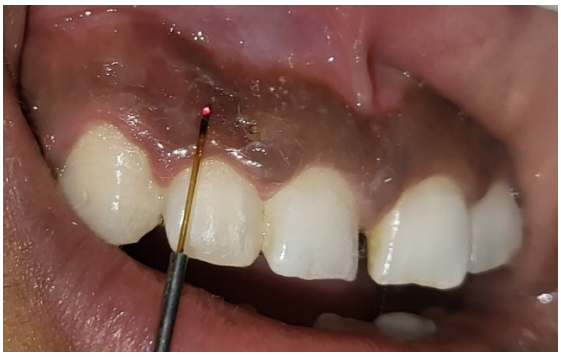

Figure 2 – Laser ablation

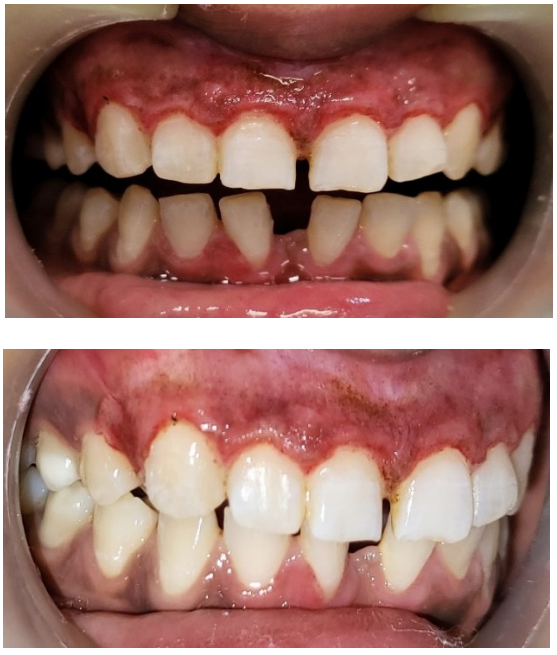

Figure 3 – Immediate post operative

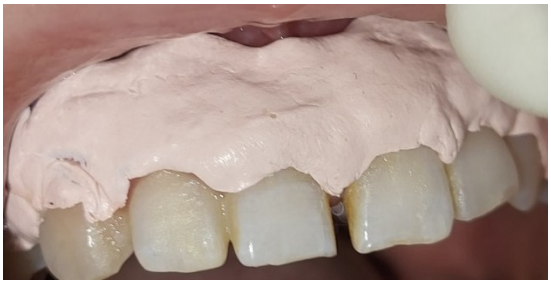

Figure 4 - Placement of periodontal pack

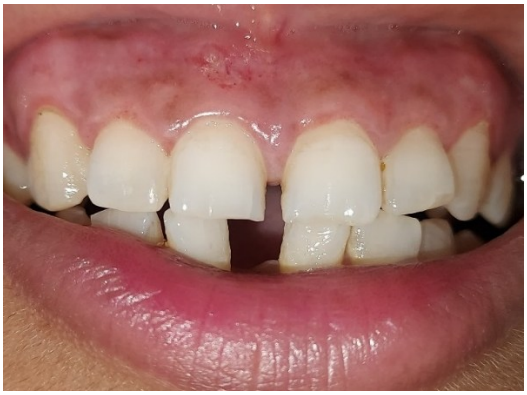

Figure 5 – 1 week post operative

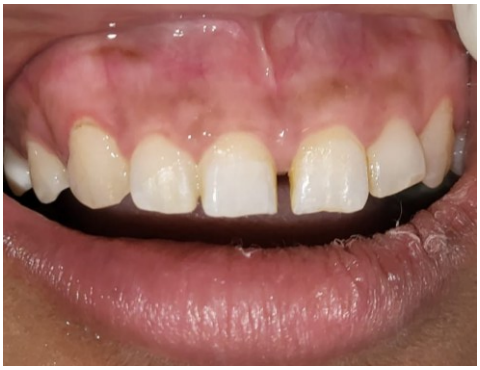

Figure 6- 6 month days post operative

Post surgical care and follow up

The patient was advised to avoid smoking and consuming hot, acidic, or spicy foods to support the healing process and minimize discomfort. After the depigmentation procedure, the patient was scheduled for follow-up visits at one week [Figure 5] and six months [Figure 6] postoperatively for clinical evaluation**.** Post operative instructions were given, and medications prescribed. The periodontal dressing was removed 7 days after depigmentation.

Clinical outcomes

The healing progressed without any complications, with no signs of pain, bleeding, or scarring. At the final evaluation, the gingiva had healed to a pale pink color, meeting the expectations of both the patient and the operator. Takashi index post-operatively was scored as "0"

Discussion

Melanin, a brown pigment, is the most common natural pigment contributing to endogenous pigmentation of the gingiva. Physiological pigmentation of the oral mucosa (mostly gingiva), is clinically manifested as multifocal or diffuse melanin pigmentation with variable amounts in different ethnic groups worldwide. [9,10] Melanin is a brown pigment which is deposited by melanocytes, mainly located intertwined between the basal and the spinous cell layers of epithelium, often observed to a greater degree at the anteriors.[11] The degree of melanin pigmentation depends on the number and distribution of melanocytes and their capacity to transfer melanin and melanin uptake by keratinocytes.[12]

The diode laser causes minimum damage to the periosteum and the bone and has a unique property of removing a thin layer of epithelium. It achieves ablation or breakdown of biological materials through photochemical, thermal, or plasma-mediated mechanisms. Thermal ablation occurs when the energy from the laser is absorbed by the irradiated tissue, causing its temperature to rise.[13] The rapid increase in intracellular temperature and pressure results in cellular rupture, releasing vapor and cellular debris, known as laser plume.[14] A study by Moritz et al. both in vitro and in vivo, demonstrated the bactericidal effect of the diode laser, showing a significant reduction in bacteria.[15]. Similar to our case studies were done by Yousuf et. al (2000)[16] and Ozbayrak et. al (2000)[17]

Re-pigmentation may also be attributed to the melanocytes which are left during surgery as stated by Ginwalla et al.[18] These may become activated and start synthesizing melanin. Ginwalla reported re-pigmentation in 50% of their cases between 24 and 55 days. Dummett and Bolden[19] operated pigmented gingiva by gingivectomy procedure in 9 cases. Re-pigmentation occurred in 67% of the areas, as early as 33 days after surgical removal. Perlmutter and Tal[20] have also reported gingival re-pigmentation that occurred 7 years after removal of gingival tissues in one patient. Tal et al.[21] and Tal[22] did not observe re-pigmentation until 20 months after cryosurgical depigmentation. No re-pigmentation was found in any of the four patients treated by Atsawasuwan et al.[23] at 11-13 months after gingival depigmentation using Nd: YAG laser. Nakamura et al.[24] described depigmentation with CO2 laser in 10 patients. No re-pigmentation was seen in the first year, but 4 patients showed re-pigmentation at 24 months. Tal et al.[25] observed no re-pigmentation occurring in any of the patients with Er: YAG laser after 6 months

Conclusion:

In this case report, the 970 nm diode laser was used for gingival depigmentation, leading to complete healing by week 12. The procedure proved to be safe, effective, and provided satisfactory aesthetic results with maximum patient comfort. However, a longer follow-up is required to assess the potential for repigmentation.

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