Management of Gingival Hyperpigmentation Using Surgical Blade, Diamond Bur and Diode Laser Therapy: A Case Report

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Summary: Esthetics has become a significant aspect of dentistry and clinicians are faced with achieving acceptable gingival esthetics as well as addressing biological and functional problems. The gingiva is the most commonly affected intraoral tissue that is responsible for a displeasing appearance. Melanin pigmentation often occurs in the gingiva as a result of an abnormal deposition of melanin, due to which the gums may appear black, but the principles, techniques, and management of the problems associated with gingival melanin pigmentation are still not fully established. Depigmentation procedures such as scalpel surgery, gingivectomy with free gingival autografting, electrosurgery, cryosurgery, abrasion with diamond bur, Nd:YAG laser, semiconductor diode laser, and CO_2 laser have been employed for removal of melanin pigmentation.

The following case report describes three different surgical depigmentation techniques: scalpel blade surgery, abrasion with diamond bur, and semiconductor diode laser. The diode laser is a solid-state semiconductor laser that typically uses a combination of Gallium (Ga), Arsenide (Ar), and other elements, such as aluminium (Al) and indium (In) to change electrical energy into light energy. Better results were achieved with semiconductor diode laser than conventional scalpel blade and abrasion with bur.

Keywords: diode laser, hyperpigmentation, repigmentation.

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An attractive smile has always been the focal point of a person's attention, in order to improve esthetic appearance and thus self-esteem. It is not only the contrasts of shape, color of teeth, line, and texture that enable us to determine a beautiful smile, but also the gingival tissue is esthetically important. Melanin pigmentation of the gingiva occurs in all ethnicities and is completely benign, but complaints of black gums are common.[1] The demand for depigmentation is usually made for esthetic reasons. Several treatment modalities have been suggested and presented in the literature, ranging from a simple slicing method to free gingival grafts. Although many easy, simple and effective techniques are available which give the desired results, there is not much information in the literature about effective depigmentation of gingiva. Elimination of these melanotic areas through surgery,[2,3] laser,[4,5] bur abrasion,[6] or cryosurgery[7] has been reported by

many authors. Each technique has its own advantages and disadvantages. Pigment recurrence has been documented to occur following the surgical procedure anywhere from 24 days to 8 years.[8]

Lasers have been used in dentistry since the beginning of the 1980s.[9] Semiconductor diode laser has been used for gingivectomy, frenectomy, incisional and excisional biopsy, and depigmentation procedures.[5] The present case report describes three simple depigmentation techniques and their effectiveness in fulfilling the patient's needs. The three techniques used were scalpel blade surgery, abrasion with bur, and semiconductor diode laser.

CASE DESCRIPTION

A 22-year-old female patient complaining of heavily pigmented gums visited the Department of Periodontics, Rural Dental College, Loni, Maharashtra, India (Fig 1). The pigmentation was esthetically displeasing and hence depigmentation was planned. The patient was informed in advance regarding possible outcome of the therapy including possible recurrence. Informed consent was given.

The patient received oral hygiene instruction and underwent scaling. The patient was called after 1 week and the melanin pigmentation index (MPI) (Takashi et al[14]) was taken. A biopsy was taken using disposable skin biopsy punch (Fig 2) from the 1st, 2nd quadrant and mandibular premolar area (Figs 3 to 5) and the depigmentation procedure was carried out. Gingival pigmentation was planned from the second premolar to the central incisor of the first quadrant with scalpel blade (no. 15) using the slicing method, and from the second premolar to the central incisor of the second quadrant with a high-speed handpiece and straight diamond bur (no. 8) with copious water lavage. It is recommended to use the largest size diamond bur suitable; small burs do not smoothen surfaces easily and have a tendency to make small pits in the area to be corrected. Feather-light strokes were used to remove the pigmented areas of epithelium without the holding bur in one place.

Depigmentation of the mandibular region was done from the second premolar to the second premolar with a semiconductor diode laser unit (ezlase, Biolase Technology; Irvine, CA, USA; wavelength 800 to 980 nm) The laser tip was held slightly away from the tissue and the laser beam was directed to the target tissue with a fast motion until blister formation occurred. The blistered gingiva was then scraped with wet cotton to remove the epithelium containing the melanin pigmentation (Fig 6). Coe-pak dressing was placed on the operated site and analgesic was prescribed. No antibiotics were given. The patient was prescribed chlorhexidine mouthwash (0.12%) for 2 weeks.

Clinical parameters were recorded: pain was evaluated using the VAS at 1 day and 1 week (Table 1), whereas wound healing was evaluated immediately after and then at 1 week and 1, 2, and 3 months postoperatively (Table 2) using criteria given by Ishii et al[15] and Kawashima et al[16]; MPI (Takashi et al[14]) was recorded at 1, 2, and 3 months postoperatively to check for any recurrence (Table 1).

To comply with laser safety protocol, safety glasses were used by the operator, patient, and assistant. Highly reflective instruments or instruments with mirrored surface were avoided as there could be reflection of the laser beam. Care was taken to avoid using laser in presence of explosive gas.

CLINICAL EVALUATION AND INDICES

Melanin Pigmentation Index (Takashi et al[14])

The degree of melanin pigmentation was determined based on the following scoring system: score 0: no pigmentation; score1: solitary unit(s) of pigmentation in papillary gingiva without extension between neighboring solitary units; score 2: formation of continuous ribbon extending from neighboring solitary units (Fig 7).

Visual Analog Scale

The visual analog scale (VAS) was used to evaluate the subjective pain level experienced by the patient. The VAS consisted of a horizontal line of 10 cm (100 millimeter) long, anchored at the left end by the descriptor "no pain" and at the right end by "unbearable pain". The patient was asked to mark the severity of the pain. The distance of this point, in centimeters, from the left end of the scale was recorded and used as the VAS score: 0 = no pain; 1 - 3 = slight pain; 3.1 – 6 = moderate pain; 6.1 - 10 = severe pain.

Wound Healing

Wound healing was evaluated based on the following scores: A. complete epithelization, B. incomplete epithelization, C. ulcer, D. tissue defect or necrosis (Table 2).

Fig 1 Pre-operative view of pigmented gingiva.

Fig 2 Punch used for taking biopsy.

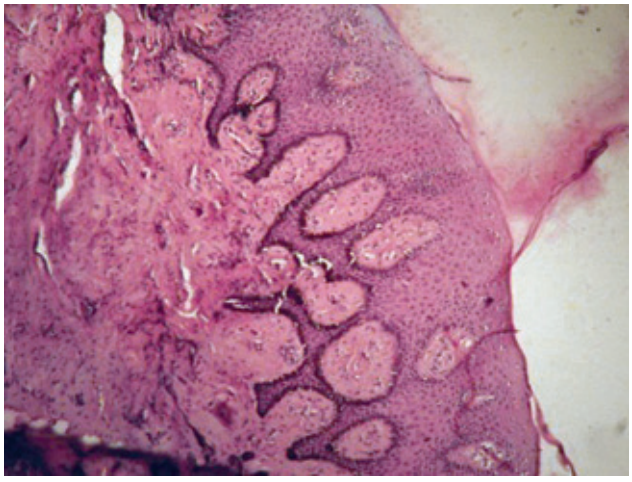

Fig 3 Pre-operative biopsy of 1st quadrant.

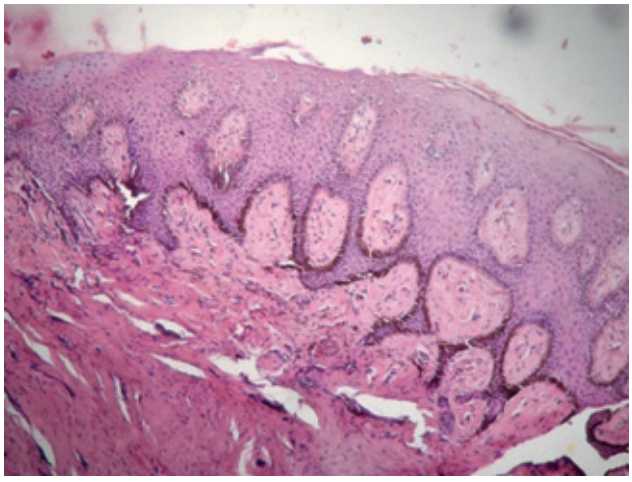

Fig 4 Pre-operative biopsy of 2nd quadrant.

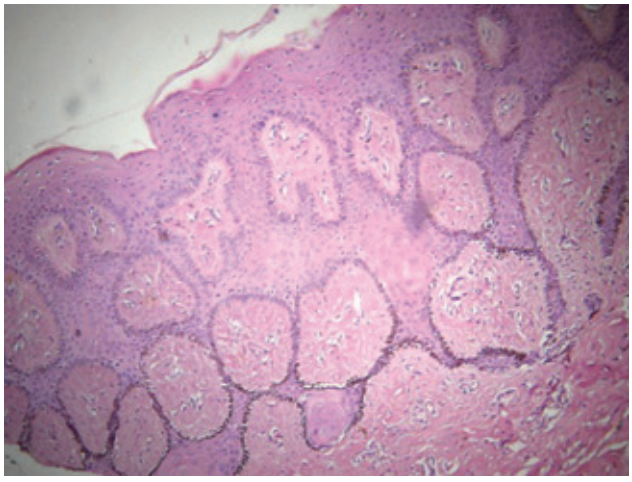

Fig 5 Pre-operative biopsy of mandibular region.

Fig 6 Immediately after laser dipigmentation.

Table 1 Clinical evaluation of pain (VAS) and recurrence of pigmentation (MPI)

Method	VAS		MPI score				
	1 day postop	1 week postop	Immediately	1 week postop	1 month postop	2 months postop	3 months postop
Surgical blade	3.5	1	2	0	0	0	2
Bur abrasion	5	1.5	2	0	0	0	2
Laser	2.5	0.5	2	0	0	0	0

Table 2 Clinical evaluation of wound healing

Method	Wound healing				
	Immediately	1 week postop	1 month postop	2 months postop	3 months postop
Surgical blade	C	A	A	A	A
Bur abrasion	C	A	A	A	A
Laser	C	B	A	A	A

Scores: A. complete epithelization, B. incomplete epithelization, C. ulcer.

RESULTS

Because the patient was under anaesthesia, evaluation of pain was done 1 day postoperatively. Compared to scalpel blade and bur abrasion depigmentation, diode laser showed delayed healing (Table 2). At the VAS evaluation sites operated on with scalpel blade and bur abrasion, the patient complained of moderate pain, but at the site treated with diode laser, only slight or no pain was recorded. However, the pain had reduced considerably 1 week after the surgery (Table 1). The MPI score also showed that there was no recurrence of pigmentation at 3 months (Figs 8 and 9) in the mandibular region which was done by laser (Table 1). This was supported by the biopsies which were taken preoperatively and then at 3-month intervals (Figs 10 to 12).

DISCUSSION

Scalpel surgery causes unpleasant bleeding during and after the operation, and it is necessary to cover the exposed lamina propria with periodontal pack for 7 to 10 days. There is a slight predilection for postoperative discomfort in bur abrasion surgeries. The diode laser causes minimal damage to the periosteum and bone under the gingiva being treated, and it has the unique property of being able to remove a thin layer of epithelium cleanly. Although healing of laser wounds is slower than healing of scalpel wounds, the laser wound is sterile and has no inflammatory reaction.[12] Blood vessels in the surrounding tissue up to a diameter of 0.5 mm are sealed by the laser; thus, the primary advantage is hemostasis and a relatively dry field.

The semiconductor diode laser is emitted in continuous-wave or gated-pulsed modes, and is usually operated in contact mode using a flexible fiber optic delivery system. Laser light at 800 to 980 nm is poorly absorbed in water, but highly absorbed in hemoglobin and other pigments.[13] Since the diode basically does not interact with dental hard tissues, the laser is an excellent soft tissue surgical laser, indicated for cutting and coagulating gingiva and oral mucosa, and for soft tissue curettage or sulcular debridement. The diode laser exhibits thermal effects using the "hot-tip" effect caused by heat accumulation at the end of the fiber, and produces a relatively thick coagulation layer on the treated surface. The mode of action is quite similar to electrocauterization. Tissue penetration of a diode laser is less than that of the Nd:YAG laser, while the rate of heat generation is higher. The advantages of diode lasers are the smaller size of the units as well as the lower financial costs.

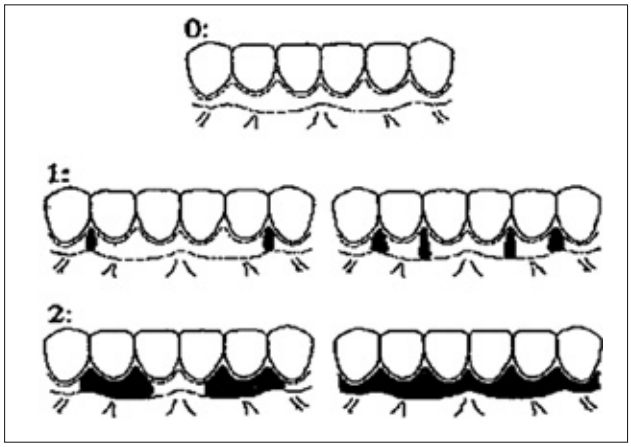

Fig 7 Melanin pigmentation index (Takashi et al[14]).

Fig 8 2 months postoperatively.

Fig 9 3 months postoperatively.

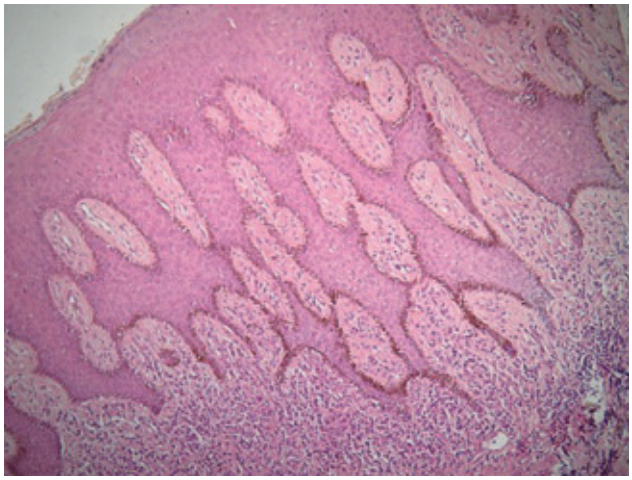

Fig 10 3-month postoperative biopsy of 1st quadrant.

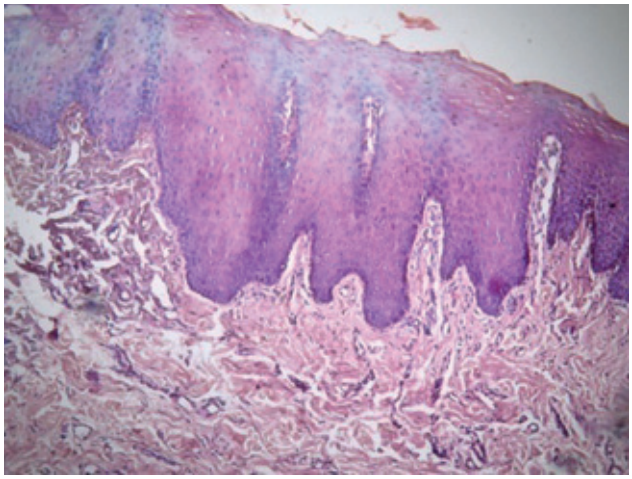

Fig 11 3-month postoperative biopsy of 2nd quadrant.

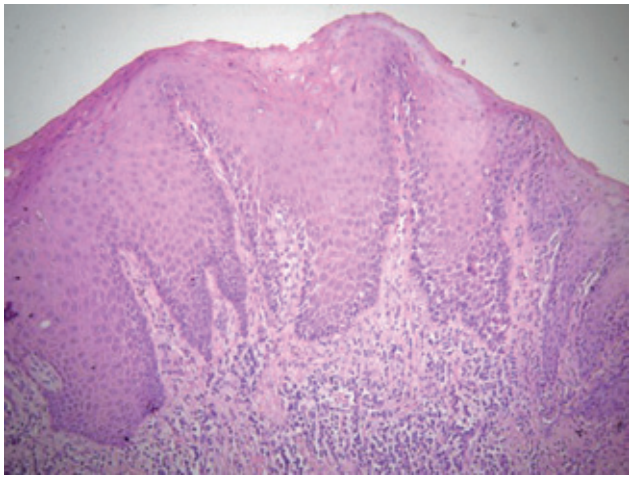

Fig 12 3-month postoperative biopsy of mandibular region.

Diode laser did not produce any deleterious effect on the root surface. Thus, it is generally considered that diode laser surgery can be performed safely in close proximity to dental hard tissue. A relatively bloodless surgical and postsurgical course can be maintained throughout the surgery.

The mechanisms of diode laser that lead 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.[11] As the temperature increases at the surgical site, the soft tissues are subjected to warming (37 to 60°C), protein denaturization, coagulation (> 60°C), welding (70 to 900°C), vaporization (100 to 150°C), and carbonization (> 200°C).[3] 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.[9] Moritz et al in an in vitro and in vivo study showed a bactericidal effect of diode laser.[10] They found an extraordinarily high reduction of bacteria.

CONCLUSION

The need and demand for esthetics requires the removal of unsightly pigmented gingival areas to create a pleasant and confident smile, which altogether may alter the personality of an individual. This could be easily attained by using any of the methods described above. The application of diode laser appears to be a safe and effective alternative procedure for the treatment of gingival melanin pigmentation. Its benefits include ease of usage, effectiveness in the treatment of superficial benign pigmented lesions, convenience in dental clinics, and decreased trauma for the patient.

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