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CASE REPORT
Aesthetic Treatment of Gingival Hyperpigmentation by Er:YAG Laser

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Gingival hyperpigmentation may cause aesthetic problems and embarrassment, especially in patients with a gummy smile. This report presents the use of the Er:YAG laser (settings: 250 mJ, LP mode, 15 Hz, with water and air) for gingival depigmentation. This patient's treatment required about 20 to 25 minutes for completion of the procedure. Ablation of the gingival hyperpigmented areas was accomplished without bleeding complications or postoperative pain. The patient was evaluated three months after completion of the treatment and no recurrence of hyperpigmentation had been found.

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I. INTRODUCTION

One of the important factors in a "smile" is the color of the gingiva. Several factors determine the color, including increase or decrease in blood vessels, thickness of the epithelium, extent of keratinization, and endogenous and exogenous pigmentation [1]. Oral pigmentation is a discoloration of the oral mucosa or gingiva due to a variety of conditions associated with several exogenous and endogenous etiological factors [1]. Most pigmentation is caused by five primary pigments: melanin, melanoid, oxyhemoglobin, reduced hemoglobin, and carotene [2]. Melanin is the most common of the endogenous pigments and is produced by melanocytes present in the basal and supra basal cell layers of the epithelium [2, 3]. The degree of pigmentation depends on a variety of factors, especially the activity of melanocytes. Fair-skinned individuals are very likely to have non-pigmented gingiva, but in darker skinned persons, the chance of having pigmented gingiva is extremely high. The highest rate of gingival pigmentation has been observed in the area of the incisors. The rate decreases considerably in the posterior regions [4]. Several procedures have been used for gingival depigmentation. Although some procedures, such as chemical methods [5] are no longer in use, other methods, such as gingival abrasion [6] and scalpel methods [7], have been applied with variable results. Recently, laser ablation has been recognized as one of the most effective, comfortable, and reliable techniques [5]. Many laser systems such as Q-switched ruby laser, flash-lamp pumped-dye laser, argon laser, CO2 laser, Nd:YAG laser, diode laser and Er:YAG laser have been used for dermal depigmentation [1,8,9,15]. The Er:YAG laser produces invisible, infrared light with a wavelength of 2940 nm, which is ideal for absorption by water and hydroxyapatite. Therefore, it is used for hard-tissue (enamel, dentin, cementum, and bone) and soft-tissue procedures. The Er:YAG wavelength corresponds to the highest absorption coefficient in water, causing water to evaporate into steam in the tissues, resulting in microexplosions (a thermomechanical effect) in the tissue. The Er:YAG wavelength has the highest water absorption and least penetration inside the tissues (1 μm) [10]. Therefore, it causes the least thermal damage, avoids scarring and enables faster wound healing. The following case report describes a successful depigmentation using the Er:YAG laser. The Er:YAG wavelength (2940 nm) does not coincide with melanin's absorption spectrum (351 to 1064 nm) [10,11]. However, in cases of gingival hyperpigmentation, the Er:YAG laser is used to remove the melanin pigmentations by ablating epithelial tissues up to the suprabasal and basal layers of the epithelium, where melanocytes reside. The only reason for depigmentation in this patient was to satisfy their demand to improve aesthetics. The following case shows successful depigmentation using an Er:YAG laser.

II. CASE

A 34-year-old female with dark skin color complained about her colored gingiva (Fig 1). The color of the gingiva was dark to black, and there were no contributory medical problems. The pigmented regions were most pronounced in the anterior region, so that she was not happy with her smile and esthetic appearance.


Fig 1: Intraoral, pre-operative view of the case.

Topical anesthetic gel was applied to the operational field. In compliance with FDA rules, the patient and staff used special eyeglasses for protection. Caution was also taken near reflective surfaces, since the laser beam may be reflected from dental mirrors or instruments and absorbed by other intraoral regions. The Er:YAG laser (LightWalker, Fotona, Slovenia) was set at 250 mJ (delivered fluence per pulse: 31.8 J/cm^2), 15 Hz, LP mode (600 μsec) with air and water 16 ml/min; a contact handpiece (H14) with 1 mm distance was guided with a sweeping motion, localized only on the pigmented regions. The procedure was performed in a cervico-apical direction on all pigmented areas. During the procedure, the operational field was wiped with sterile gauze soaked in 1% normal saline solution. The depigmentation procedure continued until no pigments remained. The complete treatment was performed in 20-25 min. After wiping the operation field for the last time, there was slight bleeding (Fig 2, 3). No periodontal pack or additional material was applied to support the healing procedure. The patient was instructed to avoid smoking, alcohol, and spicy foods. He was advised to keep his wound area clean by soft brushing for the first week. No analgesic was prescribed.


Fig 2: Immediately after irradiation of upper jaw.


Fig 3: Immediately after irradiation of the lower jaw.

III. CLINICAL RESULTS

The Er:YAG laser used with water spray effectively ablated the epithelial tissue exhibiting melanin pigmentation. Immediately after the procedure, gingival connective tissue was exposed with slight bleeding; the treated surface did not exhibit major thermal changes (Figs. 2, 3). At the 3-month evaluation (Fig. 4), the Er:YAG laser surgery was successful and the treated site showed uneventful wound healing without any severe post-surgical problems. Laser ablation was performed on keratinized gingival oral mucosa. No recurrence of gingival hyperpigmentation was found during the follow-up period (3 months).


Fig 4: Three months after treatment. Note the excellent improvement of severe maxillary and mandibular gingival discoloration, without gingival recession and deformity.

IV. DISCUSSION

Recently, laser ablation has been recognized as an effective, pleasant, and reliable technique [10]. It is preferred over scalpel techniques by many clinicians. When laser energy interacts with biologic tissue, the effect is influenced by the emitted wavelength, laser energy, time of exposure, and rate of movement of the fiber tip across the target tissue. The tissue's optical properties and the color of the tissue are also important factors. Actually, the absorption of laser energy in the tissue is the key element of laser-tissue interaction. Pain reduction, intra- and postoperatively, and rapid wound healing are important advantages of laser use [12].

In this case, the patient reported an absence of pain intra-operatively (without the use of local anesthesia) and immediately postoperatively. No analgesics were prescribed. Pain reduction after using lasers may be due to the protein coagulum that is formed on the wound surface, thereby acting as a biologic dressing [12]. In addition, it may be due to the sealing of the ends of the sensory nerves [13]. The Er:YAG laser has the least thermal damage and least tissue penetration

(1 mm)[10], resulting in minimal tissue necrosis. All of these factors can reduce pain. In addition, rapid wound repair following Er:YAG treatment and its bactericidal effect can be related to the generation of reactive oxygen species in irradiated tissue, which have sterilization effects, stimulate fibroblasts, and cause collagen and extracellular matrix formation. All of these factors may explain rapid wound healing after using an Er:YAG laser [14]. Because the Er:YAG laser has the least thermal damage [10], there were no reported complications of tissue carbonization or gingival damage. In the present study, laser ablation of papillae and the gingival margin gave excellent results without any reported damage (Figs. 2, 3). The advantages of laser use in periodontal surgeries include the following: 1) a relatively bloodless surgical and post-surgical course; 2) the ability to coagulate, vaporize, or cut tissues; 3) sterilization of the wound site; 4) minimal swelling and scarring. Taking into account all these advantages of laser usage, it can be concluded that laser treatment is more predictable then other treatment modalities.

V. CONCLUSIONS

In the present case report, the depigmentation of melanin hyperpigmented gingiva by the Er:YAG laser gave superior results in terms of improving the patient's aesthetics, taking into account the advantages of using lasers such as rapid wound healing and the absence of discomfort, sensitivity, pain, or bleeding complications intra-operatively and postoperatively. During the follow-up period, no recurrence of gingival hyperpigmentation was found in this case.

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