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Assessment of Erbium laser therapy for gingival depigmentation, its safety and effectiveness

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Abstract

Background: Erbium lasers may be used for both soft and hard tissue treatments, they are a more beneficial tool for dentists than other tools. Thus, we used erbium lasers to treat the gingival depigmentation.

Materials and methods: The purpose of this randomized prospective trial was to evaluate erbium laser efficacy in the treatment of gingival depigmentation. (erbium, chromium: yttrium-scandium-gallium-garnet (Er, Cr: YSGG) laser (Waterlase MD, Biolase Technology, Inc., Irvine, CA) was used for the treatment of hyperpigmentation. **Results:** Erbium laser showed healing results after 7 days. An epithelial layer had formed in most laser-treated patients after 1 week, all treated cases showed complete healing, epithelialization, and tissue thickness recovery.

Conclusion: Er, Cr: YSGG laser is a more practical technique for gingival depigmentation

Keywords: gingival depigmentation, erbium, chromium: yttrium-scandium-gallium-garnet laser.

Introduction

Cosmetic procedures are becoming increasingly popular, and it is well-known that gum health is just as crucial to a good smile as teeth. Patients and professionals who want to ensure a more beautiful smile by integrating gingival and dental elements, and increasing face harmonic characteristics, have traditionally placed a high value on aesthetics. Modern technology tools combined with cosmetic surgery allow professionals, particularly in periodontics, to more accurately and predictably suit each patient's cosmetic needs [1].

The excessive accumulation of melanin in the gingival tissues leads to gingival hyperpigmentation. There are a number of potential underlying explanations for this illness, including genetic factors like physiologic pigmentation, which is the most common type of diffuse oral mucosal pigmentation and is primarily present in dark-skinned cultures. The preferred course of action for patients who are solely concerned with enhancing their aesthetic appearance is gingival depigmentation [2,3]. Melanoplasty is a periodontal cosmetic procedure used to eliminate areas of hyperpigmentation of melanin to cure gingival

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pigmentation. Numerous methods, including electro-surgery, cryosurgery, wear of a scalpel blade, and drill wear, can be used to achieve it. Laser therapy is an alternate technique for removing gingival pigmentation and melanin [4]. Among the numerous techniques, lasers have become the most popular and generally recognized treatment for gingival depigmentation. This is in contrast to the intrusive nature of traditional knife surgery, which frequently results in pain, bleeding, and large wounds after the procedure [5]. In comparison, laser ablation therapy is less intrusive, uses less local anesthetic, and produces less pain and suffering after surgery. Furthermore, the increased hemostatic activity of lasers produces a bloodless surgical area that enhances the operator's vision and, consequently, the aesthetic results [6]. Gingival depigmentation has been achieved using the diode, CO2, Erbium, and Nd: YAG lasers, compared to other types of lasers. The affinity of the laser for specific chromophores in the tissue affects the interaction between the laser and the tissue [7]. Since erbium lasers may be used for soft and hard tissue treatments, they are a more beneficial tool for dentists than other tools. Thus, we used erbium lasers to treat the gingival depigmentation.

Materials and methods

Study design:

The research was carried out following the 1975 Helsinki Declaration's amended guidelines in 2000. Before beginning, every patient received a thorough explanation of the study's goals and methods and completed an informed consent form in writing. Independent examiner unrelated to the study conducted all post-treatment observations. The purpose of this randomized prospective trial was to evaluate erbium laser efficacy and patient tolerability.

Inclusion criteria:

Based on modified Dummet et al. criteria, patients with bilateral melanin pigmentation in the anterior region of the upper and lower gingiva were classified as either severe (mixed in color) or moderate (deep brown or black). The patients were healthy, at least eighteen years old, and had previously been diagnosed but not treated. The smokers in the study group exhibited gingival hyperpigmentation before starting to smoke. [8]

Exclusion criteria:

pathologic gingival hyperpigmentation or improper wound healing (e.g., uncontrolled diabetes or autoimmune disease); and periodontal issues.

Treatment procedure:

(erbium, chromium:yttrium-scandium-gallium-garnet (Er, Cr: YSGG) laser (Waterlase MD, Biolase Technology, Inc., Irvine, CA) used for the treatment of hyperpigmentation with 2.5 W, 50 Hz, 700 μs pulse duration (S mode), 20% water, 40% air (water flow rate of 9 ml/min). Handpiece was used in a non-contact mode by sweeping motion, it was held 1 mm away from the tissue in defocused mode. Tip MZ6) [9]. The operator, assistant, and patient wore laser safety glasses during the procedures. Photographs were taken at baseline, 1st, and 7^{th} days from all patients. Pain, patient satisfaction, and gingival wound healing and repigmentation were evaluated post-operatively. by healing response and using the Likert scale and Melzack McGill pain score Likert scale measures how patients feel and the level of agreement out of 5 points and Melzack McGill pain score used for the multidimensional assessment of pain.

Results:

The average age is 30.7 with the youngest patient being 18 and the oldest being 46. 65% were males and 65% were smokers. The Likert scale had with mean of 1.75, the pain scale with a mean of 1.65, and the healing response with mean of 2.35

Table (1): Patients gender, age, and smoking history

Case	Gender	Age	Smoker
1	M	18	+
2	F	34	+
3	M	38	-
4	M	42	-
5	M	19	+
6	F	25	+
7	F	32	+
8	M	18	+
9	F	29	+
10	F	30	+
11	M	31	-
12	M	30	+
13	M	41	-
14	M	46	+
15	M	39	-
16	F	28	+
17	F	27	+
18	M	31	-
19	M	23	+
20	M	33	+
Average	M 65%	30.7	S 65%
	F 35%		NS 35%

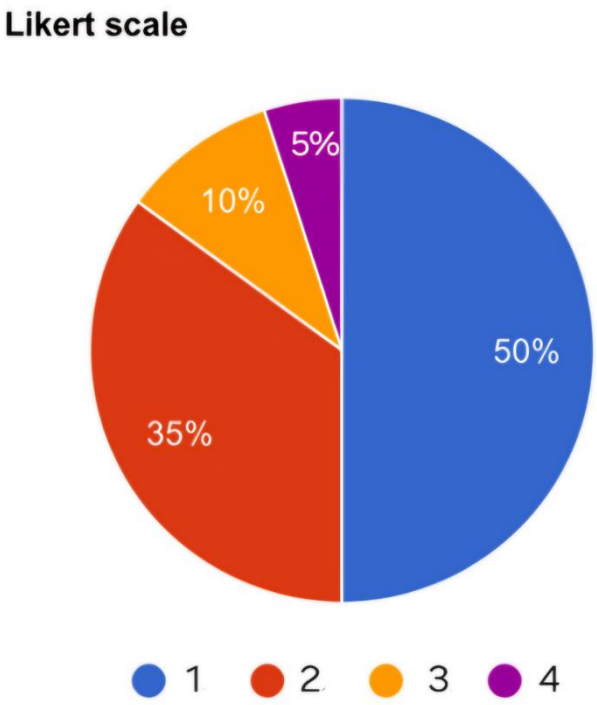

Figure (1): values according to Likert scale: According to Likert scale [58] 50% of cases are grade 1, 35% grade 2, 10 % grade 3 and 5% grade 4.

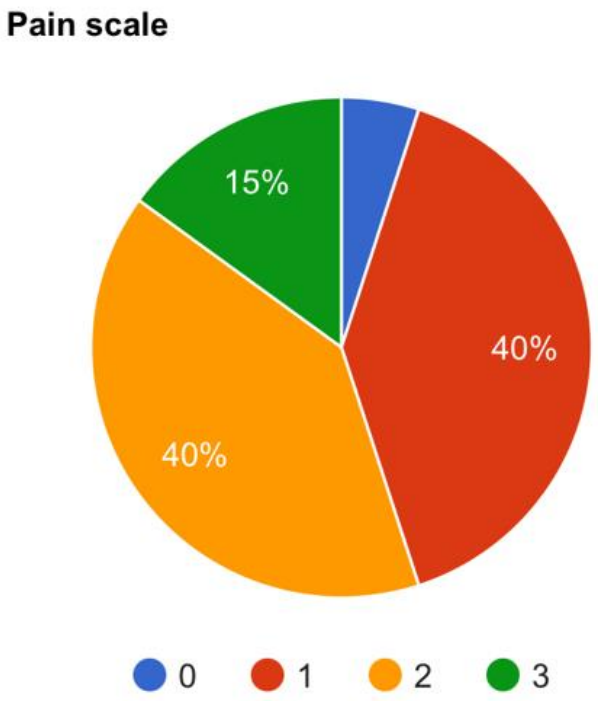

Figure (2): values according to Melzack McGill pain score, according to Melzack McGill pain score [59] 5% of cases are grade 0, 40% grade 1, 40% grade 2, and 15% grade 3.

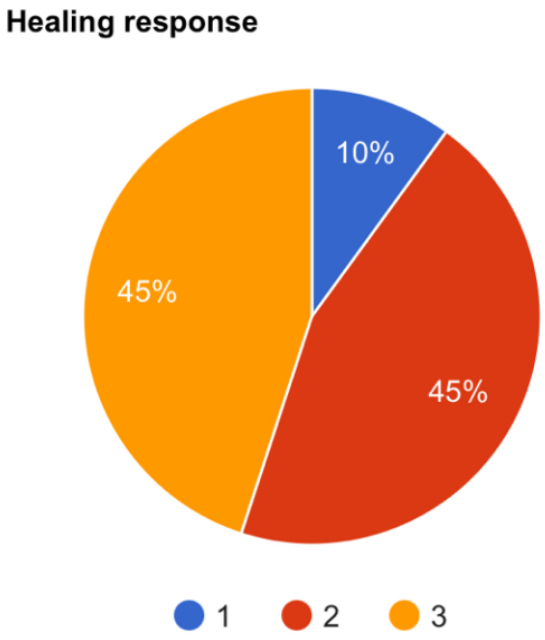

Figure (3) values according to healing response, according to healing response, 10% of cases are grade 1, 45% grade 2, and 45% grade 3.

Table (2): Relation of healing to age, smoking, and gender.

Correlation		Healing
Age	r	0.102
	p-value	0.668
Smoker	r	-0.017
	p-value	0.944
Gender	r	0.088
	p-value	0.712

Table (2) Shows that healing is positively correlated to age although that is not significant, also healing is negatively correlated to smoking, and it is not significant regarding gender, healing is positively correlated to the male gender.

Discussion

Nowadays, everyone is quite concerned with appearance. Gingival hyperpigmentation is a concern, especially in patients with high or extremely high smile lines. The only available treatment for hyperpigmentation is depigmentation [9]. Gingival hyperpigmentation can be treated with a variety of techniques, including chemical cauterization, lasers, cryotherapy, diamond bur abrasions, and scalpel de-epithelization. The most straightforward and reasonably priced treatment option among all of these is the scalpel approach in conjunction with diamond bur abrasions. The scalpel technique has a few disadvantages, including bleeding during and after surgery, a lengthy process, and pain and discomfort following surgery. Erbium lasers are one tool that can be utilized for a variety of dental treatment procedures, as other treatment methods require expensive equipment and specialized training to complete the treatment [10]. In more cases, there will be little to no discomfort throughout the treatment, based on our evaluation of patient pain levels. The larger ablative effect observed in this setting, which leads to high peak powers and a bigger ablative effect, appears to be the cause of the reduced discomfort experienced with the laser. Less heat and coagulative effects on the tissue may also result from the increased water spray in this situation. This may account for the fact that patients felt less discomfort during and immediately following the treatment [9]. In addition, Hegde et al. found that utilizing a blade during the first- and seventh days following treatment produced more pain when compared to CO2 and Er: YAG lasers [11]. Butchibabu et al. produced a case series in which they compared the blade technique to a diode laser. and on days 1, 3, and 7, following the treatment, the pain was measured using the VAS. Additionally, they reported more discomfort in the areas treated by blades than in those treated by lasers. Their findings, while comparable to ours, were likewise not statistically significant [12]. Er: YAG laser use has also been linked to less discomfort, according to Azzeh and Kishore [13, 14]. Gingival melanin pigmentation has been eliminated in case reports by using Er, Cr, and YSGG. Also, they claimed that the erbium laser was gentle, with nearly little pain or bleeding. This is related to the coagulation of nerve terminals, which produces a painless procedure and forms a layer that acts as a biological barrier containing both fibrin and coagulation proteins [15]. In this study, Erbium laser showed superior healing outcomes after 7 days, even though these results lacked statistical significance. After one week, the majority of laser-treated patients had developed an epithelial layer; all treatment cases demonstrated full healing, epithelialization, and tissue thickness recovery.

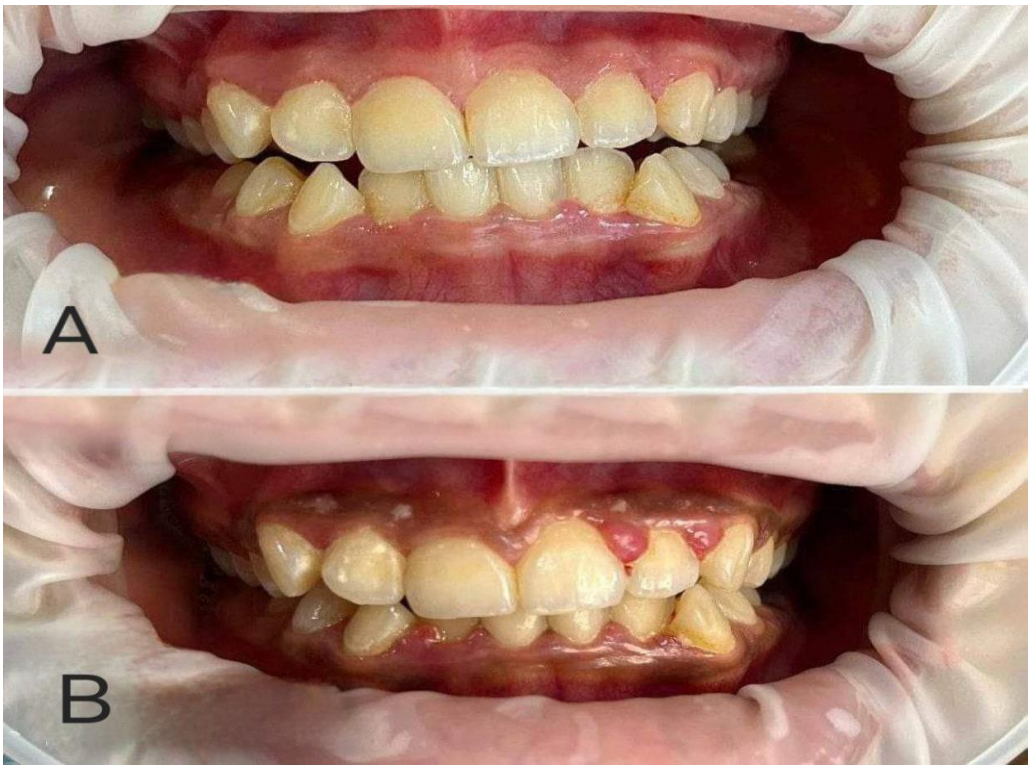

Figure (4) treatment of gingival pigmentation with (Er, Cr: YSGG) laser. A) after the treatment. B) before the treatment.

Murphy [16] looked at three methods on three patients in a case series: bur abrasion, surgical blade, and diode laser. Their findings indicate that the blade group healed the fastest, most likely as a result of possible thermal injury from the diode laser's coagulation activity. This differed from our findings since the Er, Cr: YSGG laser did not produce these effects. Additionally, the erbium laser only affects the tissue's surface layer through its ablative mechanism of action, which limits its penetration into gingival tissue. Compared to using a blade, this does less damage to deeper layers and promotes faster wound healing. This was in line with the findings of a Rosa et al. investigation on Er: YAG [17]. We noticed quick epithelialization of the gingiva in one week for the healing process, and in every case, the gingiva appeared healthy. This is because the water in the tissue absorbs a large amount of energy from erbium laser wavelengths, which quickly heats the tissue to its ablative temperatures and causes elimination by ablation. Additionally, the air stream and the water sprayed on the operation field may assist prevent heat injury to the surrounding tissues [18,19]. These lasers' antibacterial and photobiostimulation properties may help promote wound healing. During treatment, the intermittent low levels of laser light may function as low-level laser therapy, causing a chain reaction of photobiostimulative phenomena that might influence cellular metabolism and promote beneficial biological effects that enhance the healing of gingival tissue. Low-level laser treatment using an Er: YAG laser has been shown by Ogita et al. to cause enhanced proliferation and a significant change in protein expression in human gingival fibroblast cells [20, 21]. Additionally, Hedge et al. examined three approaches using CO2 lasers, Er: YAG, and blades with a 6-month follow-up. When compared to Er: YAG, they discovered that the CO2 laser healed the least quickly. Additionally, the tissue is more coagulatively affected by this laser. However, the erbium laser produced superior

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outcomes [11]. In comparison to other lasers, particularly Er, Cr: YSGG, has been shown to produce faster healing outcomes, according to a paper by Bakhshi et al. As previously indicated, the water-mediated ablation process of these lasers tends to ablate the tissue with little harm to the underlying tissues. Within the first 24 hours of therapy, a fibrin layer appears on the gingiva; a week later, healing is nearly complete, the tissue color returns to normal, and there is no scarring, comparable to the outcomes of our study [22]. Nevertheless, bleeding occurs even if the blade approach is quick, easy, and efficient. As a result, tiny hematomas may develop that take longer to fuse into a fibrin layer. When compared to laser treatment, the larger fibrin coating slightly slows down the healing process. A couple of our instances with deeper pigmentations showed signs of this. Numerous other studies have found that lasers, particularly erbium lasers, are superior to conventional blade therapy, which is consistent with our findings [12, 13, 15]. In certain circumstances, the melanin has not been fully removed. This was most likely caused by the setting's coagulative action on gingival tissue, it causes brown-black discolorations that make it more challenging to detect deeper melanin pigmentation when surgery is performed. However, when the laser and its enhanced ablative effects were combined with a water spray as a coolant, more ablation and less coagulation were seen. This, together with the water's washing effect, improved the visibility of the operating field. As a result, the pigmented tissue could be removed more precisely and thoroughly [23].

Conclusion

Our findings suggest that the Er, Cr: YSGG laser is a better technique for gingival depigmentation. A laser with a shorter pulse duration and a stronger water spray produced superior outcomes. This laser can safely and effectively eliminate pigmentations.

Funding: NONE

Conflicts of interest

The authors have no conflicts of interest.

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