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Original Research

A Retrospective Analysis of Er:YAG Laser Treatment in Solar Lentigines: Our Clinical Observations

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Abstract

Objectives: To investigate the efficacy of erbium-doped yttrium aluminium garnet (Er:YAG) laser in the treatment of solar lentigines.

Methods: A retrospective study was conducted on patients treated with the only Er:YAG laser. In this study, 14 patients with multiple solar lentigines before treatment were included. Treatment parameters and all side effects were recorded. One independent, blinded dermatologist evaluated the clinical improvement and the patients also scored their satisfaction degree with the treatment.

Results: The mean age of the patients was 41.07±7.16 years. The number of mean treatment session for each patient was 1.79±1.05. At the final visit, excellent improvement (76–100% clearance) was reached in eight (57.1%) patients, while good improvement (51-75% clearance) was achieved in five (35.7%) patients. Ten patients (71.4%) were very satisfied and four (28.5%) patients were satisfied with the results of the treatment. No side effects occurred.

Conclusion: Er:YAG laser treatment may be an effective and safe optional modality for solar lentigines.

Keywords: Erbium:YAG laser; lentigo; therapy.

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Solar lentigos are benign hyperpigmented macules that often occur due to sun exposure. In solar lentigo, melanin accumulation is observed in keratinocytes due to different degrees of melanocyte proliferation.[1] In histological examination, narrowing of rete ridges, pigmentation, increase in the number of melanocytes and melanophages are frequently observed.[2] In these lesions, dermoscopic features, such as pseudonetwork, light brown fingerprint appearance, hairpin-shaped veins, have been defined.[3] We should note that the diagnosis of solar lentigo is almost always made clinically.[1, 2] Solar lentigos are completely benign; they do not show premalign features.[1] Despite this, there is an investigation for treatment due to the esthetic concerns of the patients, as it is a significant finding of photoaging. Many treatment options, such as skin peeling creams, cryotherapy, exfoliating agents, and recently various lasers and light sources, have been applied in solar lentigos and acceptable results have been reported.[1]

Topical creams, mainly tretinoin and hydroquinone, trichloracetic acid applications, cryotherapy, are being used for years for the treatment of solar lentigo. In addition, topical tyrosinase inhibitors and different combinations of acids causing ablation have been used in its treatment. The use of ablative and pigment-specific laser systems in solar lentigos has been reported in few studies or frequently in

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case reports.[5] There are publications reporting that erbium-doped yttrium aluminum garnet (Er: YAG) lasers[6] have been used in the treatment of solar lentigo.[7, 8]

We also use the Er: YAG laser device in the treatment of solar lentigo in our clinic. In this study, we retrospectively analyzed the results of Er: YAG treatment that we applied in solar lentigo.

Methods

The Study Plan

Patients who underwent Er: YAG laser treatment due to their solar lentigo were retrospectively analyzed in this study. Patients who did not receive any treatment for solar lentigo before and patients received only Er: YAG laser treatment were included in this study. Cases with missing file information were not included in this study. Age, gender, localization of solar lentigo, number of laser treatments and treatment parameters were recorded. As with all sunlight-dependent diseases and laser procedures, Fitzpatrick skin types were recorded. This classification describes six different skin types based on the color of the skin of the people and their response after exposure to sunlight. This typing is as follows: Type I: Very white or freckled skin always burns, but does not tan when exposed to sunlight; Type II: Fair skin, burns easily tans poorly; Type III: Darker white skin, tans after initial burn; Type IV: light brown skin, burns minimally, tans easily; Type V: Brown skin, rarely burns, tans easily; Type VI: Dark brown or black skin, never burns; always tans darkly.[9]

Consent was obtained from all patients who participated in this study, indicating that their medical data could be shared at the first application. This study was approved by the hospital ethics committee and conducted in accordance with the Principles of the Helsinki Declaration.

Laser Therapy

Er: YAG laser (Fotona SP Dynamis, Ljubljana, Slovenia) treatment was applied to all patients by the same dermatologist. Laser was applied after skin cleaning of the areas to be treated.

Laser parameters were determined according to the characteristics of the patient's skin and the response in the previous session. The parameters of 2940 nm Er: YAG laser therapy were as follows: R11 head, 4-6 J/cm^2 energy, 5 mm diameter head, 3-5 Hz frequency, short pulse (SP) mode. Epidermal cooling device was used simultaneously during laser treatment, and all patients wore protective glasses. After the procedure, all patients were prescribed epithelial creams and patients were warned to avoid sun exposure.

Clinical Evaluation

Patients were photographed with a digital camera before treatment and after each procedure applied to the patient. The effectiveness of the treatment was evaluated by comparing the photos taken before and three months after the treatment. These photographs were evaluated by a neutral dermatologist who did not know about the treatment applied to the patient(s). The patients were evaluated based on a total of 4 points according to the rate of regression in pigmentation as follows: 0: mild (0-25%) improvement, 1: mild-moderate (25-50%) improvement, 3: good (51-75%) improvement, 4: excellent (76-100%) recovery. In addition, patients evaluated their level of satisfaction with the results of the treatment on a 4-point scale as follows. 1: not satisfied, 2: fairly satisfied, 3: satisfied, 4: very satisfied.

Statistical Analysis

SPSS 17 (Statistical Package for Social Sciences SPSS Inc., Chicago, IL) program was used for statistical analysis. Complementary data were expressed as mean±standard deviation, quantitative variables and percentages. The differences between the two independent groups were analyzed by the nonparametric Mann-Whitney U test. $P<0.05$ was considered statistically significant.

Results

The demographic characteristics of the patients included in this study are shown in Table 1.

Solar lentigo patients who received Er: YAG laser therapy between July 2017 and July 2018 participated in this study. Fourteen female patients were included in this study. The mean age of the patients was 41.07±7.16 (33–52 years). The skin type of all patients included in this study was Fitzpatrick skin types II and III (four patients with skin types II, and 10 patients with skin types III). The solar lentigos of nine patients were located on the face, four patients on the chest, three patients on the back and one patient on the hand.

Mean number of 1.79±1.05 (1–4) treatment sessions were

Table 1. Demographic features of the patients

Age (years)	Min–max	33-52
	Mean±SD	41.07±7.16
Gender	Female	14
	Male	0
Fitzpatrick skin type	II	% (n=4)
	III	% (n=10)
Number of treatment sessions	Min–max	1-4
	Mean±SD	1.79±1.05

applied to the patients. Three months after the last treatment session, all patients showed improvement after treatment. Eight patients (57.1%) had excellent recovery (76–100%), while five patients (35.7%) had a good recovery. Ten patients (71.4%) were very satisfed with the treatment results and four patients (28.5%) were satisfied with the treatment results (Table 2). The mean score of the response to the treatment evaluated by the dermatologist was 3.5±0.65 points, whereas the mean score of the patients showing their satisfaction with the treatment results was 3.64±0.497. There was a positive correlation between between the evaluations of dermatologist and patients ($p<0.05$).

All patients were followed for at least three months after treatment. No side effects were observed.

Discussion

In this study, where we retrospectively evaluated 2940 nm Er: YAG laser applications in the treatment of solar lentigo in our clinic, we have shown that Er: YAG laser therapy can be a safe and effective treatment method in the treatment of solar lentigo.

Solar lentigos are small, brown and benign lesions that are formed in adulthood due to sun exposure.[5]

Most solar lentigo patients seek treatment because of their cosmetic appearance. Although there are many chemical or physical treatment options, the treatment of solar lentigo is still a considerable challenge for physicians.[4, 10] Topical hydroquinone and tretinoin, chemical peeling agents, cryotherapy, laser treatments, and intense pulsed light (IPL) treatments have been used in solar lentigos.[11] There are studies in which various laser treatments, such as pulsed dye laser (PDL), Q-switched ruby, Q-switched Nd: YAG, Alexandrite, Er: YAG, and CO_2 lasers, have different degrees of effectiveness in the treatment of solar lentigos.[5, 12]

Lentigos can be treated with many ablative and non-ablative lasers. Although 532 nm Q-switched Nd YAG laser is generally reported as the first-choice device due to its high level of evidence, use of various lasers such as CO_2, argon, 532 nm Q-switched Nd: YAG, Q-switched ruby laser, Q-switched alexandrite laser and long-pulsed Alexandrite laser are also reported to be used in the treatment of solar lentigos.[4] Schoenewolf et al.[13] compared the efficacy of 694 nm Q-switched ruby laser and fractional CO_2 laser in the treatment of solar lentigo and reported better response to treatment in the Q switched ruby laser group. In the study where Vachiramon et al.[1] compared the efficacy and development of postinflammatory hyperpigmentation (PIH), Q-switched Nd: YAG and fractional CO_2 lasers in solar lentigo; Nd: YAG laser was found to be more effective. In addition, the mean pain score was found to be higher, and recovery time was longer in the Nd: YAG group compared to the CO_2 laser group, without any significant difference between the two groups in terms of PIH development.[1] Imhof et al.[14] compared the topical mixture of Q-switched ruby laser and hydroquinone 5%, tretinoin 0.03%, and dexamethasone 0.03% in solar lentigos located on the back of the hand. According to the needs of the patient, Q- switched ruby laser treatment was applied for one or two sessions, and topical treatment was applied once a day for a total of seven weeks. The Q-switched ruby laser has been found to be more effective than topical treatment.[14]

Tian et al.[7] reported good results in five Asian lentigo patients who received the combination of 532 nm Q-switched Nd: YAG and then fractional non-ablative 2940 nm Er: YAG laser for the treatment of solar lentigo. In a study where Alexandrite laser was applied to 11 solar lentigo patients, more than 50% improvement was reported in the treatment of the lesions of the patients. Fractional ablative lasers are used in photodamage treatment. Lomeo et al.[8] compared the efficacies of microfractional Er: YAG laser and microfractional CO_2 laser treatment in 10 photodamaged patients, and reported significantly more successful results with microfractional CO_2 laser. Manstein et al.[15] reported the effectiveness of the fractional laser as 34-66% in 30 patients with solar lentigo. Recently, ablative lasers such as ablative 10.500 nm fractional CO_2 laser and non-ablative 1.927 nm fractional thulium lasers have also been used in the treatment of lentigo.[16] In a study comparing the efficacy of Q-switched Nd: YAG laser, krypton laser and cryotherapy in solar lentigo, Q-switched Nd: YAG laser treatment was found to be more effective.[17]

Er: YAG lasers are used for controlled surface ablation. Since the thermal damage caused by Er: YAG lasers are more superficial than that of other ablative laser systems, Er: YAG laser treatment requires a shorter reepithelization time and is a less painful procedure.[18]

In this study, the results of solar lentigo patients who were treated with Er: YAG were examined. Thirteen of fourteen

Table 2. Evaluation of the treatment effectiveness by the physicians, and patients three months after treatment

Assessments of the physicians			
Mild recovery (0-25%)	Mild-moderate recovery (26-50%)	Good recovery (51-75%)	Excellent recovery (76-100%)
0	7.14 % (n=1)	35.7% (n=5)	57.1% (n=8)
Assessment of the patients' levels of satisfaction			
Not satisfied	Fairly satisfied	Satisfied	Very satisfied
0	0	28.5% (n=4)	71.4 % (n=10)

patients showed good and excellent recovery. All of the patients reported that they were satisfied or very satisfied with the treatment results. No side effects were reported. However, as a limitation of this study, all patients participating in this study had skin types II and III, which restricted us from commenting on how the treatment results will be in darker-skinned people. In addition, the response of solar lentigo to treatment by location could not be investigated because it was not statistically significant due to the limited number of patients in the groups. The small size of this study group and the short follow-up period are other limitations of this study.

As a result, we believe that 2940 nm Er: YAG laser can be an effective treatment for the elimination of solar lentigo lesions.

Disclosures

Ethics Committee Approval: Bahcesehir University Faculty of Medicine, Clinical Research Ethics Committee. Approval no: 22481095-020-1241, date of approval: 12/06/2018.

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