

Treatment Indications of Carbon Solution-Assisted Nd:YAG Laser According to Patient Satisfaction: A Retrospective Study

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ABSTRACT **Introduction:** Carbon solution-assisted Nd:YAG lasers were previously used in enlarged pores; hair removal; acne and acne scars; and facial rejuvenation.

Objectives: The aim of this study is to determine the patient satisfaction for different treatment indications of carbon solution-assisted 1064 nm Nd:YAG lasers.

Methods: This is a retrospective study that included the patients who were treated with carbon solution-assisted 1064 nm Nd:YAG laser with any indication in a private dermatology practice. A pre-prepared carbon solution was applied 30 minutes before the laser treatment with the following parameters: a spot size of 8mm, fluence of 1.3 J/cm² and a frequency of 8Hz. Patient satisfaction was assessed with GAIS.

Results: A total of 272 patients were included; of these 70 patients had acne lesions, 135 patients had melasma, 27 patients had post-inflammatory hyperpigmentation, 17 patients had ephelides and 23 patients had solar lentigines. The mean patient satisfaction for solar lentigo patients (4.35/5) was greater than for that of acne patients (4.26/5) which was greater than that of ephelide patients (3.94/5) which was greater than that of melasma patients (3.67/5) which was greater than that of post inflammatory hyperpigmentation patients (2.30/5)

Conclusions: This study revealed that carbon solution-assisted 1064 nm Nd:YAG laser therapy is effective in the treatment of solar lentigo, acne vulgaris, ephelides and melasma. However, it fails to provide therapeutic efficacy in post-inflammatory hyperpigmentation.

Introduction

The Q-switched neodymium doped-yttrium (Nd:YAG) lasers are used in cosmetic dermatology in order to improve skin texture, decrease wrinkling and for an overall skin rejuvenation. Nd:YAG lasers have a wavelength of 1064 nm which can penetrate deep into the dermis; however, the longer wavelength limits its efficacy in targeting epidermal melanin and hemoglobin [1]. The application of a topical carbon solution before the laser treatment was initially presented as a necessary procedure because it acts as an exogenous chromophore in increasing the heat damage; however, previous studies in the literature contradict in the additional benefit of the adjuvant carbon solution [1-5]. The previously researched application areas of carbon solution-assisted Nd:YAG lasers are enlarged pores; hair removal; acne and acne scars; and facial rejuvenation [1-7].

Carbon solution-assisted Nd:YAG lasers are used frequently in the daily cosmetic dermatology practice even though the results regarding the benefit of the addition of a carbon solution contradict in the literature [(1-7)]. With this study, we aim to determine the utilization areas of carbon solution-assisted Nd:YAG lasers, the frequency for each area, number of sessions needed per area, patient satisfaction and gender prevalence of the patient population.

Methods

Patient Selection

The patients who applied to a private cosmetic dermatology practice with any cosmetic concern that was treatable with carbon solution-assisted Nd:YAG lasers and have received at least one treatment session of carbon solution-assisted Nd:YAG laser were included in this retrospective study. All of the patients were Turkish with Fitzpatrick skin types of 3 or 4. Patients with the following characteristics were excluded from this study: photosensitivity, immunosuppression, pregnancy, lactation, active or previous malignancy and active infection. For each patient, the gender, age, diagnosis for which treatment was applied and the number of treatment sessions received were noted.

Treatment Procedure

The pre-prepared carbon solution (Brand: Taygete) was topically applied on the face of each patient. Q-switched Nd:YAG

laser (Fotona; Qxmax-M031-3A/2,R28 head-piece) treatment was initiated 30 minutes after the application of the solution. The treatment parameters were as follows: a spot size of 8mm, a fluence of 1.3 J/cm² and a frequency of 8Hz. Treatment sessions were continued until the complete regression of the lesions in acne vulgaris, solar lentigo, melasma and ephelide patients. For patients with post-inflammatory hyperpigmentation and for those who also applied for rejuvenation, further sessions were planned according to the financial capacity of the patient and the necessity according to the operating physician.

Assessment

Patient satisfaction was evaluated with the Global Aesthetic Evaluation Scale (GAIS) as 1 for exceptional improvement, 2 for marked improvement, 3 for minimal improvement compared to the beginning, 4 for same as the beginning and 5 for worse than the beginning [8].

Statistical Analysis

SPSS version 21 was used for the statistical analyses. T-test was used to analyze the relationship between gender and patient satisfaction. Pearson correlation was used to analyze the patient satisfaction according to age. ANOVA was used to determine the relationship between the treatment indications and patient satisfaction.

The approval of İstanbul University-Cerrahpaşa Faculty of Medicine, Medical Faculty Ethics Committee was taken before initiating the study. The informed consent of each patient was taken.

Results

A total of 272 patients were included in this retrospective study. Of these patients, 43 were male and 229 were female. The mean age of the patients was 34.1 years with a standard deviation of 9.9 years. The youngest patient was 15 years old and the oldest patient was 80 years old. Seventy patients received treatment for acne lesions, 135 patients for melasma, 27 patients for post-inflammatory hyperpigmentation, 17 patients for ephelides and 23 patients for solar lentigo.

Independent t-test was used in order to analyze the relationship between patient satisfaction and gender. We failed to find a statistically significant difference between gender

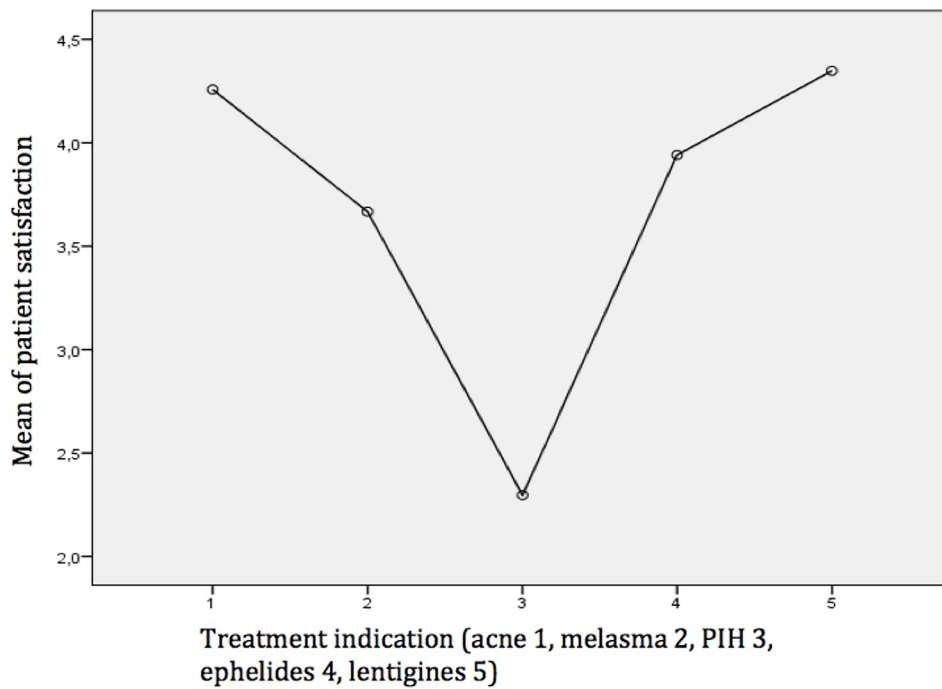


Figure 1. The relationship between patient satisfaction and treatment indication.



Figure 2. (A) Melasma patient before treatment. (B) Melasma patient after 3 sessions of monthly carbon solution-assisted Nd:YAG laser treatments.

and patient satisfaction. Thus, the treatment efficacy is independent of gender.

The Pearson correlation was used to determine the relationship between patient satisfaction and age. The Pearson correlation coefficient was calculated as -0.071 ; meaning that treatment efficacy is independent of age.

ANOVA was used to determine the relationship between patient satisfaction and treatment indications. The comparative statistical analyses revealed that the patient satisfaction was the highest in solar lentigo patients with a mean satisfaction of 4.35. The second most satisfied group was the acne patients with a mean satisfaction of 4.26. Third group was ephelide patients with a mean satisfaction of 3.94. Melasma

patients were the fourth group in terms of patient satisfaction with a mean satisfaction of 3.67. The least satisfied group was the post inflammatory hyperpigmentation group with a mean satisfaction of 2.30 out of 5. In short, the treatment efficacy can be listed as follows: solar lentigo more than acne, acne more than ephelide, ephelide more than melasma and melasma more than post inflammatory hyperpigmentation. These differences were statistically significant ($P = 0.0000$). Figure 1 visualizes the relationship between patient satisfaction and treatment indications.

Figures 2 and 3 show a melasma and an acne patient who have benefited from monthly sessions of carbon solution-assisted Nd:YAG laser treatment.

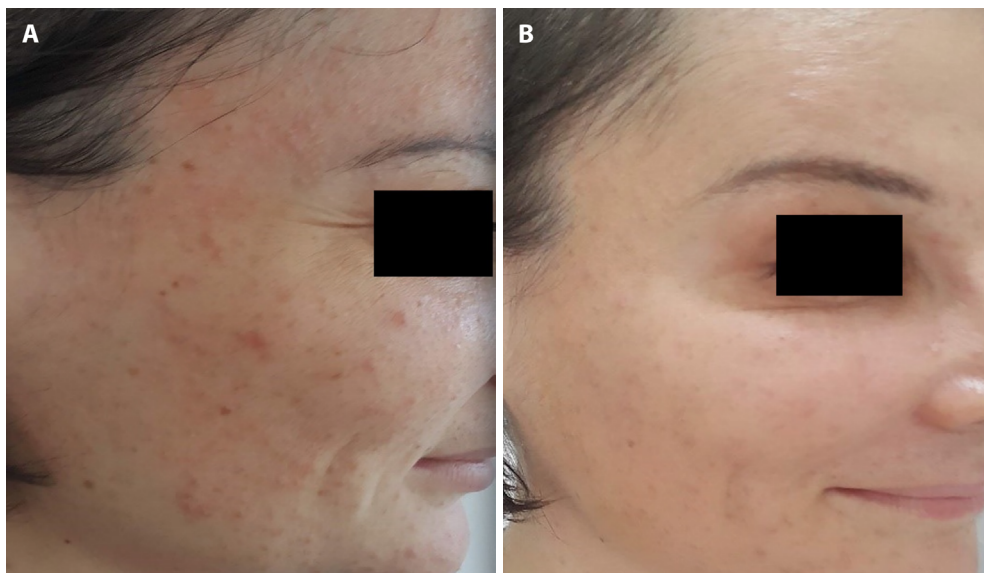


Figure 3. (A) Acne patient before treatment. (B) Acne patient after 4 sessions of monthly carbon solution-assisted Nd:YAG laser treatments.

There were not any major adverse events. The most common complaint of the patients was post-treatment mild erythema, which subsided within hours.

Conclusions

Our study revealed that the patient satisfaction for carbon solution-assisted Nd:YAG laser therapy was the highest in patients with solar lentigo. Solar lentigo are observed as a result of the photo damage and lesions show melanocytic proliferation histopathologically [9]. There is a wide spectrum of treatment modalities available for solar lentigo; these modalities can be categorized into two broad groups as the physical and topical therapies. Cryotherapy, laser therapy and chemical peels are grouped under the physical modalities group [10]. Since the absorption spectrum of melanocytes lie between 351 to 1064 nm, different laser devices with differing wavelengths can be used in the treatment of solar lentigo [11]. The use of Pulse-dye laser, copper vapor laser, krypton laser, Nd:YAG laser, frequency doubled Nd:YAG laser (KTP), Q-switched ruby laser, Q-switched alexandrite laser, Q-switched Nd:YAG laser, carbon dioxide laser and argon diode laser have been published in the literature [10]. Several studies have previously assessed the efficacy of Q-switched Nd:YAG lasers in the treatment of solar lentigo; and their efficacy was found to be inferior to KTP but superior to carbon dioxide laser [12,13]. Our study revealed a high patient satisfaction for the use of carbon solution-assisted Q-switched Nd:YAG laser in the treatment of solar lentigo. Among all the treatment indications studied in this article, solar lentiginos were the most to benefit from the carbon solution assisted Nd:YAG laser therapy. Yet,

further studies should be performed in order to compare its efficacy to Q-switched Nd:YAG laser alone and other treatment modalities.

The second patient group that benefited the most from carbon solution-assisted Nd:YAG laser therapy was the acne group. Topically applied carbon suspension distributes itself within the stratum corneum and can penetrate into the hair follicles. Carbon serves as an exogenous chromophore and the rapid increase in temperature damages the hair follicles and the surrounding sebaceous glands. With the destruction of the pilosebaceous unit, one of the key pathogenetic steps of acne vulgaris, hyper-seborrhea, is prevented. Previously, Yung et al reported that carbon assisted 1064 nm Nd:YAG laser therapy is safe and effective in the treatment of both inflammatory and non-inflammatory acne vulgaris lesions [6]. Likewise, Chun and Calderhead reported a patient with severe acne vulgaris who achieved 90 percent clearance with six treatments of carbon solution-assisted Nd:YAG laser treatment with two weeks intervals [14]. Recently, Conforti et al. reported that the carbon solution assisted Nd:YAG laser treatment is effective, without any major side effects, in the treatment of inflammatory acne lesions, enlarged pores and skin texture [15]. In alliance with the previous literature, we also report that carbon solution-assisted Nd:YAG laser therapy is an effective treatment modality for acne vulgaris with a high patient satisfaction rate.

The third and fourth groups to benefit from carbon assisted Nd:YAG laser treatment were ephelides and melasma, respectively. Similar to solar lentigo, the target chromophore is melanin in ephelides and melasma as well. The wavelength of Q-switched Nd:YAG lasers (1064 nm) lies within the absorption spectrum of melanin and therefore can be used in

the treatment of epidermal and dermal pigmented lesions [11,16]. Previously the 532 nm KTP laser was found to be effective in the treatment of ephelides and the Q-switched Nd:YAG laser has been proven to be safe and effective in the treatment of melasma [17,18]. Our results show that the use of carbon solution-assisted Nd:YAG laser treatment is effective for the treatment of ephelides and melasma, with patient satisfactions of 3.94 and 3.67 respectively.

The patient group to benefit the least was the post-inflammatory hyperpigmentation patients with a mean patient satisfaction of 2.30. Post-inflammatory hyperpigmentation is a treatment challenge for many physicians and there are many topical or physical treatment alternatives. Laser therapy is one of these modalities; however, the destruction induced by selective photothermolysis may induce reactive melanosis and increase the pigmentation, which is referred to as rebound hyperpigmentation in the literature [19,20]. Q-switched Nd:YAG lasers were used in the treatment of post-inflammatory hyperpigmentation previously. Although some therapeutic efficacy was observed, the risk of rebound hyperpigmentation still exists and therefore lower doses are recommended. The use of Nd:YAG lasers in the treatment of post-inflammatory hyperpigmentation is still controversial [21,22]. Likewise, we believe that the use of carbon solution-assisted Nd:YAG laser in the treatment of post inflammatory hyperpigmentation is controversial given the low patient satisfaction.

This study was performed to evaluate the treatment efficacy of carbon solution-assisted Nd:YAG laser for different treatment indications. Furthermore, it aimed to evaluate the treatment response regarding the age and gender. We conclude that the treatment efficacy of carbon solution-assisted Nd:YAG therapy is independent of age and gender.

This study revealed that carbon solution-assisted Nd:YAG laser therapy is effective in the treatment of solar lentigo, acne vulgaris, ephelides and melasma. However, it fails to provide therapeutic relief in post inflammatory hyperpigmentation. In addition to these, the treatment efficacy is independent of age and gender.

Informed Consent: Informed consent was taken from all the patients for the application of treatment and for the use of data and photographs.

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