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Research Article

Non-Invasive, Non-Aggressive Approach for Managing Visible Facial and Neck Lesions

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Abstract

Background: Q-switched (QS) lasers, which include the potassium titanyl phosphate (KTP) 532nm neodymium-yttrium-aluminium garnet (Nd:YAG), alexandrite, and ruby lasers, have been proven effective in the treatment of benign pigmented lesions for the past 20 years. The purpose of this study was to evaluate the efficacy and safety of a 532 nm KTP laser device for the treatment of pigmented lesions on the face and neck.

Methods: Fifteen healthy male and female patients with visible pigmented lesions of the face and neck were treated with a fractional, non-ablative, Q-switched 532-nm Nd:YAG laser device. Treatment was performed in a single session, and all patients were followed for three months after treatment. Efficacy was rated by the physician using the Global Aesthetic Improvement Scale (GAIS) and by patients using a Likert scale, both ranging from 1 (low efficacy) to 5 (high efficacy). Adverse events and patient-reported pain were monitored.

Results: The mean GAIS score was 4.2 ± 0.5 and patient satisfaction was 4.3 ± 0.4, with no significant difference (t-test =0.55, α=0.05) and a strong positive correlation between these measures (r=0.91). On a scale of 1-10, mean pain was 3.2 ± 0.9 and the only minor side effect was crusting for up to 7 days after treatment, which was expected.

Conclusion: The Q-switched Nd:YAG laser used in this study was found to be safe and effective for the treatment of facial pigmented lesions.

Keywords: Laser Treatment; Q-Switched Laser; Cosmetic Dermatology; Pigmented Lesions

Introduction

Hyperpigmentation may be defined as the darkening of the skin due to a melanin deposit in the epidermis or dermis. Benign pigmented lesions, while not physically harmful, may be distressing to patients. Such lesions are thought to be the most common reason for patients seeking dermatological care [1]. They may be congenital, acquired or age-related (e.g., through ultraviolet light exposure), superficial or in deeper dermal layers of the skin, and vary in their difficulty of removal. Benign lesions include dermal melanocytes such as nevus of Ota, melasma, lentigines, and Café-au-lait macules (CALMs), among many others. Removal of such lesions for cosmetic reasons is a procedure that is becoming more and more common in dermatologic practices. Lasers traditionally used to treat exophytic lesions, such as CO2 lasers, have been initially proposed, especially in fractional mode, exploiting their ability to convey energy in the superficial layers of the skin. These devices are associated with a more considerable risk of scarring and pigmentation changes. For this reason, lasers selectively acting on chromophores have been proposed and have obtained better results. Among these devices, different studies indicate that Q-switched lasers deliver high energies in the order of Nano or picoseconds and act selectively on the melanin chromophore sparing surrounding tissues, and therefore may be considered as the most effective and safe treatment for benign pigmented lesions. Lasers, with their ease of use and favourable side effect profile, are commonly used tools for removal of such lesions. Q-switched (QS) lasers have been used to treat benign epidermal and dermal

pigmented lesions for the past 20 years. Since their discovery as effective treatment for pigmented lesions, QS modalities including the potassium titanyl phosphate (KTP) 532nm neodymium-yttrium-aluminium garnet (Nd:YAG), alexandrite, and ruby lasers have been shown to be effective in treating benign pigmented lesions [2]. Modern lasers used in dermatology operate under the general principles of selective thermolysis, in which tissue is selectively destroyed by laser energy at specific wavelengths that spare surrounding tissue [3]. Melanin, the primary chromophore in pigmented lesions, has a spectrum of absorption between 351–1,064 nm, making it a suitable target for the 532 nm QS Nd:YAG laser [4,5]. Common side effects of laser treatment in general include purpura, minor bleeding, edema, and erythema, dyspigmentation, blistering, crusting, and scarring [2]. Patients with darker skin types are especially at risk of post-inflammatory hyperpigmentation (PIH), with a reported incidence of 10–47% [6]. In the current retrospective cohort study, we aimed to examine the effects and safety profile of 532 nm KTP laser on pigmented lesions on the face and neck. The main purpose of this data collection was to evaluate the safety and efficacy of a non-invasive approach for managing pigmented lesions, focusing on the interaction between two outcome measures: physician-assessed improvement and patient satisfaction.

Methods

Clinical Data

In this retrospective cohort study, we collected clinical data from fifteen patients with benign hyperpigmentation who received QS Laser treatment at the Klinika Mjekësore San Luca, Tirana, Albania. The study was approved by the Ethic Committee of the Albanian Ministry of Health (ethics number: 2020-020). All patients were in good physical health with no major underlying diseases, and none had skin disease or took medications that impact skin condition. Study exclusion criteria were previous treatment of the same area(s) at least six months prior to screening, skin type VI, pregnant, intending to become pregnant during study, less than 3 months postpartum or less than 6 weeks after completion of breastfeeding, exposure to the sun or artificial tanning during 3-4 weeks prior to treatment, any remaining suntan, sunburn, or artificial tanning products, active infections in the treatment area, chronic or cutaneous viral, fungal or bacterial diseases, and tattoos in the areas to be treated.

Treatment procedure

The ClearLift applicator, used with the Harmony XL platform (Alma Lasers Ltd., Caesarea, Israel), is a fractional, non-ablative, high-power, Q-switched Nd:YAG 1064/532 laser hand piece. Each patient received one session per treated area (face and neck) consisting of one pass of KTP 532 nm with a spot size of 3 mm, a 5X5 pixel tip, and an output energy of 400 mJ/pulse at a discharge frequency of 1 Hz and a fixed pulse time of 20 n sec. Patients were followed up three months after treatment.

Clinical evaluation

Primary efficacy was assessed at the follow-up visit by comparing the results to photographs taken at baseline. Using the Global Aesthetic Improvement Scale (GAIS), the physician rated the improvement on a scale of 1 to 5 as: worse, no change, improved, much improved, or very much improved. In addition, at the three-month follow-up visit, patients were asked to rate their satisfaction with the treatment on the Likert scale of 1 to 5, from "not at all satisfied" to "extremely satisfied". The primary safety endpoint was the occurrence of adverse events or complications during treatment and follow-up. In addition, patients were asked to rate their pain during treatment on a scale of 1 to 10, from "no pain" to "severe pain".

Statistical analysis

Patient demographic characteristics were summarized using descriptive statistics with appropriate measures such as means, standard deviations, and percentages. In addition, a box-whisker plot was used to visually illustrate the distribution and spread of physician and patient ratings, and the Pearson correlation coefficient was calculated to quantify the association between the two ratings. A two-sample t-test was used to analyse significant differences in mean scores between physician-assessed GAIS and patient satisfaction scores, providing insight into the level of agreement in treatment outcomes. Data analysis was performed using Microsoft Excel.

Results

Fifteen patients met the criteria and underwent treatment and follow-up between December 2020 and January 2022. Patients ranged in age from 28 to 53 years, with a mean age of 41.7 ± 7.1 years. There were eleven female patients. Four patients had Fitzpatrick skin type II, eleven patients had type III, and one patient had type IV. Eleven patients were treated on the face and one patient was treated on both the face and neck. Demographic data are presented in Table 1.

Table 1: Patients Demographic.

Characteristics	Numeric Value
No. of participants	15
Skin type II	4
Skin type III	10
Skin type IV	1
Women	11
Men	4
Age (y)	41.7 ± 7.1 (28,53)
Pain	3.2 ± 0.9
Likert scale	4.3 ± 0.4
GAIS	4.2 ± 0.5

Values are presented as total number or mean ± standard deviation, as appropriate; Pain - as reported by patients on a scale of 1-10; Likert scale - satisfaction as reported by patients on a scale of 1-5; GAIS - improvement from baseline as reported by the physician on a scale of 1-5.

Efficacy evaluation

The average physician-assessed GAIS score at the 3-month follow-up was 4.2 ± 0.5, whereas the average Likert scale patient satisfaction score was 4.3 ± 0.4. The distribution of patients across different grading scales is shown in Figure 1.

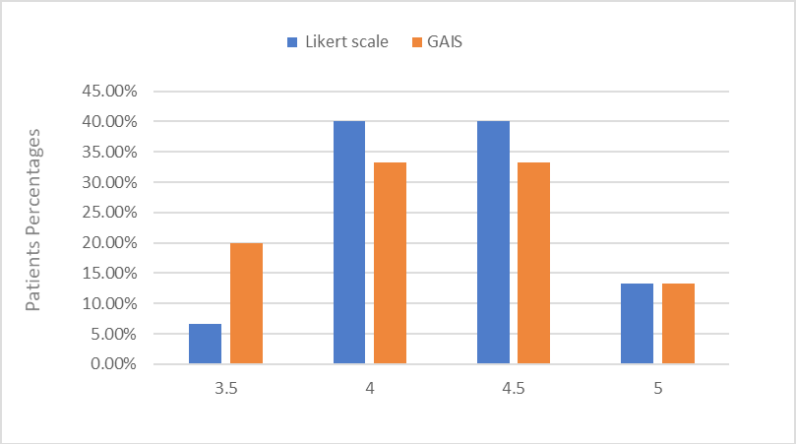

Figure 1: breakdown of patient percentages on GAIS (physician) and Likert (patients) 1-5 rating scales.

The Pearson correlation coefficient between the physician rating of the GAIS scores and the patient rating of the Likert scores was 0.91. Physician (GAIS) and patient (Likert scale) ratings are visually compared in a box-and-whisker plot in Figure 2.

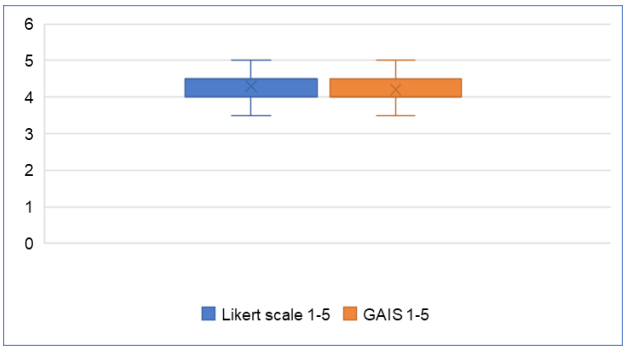

Figure 2: the distribution of physician (GAIS) and patient (Likert scale) ratings, measured from 1 (low) to 5 (high).

The two-sample t-test was used to examine the concordance between physician GAIS scores and patient satisfaction scores. The two-tailed p-value was 0.55 at a significant level of 0.05, indicating no statistically significant difference between the two measures. The lack of a significant difference between the two groups suggests agreement in the assessment of treatment outcomes from both the physician and patient perspectives. An example of visual improvement of face pigmented lesions is demonstrated in Figure 3.

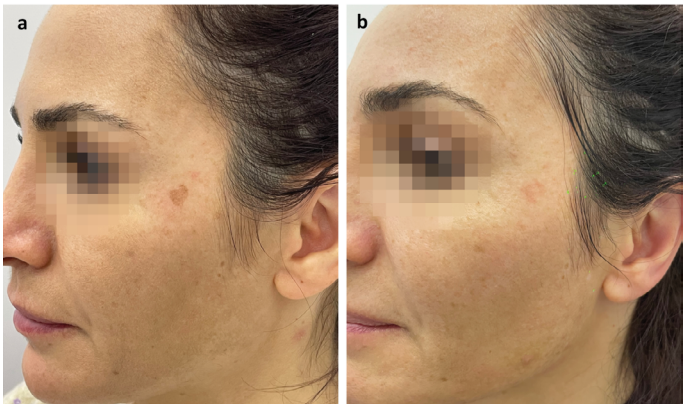

Figure 3: treatment areas at baseline (A) and (B) three months following treatment with Clear Lift applicator QS Nd: YAG laser.

Safety evaluation

None of the patients experienced major complications. A minor side effect of post-treatment crusting, which is expected, was observed in all patients and resolved within 7 days. No other adverse events were recorded. No incidence of edema, ecchymosis, vesiculation, dyspigmentation, or scarring, was observed. The average pain score, as assessed by the patients at the end of the treatment, was 3.2 ± 0.9 ranging from 3 (93%) to 6.5 (7%).

Discussion

The QS 532 nm laser used in this study demonstrated excellent clinical efficacy with a high safety profile for the treatment of benign pigmented lesions. The mean physician GAIS score at the 3 months follow-up was 4.2 and the mean patient Likert score was 4.3, both on a scale of 1-5. The only minor side effect was post-treatment crusting, as expected with this procedure, which resolved within 7 days and most patients reported a low level of pain during the treatment. Analysis of the relationship between physician and patient ratings revealed a high level of agreement, with a correlation coefficient of 0.93 and no significant difference in mean scores. The similarity in the visual representation of the two measures, as shown by the box-and-whisker plot, provides additional evidence of the consistency in physician and patient ratings. In addition, the results of this study are also in agreement with the literature. Several recent studies have established the efficacy of 532-nm KTP laser for managing various types of benign pigmented lesions and photo aging. In a cohort of 45 patients, Iraji and colleagues found that solar lentigo lightning and patient satisfaction were superior in the 532-nm QS group compared to a trichloroacetic acid peel treatment group. Only one patient presented with PIH in the laser group [7]. A study by Altalhab et al found excellent response in 30% and good response in 43% of patients treated for lip hyperpigmentation with one session of QS 532-nm laser, according to independent physician assessment after a follow-up of six months at minimum. The authors reported two cases of reactivation of herpes simplex and mottle hypopigmentation in three cases [8]. In a comparison between low-fluence QS 532-nm and QS 1064-nm Nd:YAG lasers, Zhuang and colleagues found no difference in efficacy of removing CALMs in 40 pediatric patients after six months' follow-up. For the 532-nm group, some level of clearance (defined as between a range of "fair" and "complete") was achieved in 19 cases. One case had poor clearance and one was exacerbated by the laser. Only two recurrences occurred for the 532-nm laser treatment group. Adverse events were related to dyspigmentation [9]. A comparative, split-lesion trial found that picosecond 755 nm, QS 755 nm, and QS 532 nm laser therapies were equally effective in eliminating CALMs as determined by blinded visual assessments at 3 months of follow-up. Adverse events for the 532-nm laser included hypopigmentation, which resolved within one year. For all groups, recurrence rates were overall about 26% [10]. In a study of 30 solar lentigines lesions, Vachiramon et al observed that the QS 532-nm KTP nanosecond laser provided significant pigment clearance and improved mean luminance score from baseline with no significant difference compared to the QS 532-nm KTP picosecond laser. For both lasers, pain scores were low, and crusting lasted for a mean of about 9 days. The nanosecond

laser caused prolonged erythema in two cases [5]. By delivering high intensity laser energy in short pulses, QS 532-nm lasers are postulated to stimulate collagen production and target the epidermal melanin chromophores, making them effective tools for reversing signs of photo aging such as pigmented lesions. QS Laser systems have both a thermal and no thermal photoacoustic effect on tissue, enhancing efficacy while causing minimal side effects [11]. The positive results of the laser system used in this study attest to this concept. Of note, all participants were of skin types between II and IV. Due to increased absorption of melanin in darker complexions, some practitioners and researchers caution against using the KTP 532-nm laser in such patients [11]. None of the patients in this study experienced side effects of dyspigmentation.

Limitations

The primary limitation of the study is its retrospective nature, which results in a lack of control. Another limitation is the small size of the treatment cohort. However, the study is well balanced in terms of age and gender.

Conclusion

The fractional, non-ablative Q-switched 532 nm Nd: YAG laser device has demonstrated a dramatic improvement in the treatment of pigmented lesions. The results, as assessed by an expert physician, correlate strongly with patient satisfaction, and the treatment is well tolerated and safe, making it particularly suitable for use in sensitive areas such as lips, nose, periorbital and neck areas.

Disclosure: The author discloses no competing interests.

Informed consent: The fractional, non-ablative Q-switched 532 nm Nd: YAG laser device has demonstrated a dramatic improvement in the treatment of pigmented lesions. The results, as assessed by an expert physician, correlate strongly with patient satisfaction, and the treatment is well tolerated and safe, making it particularly suitable for use in sensitive areas such as lips, nose, periorbital and neck areas.

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