Original Investigation
Orijinal Araştırma

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The first-year experience of a university hospital laser unit

Üniversite hastanesi lazer ünitesi ilk yıl deneyimleri

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Abstract

Background and Design: The aim of this study was to evaluate the efficacy and safety of neodymium-doped yttrium aluminum garnet (Nd:YAG) laser and intense pulsed light (IPL) systems, and the variety of indications involved.
Materials and Methods: First-year treatments in our clinic were evaluated retrospectively. Results were classified according to improvement rates: <25% as mild improvement; 25-75% as moderate improvement and >75% as excellent improvement.
Results: One hundred thirty-three patients aged 3-79 years (mean: 35.91) with 14 different indications were treated. Pigmented lesions were treated with IPL, and vascular lesions with IPL and/or Nd:YAG. Combined therapy with IPL and Nd:YAG at two-week intervals resulted in excellent improvement in 70.21% of vascular lesions (34 rosacea, 8 nevus flammeus, and 5 hemangioma), and moderate improvement in the rest. Telangiectasia and angiomatous lesions exhibited excellent improvement in 93.65% of patients with Nd:YAG, and moderate improvement in the rest. IPL resulted in excellent improvement in 78.49% of cases of solar lentigo, and moderate improvement in the rest. Moderate improvement was observed in 66.67% of patients with melasma using IPL, and mild improvement in the rest. Pain scores were significantly lower with Nd:YAG than IPL ($p<0.05$). Complications related to treatment were observed in 3 patients (vesicles in two patients and atrophic scar in 1), all of which developed after Nd:YAG laser application.
Conclusion: Nd:YAG and IPL were successful with very low side-effect rates in a wide range of indications. Our study is the first evaluation of the efficacy of Nd:YAG and IPL combination therapy applied at 2-week intervals, and high efficiency was observed with no increase in any complication rate by intermittently combining different wavelengths.
Keywords: Laser therapy, rosacea, port-wine stain, lentigo, hemangioma, telangiectasia

Öz

Amaç: Çalışmamızda neodim-itriyum alüminyum garnet (Nd:YAG) lazer ve yoğun atımlı ışık (IPL) sistemlerinin etkinlik ve güvenilirliğini belirlemenin yanı sıra endikasyon çeşitliliğinin değerlendirilmesi amaçlandı.
Gereç ve Yöntem: Kliniğimizde ilk bir yılda yapılan uygulamalar retrospektif olarak değerlendirildi. Tedavi sonuçları elde edilen düzelme oranlarına göre; <%25 hafif, %25-75 orta ve >%75'ten fazla, çok iyi düzelme olarak sınıflandırıldı.
Bulgular: On dört farklı endikasyonda, toplam 133 hastaya tedavi uygulandı. Hastaların yaşları 3 ile 79 arasında değişmekteydi (ortalama 35,91). Pigmente lezyonların tamamına IPL, vasküler lezyonlara ise IPL ve/veya Nd:YAG tedavisi uygulandı. İki hafta arayla IPL ve Nd:YAG tedavilerinin kombine uygulandığı vasküler lezyonlarda (34 rozase, 8 nevüs flammeus, 5 hemanjiyom) %70,21 oranında çok iyi düzelme, geri kalanında da orta derecede düzelme elde edildi. Telanjiektazi ve anjiyomatöz lezyonlarda Nd:YAG lazer tedavisi %93,65 oranında çok iyi, geri kalanında orta derecede düzelme ile sonuçlandı. Solar lentigolarda IPL ile %78,49 oranında çok iyi, geri kalanında orta derecede düzelme saptandı. Melasmada ise IPL ile %66,67 oranında orta derecede düzelme gözlenirken, geri kalanında düzelme hafif derecede kaldı. Nd:YAG lazerde ağrı skoru, IPL'ye göre anlamlı derecede düşük bulundu ($p<0,05$). Tedaviye bağlı komplikasyon gelişimi sadece üç hastada (iki hastada vezikül, bir hastada atrofik skar) gözlendi, bunların 3'ü de Nd:YAG lazer uygulama sonrası gelişmiştir.
Sonuç: Nd:YAG ve IPL tedavileri, geniş bir endikasyon alanında, oldukça düşük komplikasyon oranlarıyla başarılı bulunmuştur. Çalışmamızda iki hafta arayla uygulanan Nd:YAG ve IPL kombinasyon tedavisinin etkinliği ilk kez değerlendirilmiştir, bu şekilde farklı dalga boylarının aralıklı kombine edilmesiyle yüksek etkinlik izlenirken komplikasyon oranında herhangi bir artış saptanmamıştır.
Anahtar Kelimeler: Lazer tedavisi, rozase, porto şarabı lekesi, lentigo, hemanjiyom, telanjiektazi

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Introduction

The term laser is an acronym for "Light amplification by stimulated emission of radiation" and refers to a beam of light amplified by the concentration of stimulated radiation. Since they were first developed, laser systems have been increasingly successfully used in various medical fields, and particularly dermatology, for approximately 50 years. Laser systems are used in the treatment of various different conditions, such as vascular lesions, pigmented lesions, scars and striae, as well as for tattoo removal, epilation, and skin renewal aimed at the elimination of wrinkles. However, these costly devices are usually found in cosmetology clinics. This results in their use being concentrated on cosmetic indications. Expanding the establishment of laser units in university hospitals will be useful in broadening these areas of indication and in the more effective use of laser systems.

Neodymium-doped yttrium aluminum garnet (Nd:YAG) laser and intense pulsed light (IPL) procedures have been performed for various indications in the laser unit established in our clinic for more than one year. This retrospective study reviews the results of therapeutic applications in our laser unit.

The purpose of the study was to reveal our laser unit's first year experience and the favorable effect and side-effect rates. We anticipate that this review of our treatment indications and results will assist with more effective laser therapy procedures and will shed light on future studies.

Materials and Methods

Data forms concerning procedures performed for the year following the opening of the laser unit within the body of our university hospital dermatology and venereology department were evaluated retrospectively. Patients' demographic characteristics, Fitzpatrick skin types, diagnoses, treatments administered, degrees of improvement in lesions before and after treatment, and complications developing were recorded on these forms. Disease severity in patients diagnosed with rosacea was evaluated using the method of calculating rosacea severity score described by Say et al.[1] Rosacea was evaluated in two distinct groups: Papulopustular rosacea (PPR) and erythematotelengiactic rosacea (ETR), and scored accordingly on the data forms. Pain associated with the procedure was scored by the patient using a numerical scale, and was again recorded onto the form. Digital photographs of the patients were taken before and after treatment at each session.

Treatment Application

A Xeo laser device [(Xeo laser device, Cutera Inc., Brisbane, CA, United States of America (USA)] was used in our study. This device has two options, Nd:YAG laser and IPL. The IPL device has three programs: A (520 nm wavelength, 2-12 ms pulse width), B (560 nm wavelength, 5-29 ms pulse width), and C (580 nm wavelength, 10-60 ms pulse width).

Treatments in our study were applied with parameters selected based on all indications and the patient's skin type. Treatments were administered using Aquasonic® 100 ultrasound gel (Parker Lab, Inc. Fairfield, New Jersey 07004, USA) and by a single specialist.

Cold application for 5-10 minutes and medium-potency topical corticosteroid cream use for one to three days were recommended depending on signs of inflammation developing after sessions. All patients were notified of the need for protection against the sun, from the time of laser therapy planning and for at least 3 months after the end of treatment. Sessions were performed at 2- to 4-week intervals. Presence of any complications was recorded at controls in the second week after procedures, and additional applications were performed in case of necessity.

Evaluation of the Efficacy of Treatment

The efficacy of treatment was evaluated separately by the patient and the physician. Digital photographs taken before and after treatment were used in this evaluation. Based on the rates of improvement achieved, treatment results were classified as 0-25% - mild improvement, 25-75% - moderate improvement, and over 75% - excellent improvement. The study was approved by the Karadeniz Technical University Faculty of Medicine Clinical Research Ethics Committee (approval number: 43, date: 2017), and written informed consent have been obtained from the patients.

Statistical Analysis

Data analysis was performed using SPSS 22.0 software. Data were expressed as number, percentage (%), and arithmetic mean ± standard deviation. Descriptive statistics and a chi-square test were used for data analysis. A p value of less than 0.05 was considered statistically significant.

Results

A total of 133 patients (58 female, 75 male) were treated in the first year in our laser unit. The mean age of the patients was 35.91±15.56 (3-79) years. Eighty-eight patients had Fitzpatrick skin type 2, 35 - type 3, one patient - type 1, and one had type 4.

One hundred eleven patients were treated for vascular lesions, and 25 for pigmented lesions. Both vascular and pigmented lesions were present in 3 patients. The selected treatment was IPL in all pigmented lesions. In the case of vascular lesions, IPL alone, or Nd:YAG alone, or the two in combination in consecutive sessions at least 2 weeks apart were applied in treatment. IPL was applied in 73 patients for various indications, and Nd:YAG therapy in 110. IPL and Nd:YAG were used in combination in different sessions at intervals of at least 2 weeks in 47 patients. In addition, Nd:YAG in genesis mode (5 mm spot diameter, 14 j/cm^2 energy, 0.3 ms pulse width, 10 Hz frequency) was applied in 4 cases of keloid, atrophic scar and onychomycosis. The total number of sessions administered ranged between 1 and 9 (mean: 1.98±1.29). Treatment was applied in 14 for different indications. Thirty-four patients were treated in our unit for rosacea, 29 for spider angioma, 28 for telangiectasia, 19 for solar lentigo, 9 for nevus flammeus, 5 for hemangioma, 5 for cherry angioma, 3 for melasma, 2 for keloid, 1 for atrophic scar, 2 for poikiloderma (1 poikiloderma of Civatte, the other scleroderma-related poikiloderma), 1 for onychomycosis, 1 for axillary freckling secondary to neurofibromatosis, and 1 for venous lake. The treatments administered, session numbers, and improvement levels are summarized in Table 1.

Complications developed in 3 patients, vesicles in 2, and depigmented atrophic scar in 1. These complications all developed following Nd:YAG laser application.

When pain severity was assessed using a numerical scale from 0 (no pain) to 10 (unbearable pain), the mean pain score in patients receiving treatment with IPL and Nd:YAG was 5.26 and 2.92, respectively. The difference was statistically significant ($p<0.05$). In terms of pain scores, Nd:YAG was more tolerable than IPL procedures. Two patients reporting severe pain in the first session received topical anesthesia with 5% EMLA® cream occlusion at least half an hour prior to the subsequent sessions.

IPL and Nd:YAG were used in combination in 34 patients with rosacea (2 with severe and 30 with moderate ETR, and 1 with moderate and 1 with mild PPR). In the first session, Nd:YAG laser therapy was applied by tracing vessels over the telangiectasia (3 mm spot diameter, 120-150 j/cm^2 energy, and 10-15 ms pulse width). At the end of two weeks, treatment continued with IPL (14-24 j/cm^2 in A or B mode). In patients receiving IPL once every four weeks, areas in which telangiectasia was observed at 2-weekly controls between sessions were treated with Nd:YAG. At the end of the sessions (varied between 2 and 6), improvement exceeding 75% was observed in 28 patients with ETR, 2 severe and the remainder moderate. Treatment concluded with moderate improvement in the remaining 6 cases (2 PPR, and 4 moderate ETR) (Figure 1). Five patients with almost complete resolution at the end of 6-month follow-up presented to our clinic due to recurrence of erythema, and these were again enrolled in the treatment plan.

Nd:YAG therapy (3 mm spot diameter, 120-150 j/cm^2 energy, and 10-15 ms pulse width) was applied to all 47 lesions in 29 patients with spider angiomas. Either 1 or 2 sessions were performed, and improvement greater than 75% was observed in all patients (Figure 2). Vesicles developed in 1 patient on the day after treatment, and depigmented atrophic scar developed in another.

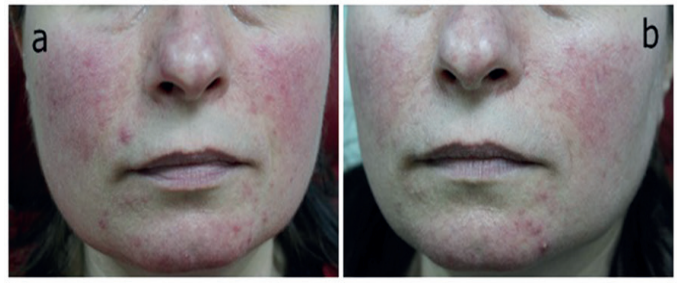

Figure 1. Comparison of photographs taken before (a) and one month after (b) combined treatment of papulopustular rosacea with neodymium-doped yttrium aluminum garnet (3 mm, 130 j/cm^2, 10 ms) and intense pulsed light (A20) in a single session at two-week intervals shows moderate improvement in lesions with treatment

Table 1. Treatments applied, session numbers, and outcomes

Indication	Number of patients treated			Number of sessions	Patient numbers in terms of treatment outcomes		
	Nd:YAG	IPL	Combined		0-25% improvement	25-75% improvement	>75% improvement
Rosacea	-	-	34	2-6	-	6 17.64%	28 82.35%
Spider angioma	29 (47 lesion)	-	-	1-2	-	-	29 100%
Telangiectasia	28	-	-	1-3	-	4 14.29%	24 85.71%
Nevus flammeus	-	1	8	3-9	-	5 55.56%	4 44.44%
Solar lentigo	-	19	-	2-4	-	4 21.05%	15 78.94%
Cherry angioma	5 (28 lesion)	-	-	1-2	-	-	5 100%
Hemangioma	-	-	5	4-6	-	3 60%	2 40%
Melasma	-	3	-	1-3	1 33.33%	2 66.67%	-
Scar	3	-	-	1	3 100%	-	-
Axillary pigmentation	-	1	-	2	-	-	1 100%
Poikiloderma	-	2	-	3	-	2 100%	-
Venous lake	1	-	-	1	-	-	1 100%
Onycho-mycosis	1	-	-	2	1 100%	-	-

Nd:YAG: Neodymium-doped yttrium aluminum garnet, IPL: Intense pulsed light

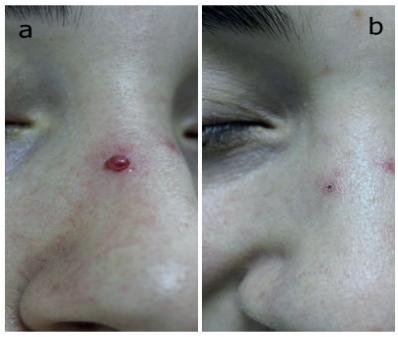

Figure 2. Comparison of photographs taken before (a) and two weeks after (b) treatment of spider angioma with neodymium-doped yttrium aluminum garnet (3 mm, 140 j/cm^2, 10 ms) in a single session shows that almost complete elimination of lesions was achieved with treatment

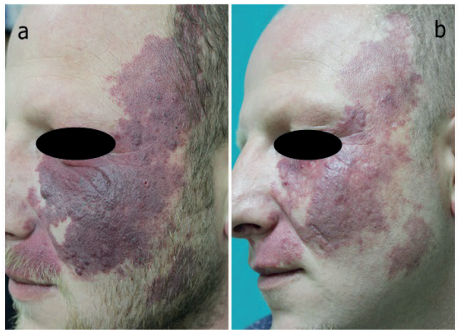

Figure 3. Comparison of photographs taken before (a) and one month after (b) combined treatment of nevus flammeus with neodymium-doped yttrium aluminum garnet (3-5 mm, 60-120 j/cm^2, 10-40 ms) and intense pulsed light (A20-24) in three sessions at two-week intervals shows moderate improvement was achieved in lesions

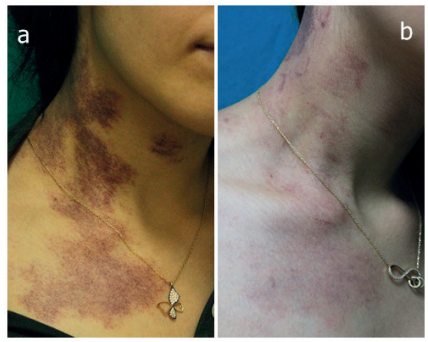

Figure 4. Comparison of photographs taken before (a) and two weeks after (b) treatment of nevus flammeus with intense pulsed light (A20-24) applied in two sessions at four-week intervals shows almost complete resolution of lesions

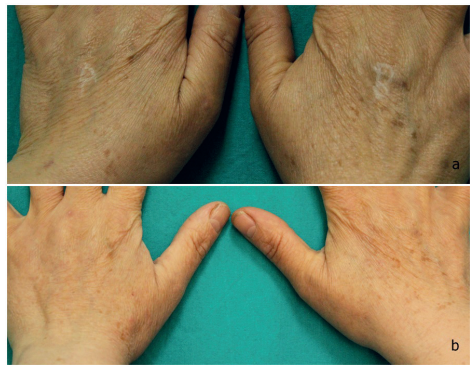

Figure 5. Comparison of photographs taken before (a) and one month after (b) of solar lentigo with intense pulsed light (B18) application to the left handand cryotherapy to the right hand shows almost entire elimination of lesions with treatment, as well as a decrease in fine wrinkles on the hand receiving IPL

Nd:YAG therapy (3 mm spot diameter, 100-160 j/cm^2 energy, and 10-20 ms pulse width) was applied alone in 28 patients with isolated telangiectasia. Excellent improvement was achieved in 24 patients after 1 to 3 sessions. Treatment in the remaining cases resulted in moderate improvement. However, 3 patients presented to our clinic during 10-month follow-up due to recurrence of lesions, and these lesions also regressed with repeat Nd:YAG laser therapy.

IPL and Nd:YAG therapies were applied in combination in 8 patients with nevus flammeus. Hypertrophic areas were first treated with Nd:YAG laser. In the subsequent sessions, the two therapeutic options were used consecutively in combination at 2- to 4-week intervals. Nd:YAG laser was applied at spot diameters of 3-7 mm, with a 60-140 j/cm^2 energy, and pulse widths of 10-40 ms. IPL was used at doses of 14-27 j/cm^2 in A or B mode. Following 3 to 9 sessions, treatment was completed with excellent improvement in 3 patients and moderate improvement in 5 (Figure 3). Five patients were still receiving treatment when our study period ended. Almost complete eradication of lesions was achieved with IPL alone in another patient with nevus flammeus on the neck (Figure 4).

IPL was applied alone in 19 patients with solar lentigo. Lesions were located on the face in 7 patients and on the back of the hand in 12. IPL was applied in sun mode, at 12-24 j/cm^2 in A or B modes. The number of sessions ranged between 2 and 4, and resulted in excellent improvement in all lesions on the back of the hand, while excellent improvement was achieved in 3 patients with facial lesions and moderate improvement in 4. In addition to improvement of lesions, we also observed a decrease in photoaging signs and fine wrinkles in the skin of the hand in patients we applied IPL alone due to solar lentigines and scanned the entire back of the hand (Figure 5).

Nd:YAG therapy with a 3 mm spot diameter, 140-150 j/cm^2 energy, and 10-15 ms pulse width was applied in 28 lesions in 5 patients with cherry angioma. Complete elimination of lesions was observed in 1 or 2 sessions in all patients, although vesicle formation was observed in 1 patient on the third day after treatment.

IPL and Nd:YAG therapies were applied in combination in 5 patients with hemangioma. Nd:YAG was first applied at spot diameters of 3-7 mm, with a 50-150 j/cm^2 energy and 10-40 ms pulse width. IPL therapy was then applied in A or B mode at doses of 12-20 j/cm^2. Following combined treatment at 2-week intervals and 4 to 6 sessions, moderate improvement was observed in 3 patients, and excellent improvement in 2. These patients were still receiving treatment at the end of the study period.

IPL was applied in 3 patients with melasma, in sun mode using the B program at the doses of 16-20 j/cm^2 at 4-week intervals. Following 1 to

3 sessions, mild improvement was observed in 1 patient and moderate improvement in 2, and it was decided not to continue the treatment.

Nd:YAG was applied in genesis mode in 2 patients with keloid and 1 with atrophic scarring. Treatment was applied with 300-750 total pulses until the patient described severe burning. Only 1 session was performed, and no marked response was achieved. Treatment was discontinued at the patients' request.

Nd:YAG therapy was applied in genesis mode in 1 patient with onychomycosis in the fingernails in the form of at least 200 pulses per nail. No significant improvement was obtained after 2 sessions, and the treatment was discontinued at the patient's request because the procedure was very painful.

IPL was applied in B mode at 12-20 j/cm^2 energy densities over 2 sessions in 1 patient with axillary pigmentation diagnosed with neurofibromatosis. A significant improvement was observed in the lesions from the first session, the patient did not continue treatment due to severe pain despite topical anesthesia.

Nd:YAG was applied in 1 patient with venous lake in the lip at a 5 mm spot diameter, 90 j/cm^2 energy , and 10 ms pulse width. The lesion resolved entirely in a single session.

IPL in B mode with a 16-20 j/cm^2 energy was applied in 3 sessions in 1 patient with poikiloderma of Civatte and another with diffuse scleroderma-related poikiloderma. Moderate improvement of poikiloderma was achieved with IPL.

Discussion

There are several studies in the literature concerning the use of Nd:YAG lasers and IPL systems for different indications in superficial cutaneous lesions[1-36]. These therapies have been used either alone or in combination with other medical treatments and laser systems in previous studies, and differing success rates have been reported. However, devices with different technologies also have different therapeutic parameters for each lesion and skin type. Direct comparisons between studies are therefore impossible.

The long-pulse 1064 nm Nd:YAG laser systems used in our study to treat superficial cutaneous lesions such as spider angioma, cherry angioma, and telangiectasia on the face and legs are reliable and effective. One of the largest-scale studies on this subject reported successful treatment of 100% of spider angiomas and 97% of facial telangiectasia[2]. Another study reported success rates of 63.2% in nevus flammeus, 80.0% in hemangiomas, 66.7% in telangiectasia, and 84.6% in other vascular lesions[3]. One study assessing the effectiveness of 532-nm potassium-titanyl-phosphate (KTP) and Nd:YAG lasers in cherry angiomas reported that KTP lasers required significantly more sessions than Nd:YAG laser (1.35 and 1.11 sessions, respectively), but that more complications such as erythema, edema, pain, and scar formation occurred with Nd:YAG laser[4]. Nd:YAG laser is also quite effective in the treatment of venous lake in the lip[5,6]. John et al.[5] reported that Nd:YAG laser therapy resulted in complete eradication of lesions in a single session in 20 out of 21 patients, with 95% regression being observed in the remaining patient after 1 session and complete resolution after a second session. The efficacy of Nd:YAG laser in the treatment of superficial vascular lesions in our study was comparable with that reported in the previous literature.

Both IPL and Nd:YAG systems are regarded as effective in the treatment of rosacea[1,7]. Two studies comparing the effectiveness of IPL and pulsed dye laser (PDL), another commonly employed system, in the treatment of rosacea and facial erythema reported similar efficacy and safety for both[8,9]. While some studies have described Nd:YAG therapy as superior to PDL in the treatment of rosacea, others have reported similar efficacy but better tolerability in terms of pain[10,11]. Nd:YAG laser has been reported to be effective in both ETR and PPR, but to be more successful in the treatment of ETR[1]. In our study, ETR represents 94.11% of all rosacea patients. We used Nd:YAG and IPL in combination at two-week intervals in our study and achieved very good improvement at a level of 88% and moderate improvement in the remaining cases. Since PPR patients in our clinic are generally under systemic treatment that can result in photosensitivity, laser therapy is planned after the regression of the existing inflammatory lesions. There were only 2 PPR patients in our study, and moderate improvement was achieved in both using combined treatment with topical azelaic acid therapy.

We encountered no previous studies assessing the effectiveness of Nd:YAG laser and IPL in combination in the treatment of rosacea in the available literature. In their study published in 2017, Liu et al.[12] applied Nd:YAG and IPL in combination in the same session and also consecutively, Nd:YAG 3 days after IPL, in the treatment of facial telangiectasia independently of diagnosis of rosacea. Both methods were determined to be effective, although combined application was more effective than consecutive application, but was also more painful. Erythema, purpura, and development of edema are more common 48 h after treatment in areas receiving combined therapy, but no scar formation has been reported. In our study, the two laser options were used consecutively at intervals of at least 2 weeks in rosacea patients, and no complications were observed. Ours is the first study to demonstrate the effectiveness of combined therapy in rosacea. Our patients reported an intense burning sensation and pain during IPL application, while Nd:YAG therapy was better tolerated. We think that the combined use of Nd:YAG and IPL, albeit at intervals, can increase therapeutic success in rosacea without involving additional risks since different targets will be treated at different wavelengths.

Nd:YAG and IPL systems have been reported to be individually effective in the treatment of nevus flammeus[13-20]. However, there have been no previous studies of their combined use. Treatment has been found to be more effective in patients who developed bullae and dark and light gray colorings after laser treatment[13]. In our study, too, the target dose was determined as that in which mild, light gray coloring was observed. Treatments are more successful in purple lesions compared to pink lesions, and when located in the neck rather than in the face[13,14]. Treatment in our study was also more effective when the lesions were in the neck, and almost complete elimination of lesions was achieved with IPL alone. IPL therapy in nevus flammeus in previous studies has generally been applied over 3 to 6 sessions at 4- to 6-week intervals, and at least moderate success has been reported in more than half of patients[15-18]. IPL therapy is also thought to be capable of bestowing additional benefit in nevus flammeus resistant to PDL[19,20].

Studies evaluating the efficacy of combined PDL and Nd:YAG in nevus flammeus have generally reported successful outcomes[21,22], although one study comparing the effectiveness of combined therapy with PDL alone reported no additional benefit of combination therapy over PDL

alone, and that it also involved disadvantages such as scar formation[23]. A combination of different wavelengths in the same session is thought to bestow additional benefit, particularly in the case of treatment-resistant lesions. In our study, Nd:YAG and IPL therapies were applied in combination at 2-week intervals. This resulted in excellent improvement in 37.5% of cases of nevus flammeus and moderate improvement in the remainder. No complications were observed at controls during sessions performed at 2-week intervals. Ours is the first study to assess the effectiveness of combined Nd:YAG and IPL in the treatment of nevus flammeus. We think that combination therapy at 2-week intervals can extend the treatment period while bestowing additional benefit with no additional risk.

The laser system the efficacy of which has been most studied in infantile hemangioma is PDL. However, Nd:YAG lasers have also been shown to be 87.57% effective, and to be more successful in the treatment of superficial lesions in particular[24,25]. The efficacy of a combination of Nd:YAG and PDL in the same session has been shown to be 92.6% in infantile hemangiomas[26]. To the best of our knowledge, the effectiveness of a combination of IPL and Nd:YAG in infantile hemangioma has not been evaluated previously. In our study, we combined IPL and Nd:YAG therapies at 2-week intervals and achieved moderate improvement in 3 out of 5 patients with infantile hemangiomas and excellent improvement in 2.

IPL therapy has been reported to be quite successful in the treatment of solar lentigines[27-29]. One study of 31 women with solar lentigines on the hands reported more than 50% improvement in 62% of patients following treatment over 3 to 5 sessions at 1-month intervals, with improvement exceeding 75% in 23% of these[28]. Another study reported marked improvement with a single session of IPL in all solar lentigines on the hands and face[27]. Very good improvement was achieved in our study with IPL in all lesions on the back of the hand, while excellent improvement was determined in 43% of facial lesions and moderate improvement in the remaining cases. We attributed the lower success rate in the face to the selection of relatively lower doses than those used on the hands in order to avoid complications.

One study from Turkey described a combination of IPL and Nd:YAG applied at 2-week intervals as more successful in hand rejuvenation than Nd:YAG therapy alone[30]. In our study, in addition to the improvement of lesions in all the patients in whom we applied IPL alone for solar lentigines and scanned the entire back of the hand, we also observed a decrease in signs of photoaging and fine wrinkles in the skin of the hand.

IPL is known to be an effective technique for treating melasma due to its ability to target epidermal and dermal lesions. Moderate-good improvement has been reported in more than half of patients with three to four sessions of IPL administered at intervals of three to five weeks. Treatment is more effective in epidermal-type melasma[29,31,32]. In our study, moderate improvement was achieved in 2 and mild improvement in 1 of 3 patients with both epidermal and dermal component melasma after IPL therapy. IPL was also applied for axillary pigmentation associated with neurofibromatosis, and excellent improvement was achieved in the areas of application, but treatment was discontinued of the patient's own volition.

IPL systems are also generally effective in the treatment of poikiloderma[33-36]. We achieved moderate improvement, compatible with the previous literature, in a patient diagnosed with poikiloderma of Civatte and scleroderma.

All studies comparing IPL and Nd:YAG systems in terms of pain have used therapies for purposes of epilation. However, since the systems used differ, it is not possible to perform any direct comparison between them, although, in contrast to our findings, studies have generally reported that IPL systems caused less pain than Nd:YAG procedures[37-41]. Goh CL reported that patients described a prolonged burning sensation with the IPL system, but a transient stinging sensation with Nd:YAG[41]. We thing that with its own cooling headpiece, the Nd:YAG system used in our study was effective in overcoming pain by cooling the area before treatment.

Complications develop with varying frequencies with both IPL and Nd:YAG laser procedures, depending on the indication, the device used, the procedure parameters selected, and the patient's skin type. The most common complications are erythema, purpura, bullae, crust, hypo/hyperpigmentation, infection, and scar formation[42]. The risk of post-inflammatory hyperpigmentation and atrophic scar formation is higher in patients with skin types 4 and 5. Studies comparing IPL and Nd:YAG in terms of complications have reported a higher incidence of hyperpigmentation development in vascular lesions with Nd:YAG[43]. In contrast, a greater incidence of bullae and post-inflammatory hyperpigmentation has been reported with IPL used for epilation purposes than with Nd:YAG laser[41]. Complications developed in only 3 patients in our study (vesicles in 2, and atrophic scar in 1), all of which occurred after Nd:YAG laser application. Although it is not possible to perform a direct comparison between studies due to differences in the devices used, application parameters, and patient skin types, we attribute the low complication rate in our study to a lighter skin type of our patients, to our taking greater care in the selection of application parameters and informing patients about sun protection, to routine post-procedural cold application, and to the use of topical corticosteroids.

Study Limitations

The principal limitation of our study is that the number of patients was not sufficient to permit evaluation of effectiveness for every indication. Our retrospective review of applications performed in only the first year restricted the number of cases enrolled. This problem can be overcome with future larger-scale prospective studies. Our study may contribute to such studies.

Conclusion

In our one-year study period, Nd:YAG and IPL therapies both achieved successful outcomes in a wide area of indications, with relatively low complication rates. The risk of complications may be worrying for physicians newly embarking on laser therapy, and may lead to the selection of more traditional therapeutic methods in which experience is greater in appropriate indications. However, it is very probable that as experience with laser therapy increases and when appropriate parameters are used, cosmetically more acceptable, successful cosmetic results will be achieved compared to electrocauterization, cryotherapy, or other invasive surgical procedures. We therefore think that broadening the use of laser devices in training and research hospitals right from the intern period will increase their therapeutic effectiveness

and enable the correct parameters and the variety of indications in treatment to be determined.

Our study represents the first analysis in the literature of the effectiveness of Nd:YAG and IPL therapies in combination applied at 2-week intervals in rosacea, nevus flammeus and hemangioma. We think that combinations applied at different sessions can prolong the duration of treatment and bestow additional benefits with no additional risk compared to combinations applied in the same session, since each wave length will have a separate target. Further comparative and larger-scale studies for each indication are now needed to prove this hypothesis.

We think that our study results can serve as a guide for newly established units, encourage new applications, and shed light on future studies by revealing the first-year experience of a newly opened laser unit in a university hospital dermatological and venereal diseases department.

Ethics

Ethics Committee Approval: The study was approved by the Karadeniz Technical University Faculty of Medicine Clinical Research Ethics Committee (approval number: 43, date: 2017).

Informed Consent: Written informed consent have been obtained from the patients.

Peer-review: External and internal peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: D.A.A., L.B.S., Concept: D.A.A., Design: D.A.A., Data Collection or Processing: D.A.A., L.B.S., S.B., Analysis or Interpretation: D.A.A., L.B.S., Literature Search: D.A.A., Writing: D.A.A., L.B.S., S.Y., S.BA.

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