

Efficacy and Safety of Alexandrite and Nd:YAG Laser Combination in Permanent Hair Removal

Şule Gençoğlu 

Department of Dermatology, Private Gözde Akademi Hospital, Malatya, Türkiye
Email: sulegencoglu2309@gmail.com

How to cite this paper: Gençoğlu, Ş. (2023) Efficacy and Safety of Alexandrite and Nd:YAG Laser Combination in Permanent Hair Removal. *International Journal of Clinical Medicine*, 14, 419-427.
<https://doi.org/10.4236/ijcm.2023.149037>

Received: August 28, 2023

Accepted: September 22, 2023

Published: September 25, 2023

Copyright © 2023 by author(s) and Scientific Research Publishing Inc.
This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).
<http://creativecommons.org/licenses/by/4.0/>



Open Access

Abstract

Background and Objective: Unwanted hair growth is a discomforting issue affecting both genders. People have tried various methods to get rid of this situation. This study aims to evaluate the efficacy and safety of a combined Alexandrite and Nd:YAG laser treatment for permanent hair removal, drawing insights from existing literature. **Materials and Methods:** This study included a total of 2127 patients (302 males, 1825 females) aged 18 - 65, with complete data, who underwent hair removal treatment between December 2018 and April 2021. These patients were treated using the Duetta laser system (Quanta system, Samarate, Italy), combining Alexandrite 755 nm and Nd:YAG 1064 nm wavelengths. The patients' skin types were classified according to the Fitzpatrick classification scale. Target area/areas for laser hair removal was/were determined. Laser parameters, pulse counts, pain levels assessed through the Visual Pain Scale (VPS), and patient satisfaction were documented based on skin types. **Findings:** Across various skin types, Types I - II exhibited the highest treatment success rates (87%), with the axillary region achieving the highest rate (83%) and the face region achieving the lowest rate (75%). Pain scale analysis indicated that 98% of patients tolerated the procedure well. Patient satisfaction levels exceeded 90%. Evaluation of complication rates revealed minimal occurrences. **Conclusion:** The combined Alexandrite and Nd:YAG laser system demonstrates both efficacy and safety across diverse skin types, attributed to its notable success rates, minimal adverse effects, and high patient tolerance.

Keywords

Laser Hair Removal, Alexandrite Laser, Nd:YAG Laser

1. Introduction

Unwanted hair growth is a discomforting issue that affects both genders, not

only causing psychological distress, but also impacting the overall quality of life and self-esteem. Despite various attempts to combat this issue [1] [2], traditional methods, like shaving, waxing, tweezing, chemical hair removal, and electrolysis, offer temporary solutions and may result in complications, such as skin lesions and infections [1] [3]. Among these, electrolysis appears marginally more effective, involving the destruction of hair follicles through electrical energy applied via a fine needle, with varying results in terms of permanence [2] [4]. However, compared to laser methods, it is less efficient, slower, more painful, and associated with hyperpigmentation and scarring in the treated area [5].

Addressing these shortcomings, light-based (laser) hair removal methods have emerged with technological advancements. Laser hair removal devices received FDA approval in 1996, operating on the principle of photo thermolysis to selectively target melanin in chromophore hair follicles [6]. Currently utilized photo thermolysis-based devices include:

- Ruby 694 nm laser: It has been reported to be more effective in individuals with darker skin tones and Fitzpatrick skin Types I - III [1] [7].
- Intense Pulsed Laser (IPL): Acting by emitting pulses within a broad range of 400 to 1400 nm, studies have indicated its primary effectiveness on skin Types II - IV [8] [9].
- Alexandrite 755 nm Laser: This laser system, less absorbed by melanin pigment and penetrating the skin more deeply, is preferred for lighter skin types. It stands among the most commonly preferred systems [3] [10] [11].
- Nd:YAG Laser: Emitting pulses at 1064 nm wavelength and being minimally absorbed by melanin, this laser system is considered highly secure for darker skin types [12] [13].
- Diode laser: Emitting at a wavelength of 810 nm, it exhibits greater effectiveness on darker skin types [14].

In contemporary practice, these laser types are combined in systems to enhance efficacy and minimize side effects.

This study aims to examine the efficacy and safety of the Alexandrite and Nd:YAG laser combination used for permanent hair removal in our patients, drawing insights from existing literature.

2. Materials and Methods

Our study included 2127 patients who sought laser hair removal at our clinic from December 2018 to April 2021 and had complete data. Ethical approval was obtained from the local ethics committee prior to the study (Malatya Turgut Özal University Non-Invasive Clinical Research Ethics Committee, approval date: 29.04.2023, number: E-30785963-020-155317). These patients were treated using the Duetta laser system (Quanta system, Samarate, Italy), combining Alexandrite 755 nm and Nd:YAG 1064 nm wavelengths. The study encompassed 2127 patients, including 302 males and 1825 females, aged 18 - 65 years. The patients' skin types were classified according to the Fitzpatrick classification scale.

Target area/areas for laser hair removal were determined. Photographs of the treatment area were taken before and after the procedure (**Figure 1**, **Figure 2**). Factors such as patients' occupations, presence of chronic diseases, prior laser hair removal on the treated area, and use of chronic medications were determined. Patients with active infections in the target area, pregnancy or breast-feeding, a history of epilepsy or seizures, skin lesions, malignancies, immune disorders, depression, allergies to drugs to be used for treatment, latex sensitivity, or sensitivity to other substances were excluded from the study. It was found that patients received different laser procedures, numbers of sessions, and energy doses tailored to each region. Patients who had direct sun exposure within 1 month following laser sessions, used topical chemical depilatories, light-sensitizing drugs or substances, or topical anesthetic agents were also excluded from the study.

Subsequent to initial admission, photographs of patients who were scheduled for laser hair removal and had given their consent were taken before the actual procedure commenced. Laser energy and pulse settings were adjusted based on the patients' skin types (**Table 1**). Patients who completed the Visual Pain Scale (VPS) to quantify their pain level were included in the study. Pain was categorized into very severe (10 - 8), high (7 - 5), moderate (4 - 2), and mild (1 - 0)



Figure 1. Before (a) and after (b) combined laser treatment for lower limb.



Figure 2. Before (a) and after (b) combined laser treatment for axillary area.

Table 1. Treatment parameters for skin types.

Skin Type (Fitzpatrick)	Treatment Parameter
I - II	Pulse duration 6 - 20 ms 9 - 12 J/cm ² (Alex) + 16 - 20 J/cm ² (Nd:YAG)
III - IV	Pulse duration 10 - 25 ms 7 - 9 J/cm ² (Alex) + 13 - 18 J/cm ² (Nd:YAG)
V	Pulse duration 15 - 34 ms 4 - 5 J/cm ² (Alex) + 12 - 18 J/cm ² (Nd:YAG)

based on the pain scale. Additionally, patients were asked to assess their level of satisfaction using the Global Aesthetic Improvement Scale (GAIS). Satisfaction was classified as poor (0% - 24%), moderate (25% - 49%), good (50% - 74%), and very good (75% - 100%) on this scale.

3. Statistical Analyses

Statistical analyses were conducted using SPSS software (Version 21, IBM SPSS Inc., IL, USA), and were carried out within a 95% confidence interval. A p-value of 0.05 or less was considered statistically significant. The normality and suitability of values were assessed using the Student's t-test. Analyses focused on patients with matching sessions and skin type groups. Patient questionnaire data were employed to evaluate adverse event incidence, satisfaction scores, and pain tolerance levels.

4. Findings

Demographic patient characteristics were categorized by skin types and are comprehensively presented in **Table 2**. Skin Types I and II, reacting to sunlight and light at a comparable rate, were assessed in the same category. Our study noted a higher number of females compared to males. Moreover, our treatment protocol classified patients into 4 sub-categories based on skin types: Type I - II, Type III, Type IV, and Type V. According to the results of statistical analysis conducted on the collected data, the success rates of treatment by skin types were 87% for Types I - II, 82% for Type III, 76% for Type IV, and 68% for Type V (**Table 3**). Furthermore, regarding specific treatment areas, the highest success rate was observed in the axillary region (83%), while the lowest success rate was in the facial region (75%). The success rates for other areas were calculated as follows: genital area (82%), legs (80%), arms (81%), back (81%), chest (79%), abdominal area (80%), nape (79%), nipple (80%), and neck (79%) (**Table 4**). Examining pain scales, it was noted that 98% of patients reported tolerable pain, with others experiencing a bearable burning sensation during treatment. Using the Global Aesthetic Improvement Scale (GAIS) to rate patient satisfaction, both male and female patients expressed satisfaction rates exceeding 90% across different skin types (**Table 5**). When assessing complication rates, it was observed that out of 2127 patients, 74 (3.4%) experienced erythema, 5 (0.2%) had postin-

inflammatory hypopigmentation, 2 (0.09%) had postinflammatory hyperpigmentation, 10 (0.4%) had paradoxical hypertrichosis, and 8 (0.3%) suffered from first-degree skin burns (Table 6). None of these complications required hospitalization.

Table 2. Age and gender distribution of patients undergoing laser hair removal by skin type.

Skin Type	Gender	Age/Number of Patients
Types I - II	Female	18 - 30/116
		31 - 45/124
		46 - 65/19
	Male	18 - 30/51
		31 - 45/48
		46 - 65/7
Type III	Female	18 - 30/626
		31 - 45/568
		46 - 65/218
	Male	18 - 30/72
		31 - 45/69
		46 - 65/42
Type IV	Female	18 - 30/59
		31 - 45/52
		46 - 65/38
	Male	18 - 30/6
		31 - 45/1
		46 - 65/1
Type V	Female	18 - 30/3
		31 - 45/2
		46 - 65/0
	Male	18 - 30/4
		31 - 45/1
		46 - 65/0

Table 3. Treatment outcomes by skin type.

Skin Type	Success Rate (%)	Mean Amount of Energy
Types I - II	87	20 J/cm ²
Type III	82	19 J/cm ²
Type IV	76	18 J/cm ²
Type V	68	16 J/cm ²

Table 4. Treatment outcomes by target area of laser hair removal.

Area	Success Rate (%)
Face	75
Axilla	83

Continued

Genital Area	82
Leg	80
Arm	81
Back	81
Chest	79
Abdominal Area	80
Nape	79
Nipple	80
Neck	79

Table 5. Patient satisfaction levels by skin types.

Skin Type	Level of Satisfaction (GAIS)	
	Male	Female
Types I - II	96.4%	96.1%
Type III	94.8%	94.4%
Type IV	94.1%	93.9%
Type V	93.6%	93.4%

Table 6. Complications and complication rates.

Complication	Number and Percentage of Patients
Erythema	74 (3.4%)
Hypopigmentation	5 (0.2%)
Hyperpigmentation	2 (0.09%)
Paradoxical Hypertrichosis	10 (0.4%)
First-degree Burns	8 (0.3%)

5. Discussion

The rates of hair removal achieved through standalone use of Alexandrite or Nd:YAG lasers have been found to be low [10] [15]. However, these rates have shown gradual improvement with the introduction of combined laser systems, with the success rates reported in the literature exceeding 80% [16] [17]. Evaluating outcomes based on the treatment area, the combined laser approach yields the most satisfactory results in the axilla, genital region, and legs. Our study aligns with existing literature when considering overall success [18].

When treating the facial area that typically exhibits resistance to laser hair removal, laser treatment alone yields low success rates, however, this is enhanced when combined laser treatment is used. In our study, the success rate for combined laser treatment on the face also aligns with the literature results [19] [20].

Studies have indicated that patients undergoing single-source laser treatment

experience greater pain during procedures [21]. Excessive pain can impede success. However, the utilization of additional cooling systems with combined laser treatment nearly eliminates pain sensation. In our patient cohort, pain was minimal and reported at negligible levels [22].

While patient satisfaction tends to be low with single-source laser procedures, combining laser methods often elevates satisfaction levels [23] [24]. In our study, patient satisfaction was consistently rated as very good according to GAIS.

Temporary side effects are commonly observed after laser hair removal, and these often respond well to simple medical interventions [25] [26]. Serious complications such as scar tissue formation have been reported during single-source laser procedures [27], whereas combined laser approaches notably decrease the occurrence of severe side effects [28]. Within our patient group, instances of erythema, hypo-hyperpigmentation, and minor skin burns were noted, all of which responded well to simple medical treatments. Our complication rates are in line with established literature.

6. Conclusion

Our study yielded results consistent with other studies in the literature on combined laser approaches, demonstrating efficacy, minimal pain, high patient satisfaction, and low rates of side effects. In comparison to standalone Alexandrite or Nd:YAG laser treatments, the combined laser system proves to be both safe and effective across various skin types with a superior success rate, reduced side effects, and higher patient tolerance.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

References

- [1] Gan, S.D. and Graber, E.M. (2013) Laser Hair Removal: A Review. *Dermatologic Surgery*, **39**, 823-838. <https://doi.org/10.1111/dsu.12116>
- [2] Thomas, M.M. and Houreld, N.N. (2019) The “In’s and Outs” of Laser Hair Removal: A Mini Review. *Journal of Cosmetic and Laser Therapy*, **21**, 316-322. <https://doi.org/10.1080/14764172.2019.1605449>
- [3] Kang, C.N.-Y., Shah, M., Lynde, C. and Fleming, P. (2021) Hair Removal Practices: A Literature Review. *Skin Therapy Letter*, **26**, 6-11.
- [4] Ramos-e-Silva, M., de Castro, M.C.E. and Carneiro Jr., L.V. (2001) Hair Removal. *Clinics in Dermatology*, **19**, 437-444. [https://doi.org/10.1016/S0738-081X\(01\)00200-0](https://doi.org/10.1016/S0738-081X(01)00200-0)
- [5] Matheson, E. and Bain, J. (2019) Hirsutism in Women. *American Family Physician*, **100**, 168-175.
- [6] Lee, C.-M. (2018) Laser-Assisted Hair Removal for Facial Hirsutism in Women: A Review of Evidence. *Journal of Cosmetic and Laser Therapy*, **20**, 140-144. <https://doi.org/10.1080/14764172.2017.1376099>
- [7] Shi, Z., Duan, X., Jiang, M., Zhang, C. and Xiang, L. (2022) Treatment of Linear and

- Whorled Nevoid Hypermelanosis Using QS 694-NM Ruby Laser. *Journal of Cosmetic and Laser Therapy*, **24**, 56-59. <https://doi.org/10.1080/14764172.2022.2066135>
- [8] Babilas, P., Schreml, S., Szeimies, R.-M. and Landthaler, M. (2010) Intense Pulsed Light (IPL): A Review. *Lasers in Surgery and Medicine*, **42**, 93-104. <https://doi.org/10.1002/lsm.20877>
- [9] Town, G., Botchkareva, N.V., Uzunbajakava, N.E., Nuijs, T., van Vlimmeren, M., Ash, C. and Dierickx, C. (2019) Light-Based Home-Use Devices for Hair Removal: Why Do They Work and How Effective They Are? *Lasers in Surgery and Medicine*, **51**, 481-490. <https://doi.org/10.1002/lsm.23061>
- [10] Eremia, S., Li, C.Y., Umar, S.H. and Newman, N. (2001) Laser Hair Removal: Long-Term Results with a 755 nm Alexandrite Laser. *Dermatologic Surgery*, **27**, 920-924. <https://doi.org/10.1046/j.1524-4725.2001.01074.x>
- [11] Nistico, S.P., Bennardo, L., Del Duca, E., Tamburi, F., Rajabi-Estarabadi, A. and Nouri, K. (2021) Long-Pulsed 755-nm Alexandrite Laser Equipped with a Sapphire Handpiece: Unwanted Hair Removal in Darker Phototypes. *Lasers in Medical Science*, **36**, 237-238. <https://doi.org/10.1007/s10103-020-03004-3>
- [12] Ross, E. and Domankevitz, Y. (2021) Hair Removal with Blended 755/1064 nm Laser Energy. *Lasers in Surgery and Medicine*, **53**, 1020-1025. <https://doi.org/10.1002/lsm.23381>
- [13] Littler, C.M. (1999) Hair Removal Using an Nd:YAG Laser System. *Dermatologic Clinics*, **17**, 401-430. [https://doi.org/10.1016/S0733-8635\(05\)70096-6](https://doi.org/10.1016/S0733-8635(05)70096-6)
- [14] Załęska, I. and Atta-Motte, M. (2019) Aspects of Diode Laser (805 nm) Hair Removal Safety in a Mixed-Race Group of Patients. *Journal of Lasers in Medical Sciences*, **10**, 146-152. <https://doi.org/10.15171/jlms.2019.23>
- [15] Zerbinati, N., Protasoni, M., Dalla Gasperina, D., Coricciati, L., Mezzana, P., Sbano, P., Greco, M., D'Este, E., Rodighiero, E. and Satolli, F. (2021) Combined Laser Assisted Treatment for Permanent Hair Removal for Skin Types I - V with Alexandrite 755 nm and ND:YAG 1064 nm Lasers. *Dermatologic Therapy*, **34**, e14599. <https://doi.org/10.1111/dth.14599>
- [16] Naranjo García, P., López Andrino, R., Gómez González, C. and Pinto, H. (2022) Three Wavelengths Integrated: Efficacy and Safety of A Novel Combination for Hair Removal. *Journal of Cosmetic Dermatology*, **21**, 259-267. <https://doi.org/10.1111/jocd.14371>
- [17] Davoudi, S.M., Behnia, F., Gorouhi, F., Keshavarz, S., Nassiri Kashani, M., Rashighi Firoozabadi, M. and Firooz, A. (2008) Comparison of Long-Pulsed Alexandrite and ND:YAG Lasers, Individually and in Combination, for Leg Hair Reduction: An Assessor-Blinded, Randomized Trial with 18 Months of Follow-Up. *Archives of Dermatology*, **144**, 1323-1327. <https://doi.org/10.1001/archderm.144.10.1323>
- [18] Khoury, J.G., Saluja, R. and Goldman, M.P. (2008) Comparative Evaluation of Long-Pulse Alexandrite and Long-Pulse Nd:YAG Laser Systems Used Individually and in Combination for Axillary Hair Removal. *Dermatologic Surgery*, **34**, 665-671. <https://doi.org/10.1097/00042728-200805000-00011>
- [19] Hovenic, W. and DeSpain, J. (2011) Laser Hair Reduction and Removal. *Facial Plastic Surgery Clinics of North America*, **19**, 325-333. <https://doi.org/10.1016/j.fsc.2011.04.002>
- [20] Bouzari, N., Tabatabai, H., Abbasi, Z., Firooz, A. and Dowlati, Y. (2004) Laser Hair Removal: Comparison of Long-Pulsed Nd:YAG, Long-Pulsed Alexandrite, and Long-Pulsed Diode Lasers. *Dermatologic Surgery*, **30**, 498-502.
- [21] Nistico, S.P., Bennardo, L., Bennardo, S., Marigliano, M., Zappia, E., Silvestri, M.

- and Cannarozzo, G. (2022) Comparing Traditional and in Motion Nd:YAG Laser in Hair Removal: A Prospective Study. *Medicina*, **58**, Article 1205. <https://doi.org/10.3390/medicina58091205>
- [22] Noyman, Y., Levi, A., Reiter, O. and Lapidoth, M. (2021) Using Blend Wavelengths in Order to Improve the Safety and Efficacy of Laser Hair Removal. *Journal of Cosmetic Dermatology*, **20**, 3913-3916. <https://doi.org/10.1111/jocd.14535>
- [23] Sochor, M., Curkova, A.K., Schwarczova, Z., Sochorova, R., Simaljakova, M. and Buchvald, J. (2011) Comparison of Hair Reduction with Three Lasers and Light Sources: Prospective, Blinded and Controlled Study. *Journal of Cosmetic and Laser Therapy*, **13**, 210-215. <https://doi.org/10.3109/14764172.2011.586422>
- [24] Lehavit, A., Eran, G., Moshe, L. and Assi, L. (2020) A Combined Triple-Wavelength (755 nm, 810 nm, and 1064 nm) Laser Device for Hair Removal: Efficacy and Safety Study. *Journal of Drugs in Dermatology*, **19**, 515-518. <https://doi.org/10.36849/JDD.2020.10.36849/JDD.2020.4735>
- [25] Aimonetti, J.-M. and Ribot-Ciscar, E. (2016) Pain Management in Photoepilation. *Journal of Cosmetic Dermatology*, **15**, 194-199. <https://doi.org/10.1111/jocd.12196>
- [26] Gold, M.H., Weiss, E. and Biron, J. (2023) Novel Laser Hair Removal in All Skin Types. *Journal of Cosmetic Dermatology*, **22**, 1261-1265. <https://doi.org/10.1111/jocd.15674>
- [27] Gold, M.H., Biron, J., Wilson, A., Viera-Mármol, G., Lamas, R.E.V., Castillejos-Pallàs, M. and Ferrández-Martínez, J.A. (2022) Safety and Efficacy for Hair Removal in Dark Skin Types III and IV with a High-Powered, Combined Wavelength (810, 940 and 1060 nm) Diode Laser: A Single-Site Pilot Study. *Journal of Cosmetic Dermatology*, **21**, 1979-1985. <https://doi.org/10.1111/jocd.14926>
- [28] Lapidoth, M., Dierickx, C., Lanigan, S., Paasch, U., Campo-Voegeli, A., Dahan, S., Marini, L. and Adatto, M. (2010) Best Practice Options for Hair Removal in Patients with Unwanted Facial Hair Using Combination Therapy with Laser: Guidelines Drawn up by an Expert Working Group. *Dermatology*, **221**, 34-42. <https://doi.org/10.1159/000315499>