

Characteristics of Patients Undergoing Nd Laser Treatment at the Dermatology, Venereology, and Aesthetic Outpatient Clinic of Dr. Moewardi General Hospital, Surakarta, 2016–2025

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ABSTRACT

Background: Nd:YAG laser is an important therapeutic modality in dermatology, venereology, and aesthetics due to its precision, effectiveness, deep tissue penetration, and favorable cosmetic outcomes. However, comprehensive data regarding patient demographics and treatment indications for Nd:YAG laser therapy in Indonesia, particularly in tertiary referral institutions, remain highly limited. **Objective:** To determine the characteristics of patients undergoing Nd:YAG laser therapy at the dermatology and venereology outpatient clinic of Dr. Moewardi General Hospital, Surakarta, for the period of 2016–2025.

Subject and Method: A retrospective descriptive study was conducted by analyzing secondary data from the medical records of patients who underwent Nd:YAG laser therapy. The variables examined included demographic characteristics, clinical characteristics such as diagnosis and lesion size, as well as the intensity or number of treatment sessions.

Results: A total of 172 patients underwent Nd:YAG laser procedures. Female patients (58.14%) predominated over males (41.86%). The most frequent diagnoses were nevus of Ota (18.02%), tattoo removal (8.72%), and melanocytic nevus (8.14%). Most patients required only 1–2 treatment sessions (58.72%), while 3.49% of patients required more than 15 therapy sessions.

Conclusion: Nd:YAG laser therapy at Dr. Moewardi General Hospital is more frequently used for congenital dermal pigmentary disorders (melanocytosis) such as nevus of Ota compared to classic global indications like sociocultural tattoo removal. This difference emphasizes that laser practice is not only determined by global trends but is also strongly influenced by local epidemiology, modality availability, and clinician preferences.

Keywords: characteristics, Nd:YAG laser, retrospective, patient profile

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BACKGROUND

Neodymium-doped yttrium aluminum garnet (Nd) laser is a light-based tissue modification technique that operates at a wavelength of 1064 nm. The laser induces

selective photothermolysis, resulting in damage to specific chromophores, such as melanin and hemoglobin, as well as microvascular coagulation, leading to pigment particle fragmentation and tissue

injury (Agarwal, 2020). Laser therapy is an important treatment modality because of its precision, ability to penetrate deep tissues, effectiveness, and favorable cosmetic outcomes. The mechanism of laser therapy, particularly in the Q-switched mode, involves the delivery of high-energy pulses over a short duration, inducing shock waves and photothermal effects that damage the target chromophores while minimizing excessive injury to the surrounding tissues (Agarwal, 2020). This technique is widely used in dermatological practice because it is minimally invasive, precise, rapid, and suitable for individuals with darker skin phenotypes, including Indonesian and other Asian populations.

Laser therapy in dermatology is used for a wide range of skin conditions, including benign pigmented lesions, such as nevus of Ota, nevus of Becker, melanocytic nevi, post-inflammatory hyperpigmentation, and melasma; vascular lesions, such as hemangiomas, port-wine stains, telangiectasia, and Klippel–Trenaunay syndrome; as well as aesthetic and cosmetic applications (Campolmi, 2024). For dermal hypermelanosis and tattoo removal, Q-switched Nd:YAG laser therapy has been recommended as a first-line treatment for pigmentary disorders (Ho, 2015).

Lasers are also used for aesthetic indications, including reducing enlarged pores, improving skin texture, and promoting skin rejuvenation in the context of skin aging (Soebono, 2024). A previous study by Houhuang Qiu et al. demonstrated that combining different Nd:YAG laser modalities could reduce the severity and recurrence of melasma compared with low-fluence laser monotherapy. The study entitled “The Low-Fluence Q-Switched Nd:YAG Laser Treatment for Melasma” also confirmed that Nd:YAG laser therapy is effective and safe for complex pigmentary

disorders; however, its aggressive use is limited by the risk of inducing inflammation and mottled hypopigmentation (Kim, 2022).

The efficacy and safety of Nd:YAG laser therapy are influenced by patient characteristics, such as age and Fitzpatrick skin type; lesion characteristics, including size, depth, and disease duration; and the laser parameters used, particularly fluence and spot size. Darker lesions tend to require a greater number of treatment sessions (Yang, 2023).

Laser therapy may also cause adverse effects, including pain, erythema, edema, petechiae, prolonged healing, post-inflammatory hypopigmentation or hyperpigmentation, and scar formation (Lanigan, 2003). In the article “Corneal Perforation after Nd:YAG Capsulotomy: A Case Report and Literature Review,” one reported complication of laser therapy is inadvertent damage to unintended targets. Therefore, appropriate eye protection is mandatory during laser procedures involving the facial area (Mujaini, 2019).

A study by Wanitphakdeedecha et al. (2020) emphasized that although numerous studies have reported the clinical efficacy of Nd:YAG laser therapy, data describing the overall characteristics of patients undergoing Nd:YAG laser treatment in real-world clinical practice remain limited (Wanitphakdeedecha, 2020). Most existing publications have focused on therapeutic outcomes, whereas comprehensive descriptions of patient demographics and treatment indications remain scarce in Southeast Asia, where disease patterns and patient profiles may differ from those of Western populations. Although the international literature has described various clinical parameters of Nd:YAG laser therapy, local data from Indonesia, particularly from tertiary referral institutions in Central Java, remain limited. Therefore, this study aimed to describe the

demographic and clinical characteristics of patients undergoing Nd:YAG laser treatment at the outpatient Dermatology, Venereology, and Aesthetic Clinic of Dr. Moewardi Regional General Hospital from 2016 to 2025. The findings are expected to provide a basis for optimizing clinical services and treatment protocols.

This study aimed to determine the characteristics of patients undergoing Nd laser therapy at the outpatient Dermatology and Venereology Clinic of Dr. Moewardi Regional General Hospital, Surakarta, Indonesia, from 2016 to 2025.

SUBJECTS AND METHOD

1. Study Design

This study employed a retrospective descriptive study design conducted at the outpatient Dermatology, Venereology, and Aesthetic Clinic of Dr. Moewardi Regional General Hospital, Surakarta, Indonesia, from 2016 to 2025. The study analyzed secondary data obtained from the medical records of patients who underwent Nd:YAG laser therapy at the clinic.

2. Population and Sample

The study population comprised all patients who underwent Nd:YAG laser therapy at the outpatient Dermatology, Venereology, and Aesthetic Clinic of Dr. Moewardi Regional General Hospital during the study period. The sample consisted of patients who met the predetermined inclusion and exclusion criteria.

3. Inclusion and Exclusion Criteria

The inclusion criteria were patients of any age and sex who underwent at least one Nd:YAG laser treatment during the study period and had complete medical records. Patients with incomplete medical records or records that did not contain sufficient information for analysis according to the study objectives were excluded.

4. Study Variables

The variables assessed in this study included demographic characteristics (sex), clinical characteristics (clinical diagnosis), and the number of Nd:YAG laser modalities used.

5. Operational Definition of Variables

Patient characteristics were defined based on demographic and clinical information documented in the medical records. Sex was categorized as male or female. Clinical diagnosis was determined based on the diagnosis documented by the treating physician. Nd:YAG laser modality was defined according to the type of Nd:YAG laser treatment documented in the medical record.

6. Data Analysis

The collected data were analyzed descriptively and presented in narrative form to provide a comprehensive description of the demographic and clinical characteristics of patients undergoing Nd:YAG laser therapy.

7. Research Ethics

Ethical approval for this study was obtained from the Health Research Ethics Committee (Komite Etik Penelitian Kesehatan [KEPK]) of Dr. Moewardi Regional General Hospital, Surakarta, Central Java, Indonesia (Approval No. 605/IV/HREC/2026), on April 14, 2026.

RESULTS

A total of 172 patients underwent Nd:YAG laser procedures at the outpatient Dermatology, Venereology, and Aesthetic Clinic of Dr. Moewardi Regional General Hospital, Surakarta, during the 2016–2025 study period. All patients were confirmed to have received treatment exclusively at the clinic. Regarding demographic characteristics, females accounted for the majority of patients, with 100 patients (58.14%), while males accounted for 72 patients (41.86%). Based on age group, Nd:YAG laser

procedures were most frequently performed in young and middle-aged adults. The largest proportion of patients was in the 20–29-year age group, comprising 58 patients (33.72%), followed by those aged 30–39 years with 51 patients (29.65%), 40–49 years with 27 patients (15.70%), ≥50 years with 23 patients (13.37%), and <20 years with 13 patients (7.56%).

Regarding occupation, housewives represented the largest group, comprising 50 patients (29.07%), followed by private-sector employees with 46 patients (27.33%), students with 34 patients (19.77%), civil servants with 17 patients (9.88%), and other occupations with 25 patients (14.53%). The patient characteristics are presented in Table 1.

Table 1. Patient Characteristics Undergoing Nd:YAG Laser Therapy

Characteristics	Number of Patients (n)	Percentage (%)
Sex		
Female	100	58.14
Male	72	41.86
Age		
<20 years	13	7.56
20–29 years	58	33.72
30–39 years	51	29.65
40–49 years	27	15.70
≥50 years	23	13.37
Occupation		
Civil servant	17	9.88
Housewife	50	29.07
Private-sector employee	46	27.33
Student	34	19.77
Other	25	14.53

The most common lesion size category was 5–10 cm, comprising 82 patients (47.67%). Lesions larger than 10 cm were also frequently treated, accounting for 51 patients (29.65%). In addition, 16 patients (9.30%) underwent Nd:YAG laser proce-

dures for lesions categorized as general or unspecified in size. A total of 23 patients (13.37%) had multiple lesions involving both the 5–10 cm and >10 cm size categories. The distribution of lesion size categories is presented in Table 2.

Table 2. Nd:YAG Laser Treatment Categories

Lesion Size Category	Number of Patients (n)	Percentage (%)
General/unspecified lesion size	16	9.30
5–10 cm	82	47.67
>10 cm	51	29.65
5–10 cm and >10 cm	23	13.37

The most common diagnosis among patients undergoing Nd:YAG laser therapy was nevus of Ota, observed in 31 patients

(18.02%). Other relatively common diagnoses included tattoo removal (15 patients, 8.72%), melanocytic nevus (14 patients,

8.14%), post-inflammatory hyperpigmentation (11 patients, 6.40%), keloid (11 patients, 6.40%), and nevus of Becker (11 patients, 6.40%). Other diagnoses occurred less frequently, including acne scars, café-au-lait macules, chloasma, Hemangi-

oma, and port-wine stains, as well as less common conditions such as chromoblastomycosis, congenital pigmented nevus, congenital melanocytic nevus, and other diagnoses. The distribution of diagnoses is presented in Table 3.

Table 3. Primary Diagnoses of Patients Undergoing Nd:YAG Laser Therapy

Primary Diagnosis	Number of Patients (n)	Percentage (%)
Nevus of Ota	31	18.02
Tattoo removal	15	8.72
Melanocytic nevus	14	8.14
Post-inflammatory hyperpigmentation	11	6.40
Keloid	11	6.40
Nevus of Becker	11	6.40
Melasma	8	4.65
Telangiectasia	8	4.65
Acne scar	7	4.07
Café-au-lait macule	6	3.49
Chloasma	6	3.49
Hemangioma	6	3.49
Port-wine stain	5	2.91
Other diagnoses	35	20.34

Regarding treatment frequency, most patients underwent Nd:YAG laser therapy 1–2 times (101 patients, 58.72%), indicating that most cases either required only a limited number of treatment sessions or that the patients were receiving their initial

treatment. Approximately 21.51% of patients underwent 3–4 treatment sessions, while 9.88% required 5–7 sessions. Only 3.49% of patients underwent ≥15 treatment sessions. The distribution of treatment frequency is presented in Table 4.

Table 4. Frequency of Nd:YAG Laser Treatment

Number of Treatment Sessions	Number of Patients (n)	Percentage (%)
1–2 sessions	101	58.72
3–4 sessions	37	21.51
5–7 sessions	17	9.88
8–10 sessions	9	5.23
11–14 sessions	2	1.16
≥15 sessions	6	3.49

In this study, lesion size was not the only factor determining the number of Nd:YAG laser treatment sessions required. The highest mean treatment frequency was observed in patients with multiple lesions

measuring 5–10 cm and >10 cm, with a mean of 6.43 sessions per patient and a maximum of 25 sessions. Patients with lesions >10 cm underwent a mean of 4.08 treatment sessions, with a maximum of 25

sessions. Patients with general or unspecified lesion sizes underwent a mean of 3.44 treatment sessions, with a maximum of 11 sessions. Patients with lesions measuring 5–10 cm had the lowest mean treatment

frequency, at 3.30 sessions per patient, with a maximum of 20 sessions. The relationship between lesion size and treatment frequency is presented in Table 5.

Table 5. Relationship Between Lesion Size and Treatment Frequency

Lesion Size Category	Mean Treatment Frequency (Sessions/ Patient)	Maximum Treatment Frequency (Sessions)
Multiple (5–10 cm and >10 cm)	6.43	25
5–10 cm	3.30	20
General/unspecified	3.44	11
>10 cm	4.08	25

DISCUSSION

Nd:YAG laser is a light-based therapeutic modality that has long been used in dermatology, venereology, and aesthetic medicine, based on the principle of tissue modification through selective photothermolysis at a wavelength of 1064 nm. Its pathophysiological mechanism involves the absorption of photon energy by specific chromophores and the generation of shock waves, resulting in fragmentation of target pigments and microvascular coagulation (Anderson, 1983). The advantages of Nd:YAG laser therapy include deep dermal penetration, suitability for darker skin types, applicability in outpatient settings, short recovery time, and favorable cosmetic outcomes. These advantages have established Nd:YAG laser as an important treatment modality for various benign pigmented lesions, vascular lesions, and aesthetic applications.

In this study, among 172 patients who underwent Nd:YAG laser therapy, females predominated (58.14%) compared with males (41.86%). This predominance may be partly related to the relatively high proportion of patients with nevus of Ota (18.02%). Nevus of Ota is a manifestation of dermal melanocytosis that typically occurs along the distribution of the trigeminal nerve on the face. Globally, the prevalence of nevus of Ota

has been reported to range from 0.2% to 0.8% among Asian populations, with onset most commonly occurring during early childhood or puberty (Stanford, 1996). A retrospective study by Yang et al. (2023) in China involving more than 1,000 patients undergoing laser treatment also reported that dermal pigmented lesions were the most common indication, accounting for more than 50% of cases.

Current dermatological consensus supports Q-switched Nd:YAG laser therapy as a first-line treatment for nevus of Ota, with reported clearance rates of 70%–100%, although multiple treatment sessions are generally required (Geronemus, 1992). This finding is consistent with the present study, in which some patients required more than four treatment sessions. The treatment response may be influenced by lesion depth, anatomical location, and skin type, which are important factors affecting treatment outcomes.

The next most common indications were tattoo removal (8.72%) and melanocytic nevi (8.14%). Nd:YAG laser therapy has been reported to be effective for both conditions, with substantial pigment fragmentation and satisfactory cosmetic outcomes (Trelles, 2024). Nevertheless, the risks of post-inflammatory hyperpigmentation (PIH) and changes in skin texture should be

considered (Greve, 2002). Globally, Nd:YAG laser therapy for tattoo removal is more commonly reported as a major indication in Western countries, partly reflecting socio-cultural trends. In contrast, the present study showed a predominance of nevus of Ota and other pigmented lesions, including congenital lesions.

In the present study, post-inflammatory hyperpigmentation (PIH) and melasma together accounted for 11.05% of patients. In these conditions, Nd:YAG laser therapy is thought to act through sublethal damage to melanosomes and downregulation of melanogenesis (Mun, 2011). A prospective study by Kim et al. (2022) demonstrated that low-fluence Nd:YAG laser toning could improve pigment severity and subjective symptoms; however, recurrence remained relatively high when used as monotherapy (Kim, 2022). Nd:YAG laser therapy has therefore also been recommended as an adjunctive treatment in combination with topical depigmenting agents or chemical peeling (Rivas, 2013).

Vascular conditions, including hemangiomas and telangiectasia, together accounted for approximately 8.14% of the cases in this study. Long-pulsed Nd:YAG laser therapy targets intravascular oxyhemoglobin and induces vascular endothelial destruction (Niaimi, 2017). Other diagnoses, including acne scars, skin aging, hypertrichosis, and café-au-lait macules, have also been reported as indications for Nd:YAG laser therapy, although the evidence supporting complete clearance varies across these conditions (Belkin, 2017).

The distribution of treatment sessions showed that more than half of the patients underwent only 1–2 Nd:YAG laser treatment sessions (58.72%), whereas a small proportion (3.49%) required ≥ 15 sessions. This finding is consistent with previous reports indicating that some superficial epidermal

lesions may respond after several treatment sessions, whereas refractory conditions, such as café-au-lait macules, deep dermal PIH, and nevus of Becker, may require multiple and prolonged treatment sessions (Karsiyakali, 2023).

Compared with the literature on Nd:YAG laser indications, an important difference was observed in the present study. Globally, Nd:YAG laser therapy is frequently used for tattoo removal and general skin rejuvenation, whereas dermal melanocytosis, particularly nevus of Ota, was the predominant indication in this study. This finding may reflect differences in the epidemiology of melanin-related disorders among Asian populations, including individuals with Fitzpatrick skin types III–V in Indonesia. Similarly, café-au-lait macules and melasma, which are considered challenging and prone to recurrence in the literature, represented a notable proportion of cases in this study. These differences suggest that laser treatment practices are influenced not only by global evidence but also by local disease epidemiology, availability of treatment modalities, and clinician preferences (Goldberg, 2001).

This study has several limitations. The retrospective descriptive design precludes assessment of long-term treatment efficacy and recurrence rates. Furthermore, the data were obtained from a single hospital, limiting the generalizability of the findings to broader populations. Rare diagnoses were represented by small numbers of patients, preventing further meaningful subgroup analysis. Nevertheless, this study provides an important overview of Nd:YAG laser utilization in the outpatient Dermatology, Venereology, and Aesthetic Clinic of Dr. Moewardi Regional General Hospital and provides a basis for future larger prospective studies incorporating long-term treatment outcomes and recurrence assessment.

This retrospective descriptive study evaluated the characteristics of patients undergoing Nd laser therapy at the out-patient Dermatology, Venereology, and Aesthetic Clinic of Dr. Moewardi Regional General Hospital, Surakarta, Indonesia, from January 2016 to December 2025, involving 172 patients. Female patients predominated over male patients, with nevus of Ota being the most common diagnosis, followed by tattoo removal, melanocytic nevi, and post-inflammatory hyperpigmentation. Most patients underwent 1–2 Nd laser treatment sessions, although a small proportion required ≥ 15 sessions.

These findings indicate that, in the study setting, Nd laser therapy was predominantly used for congenital dermal pigmented disorders, particularly dermal melanocytosis, rather than for globally recognized indications such as skin rejuvenation or purely cosmetic procedures. The number of treatment sessions varied according to the type of lesion and patient characteristics.

AUTHORS' CONTRIBUTIONS

All authors contributed to the conception and design of the study, data collection, data analysis and interpretation, manuscript preparation, and critical revision of the manuscript. All authors approved the final version of the manuscript.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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