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THE EFFICACY AND SAFETY OF LASER THERAPY AS A METHOD OF DIRECT HAIR REMOVAL IN HIRSUTISM: SUMMARY OF FINDINGS

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ABSTRACT

Introduction: Hirsutism, which affects approximately 5–15% of women during their reproductive years, is defined by the emergence of coarse terminal hair in androgen-sensitive regions typically associated with male distribution patterns. The clinical presence of visible terminal hair frequently precipitates significant psychological morbidity, including elevated levels of anxiety, clinical depression, and a compromised sense of femininity, which collectively diminish overall quality of life. Empirical data from clinical investigations identify laser therapy as a secure and efficacious modality for the long-term reduction of unwanted hair.
Aim of the study: This investigation aims to provide a rigorous synthesis of existing scientific evidence regarding the safety and clinical efficacy of laser-assisted hair removal in the management of female hirsutism. The analysis specifically evaluates monotherapy utilizing alexandrite, diode, and long-pulse Nd:YAG laser systems, while providing a comparative appraisal of these laser technologies against intense pulsed light devices. The goal is to provide a descriptive synthesis that supports the evaluation of various photoepilation-based treatment strategies.
Material and method: The current study utilized a systematic literature review methodology to evaluate the performance of laser therapy for hirsutism. A comprehensive search was conducted via the PubMed platform, encompassing peer-reviewed literature published between the years 2000 and 2026.
Results: The synthesis of clinical outcomes suggests that laser therapy represents a reliable and safe intervention for achieving durable hair reduction in patients presenting with hirsutism. However, the literature indicates a continued need for clinical refinement to resolve uncertainties regarding optimal laser configurations - specifically wavelength, pulse duration, and fluence - to enhance therapeutic success and optimize clinical outcomes for this patient population.

KEYWORDS

Hirsutism, Nd:YAG Laser, Diode Laser, Alexandrite Laser, Intense Pulsed Light, Laser Hair Reduction

CITATION

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Introduction

Hirsutism is characterized by the development of coarse terminal hair in females following an androgen-dependent male distribution pattern, typically affecting regions such as the chin, upper lip, chest, abdomen, and thighs (Martin et al., 2018). This condition is prevalent in approximately 5-10% of women of reproductive age (Mohamed et al., 2016). The presence of conspicuous hair often results in profound psychological distress, as it can undermine a patient's sense of femininity and significantly diminish self-esteem, potentially leading to depression and a marked reduction in quality of life (Lapidoth et al., 2010). Clinically, hirsutism is often diagnosed using the Ferriman-Gallwey scoring system, with a score exceeding the 95th percentile for a given population serving as the diagnostic threshold (Martin et al., 2018). Polycystic ovary syndrome is the most frequent underlying etiology, accounting for 70-80% of cases, followed by idiopathic hirsutism, which is diagnosed upon the exclusion of other endocrine disorders (Karn et al., 2014). Management strategies encompass a variety of interventions, including hormonal pharmacotherapy, mechanical epilation, electrolysis, and photoepilation (Üstüner et al., 2016). The Food and Drug Administration has cleared several photoepilation devices - including both laser and intense pulsed light systems (IPL) - for permanent hair reduction, which is defined as maintaining at least a 30% reduction in terminal hair for a duration exceeding a complete follicular growth cycle (Ebrahimzadeh Ardakani et al., 2021). Laser-assisted hair removal has gained significant clinical acceptance and is currently ranked as the third most frequent aesthetic procedure performed in the United States (Ganesh S. et al., 2011). The fundamental mechanism of this therapy is selective photothermolysis, in which follicular melanin acts as the primary chromophore, absorbing laser energy and converting it into localized heat to destroy the follicle while sparing surrounding tissues (Nabi et al., 2022). Standard clinical side effects, such as transient perifollicular erythema and edema, are considered direct indicators of successful thermal follicular injury (Martin et al., 2018). Primary technological modalities utilized for this purpose include ruby, alexandrite, diode, and long-pulse Nd:YAG lasers, as well as IPL sources (Li et al., 2016).

Methodology

This investigation adopted a systematic literature review methodology to synthesize the scientific evidence regarding the efficacy of and safety profiles of laser interventions for the management of female hirsutism. The search strategy incorporated the keywords: hirsutism, Nd:YAG laser, diode laser, alexandrite laser, intense pulsed light, and laser hair reduction. The temporal scope of the review encompassed peer-reviewed literature published between 2000 and 2026. The selection process involved a multi-stage screening of titles and abstracts, followed by a rigorous full-text appraisal of eligible studies. Inclusion was restricted to full-text manuscripts published in the English language. Following this process, 25 publications were finalized for inclusion, comprising randomized controlled trials, prospective observational studies, case series, and established clinical guidelines. These selected works were subjected to a qualitative synthesis focusing on study architecture, patient demographic characteristics, primary and secondary therapeutic endpoints, and documented safety outcomes.

Alexandrite Laser

In a randomized controlled trial, Clayton et al. evaluated the efficacy of 755-nm alexandrite laser therapy in reducing facial hirsutism and associated psychological distress in women with polycystic ovary syndrome. The study enrolled 88 participants, who were randomized into an intervention group receiving high-fluence treatments or a control group receiving low-fluence treatments. Both cohorts received five treatment sessions over a 6-month period. By the end of the study, the intervention group demonstrated statistically significant improvements in mental health compared to the control group. Specifically, mean depression scores in the intervention group declined from 6.7 to 3.6, whereas scores in the control group decreased from 6.1 to 5.4. Similarly, mean Hospital Anxiety and Depression Scale scores in the intervention group decreased from 11.1

to 8.2, compared to a shift from 9.6 to 9.3 in the control group. Furthermore, subjective assessments of facial hair density in the intervention group improved significantly, with scores decreasing from 7.3 to 3.6 on a 10-point scale, compared to a reduction from 7.1 to 6.1 in the control group. Consistent with these findings, the time participants dedicated to weekly hair removal decreased from 112 to 21 minutes in the intervention group, compared to a reduction from 92 to 56 minutes in the control group (Clayton et al., 2005). An alternative prospective trial investigated the clinical efficacy of 755-nm alexandrite laser hair removal by examining the influence of differing pulse durations. The study population consisted of 50 women with facial hirsutism, specifically those with Fitzpatrick skin phototypes II-IV. Among these participants, 16% were diagnosed with polycystic ovary syndrome, whereas the remaining 84% lacked any history of PCOS or endocrine dysfunction. The methodology utilized a split-face approach: one side of the face was randomly selected for treatment with a 10 millisecond pulse duration, while the contralateral side received a 3 millisecond pulse duration. Following three treatment sessions administered at five-week intervals, outcomes were assessed. Treatment success, defined as >50% hair reduction, occurred in 56% of cases across both experimental conditions. There were no statistically significant differences in adverse event profiles between the pulse settings. Furthermore, subgroup analysis comparing participants with and without PCOS revealed no statistically significant variations in treatment efficacy regarding pulse duration (Noormohammadpour et al., 2021). Rajpar et al. conducted a retrospective analysis of clinical records for 24 pediatric patients to evaluate the safety and tolerability of laser-assisted hair removal. All participants had completed a minimum of three treatment sessions, with constitutional hirsutism identified as the primary indication, followed by polycystic ovary syndrome. Protocols utilized 755 nm long-pulse alexandrite lasers for Fitzpatrick skin phototypes II-IV, whereas a 1064 nm long-pulse Nd:YAG laser was employed for phototypes IV-VI. Local anesthesia was necessary for eight patients. Application patterns varied, with six requiring anesthesia throughout the entire procedure, one during the initiation phase, and one specifically at higher fluences. The sole adverse event reported was intractable discomfort in two patients receiving treatment on the trunk and limbs, which was successfully managed through fluence modulation and the application of local anesthesia. No severe complications, such as blistering, hyperpigmentation, scarring, infection, or thrombophlebitis, were documented (Rajpar et al., 2009). Photoepilation involves the absorption of light pulses by melanin within the hair shaft and follicle, resulting in selective photothermolysis of pigmented hair follicles. Consequently, the elimination of light and fine hair poses a significant challenge owing to the chromophore's limited capacity to absorb laser energy in such hair types (Martin et al., 2018). Üstüner et al. performed a randomized clinical trial examining whether the topical application of mascara to the hair follicle immediately prior to laser hair removal with Alexandrite and Nd:YAG lasers could enhance procedural efficacy. The investigation enrolled 16 patients with unwanted white or light facial hair and 20 patients with unwanted underarm hair. Eligibility criteria encompassed Fitzpatrick skin types I-III and primary hirsutism. In Group I, participants received treatment using a 1064 nm Nd:YAG laser, with one facial side serving as the control and the contralateral side treated with dark black mascara applied to fine white hairs 10 minutes preceding the procedure. Group II underwent alexandrite laser treatment at 755 nm wavelength, applying a similar split-side protocol to the axillae with mascara application on the intervention side. Treatments were administered at four-week intervals across six sessions. Results demonstrated a significantly reduced number of terminal hairs on the mascara-treated sides of the face and axillae compared to controls throughout the study period, except during the initial month (Üstüner et al., 2016).

Diode Laser

Rafi et al. conducted a prospective observational study involving 73 female patients presenting with facial hirsutism, specifically those with Fitzpatrick skin types III-IV. Participants underwent a maximum of six sessions of diode laser treatment (805 nm) at monthly intervals, with clinical and trichoscopic evaluations performed during each visit to monitor progress and record adverse events. Frequent side effects included erythema and patient-reported pain, the latter of which was noted in 97.3% of the cohort. Clinical assessment revealed a statistically significant reduction in modified Ferriman–Gallwey scale scores from baseline. Trichoscopic analysis indicated a temporal decline in the prevalence of terminal hair, with predominance observed in 86.3%, 69.1%, and 48% of patients at the first, third, and sixth sessions, respectively. Furthermore, the frequency of hair removal was substantially reduced, increasing from an average of 13.16 days at baseline to 52.8 days at the third visit and 69.8 days by the conclusion of the study (Rafi et al., 2024). In a prospective, open-label comparative study, Lachure et al. investigated the relationship between serum androgen levels and the clinical efficacy of diode laser treatment in women with hirsutism. The study compared a cohort of 18 patients with elevated dehydroepiandrosterone sulfate and dihydrotestosterone levels (Group A) against 16

subjects with physiological hormonal profiles (Group B). Over a six-month period, all participants underwent three diode laser sessions. The results indicated that while the therapy was beneficial for all subjects, the reduction in hair density - quantified via densitometry and dermoscopy - was significantly more pronounced in the group with normal hormone levels. Specifically, Group B exhibited lower density scores of 8.38 ± 2.85 and 3.87 ± 2.66 at the first and second follow-up intervals, respectively, compared to 13.44 ± 2.23 and 8.89 ± 2.08 in Group A. Furthermore, the ratio of terminal to vellus hair at the conclusion of the study was notably lower in Group B (0.40 ± 0.18) than in Group A (1.26 ± 0.66). These findings suggest that although diode laser irradiation is an effective intervention regardless of hormonal status, patients with balanced dehydroepiandrosterone sulfate and dihydrotestosterone levels achieve more optimal hair reduction outcomes (Lachure et al., 2022). A retrospective analysis investigated the efficacy of a high-power diode laser system, utilizing a combination of 755, 810, and 1064 nm wavelengths, in nine patients presenting with facial hirsutism and associated follicular disorders. All study participants were classified as Fitzpatrick skin types IV-V, and the study aimed to evaluate the safety and clinical effectiveness of this triple-wavelength approach for hair reduction in darker skin phototypes. The treatment regimen comprised four to ten sessions administered at intervals of six to twelve weeks. Clinical outcomes, assessed via the Global Aesthetic Improvement Scale (GAIS), yielded a mean improvement of 3.4 ± 0.4 out of 4, corresponding to an average reduction of 50% to 75%. Furthermore, quantitative hair assessment demonstrated a statistically significant hair reduction of 82.9 ± 15.4%, with observed reductions ranging from 56.0% to 100.0%. The procedure exhibited a favorable safety profile, with only mild to moderate erythema and localized edema, which consistently resolved within 48 hours post-treatment (Pall, 2025). Another retrospective analysis was conducted to evaluate the longitudinal efficacy of an 800-nm diode laser in reducing pigmented hair and prolonging the intervals between subsequent depilation procedures. This study enrolled 242 participants suffering from unwanted hair, with a predominance of Fitzpatrick skin type III and a mean history of excessive hair growth exceeding 15 years. Psychological morbidity associated with hirsutism was reported by 82.55% of the cohort. Over a 48-month observational period, participants received a mean of 2.98 sessions. Clinical outcomes indicated that after an average of 1.97 treatments, satisfactory reduction of pigmented hair was maintained for a mean duration of 8.1 months. Furthermore, the interval between hair removal sessions extended 4.11-fold, increasing from a median of 3.69 days pre-treatment to an average of 15.19 days post-intervention. The therapeutic regimen was well-tolerated, with 81.4% of patients reporting the procedure to be painless, and 82.55% expressing overall satisfaction with the clinical results (Kopera, 2003). Tulpule et al. conducted a prospective observational study that also evaluated the efficacy of diode laser therapy for long-term hair reduction in individuals with darker skin phototypes (Fitzpatrick skin types III, IV and V). Following three treatment sessions, a mean terminal hair growth reduction of 61.25% was observed, as quantified via a Visual Analog Scale (VAS). Reported adverse events included superficial burns and post-inflammatory hyperpigmentation in two subjects, while an acneiform rash occurred in another two. The procedure was well-tolerated. No patients necessitated topical anesthetic application or ceased treatment prematurely due to procedure-related pain. In a subsequent two-year follow-up assessment of 55 participants treated with an 810 nm diode laser, all but one individual reported a clinically significant reduction in long-term hair growth on the VAS scale. Although polycystic ovary syndrome was identified in 9.8% of the female cohort, requiring a greater mean number of sessions compared to the non-PCOS group, the therapeutic efficacy regarding hair reduction remained comparable between the two groups (Tulpule et al., 2020). Two prospective investigations have compared the clinical efficacy and safety of low-fluence, high-repetition-rate 810-nm diode laser systems - operating in Super Hair Removal mode (SHR), against high-fluence, low-repetition-rate systems in conventional hair removal mode (HR). In a study involving 92 Chinese women, Li et al. implemented a split-site design for axillary hair reduction, applying SHR and HR modalities to contralateral sides over four sessions spaced at 4-week intervals. Post-treatment analysis revealed no statistically significant disparity in median hair reduction between the SHR (90.2%) and HR (87%) modes. However, the SHR mode demonstrated a significantly superior safety and comfort profile, characterized by a markedly lower median visual analog scale pain score (2.75) compared to the HR mode (6.75). Furthermore, HR mode administration was associated with post-inflammatory hyperpigmentation in two subjects (Li et al., 2016). Similarly, Ganesh S. et al. conducted a split-face study on 42 patients diagnosed with polycystic ovary syndrome and facial hirsutism, comparing the Soprano XL device with the LightSheer device across six treatments at 4–6-week intervals. Consistent with the findings of Li et al., results indicated no statistically significant difference in median hair reduction rates, which were 90.5% for the Soprano XL and 85% for the LightSheer device. Nevertheless, the Soprano XL system yielded significantly lower median VAS pain scores compared to the LightSheer device (Ganesh S. et al., 2011).

Collectively, these investigations suggest that while both modalities achieve comparable long-term hair reduction, laser treatments using low fluence and high repetition rates provide a more favorable patient experience, characterized by reduced procedural discomfort and a diminished risk of adverse cutaneous effects.

Nd:YAG Laser

In a prospective observational investigation, Nabi et al. compared the therapeutic efficacy of a long-pulsed 1064 nm neodymium-doped yttrium aluminum garnet (Nd:YAG) laser in two cohorts: 50 women diagnosed with idiopathic hirsutism (Group A) and 50 women with hirsutism secondary to polycystic ovary syndrome (Group B). The treatment protocol involved up to six laser sessions administered at four-week intervals, with a definitive clinical follow-up conducted three months after the final intervention. The study findings revealed that 70% of the idiopathic cohort achieved a superior clinical response, defined as a hair reduction exceeding 75% of baseline levels. In contrast, this degree of success was observed in 54% of the PCOS cohort. Furthermore, longitudinal assessments indicated that the inhibitory effects on hair growth were more durable in patients with idiopathic etiologies compared to those with PCOS. Regarding safety, the incidence and nature of adverse events were comparable across both groups. Reported complications included localized erythema, thermal sensations, pigmentary alterations, folliculitis, blisters, and instances of paradoxical hypertrichosis (Nabi et al., 2022). Another prospective investigation evaluated the comparative efficacy of long-pulse Nd:YAG laser therapy in a cohort of 60 women presenting with Fitzpatrick skin types III, IV, or V. The participants were stratified into two distinct groups based on their endocrine profiles: Group A (30 women) comprised individuals with biochemical markers consistent with polycystic ovary syndrome, including hyperandrogenism (elevated total testosterone and dehydroepiandrosterone sulfate) or an abnormal LH:FSH ratio, while Group B (30 women) consisted of normoandrogenic controls. The therapeutic protocol involved administering laser sessions at four-week intervals with the objective of achieving a minimum of 50% reduction in hair growth. The findings indicated a significant discrepancy in the clinical course required to reach this endpoint. Specifically, patients in the hyperandrogenic cohort necessitated a significantly higher number of sessions (8,1±1,28) compared to the normoandrogenic group (5,7±1,01), suggesting that underlying hormonal dysregulation may increase the resistance of terminal hair to Nd:YAG laser-induced photothermolysis, thereby requiring a more prolonged intervention to attain satisfactory clinical outcomes (Karn et al., 2014). In a prospective clinical evaluation, a cohort of 70 women presenting with idiopathic facial hirsutism (Fitzpatrick skin types III-IV) and dark terminal hair underwent six monthly therapeutic sessions utilizing a 1064 nm long-pulse Nd:YAG laser. The study participants had an average history of hirsutism spanning 3.5 5 ± 1.9 years. At the one-month follow-up assessment after the final intervention, trichoscopic analysis revealed a significant regression in hair growth parameters compared to baseline. Specifically, mean hair density, the ratio of terminal to vellus hair, and hair shaft thickness were reduced by 73.6%, 70.6%, and 78.9%, respectively. Regarding the safety profile, the procedure was associated with universal reports of mild-to-moderate discomfort (100% of treatment sites). Other localized adverse effects were transient and included erythema in 22.9% of the cohort and perifollicular edema in 11.4% of patients (Mohamed et al., 2016). In a subsequent clinical investigation, a cohort of 29 patients completed a therapeutic regimen consisting of three sessions with a long-pulse Nd:YAG laser administered at monthly intervals. Quantitative assessment of hair density demonstrated a mean reduction of 43% at three months post-treatment, 36% at six months, and 46% at nine months following the final laser session. Furthermore, subjective evaluation of clinical efficacy revealed that the duration of the hair-free interval following laser intervention was between two and six times longer than that achieved with conventional mechanical or chemical depilatory methods, including shaving, plucking, depilatory creams, and waxing (Lévy et al., 2001). In an investigation involving fifteen subjects, Goldberg et al. assessed the clinical efficacy of a Q-switched Nd:YAG laser for hair reduction. Their results indicated mean reductions in hair density of 36% at 7 days, 52% at 30 days, and 59% at 90 days post-intervention. Furthermore, the researchers reported a favorable safety profile, with no significant complications or adverse events observed during the study period (Goldberg & Samady, 2000). In a prospective observational investigation, the clinical efficacy of a short-pulse Nd:YAG laser system for hair reduction was evaluated in fifty female subjects with Fitzpatrick skin phototypes III-V. The therapeutic protocol consisted of four sessions targeting various facial regions - including the upper lip, chin, and neck - conducted at six-week intervals, followed by a six-month longitudinal assessment. The results demonstrated high therapeutic success, with 92% of the participants achieving a reduction in facial hair exceeding 50%. Specifically, 58% of the cohort exhibited "excellent" clinical improvement, while 34% showed "good" improvement. Conversely, moderate and poor responses were limited to 6% and 2% of the population, respectively. Regarding safety and tolerability, the

procedure was well-tolerated, with a mean Visual Analogue Scale pain score of 1.7. No adverse complications were recorded. However, universal post-treatment perifollicular erythema was observed, which is considered a standard and desirable clinical indicator of follicular thermal damage (Jane & Mysore, 2018). Esmat et al. investigated the influence of varying pulse durations on the efficacy of a long-pulse Nd:YAG laser for treating hirsutism in 30 women. The patients' chins were split to receive treatment with standard parameters on one side (pulse duration 20 ms and fluence 40 J/cm²), while the contralateral side was treated with an extended pulse duration (50ms). This latter side was further subdivided to receive either equivalent (40 J/cm²) or increased fluences (50–55 J/cm²) compared to the standard side. Following four laser hair reduction sessions administered at four-week intervals, clinical assessment indicated that extending the pulse duration did not exert a statistically significant effect on the timing of hair regrowth. Although the anagen/telogen ratio and hair shaft diameter were significantly reduced on the side treated with the prolonged pulse duration, the application of higher fluences did not improve the percentage reduction in hair density. The treatment was well-tolerated, with only immediate, transient side effects such as perihair erythema, swelling, and pain reported, and no long-term adverse events were observed (Esmat et al., 2014).

Photoepilation laser vs IPL

In a randomized comparative investigation, the clinical efficacy and safety of a 1064 nm long-pulse Nd:YAG laser were evaluated against an intense pulsed light system (IPL) operating at 755 nm for the management of idiopathic facial hirsutism. The study population comprised 33 female participants who were stratified into two treatment arms: Group A received long-pulse Nd:YAG laser therapy, while Group B underwent IPL-755 treatment. Both cohorts completed six therapeutic sessions administered at monthly intervals. The results demonstrated a statistically significant disparity in treatment outcomes between the two modalities. In the Nd:YAG laser group, an excellent therapeutic response - defined as greater than 75% reduction in hair density - was achieved in 14 of 15 patients, corresponding to a success rate of 93.33%. Conversely, the IPL-755 cohort exhibited markedly inferior efficacy, with only 3 of 18 patients (16.66%) attaining comparable clinical improvement. Regarding the safety profile, the Nd:YAG laser demonstrated a more favorable adverse event profile. Erythema was documented in 26.67% of patients in Group A, while perifollicular edema and hyperpigmentation each occurred in 13.33% of this cohort. In contrast, the IPL-755 group exhibited higher complication rates, with erythema observed in 50% of patients, perifollicular edema in 16.67%, and hyperpigmentation in 38.89% of participants (Shrimal et al., 2017). In a randomized, split-face comparative investigation, the clinical efficacy and safety of intense pulsed light therapy were evaluated against a triple-wavelength diode laser system for the management of lower facial hirsutism. The study population comprised 33 female participants classified as Fitzpatrick skin phototypes III–V. Each patient received four treatment sessions administered at 4-6 week intervals, with one facial side randomly assigned to triple-wavelength diode laser treatment (755 nm, 810 nm, and 1064 nm) and the contralateral side receiving IPL intervention. Quantitative assessment conducted one month following the final treatment session demonstrated a statistically significant disparity in therapeutic outcomes between the two modalities. The triple-wavelength diode laser group achieved a mean hair reduction of 74.15 ± 5.38%, whereas the IPL cohort exhibited a substantially lower mean reduction of 46.47 ± 6.91%. Furthermore, the diode laser intervention resulted in a significantly prolonged duration of hair regrowth, with a mean interval of 22.67 ± 1.78 days compared to 13.58 ± 0.94 days in the IPL group. Regarding tolerability and safety profiles, both modalities demonstrated comparable adverse event incidence. However, procedural discomfort was less frequently reported in the diode laser group, with 33.33% of patients experiencing pain, compared to 57.58% in the IPL cohort. Transient erythema was universally observed across all participants following both treatment modalities (Agashe et al., 2025). In a randomized controlled split-face clinical trial, McGill and colleagues evaluated the comparative efficacy of a 3 ms pulse duration alexandrite laser and the Lumina intense pulsed light system. The study cohort included 38 women diagnosed with polycystic ovary syndrome and facial hirsutism across Fitzpatrick skin phototypes I-V. Participants underwent six therapeutic sessions at six-week intervals, with each facial side randomly assigned to either the alexandrite laser or IPL intervention. Clinical assessments conducted at one, three, and six months post-treatment revealed that the alexandrite laser achieved significantly prolonged median hair-free intervals compared to IPL (7 weeks vs. 2 weeks; $p < 0{,}001$). Furthermore, the alexandrite laser demonstrated superior hair count reduction at all follow-up intervals (52%, 43%, and 46%) relative to the IPL group (21%, 21%, and 27%). Patient satisfaction, quantified via linear analog scales, was also significantly higher for the laser treatment ($p \leq 0{,}002$). The primary adverse effect noted was erythema, occurring in 13% of patients at higher fluences (McGill et al., 2007). Conversely, a similar

investigation by Al-Dhalimi et al. involving 35 female subjects produced contrasting findings. Utilizing a split-face methodology with six sessions administered at four-week intervals, this study compared a long-pulse alexandrite laser on the left facial side against IPL on the right. In this instance, the IPL-treated sides exhibited superior clinical outcomes, including longer median hair-free periods and significantly greater hair reduction following the first, third, and sixth sessions compared to the ALX-treated sides (Al-Dhalimi & Kadhum, 2015).

Discussion

Since the introduction of FDA-cleared systems for permanent hair reduction in 1997, laser-assisted hair removal has evolved into a globally standardized dermatological procedure. By 2012, it was recognized as the third most prevalent non-invasive aesthetic intervention in the United States, surpassed only by botulinum toxin and hyaluronic acid administrations. Clinical literature often identifies physiological responses - such as mild procedural discomfort, transient perifollicular erythema, and localized edema - as valid clinical endpoints indicating successful follicular thermal damage rather than adverse complications (Martin et al., 2018). In an evaluation of diode laser efficacy over six monthly sessions, Rafi and colleagues documented that 97.3% of participants reported procedural pain, followed by clinical observations of erythema in 89% and perifollicular edema in 83.6% of the cohort (Rafi et al., 2024). Correspondingly, an investigation involving 70 female subjects with idiopathic facial hirsutism treated with a 1064-nm Nd:YAG laser at four-week intervals reported a universal incidence of mild-to-moderate discomfort (100%). However, transient erythema and perifollicular edema were less frequent, occurring at 22.9% and 11.4% of treatment sites, respectively (Mohamed et al., 2016). Comparative analyses of diode laser delivery modes - specifically low-fluence, high-repetition-rate versus high-fluence, low-repetition-rate configurations - suggest significant differences in patient tolerability. Two independent prospective studies confirmed that the SHR modality consistently yields lower median pain scores. Specifically, Pai and colleagues utilized a Visual Analogue Scale across six sessions to demonstrate median pain scores of 2 for the Soprano XL compared to 6 for the LightSheer, a discrepancy that achieved high statistical significance ($p < 0.0005$). These findings were corroborated by Li and colleagues, who reported median VAS scores of 2.75 for SHR mode and 6.75 for HR mode ($p=0.0005$), further establishing the superior tolerability profile of high-repetition-rate systems (Ganesh S. et al., 2011; Li et al., 2016).

Prospective randomized controlled trials evaluating various FDA-cleared photoepilation technologies, including both laser systems and intense pulsed light devices, consistently demonstrate long-term efficacy in the reduction of pigmented terminal hair. However, comparative analyses between laser modalities and IPL have yielded heterogeneous results.

The clinical utility of these comparisons is often constrained by the fact that therapeutic efficacy is heavily contingent upon the fluence utilized during treatment. In objective evaluations conducted six months following a series of four to six sessions, the performance of Nd:YAG, diode, and alexandrite lasers was contrasted with IPL outcomes. Specifically, the 1064-nm long-pulse Nd:YAG laser demonstrated an "excellent" therapeutic response - characterized by a hair density reduction exceeding 75% - in 93.33% of the cohort (14 of 15 patients). In comparison, the IPL-755 modality achieved significantly lower efficacy, with only 16.66% of participants (3 of 18) reaching equivalent clinical endpoints (Shrimal et al., 2017). Similarly, the implementation of a triple-wavelength diode laser (755 nm, 810 nm, and 1064 nm) resulted in a mean hair reduction of 74.15 ± 5.38%, which was significantly superior to the 46.47± 6.91% reduction documented in the IPL group (Agashe et al., 2025).

These data suggest that both long-pulse Nd:YAG and triple-wavelength diode lasers offer higher clinical efficacy than IPL for the management of facial hirsutism. Furthermore, randomized controlled split-face trials comparing alexandrite lasers to IPL systems have produced conflicting findings. McGill et al. observed that the alexandrite laser facilitated significantly longer median hair-free intervals compared to IPL (7 weeks versus 2 weeks; $p < 0.001$) (McGill et al., 2007). Conversely, subsequent research by Al-Dhalimi et al. failed to replicate these results, highlighting the variability in clinical outcomes between these two therapeutic modalities (Al-Dhalimi & Kadhum, 2015).

Conclusions

Laser-assisted hair reduction represents a globally ubiquitous dermatological intervention, widely regarded as a secure and efficacious modality for the longitudinal reduction of superfluous terminal hair. However, the attainment of permanent hair reduction is a gradual, iterative process necessitating multiple therapeutic sessions. The requisite inter-treatment intervals are contingent upon several factors, including follicular morphology, the patient's Fitzpatrick skin phototype, and the specific anatomical topography under treatment. Consequently, prospective academic investigations remain essential to resolve clinical uncertainties surrounding the optimal configuration of laser systems - specifically regarding wavelength, pulse duration, and fluence - to enhance therapeutic indices and clinical outcomes for women presenting with hirsutism.

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