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ORIGINAL ARTICLE

Laser and light therapy for pediatric hair removal: a systematic review

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Abstract

Hair removal with lasers and intense pulsed light (IPL) is considered safe. However, data on the efficacy and safety of these procedures specifically in the pediatric population remain sparse. To determine the efficacy and safety of lasers and IPL for hair reduction in children and adolescents, a systematic review was conducted of original studies evaluating hair removal with lasers or IPL in patients aged less than 18 years. Primary outcome measures were efficacy and safety of treatment. The literature review yielded 2 retrospective cohort studies and 11 case reports/case series including a total of 71 patients aged 9 months to 17 years. Diagnoses ranged from localized lumbosacral to generalized hypertrichosis. Six treatment modalities were evaluated: alexandrite, Nd:YAG, Q-switched Nd:YAG, ruby, and diode lasers and IPL. Only one of the cohort studies ($n = 28$), using the ruby laser, provided efficacy data. The results showed a 63% hair loss in 89% of patients after completion of treatment, although partial regrowth was evident during 6 to 32 weeks of follow-up. Most of the case reports and case series (10/11) reported significant hair reduction following laser and IPL treatments. None of the patients experienced scarring or dyspigmentation. Some kind of pain management was necessary in 65% of patients; 25% required general anesthesia. On the basis of the limited available data which consisted primary of case reports and case series, lasers and IPL might be effective for pediatric hair reduction. Recurrence following treatment may be higher in children than adults, and pain control may be a limiting factor.

Keywords Laser · Intense pulsed light · Pediatric · Hair removal

Key summary points

- Review of the literature review yielded only 2 cohort studies and 11 case series/reports on the efficacy and safety of lasers and intense pulsed light for the treatment of unwanted hair growth in children and adolescents.
- Almost all reported satisfactory hair reduction after a number of sessions. However, some degree of regrowth was not uncommon, and pain was a major factor.
- The substantial heterogeneity among the studies and patient characteristics highlights the need for larger comparative studies.

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Introduction

Unwanted or excessive hair growth may be classified into two categories. (1) Hypertrichosis can occur anywhere on the body. It affects both genders and is androgen-independent. It can be localized or generalized and may be related to genodermatoses and systemic conditions. (2) Hirsutism is excessive growth of androgen-dependent terminal hairs in a male pattern and occurs only in females.

In the last 25 years, different lasers and intense pulsed light (IPL) systems have been increasingly employed for hair removal in the adult population. Today, they constitute the most frequently performed cosmetic procedures [1, 2], with a good safety profile. According to the theory of selective photothermolysis, lasers and IPL target melanin pigment in unwanted hairs thereby facilitating their removal. The relatively selective absorption of light produced by these modalities limits the damage to hair follicles so that surrounding structures, including the epidermis, are spared [3].

Excessive hair growth can have a major adverse impact on quality of life [4]. This is particularly true in children

and adolescents who may experience reduced confidence and self-esteem, leading to mood and behavioral problems. However, data on the effectiveness and safety of treatment with lasers and IPL in the pediatric population are still sparse [5].

The aim of the present systematic review was to evaluate the safety and efficacy of lasers and IPL for removal of unwanted hair in children and adolescents (age <18 years), and to determine if certain patient characteristics and treatment modalities may be associated with outcome.

Materials and methods

Search strategy

A systematic review was conducted and reported in accordance with the PRISMA statement. The search was performed without date limits during September 2022 using PubMed and Google Scholar. Reference lists from key trials were manually scanned for additional results. The following search criteria were used: "hair removal"[MeSH Terms] OR "hair removal"[All Fields] OR "photoepilation"[MeSH Terms] OR "photoepilation"[All Fields] OR "hair reduction"[MeSH Terms] OR "hair reduction"[All Fields] OR "depilation"[MeSH Terms] OR "depilation"[All Fields] OR "hypertrichosis"[MeSH Terms] OR "hypertrichosis"[All Fields]) and ("laser"[MeSH Terms] OR "laser"[All Fields] OR "IPL"[MeSH Terms] OR "IPL"[All Fields] OR "intense pulsed light"[MeSH Terms] OR "intense pulsed light"[All Fields]) and filters: child birth-18 years.

Eligibility criteria

Studies that met the following criteria were included: (1) relevance — original study of any design that evaluated treatment with an IPL or laser for removal of unwanted hair in children and adolescents; (2) participants — patients younger than 18 years of both sexes with localized or generalized hypertrichosis or hirsutism. Studies evaluating lasers or IPL combined with other treatment modalities were excluded to ensure that the findings pertained exclusively to laser/IPL technology. Also excluded were studies focusing on treatment for a specific condition associated with hypertrichosis, such as Becker's or congenital nevus.

Outcome

The primary outcome measures were the efficacy and safety of lasers or IPL for pediatric hair removal.

Study selection and data extraction

Two reviewers (E.S. and I.S.) independently screened titles and abstracts, followed by the full text, of potentially eligible studies. One author (I.S.) extracted data onto an electronic form, including the first author's name, year of publication, number of participants, sex, skin type, treatment modality and characteristics of treatment (fluence, number of sessions), location of hypertrichosis, outcome, adverse effects, and follow-up. One author (I.S.) assessed risk of bias for observational studies using the Newcastle-Ottawa Scale.

Results

Characteristics of studies

The search of the literature yielded 410 publications (Fig. 1). After the exclusion process, 13 eligible studies were identified, consisting of 2 retrospective cohort studies and 11 cases reports and series [5–17]. All included studies were published in peer-reviewed journals. The earliest was published in 1997 by Littler et al. [11] and investigated use of the diode laser in an 8-year-old girl with hypertrichosis lanuginosa congenita.

The 13 publications included a total of 71 children who underwent laser or IPL removal of unwanted hair. Mean patient age was 11 years (range, 9 months to 17 years). There were 53 female (75%) and 16 male (23%) patients; in 2% of cases, sex was not noted. Information on Fitzpatrick skin type was available for 32 patients (45%) of whom 10% each had types II and III, 7% had type IV, and 18% had type V.

Treatment modalities varied. Alexandrite laser was evaluated in 4 studies [no study employed the super hair removal (SHR) mode], Nd:YAG laser and IPL were evaluated in 3 studies each, ruby laser in 2 studies, and diode and Q-switched Nd:YAG lasers in 1 study each. A single study evaluated 2 modalities. The characteristics of the included studies are detailed in Table 1.

Risk of bias

On bias assessment, both cohort studies were found to be of moderate quality. Points were lost on assessment of outcome and comparability.

Cohort studies

The first retrospective cohort study, by Rajpar et al. [8], evaluated the safety of laser hair removal in 24 children of mean age 12 years (range 5–15 years) for various indications,

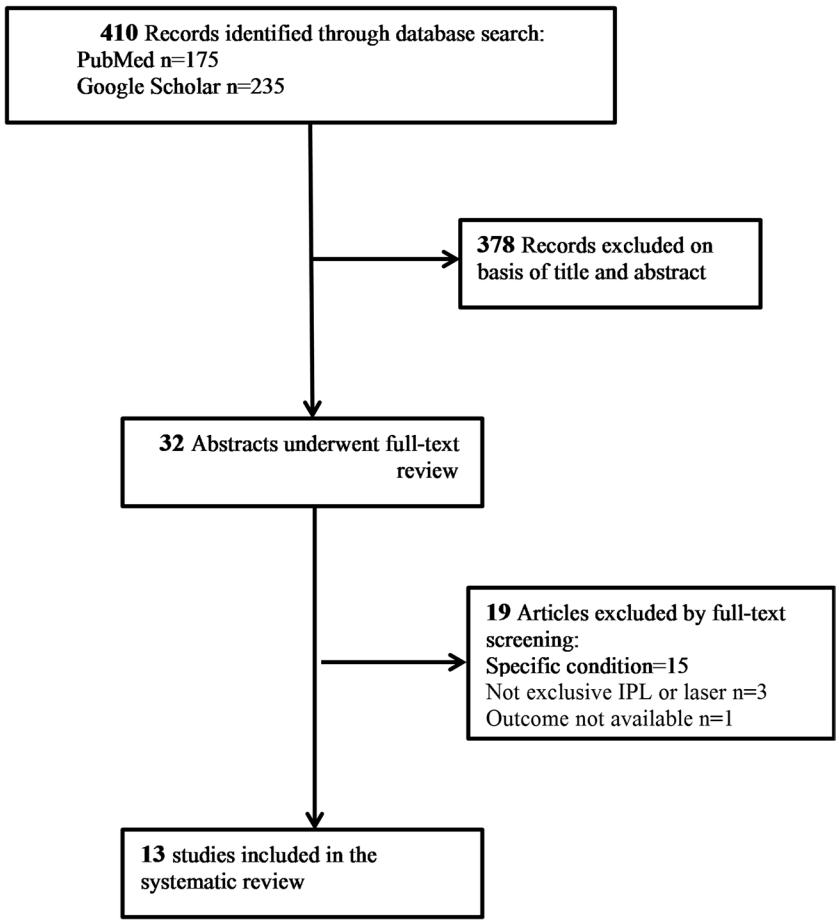

Fig. 1 Flow chart of study selection for systematic review

mostly (>80%) in the facial/neck region: constitutional hirsutism ($n = 14$), polycystic ovary syndrome ($n = 5$), generalized hypertrichosis ($n = 2$), congenital nevus ($n = 2$), and nevoid hypertrichosis ($n = 1$). Alexandrite laser was used for patients with skin types I–IV (fluence 16–32 J/cm^2, spot size 10–15 mm, pulse duration 3–60 ms), and Nd:YAG laser (fluence 16–35 J/cm^2, spot size 10–15 mm, pulse duration 20–60 ms) for patients with darker skin types. Overall, the median number of treatment sessions was 6.5. Topical anesthesia was used in 8 patients and general anesthesia in 1; 15 patients did not require anesthesia. The efficacy outcome was not reported; however, none of the patients had permanent side effects, and only 2 experienced intolerable discomfort that was managed with local anesthesia and fluence adjustment.

The other retrospective cohort study, by Morley and Gault [5], evaluated the efficacy and safety of laser hair removal in 28 children of mean age 9 years (range 2–16 years). Indications varied, including congenital nevus ($n = 18$), isolated hypertrichosis ($n = 4$), ear reconstruction covered by scalp hair ($n = 3$), pilonidal sinus ($n = 1$), hair at site of anotia ($n = 1$), and Becker's nevus ($n = 1$). Although some of the mixed diagnoses were beyond the scope of the present review (such as congenital nevus and Becker's nevus), we included this study because several patients had isolated hypertrichosis. Treatment was performed with the ruby laser (free running mode, wavelength 694 nm, fluence 6.5–19.5 J/cm^2 , spot size 5 mm) for a mean of 2.1 sessions. Seven patients required topical anesthesia, and 15, general anesthesia; no anesthesia was used in 6 patients. The majority of patients (89%) showed an objective benefit, with mean hair loss of 63% 6 months after completion of treatment. However, in the patients with available data ($n = 19$), partial regrowth was evident at 6 to 32 weeks of follow-up.

Case reports and series

The 11 case reports and case series included a total of 19 children aged 9 months to 16 years (mean 11 years) [6, 7, 9–17]. Sample size ranged between 1 and 7. Nd:YAG, diode, alexandrite, and ruby lasers and IPL were evaluated for various indications: lumbosacral hypertrichosis ($n = 7$), generalized hypertrichosis ($n = 5$), nevoid hypertrichosis ($n = 4$), hypertrichosis lanuginosa congenital ($n = 2$), and anterior cervical hypertrichosis ($n = 1$). No anesthesia was required in 2 patients — a 9-month-old girl and a 17-year-old boy.

Table 1 Systematic literature review of studies investigating the efficacy and safety of laser and IPL treatment for unwanted hair growth in children

Author (study type)	No. pts. (female)	Age (yr), mean (range)	Skin type (no.)	Diagnosis (no.) [hormonal abnormality]	Treatment site (no.)	Modality	Outcome (no.)	Adverse effects (no.)	Follow-up
Cohort studies									
Rajpar et al., 2009 (retrospective cohort) [8]	24 (23)	12 (5–15)	II (6), III (4), IV (2), V (12)	Constitutional hirsutism (14), PCOS (5), generalized hypertrichosis (2), congenital nevus (2), nevoid hypertrichosis (1) [NA except 5 patients with PCOS]	Face and/or neck (18), face and axillae (1), face and back (1), legs (1), back (3)	Alexandrite 16–32 J/cm^2 for skin types II–IV, Nd:YAG 16–35 J/cm^2 for skin type V. Median 6.5 treatments. Eight patients had topical anesthesia and 1, general anesthesia	Not stated	Intolerable discomfort (2) treated by local anesthesia and fluency adjustment	NA
Morley & Gault, 2000 (retrospective cohort) [5]	28 (13)	9 (2–16)	NA	Congenital nevus (18), isolated hypertrichosis (4), ear reconstruction covered by scalp hair (3), pilonidal sinus (1), hair at site of anotia (1), Becker's nevus (1) [NA]	NA	Ruby laser 694 nm, 6.5–19.5 J/cm^2, 1 to 10 treatments (mean 2.1). Seven patients had topical anesthesia, 15 general anesthesia, 6 no anesthesia	Twenty-five (89%) showed objective benefit with mean hair loss of 63% after 6 treatments. Partial regrowth was evident 6 to 32 weeks after last treatment. Of 21 parents that completed satisfaction questionnaire, 13 (62%) were happy or very happy	Temporary blistering (1)	6 mos. since the last treatment
Case reports									
Hossain et al., 2022 (case report) [6]	1 (1)	12	IV	Generalized congenital hypertrichosis [normal]	Body	Nd:YAG, anesthesia data NA	Facial hair significantly improved	NA	NA
Cervantes et al., 2016 (case report) [7]	2 (2), twins	9	IV	Congenital hypertrichosis universalis [NA]	Body	Nd:YAG, anesthesia data NA	Successful results	NA	8 years
Koch et al., 2015 (case report) [16]	2 (NA)	10 and 12	NA	Nevoid hypertrichosis [NA]	Back	Alexandrite 20–26 J/cm^2, 3 to 4 treatments, anesthesia data NA	Marked hair reduction at follow-up	NA	4 months
Salas-Alanis et al., 2014 (case report) [9]	1 (1)	9 months	III	Hypertrichosis lanuginosa congenita [normal]	Body	Diode, 10–12 J/cm^2, 20 treatments without anesthesia	80% hair reduction	None	3.3 years

Table 1 (continued)

Author (study type)	No. pts. (female)	Age (yr), mean (range)	Skin type (no.)	Diagnosis (no.) [hormonal abnormality]	Treatment site (no.)	Modality	Outcome (no.)	Adverse effects (no.)	Follow-up
Kacar et al., 2013 (case report) [12]	1 (1)	6	III	Anterior cervical hypertrichosis [normal]	Neck	Alexandrite 16–21–24 J/cm^2, 3 treatments under local anesthesia	Acceptable results after 6 months	None	6 months
Attia et al., 2012 (case report) [10]	1 (1)	1	V	Generalized hypertrichosis terminalis [normal]	Face and body	IPL 40 J/cm^2 every 3 weeks, 12 facial and 15 body sessions. Ice cubes were put to torso before and after treatment	75% hair reduction and remaining hair became thin and sparse. No recurrence at 1 year of follow-up	None	1 year
Ozdemir et al., 2010 (case report) [17]	1 (1)	17	III	Faun-tail nevus/nevoid hypertrichosis [NA]	Lumbosacral area	IPL 650 nm 18–26 J/cm^2, 6 sessions without local anesthesia	86% hair reduction	None	6 months
Cheung & Lanigan, 2004 (case report) [14]	1 (1)	10	II	Nevoid hypertrichosis [NA]	Back	Alexandrite 20 J/cm^2, 5 treatments under topical anesthesia	Significant resolution	None	4 months
Mahendran & Sheehan-Dare, 2003 (case series) [13]	7 (7)	13 (7–16)	NA	Lumbosacral hypertrichosis [NA]	Lumbosacral area	Ruby 694 nm, 20 J/cm^2, 3 sessions. Ice cubes were placed before and after treatment	2 (29%) had significant hair reduction. Remaining patients had no visible changes	None	6 months
Vashi et al., 2001 (case report) [15]	1 (1)	5	NA	Generalized hypertrichosis [normal]	Body	IPL, number of session not available, anesthesia data not available	Positive results, but treatment was very painful and costly	Not available	NA
Littler, 1997 (case report) [11]	1 (1)	8	NA	Hypertrichosis lanuginosa congenita [normal]	Upper lip, back, and dorsal hands	Q-switched Nd:YAG under topical anesthesia, 8 sessions	40% hair reduction on upper lip, 60% on upper back, 80% on dorsal fingers	None	4 months

IPL, intense pulsed light; *NA*, not available; *PCOS*, polycystic ovary syndrome

Among the others for whom data were available, placement of ice cubes ($n = 8$) or local anesthesia ($n = 3$) was required to control pain. One 5-year-old girl with generalized hypertrichosis discontinued IPL treatment because of cost and pain. Patients underwent between 3 and 20 treatment sessions (data were unavailable for 3 patients), and follow-up ranged between 4 months and 8 years (data were unavailable for 2 patients). In a single case series ($n = 7$) that evaluated the effectiveness of ruby laser for lumbosacral hypertrichosis, 2 patients experienced significant hair reduction but the other 5 had no visible changes. The remaining 10 case reports and series reported either ≥60% or significant hair reduction (or, in 1 patient, acceptable hair reduction). No recurrences were reported in any of the studies. In the 13 children for whom safety data were available, no side effects were reported.

Discussion

This is the first systematic review to investigate the efficacy and safety of IPL and lasers for the removal of unwanted hair in children and adolescents. Thirteen studies using various designs were included, with a total of 71 patients aged 9 months to 16 years.

Only a single cohort study investigated the efficacy of laser treatment, specifically the ruby laser. Treatment was administered over a mean of 2.1 sessions to 28 children and adolescents with heterogeneous diagnoses. The majority experienced a mean hair loss of 63% [5]. These findings were supported by the significant reduction in hair growth reported in 10 of 11 case reports/series using alexandrite or Nd:YAG laser or IPL. In the remaining case series, which evaluated the ruby laser for lumbosacral hypertrichosis, only 2 of 7 patients had significant hair reduction. It is noteworthy that several of the children who experienced successful laser/IPL-induced hair reduction had generalized hypertrichosis, and some were as young as 9 months to 1 year (Table 1).

Recurrence of hair growth may be a major limiting factor of laser/IPL treatment. In the mentioned cohort study, included partial regrowth was evident 6–32 weeks after the last treatment in all patients for whom data were available [8]. Larger studies are needed to determine whether recurrence rates are higher in children than adults and whether they are affected by certain patient characteristics and treatment modalities. Additionally, given the considerable variation in treatment modalities and protocols, determination of the single most effective ones require further investigation.

Pain is an important consideration in hair growth treatment. Only 35% of patients in this systematic review required no pain control, whereas 65% required either ice cubes (13%), topical anesthesia (27%), or general anesthesia (25%). One 5-year-old patient discontinued treatment partly because of the severe pain [15]. This aspect should be thoroughly discussed with patients and parents before initiation of treatment.

None of the patients included in either the cohort studies or the case series/reports had permanent or significant side effects such as scarring, dyspigmentation, or paradoxical hypertrichosis. Except for the patient who discontinued treatment, only 3 patients experienced temporary blistering or intolerable discomfort which were treated with local anesthesia. This suggests that hair removal with lasers and IPL is equally safe in children and adults. The good safety profile is supported by the heterogeneous indications for which patients were treated, from facial hirsutism and nevoid hypertrichosis to generalized hypertrichosis, using 6 different treatment modalities, and by the dark skin types (IV to VI) in about one-fourth of patients.

The present systematic review has several limitations. First, all studies were observational and only 2 were retrospective cohort studies, both small, with the remainder being case series or case reports. Second, types of hypertrichosis, skin types, and treatment sites, as well as treatment modalities, varied considerably among studies, precluding a meta-analysis.

Conclusions

On the basis of the sparse available data which consisted mainly of case reports and case series, our study shows that lasers and IPL might be effective for hair reduction in children and adolescents. Recurrence following treatment may be higher in children than adults and pain may be a limiting factor. The substantial heterogeneity among the studies reviewed and the patient characteristics highlights the need for larger comparative studies to corroborate these findings.

Author contributions E.S. and I.S. were responsible for the data analysis and wrote the first draft of the manuscript. All coauthors contributed to writing of the manuscript. All coauthors provided important intellectual input and approved the final version of the manuscript.

Data Availability The authors confirm that the data supporting the findings of this study are available within the article and its supplementary materials.

Code Availability Not applicable.

Declarations

Ethics approval No ethics approval was needed because data were retrieved from previously published studies in which informed consent was obtained by the primary investigators.

Consent to participate Not applicable.

Consent for publication Not applicable.

Conflict of interest The authors declare no competing interests.

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