Efficacy of lasers and light sources in long-term hair reduction: a systematic review

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ABSTRACT

Laser and light-based devices provide scope for long-term “hair-removal” however, there is limited evidence supporting their long-term efficacy. This study aimed to assess the long-term efficacy of laser and light-based “hair-removal” devices, taking into account variations in body site-specific variations in hair growthcycles. A systematic review of randomized controlled trials (RCTs) with follow-up periods greater than or equal to the length of one complete hair growth cycle in the body site targeted was conducted. Only five eligible RCTs were identified as suitable for inclusion, and these comprised a total of 223 patients. The average long-term hair reduction reported for neodymium:yttrium-aluminum-garnet (Nd:YAG) laser ranged from 30 to 73.61%, Alexandrite laser ranged from 35 to 84.25%, and Diode laser ranged from 32.5 to 69.2%. In all three devices, the greatest long-term reduction was observed from trials targeting leg hair (1-year growth cycle) and lowest from targeting facial hair (6-month growth cycle). Intense pulsed light (IPL) produced average long-term hair reduction of 52.7–29%; smallest reduction was observed from targeting the face area and greatest from targeting the axillary area (7-month growth cycle). In conclusion, greater long-term hair reduction was observed on body sites with longer hair growth cycles. Future trials should take into account the variation of hair growth cycles across body sites to provide accurate long-term data on treatment outcomes.

Introduction

Over 40% of women in the general population have some degree of unwanted hair growth (1). Up to 10% of these women are of reproductive age and suffer from hirsutism, which is defined as the presence of thick terminal hairs in androgen-dependent areas of the body due to excess circulating androgens – most commonly as a result of polycystic ovarian syndrome (PCOS) (2,3). Notably, most individuals affected by unwanted or “excessive” hair have no underlying medical conditions; however, their symptoms still cause significant distress. Several trials have investigated the impact of unwanted hair on an individual’s quality of life and psychological well-being and have found an increased risk of suffering from emotional distress, depression, and social isolation (4–9). Therefore, the effective long-term removal of unwanted hair within these patients is important to prevent and reduce the associated negative psychological sequelae. The advent of laser and light-based hair removal systems and their increasing popularity for “long-term” hair removal offers a potentially effective therapeutic opportunity (10–15). However, with a lack of robust evidence concerning their safety and efficacy profiles, there is an urgent need for more comprehensive studies.

Functionally, laser hair-removal systems utilize the theory of selective photothermolysis, which involves targeting an area capable of absorbing light at a specific wavelength (chromophore) (2,11,12,16). The commonest chromophore targeted is melanin, which is a pigment concentrated within the hair follicle and not found in the dermis and thus enables targeted destruction of the follicle without nearby structure damage (10,12,16,17). Understanding laser parameters is important in targeting hair removal specifically to individual patients. Laser hair-removal devices range from shorter wavelengths, e.g. 694 nm Ruby laser, which generally produces more superficial penetration due to increased scattering absorption pattern, which causes increased competition with other chromophores (particularly hemoglobin) to mid-spectrum 755 nm Alexandrite and 800–810 nm Diode laser to the 1064 nm neodymium:yttrium-aluminum-garnet (Nd:YAG) laser, which displays such low melanin absorption that very high fluences or short pulse durations must be present for effective hair shaft heating (2,12,17,18). Intense pulsed light (IPL) is another device used for hair reduction and can limit wavelengths to a specific portion of the spectrum (2,12,17), varying from 590–1,200 nm depending on what filter is selected (17,19).

Hair follicles repeatedly undergo three phases in their growth cycle, namely, anagen (growth), catagen (regression), and telogen (rest) (2,20). Hair at different body sites grows at different rates with differing anagen:telogen ratios (20,21). The duration of the anagen phase varies significantly depending on various factors, e.g. age, season, gender, body site, and hormones (2). The catagen phase is usually around 3 weeks long, while telogen is usually around 3 months (2). During telogen, the bulb of the hair is unpigmented because of cessation of melanogenesis during catagen (18). During early anagen, the process of melanogenesis in the bulb resumes so the bulb becomes located more superficially,
closer to the bulge, and so the bulge cells are more susceptible to injury (18). With the progression of anagen, the bulb and papillae move down and beyond the dermis (18). As a consequence of this, the late anagen hairs may also be relatively resistant to damage by laser pulses (18). Therefore, follicles should theoretically be most susceptible to laser damage during the early anagen stage. Hair growth cycles have been observed to be as follows: face, 6 months; axilla, 7 months; forearm, 8 months; pelvic area, 7 months; buttock, 1 year; calf/thigh, 1 year (22).

Understanding the effects of different laser parameters and how individual characteristics, e.g. growth site targeted and hair-cycle phase effect laser/IPL efficacy is key in maximizing therapeutic effects in those who experience psychological stress due to unwanted hair; however, limited evidence is currently available. Few reviews have compared efficacy of lasers and light sources (23–26). To the best of our knowledge, this is the first systematic review that has evaluated data on long-term laser hair-reduction outcomes while also taking into account differing hair growth cycles of treatment sites when comparing “long-term” efficacy of hair reduction.

Materials and methods
This systematic review was prepared in concordance with the recommendations of the Preferred Reporting Items of Systematic Reviews and Meta-analyses (PRISMA) checklist (27).

Inclusion and exclusion criteria
As suggested by the Cochrane Collaboration, the core constituents of the review question were divided into subheadings using the PICO format (participant, intervention, comparator, outcome, and study type) (28).

Search strategy
A search of literature was conducted using the following six databases: Medline, Embase, PubMed, Web of Science, CINAHL, and Cochrane library. Search terms used include “laser” or “light” and “hair” or “hirsutism” or “hypertrichosis” or “hyperandrogenism” or “hyperandrogenous”.

Screening
PICOS criteria were used as a screening tool for assessing the suitability of papers obtained through online database search. Initially, the papers were screened by title, then by abstract, and finally by full text. After the screening was complete, a list of relevant papers for inclusion in the review was produced.

Data extraction and synthesis
Data extraction was carried out using an adapted version of the Cochrane Data Extraction form (29) (Table 1). Data were too heterogenous to be pooled for meta-analysis.

Bias analysis
Risk of bias was assessed by two independent reviewers using the Cochrane Risk of Bias Tool (30).

Critical appraisal
Critical appraisal of the final five papers was also conducted in duplicate using the GRADE tool (31).

Results

Literature search results
As depicted in Figure 1, a total of 893 papers were screened after removal of duplicates. Following title and abstract screening, 26 of these trials were retained for full-text review. Of these, 5 randomized controlled trials (RCTs) were deemed suitable for inclusion in this systematic review (32–36) (Figure 1). These trials included 223 patients in total: Nd:YAG laser (2 trials, 55 patients), Diode laser (3 trials, 97 patients); Alexandrite laser (3 trials, 111 patients), Ruby laser (1 trial), and IPL (3 trials, 103 patients) (Figure 1). Sample sizes ranged from 20 to 100 participants and skin types I–VI; all participants had brown-black hair. A summary of study characteristics can be found in Table 2.

Risk of bias assessment
Results of risk of bias assessment are summarized in Figure 2. The overall risk of bias in four of the five trials was unclear, with the remaining trial being low risk (35). Sequence generation and allocation concealment were concurrently adequately reported in only two (33,35) trials. Blinding of both participants and investigators was only adequately reported in three trials (32,33,35). Risk of attrition bias and reporting bias was judged as unclear in all five trials. Furthermore, three trials (32–34) were found to have high risk of selection bias.

Critical appraisal
Four (20–22,24) of the five studies were graded as moderate quality and one as low quality (23) for the outcome “long-term hair reduction” (Appendix 4).

Long-term hair reduction
All the five trials reported data on the primary outcome of interest: long-term hair reduction. Average hair reduction reported from trials of Nd:YAG laser (35,36) (n = 2) for short-term follow-up varied from 60–73.60% and long-term ranged from 30–73.61%. Diode laser was assessed in three trials (32,33,35) and resulted in average hair reductions of 59.7–70% in the short-term and 32.5–69.2% in the long-term. Average hair reduction in trials of Alexandrite laser (34,36) (n = 3) ranged from 52–85.99% in the short-term and 35–84.25% in the long-term. Three trials (32–34) investigated IPL with average hair reduction ranging in the short-term from 21–77% and in the long-term from 52.7–27%.
| Author, Year | Laser Types | % Mean Reduction in Hair Count from baseline at LAST follow-up ± SD | % Mean Reduction in Hair Count from baseline at FIRST follow-up ± SD | Average Patient Satisfaction Scores |
|--------------|-------------|---------------------------------------------------------------|---------------------------------------------------------------|------------------------------------|
| Davoudi, 2008 | Nd:YAG 12mm Alexandrite 18mm Alexandrite Randolph + Nd:YAG | 73.61% ± 11.4 75.89% ± 19.0 84.25% ± 12.4 77.81% ± 15.9 | Digital camera Visomed AG device | 73.60% ± 16.6 79.6% ± 19.59 85.99% ± 11.62 | 73.60% ± 16.6 | 79.6% ± 19.59 | 85.99% ± 11.62 |
| Galadari, 2003 | Nd:YAG Alexandrite Diode 3 sessions 6 sessions Average | 3 sessions 6 sessions Average | NS | 79.61% ± 18.1 | 50% | 70% | 60% |
| Haak, 2010 | Diode IPL | 34% 40% | 68% | 50% | p = 0.277 | 60% | p = 0.125 |
| Klein, 2013 | Diode IPL | 69.2% 52.7% | 59.7% 42.4% | p ≤ 0.01* | p ≤ 0.01* | NS | NS |
| McGill, 2007 | Alexandrite IPL | 46% 27% | 52% 21% | p < 0.001* | p < 0.001* | 7.7/10 | p ≤ 0.002* |

Table 1: Data extraction form.
Among the five trials included; Davoudi et al. (35) performed a within-patient RCT on 20 volunteers of skin types III–IV to compare lasers on hair removal in the leg area including Nd:YAG, 12 mm; Alexandrite, 18 mm; Alexandrite, and a combination of Alexandrite+Nd:YAG. Follow-up was 18 months post-final treatment and showed greater long-term hair-count reduction using 18 mm Alexandrite (84.25%), followed by 12 mm Alexandrite (75.89%) then Nd:YAG (73.61%); however, these differences were non-significant (p = .25). Galadari et al. (36) also performed an RCT comparing Nd:YAG, Alexandrite, and Diode in 100 volunteers of skin types IV–VI, with treatment directed to the face. Again, 12-month follow-up showed superior long-term hair-count reduction using Alexandrite (35%) followed by Diode (32.5%) then Nd:YAG (30%); however, statistical tests and drop-out rate were not reported; thus, data were difficult to interpret. Haak et al. (32) completed a within-patient RCT on 35 volunteers with skin types III–IV to compare Diode laser against IPL, with treatment directed to the face. Six-month follow-up showed greater but non-significant (p = .427) long-term hair-count reduction by IPL (40%) compared to Diode (34%). Klein et al. (33) also compared Diode to IPL in a within-patient RCT of 30 volunteers with skin types I–III with treatment targeted at the axillary area; however, comparatively, their 12-month follow-up showed that Diode (69.2%) produced a significantly greater (p ≤ .01) long-term hair-count reduction than IPL (52.7%). McGill et al. (34) performed a within-patient RCT on 38 volunteers with PCOS and skin types I–IV to compare Alexandrite laser against IPL with treatment directed to the face. Six-month follow-up showed significantly greater (p < .001) long-term hair-count reduction by Alexandrite (46%) compared to IPL (27%).

**Discussion**

Review of the five RCTs included in this review did not demonstrate superiority of one laser or light device over another; however, it did provide evidence suggesting that hair-cycle lengths of specific sites should be considered when evaluating long-term efficacy of lasers and light devices in hair reduction for problematic hair. Notably, there was only a small number of total participants in the five trials included in this review, and despite all being RCT, none were deemed to be of high methodological quality, so it may be that the question of actual efficacy of laser and photo-epilatory devices cannot be answered until high-quality trials are published.

The average hair reduction reported from trials of Nd:YAG laser (n = 2) for short-term follow-up varied from 60 to 73.60% and long-term ranged from 30 to 73.61%. The trial reporting both greatest short-term and long-term efficacy (35) focused on treatment of leg hair vs the other trial focused on treating the facial area (36). As leg hair has a longer growth cycle (1-year) compared with the face (6-months) (22), this may account for the greater reduction of hair seen in this trial. Interestingly, one trial (36) implemented different numbers of treatment sessions between groups and found that increasing
| Author, Year | Trial Type | Population | Sample Size | Age, mean (range) | Female, No. (%) | Skin type (%) | Anatomical location (hair colour) |
|--------------|------------|------------|-------------|-------------------|----------------|---------------|----------------------------------|
| Davoudi, 2008 | Within-patient RCT | Volunteers with skin type III–IV | 20 | 32.6 (16-50) | 11 (55) | 0 | 0 | 15 (75) | 5 (25) | 0 | 0 | Legs (black) |
| Galadari, 2003 | RCT | Females with skin type IV–VI | 100 | NS | 100 (100%) | 0 | 0 | 0 | NS | 0 | Upper lip, face (black) |
| Haak, 2010 | Within-patient RCT | Hirsute women with intrinsically normal or medically normalized testosterone levels; skin type IV–V | 35 | 38 (19-59) | 35 (100) | NS | 0 | 0 | 0 | 0 | Face (brown, black) |
| Klein, 2013 | Within-patient RCT | Fitzpatrick skin type I–III and brown to black axillary hair | 30 | 33.7 (21–50) | 30 (100) | 0 | 18 (60) | 12 (40) | 0 | 0 | 0 | Axilla (brown, black) |
| McGill, 2007 | Within-patient RCT | Women with diagnosis of PCOS; Fitzpatrick skin types I–IV | 38 | 34 (16-69) | 38 (100%) | 34 | 4 | 0 | 0 | 0 | Face (brown, black) |
targeted the legs (35). Again, this may be explained by the fact that the leg area has a longer hair growth-cycle duration compared to the face (22).

Average hair reduction from IPL trials ranged from 21 to 77% in the short-term and from 52.7 to 27% in the long-term. The lowest short-term and long-term hair reduction came from a trial targeting the face (34). The highest short-term reduction in hair came from a trial by Haak et al. (32), which also targeted the face, and the highest long-term reduction in hair came from the Klein et al. (33) trial, which targeted the axilla. Haak et al. (32) found that IPL produced greater long-term hair reduction than Diode long-term; however, Klein et al. (33) found the reverse, and the latter is supported by a randomized split-body comparison of IPL with Diode laser by Sochor et al. (38). A comparison study by Chen et al. (39) also compared the efficacy of Diode laser with IPL for hair but found no statistically significant difference in hair reduction between the Diode laser and IPL. Therefore, there is much conflicting data on this outcome, and more research is needed.

There have been many non-RCTs (39–45) and RCTs (38,46–51) on the efficacy of laser and IPL-based hair removal previously, most of which only follow participants short term (39,41,42,45). There is evidence that some trial (51) definitions of “long-term” hair reduction fail to take into account the site-specific periods of hair growth cycles of the areas they measured long-term hair reduction for. An RCT by Handrick et al. (51) targeted underarm hair with follow-up 6 months from last treatment; however, the growth-cycle for under-arm hair has been found to be 7 months (22); therefore, follow-up at 6 months cannot provide a true measure of “long-term” hair reduction. There was heterogeneity in body site treated in some trials including Lin et al. (41), who compared 694 nm Ruby with 800 nm Diode and targeted abdomen, buttock, back, shoulder, forearm, upper arm, thigh, and lower leg. As these areas have different growth-cycle lengths, it is difficult to compare long-term efficacy of devices. The trials implemented varying device parameters and treatment protocols with different numbers of treatment sessions at different intervals (weeks to months). There was also widespread variation in participant characteristics with regards to skin and hair color, anatomic region treated, and endocrine system function, which may also impact treatment outcomes. While all trials in this review only included people with dark hair and some even selected for this (32–34), a non-randomized trial by Rao et al. (43) found that participants with red or light-colored hair saw 5–15% less efficacy in hair reduction with any laser system used compared with dark-haired participants; thus, the findings from the small number of trials suitable for inclusion in this review are not generalizable to the wider population.

**Conclusion**

Nd:YAG, Diode, Alexandrite, and Ruby lasers, as well as IPL devices, have all been previously studied and shown to be valuable in the short-term for hair-reduction with varying risk of adverse events. Analysis of the five long-term RCTs included in this review did not indicate a clear pattern of superiority of one laser or light device over another in terms of efficacy or safety. Of note, however, is that in all three trials

![Figure 2. Risk of bias assessments.](attachment:image.png)
where Alexandrite was compared to other devices, it produced the greatest long-term hair reduction in each case. Non-standardized treatment protocols, including variations in device energy settings, pulse-width, number of treatments, and body-site targeted made it impossible to determine whether a dose–cause relationship for any individual parameter was present. However, targeting anatomic regions with longer hair growth cycles, such as the legs, appeared to result in greater long-term reduction in hair growth, therefore fitting with the theory that the assessment of efficacy of laser and light devices in long-term hair-reduction should adjust for site-specific growth-cycle lengths.

**Implications for future research**

There is growing demand for high-quality trials with regards to outcomes related to laser and photo-epilation. Especially needed are trials with truly long-term evaluations of efficacy using site-specific measurements of hair re-growth based on knowledge of length of hair growth cycles. Moreover, prospective trials must standardize treatment protocol for all parameters, including number of treatment sessions, treatment interval, treatment location, and device settings to produce comparable data evaluating the safety and efficacy of devices across patients. There is also a lack of trials evaluating the efficacy of lasers and IPL versus untreated controls and trials comparing all four lasers (Ruby, Alexandrite, Diode, and Nd: YAG) and IPL within the same group of participants, which is important to reduce the effect of within-participant variables on outcome measures. The effects of participant characteristics on individual hair-removal outcomes remain broadly unclear, and an increase in trials investigating patient-specific variables may allow practitioners to apply a more strategic and personalized approach to treatment of unwanted hair, in addition to providing more accurate information for the general public considering undergoing these treatments. Overall, larger, prospective, blinded RCTs with longer follow-up and including patients of all skin types and uniform treatment protocols are necessary to fully understand the long-term efficacy of lasers and IPL devices in hair reduction.

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**Supplementary materila**

Supplemental data for this article can be accessed here.

**References**

1. Blume-Peytavi U, Gieler U, Hoffmann R, Lavery S, Shapiro J. Unwanted facial hair: affects, effects and solutions. Dermatology. 2007;215(2):139–46. doi:10.1159/000104266.
2. Barnes RB, Neithardt AB. The diagnosis and management of hirsutism. Semin Reprod Med. 2003;21(3):285–94.
3. Mofid A, Seyyed Alinaghi SA, Zandieh S, Yazdani T. Hirsutism. Int J Clin Pract. 2008;62(3):433–43. doi:10.1111/j.1742-1241.2007.01621.x.
4. Lipton MG, Sherr L, Elford J, Rustin MHA, Clayton WJ. Women living with facial hair: the psychological and behavioral burden. J Psychosom Res. 2006 Aug;61(2):161–68. doi:10.1016/j. jpsychires.2006.01.016.
5. Barth JH, Catalan J, Cherry CA, Day A. Psychological morbidity in women referred for treatment of hirsutism. J Psychosom Res. 1993 Sep 1;37(6):615–19. 10.1016/0022-3999(93)90056-L.
6. Palmetun Ekbbäck M, Lindberg M, Benzein E, Årestedt K. Health-related quality of life, depression and anxiety correlate with the degree of hirsutism. Dermatology. 2013 Nov;227(3):278–84. doi:10.1159/000355536.
7. Keegan A, Liao LM, Boyle M. “Hirsutism”: a psychological analysis. J Health Psychol. 2003;8(3):327–45. doi:10.1177/1359105300083004.
8. Pasch L, He SY, Huddleston H, Cedars MI, Beshay A, Zane LT, Shinkai K. Clinician vs self-ratings of hirsutism in patients with polycystic ovarian syndrome: associations with quality of life and depression. JAMA Dermatol. 2016 Jul 1;152(7):783–88. 10.1001/jamadermatol.2016.0358.
9. Rahnama Z, Sohbbati S, Safizadeh H. Effect of hirsutism on quality of life: a study in Iranian women. J Pakistan Assoc Dermatol. 2013;23(1):28–33.
10. Haedersdal M, Wulf HC. Evidence-based review of hair removal using lasers and light sources. J Eur Acad Dermatol Venereol. 2006 Jan;20(1):9–20. doi:10.1111/j.1468-3033.2005.01327.x.
11. Thomas MM, Hourold NN. The “ins and outs” of laser hair removal: a mini review. J Cosmet Laser Ther. 2019 Aug;21(6):316–22. doi:10.1080/17464172.2019.1605449.
12. Haedersdal M, Beerwerth F, Nash JF. Laser and intense pulsed light hair removal technologies: from professional to home use. Br J Dermatol. 2011 Dec;165:31–36. doi:10.1111/j.1365-2133.2011.10736.x.
13. Alora MBT, Anderson RR. Recent developments in cutaneous lasers. Lasers Surg Med. 2000;26(2):108–18. doi:10.1002/(SICI)1096-9101(2000)26:2<108::AID-LSM2>3.0.CO;2-4.
14. Anderson RR. Lasers in dermatology—a critical update. J Dermatol. 2000 Nov;27(11):700–05. doi:10.1111/j.1346-8138.2000.tb02282.x.
15. Ort RJ, Anderson RR. Optical hair removal. Semin Cutan Med Surg. 1999 Jun;18(2):149–58. doi:10.1053/scms.1999.08039-X.
16. Anderson RR, Parrish JA. The optics of human skin. J Invest Dermatol. 1981 Jul;77(1):13–19. 10.1111/1523-1747.ep12479191.
17. Liew SH. Laser hair removal. Am J Clin Dermatol. 2002 Apr;3(2):107–15. doi:10.2165/00128071-200203020-00004.
18. Ross E. Extended theory of selective photothermolysis: a new recipe for hair cooking? Lasers Surg Med. 2001;29(5):413–15. doi:10.1002/lsm.1135.
19. Martella A, Raichi M. Photoepilation and skin photorejuvenation: an update. Dermatol Reports. 2017 Jun 13;9(1):9–13. 10.4081/dr.2017.7116.
20. Loriaux DL. An approach to the patient with hirsutism. J Clin Endocrinol Metab. 2012 Sep 1;97(9):2957–68. 10.1210/jc.2011-2747.
21. Higgins CA, Petukhova L, Harel S, Ho YY, Drill E, Shapiro L, Wajid M, Christiano AM. FGFR5 is a crucial regulator of hair length in humans. Proceedings of the National Academy of Sciences of the United States of America, United States of America. 2014 Jul 22;111(29):10648–53.
22. Laughlin SA, Dudley DK. Long-Term hair removal using a 3-Millisecond alexandrite laser. J Cutan Med Surg. 2000 Apr;4(2):83–88. doi:10.1097/00003475-000004002008.

23. Dorgnah MA, Dorgnah DA. Lasers for reduction of unwanted hair in skin of colour: a systematic review and meta-analysis. J Eur Acad Dermatol Venereol. 2020 May;34(5):948–55. doi:10.1111/jdv.15995.

24. Sadighha A, Mohaghegh Zahed G. Meta-analysis of hair removal laser trials. Lasers Med Sci. 2009 Jan;24(1):21–25. doi:10.1007/s10103-007-0515-1.

25. Foyne RA, Perper M, Eber AE, Aldahan AS, Nouri K. Laser and light treatments for hair reduction in Fitzpatrick Skin Types IV–VI: a comprehensive review of the literature. Am J Clin Dermatol. 2018 Apr;19(2):237–52. doi:10.1002/sde2.716.00007.

26. Haedersdal M, Gotschke PC. Laser and photoepilation for unwanted hair growth. Cochrane Database Syst Rev. 2006(4):1–21. doi:10.1002/14651858.CD004684.pub2

27. Hoher D, Liberati A, Tetzlaff J, Altman DG, Prisma Group. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. PLoS Med. 2009 Jul 21;6(7):e1000697. doi:10.1371/journal.pmed.1000697.

28. Higgins JPT, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, Welch VA, editors. Cochrane Handbook for Systematic Reviews of Interventions John Wiley & Sons; 2019 Sep 23. 81–94.

29. Data collection form (for RCTs) [Internet]. Training.cochrane.org. 2021 Accessed 1 April 2020. https://training.cochrane.org/data-collection-form-rcts

30. Sterne JAC, Savović J, Page MJ, Elbers RG, Blencowe NS, Boutron I, Cates CJ, Cheng HY, Corbett MS, Eldridge SM, et al. RoB 2: a revised tool for assessing risk of bias in randomised trials. BMJ. 2019 Aug 28;366.

31. Balshem H, Helfand M, Schünemann HJ, Oxman AD, Kunz R, Brozek J, Vist GE, Falck-Ytter Y, Meerpohl J, Norris S, et al. GRADE guidelines: 3. Rating the quality of evidence. J Clin Epidemiol. 2011 Apr;64(4):401–06. doi:10.1016/j.jclinepi.2010.07.015.

32. Haak CS, Nymann P, Pedersen AT, Clausen HV, Feldt Rasmussen U, Åk R, Main K, Haedersdal M. Hair removal in hisure women with normal testosterone levels: a randomized controlled trial of long-pulsed diode laser vs. intense pulsed light. Br J Dermatol. 2010 Nov;163(5):1007–13. doi:10.1111/j.1365-2133.2010.10004.x.

33. Klein A, Steinert S, Baemmer W, Landthaler M, Babillas P, Babillas P. Photoepilation with a diode laser vs. intense pulsed light (IPL): a randomized, intra-patient left-to-right trial. Br J Dermatol. 2013 Jun;168(6):1287–93. doi:10.1111/bjd.12182.

34. McGill DJ, Hutchison C, McKenzie E, McSherry E, Mackay IR. A randomised, split-face comparison of facial hair removal with the alexandrite laser and intense pulsed light system. Lasers Surg Med. 2007 Dec;39(10):767–72. doi:10.1002/lsm.20584.

35. Davoudi SM, Behnia F, Gorouhi F, Keshavzar S, Kashani MN, Firoozabad MR, Firooz A. 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. Arch Dermatol. 2008 Oct;144(10):1323–27. doi:10.1001/archderm.144.10.1323.

36. Galadari I. Comparative evaluation of different hair removal lasers in skin types IV, V, and VI. Int J Dermatol. 2003 Jan;42(1):68–70. doi:10.1046/j.1365-4632.2003.01744.x.

37. Dierickx C. Laser-assisted hair removal: state of the art. Dermatol Ther. 2000 Jan;13(1):80–89. doi:10.1046/j.1529-8019.2000.00009.x.

38. Sochor M, Curkova AK, Schwarczova Z, Sochorova R, Simaljakova M, Buchvald J. Comparison of hair reduction with three lasers and light sources: prospective, blinded and controlled study. J Cosmet激光 Ther. 2011 Oct;13(5):210–15. doi:10.3109/14764712.2011.586422.

39. Chen J, Liu XJ, Huo MH. Split-leg comparison of low fluence diode laser and high fluence intense pulsed light in permanent hair reduction in skin types III to IV. Australas J Dermatol. 2012 Aug;53(3):186–90. doi:10.1111/j.1440-0960.2012.00879.x.

40. Li R, Zhou Z, Gold MH. An efficacy comparison of hair removal utilizing a diode laser and an Nd:YAG laser system in Chinese women. J Cosmet Laser Ther. 2010 Oct;12(5):213–17. doi:10.3109/14764712.2010.514922.

41. Lin TY, Dierickx CC, Campos VB, Farinelli WA, Rosenthal J, Anderson RR. Reduction of regrowing hair shaft size and pigmentation after ruby and diode laser treatment. Arch Dermatol Res. 2000 Feb;292(2):60–67. doi:10.1007/s004030050011.

42. Khoury JG, Saluja R, Goldman MP. Comparative evaluation of long-pulsed alexandrite and long-pulse Nd:YAG laser systems used individually and in combination for axillary hair removal. Dermatol Surg. 2008;34(5):665–71. doi:10.1097/DSS.0b013e318142f28a.

43. Rao J, Goldman MP. Prospective, comparative evaluation of three laser systems used individually and in combination for axillary hair removal. Dermatologic Surgery: Official Publication for American Society for Dermatologic Surgery [Et Al.]. 2005 Dec;31(12):1671–77. doi:10.2310/6350.2005.31307.

44. Rogers CJ, Anna Glaser D, Siegfried EC, Walsh PM. Hair removal using topical suspension-assisted Q-switched Nd:YAG and long-pulsed alexandrite lasers: a comparative study. Dermatol Surg. 1999 Nov;25(11):844–50. doi:10.1097/00003475-199911.01030.x.

45. Paasch U, Wagner JA, Paasch HW. Novel 755-nm diode laser vs. conventional 755-nm scanned alexandrite laser: side-by-side comparison pilot study for thorax and axillary hair removal. J Cosmet Laser Ther. 2015 Jul;4(7):189–93. doi:10.1016/j.cjlnt.2015.1007062.

46. Erikkert-Polgau A, Algier-Zielinska B, Skubalski J, Rotsztejn H. Comparison of hair reduction by intensive pulsed light device and combined intense pulsed light with a bipolar radiofrequency. J Dermatol Treat. 2020;7:1–5.

47. Ismail SA. Long-pulsed Nd:YAG laser vs. intense pulsed light for hair removal in dark skin: a randomized controlled trial. Br J Dermatol. 2012;166(2):317–21. doi:10.1111/j.1365-2133.2011.10695.x.

48. Khatri KA, Lee RA, Goldberg LJ, Khatri B, Garcia V. Efficacy and safety of a 0.65 millisecond pulsed portable ND:YAG laser for hair removal. J Cosmet Laser Ther. 2009 Mar;11(1):19–24. doi:10.1071/JD070062.

49. Ormiga P, Ishida CE, Boechat A, Ramos-E-Silva M. Comparison of the effect of diode laser versus intense pulsed light in axillary hair removal. Dermatol Surg. 2014 Oct 1;40(10):1061–69. doi:10.1097/DSS.000000000000138.

50. Wanithphakdee Decha R, Thanomkitti K, Sethabutra P, Eimpanth P, Manuskiatti W. A split axilla comparison study of axillary hair removal with low fluence high repetition rate 810 nm diode laser vs. high fluence low repetition rate 1064 nm Nd:YAG laser. J Eur Acad Dermatol Venereol. 2012 Sep;26(9):1133–36. doi:10.1111/j.1468-3083.2011.04231.x.

51. Handrick C, Alster TS. Comparison of long-pulsed diode and long-pulsed alexandrite lasers for hair removal: a long-term clinical and histologic study. Dermatol Surg. 2001 Jul;27(7):622–26. doi:10.1097/00003484-200107000-00013.