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Lasers Uses in the Treatment of Alopecia Areata: Review Article

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ABSTRACT

Background: Non-scarring alopecia, one of the most common causes that involves the scalp, but it can also affect other hairy areas. Alopecia areata usually occurs in a patchy pattern, but it can also affect all scalp and body hairs (Alopecia Totalis or Alopecia Universalis). Fractional lasers have the potential to stimulate hair growth when used in the right way. The most likely culprit is a wound healing mechanism activated by stress, although the particular methods by which fractional lasers affect hair development are still unknown. For epidermal deficiencies, stem cells from hair follicles can be used to supply offspring that can go to the skin. Hair follicles are more likely to recover following tissue damage during the anagen phase of the hair cycle.

Objective: This review article aimed to evaluate the role of lasers in alopecia areata treatment.

Methods: PubMed, Google scholar and Science direct were searched using the following keywords: Laser, Alopecia areata and Fractional laser therapy. The authors also screened references from the relevant literature, including all the identified studies and reviews, only the most recent or complete study was included, and in peer-reviewed articles between April 2000 and June 2021.

Conclusion: Fractional laser therapy stimulates hair regeneration by causing the skin to heat up. Fractional lasers have both a direct and indirect therapeutic effect on the hair follicle via transepidermal drug delivery of minoxidil and/or topical steroids. Topical minoxidil and/or topical corticosteroids for resistant alopecia areata can now be delivered via fractional carbon dioxide laser–assisted drug delivery.

Keywords: Laser, Alopecia areata**,** Fractional laser therapy.

INTRODUCTION

Approximately 2.1% of the population suffer from the autoimmune disease alopecia areata, which is characterized by recurrent patches of hair loss that come and go. It is most commonly seen in the form of circular patches of hair loss, but it can appear at any age **(1).** Non-scarring alopecia areata comes in second to male and female pattern alopecia as a cause of hair loss **(2)**. Patients with alopecia areata have different types of clinically observed hair loss. As one of the most common forms of alopecia areata, the condition can cause complete hair loss on the scalp as well as on the rest of the body if left untreated (hair loss that affects everywhere) **(3)** (Figures 1, 2, 3 and 4)**.**

Many theories have been proposed in the past about the causes of alopecia areata, including the "trophoneurotic hypothesis," which is based on a link between the onset of Alopecia areata and emotional or physical stress or trauma. Thyroid disease and hormonal fluctuations have also been linked to alopecia areata. Also, Toxic effects of thallium acetate on the body **(4).**

For those who suffer from the autoimmune condition alopecia areata, hair loss is not permanent. Alopecia areata is estimated to affect 2.1% of the general population over the course of one's lifetime, with no gender-specific differences in incidence **(1).**

No medication has been shown to be uniformly effective or to eradicate the condition completely in the fight against hair loss. RCTs are challenging to evaluate because of the high percentage of spontaneous remission. In the case of a moderate condition affecting only a few small locations, topical steroids may be the best alternative. Despite the fact that the results of RCTs are highly variable, some people appear to benefit from them **(5).**

Laser treatment:

In some cases, laser therapy might help people with alopecia areata improve their hair growth. It is possible to employ excimer lasers, which are regularly used UV lasers, as a safe and effective therapy option for skin cancer. A randomized clinical research is needed to confirm that increasing the width of hair shafts is a more effective technique than medicinal treatment during this interim time **(6).**

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Figure (1): Patchy alopecia areata.

Figure (2): At the top of the hair shaft, hairs are denser than they are at the base.

Figure (3): Alopecia totalis.

Figure (4): Alopecia in an ophiasis pattern.

308-NM Excimer Laser:

There is no need for xenon or chloride in order for the excimer laser to operate. The wavelength is 308-nm [(7)]. Because of the pathology they use excimer lasers to treat alopecia areata that are believed to act differently than other lasers [(8)]. Inflammatory disorders such as psoriasis are expected to benefit from excimer laser therapy, despite the particular mechanism being unknown [(9)].

Alopecia areata is an auto-immune condition that causes hair follicles to be inflamed by T cells [(10)]. Excimer lasers have been suggested as a possible treatment option, since **Gundogan *et al.*** [(11)] first reported the benefit of the excimer laser on alopecia areata [(11)]. Its effectiveness has been demonstrated in numerous studies [(12, 13)].

Most patients with recalcitrant fractional laser therapy is thought to stimulate hair regrowth by causing the skin to heat up. Fractional lasers have both a direct and indirect therapeutic effect on the hair follicle via transepidermal drug delivery of minoxidil and/or topical steroids. Topical minoxidil and/or topical corticosteroids

for resistant alopecia areata delivered via fractional carbon dioxide laser–assisted drug delivery to scalp, beard, arms, and legs are studied. This was the largest study done to date. Each alopecic patch got twice-weekly therapy for a minimum of 24 treatments. Although only 41.5% of patches showed development in the form of hair, in the control patches, no growth was identified. In the opinion of **Al-Mutairi [12],** the treatment has been shown to be effective.

Excluding 11 children with resistant alopecia areata of the scalp who had been treated for 12 weeks with the excimer laser, regrowth was observed in 60% of the patches treated over that time frame. It is safe and effective for individuals with refractory epilepsy, tissues of alopecia, and youngsters, according to **Al-Mutairi [14].** One patch of alopecia was recently divided into two separate groups for a 12-week, twice-weekly trial using the excimer laser. The hairs in the treated area was found to be considerably bigger in diameter than those in the control area. According to these investigations, excimer laser therapy can be used to cure refractory cases of alopecia areata **[6].**

A common excimer laser therapy plan was utilised, with an initial dose of 50 mJ/cm^2 less than the minimal erythema dose and subsequently increased by 50 mJ every two sessions, since the treatment sessions were frequently twice a week [2, 6].

In dermatology, the most prevalent adverse effects include burns, prolonged erythema and pain, which are the most common consequences of its use **[6].** Itching, erythema, and moderate skin peeling were common side effects of excimer laser treatment for alopecia areata in several investigations, even in youngsters [12, 14]. There has been no hair regrowth in patients with alopecia universalis or alopecia totalis, despite the success of excimer laser treatment in alopecia areata **[15].**

Patients with atopic disorders have also demonstrated low response to the medication, which has been a bad prognostic factor. Laser treatment of recalcitrant alopecia areata limited to the scalp was successful, according to these results **[12].** There is some evidence that excimer lasers are useful and safe in the treatment of alopecia areata sufferers, but large-scale clinical research are needed to prove this.

Photothermolysis Laser:

When wounds are healing, it is possible to promote hair growth and so hair restoration **[16].** Because it doesn't damage the stratum corneum, fractional non-ablative photothermolysis spares the surrounding tissues. Wound healing would then be induced, and hair growth could theoretically result **[17].** After using topical steroids, corticosteroid injections, and minoxidil, a 35-year-old alopecia areata patient initially reported the efficacy of a non-ablative fractional photothermolysis laser **[18].**

Using a pulse energy of 10–15 mJ, a density of 300 MTZ/cm^2/pass, and two passes per session, patients were treated weekly for 24 weeks with fractional erbium glass laser treatment. After one month of treatment, hair regrowth was evident, and it remained that way for six months. Erbium glass laser has also been shown to be effective in the treatment of alopecia areata in a recent study. On average, the patients received two to three sessions of treatment at 30-45 mJ/cm^2, 6--8 density, and 8–10 passes, with a three- to six-week interval between sessions. Within three months of treatment, all patients showed complete or nearly complete regrowth with very slight pain as a side effect **[19].**

Fractional photothermolysis laser hair regrowth may be facilitated by the induction of T-cell apoptosis and the stimulation of hair growth **[18].** There is growing evidence that laser therapy can help patients suffering from androgenic alopecia, but more research is needed to determine exactly how laser therapy works [20, 21]. Alopecia areata may benefit from fractional photothermolysis laser treatment in the future, but further research is needed to confirm this **[19].**

Lasers used to increase drug delivery:

Erbium glass, fractional CO_2 and non-ablative Nd:YAG (neodymium-doped yttrium aluminium garnet) lasers have been used for the treatment of alopecia areata. A chromophore of water is found in both CO_2 and Erbium glass lasers where they both effectively vaporise or coagulate tissue. In order to reach deeper layers of tissue, the non-ablative Nd:YAG laser utilises a melanin chromophore as a target **[22].**

Studying the effects of laser therapy on the delivery of topical medications used in alopecia areata has been examined. Due to the stratum corneum's barrier function, effective topical drug delivery may be difficult. Using lasers, the stratum corneum can be removed in a safe and painless manner **[23].**

Three patients with alopecia areata (ophiasis) were retrospectively reviewed after receiving CO_2 and Erbium glass laser treatment, two of the patients showed moderate to significant improvement, while the third patient showed no change **[24].** An intrafollicular corticosteroid injection was administered concurrently to that patient who then improved.

Erbium glass laser usage in a study reported that a male patient with alopecia areata regrew all of the affected areas after 24 weekly treatment sessions [18, 19]. During this time, the patient received no additional treatments, and his hair continued to grow normally six months later. A 28-year-old male with complete baldness was treated with erbium glass laser and intralesional corticosteroid injections **[25].** An improvement in the site treated with combination therapy compared to corticosteroid injection alone was observed following a course of 12 weekly treatments. Three months after Erbium glass laser treatment, five alopecia areata patients were followed for two to four years with no signs of return to the previously-treated area **[19].**

Fractional lasers and microneedling have been shown to stimulate hair regeneration by changing the local microenvironment and influencing the local immune cells, among other possibilities [17]. Release of chemokines can be used to move the perifollicular infiltration around in the dermis and epidermis Apoptosis of lymphocytic cells may be induced by laser light, stopping the killing of follicles by the immune system [24].

Fractional laser therapy and microneedling are safe and effective treatments for Alopecia areata, according to modest studies. Many hypotheses have been put up as to why hair regrowth occurs following skin resurfacing operations. There aren't enough clinical data to draw any firm conclusions about the effectiveness of these new treatment modalities. The combination of therapies with topical drug administration has the potential to be effective because of enhanced drug delivery [26].

Patients with alopecia areata were treated with radiofrequency or fractional CO_2 lasers followed by topical triamcinolone administration and acoustic pressure wave ultrasound application. Patients were able to resume their regular routines after as little as one to six therapy sessions [27]. It's possible that lasers can interact with sebum to disrupt the skin's barrier function, which would increase drug delivery to deeper tissues than just the stratum corneum. Laser-mediated drug permeation, a minimally invasive and well-controlled approach, could be a treatment option for alopecia [28].

Low-level laser therapy:

In 1967, while investigating whether low-powered ruby laser therapy could induce cancer, researchers noticed an increase in hair growth and this led to development of the concept of low-level laser therapy (LLLT) (694 nm). The shaved skin of mice was treated with LLLT, which resulted in faster hair regrowth compared to the untreated mice [29]. LLLT's efficacy in treating various forms of hair loss, particularly androgenetic alopecia, has been evaluated in a number of previous studies, with promising results [23, 30]. Efficacy in a heat-induced C3H/HeJ mouse model of alopecia areata was examined using the FDA-approved LLLT device HairMax LaserComb (Lexington International, Boca Raton, FL, USA). After six weeks of daily 20-second treatments, three times a week, the treated group of mice had a larger number of anagen hair follicles than the untreated group [31].

In a recent study, a pulsed infrared diode laser was utilised to treat 23 individuals with 52 stubborn areas of alopecia areata who had failed to respond to other treatments. The treated patches had significantly more hair growth than the control sections, as well. Patients with alopecia areata were given linear polarised infrared light frequencies of 600–1600nm for 3 minutes twice or thrice a week as an alternate treatment. A full 1.6 months sooner than in non-irradiated areas, 46.7% of the population had started growing hair in the irradiated zones [32].

Hair follicle proliferation in anagen and prevention of early catagen development are all believed to be the fundamental effects of low-level laser therapy. LLLT may be regarded as a therapy option in the future, despite a lack of research and a lack of understanding of its mechanics [31].

CONCLUSION

Fractional laser therapy stimulates hair regeneration by causing the skin to heat up. Fractional lasers have both a direct and indirect therapeutic effect on the hair follicle via transepidermal drug delivery of minoxidil and/or topical steroids. Topical minoxidil and/or topical corticosteroids for resistant alopecia areata can now be delivered via fractional carbon dioxide laser–assisted drug delivery.

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