ROLE OF EXCIMER LIGHT/LASER IN THE TREATMENT OF ALOPECIA AREATA

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ABSTRACT

Background: Alopecia Areata (AA) is a complex autoimmune disease characterized by round or oval patches of non-scarring hair loss that is mediated by lymphocytes affecting the hair follicles. Current therapies consisting of topical corticosteroids or intralesional injections are often the first choices for treatment, but are limited by unsatisfactory outcomes. Various lasers have been suggested in recent studies to treat AA but effect of 308-nm excimer laser was the most studied. 308-nm Excimer Laser (EL) has been approved by the Food and Drug Administration for the treatment of psoriasis and vitiligo. The aim of this article is to review the efficacy of excimer laser/ light in the treatment of AA.

Conclusion: The 308-nm excimer laser is effective in the treatment of AA conditions and it is well tolerated, with few adverse reactions.

Key words: Alopecia areata, Excimer laser, Monochromatic Excimer Light.

I. INTRODUCTION

Monochromatic Excimer Light (MEL) offers a new source of narrow-band UVB emitting at 308 nm which represents the latent advance in concept of selective phototherapy and proves effective approach to different chronic and recurrent skin diseases especially the immune-mediated diseases due to its potent immune-suppressant action [1]. 308 nm light can be emitted as coherent (laser) or non-coherent light [2]. Both seem effective but the cost effectiveness ratio seems more favourable to the light, on the other hand the excimer laser limits UV exposure to affected skin, while sparing healthy skin [3]. Excimer laser (EL) delivers UV light via a hand piece with a spot diameter of 14 to 30 mm. So it is most appropriate for localized lesions and limited disease. It can be used in difficult to reach sites, such as the scalp, palms, and soles that would have limited UV exposure with conventional phototherapy. It allows for region specific dosing, which is important in the treatment of recalcitrant lesions. In comparison to standard NBUVB, the excimer laser requires fewer treatment sessions, which reduced treatment duration, and requires a lower cumulative UVB dose, thus reducing the side effects associated with UV therapy [4]. The increased efficacy observed in excimer laser compared with NBUVB may be due to the deeper penetration and higher irradiance of laser [5]. Due to its many advantages, the excimer laser has emerged as a good modality for the treatment of several dermatologic conditions. It is currently approved by the Food and Drugs Administration (FDA) for the treatment of alopecia areata (AA), psoriasis, vitiligo, and leukoderma. In addition to these diseases, excimer laser has also demonstrated efficacy in the treatment of other hypopigmented disorders, and cutaneous T-cell lymphoma [6].

Mechanism of action of excimer laser

The absorption of 308 nm light by T lymphocytes and keratinocytes causes DNA damage, leading to a reduction in T-lymphocyte inflammation and keratinocyte proliferation. Also leads to the upregulation of the p53 tumor suppressor pathway and downregulation of the Bcl-2 proto-oncogene, causes cell cycle arrest and apoptosis. Moreover it causes repigmentation through melanocyte migration and promoting melanogensis. Mechanism of action of Excimer Laser in treatment of AA depends on inducing immunological action through water-soluble
mediators, such as IL-4, IL-10, prostaglandin E2, platelet-activating factor, histamine, and cis-urocanic acid. It is the most widely studied laser to date for the treatment of AA [7].

**Alopecia areata in the clinical practice**

Alopecia areata (AA) is a chronic, immune mediated inflammatory disorder leads to nonscarring hair loss. It is a common disease affects approximately 0.1-0.2% of all population. A hallmark of active AA is the presence of peribulbar lymphocytes around the bulb region of anagen hair follicles [8]. The most important factors indicating a poor prognosis are the extent of hair loss presentation, duration of hair loss, a positive family history, the presence of other autoimmune diseases, nail involvement, and young age at first onset [9]. Many therapies were tried for the treatment of AA, including topical, systemic, and injectable therapies. Over the past century, Phototherapy had been a potential treatment available to patients [10]. In 1965, Endre Mester incidentally discovered the growth-promoting effect of lasers on hair, while performing tests on mice to determine if low-powered ruby lasers exert a carcinogenic effect.

This observation, along with multiple cases thereafter reporting a paradoxical growth of hair following laser hair removal, led to the development of various investigations testing the potential therapeutic effect of lasers on alopecia [11]. Excimer laser has a good safety profile. The most common side effects include pruritus, erythema, blistering and hypopigmentation [2].

**Excimer laser/ light benefits in alopecia areata**

The benefits of the excimer laser on alopecia areata was discussed in many studies (Table 1). It was first seen in Gundogan and colleagues in which 1 patient with hair regrowth in 12 sessions and a second patient in 11 sessions [12]. Additionally, to demonstrate that the excimer laser was causing hair growth as opposed to spontaneous remission of the disease, a half of an alopecia patch was treated with the excimer laser while the other half served as a control. After 27 sessions and a cumulative dose of 52.6 J/cm, only the treated side grew hair suggesting that the excimer laser was beneficial [13,14]. Excimer laser has demonstrated efficacy in treating AA in children, with clinical trials reporting between 36.9% and 100% of patients experiencing hair regrowth of 50% or greater. Most of these patients had previously failed standard treatment, indicating the excimer laser’s efficacy but it has not demonstrated efficacy in alopecia universalis or totalis [15]. In Al-Mutairiet al 2007 study, 18 patients with 42 recalcitrant patches were enrolled in their study and the lesions were treated with the 308-nm excimer laser twice a week for a period of 12 weeks; one lesion on each patient was left as a control for comparison.

They found that regrowth of hair was observed in 17 (41.5%) patches and 13 of the 18 lesions in scalp showed a complete regrowth of hair but the extremity regions failed to show a response [16].

Yoo et al. (2010) reported complete hair regrowth after multiple sessions with fractional Er:Glass laser in a 35-year-old male patient who had AA for 2 years and who was nonresponsive to treatment with minoxidil, topical corticosteroids, and ILCs. The mechanism of action is thought to involve the induction of T-cell apoptosis and direct enhancement of hair growth [17]. Another study by Al Hamzawy, 2019 reported that nearly 33.33% of patients showed a very good response, 27.77% of patients showed a good response, 33.33% of patients showed a mild response, and one patient was recorded with a poor response [18].

**Side effects and disadvantages of excimer laser in the treatment of alopecia areata**

The 308-nm excimer laser has been claimed to offer an effective alternative without significant risks, though there exists a lack of guidelines in this setting [18]. Similarly, in Alhamzawy2019, The main side effects noticed through excimer laser treatment modality were painful redness in three patients (16.6%), temporary post inflammatory hyperpigmentation in five patients, and fine desquamation in five patients and 21 patients (70%) reported it as moderate [18]. In Lacour et al., 2004 study, 308-nm excimer laser induces effective hair regrowth in all patients with alopecia areata partialis (AAP). The side effects were limited to mild erythema and hyperpigmentation, and the tolerance was excellent [19]. Multiple studies have demonstrated its effectiveness; although, it has not been shown effective in alopecia universalis, alopecia totalis, and for patches on the extremities [15,20,21].

**Comparison between excimer laser and other treatment modalities of alopecia areata**

The excimer laser treatment has apparent advantages over conventional treatments such as intralesional corticosteroid injection, topical immunotherapy, and systemic immunotherapy [22]. Injection pain of intralesional corticosteroid is often problematic, especially in children. Topical immunotherapy frequently causes severe
contact dermatitis and/or hyper- pigmentation [23]. Systemic immunosuppressants have often been used as off-label AA management, but their effectiveness remains controversial; the drugs may be toxic to internal organs. Although JAK inhibitors have shown promising results in the treatment of extensive AAs, recently they may be associated with systemic side effects and high cost. Moreover, topical JAK inhibitors have yielded disappointing results so far [24].

II. CONCLUSION

Even in the era of biologics, excimer laser should be still required to treat Alopecia Areata. Excimer laser lacks systemic pharmacological side effects, is pain free, and simple. Larger studies are needed to evaluate the long-term effects of the 308-nm excimer laser.

REFERENCES