Evaluation of the Efficacy and Safety of 308-nm Monochromatic Excimer Lamp in the Treatment of Resistant Alopecia Areata

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Abstract

Context:

Treatment of resistant alopecia areata (AA) can be very challenging and include many options with variable efficacy and safety profiles. The 308-nm excimer lamp has been claimed to offer an effective alternative without significant risks, though there exists a lack of guidelines in this setting.

Aims:

This study aimed to evaluate the efficacy and safety of the 308-nm excimer lamp in treating resistant AA in Iraqi patients.

Settings and Design:

A prospective interventional study.

Subjects and Methods:

Eighteen patients with multiple AA were enrolled in this study. All patients were treated with a 308-nm monochromatic excimer lamp, in two sessions per week for 12 weeks. The efficacy of this modality was evaluated using two methods, namely the Severity of Alopecia Tool (SALT) score and digital photographs which were taken at four points (baseline, 4 weeks, 8 weeks, and 12 weeks). The safety of the equipment was evaluated by the objective recording of adverse reactions and patient satisfaction. Follow-up continued for 6 months after treatment to assess the level of recurrence.

Statistical Analysis Used:

SPSS software version 23.

Results:

There was a statistically significant decrease in the SALT score from the baseline (range 11–30; mean 20.33 ± standard deviation [SD] 4.78) to 12 weeks (range 2–24; mean 9.11 ± SD 5.41) ($P < 0.001$). The overall response rate was 100%, and successful (>50%) regrowth of hair was seen in 55.5% of patients ($n = 10$). Younger patients responded to the treatment more than the older age group ($P < 0.05$). No significant side effects were recorded.

Conclusions:

The results suggest that 308-nm excimer light has a significant effect on resistant cases of multiple AA, with considerable safety and tolerability.

Key words: 308-nm excimer lamp, alopecia areata, efficacy, safety, Severity of Alopecia Tool score

INTRODUCTION

Alopecia areata (AA) is a chronic, nonscarring, autoimmune disease, presenting with localized or diffuse hair fall in hair-bearing areas. Approximately 1.7% of the population experience an episode of AA during their lifetime. Both sexes are equally affected, and most new cases are recorded below the age of 30 years.[1] Several environmental factors have been suggested as triggering AA, including infection, drugs, trauma, and stress. Thyroid autoimmune disease, atopy, and vitiligo are commonly associated. Diverse physical or psychological insults may trigger the episodes of AA, but there is no evidence that they influence prognosis.[2]

In AA, autoreactive CD8+ lymphocytes attack the hair in the anagen phase, leading to a rapid transition to catagen and telogen, resulting in hair loss.[3] This pathogenesis is driven by Janus kinase/signal transducer and activator of transcription-dependent cytokines, including interferon-gamma and interleukin (IL)-15.[4]

AA is clinically manifested by circumscribed, smooth patches of hair loss on the scalp, beard, and body. It can later progress to a total loss of scalp hair (alopecia totalis) or complete loss of body hair (alopecia universalis).[5] Alopecia sisaipho, which describes the loss of hair in frontal,

temporal, and parietal areas, can mimic androgenic alopecia. Alopecia ophiasis indicates hair loss in the parietal and occipital regions and can carry a poor prognosis.[6]

Diagnosis of AA is based on clinical grounds and confirmed by skin biopsy. The histopathological features depend on the stage of the current episodes of the disease. In the early stage, bulbar lymphocytes surrounding terminal hairs are found. In late stages, miniaturized hairs with a high percentage of telogen hairs are present.[7] The natural outcome of AA is unpredictable; however, spontaneous regrowth of hair may occur within 1 year.

Various therapeutic approaches including topical immunotherapy such as diphenylcyclopropenone or squaric acid dibutyl ester and systemic treatment such as corticosteroids, psoralen plus ultraviolet (UV) A, or immunosuppressive drugs are recommended for the treatment of AA, but none are curative or preventive.[8,9,10]

Excimer laser using high-dose monochromatic UV radiation can trigger apoptosis and induce immunological suppression through altering cytokine production such as IL-4, IL-10, prostaglandin E2, platelet-activating factor, and cis-urocanic acid. Benefits have only been seen with localized patches of AA, and regrowth of hair occurs only in treated areas.[6] The novel 308-nm excimer lamp is less expensive than excimer laser, and because it has a larger spot size, it can deliver a high dose of UV radiation to the selected treatment area. Both the monochromatic 308-nm excimer lamp and laser have a similar effect, but they differ in their technology.

The present study was aimed to evaluate the efficacy and safety of 308-nm excimer lamp in the treatment of resistant AA in Iraqi patients.

SUBJECTS AND METHODS

Patients

Eighteen patients with multiple AA were enrolled in this prospective open-label interventional study. Participants were enrolled from the outpatient clinic of dermatology department, from July 2018 to March 2019. This study was approved by the local medical ethics committee and adhered to the principles of Declaration of Helsinki. The patients were informed about the expected outcome, duration, and adverse reactions to the procedure. Informed consent was obtained from the patients to participate in the study and be photographed.

Patient inclusion criteria were:

- Having multiple forms of AA
- Duration of alopecia >1 year
- No topical or systemic treatment for the last 4 months
- Agreement to regular visits for treatment and follow-up.

Exclusion criteria were:

- A single form of AA
- Alopecia for <1 year
- Being on other modalities of treatment
- Treatment within the last 4 months
- Photosensitive disorders
- Pregnancy or breastfeeding.

All patients had a history including age; sex; duration of the current AA lesion; types of treatment received; and family history of atopy, thyroid disease, and autoimmune diseases. Diagnosis of AA was made on a clinical basis. The severity of AA was assessed using the Severity of Alopecia Tool (SALT) score grading system, as shown in Figure 1. The baseline SALT score in all patients ranged from 11 to 30 (mean 20.33 ± SD 4.78). Laboratory analysis for all patients revealed negative results for antinuclear antibody tests, thyroid function tests, and syphilis serology.

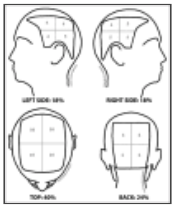

Figure 1
Severity of Alopecia Tool score aid to determine the surface area of alopecia areata. Reproduced from http://dx.doi.org/10.1016/j.jaad. 2016.08.042

Treatment source

The 308-nm excimer lamp (ExciplexXeCL; CLARTEIS, France), a Class II b, spot size 25 cm^2 5 × 5 lamp, with a power density of 100 mJ/cm^2, and maximum fluence 3000 mJ/cm^2, was used as the light source in this study.

Treatment protocol

The treated patches of AA were irradiated twice weekly. The initial dose was 150 mJ/cm^2 for skin type III and 200 mJ/cm^2 for skin type IV, with a 50 mJ/cm^2 increment at every subsequent visit, until fine or asymptomatic erythema became visible. When erythema persisted for <48 h, the treatment remained fixed, and if erythema persisted longer than 48 h, the dose was reduced by 50 mJ. When erythema became painful or associated with edema, the next treatment was postponed. The treatment continued for 24 sessions, and the maximum dose reached was 1450 mJ/cm^2. If no response was noticed after eight sessions, treatment was stopped.

Severity of Alopecia Tool score

The scalp is divided into four parts on the basis of surface area as follows: vertex or top = 40% (0.40), right side = 18% (0.18), left side = 18% (0.18), and the posterior aspect = 24% (0.24) [Figure 1]. Percentage of hair loss in any of the four areas was multiplied by the percentage of the scalp covered in that area. The SALT score is the sum of the percentage of hair loss in all the areas mentioned above.[11] For example, if the percentage hair loss in the vertex, right side, left side, and posterior aspect is 30%, 20%, 40%, and 50%, respectively, then SALT score = (30 × 0.4) + (20 × 0.18) + (40 × 0.18) + (50 × 0.24) = 12 + 3.6 + 7.2 + 12 = 34.8.

Evaluation protocol

Each patient was evaluated at four points (baseline, 4 weeks, 8 weeks, and 12 weeks). The SALT score was recorded from the baseline to the last visit, and digital photographs were taken at the same points using Samsung Galaxy® S7 edge mobile camera by Samsung manufactured in Vietnam with 12 Megapixels, to evaluate the response to the treatment.

Hair regrowth was assessed based on the change in the SALT score.

Absolute change in SALT score = SALT score at baseline − SALT score at 12 weeks.

Percent scalp hair regrowth based on SALT score = (100 × [baseline SALT score − SALT score at 12 weeks])/baseline SALT score.

Assessment of percentage hair regrowth was graded into the following six grades:

- A0 = No change or further loss of hair (poor response)
- A1 = 1%–24% regrowth (mild)
- A2 = 25%–49% regrowth (moderate)
- A3 = 50%–74% regrowth (good)
- A4 = 75%–99% regrowth (very good)
- A5 = 100% regrowth (excellent).

In the current study, regrowth of hair in more than 50% of the lesional area (SALT >50% or A3, A4, A5) was labeled as a successful response, whereas regrowth under 50% (SALT <50% or A1, A2) was labeled as an unsatisfactory response. A poor response was assessed when SALT equaled 0. The overall response is the percentage of positive response in all the treated patients.

The adverse reactions were recorded at every visit to evaluate the safety of the treatment.

Statistical analysis

Data were analyzed using SPSS software version 23, by IBM, Chicago, USA, where data were expressed as mean and standard deviation (SD) or number and percentage. Paired *t*-test was used to study the changes in SALT score before and 12 weeks after treatment. Spearman's correlation was used to determine the association between changes in SALT score and age. Independent samples *t*-test was used to compare differences in SALT score between male and female patients. $P < 0.05$ was considered statistically significant.

RESULTS

Out of 18 patients, there were ten males and eight females, aged between 16 and 40 years (mean 21.6 ± SD 2.01). The total number of AA patches in all patients was 64 (35 in males, 29 in females). The duration of the disease ranged from 1 to 4 years, with a median of 1.5 years [Table 1].

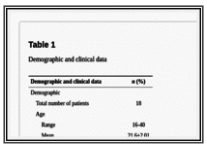

Table 1

Demographic and clinical data

The sizes of the patches ranged from 1 to 5 cm in diameter, and their average number ranged from 2 to 8 in each patient, with a mean of 4. Some lesions were joined together to form a sizeable conjoined patch. Ophiasis was present in two patients.

The geographical distribution of the patches on the scalp included 29 on the vertex, 18 on the posterior aspect, ten on the right profile, and seven on the left profile [Table 2].

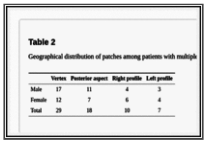

Table 2

Geographical distribution of patches among patients with multiple alopecia areata

The maximum dose that achieved clinical response reached 1450 mJ, and the lowest dose was 900 mJ. At the baseline point, the severity of hair fall based on the SALT score grading system ranged from 11% to 30% of scalp surface area, compared with 2%–24% at the end of the study ($P < 0.001$) [Table 3 and Figure 2].

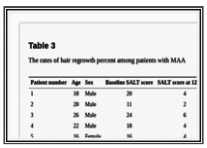

Table 3

The rates of hair regrowth percent among patients with MAA

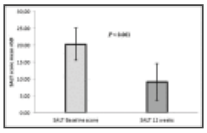

Figure 2

The Severity of Alopecia Tool score at two points: baseline and 12 weeks after treatment

Nearly 33.33% of patients ($n = 6$) showed an A4 (75%–99%) grade of growth, 27.77% of patients (n=5) showed an A3 (50-74%) regrowth, 33.33% (n= 6) of patients showed an A2 (25-49%) regrowth, and one patient was recorded with grade A1 (1–24%) regrowth of hair. None were classified under Grade A5 or A0.

Among patients with Grade A4 regrowth, four were males and two were females. Among those with Grade A3, two were males and three were females. In patients with Grade A2, four were males and two were females. One female patient was recorded as Grade A1 [Table 4].

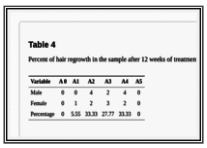

Table 4

Percent of hair regrowth in the sample after 12 weeks of treatment

Younger patients responded to the treatment more than older age groups ($P < 0.05$) [Figures 3-5], while gender had no statistically significant effect on response to treatment ($P = 785$) [Table 5].

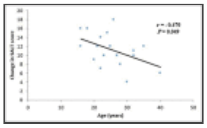

Figure 3

Changes in the Severity of Alopecia Tool score (mean ± standard deviation) concerning the age of the patients

Figure 5
The progression of hair growth in a 24-year-old female, from baseline (a) to 4 weeks (b), 8 weeks, (c) and 12 weeks (d)

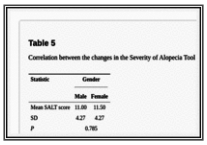

Table 5
Correlation between the changes in the Severity of Alopecia Tool score and patient gender

Patients responded to the treatment with varying degrees of improvement. The results showed that the overall response rate was 100%, and a successful (>50%) regrowth of hair was seen in 55.5% (10) of the patients [Table 6].

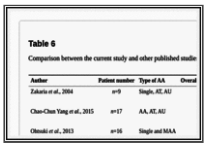

Table 6
Comparison between the current study and other published studies

All the patches that showed an adequate response (A3 and A4) were located on the vertex and posterior aspect of the scalp. In most of the patches on the parietal regions of the scalp, the regrowth of hairs did not exceed 50% [Figures 4-7].

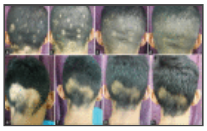

Figure 4
Progressive changes in the Severity of Alopecia Tool score in two young male patients. (a and e) At baseline point, (b and f) at 4 weeks, (c and g) at 8 weeks, and (d and h) at 12 weeks of treatment

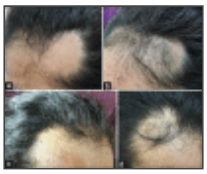

Figure 7
(a and c) Bilateral ophiasis in a 16-year old female, (b and d) the same patient after 12 weeks of treatment with excimer lamp

Figure 6
(a) Resistant alopecia areata in a 40-year-old female. (b-d) Regrowth of hair after 4, 8, and 12 weeks of 308-nm excimer lamp sessions

There was no difference in response to the treatment based on the duration of alopecia unless there are associated comorbidities, such as atopy, thyroid disease, and autoimmune disorders. A partial regrowth of hair <50% was recorded in patients with ophiasis [Figure 7]. No recurrences were recorded after 6 months of follow-up.

The main side effects noticed with this modality were painful redness in three patients (16.6%), temporary postinflammatory hyperpigmentation in five patients, and fine desquamation in five patients. For painful redness, treatment was temporarily stopped for 1 week and resumed with a reduction of the dose by 50 mJ/cm^2.

DISCUSSION

The excimer laser was first used in 1997 when Bónis *et al*. tested a novel application.[12] They reported that psoriatic plaques could be cleared in eight to ten laser sessions, instead of thirty sessions of treatment of narrowband (NB) UVB phototherapy. The study suggested that excimer lasers might allow targeted, rapid phototherapy superior to the conventional UV phototherapy with incoherent light. Other dermatological applications of excimer 308 include vitiligo, atopic eczema, and mycoses fungoides.[13,14,15] A few number of studies have investigated the effect of excimer on AA.[16,17,18] The current study had an overall response rate of 100% and a success rate of 55.5%, which were higher than that recorded in other researches [Table 6]. The difference in the results between the previous studies and the present one may be due to variation

in the selected samples, inclusion criteria and treatment protocols. In the current study, the patches of AA were irradiated twice weekly to achieve a significant change in the SALT score within a short course of treatment, in contrast to a study by Ohtsuki *et al*.[18]

Excimer lamp is a targeted phototherapy that delivers a specific wavelength of 308 nm of UVB radiation to localized areas of skin lesions. Compared with NB UVB, targeted phototherapy has many advantages, including that the healthy skin surrounding the affected areas is not exposed to the radiation because templates are used according to the size and shape of the treated area. Furthermore, it can deliver a high dose of radiation with a reduced cumulative dose, so it is less risky than NB. The duration of treatment is shorter, and a complete response may take 24 sessions. The spot size of the Exciplex lamp (25 cm^2, 5 × 5) is broader than that of other excimer devices, which helps in the rapid treatment of large areas of alopecia in a short time.

The side effects of targeted radiation include painful erythema, temporary postinflammatory hyperpigmentation, and blistering. These are limited to the treated areas and do not involve healthy skin, unlike NB UVB. The painful redness observed with increasing doses in this study improved as soon as the sessions stopped, proving that this type of therapy is almost without side effects. In general, the procedure is considered safe and tolerable, and patients can resume their daily activities soon afterward with no downtime required.

The natural outcome of AA is unpredictable. Around 34%–50% of patients spontaneously recover within 1 year, and 15%–25% will progress to loss of hair from the entire scalp and body.[19] For this reason, the current study included only patients who had persistent alopecia of more than 1 year to ensure that any improvement, if it occurs, will be due to the treatment and not spontaneous.

Factors such as thyroid disease, atopy, and autoimmune disorders may predict the outcome of treatment. The two patients with ophiasis in this study were found to have a history of atopy. The regrowth of hairs on the vertex and posterior aspect of the scalp was more noticeable than on the parietal areas. This anatomical variation in the response is likely because of a difference in immunological reactants from one area to another. In the current study, up to 90% of patients with a successful regrowth rate were below the age of 25 years, meaning that treatment response is inversely proportional to patient age. Furthermore, the rate of hair regrowth was higher in those with an AA of short duration and no associated comorbidities, such as atopy, thyroid disease, and autoimmune disorders.

Limitations

1. The sample was small, making it difficult to generalize the results to the whole population
2. There was no opportunity to select different age groups to determine the outcome of this treatment in children and older people.

CONCLUSIONS

308-nm excimer light is an effective modality for the treatment of AA with considerable safety and tolerability. Extensive studies are needed to establish a therapeutic protocol of this option to manage AA.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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