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· Clinical Experience ·

Clinical efficacy of 308nm monochromatic excimer light for the treatment of alopecia areata in children and teenagers

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Abstract: **Objective:** To investigate the clinical efficacy and safety of 308nm monochromatic excimer light for the treatment of alopecia areata in children and teenagers. **Methods:** A total of 26 children and teenagers (age ⩽ 19 years) with 49 recalcitrant patches alopecia areata were enrolled in a self-control clinical trail. Lesion was treated twice a week by the 308nm monochromatic excimer light for 15 treatments. Every patient selected one untreated alopecia areata patch that was used as a control site. **Results:** While no improvement of all the untreated alopecia areata patches were observed, the clinical efficacy of treated patients was as follow: effective group 30 cases, and total effective rate of improvement was 61.22%. **Conclusion:** The 308nm monochromatic excimer light is safe and effective for treatment of alopecia areata in children and teenagers.

Key words: 308nm monochromatic excimer light; alopecia areata; clinical efficacy

Alopecia areata is a common disease, which is characterized by asymptomatic localized patchy alopecia, with scalp as the main part involved, and occasional alopecia may involve the whole scalp (total alopecia) or the whole body (general alopecia). In recent years, the number of children and adolescents with alopecia areata has gradually increased, and the research on its treatment methods is attracting increasing attention [1]. Among them, the conventional treatment of intractable focal alopecia areata is not effective, and 308nm excimer laser is recommended as an auxiliary method for the treatment of intractable focal cases in children [2]. In order to understand the efficacy of 308nm excimer light in the treatment of alopecia areata in children and adolescents, 49 skin lesions of 26 intractable focal alopecia areata patients in our hospital from January 2014 to January 2016 were treated with 308nm excimer light and achieved good results. The report is as follows.

1 Materials and Methods

1.1 General information from January 2014 to January 2016, 26 children and adolescents with intractable focal alopecia areata were treated with 308nm excimer light in 49 areas of complete alopecia, and each patient left a complete alopecia spot with a diameter of more than 1 cm without irradiation treatment as its own blank control.

Among them, there were 15 males and 11 females with an average age of 10.6 years, ranging from 6 to 18 years old. The course of disease exceeded 6 months, with an average of 0.67 years. Every patient had no improvement or ineffectiveness in other treatments or repeated alopecia could not be consolidated. 21 cases had been treated with hormone ointment or other drugs, 14 cases had been treated with oral drugs (including compound glycyrrhizic acid, vitamins, traditional Chinese medicine, etc.), and 2 cases had been treated with hormone injection into local skin

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lesions. Patients should stop all other local and systemic treatments for at least 6 weeks. Excluding autoimmune diseases, genetic factors and mental factors, no history of trauma, no recent history of infection, no use of photosensitive drugs, no history of photosensitivity, no light-aggravated diseases and children under 5 years old. Informed consent of all children and their families has been obtained.

1.2 The treatment method was Eximal, 308nm excimer light system by GSD. Before starting treatment, the minimal erythema dose (MED) was determined and the skin of forearm was selected.

The initial dose is 50mj/cm^2, which is less than MED. Each lesion is treated twice a week, and the dose is increased by 50mj/cm^2 every two times (the maximum number is less than 24 times) [3], and 15times is a course of treatment. At the same time, observe and record the possible erythema after treatment, and the erythema lasts for 24 ~ 48h, and maintain the original plan for the next treatment; Erythema lasts for 48 ~ 60h, and the treatment energy needs to be reduced by 25 ~ 50mj/cm^2. If erythema lasts for 60 ~ 72h or blisters, itching, burning pain and other symptoms appear, the treatment should be postponed until erythema, blisters or symptoms basically subside and decrease by 100mj/cm^2 in the next treatment. Attention should be paid to special protection of children's eyes during each treatment. After treatment, family members of children should pay attention to local nursing and avoid scratching.

1.3 MacDonald Hull and Norris scoring system [4] was selected for hair growth evaluation of curative effect and adverse reactions, i.e. I-grade is hair growth, I-grade is scattered hair growth, I-grade is hair growth, but there is still flaky alopecia, and IV-grade is full hair growth. Hair growth score I or IV was regarded as effective group. Total effective rate = effective group/(effective group + ineffective group). The new growth and peripheral hair were observed and recorded 3d after 5 treatments and 3d after 15 treatments. The occurrence of adverse reactions was reported by parents, and skin adverse reactions including erythema, stinging and itching were recorded during each follow-up.

1.4 Statistical analysis was carried out by SPSS17.0 software. All data were tested by nonparametric test, Kruskal Wallis test was used to compare the difference of curative effect between different treatment times, and rank sum test of two independent samples was used to compare the difference of curative effect between 5 and 10times, 10 and 15times, and the difference of curative effect between 6 ~ 9months and 9 ~ 12months, 9 ~ 12months and > 12months. $P < 0.05$ is statistically significant.

2 Results

2.1 Observation of curative effect: 49 skin lesions in all children have been treated for 15 times, including 6 cases with grade IV (12.24%), 24 cases with grade III (48.98%), 14 cases with grade I (28.57%) and 5 cases with grade I (10.20%), with a total effective rate of 61.22%. No hair growth was found in the non-illuminated parts. The results of skin lesions in the treatment group are shown in Table 1. Kruskal Wallis test was used to compare the difference of curative effect among different treatment times. The results showed that x2=25.802, $P < 0.001$, and the difference of curative effect among the three groups was statistically significant.

The rank sum test of two independent samples was used to compare the curative effects of 5times and 10times, 10times and 15times respectively. The results showed that 6 patients were effective after 5times of treatment, and the total effective rate was 12.24%; Among the patients treated 10times, 19 were effective, and the total effective rate was 38.78%. Among the patients treated

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15times, 30 were effective, and the total effective rate was 61.22%. There is a significant difference in the effective rate among the three groups with different treatment times (x2=25.158, p < 0.001). The difference in effective rate between 5 and 10times, 10 and 15times, respectively, shows that there is a significant difference in effective rate between 5 and 10times (x2=9.075, P=0.003); It shows that the total effective rate is related to the times of treatment, that is, the more times of treatment, the higher the total effective rate and the better the therapeutic effect.

Table 1 Observation on the frequency and curative effect of 308nm excimer light therapy [n (%)]

Number of treatments	Class IV	Class I	Class I	Class I
5 times	0 (0.00)	6 (12.24)	25 (51.02)	18 (36.73)
10 times	2 (4.08)	17 (34.69)	19 (38.77)	11 (22.45)
15 times	6 (12.24)	24 (48.98)	14 (28.57)	5 (10.20)

2.2 Analysis of influencing factors Kruskal Wallis test was used to compare the difference of curative effect among patients with different courses of disease. The result showed that x2=9.578, P=0.008, and the difference of curative effect among three groups was statistically significant. Rank sum test of two independent samples was used to compare the curative effect differences between 6-9months and 9-12months, 9-12months and > 12months respectively. The results showed that the curative effect differences between 6-9months and 9-12months were statistically significant (Z=-2.067, P=0.038), there was no significant difference in curative effect between 9-12months and > 12months (Z=-1.723, P= 0.085). The curative effects of grade III and IV were regarded as effective. The results showed that 20 patients with a course of 6 ~ 9 months were effective, and the total effective rate was 83.33%. Among the patients with a course of 9 ~ 12months, 10 were effective, and the total effective rate was 47.62%. The effective rate was 0 in patients with course of disease > 12months, and the total effective rate was 0.00%. Comparing the difference of effective rate between 6 ~ 9months and 9 ~ 12 months, the results showed that the difference of total effective rate between 6 ~ 9months and 9 ~ 12months was statistically significant (x2=6.429, P=0.011), indicating that the shorter the course, the better the curative effect. See table 2.

Table 2 Observation of curative effect and course of disease with 308nm excimer light [n (%)]

Course of disease	Complete alopecia area	Class IV	Class I	Class I	Class I
6 ~ 9 months	24	4 (16.67)	16 (66.67)	2 (8.33)	2 (8.33)
9 ~ 12 months	21	2 (9.52)	8 (38.10)	9 (42.85)	2 (9.52)
> 12 months	4	0 (0.00)	0 (0.00)	3 (75.00)	1 (25.00)

2.3 Adverse reactions Most patients had a slight burning sensation in local skin during the treatment, 7 cases had mild erythema after treatment, and the erythema basically subsided after 24~48h, 5 cases had mild skin itching, which was relieved by themselves without special treatment, and no adverse reactions such as blisters and pigmentation, folliculitis, skin infection, wart, herpes simplex and herpes zoster occurred. None of them stopped treatment due to adverse reactions.

3 Discussion

The etiology of alopecia areata is unknown. Current research shows that alopecia areata is an autoimmune-related disease which is mainly mediated by T cells involved by environmental and genetic factors [5-6]. Alopecia areata can cause psychological stress, shyness and anxiety, which affects the mental health of children and also brings psychological and social pressure to parents. Safety is the main treatment for alopecia areata in children and adolescents, and systemic toxic drugs are not suitable [7]. At present, glucocorticoid, minoxidil, sensitizer, dithranol, tacrolimus and pimecrolimus, onion

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juice extract, local UVA treatment and 308nm xenon chloride excimer laser can be used locally in children and adolescents with alopecia areata [8].

Studies have shown that the 308nm excimer laser treatment of alopecia areata is more convenient and safe, and has better compliance than traditional drug therapy [9]. Common drugs for external use need to be absorbed slowly through the skin before they can take effect, while 308nm excimer laser is a kind of ultraviolet light source, which belongs to pulsed gas laser. It has similar action mechanism to local immunosuppressants, strong penetrating power, can quickly act on skin lesions, and is more likely to induce T cell apoptosis in vitro to play a therapeutic role [10]. Compared with traditional UVA, 308nm excimer laser is more likely to cause apoptosis of T cells infiltrated by skin lesions, and can inhibit the production of cytokines, such as IFN-γ, TNF-α and IL-8, and inhibit the function of antigen presenting cells [11]. Laser only acts on skin lesions with better selectivity and less adverse reactions. 308nm excimer laser can be used as a safe treatment for alopecia areata in children and adolescents [3, 12]. Al-mutairi et al. [3] used 308nm excimer laser to treat head skin lesions with an effective rate of 81%. The common short-term adverse reactions of this method are erythema and pigmentation, and the long-term adverse reactions are photoaging, which is of high safety. At present, 308nm excimer laser is recommended to treat intractable focal cases in children [2]. The main mechanism of 308nm excimer light and 308nm excimer laser in the treatment of inflammatory dermatosis is the apoptosis of infiltrating T lymphocytes, and the possible mechanisms affecting T lymphocytes include damaging Langerhans cell function and changing the production of cytokines and the expression of keratinocyte adhesion molecules. It has also been reported that 308nm excimer light is feasible to treat alopecia areata [13]. Compared with 308nm excimer laser, 308nm excimer laser has stronger wavelength uniformity, but because of the limitation of light source, it is inconvenient to treat in large area, and the maximum spot area of 308nm excimer laser can reach 264cm^2; Moreover, the 308nm excimer laser needs to replace the chlorine tank, and the cost of consumables is high. These advantages make the 308nm excimer laser have more potential in practical application [14].

In this study, 26 children and adolescents with intractable focal alopecia areata were irradiated with 308nm excimer light. After the treatment, the hair growth scores were grade I (24) and grade IV (6), which basically met the beauty needs and reached the standard of clinical cure. The total effective rate reached 61.22%. With the increase of treatment times, the total effective rate increased, that is, the more treatment times, the higher the total effective rate and the better the therapeutic effect.

To sum up, children and adolescents are still in the stage of physical and mental development, and the appropriate treatment should be selected according to their illness and individual differences. As a new means of treating various chronic skin diseases, 308nm excimer light has the characteristics of high compliance and high efficiency in treating alopecia areata in children and adolescents. We can refer to the treatment scheme recommended by foreign countries [15], 308nm excimer light treatment for children and adolescents with intractable focal alopecia areata, but its mechanism and long-term adverse reactions need further study.

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