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ORIGINAL ARTICLE

Treatment of atopic dermatitis with the xenon chloride excimer laser

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Abstract

Background Narrow-band ultraviolet B phototherapy is an effictive and safe treatment for atopic dermatitis. We have previously found that the 308 nm xenon chloride excimer laser was more effective than the narrow-band ultraviolet B light for the treatment of psoriasis, suggesting that ultraviolet B laser might offer advantages over narrow-band ultraviolet B.

Objective The purpose of this study was to evaluate the therapeutic efficacy of the 308 nm excimer laser in atopic dermatitis.

Patients and methods Fifteen patients with atopic dermatitis (less than 20% body area involvement) were treated with a xenon chloride excimer laser (XTRAC laser, Photomedex Inc.) twice weekly. The severity of the atopic dermatitis was assessed via (i) a clinical score characterizing the intensity of erythema, infiltration, lichenification and excoriation; (ii) the quality of life, determined by means of a questionnaire; and (iii) a visual linear analogue scale, with which the patients scored the severity of their pruritus.

Results After 1 month of laser therapy, the clinical scores were significantly lower than the initial values. Similar decreases were observed for the quality of life and pruritus scores. No serious or unpleasant side-effects were observed.

Conclusion These results suggest that the xenon chloride excimer laser is an effective and well-tolerated treatment for localized atopic dermatitis.

Introduction

Phototherapy and photochemotherapy are well-established and widely used treatment modalities for patients with atopic dermatitis (AD).[1] In patients with acute exacerbation of AD, irradiation with high-dose ultraviolet (UV) A1 radiation has been reported to produce a rapid improvement of the skin condition.[2] Narrow-band (NB) UVB therapy is effective against moderate to severe atopic eczema, and is well tolerated by most patients.[3] The main disadvantage of such phototherapy is that the whole body surface is exposed to UV radiation, and not merely the affected areas.

We recently found that the 308 nm xenon chloride (XeCl) excimer laser is more effective than NB-UVB light (311–313 nm) for the treatment of psoriasis, suggesting that the UVB laser might offer advantages over NB-UVB.[4,5] Setting out from the data that indicate NB-UVB phototherapy to be an efficacious and safe treatment modality for AD, we embarked on a study of targeted phototherapy using a 308 nm XeCl laser to treat focal areas of AD. In the present study, our aim was to evaluate the effectiveness and safety of 308 nm XeCl laser phototherapy in flexural AD.

Patients

Fifteen patients with AD entered the study after receiving full information on the procedure and purpose of the trial. The mean age was 17.3 years (range from 13 to 24); there were 9 females and 6 males. The patients satisfied the diagnostic criteria of Hanifin and Rajka. They had lesions

exclusively on the flexor surfaces of the upper and/or lower extremities. Less than 20% of the body surface was affected. A wash-out period of 2 weeks after topical corticosteroid treatment and 4 weeks after systemic treatment was required before starting phototherapy.

Methods

Phototesting and laser treatment were carried out with the XTRAC laser (Photomedex Inc.) instrument. This is a 308 nm excimer laser based on a self-contained gas system of XeCl. The output is initiated by a foot switch and consists of a train of short pulses, delivered through a fibre-optic hand piece, with pulse repetition of up to 200 Hz. The energy of each light impulse is 3 mJ, with a pulse width of 30 ns, the beam diameter is 2 cm. The laser allows fixed fluences to be delivered, starting from 100 mJ/cm^2 with 50 mJ/cm^2 increments up to a maximum dose of 2100 mJ/cm^2.

Prior to treatment, all patients were phototested in order to determine the minimal erythema dose (MED) of the excimer laser, by exposing the buttock to a geometrical dose range between 100 and 350 mJ/cm^2. For topical emollient Repair® (Yamanouchi) was used 1 week before starting the phototherapy and throughout the study. The initial irradiation dose was 50 mJ/cm^2 less than the MED. The dose was increased by 50 mJ/cm^2 each week. The laser pulses were not overlapped, and just right up to the margin of the affected areas were treated.

The patients were treated twice weekly, never on consecutive days. The total treatment period was 4 weeks, for a maximum of eight treatment session, but fewer if the lesions cleared. During the study, no additional topical or systemic treatments were allowed, with the exception of the Repair emollient. The eyes were protected with UV-blocking goggles.

We used the local eczema area severity index (EASI) to determine the severity of the AD. The local EASI score is the sum of the scores of four clinical symptoms (erythema, infiltration, lichenification and excoriation), these being graded from 0 to 3 (0, absent; 1, mild; 2, moderate; 3, severe). The patients rated the intensity of itching during the 24-h period, using a 10-cm visual analogue scale, with 0 cm indicating 'no itching' and 10 cm indicating 'worst itching imaginable'. The aim of the quality of life questionnaire (10 questions) was to measure how much the skin problem had affected the patients (0, not at all; 1, mildly; 2, moderately; 3, very much) during the past week. Photographs were taken 1 week before the commencement of laser therapy and at the completion of the therapy. The severity of the AD was scored after the 1-week wash-out period at the baseline visit, and then once weekly during the laser treatment. Statistical analysis were performed with Friedman's nonparametric repeated measures ANOVA, followed by the Student–Newman–Keuls multiple comparison procedure. A probability of $P < 0.05$ was considered to be statistically significant.

Results

Of the 15 patients enrolled in the study, one was lost to follow-up because of noncompliance. Fourteen patients completed the study. Depending on the skin type and the MED, the initial doses in the individual patients ranged from 150 to 450 mJ/cm^2. The mean cumulative dose of UVB was 1.66 J/cm^2. Figure 1 shows the reduction in the intensity of erythema (fig. 1a), infiltration (fig. 1b), excoriation (fig. 1c) and lichenification (fig. 1d), with a mean reduction of 58%. At the completion of laser therapy, each score was significantly lower than the initial value. The local EASI scores are presented in fig. 1e. Before the laser treatment, the EASI scores ranged between 3 and 14 (mean 8.5). At the end of the treatment period, the EASI scores were between 0 and 15 (mean 3.57), and significantly lower as compared with the initial values. Figure 1f depicts the quality of life (QL) data. Before the laser treatment the QL scores ranged between 4 and 11 (mean 6.57), whereas at the end of the treatment period they were between 0 and 6 (mean 1.71), and significantly lower than the baseline values. Figure 1g demonstrates an 81% reduction in the itching score after 1 month of phototherapy, from 2 to 8 (mean 5.57) to 0–4 (mean 1.02). The score values of erythema, infiltration, excoriation and itching significantly decreased after 1 week of treatment while the intensity of lichenification reduced after 2 weeks. EASI scores significantly decreased upon treatment showing the most dramatic decrease in the first 2 weeks. No serious or unpleasant side-effects were observed. There was no exacerbation at the 1-month follow-up, although relapse is possible as with other phototherapies.

Discussion

The management of AD entails different approaches, depending on the severity, extent and distribution of the skin lesions and other patient characteristics. The mainstays of topical therapy include the regular use of emollients, coupled with antimicrobials, corticosteroids and immune modulators. For severe disease, systemic medication such as cyclosporin A can be used for limited periods. Various forms of phototherapy are quite effective for the treatment of AD. Specific protocols, including UVA1 (340–400 nm) at various dosages, UVAB (290–400 nm), UVB (290–320 nm), NB-UVB (311–400 nm), PUVA (either oral or bath), balneophototherapy, climatotherapy and extracorporal photopheresis have all shown promise in the treatment of AD.[6–8]

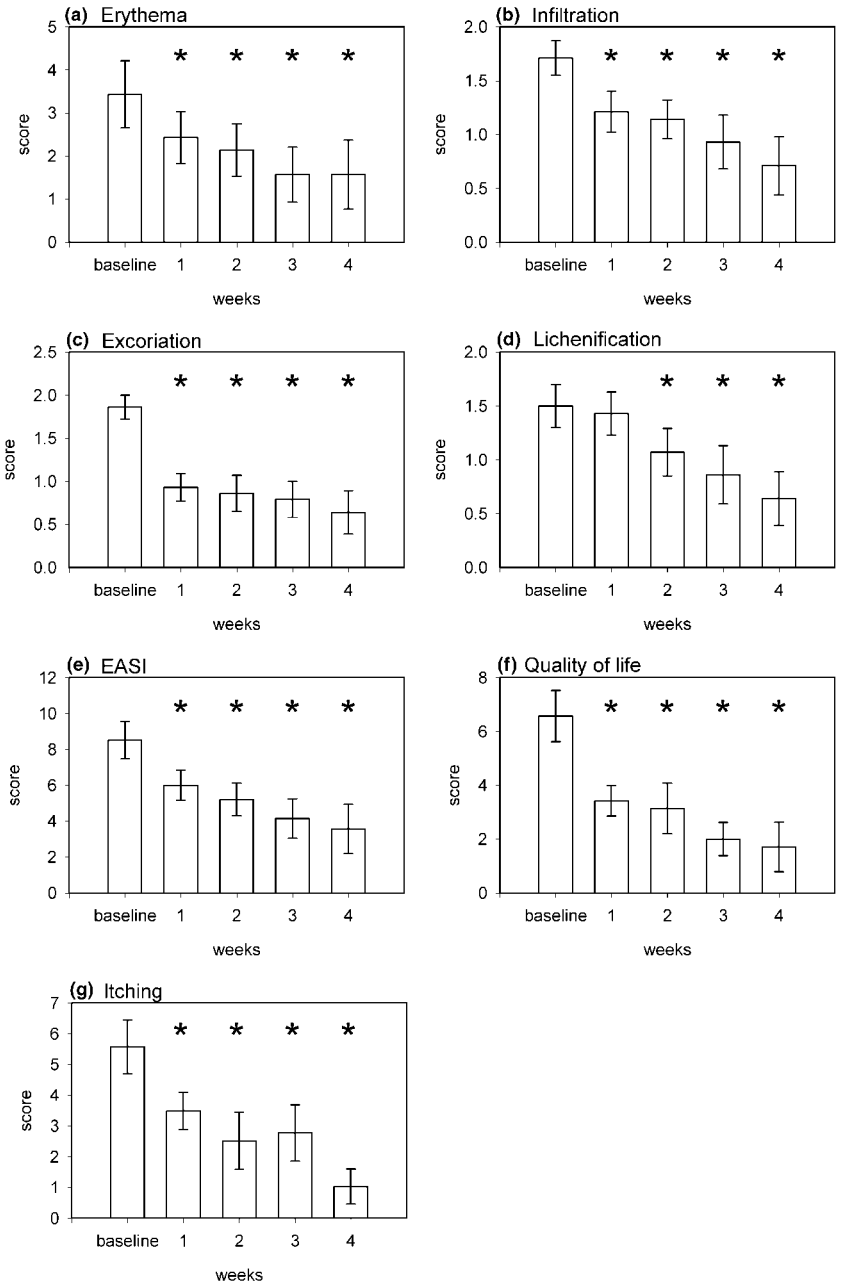

fig. 1 The scores of erythema (a), infiltration (b), excoriation (c), lichenification (d), EASI (e), quality of life (f), and itching (g) significantly decreased during the laser treatment. All values are expressed as means ± standard error. The asterisks indicate statistically significant differences ($P < 0.05$) in comparison with the baseline values.

The most frequently applied effective forms of phototherapy include NB-UVB and PUVA in patients with moderate to severe AD.[1] Although insufficient human data are available, it is supposed that long-term NB-UVB therapy may involve a lower risk of skin cancer than that of PUVA therapy.[9]

A new development in phototherapy was the introduction of the 308 nm XeCl laser.[4] Although the wavelengths of NB-UVB at 311 nm and the excimer laser are close to each other, we found the XeCl laser to be more effective than NB-UVB light in treating psoriasis and inducing T-cell apoptosis, suggesting that the UVB laser might offer advantages over NB-UVB.[4,5] We recently demonstrated that the laser is useful and well tolerated for the treatment of localized vitiligo.[10] In the present study, the XeCl UVB laser proved effective for the treatment of AD. Whereas the whole body is exposed to UV radiation in conventional phototherapy and photochemotherapy, the region of action of the 308 nm excimer laser can be restricted to the involved areas. Exposure of the uninvolved skin to UV radiation results in greater risks of short-term adverse effects such as burning or pruritus, and long-term effects

such as accelerated photoaging and photocarcinogenesis. The side-effects, and especially the carcinogenicity, of the different types of UV therapy increase with the cumulative UV dose to which a person is exposed throughout life. The mean cumulative dose required for the clearance of AD with the XeCl laser is lower than the dose required to achieve comparable clinical results with the NB-UVB therapy.[3] With our treatment modality, only the affected areas are treated by UVB light, so that the risks of carcinogenesis and other UVB side-effects occurring on the surrounding skin are much lower.

Our results suggest that the xenon chloride laser is effective and well-tolerated treatment for atopic dermatitis. Although long-term results are not yet available and the number of patients treated in this study is few, this innovative therapy seems to be a promising modality for atopic dermatitis. Further randomized clinical studies, including a higher number of patients, are necessary to show the efficacy of 308 nm XeCl laser in combination with conventional treatment modalities in atopic dermatitis and also the cost-effectiveness.

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