

Narrow-band ultraviolet B and Conventional UVB phototherapy in Psoriasis: a Randomised Controlled Trial

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Abstract: The narrow-band (NB-UVB) was developed for use in phototherapy, as an alternative to a broad-band UVB source and to photochemotherapy, both of which have significant side effects and carry a risk of carcinogenesis. NB-UVB is a new phototherapy option that has proved to be particularly effective at clearing psoriasis vulgaris, with a reduced capacity to produce erythema. This study was designed to explore the effects of NB-UVB on psoriasis vulgaris in comparison with the conventional UVB. 73 psoriasis patients were divided into treatment group (43 patients) and control group (30 patients). The treatment group was radiated with NB-UVB while the control group radiated with conventional UVB for 6 weeks, 3 times a week; in addition, 30 healthy volunteers were selected as healthy control group. Among the 43 patients of treatment group, 11 were clinically cured after radiated with NB-UVB, and the total effective rate was 83.7 %; while only 3 were clinically cured after radiated by conventional UVB among the 30 patients of control group, with a total effective rate of 37.8%.

Key words: Psoriasis, Psoriasis vulgaris; Narrow-band UV (NB-UVB)

INTRODUCTION

Psoriasis is a chronic inflammatory disease of the skin and joints that affects 2–3% of the world's population ^[1] with men and women being equally affected. Although psoriasis does not ordinarily affect the general health of a patient, physicians and other health-care practitioners consistently underestimate its social and economic impact, resulting in less-than-optimal care. Fortunately, an increased understanding of its pathogenesis and recent advances in treatment are improving the care of patients with psoriasis. The use of the various forms of phototherapy remains an essential treatment option for psoriasis vulgaris. NB-UVB is used in phototherapy in a number of dermatology departments ^[2] as an alternative to broad-band UVB (270-350 nm) or psoralen plus UVA (PUVA). Conventional UVB sources can lead to erythema and may carry a theoretical risk of carcinogenesis, although this has not been confirmed in retrospective studies ^[3]. PUVA can also cause side effects such as nausea and is contraindicated in pregnancy; it is a recognized

carcinogenic treatment, with up to fifty times the normal risk (uvirradiated individuals) of developing cutaneous squamous cell carcinoma ^[3-5]. Monochromator studies have shown that wavelengths of less than 290 nm are erythemogenic, but not therapeutic, for the treatment of psoriasis ^[6]. Ultraviolet B (UVB light) (290–320 nm) is a widely used therapeutic modality for it. Initially, broad-band (BB)-UVB light sources were applied which emit wavelengths throughout the whole spectrum of UVB light. An action spectrum study in patients with psoriasis established that at wave-lengths from 304 to 313 nm suberythemogenic exposure doses resulted in complete clearing, while wavelengths from 290 to 300 nm produced the sunburn reaction, but had no therapeutic benefit ^[7]. These findings led to the introduction of the narrow-band (NB)-UVB light source in the therapy. In a bilateral comparative study, NB-UVB light proved superior to BB-UVB for the treatment of psoriasis ^[8]. In addition, narrow-band 311 nm UV phototherapy is particularly effective at clearing psoriasis, with a reduced capacity to produce

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erythema^[9]. Furthermore, NB-UVB is significantly better than broad-band UVB irradiation at clearing psoriasis in a shorter period of time, with only a 10% incidence of burning, compared with 28% for conventionally treated patients^[10]. In domestic, narrow-band ultraviolet (NB-UVB) with wave length of 311-313 nm) has been used for treating psoriasis, but the relative reports are few. This study was designed to explore the therapeutic effect of NB-UVB on psoriasis patients, to further investigate the relative mechanism of NB-UVB treating psoriasis.

MATERIALS AND METHODS

Clinical materials: 73 outpatients with psoriasis vulgaris of our hospital from January of 2003 to January of 2006 were selected, whose skin lesions were typical and clinical diagnosis clear; among them, 39 were males and 34 females; age ranged from 16 to 61, with a mean of 37.1+8.3; course of disease ranged from 2 weeks to 21 years, with a mean of 7.5+4.3 years. All the selected patients were all initial-onset, or haven't accepted any phototherapy or photochemistry-therapy for 3 months before the treatment, or taken any oral or external drug for one month before the treatment; none was with serious heart, liver, or kidney diseases. They were randomly divided into NB-UVB radiation group (treatment group, 43 patients) and control group (30 patients). The compositions of age and sex of the 2 groups were mainly coincident, and the difference has no statistical significance ($P>0.05$).

Treating method: The patients of treatment group were treated with NB-UVB radiation in UV100L system (produced by Germany Waldmann Co., Ltd, with radiant intensity of 9.13 mW/cm² and wave length of 309~313nm). Based on the study result of Feng Ge et al.^[11], all the minimal erythema doses (MED) were set as 0.6 J/cm², and initial radiant dose as 50% MED (namely 0.3 J/cm²), which was then progressively increased by 10% once and maintained until light erythema appeared at the radiated site or withdrawn when painful erythema appeared; after the painful erythema was disappeared, the initial radiant dose was reset as 50% of the previous one, then progressively increased by 10% once and maintained until light erythema appeared. NB-UVB was radiated for 3 times a week, and 6 weeks was a course of treatment. The control group was treated with UVB radiation by SS-03AB ultraviolet phototherapy instrument (produced by Shanghai SIGMA High-tech Co., Ltd), with a radiant

intensity of 210uW/cm², radiant distance of 20cm, and initial radiant dose of 0.02J/cm²; the dose was properly increased according to the patients' responds (increased radiant dose per time ≤ 0.01 J/cm²) until the greatest dose no more than 0.06/0.01 J/cm²; UVB was radiated for 3 times a week, and 6 weeks was a course of treatment. The healthy control group didn't undergo any treatment during the observed period.

Therapeutic effect assessment criterion: Pre- and post-radiation skin lesion sites, range, size of erythema, scale, and skin infiltration etc. were recorded, and PASI of every site of the patients of every group was calculated to get the total score of PASI according to the score criterion of psoriasis area and severity index (PASI)^[12]

PASI change value was calculated by the current formula, namely PASI change value = [(pretreatment total score of PASI – post-treatment total score of PASI)/ pretreatment total score of PASI] $\times 100\%$, and it is cured when: skin lesion of the patients is disappeared, or PASI change value $\geq 90\%$, obviously effective when: PASI change value ranges from 60% to 89%, effective when: PASI change value ranges from 25% to 59%, ineffective when: PASI change value $< 25\%$. Effective rate = (cured cases + obviously effected cases)/ total cases $\times 100\%$.

Statistical analysis: Analyses were performed using Statistical Package for Social Sciences SPSS 11.5 software on an intention-to-treat basis. Quantitative variables were presented as means and standard deviations and categorical or dichotomous variables as absolute or relative frequency by class. Where global treatment effects were significant, two-by-two comparisons were performed at a significance level of 5%. Mean values of every group were compared by t-test, and when $P<0.05$, the difference is of statistical significance.

RESULTS

Comparison of clinical effects on patients of two groups: After the patients were treated for 6 weeks, the clinical effects on patients of treatment group and control group can be seen from Table 1 for detail. A total of 29 patients of control group completed the treatment (1 patients withdrew from the radiation because of his hypersensitivity to ultraviolet), and the greatest radiant dose of control group was 0.95-1.20 J/cm², mean accumulated dose (16.10 \pm 4.13)J/cm²

Table 1: Comparison of clinical effects on patients of treatment group and control group (people, %)

Groups	People	Cured	Obviously effective	Effective	Ineffective	Effective rate (%)
Treatment group	43	11(25.6)	25(58.1)	5(11.6)	2(4.7)	83.7
Control group	29	3(10.3)	8(27.6)	9(39.1)	9(39.1)	37.9*

Note: Compared with treatment group, *P<0.01.

and pre-treatment and post-treatment mean PASI scores respectively (11.2±3.6) and (2.9±1.3); the greatest radiant dose of treatment group was 1.3 J/ cm², mean accumulated dose (16.10±4.13)J/ cm²; pre-treatment and post-treatment mean PASI scores respectively (11.6±4.1) and (2.2±0.9). After radiated with NB-UVB, 11 patients of treatment group were clinically cured, and 2 re-suffered in one year of following-up and improved after retreated with NB-UVB radiation; After radiated with UVB, 3 patients of control group were clinically cured, and 1 re-suffered in one year of following-up and improved after retreated with UVB radiation

Comparison of adverse effects of every group: 17 patients of treatment group and 21 of control group experienced pruritus and asteatosis cutis etc. after the treatment, which were improved after external use of moisturizer; and 3 of treatment group and 7 of control group underwent light tan pigmentary cirrhosis at irradiated sites after irradiated for 9-18 times, which was spontaneously disappeared 3-4 months after the treatment

DISCUSSION

NB-UVB penetrates more deeply into the skin than broad-band UVB and is therefore highly effective for the treatment of psoriasis vulgaris. It is also less carcinogenic [13, 14] and has become popular as routine phototherapy in many countries around the world. Narrowband ultraviolet B (NB-UVB) irradiation is frequently the treatment of choice in mild to moderate cases of psoriasis vulgaris [15]. Its therapeutic effects involve several mechanisms, including the induction of anti-inflammatory and immunosuppressive cytokines [15-18]

Ultraviolet phototherapy is one of the primary methods for treating psoriasis, and wave length choosing is of important significance for the effect of phototherapy on psoriasis; UVB with wave length of 290-320nm (with the most active bioactivity among ultraviolet), can permeate skin until to dermal superficial and intercellular layers; while NB-UVB with stronger permeating power than conventional UVB and un-prone to burn the skin, can effectively induce the apoptosis of T cell within corium [19] and inhibit

Langerhans cell's antigen presentation and effect of activating T cell [20], can escape from DNA absorption peak (about 265nm) and consequently decrease carcinogenicity. Reported by Tzung et al [21], at the same radiation dose level, UVB may cause more serious DNA damage than NB-UVB; to achieve the same therapeutic effect, the radiant dose of NB-UVB is 10 times higher than UVB, but there is no significant difference of DNA damage caused by the two; in addition, erythema effect of NB-UVB is slighter than conventional UVB. It is reported that the wave length most prone to cause erythema effect is about 300 nm, and discovered by the experiment on healthy volunteers that Joule amount for NB-UVB to cause the smallest erythema is 4 times of UVB, which indicate NB-UVB is less prone to cause erythema effect [22]. Revealed by the study, the effective rate of NB-UVB radiation on psoriasis vulgaris is 83.7%, which is similar with the domestic and overseas reports [19-24], while the effective rate of UVB radiation on psoriasis vulgaris is only 37.9%, which indicates NB-UVB is with better therapeutic effect and fewer adverse effect than UVB, and NB-UVB radiation is one of the primary methods for treating psoriasis.

CONCLUSION

In conclusion, these findings demonstrated that NB-UVB is more efficacious than conventional UVB in improving psoriatic lesions, and the treatment is well tolerated by most patients. NB-UVB may be considered as a valuable therapeutic option in the treatment of psoriasis. However, long-term adverse effects and cost-benefit analysis of NB-UVB therapy compared to other treatment modalities remain to be determined.

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