

# Comparison of efficacy and safety of ultraviolet A radiation versus ultraviolet B radiation in atopic dermatitis

Sadia Qayyum, Faria Asad\*, Rajani Agrawal\*, Khawar Khurshid\*, Zahida Rani\*, Sabrina Suhail Pal\*

Department of Dermatology, Fatima Jinnah Medical University/ Sir Ganga Ram Hospital/ Government Teaching Hospital Shahdra, Lahore

\* Department of Dermatology, King Edward Medical University, Lahore

**Abstract** *Objective* To compare the efficacy and safety of ultraviolet A versus ultraviolet B in atopic dermatitis.

*Methods* In this randomized trial, conducted in the Dermatology Department Unit-II, King Edward Medical University Mayo Hospital, Lahore, 60 patients with AD fulfilling the inclusion criteria were entered in the study. In group A, 30 patients were given UVA treatment. In group B, 30 patients were treated with UVB. The treatment was given thrice a week till clearance or for maximum of 12 weeks. Emollients were applied in both groups. Patients were assessed at 2<sup>nd</sup>, 4<sup>th</sup>, 6<sup>th</sup>, 8<sup>th</sup>, 10<sup>th</sup> and 12<sup>th</sup> weeks. After completion of treatment they were followed monthly for 3 months.

*Results* 100% patients in group B (UVB) and 93% patients in group A (UVA) showed >50% reduction in SCORAD. Side effects were observed in 47% patients in group A (pigmentation being statistically significant) and 25% patients in group B in which serious side effects of erythema and burns were seen, though statistically insignificant.

*Conclusion* Both UVA and UVB are equal in terms of efficacy. Pigmentation is more common with UVA while erythema and burns were only seen with UVB.

**Key words**

Atopic dermatitis, UVA, UVB, efficacy, safety.

## Introduction

Atopic dermatitis (AD) is a chronic, relapsing inflammatory skin disorder characterized by itchy papules, vesicles, excoriations and lichenification.<sup>1,2</sup> It is often associated with personal or family history of other atopic conditions as asthma, allergic rhinitis or hay fever.<sup>3</sup> Diagnosis is made clinically on the basis

of history and examination.

AD usually presents during early infancy and childhood, but it can persist into or start in adulthood.<sup>4</sup> The lifetime prevalence of AD is 10-20% in children and 1-3% in adults.<sup>5</sup> AD is the most common type of eczema seen in children in Pakistan.<sup>6</sup>

Genetic, environmental, skin barrier defects and immunological factors are involved in its pathogenesis.<sup>1,7</sup>

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**Address for correspondence**

Dr. Sadia Qayyum, Assistant Professor  
Department of Dermatology,  
FJMU/ SGRH/ GTHS, Lahore  
Email: drsadiaqayyum@hotmail.com

Successful management of AD requires a multifaceted approach. This includes avoidance of irritants and specific immunologic stimuli, including food and aerollergens along with skin hydration and emollients. Various topical agents like steroids and calcineurin inhibitors do improve the condition and are usually used for limited body involvement and with milder forms of disease.

A number of systemic therapies are available for recalcitrant cases. Limited effectiveness or concern regarding toxicity restricts their long-term usefulness. These include corticosteroids, azathioprine, cyclosporine, sodium cromoglycate, mycophenolate mofetil, ketoconazole and montelukast. As there is no standard therapeutic approach for patients with moderate to severe disease, the risks and benefits of above mentioned therapies must be weighed carefully in each case. There is always search for new therapies aimed at good control of disease, cost effectiveness and fewer side effects.

Numerous types of phototherapies have undergone trials for the treatment of moderate to severe AD and proven to be effective. *Selvaag et al.*<sup>8</sup> reported 64% clinical improvement after UVB administration. UVA has a wavelength ranging between 320-400nm and UVB has a wavelength ranging between 290-320nm and acts primarily on the epidermis. The photoimmunologic effects target Langerhan cells and keratinocytes interfering with cytokine production and decreasing expression of activation markers.<sup>9</sup>

To the best of our knowledge there is no local data on comparison of safety and efficacy of UVA and UVB in patients with AD. The present study will help to provide a choice between UVA and UVB in AD, which is a common disease.

## Methods

This was a randomized trial conducted in the Dermatology Department Unit II, Outpatient Department of Mayo Hospital, King Edward Medical University, Lahore from Jan 2011 to June 2012. 60 patients of AD were randomly allocated into two study groups, group A and group B, with 30 patients in each group. Group A was given UVA phototherapy and group B was given UVB phototherapy for the treatment.

Patients of either sex presenting between 5-70 years of age with SCORAD score between 15-70 (moderate to severe AD) of skin type III and IV were enrolled. Patients on topical therapy during last 2 weeks and on systemic therapy during last 4 weeks, as well as, known case of photosensitivity or on photosensitizing therapy and patients having any premalignant or malignant skin disorder or any systemic disease were excluded from study. Pregnant and lactating women were also excluded.

After obtaining informed consent and explaining the risks and benefits of treatment to the patient or the parent/guardian (where applicable), the demographic data was obtained. Detailed history about duration of disease, family history and use of any topical and systemic medication was taken. General physical, cutaneous and relevant systemic examination was carried out. The patients were allocated into group A for treatment with whole body UVA phototherapy (Waldmann 1000 equipment) and group B for treatment with whole body UVB phototherapy (Waldmann 1000 equipment). The UVA radiation in its chamber at the surface of patient's skin was 4 mW/cm<sup>2</sup> and for UVB the radiation was 1.25 mW/cm<sup>2</sup>. Both groups were given treatment thrice a week till clearance, or for a maximum of 12 weeks. For group A,

starting dose was 1 J/cm<sup>2</sup> and on each visit was increased by 0.5 J/cm<sup>2</sup> until response. For group B, starting dose was 75% of minimal erythema dose (MED) for the skin type. Dose was increased by 20% in each visit as tolerated by the patients. Emollients were applied in both groups. Patients were followed at 2, 4, 6, 8, 10 and 12 weeks of study. Efficacy of the agent was assessed by reduction in the involved surface area and severity of the disease. Any side effects like itching, erythema, blisters, hyperpigmentation, freckles and lentigines were observed to assess safety of the drug. The patients were further followed up for any relapse at 1, 2 and 3 months after completion of treatment.

The quantitative data like age and SCORAD were presented as mean±SD. Qualitative outcomes variables like sex, efficacy and adverse effects were presented as frequency, percentage and proportions. Qualitative variables were analyzed by Chi square test and *p* value equal to and less than 0.05 was considered significant. Multivariate repeated measurement

analysis of variance was also be used. If assumptions failed, Friedman’s test was used instead of repeated measurement ANOVA.

**Results**

All thirty patients in group A (UVA therapy) successfully completed the study while in group B (UVB therapy) two patients were excluded because of side effects and two patients were lost to follow-up, resulting in 26 patients completing the study in group B.

There were 21 males and 9 females in group A and 17 males and 13 females in group B respectively. Overall male to female ratio was 1.7:1. In group A, age ranged from 5 to 62 years and in group B from 5 to 70 years, with mean age 21± 18 and 22± 21 years, respectively.

The mean baseline SCORAD Score was 45 (min 34 to max 58) in group A and 51 (min 30 to max 70) in group B. The mean SCORAD at the end of treatment was 5 and 8, respectively in group A and B (Table 1 and 2, respectively). Mean

**Table 1** SCORAD score in group A treated UVA therapy (n=30).

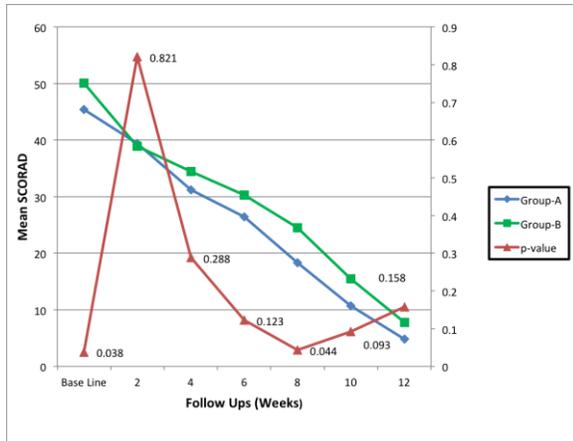
	Mean rank	SCORAD		
		Mean	Minimum	Maximum
Baseline	5.83	45.383 ± 6.6601	34.0	58.5
Week 2	5.02	39.383 ± 8.6350	13.0	55.0
Week 4	4.05	31.200 ± 9.0816	9.5	56.5
Week 6	3.45	26.401 ± 9.234	8.5	58.5
Week 8	3.07	18.333 ± 9.8561	5.5	60.0
Week 10	1.87	10.717 ± 8.6330	0.0	39.0
Week 12	1.17	4.813 ± 6.8315	0.0	28.5

*p* value=0.000

**Table 2** SCORAD score in group B treated UVB therapy (n=26)

	Mean rank	SCORAD		
		Mean	Minimum	Maximum
Baseline	6.00	50.750 ± 9.8359	29.5	69.5
Week 2	4.62	38.885 ± 7.8183	22.5	51.5
Week 4	4.12	34.442 ± 12.836	16.5	69.0
Week 6	3.91	30.342 ± 12.349	10.5	65
Week 8	3.19	24.500 ± 12.1622	5.5	54.5
Week 10	1.96	15.481 ± 11.6400	0.0	47.5
Week 12	1.12	7.808 ± 8.5277	0.0	27.0

*P* value=0.000



**Figure 1** SCORAD index with respect to treatment group at different intervals.

**Table 3** Comparison of efficacy of group A (UVA radiation) and group B (UVB radiation).

Efficacy	Group A	Group B
Excellent	17 (56%)	12 (46%)
Good	6 (20%)	8 (31%)
Satisfactory	5 (17%)	6 (23%)
Fair	2 (7%)	0

P value=0.397

rank depicts application of Friedman test which showed significant reduction ( $p=0.00$ ) from baseline to 12<sup>th</sup> week in both groups. Efficacy was seen in 93% patients in group A with excellent result in 56% of patients (**Table 3**). In group B, efficacy was seen in 100% patients with 46% showing excellent response (**Table 3**). But the difference is statistically insignificant ( $p=0.39$ ) by chi-square test.

Side effects were seen in 47% patients in group A and 25% in group B. Pigmentation was seen in both the groups while erythema and itching were seen only in group B. This difference was found to be statistically significant ( $p=0.031$ ) after application of chi-square test. In group A, pigmentation was only visible after 8 weeks in 3 patients and at 10 weeks in a similar number of cases. In all the other (8 cases) pigmentation was visible by the end of 12 weeks. In contrast pigmentation was only observed in 5 patients treated with UVB as compared to UVA.

Mean cumulative dose for UVA was 121 J/cm<sup>2</sup> and for UVB was 8151 mJ/cm<sup>2</sup>.

## Discussion

The present study was conducted to assess the role of broadband UVA and UVB in terms of efficacy and safety in AD in type III and IV skin.

In our study there were 38 males and 22 females. Patients were enrolled randomly but male to female ratio was 1.7:1. This is in contrast to international sex distribution of AD which is almost equal.<sup>1,2,10</sup> This male predominance is supported by Indian studies.<sup>11</sup> As epidemiologic studies of AD have not been conducted in Pakistan there may be difference in sex distribution of AD in this part of world. Another reason may be social setup in which less number of females are presenting to hospitals.

We found the mean age to be 21 years (18; 5-62) in group A and 22 years (21; 5-70) in group B. This was similar to studies by *Salvaag* and *Jekler et al.*<sup>8,12</sup> AD is known to be a childhood disorder that improves with age. The reason for mean age to be in early part of 3<sup>rd</sup> decade in our patients may be the exclusion of children below 5 years.

The two groups were well-matched in pretreatment parameters and distribution of disease. In our study results were equal with both the modalities.

Our results with UVA revealed that 93% of the patients had reduction in SCORAD. *Jekler* and *Larko*<sup>12,13</sup> (Sweden) in their two studies on UVA showed improvement in 71% and 68% patients. The treatment was given three times a week for 8 weeks. *Reynolds et al.*<sup>14</sup> (UK) in their study gave 24 patients UVA twice a week for 12

weeks along with application of topical steroids. They reported improvement in 47% of his patients. Maximum number of sessions in international studies was 24 as compared to 36 in our study.

Regarding efficacy of UVB, we observed more than 50% improvement in all the patients who completed the study. In a study by Jekler and Larko on UVB, 62% patients showed improvement.<sup>12</sup> In another study by the same group, response was 83%.<sup>15</sup> They gave treatment three times a week for 8 weeks in both their studies. Falk in his study with UVB showed improvement in 84% patients.<sup>16</sup> In another study by Jekler and Larko<sup>17</sup> 13 of the 17 (76.5%) patients showed improvement with UVB, given 3 times for 8 weeks. The total pruritus score and overall evaluation scores were reduced. Selvaag *et al.*<sup>8</sup> in their study on UVB observed good response in his patients. They gave treatment for 3-5 times for 6 weeks. Mean cumulative dose in his study was 124 mJ/cm<sup>2</sup>. We used a higher cumulative dose in our study which may be because of difference of skin type, since the MED is different for different skin types.

The reason for better results with both the treatment modalities in our study seems to be the greater number of treatment sessions which were thrice a week for 12 weeks (36 sessions). Another reason may be the difference of scoring system in other studies, except the one by Selvaag *et al.*<sup>8</sup> in which SCORAD was used similar to our study. Other differences that may have contributed could be those of skin type, dosimetry and genetic and environmental factors as these studies have been conducted in Europe.

Pigmentation was the only side effect observed in our cases (47%) treated with UVA. It was seen only after 8<sup>th</sup> week (24 sessions) and peaked at 12<sup>th</sup> week after 36 sessions. In the study by Reynolds from UK, 60% of patients

developed pigmentation. In our patients, in spite of belonging to skin type IV where pigmentation is more common than white skin, less number of patients had pigmentation as compared to the study in UK. Since UK has large number of immigrants from Asian and African countries, the difference might be due to the inclusion of this population.

Regarding side effects of UVB, the major side effect observed was pigmentation. It was seen in 18% of our patients and appeared between 10<sup>th</sup> to 12<sup>th</sup> weeks. 7% of patients had exacerbation of disease manifesting as burning erythema and itching which were treated with topical steroids. Falk<sup>17</sup> in his study observed no side effects with UVB in all of his 52 patients. His patients in spite of belonging to skin type I and II, where burns are more common than type IV skin, none had erythema and burns. Study done a few years later by Jekler and Larko<sup>18</sup> showed burns and erythema in 67% (20 out of 30) of their patients belonging to similar skin phototype as of Falk.<sup>17</sup> Side effects of erythema and burns in Jekler and Larko study were in contrast to our findings. This may be due to the difference of skin type and of dosimetry.

UVA has less energy but reaches to deep dermis. It affects fibroblasts, dendritic cells, endothelial cells and T lymphocytes within dermis in addition to effects on epidermal keratinocytes and Langerhan cells. Wavelengths in UVB possess greater energy than UVA. They have more superficial depth of penetration, affecting epidermal keratinocytes and Langerhan cells, reaching dermo-epidermal junction.

Phototherapy improves AD by its immunosuppressive effects leading to apoptosis of T cells, release of cytokines and decreasing number of Langerhan cells. Interferons have also been postulated to increase in tissues exposed to UVR. They exert their immunomodulatory

action and inhibit delayed type hypersensitivity. Furthermore, phototherapy exerts antimicrobial action which is important from the aspect of pathogenesis.

Both UVA and UVB proved beneficial regarding their good tolerability in our patients. More studies with larger number of patients with AD in our community may help to document more effective and safe treatment of this disease.

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