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Impact of heliotherapy and phototherapy on the course of atopic dermatitis

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Abstract

Introduction and purpose. Atopic dermatitis (AD) is a common chronic inflammatory skin disease that affects many children and adults around the world. It has been also empirically known that some environmental factors such as exposure to the sun can be beneficial for patients with AD. The purpose of this literature review is to present positive impact, as well as challenges and risks of heliotherapy and phototherapy on patients suffering from AD.

Material and methods. The article is a review of publications obtained from the PubMed database and published between 2017-2023. Based on the keywords "phototherapy" "heliotherapy"and "atopic dermatitis", 14 articles were selected. Finally, 1 meta-analysis and 3 observational studies were included in the rewiev.

Brief description of the state of knowledge. People with AD have a compromised skin barrier, which favors infiltration by activated Th2 cells, and their cytokine, causing thickening of the skin. It makes management of AD challenging. It is known that most patients' skin condition improves due to sun exposure. This is why an artificial UV radiation (UVR) is employed for the treatment. The idea is to administrate a non-ionizing radiation to the skin. Both sunlight and artificial light have a significant immunosuppressive effect on the skin.

Summary. Phototherapy as well as heliotherapy improved skin condition of people suffering from AD. It was appreciable by the end of few weeks of studies and also afer 3 months, reflected by improvement in PO-SCORAD, VAS and DLQI scales. During some of the studies there have been incidents of side-effects. More research is necessary to define a long-term effect of this kind of treatment and the role of chronic and prolonged therapy of AD.

Keywords: phototherapy; heliotherapy; atopic dermatitis

Introduction and purpose

Atopic dermatitis (AD) is a chronic and relapsing inflammatory skin disease that is problematic for many people in different age, nationality and sex. It affects one in 10 people in their lifetime. [1] Its management is challenging and usually requires treatment with topical and/or systemic antiinflammatory agents and appropriate skin care. The etiology of this disease is still unknown but there is data confirming the role of the genetic background and the influence of environmental factors that are triggering as well as the factors that improve skin condition. It has been also empirically known that some environmental factors such as changes in season and climate and exposure to the sun can be beneficial for patients with AD. Having it noticed, people started to use heliotherapy and phototherapy to reduce AD symptoms. However, it brought not only positive effects. Unfortunately, same patients exacerbate as a result of this kind of therapy.

Description of the state of knowledge

People with AD have a compromised skin barrier that is more open to invasion from allergens, irritants, and germs. [2] The pathology behind AD is an infiltration of the skin by activated Th2 cells, and their cytokine IL-4, IL-13, IL-31, which leads to increased proliferation of keratinocytes. The result is thickening of the skin and consequently a challenging management that requires a proper skin care and treatment with antiinflammatory agents. It is also well known that exposure to certain environmental factors, such as irritants, stress or allergens may worsen AD. However, most patients' skin condition improves during sun exposure. This is why an artificial UV radiation (UVR) is employed for the treatment. [3] The idea is to administrate a non-ionizing radiation to the skin, which involves the ultraviolet part of the electromagnetic spectrum. It includes ultraviolet A (UVA), A-1 (UVA-1) spectrum, UVA spectrum with a psoralene sensitizer (PUVA), and ultraviolet B (UVB) spectrum, which may be delivered as full-spectrum (broad-band UVB lamps 270-350nm) or as small-spectrum (narrow-band UVB lamps 311-313nm). [4] Ultraviolet light from the sun and artificial light sources have a significant immunosuppressive effect on the skin – an apoptotic cell death in activated T cells is induced. This effect depends on different variables, such as the wavelengths, the radiation intensity and dose, the number of treatment sessions. [5]

Phototherapy – Narrow-band UVB

In one multicenter study conducted by eight hospitals of Finland, researchers tried to find out the role of Narrow-band UV (NB-UV) in atopic dermatitis treatment. 144 atopic dermatitis patients have been observed. Disease severity was measured using PO-SCORAD (Patient-Oriented Scoring of Atopic Dermatitis) and the Visual Analogue Scales (VAS). Quality of life was assessed using

Dermatology Life Quality Index (DLQI). All measures were filled in three times: at baseline, at the end of the NB-UVB course, and 3 months after the course.

During the NB-UVB course, AD patients received a cumulative UVB dose of 12.2 ± 5.5 J/cm2. The number of NB-UVB exposures was 17 ± 4. They were given three times a week. The duration of phototherapy was 7.3 ± 2.5 weeks.

As a result, PO-SCORAD in AD patients decreased from value of 40.4 ± 14.3 by 18.9 units ($P < 0.001$) and DLQI from 12.9 ± 6.0 by 8.1 ($P < 0.001$). VAS also decreased statistically significantly ($P < 0.001$), which suggests that patients in general improved. At the end of the course, only two (1.4%) of AD patients were completely cleared.

Three months after the NB-UVB course, PO-SCORAD decreased from the baseline value by 16.5 units ($P < 0.001$), DLQI by 8.0 units ($P < 0.001$) VAS was also still significantly decreased ($P < 0.001$).

Researchers reported some side effects of the NB-UVB expousure. 61% of patients experienced some erythema and 13.9% had burns. There also have been nine reported dryness, eight pruritus, four tingling and burning, two herpes simplex, and one tiredness.

Researchers showed that NB-UVB phototherapy is efficient and its positive effects last for at least 3 months but can also bring some side effects. [6]

Heliotherapy

Heliotherapy (HT) in the form of heliomarinotherapy, heliothalassotherapy or climate therapy is a light-based therapy, that is effective in reducing inflammatory skin changes. The UV light reaches the most outer layers of the skin including epidermis and dermis triggering immunosuppression and inducing vitamin D production. It is also considered that light therapy has strong antipruritic effects. In another observational study carried out in 2023 the power of heliotherapy was evaluated.

24 patients with moderate to severe form of AD were included in the study. They were exposed continuously to natural UV lights 3 to 4 h daily avoiding the hours of the highest radiation and without using sunscreens. The study lasted for 2 weeks in July/August 2021, at the Montenegrin coast. Patients had a different skin type in Fitzpatrick's scale. Skin type II (66.7% of the patients) were dominating, while there were no patients with Fitzpatrick's skin type IV. The UV index value was from 6 to 9.

Good clinical results were observed with a statistically significant decrease in SCORAD index by 40% immediately after heliotherapy and by 31.1% 3 months later, respectively ($p < 0.001$). There also have been a decrease in DLQI score by 31.57% 3 months after heliotherapy, comparing to baseline values ($p < 0.001$). VAS scale has not been assessed. Side effects have not been described.

These results suggest that heliotherapy does not have only short-acting effect, but is also beneficial for a longer period of time. [7]

Empowering Heliotherapy

In another observational study researchers tried to measure the influence of sunlight during Empowering Heliotherapy (EHT) on the course of atopic dermatitis. Empowering Heliotherapy is a type of traditional heliotherapy. during which the patients are away from their homes and jobs and in a stress-free environment together with peers.

Two-week EHT courses were arranged in Puerto Rico, Canary Islands, Spain, between October and April. 53 AD patients participated in the study. During the study they could use systemic and topical medication, as prescribed before. Sunbathing time varied, being initially 15–30 min. In cases of skin phototype IV, daily exposure time was increased to 120 min. Fitzpatrick's skin phototype varied - II/III/IV with distribution 11/44/4.

As the result of the study the DLQI and PO-SCORAD scores decreased significantly from the baseline to the end of the EHT ($p<0.001$). VAS also showed a significant decline in disease severity and pruritus ($p<0.001$). Baseline disease severity and its improvement were independent of the time of year and sunbathing time. Three months after the EHT the all of the scores mentioned above were still significantly lower than at the baseline ($p<0.001$) but higher than at the end of EHT.

No side effects have been described. [8]

Phototherapy – UV-A1

Despite the fact that UV-A spectrum is very effective for AD treatment, its long exposure time is unacceptable. It no longer a problem since UV-A1 lamps have been developed. UV-A1 uses lower frequencies of UV-A light spectrum (between 340 and 400 nm) without UV-A2 radiation (320–340 nm) and its adverse effects.

In one study there have been no significant difference in efficacy or in recurrence time between high dose and medium dose UVA-A1. However, medium dose UVA-A1 brings less side effects than high dose. It has been shown that low dose UVA-A1 is not as effective and is rarely used. [9]

The mechanism of UVA-1 phototherapy is considered to be related with T and B lymphocyte apoptosis, misproduction of certain interleukins (IL-5, IL-13, IL-31), inhibition of calcineurin phosphatase, and decreased antigen presentation by Langerhans cells. UVA-1 has been used since 1992 when it was first introduced for acute exacerbations of AD. UVA-1 has been implemented mainly in acute flares but sill little is known about its role in chronic and prolonged therapy. [10]

In 2019 a randomised, controlled study was conducted by A. Pacifico et al. It was on a group of 27 adult patients with severe AD. Severity was determined by SCORAD index. VAS and DLQI have

not been examined. 13 patients were treated with high dose of (130 J/cm2) UVA1 and 14 patients received medium dose (60 J/cm2) UVA1. Phototherapy was performed five times a week for 3 weeks. Before and after UVA1 therapy patients were evaluated for skin pigmentation with the use of Melanin Index (MI).

The result of the study was a decrease of SCORAD index in all groups of patients. However among patients with darker skin types and higher MI, high dose UVA1 was significantly more effective than medium dose ($P < 0.0001$) while in the groups with lighter skin type II, no significant differences were observed between high and medium dose protocols.

This study confirms that UVA1 phototherapy should be introduced in the treatment of patients with severe AD because of its efficacy. It also shows that people with darker skin type have more benefits from high dose UVA1 than from medium dose. [11]

Table 1. Characteristics of described above phototherapy methods

	Therapy	Year of the study	author	Study design	Number of subjects	PO-SCORAD	VAS	DLQI
1.	NB-UVB	2019	Liisa Väkevä et al	Observational study	114	T1 – 40,4 T2 – 21,5 T3 – 23,9	T1- 5,1 T2 – 2,2 T3 – 2,5	T1 – 12,9 T2 – 4,8 T3 – 4,9
2.	HT	2023	Zoran Terzić et al	Observational study	24	T1 – 25,9 T2 – 15,1 T3 – 19,3	Not examined	T1 – 11,4 T2 – 6,9 T3 – 8,2
3.	EHT	2017	Toni Karppin et al	Observational study	53	T1 – 36,8 T2 – 12,8 T3 – 22,2	T1 – 3,9 T2 – 1,2 T3 - 2	T1 – 10,4 T2 – 2,7 T3 – 5,6
4.	UV-A1	2019	A. Pacifico et al	randomised, controlled study	27	T1dh – 49 T2dh – 29 T1dm – 62 T1dm – 54 T1fh – 58 T2fh – 38 T1fm – 51 T2fm – 33,5	Not examined	Not examined

T1 – baseline, **T2** – end of study, **T3** – 3 months after the study, **dh** – dark skin type, high dose, **dm** – dark skin type, medium dose, **fh** – fair skin type, high dose, **fm** – flair skin type, medium dose

Challenges and risks

Not only positive effects of the light, both natural and artificial, are appreciable. While light therapy can help to reduce symptoms, there are also some negative aspects of phototherapy and heliotherapy for people with AD.

Some people may suffer from photo-aggravated atopic dermatitis. It is estimated to affect between 1.4% and 16% of people with AD. Specific symptoms have been described by some studies, such as eczema on the face, chest, and dorsal hands. It was reported mainly in women and patients with light skin (skin phototypes I-III). [12]

In another study, 17.5% of the patients reported a worsening of AD after exposure to sunlight. This happens because of a damage of structural proteins of skin barrier by sun exposure and is more frequent in patients with late onset of AD. [3]

Moreover, it is common knowledge that sun exposure along with positive impact on health and well being also bring some negative aspects. One of them is risk of melanoma. The accumulation of UV radiation from sunlight or tanning beds leads to UV-induced DNA damage, oxidative stress, and inflammatory process in the skin. Dysregulation of this UV radiation response in melanocytes contributes to melanoma. [13]

Another risk brought by sun exposure can be lens opacifications, such as cataracts. Because of a constant exposition of eye lens to UV radiation, some modifications of proteins and lipids occur. This is a significant external source of age-related changes to eye lens. [14]

Summary

Atopic dermatitis has a noticeable influence on the quality of life. This review of literature shows that the phototherapy and heliotherapy are beneficial for patients suffering from AD but also can bring some risks.

When severe AD does not respond well to conventional therapies consisting in most cases of topical or systemic corticosteroids, phototherapy is indicated. It is proven to be effective in patients with acute, severe exacerbation of AD. Many studies described beneficial effects of either UVB or UVA administration or combined UVA/UVB radiation in AD.

Studies show that heliotherapy with its anti-inflammatory effect is also satisfactory as a treatment during summer months for the patients. This kind of treatment is highly neglected in countries with plenty of sunshine throughout the year and is poorly described in the literature.

In Empowering heliotherapy patient education is an important element in the treatment of chronic skin diseases. Peer-to-peer support, workshops, relaxation practice and multidisciplinary discussion groups are very beneficial.

The described side effects of phototherapy are usually mild. Eczema, photoaging and induction of cutaneous malignancies as potential side effects can be observed.

Physicians should be aware of the fact that AD does not always improve with sun exposure and sometimes can aggravate. They must select patients well to recommend sunbathing always along with using of appropriate sunscreens. Moreover, before phototherapy every patient should have phototesting performed to confirm the diagnosis and define the degree of sensitivity to UV light and the specific wavelength that induces the cutaneous response.

The comparison of 4 presented methods of phototherapy is difficult due to different dosage of UV spectrum, frequency of exposures, duration of the studies, as well as different skin phototypes of the patients involved in the studies.

As there are studies describing the impact of photo and heliotherapy on the skin condition of patients with AD at the end of research and 3 months later, more studies are necessary to define a long-term effect of this kind of treatment and the role of chronic and prolonged therapy of AD.

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