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Phototherapy for atopic dermatitis

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Abstract Phototherapy is a second-line treatment for moderate to severe atopic dermatitis (AD) that effectively decreases cutaneous inflammation with minimal or no systemic side effects. Children in grade school, adolescents, and adults may benefit from phototherapy, when they have chronic AD refractory to first-line topical treatments. This review focuses on six approaches for phototherapy in AD: (1) broadband ultraviolet B (UVB), (2) Goeckerman regimen (coal tar + broadband UVB), (3) narrowband UVB, (4) excimer lasers for targeted areas, (5) combination UVA/UVB, and (6) UVA-1. Phototherapy can be very effective in some individuals, but it is limited by inconvenience and adverse effects, including limited access to in-office treatment, difficulty adhering to thrice-weekly schedule, flaring from excessive heat, and increased risk of skin cancer. Dosing regimen and treatment concerns are reviewed.

Introduction

Atopic dermatitis (AD) is a chronic, relapsing and remitting, inflammatory skin disease that is intensely pruritic. AD occurs most frequently in children, and childhood disease may persist into adulthood in up to 85% of cases.[1] AD is characterized by immune system activation[2] and defective skin barrier function, resulting in increased susceptibility to pathogens and allergens.[3]

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Management of AD

Most patients with mild AD can achieve clinical improvement and short-term control of acute symptoms with topical emollients and anti-inflammatory agents, such as topical corticosteroids and calcineurin inhibitors, along with avoidance of triggers (eg, irritants and excess heat). Although these are effective in controlling mild AD, they are usually insufficient for inducing remission in more severe disease.

Limited options are currently available for the treatment of moderate to severe AD. These consist of phototherapy and systemic immunosuppressive agents, such as systemic corticosteroids, cyclosporine A, methotrexate, and azathioprine; however, systemic corticosteroids, cyclosporine A, and other immunosuppressive agents all have major side effects limiting

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long-term use. Although frequently used in clinical practice, oral antihistamines and systemic antimicrobials have scant scientific data supporting their efficacy.[4] Due to its efficacy and low side-effect profile, phototherapy is considered second-line treatment in children and adults with refractory AD.[5]

Phototherapy was first reported as a dermatologic treatment in 1925, when William Goeckerman (1884-1954) of the May Clinic formulated a regimen consisting of applying crude coal tar followed by exposure to broadband ultraviolet light B (BBUVB) for the treatment of refractory or severe psoriasis.[6] In the 1920s, it was also observed that AD improved in sea-air climates during the summer season; however, it was not until 1948 that the efficacy of BBUVB light with carbon arc lamps was found to be an effective treatment for AD.[7] Morison, Parrish, and Fitzpatrick from the Massachusetts General Hospital published a trial in 1978 that jumpstarted the study of phototherapy as a treatment for AD. They reported clearing of refractory AD in 15 patients with oral administration of 8-methoxypsoralen followed by exposure to long-wave ultraviolet A irradiation (PUVA).[5,8] It is now believed that the primary mechanisms of UV irradiation in AD and other inflammatory skin diseases are via photoimmunosuppression and immunomodulation.

Multiple forms of light therapy have been reported to be effective in AD. This review focuses on six modalities of phototherapy:

1. BBUVB
2. Goeckerman regimen
3. Narrow-band UVB (NBUVB)
4. Excimer lasers for targeted areas
5. Combination UVA/UVB
6. UVA-1, which has limited availability in the United States (Table 1).

Psoralens and UVA (PUVA) is a type of photochemotherapy and is beyond the scope of this review.

Guidelines

The American Academy of Dermatology Guidelines of Care for the Management of AD assessed the evidence for phototherapy.[4] Evidence level assigned to in-office phototherapy for AD was IIB, whereas home phototherapy was assigned only IIIC. These indicate that the utility has not been demonstrated in larger, more rigorous studies. Recommendations included supervision by an experienced physician and usage of phototherapy as a *second-line* therapy in AD, after failure of first-line treatment with emollients, topical corticosteroids, and/or topical calcineurin inhibitors (Table 2). Phototherapy can be administered as monotherapy or combination therapy with emollients and topical corticosteroids. The steroid-sparing effect of phototherapy is considered a beneficial feature of therapy. Combination therapy with phototherapy and topical calcineurin inhibitors should be avoided due to the theoretical cancer risk cited in the black box warning on the topical calcineurin inhibitor labels.

Phototherapy can be used in short courses for clearance or longer courses with variable scheduling for maintenance in patients with chronic disease. A minimum 3-month trial is usually undertaken, provided the patient can access and tolerate therapy. Major barriers to patient access for phototherapy include local availability, travel time, missed school or work, coverage by insurers, out-of-pocket costs, patient skin type, skin cancer history, and use of photosensitizing medications. Dosing is guided by Fitzpatrick phototype as per the American Academy of Dermatology guidelines (Tables 3 and 4). Home phototherapy under physician supervision is recommended as backup for patients, who are unable to access in-office phototherapy twice or thrice weekly.[9]

NBUVB was cited as the most commonly used wavelength and modality of light-based therapy for AD. NBUVB and combination UVA/UVB have largely replaced older modalities, such as BBUVB and UVA-1. The guidelines also address pediatric usage and comment on good data to support efficacy and tolerability but not on long-term data on carcinogenicity. Neither localized laser light such as pulsed dye, excimer, and diode, nor systemic extracorporeal photochemotherapy has been endorsed based on more limited evidence.

Table 1 Phototherapy modalities for the treatment of atopic dermatitis

UVB
Broadband UVB (290-320 nm)
Goeckerman regimen: coal tar and broadband UVB
Narrowband UVB (311-313 nm)
Excimer laser (308 nm)
UVA
UVA-1 (340-400 nm)
Psoralens and UVA (PUVA)
Combined UVA/UVB (280-400 nm)

Table 2 Recommendations for the use of phototherapy

- Phototherapy is a second-line treatment, after failure of first-line treatment (emollients, topical corticosteroids, and topical calcineurin inhibitors).
- Phototherapy can be used as maintenance therapy in patients with chronic disease.
- Phototherapy treatment of all forms should be under the guidance and ongoing supervision of a physician knowledgeable in phototherapy techniques.
- The light modality chosen should be guided by factors such as availability, cost, patient skin type, skin cancer history, and patient use of photosensitizing medications.
- The dosing and scheduling of light should be based on minimal erythema dose and/or Fitzpatrick skin type.
- Home phototherapy under the direction of a physician may be considered for patients who are unable to receive phototherapy in an office setting.

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