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Review article

Phototherapy and PUVA photochemotherapy in children

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The use of phototherapy and photochemotherapy in children has been limited due to concerns over their long-term carcinogenic potential. Furthermore, the method of administration is disconcerting to some children, particularly as phototherapy treatment units are seldom rendered 'child-friendly'. Despite these reservations, ultra-violet therapies can be useful treatment options for children with selected dermatological conditions provided they are used under carefully controlled conditions.

Key words: **children; eczema; phototherapy; polymorphic light eruption (PLE); psoriasis; PUVA; treatment; UVA; UVB; vitiligo.**

Ultra-violet B (UVB), ultra-violet A (UVA) and psoralen ultra-violet A (PUVA) phototherapies are seldom used in children, despite the efficacy of these treatments for selected skin disorders in adults. This mainly reflects concerns about the carcinogenic potential of ultra-violet (UV) therapies, based on epidemiological studies relating childhood sun exposure to subsequent risk of melanoma (1, 2), and the demonstration that UV therapy in adults is associated with the development of melanoma and non-melanoma skin cancer (3–5). Although there are no studies relating UV therapy in childhood to risk of skin cancer, it is easy to understand why dermatologists are cautious about prescribing such treatments for children, and conflicting opinions have been expressed regarding their role (6–8). This review examines publications mainly concerning PUVA and UVB therapies in children, and makes recommendations for their usage in the context of current guidelines for phototherapy, and medical and nursing care of children and against the background of potential adverse events.

General principles

As hospitals can be daunting places, every effort should be made to ensure that the environment in which children are seen and treated is as child-orientated as possible (9). Most hospitals have dedicated facilities for children, making compliance with this aspiration easier. However, dedicated UV light therapy facilities specifically for children are seldom justified, as the number of children requiring phototherapy or PUVA is small. Thus except in large children's hospitals, the expense of setting up and staffing a UV-therapy unit dedicated for children cannot be justified. As a result most UV-therapy units adopt a flexible policy and treat children as well as adults, and in this situation a number of simple measures can make the unit more child-friendly:

- Provision of a dedicated child-friendly waiting area.
- An explanatory booklet for younger children in the form of an illustrated story of a child having UV treatment.
- The hospital play specialist or paediatric dermatology nurse attending for first few treatments.
- Decoration of the front of the phototherapy and PUVA cabinets with stickers for example of cartoon characters or spaceships.
- Provision of compact discs or audiotapes for children to play on personal stereos. The use of earplug-type headphones will not significantly interfere with the UV exposure.
- For younger children, provision of badges during treatment and presentation of certificates when treatment has been completed.

Financial and logistical factors need to be considered, as distance from the phototherapy unit or lack of transport or time to attend with a child may all mitigate against successfully completing a course of

UV treatment. Prior to starting treatment, the child and their parents should be given an opportunity to visit the phototherapy unit, ideally with a paediatric dermatology nurse present, to see the machines, and meet the staff who will be conducting the treatments. A platform may be required in the base of the cabinet for the child to stand on, as the intensity of UV radiation declines at the cabinet peripheries, and boys should be introduced to the concept of genital protection during phototherapy. Appointment times for the child's treatments should be organised to allow them to attend when adult patients are not being treated. UV therapy should only be considered in children who are mature enough to comply with treatment. Some children do not enjoy the sensation of being inside a phototherapy cabinet; to give the child confidence, a parent or phototherapist can go into the UV cabinet (suitably protected with clothing and goggles) during the first few treatments. An alternative option if the UV cabinet has the facility to override the circuit cut-off that occurs on door opening, is to treat the child with the door of the cabinet partially or fully open. This facility can be useful, to assist monitoring and prevent misbehaviour during treatment that might compromise the unit's safety standards.

Risks of phototherapy and PUVA for children

The short-term side-effects of phototherapy are usually mild and self-limiting, presenting as erythema, xerosis, pruritus and gastrointestinal symptoms associated with systemic psoralens. The main long-term side-effects include carcinogenesis, cataracts, lentigenes and photoaging. The association between UV exposure and skin cancer has been well documented. Children aged 10 years or younger who emigrate to Western Australia have a four-fold increased risk of melanoma when compared with those aged 15 years or over on arrival (1), and children in the USA who sustained frequent episodes of sunburn before the age of 12 had a 3.6-fold increased risk of developing melanoma compared to matched controls (2). The potential of UVB (3) and PUVA (4, 5) treatments in children to induce melanoma and non-melanoma skin cancer has not been proven. Because an association has been established with PUVA in adults (which may take 15 years or more to become apparent) (4), and epidemiological and animal data supporting a role for UVB (3), it is reasonable to suppose that children are at similar risks. Additionally, concerns have been raised that PUVA may have a greater carcinogenic potential in young children than UVB phototherapy (10).

8-Methoxypsoralen is detectable in the ocular lens of humans for up to 12 h after a single therapeutic dose (11), and even, albeit in small amounts, following topical application (12). Recent guidelines from the British Photodermatology Group recommend post-PUVA treatment protective spectacles for individuals with extensive disease (>30% surface area), in individuals with atopic dermatitis (because of the increased baseline risk of cataract) and also in children both for systemic and topical PUVA (13), as their greater surface area to body mass ratio theoretically increases their risk of systemic absorption of topical psoralen. Because ensuring compliance with eye protection may be difficult in the young, phototherapy of young children with UVB or UVA is usually preferred to PUVA; thus, the British Photodermatology Group recommends that PUVA should not be used in children under the age of 10 years except in exceptional circumstances (13). In general, because of the potential side-effects, phototherapy should be reserved for those children in whom a trial of optimal topical treatments have failed, or those in whom conservative management is impractical due to rapid progression or severity of the condition. Individuals who receive multiple courses of UV therapy in childhood should be followed up by a dermatologist. It is our practice to offer annual follow-up to all individuals who have in excess of 300 UVB and 150–200 PUVA treatment sessions.

Phototherapy is contra-indicated in a few dermatological conditions. These include xeroderma pigmentosum, Gorlin's syndrome, the photoexacerbated conditions such as lupus erythematosus and dermatomyositis, and in those who have had a previous malignant melanoma (13).

Counselling and consent

In younger children counselling should be directed mainly at the parents, and include the provision of patient-advice sheets detailing safety procedures and possible adverse effects of treatment. Parents should be advised of the increased risk of photoaging and skin cancer, the expected benefits of treatment, and of therapeutic alternatives. Because children get three times as much annual sun exposure compared with adults, and over half of the life-time sun exposure occurs before the age of 18 (14), it is important to counsel the children and their parents regarding the risks of, and methods to limit, excess ambient UV exposure. Behaviour modification, use of sunscreens

and protective clothing may all reduce the long-term risk of cutaneous malignancy. Counselling should finish with the signing of a consent form by the parents. Ideally a hospital play specialist or paediatric dermatology nurse should attend the consent/counselling session, explain the treatment to the child and be available during the treatment, but in some hospitals this might be better performed by the nurse phototherapist who is going to administer the treatment. Most children with skin disease of primary school age and older, hold views about their conditions. It is important to include them in the process of informed consent, taking account of their wishes and feelings; participation not only emphasises the child's autonomy, but also improves their compliance with treatment and comprehension of their condition.

UV treatments for psoriasis

As with adults, UVB or PUVA should only be considered for psoriasis in children following an inadequate response to optimal topical treatment, ideally under the close supervision of an experienced paediatric dermatology nurse. The severity of the child's psoriasis and the disability that it produces should also be considered (15). As there is no direct correlation between percentage of the skin affected by psoriasis and disability experienced (16), the clinician needs to be satisfied that the disability in a particular child is sufficient to justify this time-consuming treatment with its attendant risks.

There are few comparative trials assessing UV therapy for psoriasis in children, and clinicians tend to have extrapolated results from trials in adults (8, 15). The emission spectrum of narrow-band UVB was developed to be in the optimum therapeutic range for psoriasis phototherapy, but in adults, little overall difference in efficacy has been shown from PUVA treatment (17). UVB should be combined with topical treatment in order to maximise efficacy and keep the course of phototherapy as short as possible (18).

UV treatments for atopic dermatitis

UV light therapy has been shown to be effective in treating childhood atopic dermatitis, but the response rate is lower than for psoriasis and remission may be shorter (8). Additional safety concerns relate to the development of cataract formation in severe atopic dermatitis. These are rare, have a peak incidence between 15 and 25 years, but may be rapidly progressive. Therefore young people with severe atopic dermatitis should have their eyes examined by slit lamp before PUVA commences, and it is essential that they comply closely with advice concerning eye protection both during and after treatment (12). The mode of phototherapy action in atopic dermatitis is uncertain, but possible mechanisms include immunomodulation, antimicrobial effects and the induction of epidermal thickening (19).

A variety of forms of UV therapy have been advocated in severe atopic dermatitis including broad-band UVB (19), narrow-band UVB (20), combined UVA–UVB (21), UVA (22), UVA_1 (23) and PUVA (24). In North America and United Kingdom, narrow-band UVB and PUVA are currently the main phototherapies for childhood atopic dermatitis, and are only used in patients with eczema that cannot be adequately controlled with emollients and topical corticosteroids or immunomodulators. These topical immunosuppressive macrolides are contra-indicated during phototherapy because of the theoretically increased risk of skin malignancy following exposure to UV radiation. Both forms of phototherapy have been demonstrated to reduce disease activity and usage of topical corticosteroids. Control of disease often takes longer than with psoriasis, and longer remissions may be achieved if maintenance therapy of at least four treatments is given following clearance (20, 24). With very active atopic dermatitis, a short course of systemic corticosteroids may be necessary at the start of therapy to prevent a flare-up.

UV treatments for vitiligo

Children with vitiligo may have a more favourable response to topical and systemic PUVA than adults with vitiligo (25). In general, psoralen paint or bath PUVA is preferred to treat children, as the risks associated with systemic PUVA are reduced (8, 26). Response to treatment is variable, as illustrated by a retrospective study of its effectiveness in treating vitiligo in both adults and children (27). In the absence of better treatments a 3-month trial of PUVA can be justified to assess the response to therapy (28). The efficacy of narrow-band UVB therapy for vitiligo in adults has been confirmed (29), with similar results from the limited number of studies assessing the response of children (30).

UV treatments for polymorphic light eruption

Large patient series with polymorphic light eruption (PLE) that include children have reported high rates of protection following 'hardening' with UVA, UVB and PUVA (31–35). Narrow-band UVB is probably

the treatment of choice for disabling PLE in children; in adults it has been shown to be as efficacious as PUVA (33), yet it avoids the use of psoralen with its associated problems of gastro-intestinal upset and the need for protective eyewear (34).

Miscellaneous conditions

Many of the following conditions in children are either rarely seen, or are rarely treated with phototherapy. Thus there are no randomised controlled trials assessing efficacy, and much of the information is based on small series or case reports. Additionally, some of these conditions have a natural tendency to remit spontaneously, which makes assessment of efficacy of phototherapy or PUVA difficult. In view of these limitations, findings from these reports should be treated with caution.

UV treatments for other idiopathic photodermatoses

Narrow-band UVB has been shown to be an effective preventative treatment for children with photodermatoses, such as actinic prurigo, hydroa vacciniforme and solar urticaria (34). In a series of patients with hydroa vacciniforme, two of three children not controlled with conservative management found prophylactic narrow-band UVB therapy improved tolerance of sunlight (35). A child with actinic prurigo was reported to clear with systemic PUVA, but the improvement was not sustained at 4 months' follow-up (36).

UV treatment of erythropoietic protoporphyria

UVB has been used to improve tolerance of sunlight in children with erythropoietic protoporphyria (EPP), either as a primary prevention (34) or following unsuccessful treatment with β-carotene (37). The peak wavelength of narrow-band UVB (311 nm) is far removed from the activating wavelengths for EPP (at 400 nm and to a lesser extent 500–600 nm) producing a UV-induced protective response in the skin (pigmentation and epidermal thickening) without inducing the photosensitivity reaction that characterises this disorder (38).

Treatment of other disorders

Although there is a consensus in the literature that UV therapy is effective at treating pityriasis lichenoides in children (8), convincing evidence is lacking in the literature, and the condition may resolve spontaneously. Two series reported success using UVB (7, 39) and a third using PUVA (40). There are several case reports and small series of children with morphoea who have apparently responded to PUVA or UVA_1 monotherapy (41–45). Significant benefit has also been reported using a combination of low-dose UVA_1 and topical calcipotriol (46). Speculation on mechanisms of this therapeutic effect has implicated the induction of dermal fibroblast collagenase (44). Similar mechanisms may explain reported successes with PUVA for scleroderma (39), and with UVA_1 for lichen sclerosus (47).

Systemic PUVA may be helpful for children with urticaria pigmentosa, improving both skin lesions and Darier's sign, but may be less successful in controlling the associated pruritus (48, 49). Cutaneous mastocytosis has been reported to respond dramatically to systemic PUVA (50).

Case reports suggest that UVB may be useful for children with subcorneal pustular dermatosis (51) and bath PUVA for lymphomatoid papulosis (52). PUVA has been reported to be useful in reducing symptoms and the oral immunosuppressive dose for some children with acute graft vs. host disease (GVHD) (53). Both PUVA and UVB may similarly be useful in chronic GVHD (54–56). Mycosis Fungoides and Sézary syndrome only rarely occur in childhood, and there are no large studies, only case reports, all using PUVA to treat affected children (57–60).

Studies including both children and adults with alopecia areata, have reported significant short-term regrowth in up to about 40% of patients. However, the natural history of the condition does not appear to be changed by any of the current topical or phototherapeutic treatments. Thus the final response rate following PUVA treatment appears no higher than would be expected without treatment, and those whose hair regrows during PUVA therapy have a relapse rate similar to untreated patients (61, 62).

Discussion

Certain childhood skin disorders respond well to therapy with UV irradiation. For some disorders such as psoriasis, atopic dermatitis, vitiligo and PLE, there exists a considerable literature documenting efficacy when used for children, with information available describing optimal modalities and treatment durations. Thus when considering treatment options for these conditions, it is necessary to carefully weigh up the risks and benefits (unfortunately often with limited study data to inform the process) of not just phototherapy, but also the alternatives. Because of the safety concerns, phototherapy and PUVA are usually reserved as second or third line treatments for children whose skin condition is difficult to control using conventional or conservative management.

Topical or systemic treatments used in combination with UV therapies in adults with similar conditions may limit the total treatments and overall dose required, but there is little information available in the paediatric dermatology literature. The evidence for the use of phototherapy in other paediatric dermatoses is more flimsy. For several conditions such as the photosensitive dermatoses, morphoea and pityriasis lichenoides, the response appears to be good, but the lack of robust studies that convincingly confirm the clinical impression makes recommendation of routine use of UV therapy difficult. For these conditions, large multicentre controlled trials will be required to show a significant effect. The evidence for the use of UV therapy for other conditions in children, such as subcorneal pustular dermatosis or mycosis fungoides is much more limited, and is based only on a few case reports. While reports of the benefit from UV treatment in such conditions should not be discounted, its routine use would be controversial, particularly in cases where more established treatments are available. Finally, for conditions such as alopecia areata, the available literature suggests little benefit of UV therapy, and in view of the possible side-effects, should not be used.

When treating children with UV therapies, safety must be the overriding feature. Because their life expectancy is significantly longer than adults, children are more likely to experience long-term side-effects, and also to require repeated treatments. The major concern is the reported association of an increased risk of skin malignancies following both UV exposure in early life, and UV therapy in adulthood, and therefore it remains important to limit phototherapy in children to conditions where the benefit is proven, and only after other treatment options have been explored. When phototherapy or PUVA are used in children, compliance with treatment protocols and guidelines must be ensured. Other than in exceptional circumstances, the use of eye protection should be enforced during all treatments to minimise the risk of acute keratitis and cataract development. Additionally, following PUVA, whether topical or systemic, it is vital to stress to both the child and their parents the importance of continued protection on the day of treatment. Furthermore, exposure to natural sunlight should be minimised, as abnormal photosensitivity resulting from psoralen-UVA monoadducts fixed in the skin can persist for at least 48 h post-treatment. Children who are unable to comply with this requirement should not be prescribed PUVA; UVB or UVA treatment may be considered as safer options.

UV treatment can be time-consuming and disconcerting, so full consent of both the parents and child is vital, explaining the possible risks and benefits, particularly with reference to alternative therapies, and respecting the wishes of the child. To ensure subsequent safe administration including compliance with recommendations for eye protection and positioning in the cabinet, UV treatment to children must be administered in an appropriate environment with constant supervision by parents and trained professional staff. Despite these censures, the child should be treated with respect and as much as possible staff should make the experience enjoyable.

In conclusion, phototherapy and photochemotherapy have a small but important role in the treatment of children with dermatological conditions. In view of the potential adverse effects associated with these therapies, units that have inadequate funding or insufficient trained staffing to allow safe administration and constant supervision of the child should not use these treatment modalities.

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References

1. Holman CD, Armstrong BK. Cutaneous malignant melanoma and indicators of total accumulated exposure to the sun: an analysis separating histogenic types. J Natl Cancer Inst 1984; **73:** 75–82.
2. Holly EA, Aston DA, Cress RD. Cutaneous melanoma in women: I. Exposure to sunlight, ability to tan, and other risk factors related to ultraviolet light. Am J Epidemiol 1995; **141:** 923–933.
3. Young AR. Carcinogenicity of UVB assessed. 1995; **345:** 1431–1432.
4. Stern RS. The risk of melanoma in association with long-term exposure to PUVA. J Am Acad Dermatol 2001; **44:** 755–761.
5. Stern RS, Lange R. Non-melanoma skin cancer occurring in patients treated with PUVA five to ten years after first treatment. J Invest Dermatol 1988; **91:** 120–124.
6. Anderson TF. Pediatric phototherapy. Symposium on paediatric dermatology. Ped Clin North Am 1983; **30:** 701–717.
7. Tay Y-K, Morelli JG, Weston WL. Experience with UVB in children. Ped Dermatol 1996; **13:** 406–409.
8. Esterley N, Atherton D, Cohen B. Phototherapy for children (symposium). Ped Dermatol 1996; **13:** 415–426.
9. Dodd KL. Children first – the Audit Commission study of hospital services. Arch Dis Child 1993; **69:** 173–175.
10. Gelmetti C, Caputo R. Psoriasis in childhood. In: Dubertrret L, ed. Psoriasis. Brescia: ISED, 1994; 248–260.
11. Lerman S, Megaw J, Willis I. Potential ocular complications from PUVA therapy and their prevention. J Invest Dermatol 1980; **74:** 197–199.

12. Halpern SM, Anstey AV, Dawe RS, et al. Guidelines for topical PUVA: a report of a workshop of the British Photodermatology Group. Br J Dermatol 2000; **142:** 22–31.
13. British Photodermatology Group. British photodermatology group guidelines for PUVA. Br J Dermatol 1994; **130:** 246–255.
14. Stern RS, Weinstein MC, Baker SG. Risk reduction for non-melanoma skin cancer with childhood sunscreen use. Arch Dermatol 1986; **122:** 537–545.
15. Burden AD. Management of psoriasis in childhood. Clin Exp Dermatol 1999; **24:** 341–345.
16. Wahl A, Moum T, Hanestad BR, Wiklund I. The relationship between demographic and clinical variables, and quality of life aspects in patients with psoriasis. Qual Life Res 1999; **8:** 319–326.
17. van Weelden H, Baart de la Faille H, Young E, van der Leun JC. Comparison of narrow-band UVB phototherapy and PUVA photochemotherapy in the treatment of psoriasis. Acta Derm Venereol 1990; **70:** 212–215.
18. Al-Fouzan AS, Nanda A. UVB phototherapy in childhood psoriasis. Ped Dermatol 1995; **12:** 66.
19. Jeckler J, Larkö O. UVB phototherapy of atopic dermatitis. Br J Dermatol 1988; **119:** 697–705.
20. Collins P, Ferguson J. Narrowband (TL-01) UVB air-conditioned phototherapy for atopic eczema in children. Br J Dermatol 1995; **133:** 653–664.
21. Jeckler J, Larkö O. Combined UVA-UVB versus UVB phototherapy for atopic dermatitis: a paired comparison study. J Am Acad Dermatol 1990; **22:** 49–53.
22. Jeckler J, Larkö O. UVA solarium vs UVB phototherapy of atopic dermatitis; a paired comparison study. Br J Dermatol 1991; **125:** 569–572.
23. Krutmann J, Czech W, Diepgen T, et al. High dose UVA_1 therapy in the treatment of patients with atopic dermatitis. J Am Acad Dermatol 1992; **26:** 225–230.
24. Sheehan M, Atherton D, Norris P, Hawk J. Oral psoralen photochemotherapy in severe childhood atopic eczema. Br J Dermatol 1993; **129:** 431–436.
25. Grimes PE, Kelly AP. Management of vitiligo in children. Ped Dermatol 1986; **3:** 498–510.
26. Mai DW, Omohundro C, Dijkstra J, et al. Childhood vitiligo successfully treated with bath PUVA. Ped Dermatol 1998; **15:** 53–55.
27. Anstey A, Hawk JL. Quelle est la place de la puvathérapie dans le traitement du vitiligo? Ann Dermatol Véneréol 1994; **121:** 273–278.
28. Lerner MR, Fitzpatrick TB, Halder RM, Hawk JL. Discussion of a case of vitiligo. Photodermatol Photoimmunol Photomed 1999; **15:** 41–44.
29. Scherschun L, Kim JJ, Lim HW. Narrow-band ultaviolet B is a useful and well-tolerated treatment for vitiligo. J Am Acad Dermatol 2001; **44:** 999–1003.
30. Njoo MD, Bos JD, Westerhof W. Treatment of generalised vitiligo in children with narrow-band (TL-01) UVB radiation therapy. J Am Acad Dermatol 2000; **42:** 245–253.
31. Mastalier U, Kerl H, Wolf P. Clinical, laboratory, phototest and phototherapy findings in polymorphic light eruption: a retrospective study of 133 patients. Eur J Dermatol 1998; **8:** 554–559.
32. Man I, Dawe RS, Ferguson J. Artificial hardening for polymorphic light eruption: practical points from ten years' experience. Photodermatol Photoimmunol Photomed 1999; **15:** 96–99.
33. Bilsland D, George SA, Gibbs NK, et al. A comparison of narrow-band phototherapy (TL-01) and photochemotherapy (PUVA) in the management of polymorphic light eruption. Br J Dermatol 1993; **129:** 708–712.
34. Collins P, Ferguson J. Narrowband UVB phototherapy (TL-01): an effective preventative treatment for the photodermatoses. Br J Dermatol 1995; **132:** 956–963.
35. Gupta G, Man I, Kemmett D. Hydroa vacciniforme: a clinical and follow-up study of 17 cases. J Am Acad Dermatol 2000; **42:** 208–213.
36. Lee DY, Young JI, Park MH, Chung J-H. Actinic prurigo: limited effect of PUVA. Br J Dermatol 1997; **136:** 972–973.
37. Roelandts R. Photo(chemo)therapy and general management of erythropoietic protoporphyria. Dermatol 1995; **190:** 330–331.
38. Todd DJ. Erythropoietic protoporphyria. Br J Dermatol 1994; **131:** 751–766.
39. Pašic A, Ceovi R, Lipozencic J, et al. Phototherapy in pediatric patients. Ped Dermatol 2003; **20:** 71–77.
40. Romaní J, Puig L, Fernández MT, et al. Pityriasis lichenoides in children: clinicopathologic review of 22 patients. Ped Dermatol 1998; **15:** 1–6.
41. Todd D, Askari A, Ektaish F. PUVA therapy for disabling pansclerotic morphoea of children. Br J Dermatol 1998; **138:** 201–202.
42. Wollina U, Looks A, Uhlemann C, Wollina K. Pansclerotic morphoea of childhood – follow-up over 6 years. Ped Dermatol 1999; **16:** 245–247.
43. Kerscher M, Volkenandt M, Gruss C, et al. Low-dose UVA1 phototherapy for treatment of localised scleroderma. J Am Acad Dermatol 1998; **38:** 21–26.
44. Stege H, Berneburg M, Humke S, et al. High-dose UVA1 radiation therapy for localised scleroderma. J Am Acad Dermatol 1997; **36:** 938–944.
45. Gruss C, Stucker M, Kobyletzki G, et al. Low dose UVA1 phototherapy in disabling pansclerotic morphoea of childhood. Br J Dermatol 1997; **136:** 293–294.
46. Kreuter A, Gambichler T, Avermaete A, et al. Combined treatment with calicipotriol ointment and low-dose ultraviolet A1 phototherapy in childhood morphoea. Ped Dermatol 2001; **18:** 241–245.
47. Kreuter A, Jansen T, Stücker M, et al. Low-dose ultraviolet-A1 phototherapy for lichen sclerosus et atrophicus. Clin Exp Dermatol 2001; **26:** 30–32.
48. Godt O, Proksch E, Streit V, Christophers E. Short- and long-term effectiveness of oral and bath PUVA therapy in urticaria pigmentosa and systemic mastocytosis. Dermatol 1997; **195:** 35–39.
49. Christophers E, Hönigsmann H, Wolff K, Langner A. PUVA-treatment of urticaria pigmentosa. Br J Dermatol 1978; **98:** 701–702.
50. Smith ML, Orton PW, Chu H, Weston WL. Photochemotherapy of dominant, diffuse, cutaneous mastocytosis. Ped Dermatol 1990; **7:** 251–255.
51. Park Y-K, Park HY, Bang DS, Cho CK. Subcorneal pustular dermatosis treated with phototherapy. Int J Dermatol 1986; **25:** 124–126.
52. Volkenandt M, Kerscher M, Sander C, et al. PUVA-bath photochemotherapy resulting in rapid clearance of lymphomatoid papulosis in a child. Arch Dermatol 1995; **131:** 1094.
53. Wiesmann A, Weller A, Lischka G, et al. Treatment of acute graft-versus-host disease with PUVA: results of a pilot study. Bone Marrow Transplant 1999; **23:** 151–155.
54. Aubin F, Brion A, Deconinck E, et al. Phototherapy in the treatment of cutaneous graft-versus-host disease. Transplant 1995; **59:** 151–155.
55. Vogelsang GB, Wolff D, Altomonte V. Treatment of chronic graft-versus-host disease with ultraviolet irradiation and psoralen (PUVA). Bone Marrow Transplant 1996; **17:** 1061–1067.
56. Enk CD, Elad S, Vexler A, et al. Chronic graft-versus-host disease treated with UVB phototherapy. Bone Marrow Transplant 1998; **22:** 1179–1183.
57. Di Landro A, Marchesi L, Naldi L, et al. A case of hypopigmented mycosis fungoides in a young Caucasian boy. Ped Dermatol 1997; **14:** 449–452.

58. Tay Y-K, Weston WL, Aeling JL. Treatment of childhood cutaneous T-cell lymphoma with alpha-interferon plus PUVA. Ped Dermatol 1996; **13:** 496–500.
59. Pabsch H, Rütten A, von Stemm A, et al. Treatment of childhood mycosis fungoides with topical PUVA. J Am Acad Dermatol 2002; **47:** 557–561.
60. Meister L, Duarte AM, Davis J, et al. Sézary syndrome in an 11-year-old girl. J Am Acad Dermatol 1993; **28:** 93–95.
61. Healy E, Rogers S. PUVA treatment for alopecia areata – does it work? A retrospective review of 102 cases. Br J Dermatol 1993; **129:** 42–44.
62. Alabdulkareem AS, Abahussein AA, Okoro A. Minimal benefit from photochemotherapy for alopecia areata. Int J Dermatol 1996; **35:** 890–891.

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