A Pilot Trial of Dermoscopy as a Rapid Assessment Tool in Pediatric Dermatoses

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Dermoscopy is a noninvasive technique to assess skin architecture. A pilot study was conducted using polarized dermoscopy as a tool to monitor the pediatric skin barrier. Ten pediatric patients (age range, 1–14 years) with mild to moderate atopic dermatitis (AD), ichthyosis vulgaris (IV), and/or keratosis pilaris (KP) participated in a 4-week clinical trial. After a week of emollient usage alone, a mid-potency topical corticosteroid cream was added twice daily if necessary to treat erythema, dermatitis, or pruritus. The participants were assessed at weeks 0, 1, and 4 using the eczema area and severity index (EASI) for atopic dermatitis, investigator global assessment for atopic dermatitis, children dermatology life quality index (CDLQI), and clinical and dermoscopic photography. Dermoscopic appearance demonstrated dermal vascular ectasia in AD and KP, hyperkeratosis and prominence of the interkeratinocyte space in AD and IV, and widening of the follicular orifice in KP. Improvements in these dermoscopic abnormalities were noted after emollient usage, mirroring improvements in clinical appearance, EASI, and CDLQI. Dermoscopy is a promising tool to assess localized improvement in skin architecture in pediatric dermatoses. Further studies and development of scoring systems will be needed to apply this technology to clinical practice.

Cutis. 2011;87:148-154.

Dermoscopy was developed as an adjunctive tool in the evaluation and follow-up of melanocytic processes of the skin. Dermoscopy can be conducted either with a lens that requires oil or with a polarized light attachment.[1] This latter form of dermoscopy is easier to perform, as it is not messy and can be performed using a lens attachment for a digital camera. Dermoscopy has been described as an adjunctive agent in the assessment of a wide variety of pediatric skin conditions in which magnification-improved visualization of small lesions, such as infestations (eg, scabies,[2] lice[3]), is needed. Because dermoscopy can allow for visualization of both epidermal and dermal elements in the skin, usage has been applied in pediatric dermatology to a variety of conditions in which the dermal component plays an important role, such as vascular disorders (eg, angioma serpiginosum,[4] port-wine stains[5]).

Atopic dermatitis (AD), ichthyosis vulgaris (IV), and keratosis pilaris (KP) are 3 pediatric dermatoses with notable barrier alterations manifesting as xerosis. Although AD has a number of validated scores, difficulty exists for IV and KP because of underrecognition and a lack of scoring systems.[6,7] The aim of this study was to look at whether dermoscopy could aid in assessment of these 3 clinical conditions and whether improved dermoscopic appearance was reflective of clinical disease state improvement.

Materials and Methods

Ten pediatric patients (age range, 1–14 years) were sequentially enrolled over 2 months based on their clinical diagnosis of mild to moderate AD, IV, and/or

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This study was supported by an unrestricted educational grant from Expanscience Laboratories. Dr. Silverberg has been a speaker for Expanscience Laboratories.
This study was presented at the 34th Annual Meeting of the Society for Pediatric Dermatology; July 9–12, 2008; Salt Lake City, Utah.
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KP. Patients and parents/guardians were required to provide informed consent to participate in a 4-week clinical trial approved by the St. Luke's-Roosevelt Hospital Center institutional review board. Participants were instructed to cleanse once daily with Mustela® Stelatopia® Cream Cleanser and apply Mustela Stelatopia Moisturizing Cream twice daily. Atopic dermatitis was diagnosed based on the criteria of Hanifin and Rajka,[8] and a diagnosis of IV was made based on moderate to severe hyperkeratosis and hyperlinearity of the anterior shins and palmar hyperlinearity. The diagnosis of KP was made based on the presence of keratotic follicular papules of the upper arms, upper thighs, and/or cheeks. Exclusion criteria included sensitivity or allergy to any ingredient of the topical products, inability to comply with the protocol, or inability to withdraw from topical corticosteroids.

Participants discontinued prior emollient or topical prescription therapy usage prior to study initiation. For the first week, participants were instructed to apply only the products provided; after the initial week of emollient use, participants with AD or KP could add a prescription topical corticosteroid (hydrocortisone butyrate cream 0.1% or fluticasone propionate cream 0.05%) if necessary for erythema, dermatitis, or pruritus. The participants and parents/guardians were given Mustela Stelatopia Cream Cleanser and Moisturizing Cream, which contain a sunflower oil distillate. Participants were evaluated at weeks 0, 1, and 4 by clinical evaluation and scoring scales including the eczema area and severity index (EASI)[9,10] and investigator global assessment, which gives the investigator's overview of the severity of AD on a 5-point scale. Presence of sleep disturbance and presence of pruritus were assessed. Additionally, all participants and parents/guardians completed the children dermatology life quality index (CDLQI) at each visit.[11] Photography was performed using a Canon Power Shot A630 digital camera and a dermatoscopic lens attachment with an optional polarized light source, the DermLite® Foto attachment, which provides 4× to 16× magnification and a 25-mm visual field of view. Transepidermal water loss (TEWL) was measured with the VapoMeter, a closed unventilated chamber system.[12] Three measurements of TEWL (g/m^2h) were taken both for unaffected and affected skin and were then averaged.

Results

The demographics of the participants are reviewed in Table 1. Two participants had overlapping diagnoses. All 3 participant groups experienced clinical, scoring, quality of life, dermoscopic, and TEWL improvements after emollient usage with Mustela Stelatopia Moisturizing Cream products both before and after the addition of adjunctive medications. Transepidermal water loss for all 3 skin conditions (n=8) improved both for unaffected volar

Table 1.

Participant Demographics

	Participants
Diagnosis, n	
Atopic dermatitis (alone)	4
Ichthyosis vulgaris (alone)	1
Keratosis pilaris (alone)	3
Atopic dermatitis/ ichthyosis vulgaris	1
All 3 diagnoses	1
Age, y	
Range	1–14
Mean	4.9
Sex, n	
Female	6
Male	4
Ethnicity, n	
Hispanic	5
Asian	2
Caucasian	2
African American	1

forearm skin and for affected skin sites (Table 2). Transepidermal water loss could not be obtained in 2 participants younger than 2 years due to movement artifact. For ease of review, the results have been broken down by disease state.

Atopic Dermatitis—Atopic dermatitis results are summarized in Table 3. All participants with AD demonstrated dermal erythema, prominent dermal vasculature, prominence of the interkeratinocyte spaces, and epidermal hyperkeratosis (Figure 1). One participant also demonstrated hyperkeratosis at the tip of the hair follicles. Reductions in background erythema, interkeratinocyte space prominence, and hyperkeratosis were noted after therapy, mirroring reductions in EASI, CDLQI, and TEWL.

Ichthyosis Vulgaris—Data for the IV participants are shown in Table 4. The atopic scores apply to only the 2 participants with comorbid AD. Average EASI scores trended slightly higher for the first 2 visits for AD participants with IV (5.4 and 2.5, respectively) than those without IV (5.1 and 2.2, respectively), but the number of participants is too small to draw a true conclusion.

The following parameters were noted under dermoscopy: prominence of linear dermatoglyphic patterning, raised or ragged keratinocyte borders, background erythema, and presence of dull sheen. Physical features are exemplified in Figure 2. Notable improvements in the skin microrelief pattern in IV participants were seen, as demonstrated in Figure 3.

Table 2.

TEWL for All Conditions Before and After Therapy[a]

TEWL	Baseline	Week 1	Week 4
Unaffected skin, g/m^{2}h	17.5	15.4	14.3
Affected skin, g/m^{2}h	18.9	15.9	13.9

Abbreviation: TEWL, transepidermal water loss.
[a]Eight participants evaluated; TEWL could not be obtained in 2 participants aged <2 years.

Table 3.

Parameters Measured in Atopic Dermatitis Participants

Parameter Assessed	Baseline	Week 1	Week 4[a]
EASI score	5.1	2.4	0.8
IGA score[b]	3.0	2.2	1.3
CDLQI	12.3	6.3	4.1

Abbreviations: EASI, eczema area and severity index; IGA, investigator global assessment; CDLQI, children dermatology life quality index.
[a]The final scores represent the cumulative results after usage of Mustela® Stelatopia® Cream Cleanser and Moisturizing Cream for 4 weeks, with usage of topical class V corticosteroids as needed for 3 weeks.
[b]IGA score ranged from 0 (clear) to 5 (very severe disease).

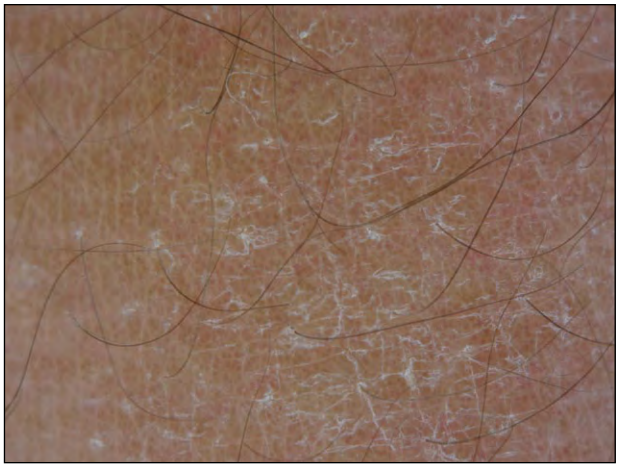

Figure 1. Typical appearance of atopic dermatitis under dermoscopy with prominence of interkeratinocyte spaces and hyperkeratosis.

Keratosis Pilaris—Data for KP participants are shown in Table 5. Keratosis pilaris participants demonstrated background dermal vascular ectasia and follicular hyperkeratosis, appearing as widening and irregular-sized tips of the hair follicles of the affected areas; these features improved with emollient application.

Comment

Dermoscopy is a useful adjunct to pediatric dermatology practice in the evaluation of pigmented and vascular lesions.[13] When performed without polarization, superficial or epidermal structures are easily visualized; hence, it is well-suited to identify follicular hyperkeratosis and other raised lesions of the skin. With polarization, deeper structures such as the vasculature are well-visualized.[1]

The barrier has been noted to be an essential part of the pathophysiology of AD, IV, and KP.[10-12,14] Specifically, mutations in the gene encoding filaggrin have been noted to participate in AD and IV, causing associated barrier abnormalities.[15,16] Furthermore, abnormalities in quality of life, TEWL, and clinical disease severity have been noted to correlate with each other in the scoring and evaluation of AD.[9-11]

Dermoscopy provides good magnification of keratinocytes and the surface barrier structures; in IV, polarization seems to enhance visualization of irregular keratinocyte borders. Dermoscopy also helps to obviate underlying vascular ectasia and erythema, which aids in identifying patients with keratosis pilaris rubra faceii.[2] Dermoscopy also demonstrated reductions in the following parameters: background erythema, hyperkeratosis, and interkeratinocyte space prominence in participants with AD, IV, and KP. Eczema area and severity index, CDLQI, and TEWL also improved.

Given the overlap of genetic abnormality of the filaggrin gene in AD and IV, similar architectural appearance under dermoscopy is not surprising.[14,15] This study demonstrates that the dermoscopic appearance of AD and IV, even in the absence of clinical overlap, demonstrate similar dermoscopic changes, namely prominence of the interkeratinocyte space and hyperkeratosis. Under dermoscopy, the presence of ragged-edge keratinocytes with

Table 4.

Parameters Measured in Ichthyosis Vulgaris Participants

Parameter Assessed	Baseline	Week 1	Week 4[a]
EASI score (n=2)[b]	5.4	2.5	0.5
IGA score[c]	3.0	2.0	1.5
CDLQI	12.5	4.0	3.0

Abbreviations: EASI, eczema area and severity index; IGA, investigator global assessment; CDLQI, children dermatology life quality index.
[a]The final scores represent the cumulative results after usage of Mustela® Stelatopia® Cream Cleanser and Moisturizing Cream for 4 weeks, with usage of topical class V corticosteroids as needed for 3 weeks.
[b]Scores for 2 participants with comorbid atopic dermatitis.
[c]IGA score ranged from 0 (clear) to 5 (very severe disease).

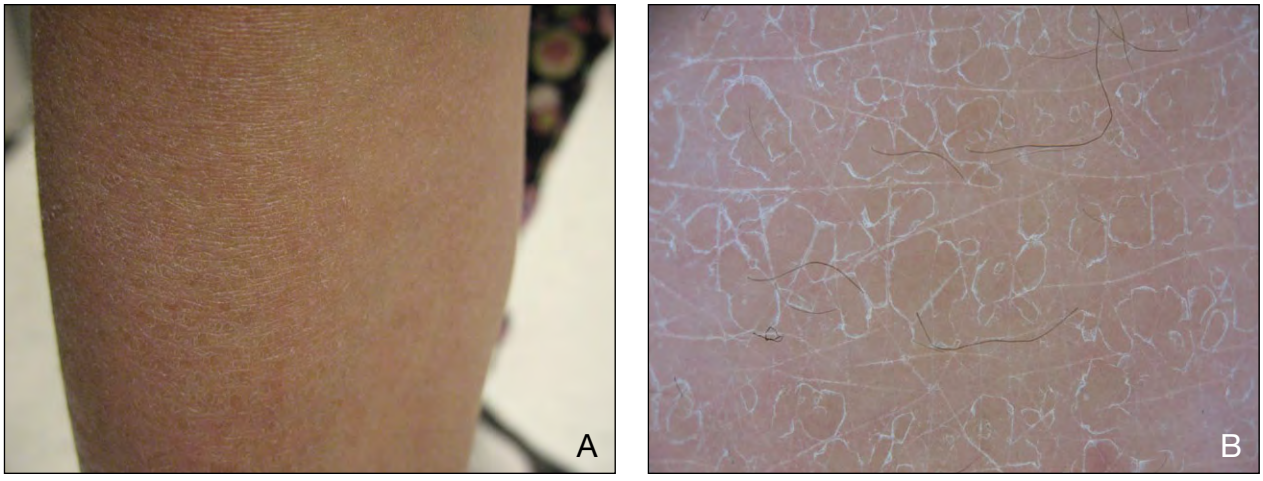

Figure 2. The right shin of a 9-year-old Asian girl with untreated ichthyosis vulgaris demonstrated prominence of the skin lines (A). Dermoscopy of the shin area demonstrated extreme prominence and ragged appearance of the interkeratinocyte space and irregular keratinocyte borders (B).

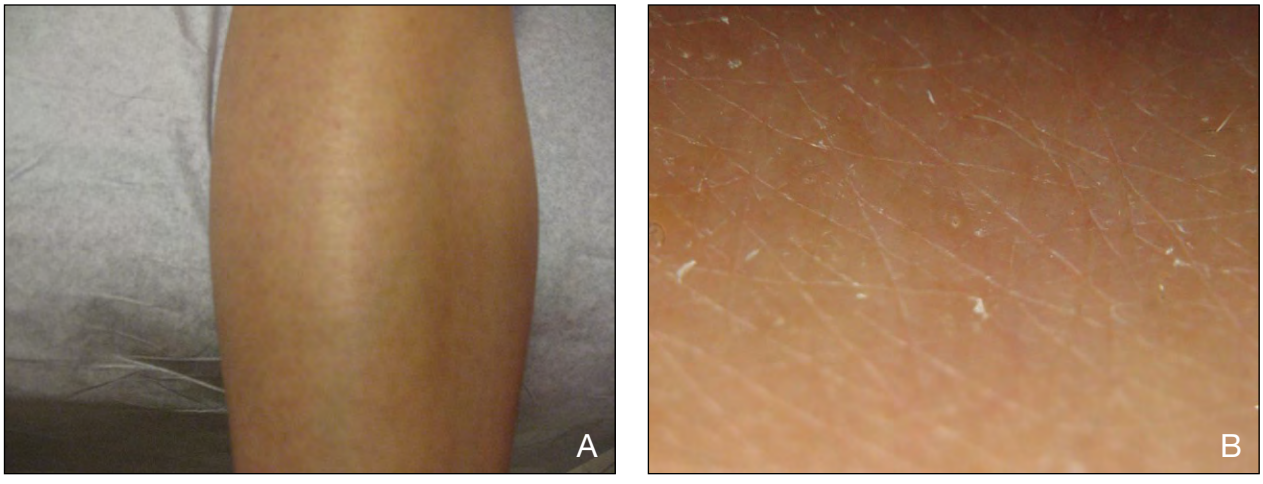

Figure 3. After 4 weeks of usage of Mustela® Stelatopia® Moisturizing Cream, clinical (A) and dermoscopic (B) improvements were noted. The interkeratinocyte space was less prominent and irregular keratinocytes were no longer noted, which equate to a reduction in children dermatology life quality index from 13 to 4.

irregular shapes seems to be limited to IV participants, but the number of participants in the pilot trial cannot exclude overlap of this finding as well.

Notable improvements in dryness, desquamation, and roughness have been described in AD patients using Mustela Stelatopia Moisturizing Cream containing sunflower oil distillate,[17] which has been shown to have anti-inflammatory properties.[17-19] These clinical improvements are reflected by dermoscopic improvements in keratinocyte shape, reductions in follicular hyperkeratosis, and improvements in the appearance of interkeratinocyte spaces.

Dermoscopy appears to be able to identify underlying improvements in cutaneous dermatoses. Although the sample size was small in this clinical trial, the improvements in barrier state are both notable and reflective of the overall EASI and CDLQI score; however, the population size is not large enough to assess statistical significance.

The absence of an IV score in the general literature is due to a difficulty in quantification of localized disease severity. Usage of dermoscopy allows for the first visually quantifiable parameters of localized disease severity for IV patients. Recognition of underlying IV also may be useful as a severity marker in atopy, thus dermoscopic analysis of target areas, such as the anterior shins, may be a useful adjunct to AD care.

Table 5.

Parameters Measured in Keratosis Pilaris Participants

Parameter Assessed	Baseline	Week 1	Week 4[a]
EASI score (n=1)[b]	4.2	2.3	0
IGA score[c]	3.0	2.0	2.0
CDLQI	14.0	3.0	2.0

Abbreviations: EASI, eczema area and severity index; IGA, investigator global assessment; CDLQI, children dermatology life quality index.
[a]The final scores represent the cumulative results after usage of Mustela® Stelatopia® Cream Cleanser and Moisturizing Cream for 4 weeks, with usage of topical class V corticosteroids as needed for 3 weeks.
[b]Scores for 1 participant with comorbid atopic dermatitis.
[c]IGA score ranged from 0 (clear) to 5 (very severe disease).

Further testing of interobserver differences and reproducibility will be required in the future. Larger-scale validation of dermoscopy as a solo tool for evaluation of barrier-based skin disease also will need to be performed.

Conclusion

Dermoscopic photography with or without a polarized light can be used to demonstrate improvement in skin health, such as improvements seen after emollient usage for AD, IV, and KP. Dermoscopic evaluation of all 3 conditions demonstrates irregular or ragged keratinocytes, prominence of the interkeratinocyte space, and follicular hyperkeratosis. Prominent background erythema is notable in many AD and KP patients, while keratinocyte irregularities are more prominent in patients with IV. This pilot study identifies several ways in which dermoscopy may aid in disease assessment and follow-up for patients with AD, IV, and KP, namely presence of erythema, keratinocyte shape and regularity, and follicular prominence. Dermoscopic improvements in erythema and skin microrelief may prove useful to reflect improvements in TEWL, reduced sleep disturbance and pruritus, improved quality of life, and improved physical appearance, though larger patient subsets would be needed to validate this method.

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