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Use of a Silklike Bedding Fabric in Patients with Atopic Dermatitis

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Abstract: **Symptoms of atopic dermatitis are often affected by environmental irritants. Modulation of potential irritants may benefit such symptoms. The purpose of this study was to evaluate the impact of a novel silklike bedding fabric for persons with mild to moderate atopic dermatitis. Participants with mild to moderate atopic dermatitis were provided a bedsheet set. Eczema Area and Severity Index and Investigator Global Assessment were the primary outcome measures. Visual Analog Scale for itch and a quality of life were also evaluated. The Wilcoxon signed rank test indicated a significant decrease in severity, with the Investigator Global Assessment score decreasing from 2.05 to 1.74 at week 8 ($p = 0.03$), the Eczema Area and Severity Index decreasing from 2.63 at baseline to 2.19 ($p = 0.014$), and the itching score decreasing from 3.97 to 3.00 ($p = 0.010$). An increase in the study-specific quality of life index was also observed, changing from −0.08 (no change in quality of life) to 1.23 (some improvement) ($p < 0.0001$). Atopic dermatitis is commonly recalcitrant to therapy and synthetic silklike bed linens may have value as another option for the treatment of this disease. This pilot study demonstrated promising results that warrant confirmation in controlled clinical studies.**

Atopic dermatitis (AD) is a chronic pruritic, inflammatory, immunologically based skin disease generally occurring in patients with a genetic predisposition. The etiology is unknown. The initial occurrence of AD is often during the first year of life, and although it may improve with age, it can persist or recur periodically. A family history of atopy (asthma, hay fever, AD) often accompanies AD. Symptoms can range from red skin with dry scale to acute vesicular lesions to painful fissures or chronic scaling thickened plaques.

Standard therapeutic modalities are directed at controlling the predominant symptoms of the disease. These therapies include the liberal use of emollients, minimizing contact with irritants, antihistamines, and antibiotics. The use of a low-potency topical corticosteroid is often recommended. Mid-to-high-potency topical corticosteroids are the therapy of choice when more aggressive treatment is needed. Corticosteroids can be associated with skin atrophy, folliculitis, acneiform eruptions, hypopigmentation, perioral dermatitis, contact dermatitis, secondary infection, skin atrophy, and striae. Another treatment modality includes use of topical calcineurin inhibitors (tacrolimus and pimecrolimus), which may have fewer cutaneous adverse effects. Ultraviolet

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A/B light treatments and systemic medications (corticosteroids, cyclosporine, antibiotics) are sometimes indicated.

Many factors are known to worsen AD including food and inhalant allergies, climatic factors, and chemical or physical irritants such as house dust mites, harsh textile fibers and clothing (particularly wool and synthetic fabrics), and aggressive detergents. Because wool and synthetics are often irritating to the AD patient (1), cotton is usually recommended. Cotton is a natural fiber that is known to conduct heat well, and to have excellent moisture absorption. Yet, when cotton is examined microscopically, it reveals enough roughness to induce a mechanical friction on the sensitive skin of a patient with AD (2). In addition, residual detergents that may be an irritant to the skin may remain in cotton fabrics after washing (3). Cotton, wool, and linen fibers are originally only 2 to 4 cm long. They have to be spun to form a unique thread that is coarse like tangled straws and therefore potentially irritating. Polyester/cotton blended fabrics have many fibers and surface contaminants that may cause skin irritation.

Several studies have demonstrated a benefit from using silk fabrics in the treatment and prevention of AD (4–7). Silk fibers are made of long filaments which are perfectly smooth and therefore are not a source of friction and irritation to the skin (4). Silk fabrics coated with antimicrobial agents intended to battle the infectious factors of AD are available, but the antimicrobial efficacy of the fabrics has not been demonstrated in vivo despite promising results in vitro (5,8,9). Although silk fabric has several favorable characteristics, it is not a practical material to use for bedding because it does not effectively wick away moisture. In addition, silk is delicate and is not durable enough to withstand continued washings.

Synthetic, silklike fabrics may offer some of the benefits of silk with greater durability. In this study, we explore the potential utility of a novel silklike bedding fabric for alleviating symptoms related to AD.

Materials

The silklike fabric (DermaTherapy^{TM}; Precision Fabrics Group, Inc., Greensboro, NC) used in the bed sheets is fabricated from a light-weight, plain-weave fabric woven of 100% synthetic yarns. The fabric comprised approximately 50% polyester and 50% nylon. It is made with 285 threads per square inch and weighs 2.33 ounces per square yard, which is 60% less than the weight of a polyester/cotton fabric.

The yarns in the fabric are formed from continuous-filament fibers, with no fibers projecting beyond the planar surface of the fabric to irritate sensitive skin (Fig. 1). The silklike fabrics have a soil/oil release finish, so that creams, body fluids, and oils are completely removed in laundering. The manufacturer also incorporates a durable antimicrobial finish to the fabrics during the polymerization process, which may be effective in preventing growth of *Escherichia coli* and *Staphylococcus aureus* on the skin.

The silklike fabrics have no dyes or other chemicals that can leach out over time. They can be laundered in a high temperature wash at home or in a hospital laundry. The fabric is designed to rapidly wick moisture, to control odors and bacteria on the fabric, and to provide a smooth sleep surface for patients with sensitive skin.

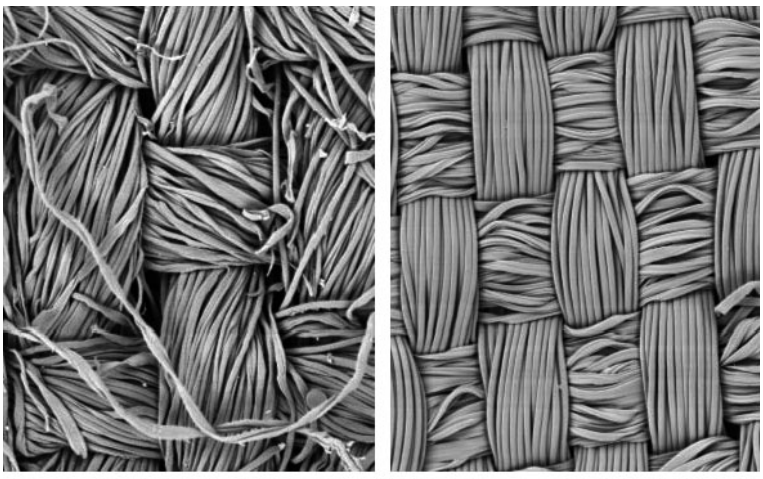

Figure 1. Photographic comparison of standard bedding fabric and silklike bedding fabric.

METHODS

Inclusion Criteria and Concomitant Therapy

Participants were enrolled with a clinical diagnosis of mild to moderate AD as determined by the Eczema Area Severity Index (EASI), Investigator Global Assessment (IGA), and a Visual Analog Scale (VAS) for itch. No topical or systemic treatments for AD were permitted during the study, except the use of emollient moisturizers. The washout periods for topical and systemic therapies were 7 and 28 days, respectively.

Study Design

Following approval by the Institutional Review Board, 37 subjects with mild to moderate AD ($>5\%$ body surface area and <3 on the IGA scale) were enrolled. Subjects were provided with a set of experimental silklike fabric bed sheets, including a bottom sheet, a top sheet, and a pillow case, and were instructed to sleep on the bedding every night for 8 weeks. Subjects were instructed to dress in underwear for the night in order to leave as much of the skin in contact with the bed sheets as possible. If the wearing of underwear was not possible, subjects were instructed to wear bed clothes with short sleeves and short pants or a sleeveless short nightgown.

Subjects were permitted to apply moisturizer (Cetaphil® Moisturizing Cream; Galderma Laboratories, LP, Fort Worth, TX) as needed during the day and in the evening. Subjects were not permitted to use any concomitant topical or systemic medication to treat AD while participating in the study. The use of concomitant medications for other medical conditions (e.g., hypertension, diabetes, acute infections) was allowed during this study.

At the 2-week, 4-week, and 8-week visits, subjects were screened for adverse events and severity of disease was assessed using the IGA and EASI. Participants (or parents, for those unable to respond) completed the VAS assessment of their pruritus and the QOL questionnaires. Safety was assessed from reported adverse events.

Statistics and Ethical Considerations

This study tested the hypothesis that a difference in efficacy changes from baseline to 8 weeks exists, as assessed by the clinical investigators using the IGA and EASI. The difference in patient assessment was evaluated using a VAS for subjective rating of itching, and the QOL Assessment, both measured from baseline to week 8. With a sample size of 37 (with 8% attrition rate), and an alpha of 0.05, the power of the test is approximately 80%. Statistical analyses were performed using nonparametric rank tests. All subjects were included in the safety analyses.

TABLE 1. *Demographics of Study Participants*

Age, mean (SD; range)	15.90 (17.73; <1–69) [≤ age 18 = 27]
Race	
White	15 (40)
Black	18 (49)
Other	4 (11)
Female	29 (78)

Values are expressed as *n* (%).

RESULTS

All 37 of the enrolled study subjects completed the trial. Demographics of the study participants are presented in Table 1. Outcomes measures are presented in Table 2/ Fig. 2. A statistical comparison of severity outcome means between week 8 and baseline, using a nonparametric signed rank test, suggests a significant decrease in severity, with the IGA score decreasing from 2.05 to 1.74 at week 8 ($p = 0.03$) Fig. 3, the EASI decreasing from

TABLE 2. *Average Study-Specific Quality of Life (QOL), Eczema Area Severity Index (EASI), Subjective Itch Assessment, and Investigator Global Assessment (IGA) scores throughout the study (QOL questionnaire not performed at week 2 of trial)*

Variable	Description	Baseline ($n = 37$)	Week 2 ($n = 35$)	Week 4 ($n = 31$)	Week 8 ($n = 35$)
Average QOL	−1 = Worse				
	0 = No change	−0.08		1.16	1.23
	1 = Some improvement	(0.44) [−0.23, 0.069]		(0.60) [0.94, 1.37]	(0.66) [1.00, 1.45]
	2 = Significant improvement				
EASI	0 = None	2.63	2.27	1.55	2.19
	72 = Severe	(1.45) [2.14, 3.11]	(1.67) [1.70, 2.85]	(1.08) [1.16, 1.95]	(2.49) [1.33, 3.05]
Assessment of Itch	0 = No itch	3.97	3.20	2.71	3.00
	10 = Worst itch	(1.01) [3.64, 4.31]	(1.94) [2.53, 3.87]	(1.75) [2.07, 3.35]	(2.54) [2.13, 3.87]
IGA	0 = Clear	2.05	2.00	1.81	1.74
	4 = Severe	(0.23) [1.98, 2.13]	(0.54) [1.81, 2.19]	(0.60) [1.59, 2.03]	(0.70) [1.50, 1.98]

SD in parentheses. 95% CI in brackets.

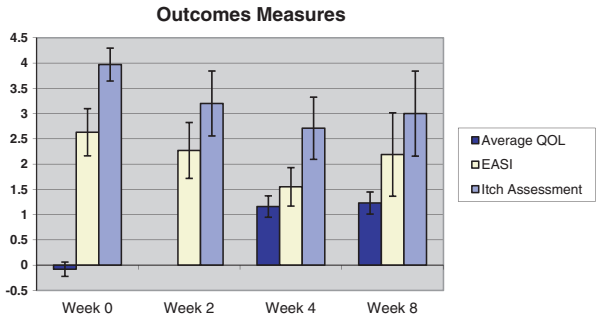

Figure 2. Comparison of mean study specific quality of life (QOL), Eczema Area Severity Index (EASI), and subjective itch assessment scores shows improved QOL, decreased skin involvement, and decreased itch at completion of the study with 95% confidence intervals.

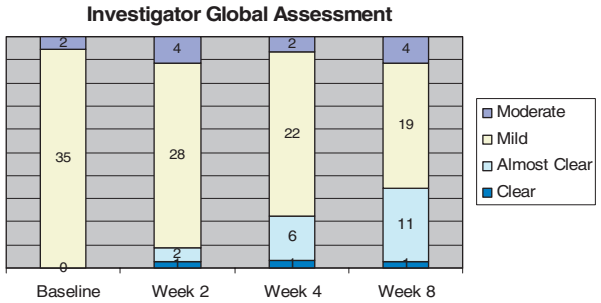

Figure 3. Investigator Global Assessment severity score shows overall decrease in severity of disease at completion of the study.

2.63 at baseline to 2.19 ($p = 0.014$), and the itching score decreasing from 3.97 to 3.00 ($p = 0.010$). A significant increase in the study-specific QOL index was also observed, changing from −0.08 (no change in QOL) to 1.23 (some improvement) ($p < 0.0001$).

Patients reported significant improvement in the amount of itching experienced, tendency to scratch, and overall skin appearance. Study subjects were asked what they liked most and least about the experimental bed sheets. Twenty-three of the subjects commented that they liked the feel of the bed sheets or felt that the bed sheets were comfortable to sleep on, while five subjects reported the sheets improved their sleep. The most frequent complaint about the bed sheets (14 of the subjects) was that the material was too smooth and had a tendency to slide off of the bed. No adverse effects reported during the study were related to the use of the silklike bed sheets.

DISCUSSION

Atopic dermatitis is a chronic inflammatory skin disease that is becoming increasingly prevalent. It is thought to be due to a loss of the barrier function of skin which results in increased epidermal water loss and easier penetration of allergens into the skin. Many exacerbating factors have been identified, including skin exposure to harsh textiles and clothing, chemical irritants, climatic factors, allergens, and cutaneous superinfection (5).

Because the disease is worsened by repetitive frictional trauma from harsh fabrics such as wool, patients with AD are frequently advised to wear clothing made of cotton (10). However, cotton is composed of many short fibers that may irritate and scratch sensitive skin (3–6). Silk has also been suggested as an alternative option for AD patients (4–6), but it is not a practical material to use for bedding because it retains moisture and is not durable.

The silklike fabric used in this study is woven in a pattern that imparts rapid wicking and drying properties when the fabric becomes wet with sweat or body fluids. The fibers used in the silklike fabric are smooth, with no loose fibers on the surface to irritate sensitive skin (Fig. 1) and have a soil/oil release finish, so that creams, body fluids, and oils are completely removed in laundering.

In this study, use of the silklike fabric bedsheets in 37 subjects with mild to moderate AD was associated with statistically significant improvements in the severity of AD, the level of itching, and perceived QOL. Although the degree of severity was small in this study, improvements in all three measured outcomes suggest that this fabric may be beneficial for those with AD.

Limitations of the study include the lack of a control group, small sample size, and limited duration of follow-up. As AD is a waxing and waning condition, and moisturizer allowed in the study may have some therapeutic effect, it is not clear how much of the improvement can be attributed solely to the bedsheets. However, the improvement of AD in these patients was not subtle, and minimal side effects not related to the study product were noted. This pilot study demonstrates promising results that warrant confirmation in controlled clinical studies.

FUNDING

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