Efficacy of a Tailored Moisturizer for Reducing Chemotherapy-Induced Skin Dryness in Breast Cancer Patients: A Randomized Controlled Trial

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Abstract

Introduction: While up to 60% of breast cancer patients undergoing chemotherapy experience skin side effects reducing quality of life, it was unclear which individual product was beneficial. To evaluate the effectiveness of a tailored moisturizer with a high content (1.5%) of pseudo-ceramides on skin dryness due to chemotherapy in breast cancer patients.

Methods: Randomized controlled trial conducted from February 2015 to October 2018. 204 breast cancer patients experiencing skin dryness after 1 cycle of chemotherapy were randomly assigned to 3 groups (tailored moisturizer with high pseudo-ceramide content; general moisturizer; and usual care). Skin dryness, dullness, quality of life, and changes in sebum level were assessed at baseline, 3 weeks, and 1 month after completion of chemotherapy. The primary objective of the trial was to compare the tailored moisturizer group to usual care.

Results: At 1 month after completion of chemotherapy, the tailored moisturizer group was significantly less likely to report severe skin dryness compared to the usual care group (8.5 vs. 27.9%, respectively, $P < 0.01$). The tailored moisturizer group reported significantly lower levels of skin dullness and lower levels of impairment of dermatological quality of life compared with the other two groups.

Conclusions: A tailored moisturizer with a high content of pseudo-ceramides improved skin dryness, dullness and dermatological quality of life compared to usual care in breast cancer patients undergoing chemotherapy.

Introduction

The majority of breast cancer patients receive standard chemotherapy regimens including doxorubicin, cyclophosphamide, fluorouracil, or taxotere (docetaxel) ^{1,2}. These regimens target rapidly dividing cells ³ and produce a variety of cutaneous adverse effects. The most common skin symptoms reported by breast cancer patients treated with chemotherapy are skin dryness (57.9%) and dullness (49.1%) ⁴, but these patients also report alopecia, erythema, pruritus, macular eruptions, hyperpigmentation, and desquamation ⁵⁻¹¹. The cutaneous adverse effects of cancer treatment are not only very common, but also often visible on the face, arms, and/or upper torso, impairing body image and quality of life of breast cancer patients. Moreover, these adverse effects can be directly responsible for treatment discontinuation, reduced compliance and therapeutic success rates.¹²

A board of experts recommended the use of clinically tested skin care interventions to manage cutaneous reactions prior to, during, and after cancer therapy ¹³. However, the evidence on interventions such as urea-based cream ¹⁴ or fluorouracil 5% cream ¹⁵ is limited by the studies that lacked a control group, by the focus on targeted therapy, or by the simultaneous use of multiple products ^{16,17}, so that it was unclear which individual product was beneficial. Moreover, there is no randomized evidence evaluating the

efficacy of any tailored intervention for managing specific skin problems such as chemotherapy-induced dryness.

A recent cohort study of breast cancer patients undergoing chemotherapy found that skin dryness after chemotherapy was significantly associated with decreased skin sebum content ⁴. Chemotherapy drugs may decrease sebum production from sebaceous glands and impair the skin barrier function with unpleasant symptoms. Furthermore, the disrupted barrier function and water deficiency that occurs in the skin of patients undergoing chemotherapy can be repaired by the topical application of natural ceramides ¹⁸ or synthetic pseudo-ceramides ¹⁹.

We thus designed a randomized controlled trial to test the efficacy of a tailored moisturizer with a high content (1.5%) of pseudo-ceramides for managing chemotherapy-induced dryness compared to usual care in patients with breast cancer receiving adjuvant chemotherapy ¹⁹. As a secondary comparison, we compared the tailored moisturizer with a general moisturizer.

Results

Among 791 patients initially eligible, 502 patients (63%) agreed to participate in the trial. After excluding 254 patients (51%), we randomized 247 participants (82 to the tailored moisturizer, 82 to usual care, and 83 to the general moisturizer) (**Figure 1**). Forty three patients withdrew prior to the baseline visit, leaving 204 patients in the study. After randomization, 16 patients withdraw because of inconvenience related to participating in the study, and 12 patients were lost to follow-up for the visit at 1 month after completion of chemotherapy, leaving 176 participants in the trial (tailored, $N = 59$; usual care, $N = 61$; general, $N = 56$).

The average age of study participants was 48.2 years, and 85.2% of participants had stage I or II breast cancer. Patient characteristics were well balanced across study groups (**Table 1**). The proportion of patients with severe skin dryness at baseline in the tailored, usual care, and general moisturizer groups were 26.7, 21.9, and 35.4%, respectively (**Figure 2**). At 1 month after completion of chemotherapy, the tailored moisturizer group was significantly less likely to report severe skin dryness compared to the usual care group (8.5 vs. 27.9%, respectively, $P < 0.01$), but similar to the general moisturizer group (8.9%, $P = 0.93$) (**Figure 2**).

Compared to the tailored moisturizer group, sebum content in the usual care group was significantly lower at 3 weeks and at 1 month after completion of chemotherapy (**Table 2** and **Figure 3A**). The general moisturizer group also showed lower sebum content compared with the tailored moisturizer group at 3 weeks and at 1 month after completion of chemotherapy, but the difference at 1 month after completion of chemotherapy was not statistically significant (**Table 2** and **Figure 3B**). The change in water content showed a similar pattern to the change in sebum content, but none of the differences across the 3 groups were statistically significant (**Table 2**).

At 1 month after completion of chemotherapy, patients in the tailored moisturizer group reported significantly lower levels of skin dryness (mean score 3.8) than those in the usual care group (mean score

5.4, $P = 0.001$), but similar to those in the general moisturizer group (mean score 4.4, $P = 0.18$) (**Table 3**). The tailored moisturizer group also reported significantly lower levels of skin dullness (mean score 3.1) than both comparison groups (usual care group 4.6, $P = 0.012$; general moisturizer group 4.4, $P = 0.024$). The tailored moisturizer group also reported significantly lower levels of impairment of dermatological quality of life (mean score 2.0) than both comparison groups (usual care group 4.8, $P < 0.001$, general moisturizer group 3.9, $P = 0.018$).

In the tailored and general moisturizer groups, 13 (22.0%) and 11 (19.6%) patients skipped moisturizer use for three consecutive days or more, respectively. In the usual care group, the median number of cosmetic products per day by patients in the usual care group was 6 (**Supplement Table 1**).

There were no participants who had unintended effects in this study.

Discussion

In this randomized controlled trial, breast cancer patients undergoing chemotherapy assigned to a tailored moisturizer with a 1.5% pseudo-ceramide content to prevent loss of sebum levels reported less dryness, less dullness, less stress, and better dermatological quality of life at 1 month after completion of chemotherapy compared to patients assigned to usual care. In addition, the usual care group experienced a significant reduction in sebum content compared to the tailored moisturizer group. Patients in the tailored moisturizer group also experienced significantly less dullness and better dermatological quality of life at 1 month after completion of chemotherapy compared to the general moisturizer group.

Chemotherapy induces skin changes comparable to accelerated aging, including increased skin fragility²⁰. Chemotherapy drugs decrease sebum production in the sebaceous glands and cause loss of the skin barrier function. This results in loss of moisture and lipids in the stratum corneum of the epidermis with a sensation of skin dryness. General moisturizers and other cosmetics which provide only lipid or water content may temporarily increase the oil and water content in the stratum corneum of the epidermis, but this is insufficient to maintain effective skin sebum levels and to improve the barrier function of the skin deteriorated by chemotherapy.

We hypothesized that a tailored moisturizer with a high level of pseudo-ceramides would prevent loss of moisture and lipids by improving skin the barrier function of the epidermis^{21,22}. The tailored pseudo-ceramide moisturizer in our study closely mimicked the composition of skin lipids, which include fatty acids, triglycerides, and cholesterol, which may also contribute to more effective absorption and to a synergistic effect of lipids and moisture. Indeed, the usual care and the general moisturizer groups in our study had a more marked decrease in sebum content compared to the tailored moisturizer group, although only the difference between the usual care and the tailored moisturizing group was statistically significant.

Restoration of skin ceramide levels is also under development to manage other skin side effects of chemotherapy in addition to dryness^{23,24}. In our study, patients in the tailored moisturizer group reported

less distress due to skin problems and better dermatological quality of life during chemotherapy compared with other groups. While the efficacy of ceramides in improving skin function has been shown in many animal and clinical studies^{19,23,25}, there was little evidence in chemotherapy-induced skin changes. Additional studies with larger sample sizes are needed to evaluate the effect of ceramides in different cancer patients and to better understand the molecular mechanisms underlying lipid barrier restoration in chemotherapy induced skin changes.

In our study, patients in the usual care group used an average of 6 cosmetics to prevent potential skin problems during chemotherapy, but they still experienced more dryness and other skin problems compared to the other study groups. It is possible that the products that they used had low skin absorption, lacked an adequate lipid content, or aimed only at immediate correction of skin dryness. These products may improve skin dryness temporarily but fail to restore skin lipids and the skin barrier function in breast cancer patients with chemotherapy. In addition, patients in the usual care may have used cosmetics on demand, while about 80% of the tailored moisturizer group used the intervention consistently throughout the study period.

There are several limitations to our study. Patients who had more sensitive skin or who were more interested in skin health may have been more likely to participate in our study. Furthermore, study participants may be more likely to report skin-related problems or symptoms than patients who did not participate in the study. However, we restricted eligibility to enroll the patients who were most likely to benefit from the intervention, a design commonly called targeted or enrichment design. In addition, patients were randomly assigned to the three study groups, and their socio-demographic and clinical characteristics at baseline were not different across the groups.

In addition, this study was conducted at a tertiary cancer hospital in South Korea, and the results may not be generalizable to patients in different settings or in other countries. Yet, chemotherapy regimens for breast cancer are standardized worldwide and chemotherapy-induced skin toxicity is a well-known side effect of breast cancer chemotherapy. However, larger studies from multiple institutions are needed to confirm our findings.

In conclusion, we found that a tailored moisturizer with a high content in pseudo-ceramides improved skin dryness, dullness and dermatological QoL compared to usual care in breast cancer patients undergoing chemotherapy. While additional clinical trials with diverse populations are needed, our trial indicates that a tailored moisturizer may provide beneficial supportive care for breast cancer patients who are likely to experience chemotherapy-induced skin dryness and associated problems.

Methods

Trial design and participants

This study was a single-center, randomized controlled trial (registered in Clinical Research Information Service, CRIS: KCT0001372 http://cris.nih.go.kr/cris/en/search/search_result_st01.jsp?seq=6665 and

date of registration and the date of enrollment of the first participant were 14/01/2015 and 16/02/2015, respectively.) conducted from February 1, 2015 to October 31, 2018 at the Samsung Comprehensive Cancer Center in Seoul, South Korea. We used a 2-phase strategy to recruit study participants with incident (new onset) skin dryness after 1 cycle of chemotherapy. First, we recruited patients 35 to 65 years of age with a postoperative diagnosis of stage I to III breast cancer who were expected to receive doxorubicin plus cyclophosphamide (AC), fluorouracil plus cyclophosphamide and doxorubicin (FAC), or taxane (T) as adjuvant chemotherapy. We excluded patients with severe skin dryness, atopic dermatitis, psoriasis, or infectious skin diseases prior to chemotherapy, as well as patients who were taking steroids, antihistamines, anti-depressants or anticonvulsants. Second, patients who had agreed to participate in the trial prior to chemotherapy were contacted after 1 cycle of chemotherapy and asked about the development of skin dryness to confirm final eligibility.

Randomization and interventions

Patients were randomized in a 1:1:1 ratio to receive either a tailored moisturizer (1.5% pseudo-ceramide content), usual care, or a general moisturizer (water-based). The primary comparison was between the tailored moisturizer and usual care. The secondary comparison was between the tailored moisturized and the general moisturizer. Randomization was conducted centrally by an independent statistician using randomly permuted blocks and stratified by menopause status and Herceptin treatment. The allocation information was concealed in sealed envelopes and stored at the investigator's premises until the end of the trial. The sealed code could only be broken at the request of the principal investigator due either to justified serious adverse events or in case of an emergency. Code breaks and their reasons were documented in the case report form.

The tailored moisturizer (cream: Primera, AMOREPACIFIC, Korea) contained 1.5% of pseudo-ceramides, a lipid that comprises more than 50% of skin lipids. Patients randomized to the usual care group did not received any products. They were told that they could use any product but were instructed to record the type of products and time of dosing during the study period. The general moisturizer (cream: AMOREPACIFIC, Korea) was a general moisturizing cream with the same color and aroma as the tailored moisturizer. Patients assigned to each moisturizer group were asked to apply the moisturizer twice a day (0.5 ml per application) from the first day of 2nd cycle of chemotherapy until 1 month after completion of chemotherapy. The initial application of moisturizers was performed under the guidance of a clinical researcher. The study products were supplied in bottles containing enough solution for approximately 3 weeks and patients received the products on the first day of each cycle of chemotherapy. Moisturizers could be stored under ambient conditions and no specific storage conditions were required. To assess compliance, patients were asked to return the dispensed bottle. We also asked patients if they had skipped the moisturizer for more than 3 consecutive days.

While it was not possible to blind the assignment of treatment vs. usual care group (control group), assignment to the tailored moisturizer and the general moisturizer groups was blinded. Both moisturizers

had same texture, smell, and color, and both were supplied in identical 30 mL plastic bottles. Investigators, outcome assessors, and statisticians were blinded to treatment assignment.

Measurements and outcomes

The primary outcome was patient-reported severe skin dryness on the face at 1 month after completion of chemotherapy. Skin dryness was assessed by the Patient-Reported Outcomes version of the Common Terminology Criteria for Adverse Events (PRO-CTCAE™) ^{26,27}. The PRO-CTCAE question originally included 5 categories that were coded as none (none), moderate (a little or moderate), and severe (severe or very severe). Severe skin dryness was thus defined as severe or very severe dryness using the PRO-CTCAE questionnaire.

The secondary outcomes were two objective skin parameters: cheek surface sebum and water content. Objective skin parameters were measured on the front of the right cheek by trained researchers according to a standard protocol using a Multi-Probe Adapter System (Courage-Khazaka, Germany). Sebum content (approximated to $\mu\text{g}/\text{cm}^2$) was measured only once per visit, while water content (in arbitrary units, AU) was measured three times per visit and the values were averaged. During measurements, patients were asked to lay face up on a bed keeping a straight body position in all visits at the room maintained temperature between 20 and 22 °C and humidity between 30 and 40% ^{28,29}. All outcomes were measured at baseline (beginning of the 2nd cycle of chemotherapy), 3 weeks after baseline, and 1 month after completion of chemotherapy.

In addition, we assessed patient-reported distress due to skin dryness and dullness as well as skin dryness and dullness using a 10-point visual analog scale with scores ranging from 0 to 10 (0 = not at all, 10 = very much). Impairment of dermatological quality of life was measured using the Korean version of the Dermatology Life Quality Index (DLQI) ³⁰. The DLQI consists of 10 simple questions to assess quality of life related to skin problems. Each question had four possible answers scored from 0 to 3. The answers to all questions were added to obtain an overall score on a scale from 0 to 30, with higher scores indicating more impairment of dermatological quality of life ³⁰.

Sociodemographic and behavioral information were collected at baseline using a questionnaire. Clinical information were obtained from electronic medical records. Adverse events were classified and graded according to the Common Terminology Criteria for Adverse Events, version 4.0 [12].

Statistical analysis

The sample size for the trial was calculated to address the primary hypothesis that the tailored moisturizer was more effective than usual care (primary comparison) in preventing chemotherapy-associated dryness at 1 month after completion of chemotherapy. We then adjusted the sample size to incorporate an additional comparison with the general moisturizer (secondary comparison). Based on prior experience, we expected that 60% of patients in the usual care group and no more than 30% of patients in the tailored moisturizer group would report severe dryness on the face 1 month after

completion of chemotherapy. We adjusted the p-values for two comparisons using the Bonferroni method. To conduct pairwise χ^2 tests comparing proportion of severe dryness under Bonferroni adjustment (2.5% level of significance; $P < 0.025$) with 80% power, the sample size of the trial was 58 patients per arm. Since we expected 15% losses to follow-up, we increased the sample size to 68 patients per arm, for a total of 204 randomized participants.

All analyses were conducted using the intention-to-treat principle, whereas study patients were assigned to their randomized group irrespective of compliance with the study intervention. Differences in baseline characteristics among 3 groups were compared using χ^2 tests for categorical variables and t-tests for continuous variables.

We used mixed effect models for longitudinal data analysis to model changes over time in sebum, and water content. P -values < 0.05 were considered statistically significant except for the primary outcome ($P < 0.025$). All analyses were conducted using Stata 15.0 (Stata Corp.; College Station, TX).

Ethical considerations

This study was conducted in accordance with the Declaration of Helsinki and with local laws and regulations. The study protocol was approved by the Medical Ethical Committee of Samsung Medical Center in Seoul, Korea. Eligible patients were fully informed about the study and volunteered to write informed consent. If during the study a patient no longer wished to participate, for whatever reason, the patient was allowed to withdraw consent at any time. An independent monitoring committee reviewed accumulating safety data throughout the trial.

Protocol changes

We revised exclusion criteria because of changes in cancer treatment practice caused by changes in insurance reimbursement. Starting on February 2nd, 2016, we did not exclude patients who received Herceptin. Starting on August 8th, 2016, we did not exclude patients who received taxanes. In addition, to minimize losses to follow-up before patients attended the clinic-based baseline measurement, from November 11th, 2017, we changed the time of randomization to the baseline study clinic visit.

Declarations

Authors' contributions

DK, JSA, and JC had the original idea for the study. All authors were involved in the study design. DZ undertook initial data management. DK undertook subsequent data management and the primary analysis and wrote the first draft. EG provided advice on data management and analysis. All authors contributed to further drafts and approved the final manuscript.

Ethical Approval

The study protocol was approved (SMC 2014-11-093) by the Medical Ethical Committee of Samsung Medical Center in Seoul, Korea. This trial were registered in Clinical Research Information Service, CRIS: KCT0001372 (http://cris.nih.go.kr/cris/en/search/search_result_st01.jsp?seq=6665) and date of registration and the date of enrollment of the first participant were 14/01/2015 and 16/02/2015, respectively. Informed consent was obtained from all the participants.

Data Sharing Statement

Data are available upon reasonable request

Conflicts of interest

JC received grants from AMOREPACIFIC. HP and EK are the employees of the AMOREPACIFIC. Other all authors no conflict of interest.

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Patient consent for publication

Not required.

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Tables

Table 1
Baseline characteristics of study participants (N = 176).

	Tailored moisturizer (N= 59)	Usual care (N= 61)	General moisturizer (N= 56)	P-value
Age at diagnosis (years)	48.0 (8.53)	48.2 (7.1)	48.3 (8.2)	0.98
Marital status (married)	51 (86.4)	57 (93.4)	46 (82.1)	0.17
Education status (> high school)	34 (57.6)	33 (54.1)	31 (55.4)	0.93
Employ status				0.25
Housewife or retired	39 (66.1)	32 (52.5)	30 (53.6)	
Employee or self-business	20 (33.9)	29 (47.5)	26 (46.4)	
Monthly family income				0.30
<\$5,000	28 (47.5)	24 (39.3)	30 (53.6)	
≥\$5,000	31 (52.2)	37 (60.7)	26 (46.4)	
Drinking status				0.33
Never drinker	38 (64.4)	35 (57.4)	26 (46.4)	
Past drinker	20 (33.9)	23 (37.7)	28 (50.0)	
Current drinker	1 (1.7)	3 (4.9)	2 (3.6)	
Smoking status				0.06
Never smoker	56 (94.9)	60 (98.4)	49 (87.5)	
Past smoker	1 (1.7)	1 (1.6)	6 (10.7)	
Current smoker	2 (3.4)	0	1 (1.8)	
Disease stage at diagnosis				0.16
Stage 1	26 (44.1)	19 (31.2)	18 (32.1)	
Stage 2	22 (37.3)	32 (52.5)	33 (58.9)	
Stage 3	11 (18.6)	10 (16.4)	5 (8.9)	
Regimen				0.67

Values in the Table are mean (SD) or number (%).

AC, doxorubicin, cyclophosphamide; FAC, fluorouracil, doxorubicin, cyclophosphamide; T, taxotere; TAC, taxotere, adriamycin and cyclophosphamide; TC, taxotere and cyclophosphamide.

	Tailored moisturizer (N= 59)	Usual care (N= 61)	General moisturizer (N= 56)	P-value
AC	27 (45.8)	35 (57.4)	25 (44.6)	
TAC	2 (3.4)	1 (1.6)	4 (7.1)	
TC	7 (11.9)	7 (11.5)	8 (14.3)	
AC + T	19 (32.2)	17 (27.9)	16 (28.6)	
Others	4 (6.8)	1 (1.6)	3 (5.4)	
Hormone therapy	42 (71.2)	49 (80.3)	38 (67.9)	0.28
Targeted therapy	7 (11.9)	7 (11.5)	8 (14.3)	0.89
Menopause	23 (39.0)	21 (34.4)	18 (32.1)	0.74
Values in the Table are mean (SD) or number (%).				
AC, doxorubicin, cyclophosphamide; FAC, fluorouracil, doxorubicin, cyclophosphamide; T, taxotere; TAC, taxotere, adriamycin and cyclophosphamide; TC, taxotere and cyclophosphamide.				

Table 2
Average difference in sebum and water contents from baseline by treatment group.

	Tailored moisturizer	Usual care	General moisturizer
Sebum content in the cheek ($\mu\text{g}/\text{cm}^2$)			
Baseline, mean (SD)	3.29 (3.64)	5.48 (9.95)	6.23 (10.21)
3 weeks, mean (SD)	4.73 (7.29)	2.44 (3.48)	3.96 (8.02)
Change from baseline (95% CI)	1.33 (-0.89, 3.55)	-3.05 (-5.40, -0.70)	-2.11 (-4.51, 0.29)
Difference between groups (95% CI)	<i>Reference</i>	-4.38 (-7.61, -1.14)	-3.44 (-6.72, -0.17)
<i>P</i> value compared to tailored moisturizer		< 0.01	0.04
1 month after completion of chemotherapy, mean (SD)	4.38 (5.76)	2.89 (4.36)	5.22 (11.24)
Change from baseline (95% CI)	0.77 (-1.53, 3.08)	-2.64 (-5.03, -0.25)	-0.96 (-3.36, 1.45)
Difference between groups (95% CI)	<i>Reference</i>	-3.41 (-6.73, -0.09)	-1.73 (-5.06, 1.60)
<i>P</i> value compared to tailored moisturizer		0.04	0.31
Water content in the cheek (AU)			
Baseline, mean (SD)	86.27 (16.68)	82.41 (16.82)	86.35 (35.69)
3 weeks after intervention, mean (SD)	86.15 (20.37)	95.33 (17.53)	79.93 (16.71)
Change from baseline (95% CI)	-0.20 (-6.57, 6.18)	-0.94 (-7.76, 5.88)	-2.32 (-9.23, 4.69)
Difference between groups (95% CI)	<i>Reference</i>	-0.74 (-10.07, 8.59)	-2.13 (-11.52, 7.27)
<i>P</i> value compared to tailored moisturizer		0.88	0.66
1 month after completion of chemotherapy, mean (SD)	88.44 (16.84)	86.94 (14.38)	82.37 (18.82)
Change from baseline (95% CI)	2.15 (-4.20, 8.50)	0.53 (-6.15, 7.21)	-0.10 (-6.80, 6.60)
Difference between groups (95% CI)	<i>Reference</i>	-1.61 (-10.83, 7.60)	-2.25 (-11.48, 6.98)
<i>P</i> value compared to tailored moisturizer		0.73	0.63

Table 3

Patient reported skin dryness, dullness, associated stress, and Dermatology Life Quality Index at 1 month after completion of chemotherapy by treatment group.

	Tailored moisturizer (N= 59)	Usual care (N= 61)	General moisturizer (N= 56)	Tailored moisturizer vs. usual care <i>P</i>-value	Tailored moisturizer vs. general moisturizer <i>P</i>-value
Dryness (0–10)	3.8 (2.6)	5.4 (2.2)	4.4 (2.5)	< 0.01	0.18
Stress due to dryness (0–10)	1.5 (2.4)	2.8 (3.1)	1.8 (2.6)	0.01	0.58
Dullness (0–10)	3.1 (3.0)	4.6 (3.0)	4.4 (3.1)	0.01	0.02
Stress due to dullness (0–10)	1.7 (2.9)	3.5 (3.3)	2.8 (3.0)	< 0.01	0.07
DLQI (0–30)	2.0 (2.8)	4.8 (4.7)	3.9 (4.2)	< 0.001	0.02
Values were mean (SD).					
DLQI, Dermatology Life Quality Index, - Higher score means greater impairment of QoL					

Figures

Figure 1

CONSORT flow diagram of study participants.

Figure 2

Proportion of patients with severe skin dryness in the tailored moisturizer group compared to the usual care (A) and general moisturizer (B) groups.

Figure 3

Average difference in sebum content in the cheek from baseline in the tailored moisturizer group compared to the usual care (A) and the general moisturizer (B) groups.

Supplementary Files

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