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Combination of laser toning, oral supplements, and cosmetic home care improves quality of life and skin lightness in patients with breast cancer: a prospective clinical study

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Abstract

Purpose

We investigated the effects of a comprehensive appearance care program that combined medical interventions and daily cosmetic home care on objective skin conditions and subjective quality of life (QoL) of patients with breast cancer.

Methods

In this single-arm prospective study, 30 female patients with breast cancer were included. The 12-week comprehensive intervention comprised low-fluence laser toning, daily oral supplements, and continuous use of a cosmetic serum. The objective skin parameters and psychological evaluation indices were assessed at baseline and during a 12-week period.

Results

After 12 weeks, skin lightness significantly increased (p = .010), and transepidermal water loss also increased (p = .043). The Perceived Stress Scale-10 and emotional QoL (Skindex-16 emotional subscale) scores significantly improved as early as 4 weeks after intervention initiation. Furthermore, the social-functional QoL (Skindex-16 functional subscale) scores showed significant improvement at 12 weeks (p = .014). Intervention-related adverse events (Common Terminology Criteria for Adverse Events Grade ≥ 1) were not observed.

Conclusions

This comprehensive appearance care intervention progressively improved objective skin lightness and patient psychological states. This study illustrated that the combination of medical and self-care approaches could be a new strategy for supportive care that addresses appearance-related distress. Future randomized controlled trials are necessary to clarify the mechanisms underlying the effects of this intervention.

Introduction

Due to the advancements in outpatient cancer therapies, an increasing number of survivors continue to engage in social activities during cancer treatment. In this context, treatment-induced skin toxicities and visible changes represent a substantial barrier that frequently lead to severe psychosocial distress, decreased self-esteem, and social impairment [1]. To mitigate these challenges, the clinical utility of supportive aesthetic care has gained widespread recognition in oncology. Rather than mere cosmetic preferences, proactive skin care and cosmetic support have been shown to alleviate emotional distress,

improve body image, and facilitate social reintegration of patients [2]. Furthermore, recent international consensus guidelines highlight that maintaining skin barrier integrity through structured dermocosmetic interventions is critical not only for emotional well-being, but also for supporting treatment adherence by preventing severe toxicities that can lead to treatment modifications or discontinuations [3].

Although the social demand for appearance care is increasing, scientific evidence regarding specific intervention methods has not been sufficiently established. In particular, for skin color changes associated with chemotherapy, cosmetic approaches such as information provision and makeup guidance have been reported to improve patient quality of life (QoL) [4, 5]; however, those studies largely focused on patient feelings as the outcomes. Few reports address the practical implementation of skin care that leads to actual improvement in skin condition. [6].

Chemotherapy-induced pigmentation is considered to be caused by drugs stimulating melanocytes in the epidermis basal layer, increasing melanin production [7]; this mechanism is thought to share pathophysiological pathways with melasma and post-inflammatory hyperpigmentation, particularly regarding subclinical inflammation [8]. Thus, laser toning, which selectively destroys melanin, combined with oral therapy such as tranexamic acid, which suppresses melanocyte activation through anti-inflammatory effects, is theoretically presumed to be effective for improving chemotherapy-induced pigmentation [9]. Beyond these medical interventions, daily skin care, despite its expected functional benefits and the emphasis placed on its importance by international expert consensus for managing treatment-related skin toxicities [3], has rarely been evaluated for its actual effects on objective skin condition.

Therefore, in this study, we proposed a “comprehensive appearance care” program within the framework of routine clinical practice. This program integrates professional care, laser toning, oral supplements, and continuous skincare routines. This study investigated the effects of this comprehensive intervention on objective skin conditions and patient-reported QoL of patients with breast cancer. We hypothesized that this multifaceted intervention, which integrates medical and cosmetic approaches, would improve objective skin conditions while simultaneously alleviating patient psychological and social stress.

Methods

Study design

This single-arm exploratory prospective intervention study was conducted at an appearance beauty clinic from August 2025 through February 2026.

The sample size was determined based on feasibility.

Inclusion and exclusion criteria

Patients were eligible for inclusion if they met all the following criteria: (1) biologically female, (2) currently undergoing systemic anticancer therapy or had a history of systemic therapy within 12 months prior to enrollment, (3) capable of understanding the study objectives and providing written informed consent, (4)able to attend the appearance beauty clinic regularly throughout the study period, and (5) without history of aesthetic medical treatments for the skin since their cancer diagnosis.

The exclusion criteria were as follows: (1) concomitant use of oral medications or supplements for purposes other than the treatment of a specific medical condition, (2) history of severe adverse skin reactions induced by cosmetic products, or (3) ineligibility for study participation at the discretion of the investigator.

Interventions

The intervention consisted of prescription of oral medications and laser toning at the medical institution, and the continuous use of brightening serum as daily home care. At the medical institution, the patients were prescribed oral medications (ascorbic acid/calcium pantothenate combination [Cinal®; Shionogi Healthcare Co., Ltd., Osaka, Japan] 2 tablets/day, active vitamin B6 preparation [Pidoxal®; TAIYO Pharma Co., Ltd., Tokyo, Japan] 40 mg/day, and anti-plasmin agent [Transamin®; Daiichi Sankyo Healthcare Co., Ltd., Tokyo, Japan] 500 mg/day). Additionally, low-fluence 1064 nm Q-switched Nd:YAG laser toning (spot size: 2 mm, fluence: 0.8–1.0 J/cm^2, frequency: 4.5 Hz, 2 passes; StarWalker®, Fotona, Slovenia) was performed by a specialist physician for a total of 3 sessions at approximately 4–week intervals. For daily home skin care, a cosmetic serum containing stearyl glycyrrhetinate [Sekkisei Blue Brightening Refiner Serum, KOSÉ Corporation, Tokyo, Japan] was applied twice daily (morning and evening).

Outcome measures and methods

Objective skin characteristics and subjective psychological assessment indicators were used. Skin measurements were obtained at 2 time points: before the intervention and at 12 weeks postintervention. Skin color tones (*L**, *a**, and *b** values) were assessed using a spectrophotometer (CM-700d, Konica Minolta,Inc., Tokyo, Japan). Additionally, skin hydration was evaluated using the SKICON-200EX (Yayoi Co., Ltd., Tokyo, Japan) and transepidermal water loss (TEWL) was determined using the VapoMeter® (Keystone Scientific K.K., Tokyo, Japan). The measurement sites on the face were the center of the right cheek for skin color tone, and the center of the left cheek for hydration and TEWL. Five recordings were obtained for each area, and the average was calculated.

Patient-reported QoL was collected and evaluated at baseline and at every clinic visit. The interval between each measurement was approximately 1 month. Patient-reported QoL was obtained from the Skindex-16 and Perceived Stress Scale-10 (PSS-10) scores.

The Skindex-16 is a dermatology-specific instrument that assesses the impact of skin diseases on patient QoL based on symptom, emotional, and functional subscales [10]. It has 16 items (4 questions in

the symptom subscale, 7 in the emotional subscale, and 5 in the functional subscale) that measure the level of bother during the previous week using a 7-point Likert scale (0 = never bothered to 6 = always bothered). Scores are transformed into a 0–100 scale; lower scores on all subscales reflect better outcomes [10]. An absolute change of ≥ 10 points is considered clinically meaningful [11].

The PSS-10 is a 10-item inventory used to assess perceived stress [12]. This scale measures the degree to which situations are perceived as stressful. The response items are rated using a 5-point Likert scale ranging from 0 (never) to 4 (very often). The scores range from 0–40; higher scores indicate higher levels of perceived stress.

Safety assessment

Safety was evaluated through physical examinations and medical interviews by a specialist physician.

Safety assessments included monitoring adverse events related to the interventions (laser toning, oral medications, and cosmetic home care) according to the Common Terminology Criteria for Adverse Events (CTCAE) (version 5.0) at each visit.

Statistical analyses

Descriptive statistics for each measurement item were calculated as the mean and standard deviation. For objective skin measurements, pre- and postintervention values were compared using a paired t-test. The *p*-values were adjusted using the Holm method [13]. For patient-reported QoL, a linear mixed model (LMM) was employed. In each model, the measurement time point (baseline, 4, 8, and 12 weeks) was set as a fixed effect, and each participant was included as a random intercept in the random effects to adjust for individual differences. Assuming that missing data were missing at random, parameters were estimated using restricted maximum likelihood, and all available observational data were included in the analysis. The Satterthwaite approximation was used to calculate the degrees of freedom for the models. After estimating the overall effect with the LMM, estimated marginal means (EMMs) derived from the model were used for pairwise comparisons (post hoc tests) between each time point. The *p*-values were adjusted using the Benjamini–Hochberg method [14] to control the false discovery rate (FDR). All statistical analyses were performed using R version 4.4.2 (R Foundation for Statistical Computing, Vienna, Austria).

Results

Participant Characteristics

Thirty Japanese women with breast cancer participated in this study. The median age was 51.5 years (range 39–68). The cohort comprised 25 patients with primary disease and 5 with recurrent disease.

Twenty-six patients had a history of cytotoxic chemotherapy (1 underwent it during the study).

Twenty-seven patients had a history of endocrine therapy (18 with tamoxifen and 9 with aromatase inhibitors), and all received endocrine therapy during the study. Four patients underwent concomitant targeted therapy with abemaciclib (a CDK4/6 inhibitor), and 2 with S-1 (an oral fluoropyrimidine anticancer agent). Twenty-three patients had histories of cytotoxic chemotherapy and endocrine therapy.

Changes in objective skin parameters

The skin characteristics measured before and after the intervention are listed in Table 1. Color information (*L**, *a**, *b**) of the cheek area at baseline confirmed that the skin color of the participants in this study was close to the average for Japanese women in their 50s (*L** = 64.9, *a** = 10.3, *b** = 18.8) [15]. In addition, the skin hydration level was relatively higher than the average level for Japanese women (65.8 μS) [16], and TEWL was approximately half the average value for Asian women in a similar age group (15.79 ± 4.16) [17].

Comparing skin parameters before and after the intervention, a significant increase in the *L** value was observed(Table 1).

The significant increase in the *L** value indicated that the intervention provided improved the lightness of the participants' skin, whereas skin surface hydration remained unchanged, and TEWL significantly increased.

Table 1
Baseline and 12-week postintervention outcomes for skin parameters

Skin parameter	Baseline	Post-intervention	Cohen's dz	95% CI	Adj. p
L*	64.02 (2.89)	64.96 (2.47)	-0.62	[-1.17, -0.24]	**.010**
a*	6.22 (1.42)	5.99 (1.30)	0.21	[-0.12, 0.61]	.532
b*	16.41 (1.84)	16.01 (1.86)	0.41	[0.08, 0.94]	.095
Skin hydration (μS)	87.53 (40.66)	91.53 (45.08)	-0.08	[-0.49, 0.27]	.649
TEWL (g/(m2*h))	8.64 (3.39)	10.81 (4.44)	-0.50	[-0.87, -0.18]	**.043**

Data are presented as the means with the standard deviations in parentheses. Adjusted *p*-values represent correction using the Holm method. Adj., adjusted; CI, confidence interval; TEWL, transepidermal water loss.

Changes in psychological indicators

The psychological indicator scores obtained are presented in Table 2. At the 4-week follow-up, psychological data for 2 participants were missing due to transmission errors in the online questionnaire system. These missing values were addressed using linear mixed models, as described in the Statistical analyses subsection. Regarding the Skindex-16 subscales, a clinically meaningful score change (≥ 10

points) between those before and those after the intervention was observed only in the mean scores of the emotional subscale.

Table 3 lists the comparison results between the measurement points based on the EMMs of each subscale obtained using the LMM. As the primary analysis, the results of the comparison between baseline (0 weeks) and each follow-up point (4, 8, and 12 weeks) are presented.

The PSS-10 scores and the motional subscale scores of the Skindex-16 significantly decreased at all time points (4, 8, and 12 weeks) compared to those at baseline. The functional scores of the Skindex-16 showed a significant difference only in the comparison between baseline and 12 weeks. The symptom scores of the Skindex-16 showed no significant change from the baseline at any point.

Table 2
QoL scores at each point of measurement

Timing	**Skindex-16**			**PSS-10**
	Symptoms	**Emotional**	**Functional**	
Before (n = 30)	12.63 (17.91)	44.70 (22.82)	13.77 (16.79)	19.23 (6.51)
4 weeks (n = 28)	13.96 (18.91)	35.04 (17.77)	10.21 (14.46)	16.50 (6.92)
8 weeks (n = 30)	16.37 (20.58)	29.87 (21.43)	9.63 (13.96)	15.97 (5.97)
12 weeks (n = 30)	10.77 (15.23)	28.23 (20.42)	7.10 (13.14)	17.10 (7.23)

The data are presented as means with standard deviations in parentheses. Lower scores reflect a better QoL. At 4 weeks, data for 2 participants were missing because of transmission failures in the online questionnaire system. PSS-10, Perceived Stress Scale-10; QoL, quality of life.

Table 3
Comparisons of each indicator value between baseline and each measurement point

Measure	Subscale	Contrast	*EMM Diff*	*95% CI*	*Adj. p*
PSS-10		0W – 4W	-2.34	[-3.86, -0.82]	**.014**
PSS-10		0W – 8W	-3.27	[-4.75, -1.78]	**< .001**
PSS-10		0W – 12W	-2.13	[-3.62, -0.65]	**.021**
Skindex-16	Symptoms	0W – 4W	0.92	[-5.73, 7.56]	.820
Skindex-16	Symptoms	0W – 8W	3.73	[-2.77, 10.23]	.385
Skindex-16	Symptoms	0W – 12W	-1.87	[-8.36, 4.63]	.683
Skindex-16	Emotional	0W – 4W	-10.42	[-18.63, -2.22]	**.046**
Skindex-16	Emotional	0W – 8W	-14.83	[-22.86, -6.80]	**.003**
Skindex-16	Emotional	0W – 12W	-16.47	[-24.50, -8.44]	**.001**
Skindex-16	Functional	0W – 4W	-3.83	[-8.18, 0.522]	.217
Skindex-16	Functional	0W – 8W	-4.13	[-8.39, 0.12]	.170
Skindex-16	Functional	0W – 12W	-6.67	[-10.92, -2.41]	**.014**

95% CI indicates unadjusted 95%CIs. The *p*-values were adjusted for multiple comparisons across all items and contrasts using the Benjamini–Hochberg (false discovery rate) method. Adj., adjusted; CI, confidence interval; Diff, difference; EMM, estimated marginal mean; PSS-10, Perceived Stress Scale-10; W, weeks.

Safety assessment and adverse events

During the observation period, no clinically significant, persistent intervention-related adverse events with a CTCAE Grade 1 or higher were observed in any of the patients. As expected, transient mild erythema and localized dryness immediately following the laser toning were commonly noted, although they resolved spontaneously within a few hours without medical intervention. Contact dermatitis and pruritus associated with continuous use of the serum were not reported. Complications such as severe erythema, blistering, or paradoxical worsening of pigmentation due to laser toning were not observed. In addition, the combination of the 3 oral supplements was well tolerated, and side effects, such as gastrointestinal symptoms, were not observed.

Discussion

Through the intervention in this study, a significant increase was observed in the *L** values, which demonstrated the effect of brightening the participants' skin color. Although the changes in the *b** values

did not reach significance (p = .095), they showed a numerical decrease. Moreover, the effect size for this change was moderate (*Cohen's dz* = 0.41). High *b** values and melanin indices have been reported as primary contributors to the visual assessment of skin dullness [18]. This suggests that in addition to skin brightness, yellowish dullness was numerically reduced, which improved the overall skin color impression.

In contrast, TEWL significantly increased, which is a commonly used indicator of reduced skin barrier function. Q-switched Nd:YAG lasers selectively shatter melanin granules through nanosecond pulse irradiation targeting melanin, thereby improving pigmented lesions and skin color [19]. Furthermore, [20] reported that following low-fluence 1064 nm Q-switched Nd:YAG laser irradiation, an increase in TEWL was observed along with a decrease in the melanin index [20]. Although the increase in TEWL observed in this study may reflect a transient change in skin barrier function after laser treatment, the concurrent increases in *L** values and the improved trend in the *b** values suggest that this intervention contributed to the skin color improvements. However, because melanin levels and histological changes in the skin were not directly evaluated in this study, further investigations are required.

The psychological indicators revealed differences in the timing of improvement for each indicator. One month after the intervention started, emotional improvements and perceived stress relief appeared, and at the 3-month mark, improvements in the indicators related to social functioning emerged. This suggests that the reduction in concern about skin conditions occurs relatively early and subsequently ripples out to QoL related to social life. Secrest, et al (2020) reported that in an isotretinoin treatment intervention for patients with acne, the emotion domain in the Skindex-16 improved earlier than improvement in other domains [21]. The high responsiveness in the emotional domain observed in this intervention aligns with trends in previous research, suggesting that our intervention produced a psychological improvement effect similar to those of treatments for dermatological symptoms.

Significant changes were not observed between the before and after intervention Skindex-16 symptom scores. Regarding chemotherapy-induced skin pigmentation, pigmentation can occur secondary to inflammatory skin disorders such as pruritus and erythema, and a certain number of cases are accompanied by these physical symptoms [7, 22]. However, the mean baseline symptom score for the participants in this study was 12.63, which is lower than that for patients with general skin diseases (29 ± 30) [23]. Therefore, because physical skin symptoms (such as pain or itching) associated with pigmentation were relatively mild in our study population, no significant fluctuation in the scores were observed before and after the intervention. Based on these findings, the intervention in this study may have contributed to the recovery of skin-related emotional and social-functional decline caused by appearance changes, not through the relief of physical symptoms, but by objectively improving external appearance, such as skin lightness.

This study has a few limitations. First, this was a single-arm observational study conducted at a single institution without a placebo control group; therefore, the efficacy of the intervention alone was not definitively proven. Second, the sample size was relatively small. Finally, as this was a composite

intervention, it was difficult to identify the individual contributions of each component. Future verification of long-term efficacy through multicenter randomized controlled trials is warranted.

Conclusions

The "comprehensive appearance care" program employed in this study, integrates medical procedures with daily cosmetic home care. The findings suggest that not only did the program objectively improve skin lightness in breast cancer survivors but it also reduced emotional distress and daily stress associated with appearance changes from an early stage and improved social-functional QoL. Furthermore, no noticeable intervention-related adverse events were observed according to the CTCAE criteria. Taken together, these results suggest the potential utility of this aesthetic intervention as a supportive care approach that may concurrently improve skin conditions and psychological well-being. Thus, further evaluations in broader clinical populations are warranted. Although interpretation is somewhat limited owing to the small sample size and single-arm design, this comprehensive approach can be a new way of providing supportive care that addresses appearance-related distress in cancer survivors. Future randomized controlled trials are required to clarify the mechanisms underlying the effects of this intervention.

Statements and Declarations

Author Contributions: All authors contributed to the study conception and design. Material preparation and data collection were performed by Kazumi Horiguchi, Risa Sung, and Hiromi Kobayashi. Data analysis were performed by Risa Sung and Hiromi Kobayashi. The first draft of the manuscript was written by Kazumi Horiguchi and Risa Sung, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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Compliance with Ethical Standards

Competing Interests: The authors have no relevant financial or non-financial interests to disclose.

Author Contributions: All authors contributed to the study conception and design. Material preparation and data collection were performed by Kazumi Horiguchi, Risa Sung, and Hiromi Kobayashi. Data analysis was performed by Risa Sung and Hiromi Kobayashi. The first draft of the manuscript was written by Kazumi Horiguchi and Risa Sung, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Ethics approval: Approval was obtained from the the Ethics Committee of Shiba Palace Clinic (approval number: 159147_rn-40333). This study was conducted in accordance with the principles of the

Declaration of Helsinki.

Consent to participate: Informed consent was obtained from all individual participants included in the study.

Consent to publish: Written informed consent was obtained from all participants for the publication of any potentially identifiable data included in this article.

Data availability statement: Individual participant data are not available for sharing in accordance with the ethical requirements of the study**.**

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