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Research Article

Assessment of the Efficacy and Safety of Employing a Duosomal Chemical Peel for Aesthetic Enhancement in the Periocular and Facial Regions

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Abstract

Introduction: The facial region is particularly vulnerable to age-related alterations, including the development of wrinkles, changes in pigmentation, increased skin roughness and enlarged pores. Duosomal peels have emerged as innovative interventions to ameliorate age-associated changes.

Purpose: This study aimed to evaluate the efficacy and safety of duosomal chemical peels in enhancing the aesthetic appearance of the periocular and facial regions.

Methods: This was a clinical, experimental, prospective and comparative before-and-after study. Duosomal chemical peels were administered to the facial area in three sessions, each conducted one week apart. During each session, documentation was performed using photographs and the SASSQ visual and Face Q scales were used to assess facial dermal changes. The Wilcoxon test was used for statistical analysis and SPSS version 31.0 was used for data analysis.

Results: In this study, a cohort of 11 patients was examined, comprising nine females (82%) and two males (18%). Following the completion of the treatment regimen, Face-Q and Skin Quality scores improved to 30.36 ($p = 0.003$) and 3.13 ($p = 0.006$), respectively. Notably, the Face-Q scale indicated significant enhancements in symmetry ($p = 0.036$), balance ($p = 0.03$), facial appearance and freshness at the end of the day, rested appearance, appearance in photographs ($p = 0.004$), profile appearance ($p=0.014$) and under strong lighting conditions ($p = 0.019$). The Skin Quality Assessment scale demonstrated significant improvements in roughness ($p = 0.008$) and pore size ($p = 0.005$).

Conclusion: Duosomal chemical peels are innovative and effective products for improving facial skin quality, with mild and temporary adverse effects, making them a therapeutic option for enhancing skin quality.

Keywords: Chemical Peel; Chemoexfoliation; Skin; Skin Aging

Introduction

The periocular region of the face is particularly vulnerable to skin aging manifestations, including the development of wrinkles, fine expression lines, loss of firmness and alterations in pigmentation. This aging process is complex and is influenced by a variety of factors, including intrinsic and extrinsic elements as well as genetic predispositions [1-4]. The pathophysiology of skin aging and hyperpigmentation involves intricate interactions among genetic, environmental and cellular factors [5,6].

Various scales exist to evaluate the skin quality of study participants, both objectively and subjectively. These scales are used to assess skin changes before and after dermatological treatment. For instance, the Scientific Assessment Scale of Skin Quality (SASSQ) evaluates skin quality based on parameters such as elasticity, wrinkles, skin surface, pigmentation, erythema and pore size [7]. Another scale, the FACE-Q satisfaction scale, is a rigorously developed patient-reported outcome measure that can be

used to assess outcomes for any type of surgical or minimally invasive facial aesthetic treatment [2,8]. It has been employed to evaluate the safety and efficacy of facial aesthetic treatments in numerous clinical trials and to provide information about the care of study participants in clinical practice.

The management of periocular skin aging and hyperpigmentation requires a comprehensive and multimodal approach. Topical agents, such as retinoids and antioxidants, are effective in improving skin texture, stimulating collagen production and reducing hyperpigmentation. Chemical peels, laser therapy and radiofrequency treatments are commonly used to address specific concerns, including wrinkles, pigmentation and skin tightening. In more advanced cases of periocular skin aging, surgical interventions, such as blepharoplasty, may be necessary to remove or reposition excess skin and fat. Combined therapeutic strategies, such as exfoliation in conjunction with minimally invasive blepharoplasty, have been evaluated and shown to produce superior rejuvenation outcomes [2].

Chemical peeling is a widely used technique for managing various dermatological conditions. The application of chemical agents facilitates epidermal exfoliation, leading to the removal of dead skin cells and the promotion of skin cell regeneration. This procedure can improve the skin appearance, address pigmentation disorders and reduce signs of aging. These agents may be employed individually or in combination to achieve the desired therapeutic outcomes [9]. The minimum recommended age for undergoing a chemical peel depends on the individual's skin type and specific dermatological concerns, although it is generally advised to defer treatment until the skin has fully matured, typically between 18 and 21 years of age. Given that these are superficial chemical peels, they may be administered every 1-3 weeks, depending on the individual's tolerance and skin type [10].

Chemical peels are indicated for a diverse array of dermatological conditions, including acne vulgaris, post-inflammatory hyperpigmentation, melasma, scars, photoaging and pseudofolliculitis barbae [9,11]. They play a pivotal role in facial rejuvenation and are ranked as the fourth most prevalent non-surgical cosmetic procedure [12]. Various agents can be employed in chemical peels, including trichloroacetic acid, salicylic acid, lactic acid, glycolic acid and mandelic acid.

Glycolic acid, classified as an alpha-hydroxy acid, is extensively utilized in chemical peels because of its mild yet efficacious properties, which do not result in adverse effects such as scarring. It penetrates the skin gradually and uniformly, making it an ideal exfoliating agent for sensitive skin. It’s employed in the treatment of acne, hyperpigmentation and aging [10,13,14].

Mandelic acid is an alpha-hydroxy acid known for its keratolytic, antibacterial and anti-inflammatory properties. It facilitates exfoliation, thereby promoting skin cell renewal and aiding in the removal of dead cells from the skin's surface. Additionally, its antibacterial properties make it suitable for individuals prone to acne [15,16]. Lactic acid, an alpha-hydroxy acid, is used in chemical peels because of its keratolytic and exfoliating properties. It facilitates the removal of dead skin cells, improves skin texture and promotes cell renewal. Additionally, lactic acid is recognized for its moisturizing effects, having been demonstrated to enhance skin hydration, diminish wrinkles and increase skin elasticity [17]. Lactic acid peels have shown efficacy and tolerability in treating melasma [18]. Owing to its mild nature, it is often used to treat sensitive skin [13].

Salicylic acid, a beta-hydroxy acid, is extensively utilized in chemical peels due to its keratolytic and anti-inflammatory properties. It facilitates skin exfoliation, unclogs pores and diminishes acne lesions [13]. Consequently, it is effective in treating acne vulgaris and post-inflammatory hyperpigmentation. Salicylic acid peels have demonstrated favorable safety and efficacy profiles in individuals from darker ethnoracial groups [13].

Liposomes are regarded as beneficial delivery systems owing to their adaptable physicochemical and biophysical properties, which allow for modifications to meet various delivery needs [18-20]. These vesicles exhibit a concentric bilayer structure, with diameters ranging from 0.01 to 5.0 μm and may consist of cholesterol, glycolipids, non-toxic surfactants, long-chain fatty acids, sphingolipids and membrane proteins [21,22]. Liposomes can be engineered and processed to vary in size, composition, charge and lamellarity. To date, liposomal formulations of antitumor drugs and antifungal agents have been commercialized [23]. The use of liposomes as a delivery system for exfoliating acids offers several advantages. Liposomes can enhance the stability and bioavailability of peeling acids by protecting them from degradation and facilitating their penetration into the skin. The liposomal formulation allows for controlled release, thereby prolonging its presence on the skin and potentially enhancing its

therapeutic effects. Additionally, liposomes improve tolerance to acids. However, encapsulation within liposomes can reduce direct contact with the skin, thereby minimizing potential irritation and enhancing the comfort of the study participants [23]. Peels utilizing duosomal technology employ an innovative approach that integrates commonly used chemical acids, with a portion of the acid encapsulated in a liposomal form while another portion remains in its free form. This strategy aims to achieve more effective outcomes and mitigate the adverse effects.

Liposomal mandelic acid is used to treat irregular pigmentation and post-inflammatory hyperpigmentation and exhibits exfoliating properties. Liposomal lactic acid, an alpha-hydroxy acid, is recognized for its minimal irritation potential, making it suitable for individuals with sensitive skin. This contributes to the enhancement of skin texture and hydration. Salicylic acid is particularly beneficial for oily skin prone to papules and pustules associated with acne because of its anti-inflammatory and bactericidal properties. Liposomal glycolic acid promotes collagen synthesis and facilitates the dispersion of melanin in the basal layer, thereby effectively reducing wrinkles and age spots and providing a significant anti-aging effect [23-25].

In this study, we evaluated the efficacy and safety of duosomal chemical peels as agents for enhancing the aesthetic appearance of the periocular and facial regions in patients at the Instituto de Oftalmologia F.A.P. Conde de Valenciana, Mexico City, Mexico.

Methodology

This was a clinical, experimental, prospective, comparative, before-and-after study. We established a sample size of 12 participants [26,27]. The inclusion criteria encompassed men and women over the age of 21 years who sought enhancement of the periocular and facial regions. The exclusion criteria were individuals with psychiatric disorders, those exhibiting symptoms indicative of body dysmorphia and those who had undergone facial filler, mesotherapy and botulinum toxin treatments within the six months preceding the procedure. The elimination criteria involved loss of follow-up of the research subject and the occurrence of an allergic reaction or intolerable adverse effects. The SASSQ visual scale (University of Hamburg, Germany; 2020) was used for the objective assessment of facial dermal changes. Six skin characteristics were evaluated: elasticity, wrinkles, roughness, pigmentation, erythema and pore size, each scored from 0 to 4, absence (0), mild (1), moderate (2), severe (3) and very severe (4). Clinically significant improvement was defined as a decrease of at least 1 point in the rating of the characteristic being analyzed, without requiring simultaneous improvement in all characteristics. For the subjective evaluation of facial dermal changes, the FACE-Q Aesthetics questionnaire was utilized, comprising 37 independent functional scales and six checklists that measure patient-relevant outcomes from their perspective, ranging from 1 to 4, where 1 signified very dissatisfied and 4 signified very satisfied. This study utilized the following scales from the questionnaire (pre- and post-assessment): symmetry, expectations facial proportion, end-of-day appearance, rested appearance, profile appearance, photographic appearance, morning appearance and appearance under strong lighting conditions.

Patients received an application of liposomed chemical peeling based on salicylic acid (Salisome Duo, Toskani®) to the facial surface through continuous massaging for a duration of five minutes, facilitating the exfoliation of the superficial epidermal layers. Subsequently, a specific medication was administered for a duration of five minutes, based on the skin characteristics and intended treatment objective: a second dosis of salicylic acid (Salisome Duo, Toskani®) for individuals predisposed to oily skin and acne, applicable for all Fitzpatrick phototypes; liposomed chemical peeling based on mandelic acid (Mandesome Duo, Toskani®) for those with irregular pigmentation and hyperpigmentation with Fitzpatrick phototype V to VI; liposomed chemical peeling based on lactic acid (Lactisome Duo, Toskani®) for individuals with sensitive skin with all skin types; and liposomed chemical peeling based on glycolic acid (Glycosome Duo, Toskani®) for those with wrinkles and pigmentation changes due to aging with Fitzpatrick phototype I to IV. A moisturizer (Total Recovery Cream, Toskani®) was then applied and massaged continuously, allowing it to act for five minutes. The treatments were administered by the same person (CAF) weekly for three weeks and received the same protocol in each session. Patients were assessed using the SASSQ and FACE-Q scales prior to treatment, following each medication application and one week thereafter, complemented by photographic documentation, carried out by an evaluator who was unaware of the treatment provided (NC). The evaluation was conducted in a before-and-after study format rather than a split-face design, in accordance with institutional ethical recommendations to avoid leaving untreated facial areas on the same subject.

Shapiro-Wilk test was established to determine normality. Descriptive statistics were used to analyze the demographic variables, means and standard deviation were used. For continuous quantitative variables, Wilconson test was applied to compare the

baseline and final results at the conclusion of the treatment. To reduce statistical type II error related to sample size, a Before/After design with the same subject was used and subject homogeneity was ensured. To reduce type I error, a non-parametric test (Wilcoxon test) was used. SPSS Statistics software version 31.0 was used for the analysis. A statistically significant value of $p < 0.05$ was established. The study adhered to the tenets of the Declaration of Helsinki, was approved by the Institutional Ethics Committee Board (Registration Number: CEI-2023/11/02) and was registered at ClinicalTrials.gov with the identifier number NCT07401342.

Results

A cohort of 12 patients was initially recruited for the study, of which 11 completed all peeling sessions, while one patient was excluded due to lack of follow-up, resulting in a final sample size of 11 patients. Among these 11 participants, 9 were female (82%) and 2 were male (18%). The age of the participants ranged from 28 to 49 years, with a mean age of 37.54 years. The most common skin phototype was Fitzpatrick IV.

The initial application of the Face-Q scale yielded a mean score of 21.25 (SD = 6.31), with scores ranging from 10-30 points. In the final evaluation, the mean score increased to 30.36 (SD = 4.61), with a range of 25-40 points (Fig. 1). A statistically significant difference was observed between the initial and final total scores, with a p-value of less than 0.003, indicating an improvement in the patients' perception of their skin. In the individual analysis, the only items that did not show a significant difference between the two periods were the perception of facial proportions and appearance of the face upon waking (Table 1).

The SASSQ scale scores at the baseline visit had a mean of 9.58 (SD = 4.66), with a range of 5-17. In the final evaluation, the mean score was 3.13 (SD = 5.63), with a range of 2-12 (Fig. 2). A significant difference was found between the baseline and final scores, with a p-value of less than 0.006, suggesting an improvement in facial appearance, as assessed by the investigator. In the individual analysis, significant differences were observed in the items related to roughness ($p = 0.008$) and pore size ($p = 0.005$) (Table 2).

No significant adverse events were reported among the study participants. No participant experienced allergic reactions or toxicity from the treatment.

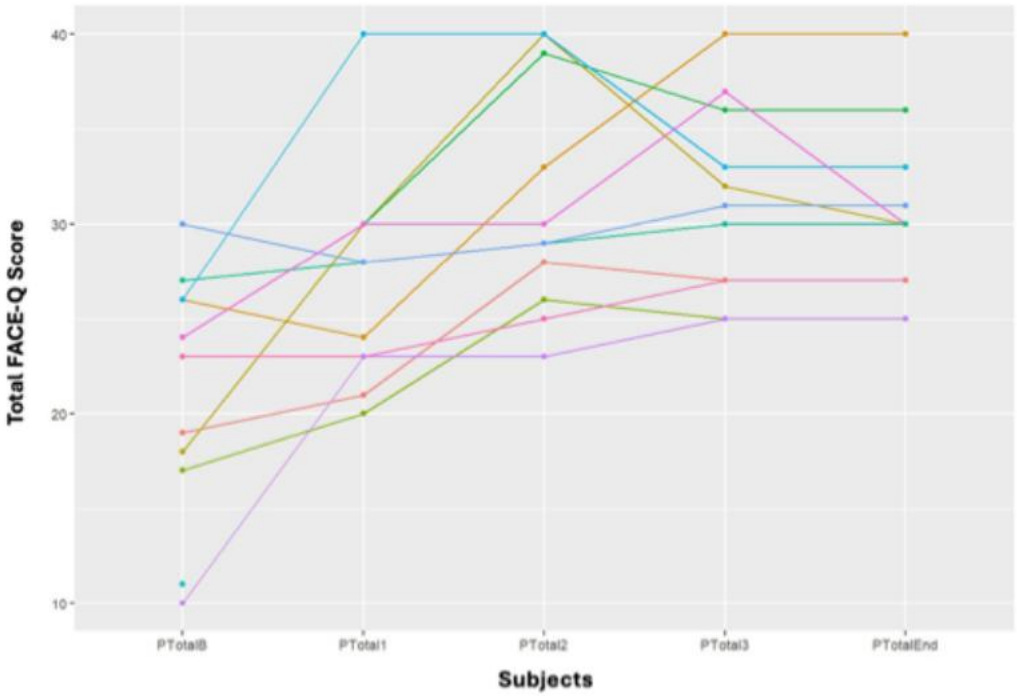

Figure 1. Total FACE-Q questionnaire score at the initial visit, at each treatment, and one week after treatment

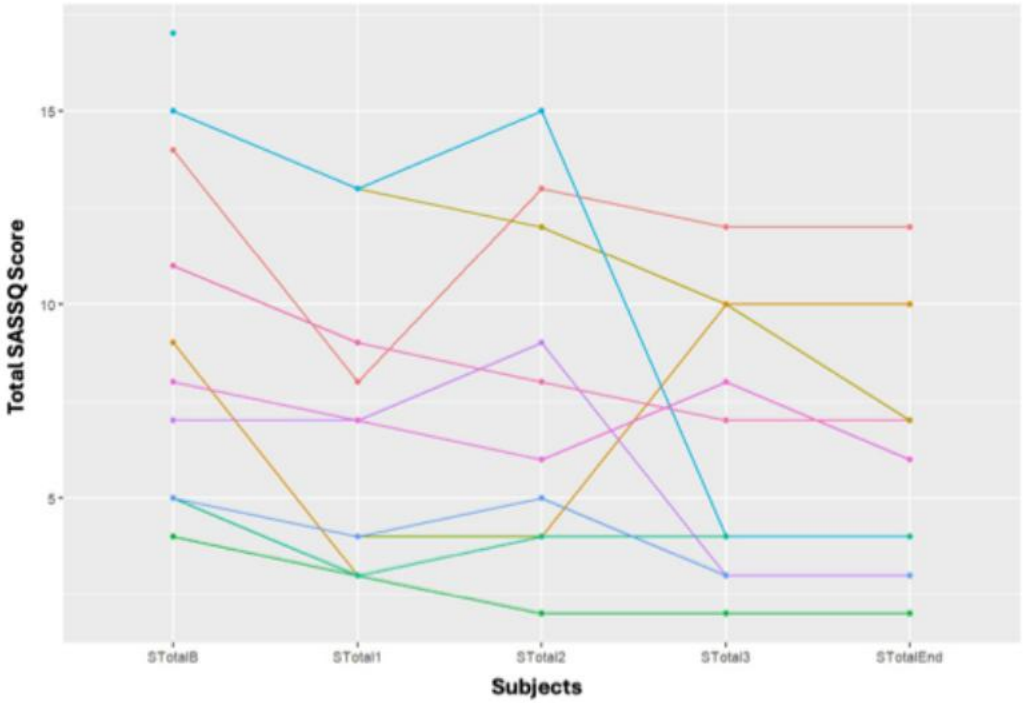

Figure 2. Total SAASQ questionnaire score at the initial visit, at each treatment, and one week after treatment

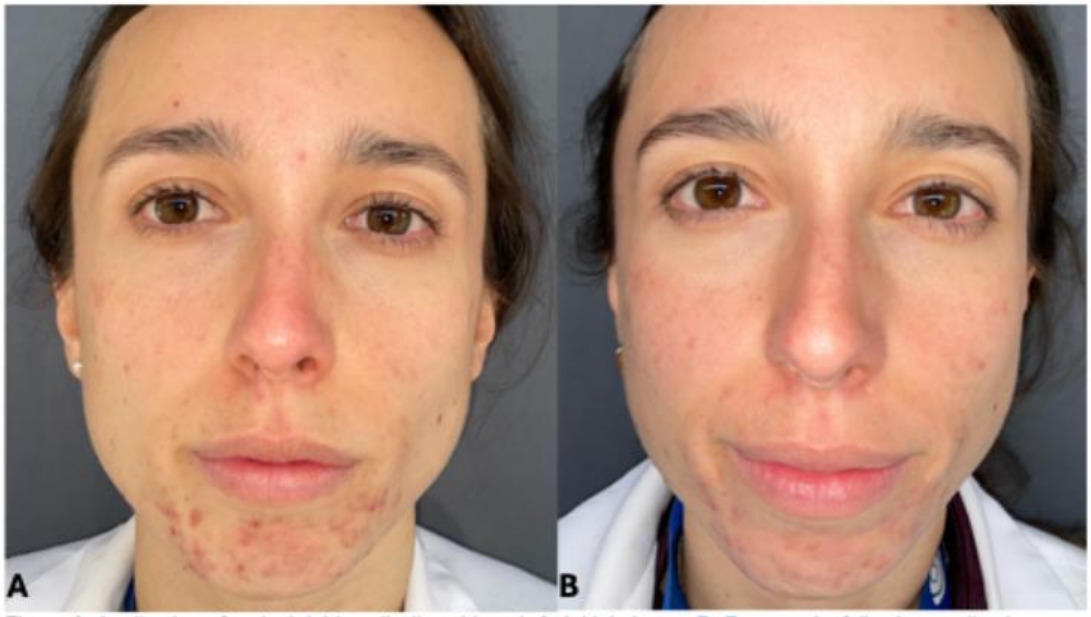

Figure 3. Application of topical doble salicylic acid peel. **A.** Initial photos. **B.** Four weeks following application. There is a noticeable enhancement in skin quality and a reduction in acne lesions, accompanied by a drying effect on the lesions.

Figure 4. Application of salicylic and mandelic acid. **A.** Initial photos. **B.** Four weeks following application A homogeneous reduction in pigmentation is observed. The skin appears less dull.

Figure 5. Application of topical salicylic and mandelic acid. **A.** Initial photos. **B.** Four weeks following application. The skin exhibits a more uniform tone and coloration. Additionally, there is a discernible reduction in the macular lesions located on the nasal bridge and cheekbones.

Figure 6. Application of salicylic and mandelic acid. **A.** Initial photos. **B.** Four weeks following application. An overall enhancement in skin appearance is observed, including improvements in hyperpigmentation resulting from photoexposure.

Variable	Basal mean	Basal SD	Final mean	Final SD	P value
How symmetrical does your face look?	2.50	0.90	3.09	0.53	0.036
How balanced does your face look?	2.58	0.90	3.18	0.60	0.03
How well-proportioned does your face look?	2.41	0.79	3.00	0.44	0.11
What does your face look like at the end of the day?	2.08	0.90	3.09	0.70	0.004
How fresh does your face look?	2.00	0.73	3.23	0.64	0.004
How rested does your face look?	1.83	0.57	3.09	0.53	0.004
What does your profile look like (viewed from the side)?	2.16	0.83	3.0	0.44	0.014
What does your face look like in the photos?	1.83	0.71	3.09	0.53	0.004
What does your face look like when you first wakes up?	2.00	0.60	2.72	0.78	0.08
What does your face look like under bright lights?	1.83	0.83	2.81	0.75	0.019

SD: Standard deviation. $p < 0.05$

Table 1: Face-Q statistical test results.

Variable	Basal mean	Basal SD	Final mean	Final SD	P value
Loss of elasticity	1.58	0.99	1.00	0.63	0.24
Wrinkles	1.25	0.86	0.90	0.94	0.37
Skin Roughness	2.00	0.85	1.09	0.70	0.008
Pigmentation/Lentigines	1.75	1.48	1.00	0.89	0.07
Erythema	1.16	0.93	0.63	0.67	0.34
Pore Size	1.83	0.71	1.00	0.44	0.005

SD: Standard deviation. $p < 0.05$

Table 2: SASSQ statistical test results.

Discussion

Duosomal chemical peels have emerged as an innovative and effective option for skin care, showing improvements in skin quality. Duosomal technology uses an innovative approach that incorporates commonly used acids in both liposomal and free forms, which protects the compounds from degradation and enhances their bioavailability and penetration into the skin. This increases their therapeutic potential and reduces their adverse effects [25].

This study focused on evaluating the benefits of using two questionnaires: an objective questionnaire that assessed and scored certain aspects of the skin and a subjective questionnaire in which the patient answered how their skin felt at various times of the day (upon waking up, at the end of the day) and how their skin felt (fresh, rested) during the treatment.

When evaluating the total scores of both questionnaires and analyzing them as a single scale score, both showed a significant difference between the total baseline and final questionnaire scores. On the Face-Q scale, the individual parameters that showed a statistically significant improvement were symmetry, balance, freshness, rested appearance, facial profile, face in photos, under strong lights and at the end of the day. Most patients reported an improvement in these parameters after three doses (Fig. 3). The improvement in these parameters may be due to the acids in the compound, which have exfoliating effects and promote cellular renewal, favoring skin renewal and improving the texture. Additionally, by stimulating the production of collagen and elastin, they improve skin elasticity and firmness, as observed in previous studies with the application of these chemicals in traditional peels [13,19].

Subjects with changes in skin pigmentation showed a decrease in pigmentation (Fig. 4-6). This is consistent with previous studies and is related to the characteristics of mandelic acid, which causes a reduction in melanin production and helps achieve a more homogeneous distribution [15]. Another important point that was not evaluated using scales was a study participant who had experienced acne breakouts associated with mask use and after three peeling sessions, showed an improvement in the lesions, which decreased in inflammation and changed from pustular lesions to scabs. This is consistent with previous studies demonstrating the keratolytic and anti-inflammatory effects of salicylic acid, which makes it effective in patients with acne [13]. The subjective parameters that did not reach statistical significance were facial appearance upon waking and facial proportionality. Facial proportionality is not expected to change with a duosomal peel, as it is a superficial treatment that does not alter facial proportions; therefore, this is a predictable result.

In the context of the Skin Quality Assessment scale, two parameters, roughness and pore size, were identified as statistically significant. This finding is consistent with the existing literature on peeling acids, which are known to stimulate collagen and elastin production as well as cell renewal, thereby reducing skin roughness and pore size [13,19]. The evaluation of pigmentation revealed an average improvement from 1.75 to 1. Although this change was not statistically significant, a noticeable reduction in skin pigmentation of 0.75 was observed. Increasing the sample size or the number of peelings administered could potentially render this improvement statistically significant in future studies. The study also concentrated on assessing adverse effects; no significant adverse effects or indications of intolerance or anaphylaxis to peeling were observed. The only noted effects were mild, transient erythema and burning, which resolved without complications. These findings underscore the efficacy of the treatment, particularly in terms of patient-perceived changes. The effectiveness of the treatment is further supported by the mild and transient nature of the side effects. Compared to other chemical peelings and treatments, this approach offers the advantages of being well tolerated, easy and quick to apply, with patients perceiving the changes as beneficial and expressing overall satisfaction.

The primary limitation of this study was its small sample size. It is imperative to develop protocols involving a larger and more epidemiologically diverse population to substantiate the overall efficacy of this treatment. Additionally, the inclusion of a control group should be considered to facilitate more reliable comparison.

Conclusion

The findings of this study indicate a significant enhancement in the overall scores of both the evaluations. These results imply that duosomal peels are a novel, effective and versatile product for improving skin quality. Their capacity to address multiple therapeutic effects, coupled with a low risk of adverse effects and potential for customization, positions them as a viable option in the repertoire for enhancing skin quality and preventing age-related changes.

Conflict of Interest
The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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Not applicable.

Ethical Statement
Ethical approval was obtained from the institutional ethics committee (EA4/257/25).

Informed Consent Statement
Informed consent was taken for this study.

Authors' Contributions
All authors contributed equally to this paper.

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