


Applied Research on APIA Scientific Skin Management Methodology: Enhancing Skin Health Through Personalized Approaches

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Background: Common cosmetic skin concerns including dryness, acne, pigmentation, sensitivity, and ageing significantly impact quality of life. Traditional skincare methods often rely on generic strategies, overlooking the complexity and individual differences in skin problems. The APIA (Assessment, Program, Implementation, Accompany) skin management system is a proven, scientific and systematic skin health management programme that prioritizes personalized assessment and long-term tracking. APIA consists of four parts: Assessment (skin identification and analysis), Program (development of a skin management programme), Implementation (programme implementation), and Accompany (ongoing care).

Purpose: This study aimed to explore and validate the application of the APIA methodology in skin management practice and its impact on skin health to offer new insights and practical recommendations for skin management practices.

Methods: This study employed a before-and-after comparative study design to evaluate the skin of 74 participants who were treated with the APIA methodology. The effectiveness of the APIA methodology was assessed by comparing skin metrics before and after its implementation. The assessment criteria included cosmetic and functional skin indicators, such as stratum corneum thickness, radiance, and sebum production.

Results: After implementing the APIA methodology, participants exhibited significant improvements in multiple skin indicators, including stratum corneum thickness, gloss, sebum secretion, pore blockage, capillary dilation, colour, softness, smoothness, elasticity, and temperature ($p < 0.05$). Additionally, improvements in self-perception, skin condition, acne, pigmentation, sensitivity, ageing, and skin around the eyes were statistically significant. There was no significant difference in pore size before and after management ($p > 0.05$).

Conclusion: The APIA skin management methodology is effective at improving skin health and offers a scientific, systematic, and sustainable solution for skin care. This method can effectively address common skin problems and maintain the healthy state of the skin. It also has potential applications in the fields of cosmetology and skin health management.

Keywords: scientific view of beauty, skin management, skin health improvement, behavioural interventions, skin managers, skin care products (cosmetics), Apia skin management system

Introduction

The skin is the largest organ of the body and serves as an important interface between the immune system and the external environment. It also provides a variety of physiological functions, including protection, regulation, metabolism and perception¹ and plays a vital role in protecting against harmful external environmental factors and maintaining overall health. Healthy skin is also a key factor in normal human activities. In modern society, skin problems are becoming increasingly prevalent due to factors such as environmental pollution, ultraviolet (UV) exposure, work stress,

misuse of skincare products, and unhealthy lifestyle habits. These problems not only affect appearance but also may cause psychological and social problems such as embarrassment, discomfort, and limited social activity and are even associated with psychological disorders such as anxiety and depression.² Chronic skin problems may aggravate patients' psychological stress, affect their quality of life and have a negative impact on their family and social relationships. Maintaining healthy skin is therefore not only about aesthetics but also about overall physical and mental health and social well-being.

With advancements in beauty technology and the improvement of living standards, people's pursuit of external beauty and internal health is also increasing. Skin management has become an increasingly important issue in daily life and work. However, the limitations of traditional cosmetic methods are gradually becoming apparent. These limitations underscore the need for a more personalized and scientifically grounded approach to skincare, moving beyond "one-size-fits-all" strategies and short-term focus. These approaches ignore the impact of lifestyle, such as diet, sleep, and stress management, on skin health^{3,4} and lack continuous follow-up and individualized adjustments. Therefore, it has become particularly urgent to develop a comprehensive and systematic approach for skin management (Table 1).

In this context, skin management planning was developed. Skin managers utilize advanced technology to not only solve immediate skin problems but also prioritize long-term skin health management. Through a tailor-made systematic, comprehensive and long-term skin management plan, customers can, under the guidance of professionals, gradually establish a scientific concept of beauty care, rationally choose skincare products and treatments, effectively reduce the chances of developing skin problems, and achieve long-term health and rejuvenation of the skin. This approach not only enhances the external appearance of the skin but also prioritizes the support of skin's intrinsic health, offering a novel perspective and direction for the field of skin management. This study aimed to investigate the application of the APIA method of skin management and its effects to provide new theoretical support and practical guidance for skin management practice.

Methods

Construction of the APIA Methodology for Skin Management

The APIA skin management system is a standardized four-phase methodology developed for comprehensive skin health management. The acronym APIA represents the core operational stages (Figure 1):

Table 1 Differences Between Skin Management Planning and Traditional Beauty Programs

Dimensions	Skin Management Planning	Traditional Beauty Program
Skin Care System Composition	<ul style="list-style-type: none"> - Comprehensive and systematic programme design - Characterized by progression and inevitability - Based on customer skin identification and analysis - Focused on achieving phased beauty goals 	<ul style="list-style-type: none"> - Single project of low relevance - Projects are relatively independent of each other, with no order of priority - Customers are randomly selected
Targeting	<ul style="list-style-type: none"> - Tailor-made professional system solutions - Strongly targeted, customer beauty results-oriented 	<ul style="list-style-type: none"> - Process-oriented services - Poor targeting and customer autonomy
Service Results	<ul style="list-style-type: none"> - Long-term protocol balancing short-term and long-term effects - Based on improving healthy skin function - Clear milestones to increase customer confidence - Enhances the professional confidence of practitioners and the reputation of beauty organizations 	<ul style="list-style-type: none"> - Short-term protocol mainly seeking short-term results - Failure to consider healthy skin function - Customers may give up when long-term results are unsatisfactory - Impact on practitioners' professional confidence and institutional credibility

APIA Methodology Construction in Skin Management Process

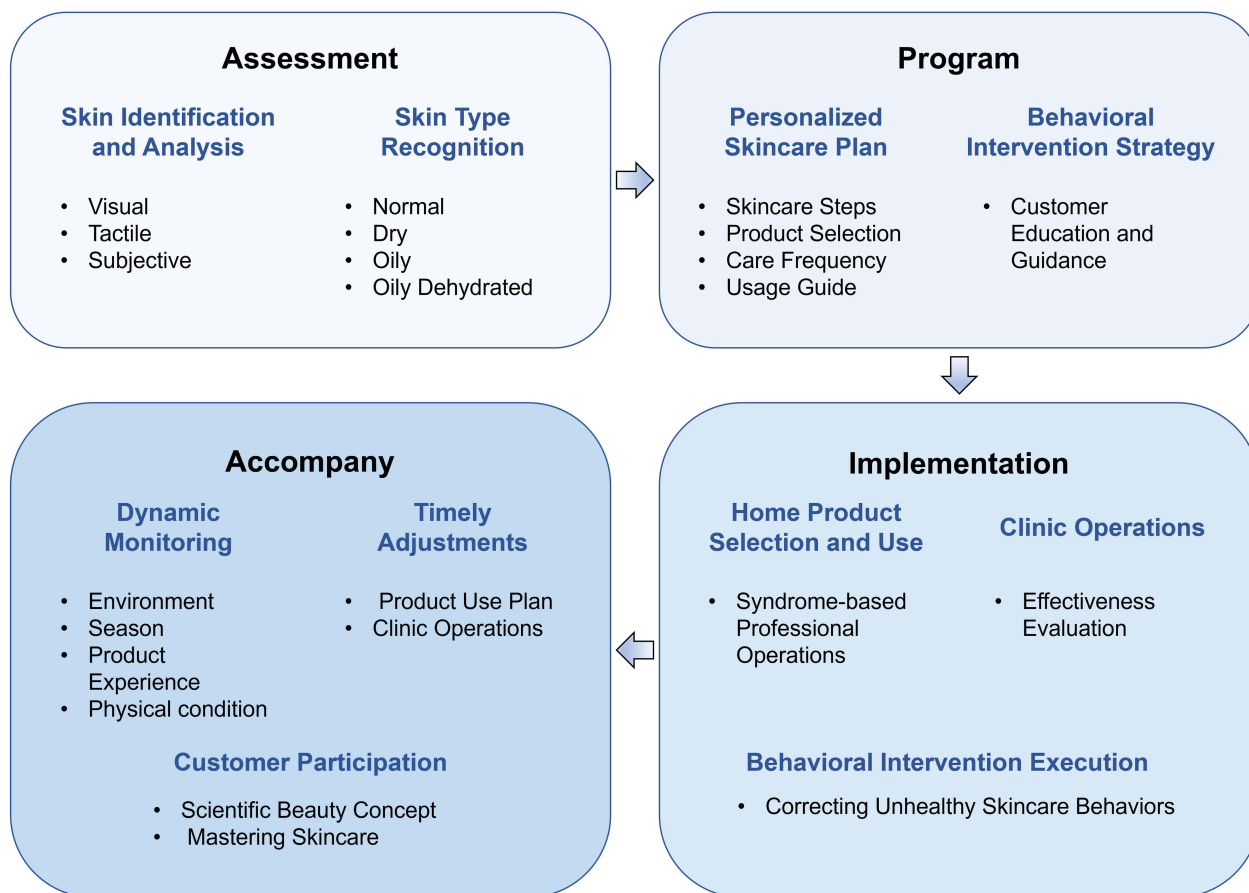


Figure 1 Apia Methodology: A Comprehensive Framework for Skin Management.

- i. Assessment (skin differentiation): Combines visual-tactile examination with instrumental measurements to establish baseline skin profiles, evaluating parameters including but not limited to stratum corneum thickness, sebum secretion, and capillary dilation (Assessment (A): Skin Identification and Analysis).
- ii. Program (formulation of a plan): Generates customized protocols addressing identified skin conditions, with defined short-term (1–2 metabolic cycles) and long-term (ongoing) therapeutic milestones (Program (P): Skin Management Programme Planning).
- iii. Implementation (management and behavioural intervention): Executes interventions using standardized procedures, incorporating behavioral modification strategies to ensure treatment adherence (Implementation (I): Programme Implementation and Behavioural Interventions).
- iv. Accompany (ongoing conditioning): Conducts periodic reassessments to dynamically adjust regimens based on skin response and environmental changes (Accompany (A): Continuity and Dynamic Adjustment in Skin Health Management).

This closed-loop system ensures both immediate therapeutic effects and sustained skin health maintenance, with all phases iteratively informed by quantitative skin measurements.

Assessment (A): Skin Identification and Analysis

Skin managers utilize the visual-tactile-subjective method, which uses sight, touch, and self-perception aided by professional skin diagnostic instruments and tools to provide customers with professional skin identification and analysis (Table 2). This process involves a thorough evaluation of the skin's basic type, condition, and requirements and includes factors such as pigmentation, texture, stratum corneum thickness, sebum secretion, radiance, pore condition, temperature, moisture level, skin elasticity, and any subjective symptoms. By integrating the customer's beauty history and skincare behaviour habits, a comprehensive analysis of the current skin issues and their causes is conducted to accurately formulate a phased skin management plan.

Program (P): Skin Management Programme Planning

After conducting a professional assessment, the skin manager tailors a comprehensive and personalized skincare regimen for each customer, adjusting the skin through our standardized three-phase protocol (Table 3) where interventions are progressively modified based on achieving phase-specific clinical targets. This plan outlines the skincare routine, lists carefully selected products, establishes the frequency of care, and provides necessary usage guidelines. Phase transitions are determined through integrated evaluation of both instrumental measurements and visible skin improvements. In addition, considering the individual needs of the customer and their willingness to cooperate, the plan also includes behavioural intervention strategies to help customers effectively implement care both at home and in professional settings. The customer is not only a participant in this process but also a learner, gradually acquiring skincare knowledge to achieve long-term maintenance of skin health.

Table 2 Basic Principles of Skin Identification and Analysis

Judgement Type	Observation Content	Description
Visual judgement	Pigmentation	Evenness of skin tone, dullness, discolouration
	Condition of the stratum corneum	Thickness and density, redness or dilated capillaries, smooth and fine skin or rough and uneven skin
	Sebum production	Sebum production, oil clogging condition
	Gloss	Brightness and tone, hydrated or dull skin
	Transparency	Glossy and flawless, transparent and delicate texture
	Pores	Size matches skin type, oil clogging, pore depressions
Tactile judgement	Wrinkles	Dry lines or wrinkles, such as forehead lines, crow's feet, and frown lines
	Capillary blood vessels	Expansion of vessels
	Hydration	Moist, smooth, soft, elastic, slightly cool skin temperature (high water content in the stratum corneum)
Self-judgement	Dryness	Dryness, roughness and unevenness, poor softness, poor elasticity, high skin temperature (low water content of the stratum corneum)
	Self-awareness	Tightness, heat, swelling, itching, tingling, heaviness, etc.
	Comfort	Comfortable and senseless on the skin

Table 3 Skin Management Planning Milestones

Period	Target	Problematic Skin	Healthy Skin	Time of Realization	Description
I	Improvement of self-perception	Self-conscious symptoms such as heat, itching, and tightness	Moisturization and softness	1 to 2 skin metabolic cycles	Targeted enhancement of the skin's water content and relief of discomfort. Provides the skin with a stable external environment that helps it repair itself
II	Improvement of cosmetic symptoms	Dryness, acne, discolouration, etc.	Fairness, translucency and radiance	2 to 3 skin metabolic cycles	Targeted solutions for all kinds of visible skin problems in addition to boosting moisture content
III	Restoring functional health	Restoration of healthy skin function and prevention of recurring problems	Delicate, fair, firm, healthy beauty and youthfulness	Ongoing process	Long-term care to maintain youthful skin developed in the first two periods

Skin management planning includes home and hospital care programmes for various skin conditions during different seasons and in different environments. The core principle of skin management planning is the enhancement of self-perception by increasing the water content and creating a stable external environment for self-repair. Additionally, it aims to improve skin appearance in a targeted manner and to conduct a scientific and systematic restoration of skin function to preserve skin health, beauty, and youthfulness. In the skin management planning process, the three phases aim to maintain the functional health of the skin systematically and scientifically. This approach aims to achieve long-term maintenance of a youthful state characterized by lightness, delicacy, firmness, and elasticity.

Implementation (I): Programme Implementation and Behavioural Interventions

During the implementation phase, treatments must be provided according to the skincare programme developed. Moreover, the necessary behavioural interventions must be implemented to help clients develop healthy habits and proper skincare practices. Behavioural intervention is one of the key components of the APIA skin management system. Education and guidance can help clients change unhealthy behavioural patterns and develop healthy lifestyles. In the field of skincare, behavioural intervention can help customers correct improper skincare behaviours and develop good skincare habits. Sensory assessment of cosmetic suitability (see [File S1](#)) can help customers choose suitable products and guide them to use the products correctly. Specialized skin identification procedures are conducted by professionals in accordance with the scientific skin management clinic programme to ensure optimal clinical treatment results.

Accompany (A): Continuity and Dynamic Adjustment in Skin Health Management

Ongoing conditioning requires timely adjustments and continuous support in response to changes in a client's skin condition and needs throughout the skincare programme. This process not only helps customers follow the skincare programme more effectively, thereby enhancing the treatment's success, but also helps them identify and respond to emerging skin challenges in a timely manner, ensuring long-term skin health maintenance. By dynamically monitoring the customer's environment, seasonal changes, at-home product experience, in-home care feedback, and changes in physical status (eg, pregnancy, colds), product usage and in-home care practices can be adjusted based on actual skin improvement. In addition, continuous treatment involves correcting improper skin care behaviours, summarizing successful experiences of skin improvement, and guiding customers to establish a scientific concept of beauty, empowering them to become the leaders of their own skin health management. Through this process, customers can not only realize significant improvement in their personal skin condition but also influence and inspire others around them to achieve skin health and beauty through a positive lifestyle and scientific skincare knowledge.

Study Design

A total of 74 healthy Chinese female volunteers, aged 20–51 years (mean age \pm SD: 32 ± 7.06 years), participated in this study after providing written informed consent. The study was approved by Scientific Research Ethics Committee of the School of Light Industry Science and Engineering, Beijing Technology and Business University, with approval number BTBUECSR2024031. All the subjects had lived in Shanghai for at least one year. The exclusion criteria were as follows: (a) menstruating, pregnant or breastfeeding; (b) use of hormonal medications or receipt of anti-immunotherapy within 1 month or during the study period; (c) cosmetic surgery, aesthetic treatments, tattooing, maintenance, spotting of moles, facial plastic surgery, or cosmetic needle injections; (d) severe systemic, immunodeficiency, or autoimmune disease; (e) significant signs of skin irritation, facial injury, swelling, or scarring; (f) cold, headache, or fever on the day of the test; and (g) lack of consent, incomplete information, or participation in other clinical trials. Informed consent was obtained from the participants, and the study complied with appropriate privacy and data protection standards.

In this study, we utilized a comprehensive design of the Skin Recognition Information Scale, which is used to quantitatively evaluate essential skin characteristics, such as the stratum corneum condition, oil shine, moisture content, elasticity, and skin texture. The assessment of each skin parameter is carried out by a professional skin therapist through visual assessment. We use standardised skin photos and text descriptions to identify skin information and obtain scale data for each skin parameter (see [File S1](#)). This scale is a reliable quantitative assessment tool to validate the effectiveness of the APIA methodology in skin management. This study utilized a before-and-after design to assess

the skin condition of 74 participants who underwent APIA skin management at the salon. To ensure consistency and accuracy in the assessments, all participating skin managers received specialized training. The study also established a standardized skin care collection process to ensure a consistent method of data collection before and after skin management. High-quality images were obtained through catheterization to visualize the effects of skin management. This study assessed the effectiveness of the APIA methodology in improving skin conditions by comparing scale scores and image analysis before and after skin treatment.

Statistical Analysis

All the statistical analyses were conducted using SPSS[®] software (SPSS Inc., Chicago, IL, USA; ver. 26) for Windows. The data analysis included the following steps: 1) Analysis of differences in categorical variables—Categorical variables such as self-perceived feelings, skin condition, acne, pigmentation, sensitivity, ageing, and eye area characteristics are described using response rates and prevalence rates. The differences between variables were analysed using chi-square tests with case weighting to assess the differences between groups. 2) Analysis of differences in continuous variables—Continuous variables such as stratum corneum thickness, sebum secretion, degree of pore blockage, skin colour, gloss, pore size, degree of capillary dilation, skin softness, smoothness, skin temperature, moisture, and elasticity are described using descriptive statistical methods (mean ± standard deviation), and Mann–Whitney *U*-tests were used to analyse the significant differences between variables. P values <0.05 were considered to indicate statistical significance.

Results

Comparison of Skin Characteristics Before and After Skin Management - Categorical Variables

In this study, we compared the response and prevalence rates of categorical variables before and after skin management. We analysed the changes using a chi-square test to evaluate the impact of the APIA methodology on skin health status. Categorical variables included self-perception, skin condition, acne, pigmentation, sensitivity, ageing, and eye skin characteristics. The response rate is defined as the ratio of the number of people reporting each skin problem to the total number of selections in the multiple-choice questions, indicating the relative proportion of a skin problem; the prevalence rate is defined as the ratio of the number of people reporting each skin problem to the total number of people, indicating the prevalence of skin problems (Figure 2 and Table 4).

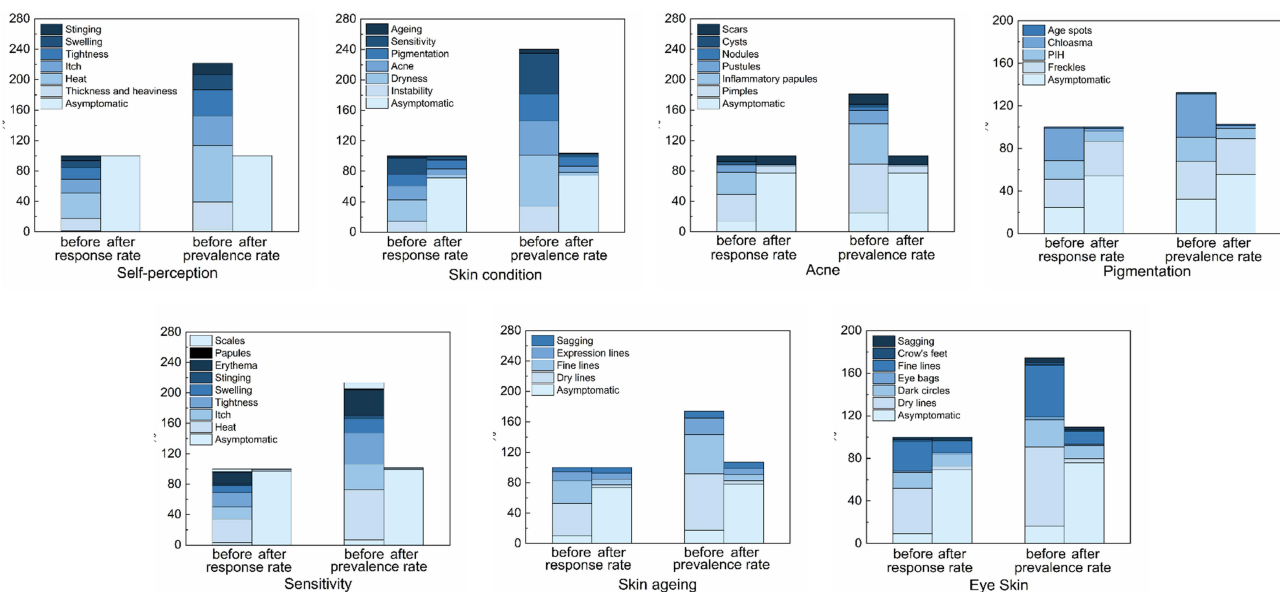


Figure 2 Apia Methodology: A Comprehensive Framework for Skin Management. Comparison of the response rate and prevalence rate before and after skin management.

Table 4 Pearson's Chi-Square Test Results for Categorical Variables

Skin Characteristics	Condition	N, %		χ^2	P value
		Before Skin Management	After Skin Management		
Self-perception	Asymptomatic	(2, 1.22)	(74, 100)	228.911a	0
	Thickness and heaviness	(27, 16.46)	(0, 0)		
	Heat	(55, 33.54)	(0, 0)		
	Itch	(29, 17.68)	(0, 0)		
	Tightness	(25, 15.24)	(0, 0)		
	Swelling	(15, 9.15)	(0, 0)		
	Stinging	(11, 6.71)	(0, 0)		
Skin condition	Asymptomatic	(0, 0)	(55, 71.43)	168.732a	0
	Instability	(25, 14.04)	(0, 0)		
	Dryness	(50, 28.09)	(3, 3.90)		
	Acne	(33, 18.54)	(6, 7.79)		
	Pigmentation	(26, 14.61)	(9, 11.69)		
	Sensitivity	(40, 22.47)	(3, 3.90)		
	Ageing	(4, 2.25)	(1, 1.30)		
Acne	Asymptomatic	(18, 13.43)	(57, 77.03)	96.738a	0
	Pimples	(48, 35.82)	(7, 9.46)		
	Inflammatory papules	(39, 29.10)	(1, 1.35)		
	Pustules	(13, 9.70)	(0, 0)		
	Nodules	(3, 2.24)	(0, 0)		
	Cysts	(3, 2.24)	(0, 0)		
	Scars	(10, 7.46)	(9, 12.16)		
Pigmentation	Asymptomatic	(24, 24.49)	(41, 53.95)	30.844a	0
	Freckles	(26, 26.53)	(25, 32.89)		
	PIH	(17, 17.35)	(7, 9.21)		
	Chloasma	(30, 30.61)	(2, 2.63)		
	Age spots	(1, 1.02)	(1, 1.32)		
Sensitivity	Asymptomatic	(5, 3.16)	(73, 97.33)	202.667a	0
	Heat	(49, 31.01)	(1, 1.33)		
	Itch	(25, 15.82)	(1, 1.33)		
	Tightness	(30, 18.99)	(0, 0)		
	Swelling	(14, 8.86)	(0, 0)		
	Stinging	(3, 1.90)	(0, 0)		
	Erythema	(25, 15.82)	(0, 0)		
	Papules	(1, 0.63)	(0, 0)		
	Scales	(6, 3.80)	(0, 0)		
	Skin ageing	Asymptomatic	(13, 10.08)		
Dry lines		(55, 42.64)	(3, 3.80)		
Fine lines		(38, 29.46)	(6, 7.59)		
Expression lines		(16, 12.40)	(6, 7.59)		
Sagging		(7, 5.43)	(6, 7.59)		
Eye skin	Asymptomatic	(12, 9.30)	(56, 69.14)	89.430a	0
	Dry lines	(55, 42.64)	(3, 3.70)		
	Dark circles	(19, 14.73)	(9, 11.11)		
	Eye bags	(2, 1.55)	(1, 1.23)		
	Fine lines	(36, 27.91)	(9, 11.11)		
	Crow's feet	(2, 1.55)	(1, 1.23)		
	Sagging	(3, 2.33)	(2, 2.47)		

Comparative analysis indicated a significant improvement in both the response and prevalence rates of self-perceived skin sensations after skin management. The chi-square test results confirmed that differences in variables such as self-perceived sensations, skin condition, acne, pigmentation, sensitivity, ageing, and skin of the eye area were statistically significant ($p < 0.05$), highlighting the positive effects of skin management.

Specifically, self-perceived sensations significantly improved following skin management, with the majority of participants transitioning from experiencing multiple symptoms to being symptom free. Moreover, key indicators such as skin condition, acne, sensitivity, pigmentation, and ageing also showed a significant increase in response and prevalence rates. Prior to skin management, the predominant self-perceived sensation was heat, accounting for 33.54% of the responses; dry skin conditions had a response rate of 28.09%; acne was primarily characterized by blackheads and whiteheads, with a significant proportion of 35.82%; pigmentation issues mainly included melasma, representing 30.61% of the cases; sensitivity was mainly manifested as heat, with a proportion of 31.01%; ageing was predominantly indicated by fine lines, with a 42.64% proportion; and in the eye area, fine lines were the primary concern, accounting for 42.64% of the responses. In terms of prevalence rates, self-perceived sensation of heat was the most prevalent, with a proportion of 74.32%; dry skin conditions had the highest prevalence at 67.57%; acne, characterized mainly by blackheads and whiteheads, had a prevalence of 64.86%; melasma was the most common type of pigmentation, with a proportion of 40.54%; heat-related sensitivity had a prevalence of 66.22%; ageing, indicated by dry lines, had a prevalence rate of 74.32%; and in the eye area, dry lines had the highest prevalence at 74.32%.

After skin management, adverse sensations were absent, and the proportion of individuals with healthy skin conditions increased to 71.43%. The prevalence of acne-free skin increased to 77.03%, that of pigmentation-free skin increased to 53.95%, that of symptom-free skin sensitivity increased to 97.33%, that of healthy ageing skin increased to 73.42%, and that of healthy eye area skin increased to 69.14%. In terms of prevalence rates, healthy skin was the most common at 74.32%, followed by absence of acne at 77.03%, absence of pigmentation at 55.41%, absence of sensitivity at 98.65%, decreased ageing at 78.38%, and healthy eye area skin at 75.68%.

Comparison of Skin Characteristics Before and After Skin Management - Continuous Variables

In this study, changes in continuous variables before and after skin management were analysed using the Mann–Whitney *U*-test to evaluate the impact of the APIA methodology on skin health status. Continuous variables included stratum corneum thickness, sebum production, degree of pore clogging, skin colour, radiance, pore size, degree of capillary dilation, skin softness, smoothness, skin temperature, moistness, and elasticity. These indicators were scored on a scale ranging from 0 to 3, with higher values indicating greater severity of skin problems (Table 5).

Table 5 Descriptive Statistics and Analysis of Variance Results for Continuous Variables

Skin Characteristic	Before Skin Management			After Skin Management			P value
	Mean \pm SD	Variance	Median	Mean \pm SD	Variance	Median	
Stratum corneum thickness	2.58 \pm 0.78	0.60	3.00	1.05 \pm 0.28	0.08	1.00	<0.001
Sebum secretion	2.50 \pm 0.80	0.64	3.00	1.07 \pm 0.25	0.06	1.00	<0.001
Pore blockage	2.43 \pm 0.68	0.47	3.00	1.23 \pm 0.43	0.18	1.00	<0.001
Skin colour	3.00 \pm 0.00	0.00	3.00	1.05 \pm 0.33	0.11	1.00	<0.001
Gloss	2.38 \pm 0.49	0.24	2.00	1.07 \pm 0.25	0.06	1.00	<0.001
Pores	1.95 \pm 0.33	0.11	2.00	1.88 \pm 0.33	0.11	2.00	0.222
Capillary dilation	2.16 \pm 0.68	0.47	2.00	1.19 \pm 0.39	0.16	1.00	<0.001
Softness	2.27 \pm 0.48	0.23	2.00	1.05 \pm 0.23	0.05	1.00	<0.001
Smoothness	2.26 \pm 0.47	0.22	2.00	1.05 \pm 0.23	0.05	1.00	<0.001
Skin temperature	2.69 \pm 0.77	0.59	3.00	1.00 \pm 0.00	0.00	1.00	<0.001
Moisture	2.36 \pm 0.48	0.23	2.00	1.04 \pm 0.2	0.04	1.00	<0.001
Elasticity	2.01 \pm 0.20	0.04	2.00	1.03 \pm 0.16	0.03	1.00	<0.001

Comparative analysis revealed that after skin treatment, both the mean and median values of the aforementioned indicators significantly decreased, indicating a marked improvement in skin condition. Specifically, the improvements in stratum corneum thickness, sebum secretion, degree of pore blockage, skin colour, gloss, extent of capillary dilation, skin softness, smoothness, skin temperature and moisture levels were all statistically significant ($p < 0.05$). These results demonstrate that the APIA methodology is significantly effective in these areas. However, the improvement in pore size did not reach statistical significance ($p > 0.05$).

Comparative Analysis of Skin Conditions with a High-Definition Imaging Device Before and After Skin Management

In this study, the skin conditions of participants before and after APIA skin management were visually compared and analysed using a DJM Cat Skin Detector II from Germany. By comparing the high-definition skin images before and after management, we observed improvements in redness, sensitivity, and oil production. These comparative images visually demonstrated the potential effectiveness of the APIA methodology in enhancing skin health and client satisfaction, providing strong visual support for skin management practices (Figure 3).

This study utilized the various imaging modalities of the DJM Cat Skin Detector II to visualize significant improvements before and after skin treatment. The heliogram revealed improvements in the surface condition of the facial skin. Post-management images showed a reduction in blackheads and surface blemishes, a smoother skin surface, and an improvement in cleanliness and overall appearance. The polarization map demonstrated improvements in uneven skin tone and microvascular structures by attenuating directly reflected light, indicating an enhancement in the overall health of the skin. The texture map emphasized improvements of a more refined skin texture, tighter pores, and fewer fine lines, indicating an improvement in skin firmness and elasticity. The sensitivity map displayed the pinkish-white colour of healthy skin, along with a reduction in inflammation-induced pitting and redness. The processed image showed a more even skin tone and effective sensitivity control. The acne and extent maps assessed improvements in acne status and underlying skin moisture saturation. The images after management showed fewer acne spots and higher skin moisture levels, indicated by a darker blue colour representing elevated moisture content. These results reflect the positive effects of skin moisturization and acne treatment.

The results of these visual image comparisons not only support the effectiveness of the APIA methodology in improving skin problems but also provide strong visual evidence for skin management practices. By comparing the images before and after the treatment, we can clearly observe positive changes in skin conditions that lead to significant improvements for the client. This finding validates the effectiveness of using the APIA methodology to improve skin health and cosmetic outcomes.

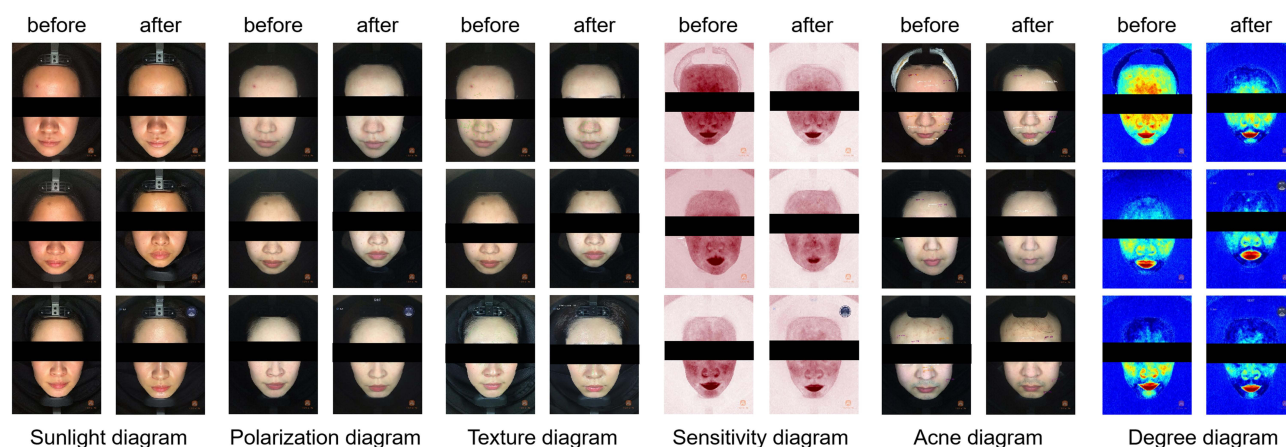


Figure 3 Comparison of different imaging modalities before and after skin management.

Discussion

Effectiveness of the APIA Skin Management Method

The comparative analysis in this study revealed a significant trend towards improvement in skin conditions after skin management. There was a notable increase in the proportion of symptom-free states after management, particularly in self-perceived sensations, which underscores the potential of the APIA methodology to enhance customer experience. The improvement in pore size did not reach a statistically significant level (with a P value of 0.222), which may suggest that pore improvement requires a longer time frame. Given that the image analysis in this study may only reflect the initial effects of the APIA methodology, future research should extend the observation period to allow for a more comprehensive assessment of changes in pore size. In addition, this study covered a wide range of skin types. Although oily dehydrated skin was more prevalent in the sample, which may reflect the more common skin problems of this skin type in daily life, the APIA methodology produced significant improvement in these participants, demonstrating its effectiveness in addressing oily dehydrated skin problems. However, given the low percentage of other skin types in the sample, future studies should include a wider range of skin types to comprehensively assess the effectiveness of the APIA methodology on different skin problems. In future studies, we will consider establishing a control group, such as participants using traditional skincare regimens or a placebo, to increase the credibility of the results.

Basic Principles of Skin Identification and Analysis

The diversity of individual skin conditions leads to a wide range of skin problems, and the same skin problems can be caused by numerous factors.⁵ Skin identification and analysis are the cornerstones of effective skin management. These processes help clients understand their own skin condition, analyse the causes of skin problems, and identify skin improvement goals. This process is essential for maintaining skin health and developing appropriate and personalized skin management strategies. Careful observation of the surface characteristics of the skin and an in-depth understanding of the physiological functions of the skin are needed.

The condition of the skin is not static; it changes according to factors such as season, age, environment, diet, or physical condition.^{6–8} For example, skin is oily in young people and dry in old people; skin tends to be oily in summer and dry in winter. Substantial changes also occur due to metabolic changes, different light environments, the amount of mental stress, or suffering from certain diseases and other factors.^{9–11} Therefore, when a customer's skin needs improvement or enhancement, the skin manager must make accurate judgements, develop a skin management plan based on the results of skin identification and analysis, and document the effects before and after skin care. The care plan should be tailored to each individual, location, and timeframe.

The collection of basic customer information is a crucial aspect of skin care reception services, representing the initial step in delivering care and establishing an essential foundation for future skin management. This information helps skincare professionals conduct scientific skin identification and analysis, thereby assisting customers in formulating personalized skincare management plans. For instance, by considering the occupation of customers, such as doctors and nurses who wear masks for extended periods at work, leading to local skin friction affecting the thickness of the stratum corneum and a hot and humid environment causing skin dryness, skincare specialists can advise customers on appropriate protective measures to prevent this dryness. Similarly, in customers with a dry or outdoor work environment, where the skin is susceptible to sensitivity or pigmentation issues, skincare specialists should emphasize hydration, moisturization, and sun protection when providing guidance on skincare. In addition, the customer's beauty history, including the use of skincare products, salon experiences, and allergy history, is crucial for formulating personalized care plans. Skincare specialists should record these details meticulously to gain a better understanding of the customer's skin needs and history. Therefore, it is crucial to collect complete basic customer information.

Skin Type Identification

In the past, skin type was primarily classified according to the level of sebaceous gland secretion. However, in recent years, through the application of scientific and objective evaluation methods that investigate various physiological functions of the skin, it has become evident that the water content of the stratum corneum and the amount of sebaceous

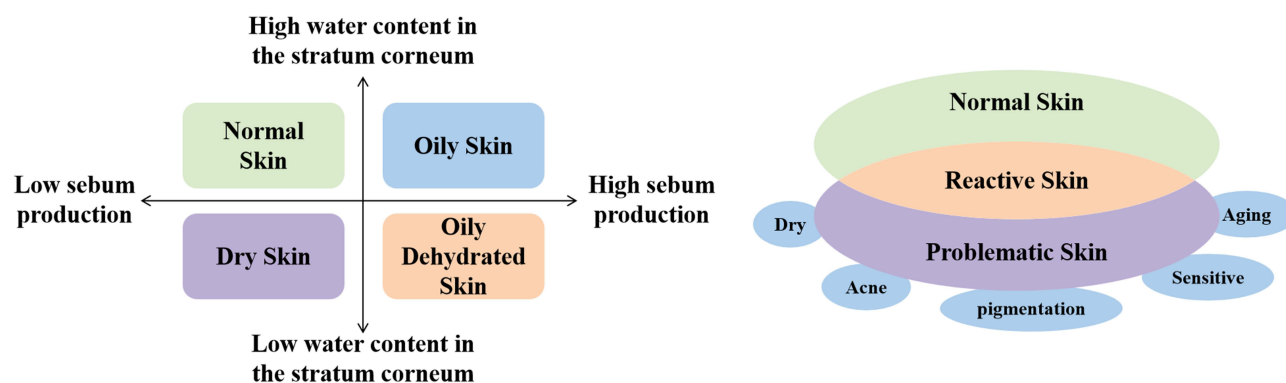


Figure 4 Skin type and condition.

secretions are distinct and independent elements. The former indicates a healthy stratum corneum formed by normal skin metabolic processes, while the latter is determined by the activity of sebaceous glands. Thus, the combination of sebum secretion and the water content of the stratum corneum results in four basic skin types: normal skin, dry skin, oily skin, and oily dehydrated skin. The typical characteristics of the skin base type serve as the reference to which improvements in the customer's skin problems are compared. Skin conditions can be categorized into normal skin, skin prone to irritation, and commonly encountered cosmetic skin issues (Figure 4 and Table 6).

The characteristics of healthy skin include smoothness, refinement, elasticity, and the ability to withstand external stimuli.¹² However, when the skin's condition fluctuates, this usually indicates that the skin is in an unstable state. Skin sensitivity is a transitional state between healthy skin and problematic skin, and it can progress to problematic skin due to a variety of factors. Skin sensitivity can manifest in various ways, such as fluctuations in skin conditions due to physiological cycles, stress, lack of sleep, sun exposure, or changes in climate; frequent, scattered redness on the sides of the nose and cheeks; unsatisfactory results despite maintenance efforts; and persistent skin irritation even after the use of carefully selected skincare products. These symptoms may indicate skin sensitivity. The causes of skin sensitivity can be categorized as external and internal. External causes include improper selection of skincare products, incorrect skincare routines, and unhealthy lifestyle habits, which can result in damage to the skin barrier.¹³ Internal factors include

Table 6 Characteristics of Skin Types and Conditions

Skin Type/Condition	Visual Judgement	Kinaesthetic Judgement	Conscious Judgement	Description
Normal skin	Rosy complexion, moderate sebum secretion, small pores, delicate skin	Moist, soft, smooth, elastic and slightly cool skin	Skin comfort without any self-consciousness	Most desirable skin type, typically prepubescent
Dry skin	Fair complexion, low sebum secretion, small and inconspicuous pores, lack of surface lustre, fine wrinkles	Skin not moist, slightly less elastic, slightly cooler skin temperature	Skin comfort without any self-consciousness	Skin is prone to dryness and lack of lustre, moisturization is the focus
Oily skin	Darker skin tone, high sebum secretion, enlarged pores and oily appearance of the skin	Skin oily, soft, elastic, slightly cool skin temperature	Skin comfort without any self-consciousness	Oily skin with enlarged pores, needs oil control and cleansing
Oily dehydrated skin	Darker and uneven skin tone, high sebum secretion, localized enlarged pores, fine dry lines or dandruff, and oily appearance	Skin rough and uneven, greasy, slightly less soft, slightly less elastic, slightly higher skin temperature	Occasional tightness	Skin with high oil secretion but lacking water, need to balance hydration and oil control
Reactive skin	Darker and uneven skin tone, localized enlarged pores, scattered red spots, clogging, flaking phenomenon	Skin rough and uneven, slightly less soft, slightly less elastic, slightly higher skin temperature	Occasional heat, itching, tightness, localized tingling sensation	Skin condition varies and needs to be stabilized and cared for
Beauty FAQ	Visual judgement based on specific issues (dryness, acne, discolouration, sensitivity, ageing)	Tactile judgement based on specific issues	Conscious judgement based on specific issues	Individualized treatment plan based on the customer's specific situation

Notes: Darker skin tone "refers to population-based comparison (Fitzpatrick types III–IV norms for East Asians)", assessed by certified technicians under D65 lighting.

mental stress, physiological periods, poor physical condition, or diseases that may affect the health of the skin.^{14–16} Under persistent adverse environmental stimuli, the stratum corneum barrier of the skin may be compromised. This, in turn, can affect the normal maturation process of keratinocytes, resulting in the premature arrival of immature keratinocytes (ie, incompletely differentiated keratinocytes). These immature keratinocytes are unable to effectively perform their barrier function, leading to increased sensitivity to external stimuli and reactive skin conditions. In addition, weakened barrier function may also affect the production and maintenance of the skin's natural moisturizing factors (NMFs), which are essential for maintaining the moisture and integrity of the stratum corneum. If left unmanaged, an unsettled state may further develop into common problematic skin conditions such as dryness, acne, discoloration, sensitivity, or ageing.

Skin Management Programme Planning

In skin physiology, the moisture content of the stratum corneum is critical for maintaining skin barrier function. A moderate level of hydration in the stratum corneum helps to maintain the water balance between the epidermal layers and prevents excessive water diffusion from the deeper layers of the skin to the surface, thereby preventing overall skin dehydration.^{17,18} Unevenness in the thickness of the stratum corneum may affect the sensitivity of the skin, as well as the capillary vasodilatory response, which may be related to an imbalance in the skin's defence mechanisms.¹⁹ Furthermore, the absence of moisture in the granular layer may weaken the ability of skin to refract UV rays and diminish its inhibitory effect on melanin production, thereby promoting the development of hyperpigmentation.²⁰ In the stratum spinosum and basal layers, a lack of moisture can lead to acne, inflammatory reactions, slowed cellular metabolism, and a darkened skin tone.²¹ Moisture loss in the dermis is closely related to ageing phenomena such as wrinkles, sagging skin, and enlarged pores.²² Increased oil production may accompany these skin problems, further exacerbating acne.²³ In summary, skin moisture deficiency is a common factor underlying a variety of dermatopathologic conditions and is crucial for maintaining skin health.

In response to these issues, the first priority in skin management planning is to increase the skin's moisture content. By making moisturization the core goal of the first phase, the aim is to maintain the skin's hydrated state and establish a foundation for subsequent skin improvement. Skin moisturization is a fundamental requirement for maintaining healthy skin. This ensures that each layer, from the basal layer outwards through the stratum spinosum and stratum granulosum to the stratum corneum, contains adequate moisture. This moisturization promotes UV refraction and accelerates cell division and proliferation in the stratum spinosum and the basal layer, thereby boosting skin cell metabolism and activating dermal fibroblasts. Consequently, this process effectively addresses various skin appearance issues, such as dryness, pigmentation, and skin ageing. Finally, to improve skin appearance, it is also necessary to restore the functional health of the skin. Only healthy skin function can truly achieve a delicate, fair, firm, and youthful state.

Advantages of the APIA Methodology

The planning and full life cycle management strategies of the APIA skin management approach are more appealing to consumers than traditional beauty methods. Against the backdrop of an expanding global beauty market, this specialized approach shows great potential for growth. On the one hand, the skin management plan is comprehensive and timely, covering all aspects of skin conditioning. The professional and customized system plan created by the skincare specialist for the customer targets long-term behaviours and accounts for both short-term and long-term skincare effects. The plan is based on improving healthy skin function, and each phase of the skin management plan is closely connected. Customers clearly understand the goals of each phase, and the fundamental improvement observed in the skin increases the professional confidence of practitioners and enhances the reputation of the beauty establishment. This approach not only focuses on the external improvement of the skin but also values the maintenance of the skin's internal functions, providing a new perspective and direction for the field of skin management. In addition, integrating the APIA skin management approach with modern technology, such as mobile apps or online platforms, can enhance the efficiency of skin management and customer engagement. These digital tools make it easy for customers to record and track the progress of their skincare treatments and provide instant feedback. These tools not only help clients better understand each stage of treatment planning and implementation but also enhance their sense of control over the skin improvement

process. In addition, these tools serve as aids for skincare professionals to communicate with customers, providing personalized care recommendations and reminders, thus enhancing customer satisfaction and loyalty.

Conclusions

The purpose of this study was to evaluate the effectiveness of the APIA skin management approach in improving skin health and client satisfaction. Through a comprehensive assessment and meticulous analysis of the skin conditions of 74 participants, we found that the APIA methodology achieved significant results in enhancing skin hydration, improving self-perceived sensations, and reducing skin issues such as acne, pigmentation, sensitivity, and signs of ageing. These results not only confirm the effectiveness of the APIA methodology for short- and long-term skin improvement but also underscore the importance of personalized and whole-life management in skin health. The scales and professional skin testers used in the study provide scientific assessments for skin management, enabling skin managers to develop and adjust treatment programmes based on the client's skin condition. This study also investigated the potential of integrating APIA methodology with modern technology to enhance client engagement and simplify care documentation.

While this study demonstrates APIA's efficacy under controlled conditions, further research is needed to evaluate its clinical feasibility in real-world settings, including cost-effectiveness analyses, practitioner training requirements, and adaptability across diverse socioeconomic contexts. The methodology's practicality may be influenced by access to specialized diagnostic tools (eg, DJM Cat Skin Detector II) and client adherence to long-term behavioral interventions.

It is important to note that the current study faced limitations in terms of research design and assessment methods. Due to the nature of the APIA method, which requires dynamic adjustments of care plans based on complete and continuous skin condition assessments, full blinding may impede the timely optimization of the care plans. To address this, we have implemented the following measures to ensure rigor in the current study: using standardized instruments to collect some objective indicators, incorporating patient self-assessment scales for cross-validation, and planning to introduce expert blinded review in future studies.

Additionally, considering the involvement of multi-center collaboration and time constraints in this study, a team assessment model was adopted. However, we have taken the following steps to ensure quality: all skin managers completed ≥ 80 hours of standardized training and assessment, regular calibration meetings were held to unify assessment standards, and double independent assessment was implemented for key indicators. Future research will prioritize the use of single-assessor designs.

To further strengthen the evaluation system, we plan to introduce standardized patient satisfaction questionnaires and self-assessment scales in subsequent studies. These tools will provide a more comprehensive understanding of patients' subjective perceptions of both the treatment process and outcomes, thereby offering additional validation of the research findings. Moreover, we intend to incorporate more compliance measurement tools in future research to objectively quantify changes in skin parameters.

In summary, the APIA skin management methodology offers a scientific, comprehensive, and personalized set of protocols for skin care practices. Its positive impact on improving skin health and customer satisfaction has been demonstrated in practical applications. Future studies should focus on: (1) standardizing training protocols for skin managers, (2) developing simplified assessment tools for resource-limited settings, and (3) conducting comparative effectiveness trials against conventional approaches, and (4) improving the blinding design and assessment standardization. With the continuous development of the beauty market, the APIA methodology is expected to become an important tool for enhancing skin health and customer satisfaction.

Data Sharing Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Ethics Approval and Consent to Participate

The study was conducted in accordance with the Declaration of Helsinki, and approved by the Scientific Research Ethics Committee of the School of Light Industry Science and Engineering, Beijing Technology and Business University, with approval number BTBUECSR2024031. Written informed consent was obtained from the patient for the publication of anonymized clinical details and accompanying images. The patient acknowledged full understanding of the purpose of this publication and confirmed no objections to the use of relevant data for academic purposes.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study. Written informed consent has been obtained from the patients to publish this paper.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare no conflicts of interest in this work.

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