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Application and Possibilities of Yin-Yang and Five Elements Constitution Theory for Beauty and Health Content Development

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Abstract

Purpose: *This study analyzed the innate organ characteristics and constitution of an individual based on the theory of yin-yang and five elements, which is a core theory of oriental medicine. The purpose is to apply a constitutional identification method utilizing the Heavenly stem and Earthly branch to identify the interactions between weak organs, meridians, and muscles according to constitution, and to design and apply beauty health content, a modern and scientific personalized program suitable for the smart beauty era, based on this.*

Method: *In order to explore the constitutive principles of the theory of yin-yang and the five elements, we investigated previous studies on the theory of yin-yang and the five elements in domestic research information services (RISS), government-funded research institutes, dissertations, and academic journals, and conducted a literature review of papers closely related to the content of this study.*

Results: *The constitutional classification method using Heavenly stem and Earthly branch was able to achieve more precise classification than the existing Sasang Constitutional System or Eight Constitutional System, and the constitutional classification based on Yin-Yang and Five Elements Constitution Theory was confirmed to be closely related to physiological characteristics such as organ function, meridian flow, and muscles. Through this process, the basis for showing the applicability of managing meridians and muscles linked to weak organs by constitution was presented.*

Conclusion: *This study analyzed the innate organ characteristics and constitution of an individual based on the constituent principles of Yin-Yang and Five Elements Constitution Theory. By supplementing the existing constitution analysis method and reflecting the physiological differences according to constitution, it enabled more scientific and efficient personalized management. This is evaluated as an alternative that can increase the feasibility and sustainability of constitution-based health management programs.*

Keywords: ***Oriental Medicine, Yin-Yang and Five Elements Constitution Theory, The Yellow Emperor's Inner Canon, Sasang Constitutional System, Eight Constitutional System***

1. Introduction

Modern society is pursuing a lifestyle that combines healthy beauty, or wellness, and beauty, and in this process, the demand for customized beauty and health content optimized for each individual's constitution and lifestyle is rapidly increasing[1][2][3]. Accordingly, the beauty and health industry is moving away from the existing uniform product-centered structure and is emerging as a core strategy for customized content design based on constitution that comprehensively considers various factors such as individual organ functions, skin characteristics, emotional temperament, and lifestyle habits. In this changing trend, the theory of yin-yang and the five elements, a concept of oriental medicine, is a theory that enables holistic health management based on the interaction between the human body and nature[4][5].

In particular, Yin-Yang and Five Elements Constitution Theory analyzes the functions of human organs according to the properties of yin-yang and the five elements[6][7], and is a structure that can comprehensively interpret the characteristics, emotional responses, skin responses, and health management of each constitution[8]. This can be applied as a basis for developing practical beauty & health content beyond simple theoretical interpretation. For example, the Wood Yang (木陽) constitution is creative and active, but is sensitive to stress and has a high incidence of inflammatory skin troubles, and the Water Yin (水陰) constitution is introverted and highly sensitive, so it is likely to have dry and sensitive skin characteristics[8][9].

In addition, the constitution should be understood as a fluid system that can change according to seasons, emotions, external stimuli, etc., rather than a fixed characteristic[5][7], and accordingly, beauty & health content also requires a dynamic content composition strategy, not a static content[3]. By incorporating the analysis of the heavenly stems and support contained in the date of birth into the theoretical structure of the yin-yang and five elements constitution, it was found that the five elements' energy is reflected as the intensity of the organ function [6], and through this, a more precise constitution classification system was established.

This serves as the basis for supporting the possibility of quantifying constitutional identification and the possibility of automating the development of constitution-based beauty & health content[8][9]. Based on this theoretical foundation, this study examines the compositional principles of Yin-Yang and Five Elements Constitution Theory, analyzes the constitutional identification method based on Heavenly stem and Earthly branch and the correlation between the organs, meridians, muscles, and skin reactions by constitution, and presents a composition strategy that integrates them[8][10][11].

2. Research Methods

Constitution Theory and the development of customized beauty & health content in domestic research information service (RISS), government-funded research institutes, dissertations, and academic journals, and conducted a literature review of papers closely related to the contents of this study. And, we reviewed the abstracts and titles using keywords such as Yin-Yang and Five Elements Constitution Theory, Emperor's Inner Scriptures, The Yellow Emperor's Inner Canon, Sasang constitutional system, and Eight Constitutional System in the academic research information service. Data collection included theoretical composition principles, application cases and surveys of Yin-Yang and Five Elements Constitution Theory, limitations and potential supplements to existing constitution analysis methods, preventive medicine value, and applicability to modern convergence healthcare[11][12].

3. Background of the Study

3.1. Personalized trends in the beauty & health industry

The beauty & health industry is moving away from a technology-centered, standardized service model and is establishing a customized approach that takes into account an individual's physiological characteristics, constitution, emotions, skin condition, and lifestyle as an essential strategy[1][2]. In particular, the K-beauty industry is evolving into a digitalized, smart consumer-centered healthcare system through convergence with 4th industrial revolution technologies, and this, coupled with the spread of demand for customized beauty & health content, is leading to a shift in the industrial paradigm[13].

The concept of smart beauty, which emerged in this trend, reflects a new shift in perception that goes beyond simple beauty and views health intervention factors and aesthetic pursuit as an integrated system. Smart beauty has a complex, convergent academic nature that pursues the '4E elements' that encompass eco-friendliness, economy, efficiency, and accessibility for everyone, and this becomes the structural foundation that can be integrated with the content of yin-yang and five elements constitution based on oriental medicine[1][14].

In addition, in the beauty and healthcare sectors, constitution-based content has great potential for convergence with personalized healthcare platforms, smart devices, and emotion-based digital management content[15][16][17]. K-smart beauty is developing into AI-based constitution analysis systems, skin care protocols based on bio-signal responses, and personalized product recommendation algorithms, which are consistent with the content composition strategy that integrates constitution, emotion, skin condition, and health condition[12][17][18].

According to Yin-Yang and Five Elements Constitution Theory, there are differences in skin sensitivity, sebum secretion, and moisturizing ability of individuals, and it has been reported that emotional response tendencies by constitution also have a significant effect on skin health [19]. Against this backdrop, beauty & health content based on constitution is attracting attention as a strategy that can simultaneously consider physiological differences and emotional receptivity, and in particular, studies that focused on the correlation between constitution, skin characteristics, and health management have been actively conducted through literature reviews of the subject scope[20][21][22].

3.2. Necessity of content based on yin-yang and five elements constitution theory

Yin-Yang and the Five Elements theory, one of the basic theories of Oriental medicine, is an integrated theory that explains the fundamental principles of the universe and human life, and plays an important role in interpreting physiological and pathological changes in the human body[23]. Yin and yang are opposing yet complementary concepts, and are essential principles for maintaining balance and homeostasis within the human body, and the five elements explain the relationship between changes in nature and the functions of organs within the human body through the circulation and interaction of the five elements of wood, fire, earth, metal, and water[24]. The theory of yin-yang and five elements has been developed beyond a simple philosophical concept by being applied to diagnosis and treatment for actual clinical practice and health management. Based on this, the ancient medical book The Yellow Emperor's Inner Canon also systematizes the harmony of internal and external functions, the causes of diseases, and the human body's response to seasonal changes[23][24].

A person's constitution is determined by innate factors, but is interpreted as a fluid system capable of gradual transformation due to acquired environmental changes, seasonal factors, emotional reactions, etc.[23]. This suggests that a dynamic and cyclical constitution analysis method is needed, rather than a static diagnosis method, and that content composition must also be able to flexibly respond to user changes[5][25]. It was emphasized that improving the constitution can be realized through a lifestyle health management approach that utilizes the interaction of yin and yang and the five elements, and this requires a long-term and organic design in planning content for each constitution[3][26].

In addition, the possibility of quantitative discrimination of constitution was presented by combining the Yin-Yang and Five Elements Constitution Theory with the heavenly support structure of Myeongri studies, which serves as a theoretical foundation that can be applied to an AI-based constitution analysis system or digital healthcare platform[18][20][26]. As a result, the yin-yang and five elements constitution theory is an integrated health management system that can interpret complex data such as book function analysis, seasonal health management, emotional control, and skin condition based on an individual's constitutional characteristics. Beauty & health content based on this is scientific and practical with user-tailored preventive care[16][17][19].

3.3. Conceptual understanding and characteristics of yin-yang and five elements constitution theory

Yin-Yang and Five Elements Constitution Theory is a theory that, based on Oriental medicine, analyzes the body's internal organs and constitutional temperament according to the properties of Yin, Yang, and the five elements (wood, fire, earth, metal, water) and classifies them into eight constitutions[25]. This constitutional theory is a form of constitutional medicine that systematically understands the functions of each person's innate organs based on the interaction of coexistence and polarity between the five elements and the principle of balance between yin and yang, and can comprehensively analyze the disease occurrence tendency, body type, and emotional characteristics[24].

It was empirically analyzed that Yin-Yang and Five Elements Constitution Theory is closely related to the physiological characteristics of the skin. Depending on the constitution, the amount of sebum secretion, sensitivity, and moisturizing power of the skin were found to be different, showing that an individual's emotional response, lifestyle habits, and essential characteristics of the constitution can be expressed externally[4][5][27]. These results serve as evidence supporting the possibility of developing customized skin care content based on body constitution in the beauty and health field[1].

The analysis method of Yin-Yang and Five Elements Constitution Theory states that an individual's strength and weakness of the organs and constitutional tendencies can be inferred through the energy of the five elements contained in the date of birth, and this has become a theoretical basis for more quantifying and objectifying constitutional identification. The combination of Mingli (four pillars of destiny) and Yin-Yang and Five Elements Constitution Theory can contribute to concretizing and systematizing the existing abstract constitutional classification [4][11][12]. In addition, it was emphasized that the constitution can be gradually transformed according to environmental stimuli, lifestyle, and emotional reactions. This means that Yin-Yang and Five Elements Constitution Theory is not simply based on innate factors, but changes fluidly according to acquired factors, and accordingly, constitutional analysis requires continuous observation rather than a fragmentary judgment[28].

3.4. Understanding the sasang constitutional system and the eight constitutional system

In oriental medicine, understanding the unique constitutional characteristics of an individual and customized diagnosis and treatment based on this have been important. Sasang constitutional theory was founded by Lee Je-ma (1837-1900), a physician in the late Joseon Dynasty, and classifies human constitutions into four types: Taeyangin, Soyangin, Taeeumin, and Soeumin[7][8][18]. This theory states that the functions of specific organs are strong or weak depending on the constitution, and explains that physical and psychological characteristics and disease tendencies differ accordingly[17][26].

For example, Taeyangin is classified as having strong lungs and weak liver, and Soyangin is classified as having strong spleen and weak kidney. The Eight Constitutional System states that each constitution is related to the strength and weakness of specific organ functions, and that this determines the individual's physical and mental characteristics. It suggests customized prescriptions for not only disease treatment but also overall lifestyle management such as diet, exercise, and emotional control based on constitution[7][18][19].

Both theories emphasize customized health management and treatment according to the individual's constitutional characteristics and share the commonality of emphasizing a preventive medicine approach[18][20]. However, while the Sasang constitutional system focuses on disease treatment through pathological symptoms, the Eight Constitutional System classifies diseases into eight types of symptoms and sees that a single symptom can include various diseases, showng a difference in theoretical approach[23][25].

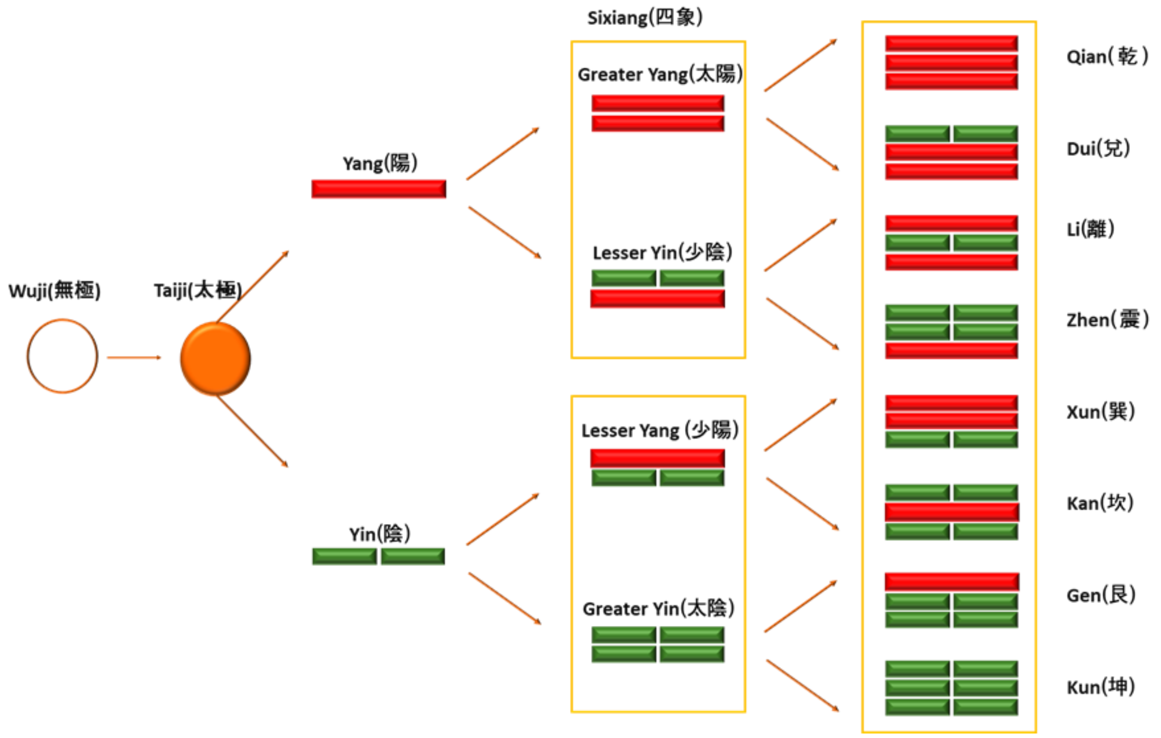
Recently, there have been active attempts to verify and apply these traditional constitution theories using modern scientific methods. For example, tools such as Ayurvedic constitution classification, face, body type, voice, and questionnaire-based constitution diagnosis tool (SCAT β-version) have been developed to increase the possibility of quantifying constitution diagnosis [9][27], and through this, they are trying to scientificize the design of constitution-based personalized medical care and beauty & health content.

4. The Constitutive Principles of Yin-yang and Five Elements Constitution Theory

4.1. Personalized trends in the beauty & health industry

From the perspective of oriental medicine regarding the principles of creation of the universe, Wuji (無極) means the original state without any nature or distinction, and from this, a central principle called Taiji (太極) is formed. Taiji is further divided into Yin and Yang, and the Sixiang (四象) expands into Greater Yang (太陽), Lesser Yin (太陰), Lesser Yang (少陽), and Greater Yin (少陰). Afterwards, Sixiang was divided into Bagua (八卦): Qian (乾), Dui (兌), Li (離), Zhen (震), Xun (巽), Kan (坎), Gen (艮), and Kun (坤), which is the structure of creation of the universe based on the theory of Tai Chi and the theory of yin and yang in The Book of Changes (周易), and is a core principle of Eastern thought that values the harmony between nature and humans[10][16][28].

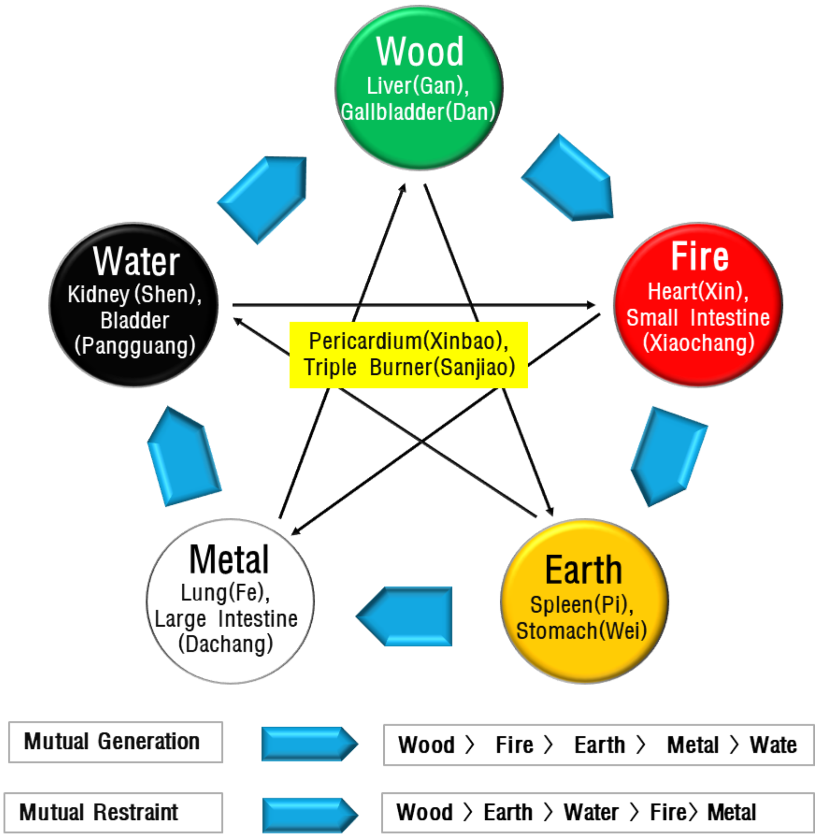
Figure 1. The process of separating wuji into bagua.



This structure is the theoretical basis of Yin-Yang and Five Elements Constitution Theory, and classifies human constitutions into eight types: Gold Yang(金陽), Gold Yin(金陰), Water Yang(水陽), Water Yin(水陰), Wood Yang(木陽), Wood Yin(木陰), Earth Yang(土陽), and Earth Yin(土陰) based on the differentiation principle of Yin-Yang and Five Elements[10][16][28]. This is based on the attributes of the Five Elements and the functional characteristics of the organs of each constitution, and allows us to know the innate strength and weakness of the constitution and the scale of health. <Figure 1> shows the transformation process from Wuji to Taiji[3][15].

The theory of yin-yang and the five elements states that the five elements of wood, fire, earth, metal, and water that make up nature maintain balance by circulating according to the principle of mutual generation and mutual inhibition, and each of these corresponds to a major organ of the human body[24]. Wood (木) is connected to the liver and gallbladder (肝·膽), fire (火) is connected to the heart and small intestine (心·小腸), earth (土) is connected to the spleen and stomach (脾·胃), metal (金) is connected to the lungs and large intestine (肺·大腸), and water (水) is connected to the kidneys and bladder (腎·膀胱)[5]. The <Figure 2> below shows the arrangement of the five elements in the five viscera and six bowels.

Figure 2. The five elements in the five viscera and six bowels.



5. Universality and Specificity of Yin-yang and Five Elements Constitution Theory

Yin-Yang and Five Elements Constitution Theory analyzes the composition of each individual's five elements through the Heavenly stem and Earthly branch of the date of birth, the Four Pillars of Destiny, and analyzes the constitution by confirming yin and yang[7]. In other words, yin and yang explain all phenomena in the world as two opposing but complementary principles, and the constitution is analyzed based on the interaction between this yin and yang and the five elements.

In particular, the information on the Heavenly Stems and Supporting Branches according to an individual's date of birth reflects the tendencies of the Five Elements and is used as a criterion for constitution diagnosis that determines the strength and weakness of the functions of the organs[6]. Ultimately, Yin-Yang and Five Elements Constitution Theory is an integrated theory that utilizes a profound philosophical system derived from ancient Eastern cosmology as a practical constitution analysis tool, and can be used to create personalized beauty & health content by comprehensively considering various factors such as organ functions, emotions, appearance, and date of birth. <Figure 3> is the Four Pillars of Destiny and Sexagenary Cycle.

Figure 3. Four pillars of destiny and sexagenary cycle[20][28].

1 甲子 Jiazi	2 乙丑 Yichou	3 丙寅 Bingyin	4 丁卯 Dingmao	5 戊辰 Wuchen	6 己巳 Jisi	7 庚午 Gengwu	8 辛未 Xinwei	9 壬申 Renshen	10 癸酉 Guiyou
11 甲戌 Jiaxu	12 乙亥 Yihai	13 丙子 Bingzi	14 丁丑 Dingchou	15 戊寅 Wuyin	16 己卯 Jimao	17 庚辰 Gengchen	18 辛巳 Xinsi	19 壬午 Renwu	20 癸未 Guiwei
21 甲申 Jiashen	22 乙酉 Yiyou	23 丙戌 Bingxu	24 丁亥 Dinghai	25 戊子 Wuzi	26 己丑 Jichou	27 庚寅 Gengyin	28 辛卯 Xinmao	29 壬辰 Renchen	30 癸巳 Guisi
31 甲午 Jiawu	32 乙未 Yiwei	33 丙申 Bingshen	34 丁酉 Dingyou	35 戊戌 Wuxu	36 己亥 Jihai	37 庚子 Gengzi	38 辛丑 Xinchou	39 壬寅 Renyin	40 癸卯 Guimao
41 甲辰 Jiachen	42 乙巳 Yisi	43 丙午 Bingwu	44 丁未 Dingwei	45 戊申 Wushen	46 己酉 Jiyou	47 庚戌 Gengxu	48 辛亥 Xinhai	49 壬子 Renzi	50 癸丑 Guichou
51 甲寅 Jiayin	52 乙卯 Yimao	53 丙辰 Bingchen	54 丁巳 Dingsi	55 戊午 Wuwu	56 己未 Jiwei	57 庚申 Gengshen	58 辛酉 Xinyou	59 壬戌 Renxu	60 癸亥 Guihai

Yin-Yang and Five Elements Constitution Theory is an oriental medical theory system that attempts to interpret human physiology and disposition according to the laws of nature, and its universality is shown in the following three aspects. First, it is a holistic theory system that presupposes the organic relationship between humans and nature[29]. That is, it has the core principle that human physiological changes and diseases appear according to the cycle and seasonal changes of nature[25][26].

Second, it is an innate analysis system that can apply the same principle to various individuals by distinguishing the constitution through factors such as Heavenly stem and Earthly branch at the time of birth and seasonal energy. It has universality in that it can be applied to anyone regardless of race, gender, or age[30]. In addition, it allows an integrated approach to human physiological changes regardless of the East or the West, and each constitution is closely related to the corresponding organs, emotions, eating habits, skin characteristics, etc.[5][7].

Third, Yin-Yang and Five Elements Constitution Theory emphasizes a preventive medicine approach. Diseases can be prevented in advance by adjusting diet, lifestyle, and environmental factors based on the characteristics of each constitution and the strength and weakness of each organ. This is in line with the personalized health management emphasized in modern medicine[14]. These characteristics have great potential for use as a theoretical basis for integrated health management, wellness industry, and beauty & health content development.

Yin-Yang and Five Elements Constitution Theory has both universality and unique specificity. First, it analyzes an individual's innate constitution based on the interaction between yin-yang and the Five Elements and the internal organs, and in particular, the Eight Constitutional System classification and the Five Elements and Internal Organs relationship have structural characteristics that distinguish them from other constitution theories[12]. Second, it uses the Heavenly stem and Earthly branch and the Four Pillars of Destiny as the basis for constitutional identification to quantitatively analyze the distribution of the Five Elements, and through this, it structurally identifies the constitutional types[6]. This has a high possibility of field applicability because it is possible to derive the same results by only acquiring a certain amount of theory while securing formal and logical systematization[4][14].

Third, recommended diets, exercise, emotional management, and environmental adaptation methods are clearly presented according to constitution, and through this, it goes beyond theoretical interpretation and includes the possibility of practical industrial application. Fourth, other existing constitutional analyses have limitations in that the results may vary due to the subjectivity of the examiner. On the other hand, Yin-Yang and Five Elements Constitution Theory utilizes fixed information to enable more consistent and objective constitutional identification [7]. This can be utilized as a highly reliable system that can produce the same results even when multiple people analyze the same person. Therefore, it has both clarity and practicality in constitutional analysis, and can be used as a tool for designing personalized, customized content.

6. Conclusion and Suggestions

Personalized beauty & health content based on Yin-Yang and Five Elements Constitution Theory has the potential to be applied as a practical customized management system by comprehensively considering the direction of the meridians and major muscles related to the strength and weakness of the innate organ functions by constitution type[15][26][31]. In particular, specialized meridian and muscle management content based on constitution classification can be an effective practical basis for achieving the goals of various programs such as skin care, body management, home training, emotional stability, and immunity enhancement[32][33].

The key to developing customized content is to design content centered on meridians and muscles that manage functional imbalances between organs in advance through constitutional identification, soothe overactive organs, and supplement weak organs. Constitutional customized management can enable differentiated beauty and health management, breaking away from the existing uniform beauty and health management methods[34]. In terms of content composition, various management techniques such as manual management, application of high-frequency and LED-based skin beauty devices, aromatherapy, meditation therapy, and fascia relaxation stretching can be combined and utilized according to the constitution type[33][34].

In terms of future feasibility, we can expect the digitalization of the constitutional identification and content prescription system based on the yin-yang and five elements constitution through convergence with information and communication technology (ICT) and artificial intelligence (AI)-based data analysis systems[19][21]. If a body type identification algorithm and an automatic content recommendation system are built based on data such as each individual's date of birth, skin condition, and lifestyle habits, it will be possible to expand into a personalized beauty & health content platform that can be used in both face-to-face and non-face-to-face environments[2].

Yin-Yang and Five Elements Constitution Theory can act as a competitive differentiation strategy in the global beauty & health market as a fusion content of modern K-beauty and oriental medicine. Such beauty & health content can become the basis for realizing smart beauty management that goes beyond simple external beauty and simultaneously aims to restore an individual's internal physiological balance and promote health. However, Heavenly stem and Earthly branch and Yin-Yang and Five Elements Theory have the disadvantage of not being easily accessible to learners because they require a three-dimensional learning method and learning difficult Chinese characters. Therefore, a step-by-step and systematic learning manual is needed. In future studies, it will be necessary to conduct management according to the analysis method of Yin-Yang and Five Elements Constitution Theory and conduct research to further increase objectivity through quantitative evaluation.

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8. Appendix

8.1. Author's contribution

	Initial name	Contribution
Lead Author	CL	-Set of concepts ☑ -Design ☑ -Getting results ☑ -Analysis ☑ -Make a significant contribution to collection ☑
Corresponding Author*	DL	-Final approval of the paper ☑ -Corresponding ☑ -Play a decisive role in modification ☑
Co-Author	JL	-Significant contributions to concepts, designs, practices, analysis and interpretation of data ☑ -Participants in Drafting and Revising Papers ☑ -Someone who can explain all aspects of the paper ☑

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Effectiveness of Cosmetics Containing Wild-Simulated Ginseng Ginsenoside for Activating Facial Skin

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Abstract

Purpose: *The domestic cosmetics industry has shown steady growth, fueled by advancements in cosmetic science and natural ingredient research. As the functional cosmetics market continues to expand, there is an increasing demand for natural materials with proven skin-enhancing properties. Therefore, this study aimed to develop a cosmetic formulation containing ginsenosides derived from wild-simulated ginseng and to scientifically evaluate its effects on facial skin through a human application study, thereby assessing its potential as an active ingredient in functional cosmetics.*

Method: *In this study, a 4-week human topical application trial was conducted by dividing participants into two groups: an experimental group to whom an essence containing ginsenosides derived from wild-simulated ginseng was topically applied, and a control group to whom an essence without ginsenosides was topically applied. The collected data were analyzed to verify the effects of the wild-simulated ginseng essence using paired t-tests and independent t-tests. Levene's test was conducted to assess the homogeneity of variances.*

Results: *The experimental group showed statistically significant improvements in wrinkles, pigmentation, and moisture levels after product use ($p < .05$). In contrast, although some improvement was observed in pore size and sebum levels (T-zone and U-zone), these changes were not statistically significant. In the control group, a statistically significant change was observed only in moisture levels, while no significant differences were found in the other parameters, including pore size, wrinkles, pigmentation, and sebum levels. In the between-group comparison, a statistically significant difference was observed only in the wrinkle parameter, with the experimental group showing greater improvement than the control group ($p < .05$). For the remaining parameters—pore size, pigmentation, sebum levels, and moisture—no statistically significant differences were found between the two groups. Meanwhile, for sebum levels in the U-zone, Levene's test indicated a violation of the assumption of homogeneity of variances. Accordingly, the data were analyzed using Welch's t-test, which does not assume equal variances.*

Conclusion: *The essence containing ginsenosides derived from wild-simulated ginseng was found to have positive effects on improving skin wrinkles, pigmentation, and hydration. These findings suggest the potential applicability of the essence as a functional cosmetic ingredient for preventing skin aging and improving the skin barrier. This study is significant in that it scientifically verified the skin benefits of ginsenosides derived from wild-simulated ginseng—a natural ingredient—through a human application trial. Future studies should include a larger number of participants and an extended application period to secure more generalizable evidence through large-scale human trials.*

Keywords: Wild Simulated Ginseng, Ginsenoside, Skin Activation, Essence, Functional Cosmetics

1. Introduction

The Korean cosmetics industry has been steadily growing, supported by advancements in cosmetic science and natural ingredient research. In particular, the market for functional cosmetics is rapidly expanding. These products go beyond basic cleansing and beauty purposes, offering specialized functions such as wrinkle reduction, skin whitening, and UV protection. According to the Ministry of Food and Drug Safety (2023), the total production value of Korean cosmetics reached approximately 14.5 trillion KRW in 2023, with exports amounting to around 11 trillion KRW, which represents a 7.5% increase compared to the previous year and recording the second-highest export volume on record. The production of functional cosmetics alone exceeded 5 trillion KRW, representing an 18.2% year-over-year increase and reflecting growing consumer demand[1].

The global market follows a similar trend. The functional cosmetics market is projected to grow from USD 11.76 billion in 2018 to USD 19.77 billion in 2024, while the domestic market is expected to expand from KRW 7.55 trillion to approximately KRW 28.4 trillion over the same period. This growth is driven by the increasing demand for anti-aging products in aging societies and the development of differentiated value chains centered on functional ingredients. As a result, interest in multifunctional ingredients with proven skin benefits has increased, and research on natural raw materials that ensure both efficacy and safety is actively underway. Among these, traditional herbal and natural ingredients have gained prominence, with a noticeable rise in related patent applications, positioning them as key components for securing market competitiveness[2].

Among natural ingredients, ginseng (Panax ginseng), traditionally used as a medicinal plant for centuries, is highly regarded as a potential material for functional cosmetics. Having been valued in East Asia for over 2,000 years, ginseng is now recognized not only in medicine and health supplements but also in high-functional skincare products. Its primary active components, ginsenosides, have been reported to exhibit diverse effects such as skin hydration, elasticity improvement, wrinkle prevention, anti-photoaging, skin regeneration, and antioxidant activity, further enhancing its potential as a cosmetic ingredient[3][4]. Recent studies demonstrated that topical application of 14% ginseng extract improved skin moisture and elasticity, while ginsenoside F1 inhibited UV-induced cell death and protected keratinocytes. Additionally, ginsenoside Rb1 has been shown to promote angiogenesis and tissue repair, contributing to skin regeneration[5].

Ginseng is categorized based on cultivation methods into cultivated ginseng, wild ginseng, and wild-simulated ginseng. Cultivated ginseng is grown in controlled farms for 4–6 years and offers consistent quality. Wild ginseng grows naturally in the mountains, making it rare and biologically active due to its slow growth and difficult harvest[6][7]. Wild-simulated ginseng combines the features of both; it is cultivated in environments mimicking natural mountain conditions and is classified as a special forest product under Korea's Forest Law. It grows without artificial coverings, maintaining natural growth conditions, and is considered an intermediate form with potentially superior bioactivity compared to cultivated ginseng[8][9][10].

Some studies report that wild-simulated ginseng contains higher levels of ginsenosides and exhibits superior antioxidant and immunomodulatory activities than cultivated ginseng[11]. As its cultivation period increases, the concentrations of Rg1, Rb1, and Rg3 rise, contributing to reactive oxygen species inhibition and skin cell protection[12]. Furthermore, its acidic polysaccharides enhance macrophage activity, potentially boosting immune functions[13]. These properties suggest that wild-simulated ginseng holds promise not only as a functional food ingredient but also as a natural source for skincare applications.

However, existing research has predominantly focused on cultivated ginseng, and scientific evidence on the skin benefits of wild-simulated ginseng remains limited. Therefore, this study aims to investigate the effects of ginsenosides derived from wild-simulated ginseng on skin activation through human trials and explore their potential as functional cosmetic ingredients.

2. Background of the Study

2.1. Definition and characteristics of ginsenosides

Ginsenosides are a class of saponin-based bioactive compounds derived from the roots of ginseng-related plants, including cultivated ginseng, wild ginseng, and wild-simulated ginseng. To date, approximately 200 types of ginsenosides have been identified. Structurally, they are glycosylated steroids, consisting of a multi-ring triterpenoid backbone with glycoside moieties composed of various sugars such as glucose, xylose, and arabinose. The type and position of the sugar residues significantly influence their solubility, absorption, and biological activity, indicating that structural diversity plays a critical role in their functional properties[14].

Based on their structural characteristics, ginsenosides are classified into three major groups: protopanaxadiol (PPD)-type, protopanaxatriol (PPT)-type, and oleanolic acid-type ginsenosides. he protopanaxadiol (PPD)-type ginsenosides include Rb1, Rb2, Rg3, Rh2, Rc, and Rd, and are primarily associated with anti-inflammatory, antioxidant, and immunomodulatory effects. In contrast, the protopanaxatriol (PPT)-type group comprises Rg1, Re, Rf, and Rh1, which are known for their neuroprotective, moisturizing, and skin regenerative properties. Meanwhile, the oleanolic acid-type ginsenoside, represented by compound Ro, exhibits strong antioxidant and anti-inflammatory effects. Together, these three types constitute the major categories of ginseng saponins. Due to these properties, ginsenosides are considered promising bioactive ingredients with customized functionality for use in functional cosmetics, health supplements, and pharmaceuticals[15][16][17].

In recent years, there has been growing interest in the skin-related bioactivities of ginsenosides, including moisturizing, regenerative, and antioxidant effects. Ginsenosides have been reported to exhibit antioxidant activity by reducing oxidative stress through the elimination of reactive oxygen species (ROS), thereby preventing skin aging[18][19][20]. They also exert anti-inflammatory effects by inhibiting the expression of inflammatory mediators such as NF-κB, COX-2, and iNOS, contributing to immune homeostasis in the skin[21]. Furthermore, ginsenosides promote fibroblast proliferation and collagen synthesis in the dermis, which enhances skin elasticity. By stimulating ceramide synthesis, they help strengthen the skin barrier and improve moisture retention[22].

Specifically, ginsenoside F1 has been shown to reduce UV-induced keratinocyte damage and enhance antioxidant activity[23], while Compound K increases hyaluronic acid biosynthesis, thereby improving skin hydration[19]. Ginsenoside Rb1 has been reported to promote angiogenesis and tissue repair, contributing to skin regeneration[24], and Rg3 and Rh2 have demonstrated potential for improving skin elasticity, reducing wrinkles, and preventing photoaging [25][26].

2.2. Skin activation

The skin serves as a biological barrier that protects the body from external environmental factors, maintaining homeostasis through keratinocyte differentiation, fibroblast activation in the dermis, collagen and elastin synthesis, immune responses, and antioxidant mechanisms. However, various factors such as pollution, ultraviolet (UV) radiation, and aging can weaken the skin's defense functions and structural stability, leading to functional decline[27][28].

To address these issues, research on physiological mechanisms and interventions for restoring and maintaining skin function has been actively conducted. Recent studies have focused on improving cellular function and promoting tissue repair to enhance skin health[21]. In particular, fibroblast proliferation and stimulation of collagen and elastin synthesis in the dermis are directly related to skin elasticity improvement[29]. In damaged skin, keratinocyte and dermal cell migration and proliferation contribute to wound healing, while increased hyaluronic acid synthesis enhances skin hydration and barrier function[27][30].

Antioxidant and anti-inflammatory activities are also considered key mechanisms in skin activation. The skin is constantly exposed to various internal and external stimuli such as UV rays, air pollution, and stress, which lead to the generation of reactive oxygen species (ROS). Since ROS are major contributors to cell damage and skin aging, antioxidant defense plays a crucial role in maintaining skin health. The body activates an antioxidant system comprising enzymes such as superoxide dismutase (SOD), catalase, and glutathione, which eliminate ROS and prevent cellular damage[31][32]. Furthermore, suppression of the NF-κB signaling pathway reduces inflammatory responses and inhibits the expression of pro-inflammatory cytokines such as COX-2 and TNF-α, thereby contributing to the alleviation of inflammatory skin conditions[33][34].

Skin activation, therefore, involves complex physiological processes such as enhancement of cellular functions, antioxidant and anti-inflammatory actions, and structural regeneration, all of which are essential for maintaining healthy skin.

To quantitatively evaluate skin activation, a comprehensive analysis of multiple physiological indicators is required, rather than relying on a single metric[35]. For instance, pore size and density reflect skin elasticity and sebum status, while wrinkle depth and area are associated with the skin's regenerative capacity through collagen and elastin synthesis. Additionally, pigmentation and skin tone uniformity relate to melanin synthesis and blood circulation, while sebum levels indicate barrier balance and protective function. Skin moisture content reflects hydration and the level of hyaluronic acid synthesis[36][37][38].

Thus, skin activation encompasses diverse physiological mechanisms, including cell regeneration, antioxidant and anti-inflammatory effects, moisturization, and elasticity enhancement. Scientific evaluation of these effects requires quantitative analysis of various skin indicators such as pores, wrinkles, pigmentation, and oil and moisture content. These parameters provide objective evidence of skin condition changes and serve as essential criteria for verifying the efficacy and credibility of functional cosmetics and skin-improving products.

2.3. Current research on ginsenoside-containing cosmetics

Ginsenosides, the primary active compounds of ginseng, exhibit a wide range of skin-related bioactivities including antioxidant, anti-inflammatory, anti-wrinkle, whitening, and moisturizing effects, and are thus actively studied as high-performance cosmetic ingredients. According to Saba et al. (2020), application of a cream containing ginseng extract for four weeks significantly improved skin hydration and elasticity[39]. Additionally, products containing ginsenoside Rb1 have been reported to accelerate skin recovery after UV exposure[40]. Rare ginsenosides derived from Rd have demonstrated wrinkle-reducing effects[41], and ginseng berry extract, known for its high polyphenol content, has shown effectiveness in improving the skin barrier, confirming its potential as a cosmetic ingredient[42].

A systematic review of the anti-aging mechanisms of ginsenosides has also been conducted[39], with Rb1 and Rg4 in particular shown to alleviate UV-induced damage and promote hair growth[43]. However, due to their large molecular size and low lipid solubility, ginsenosides face limitations in skin absorption. To overcome these barriers, various delivery systems such as nanoemulsions and liposomes have been developed[44][45].

With the growing market for oriental herbal cosmetics, studies utilizing ginsenosides derived from wild-simulated ginseng are also increasing. Recent research focuses on scientifically validating the skin-improving effects of ginsenosides and developing technologies that enhance their functionality, including hydration, antioxidant activity, and wrinkle reduction. These efforts reflect the increasing interest in effective delivery of ginsenoside efficacy and suggest growing potential for their application in cosmetics[46][47].

3. Research Methods

3.1. Selection of study participants

This study was conducted to evaluate the effects of a wild-simulated ginseng-derived ginsenoside-containing essence on skin activation in women aged 40 to 60. Participants were selected in accordance with the guidelines provided by the Ministry of Food and Drug Safety (MFDS), and the study design and procedures adhered to these standards. Individuals with specific skin conditions such as severe acne, atopic dermatitis, or infectious diseases on the facial area, as well as those with known allergic reactions to cosmetics, were excluded. In addition, individuals who had participated in similar human application studies within the past six months, those who were pregnant or breastfeeding, and those who had undergone medical procedures or physical skin treatments were excluded from the study. A total of 10 participants were ultimately selected after assessing and analyzing the facial skin condition prior to the experiment and conducting a background survey via questionnaire. Prior to the start of the study, all participants were thoroughly informed of the study's objectives and procedures, and written informed consent was obtained. The basic demographic characteristics of the participants are presented in <Table 1>.

Table 1. General characteristics of participants.

Category		Frequency	Percentage (%)
Age	40s	4	33.3
	50s	5	41.7
	60s	3	25.0
Gender	Male	0	0.0
	Female	12	100.0
Skin Type	Dry	9	75.0
	Normal	0	0.0
	Combination	0	0.0
	Sebum Deficient	3	25.0
	Sebum Deficient	3	25.0

3.2. Experimental materials

The wild-simulated ginseng extract used in this study was obtained from a certified pesticide-free farm located in Bongpyeong-myeon, Pyeongchang-gun, Gangwon Province. The farm is officially registered as a producer of specially managed forest products and holds a valid certification. The supplied ginseng was 10 years old and, after harvesting, was washed with distilled water and dried at room temperature. Hot water extraction was then performed at 80°C for four days, followed by filtration through a mesh strainer. The filtered extract was either used immediately at room temperature or stored under refrigeration for later use in the experiment.

In addition, the wild-simulated ginseng essence containing ginsenosides used in this experiment was manufactured by Company L, a cosmetics manufacturer based in Gyeonggi Province. The essence was prepared through a series of standard formulation processes, including heating, mixing, emulsification, and cooling. It contained 3% wild-simulated ginseng extract, in addition to common base ingredients such as purified water, glycerin, and preservatives. The control product was formulated using the same base ingredients but without the ginseng extract, and was used for comparative analysis with the experimental product.

3.3. Measurement instruments

In this study, the A ONE SMART Pro, a facial skin analysis device developed by Bomtech Electronics Co., Ltd., was utilized to precisely assess facial skin conditions. The device is designed to precisely measure structural changes and pigmentation characteristics of the skin by employing non-contact high-resolution imaging technology and a multi-wavelength light source system. It utilizes three types of light sources—visible light, ultraviolet (UV) light, and polarized light—which enable comprehensive evaluation of the skin's reflective and absorptive properties. Through this analysis, various physiological parameters of the skin, including pore size and density, wrinkle depth and area, pigmentation levels, skin hydration, and elasticity, can be quantitatively measured and assessed. The external appearance of the device is shown in <Figure 1>.

Figure 1. Facial skin analysis device (A ONE SMART Pro).

3.4. Measurement methods

This study was conducted over a period of four weeks, from December 21, 2024, to January 21, 2025. Ten participants were randomly assigned into two groups: the experimental group (n=5), which used an essence containing 3% ginsenosides, and the control group (n=5), which used an essence without ginsenosides. Participants applied a designated amount of the product using a standardized spoon after cleansing in the morning and evening. The use of other basic skincare products was restricted during the study, while regular use of color cosmetics was permitted.

All procedures were performed in a controlled environment with blocked direct sunlight, at a temperature of 22 ± 2°C and humidity of 50 ± 10%. Prior to measurements, participants cleansed their entire face with a standardized cleanser and underwent a 30-minute rest period to stabilize the skin. Skin conditions were quantitatively evaluated using calibrated equipment operated by the same researcher to ensure consistency and minimize measurement error.

Measurements were conducted under consistent artificial lighting in a closed, draft-free space, eliminating the influence of external light or airflow.

As illustrated in <Figure 2>, the measurement areas included the forehead, nose, cheeks, and chin on both sides of the face, centered along the midline. To ensure accuracy, participants wore headbands to prevent hair interference, and light was completely blocked during imaging. General light was used to visualize pores and wrinkles, UV light to assess pigmentation and sebum distribution, and polarized light imaging to evaluate dermal structure and microvascular patterns.

Sebum and moisture levels were measured using contact sensors placed on the cheek area. Consistent pressure was applied during the measurements to minimize error. Assessments were conducted twice—before and after the 4-week intervention—to quantitatively evaluate key skin activation indicators, including pores, wrinkles, pigmentation, sebum, and moisture content. The analyzed data are presented in <Figure 3>.

Figure 2. Facial skin analysis using three light sources.

Figure 3. 3D Surface image and cross-sectional analysis of skin measurement results.

3.5. Data analysis

In this study, statistical analyses were performed to evaluate the effects of a wild-simulated ginseng-derived ginsenoside-containing essence on facial skin activation by comparing an experimental group and a control group. To ensure the reliability of the study and derive more precise results, paired t-tests were conducted to analyze changes before and after essence application within each group, while independent t-tests were used to compare differences between the groups. The homogeneity of variance between groups was assessed using Levene’s test, and either equal or unequal variance assumptions were applied based on the test results. All statistical analyses were conducted using SPSS version 25.0, with the significance level set at $p < 0.05$.

4. Results

4.1. Pore

Wrinkle analysis revealed a significant reduction in the experimental group, from 2.811 ± 0.522 (pre-application) to 2.053 ± 0.706 (post-application) ($t = 5.372$, $p = 0.003$). In contrast, the control group showed a slight decrease from 3.521 ± 0.857 to 3.426 ± 0.935, which was not statistically significant ($t = 0.643$, $p = 0.549$) <Table 2>.

Between-group comparison showed significantly lower wrinkle scores in the experimental group (2.053 ± 0.706) compared to the control group (3.426 ± 0.935) ($t = –2.869$, $p = 0.017$), with equal variances as confirmed by Levene's test ($F = 0.226$, $p = 0.645$) <Table 3>.

As shown in <Figure 10>, the experimental group demonstrated a more pronounced reduction in wrinkles, supporting the potential efficacy of the ginsenoside essence in wrinkle improvement.

4.2. Wrinkle

Pigmentation analysis showed a significant decrease in the experimental group, from 2.211 ± 0.705 (pre-application) to 1.458 ± 0.527 (post-application) ($t = 2.747$, $p = 0.040$), while the control group showed a non-significant decrease from 2.685 ± 1.133 to 2.433 ± 1.127 ($t = 0.947$, $p = 0.387$) <Table 2>.

Between-group comparison showed significantly lower wrinkle scores in the experimental group (2.053 ± 0.706) compared to the control group (3.426 ± 0.935) ($t = –2.869$, $p = 0.017$), with equal variances confirmed by Levene's test ($F = 0.226$, $p = 0.645$) <Table 3>.

As shown in <Figure 10>, the experimental group demonstrated a more pronounced reduction in wrinkles, supporting the potential efficacy of the ginsenoside essence in wrinkle improvement.

4.3. Pigmentation

Pigmentation analysis showed a significant decrease in the experimental group, from 2.211 ± 0.705 (pre-application) to 1.458 ± 0.527 (post-application) ($t = 2.747$, $p = 0.040$), while the control group showed a non-significant decrease from 2.685 ± 1.133 to 2.433 ± 1.127 ($t = 0.947$, $p = 0.387$) <Table 2>.

Between-group comparison showed lower pigmentation scores in the experimental group (1.458 ± 0.527) compared to the control group (2.433 ± 1.127), although this difference was not statistically significant ($t = –1.409$, $p = 0.084$), with equal variances as confirmed by Levene's test ($F = 0.821$, $p = 0.386$) <Table 3>.

As shown in <Figure 10>, these results suggest a trend of pigmentation reduction in the experimental group, which may indicate a potential effect of the ginsenoside essence. However, due to the lack of statistical significance, further research with a larger sample size or longer application duration is warranted.

4.4. Sebum

Sebum analysis revealed an increasing trend in both the T-zone (from 142.166 ± 182.950 to 444.166 ± 557.839; $t = –1.787$, $p = 0.134$) and U-zone (from 250.166 ± 157.089 to 592.500 ± 491.331; $t = –1.975$, $p = 0.105$) of the experimental group, although these changes were not statistically significant. The control group also showed non-significant increases in the T-zone (from 141.000 ± 106.948 to 253.000 ± 310.399; $t = –1.233$, $p = 0.272$) and U-zone (from 376.166 ± 200.315 to 411.833 ± 176.531; $t = –0.586$, $p = 0.583$) <Table 2>.

Between-group comparisons showed no significant differences in sebum levels for either the T-zone (t = 0.734, p = 0.480; Levene’s F = 1.807, p = 0.209) or the U-zone (t = –0.848, p = 0.428). Levene’s test confirmed equal variances for the T-zone, but unequal variances for the U-zone (Levene’s F = 5.602, p = 0.039); therefore, Welch’s t-test was used for the U-zone comparison <Table 3>.

As shown in <Figure 10>, both groups exhibited increases in sebum levels, with a more pronounced trend in the experimental group. However, due to the lack of statistical significance, further research is warranted to elucidate the potential effect of the essence on sebum regulation.

4.5. Moisture

Moisture analysis revealed a significant increase in the experimental group, from 27.666 ± 1.211 (pre-application) to 39.000 ± 4.289 (post-application) (t = –7.800, p = 0.001). In contrast, the control group showed a non-significant increase from 30.166 ± 5.419 to 37.666 ± 6.377 (t = –2.082, p = 0.092) <Table 2>.

Between-group comparison showed no statistically significant difference in post-application moisture values between the experimental group (39.000 ± 4.289) and the control group (37.666 ± 6.377) (t = 0.425, p = 0.680), with equal variances confirmed by Levene’s test (F = 0.045, p = 0.836) <Table 3>.

As shown in <Figure 10>, the experimental group exhibited a greater increase in moisture content, suggesting potential hydration benefits of the ginsenoside essence. However, given the absence of statistical significance, these results should be interpreted with caution.

Table 2. Paired t-test results on changes in skin condition.

Analysis Type	Group	Pre (M ± SD)	Post (M ± SD)	T-value	P-value
Pore	Experimental	5.605±2.295	5.106±2.106	1.963	0.107
	Control	6.678±0.214	6.495±0.460	1.206	0.282
Wrinkle	Experimental	2.811±0.522	2.053±0.706	5.372	0.003
	Control	3.521±0.857	3.426±0.935	0.643	0.549
Pigmentation	Experimental	2.211±0.705	1.4583±0.527	2.747	0.040
	Control	2.685±1.133	2.4333±1.127	0.947	0.387
Sebum (U-zone)	Experimental	250.166±157.089	592.500±491.331	-1.975	0.105
	Control	376.166±200.315	411.833±176.531	-0.586	0.583
Sebum (T-zone)	Experimental	142.166±182.950	444.166±557.839	-1.787	0.134
	Control	141.000±106.948	253.000±310.399	-1.233	0.272
Moisture	Experimental	27.666±1.211	39.000±4.289	-7.800	0.001
	Control	30.166±5.419	37.666±6.377	-2.082	0.092

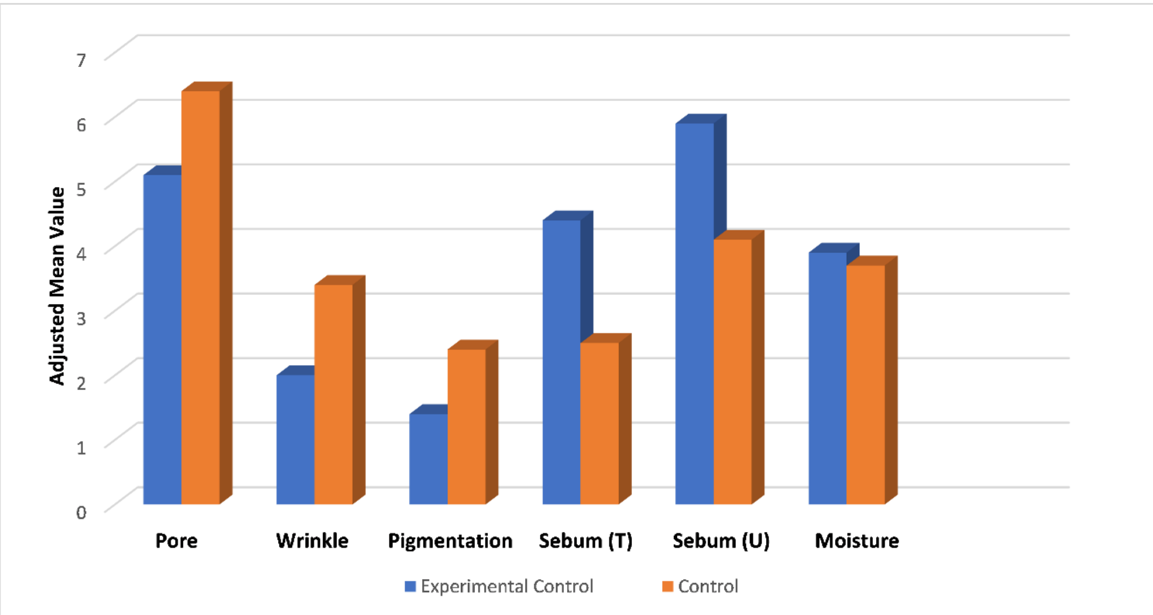
Note: p<.05.

Table 3. Independent t-test results for skin indicators after the experiment.

Analysis type	Experimental (M ± SD)	Control (M ± SD)	T-value	P-value	df	F	Levene p
Pore	5.106±2.106	6.495±0.460	1.577	0.146	10	3.237	0.102
Wrinkle	2.053±0.706	3.426±0.935	-2.869	0.017	10	0.226	0.645
Pigmentation	1.458±0.527	2.433±1.127	-1.409	0.084	10	0.821	0.386
Sebum (T-zone)	444.1±557.8	253.0±310.3	0.734	0.480	10	1.807	0.209
Sebum (U-zone)	592.5±491.3	411.8±176.5	-0.848	0.428	6.270	5.602	0.039
Moisture	39.00±4.289	37.666±6.377	0.425	0.680	10	0.430	0.527

Note: $p<.05$.

Figure 3. Post-test mean difference between the experimental and control groups.



5. Conclusion and Recommendations

In recent years, South Korea's cosmetics industry has shown increasing interest in functional cosmetics, leading to extensive research on natural ingredients with proven skin benefits. This trend is further accelerated by the rapid transition into a super-aged society, which has heightened the demand for anti-aging solutions, traditional herbal ingredients, and functional bioactive materials. Among these, wild-simulated ginseng, which is particularly rich in bioactive ginsenosides, has garnered attention as a highly promising ingredient for use in functional cosmetics due to its wide range of physiological activities[2].

In this study, an essence containing ginsenosides derived from wild-simulated ginseng was formulated and applied to human subjects to empirically evaluate its effects on various facial skin activation indicators, including pore size, wrinkle depth, pigmentation, sebum, and moisture levels. The experimental group that used the ginseng essence showed statistically significant improvements in wrinkles, pigmentation, and moisture ($p < .05$), indicating the potential of the formulation for anti-aging and enhanced skin hydration. In contrast, although no statistically significant differences were observed in pore size and sebum levels ($p > .05$), a trend toward improvement was noted. The control group exhibited a statistically significant change only in moisture content, while no significant differences were observed in other indicators.

Intergroup comparisons revealed a tendency toward improvement in pore size and sebum levels (T-zone and U-zone); however, these changes were not statistically significant. In contrast, a significant difference was observed in the wrinkle parameter ($p = 0.017$), indicating that the ginseng-based essence was effective in reducing wrinkles. This finding is consistent with a recent study by Lee et al. (2025), which also reported wrinkle-reducing effects of products containing cultivated wild ginseng[47]. Similar outcomes were noted in previous studies involving long-term use of ginseng-concentrated creams and the skin-improving effects of ginsenoside Rg3[48]. In particular, the physiological activities of ginsenosides—such as stimulation of collagen synthesis and inhibition of melanin production—have been well documented[49], thereby supporting the present study's conclusion that ginsenosides from cultivated wild ginseng have high potential as functional cosmetic ingredients.

Cultivated wild ginseng is grown in environments that closely mimic those of naturally occurring wild ginseng and is known to exhibit comparable physiological activity and ginsenoside content. It has shown higher antioxidant and immunomodulatory activity than conventionally cultivated ginseng, making it a highly promising ingredient for functional cosmetics. This study is significant in that it scientifically validated the skin-related effects of ginsenosides derived from cultivated wild ginseng through human application, thereby providing a foundation for the development of natural functional ingredients.

However, the study had certain limitations, including a small sample size, a relatively short experimental period, and limited control over external factors and lifestyle habits that may influence skin condition. These constraints restrict the generalizability of the results. Therefore, future research should aim to increase the sample size, include a broader range of age groups and skin types, and adopt long-term study designs supported by physiological biomarker-based quantitative analysis. Such efforts would enhance the reliability of the findings and contribute to the commercialization potential of cultivated wild ginseng as a functional cosmetic ingredient.

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7. Appendix

7.1. Author's contribution

	Initial name	Contribution
Lead Author	JL	-Set of concepts ☑ -Design ☑ -Getting results ☑ -Analysis ☑
Corresponding Author*	SJ	-Make a significant contribution to collection ☑ -Final approval of the paper ☑ -Corresponding ☑ -Play a decisive role in modification ☑
Co-Author	SP KL DL SK JK	-Significant contributions to concepts, designs, practices, analysis and interpretation of data ☑ -Participants in Drafting and Revising Papers ☑ -Someone who can explain all aspects of the paper ☑

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The Effect of Toenail Beauty Care Behavior using Reverse Pinching Technique on Customer Stress and Self-Esteem -Focusing on a Case Study of Problematic Toenails Care-

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Abstract

Purpose: *As interest in appearance and style increases in modern society, the beauty industry is developing and research on it is actively being conducted. In addition, the beauty industry is not limited to decorating appearance and style, but also contributing to the psychological stability and self-esteem of individuals. In particular, nail care is a very important part of providing external confidence. This study aims to confirm the positive effects through nail care behavior and develop a service strategy for improving professional nail care services and specialized nail care management in the future. In addition, it was conducted with the purpose of improving the quality of life of individuals along with the continuous growth of the beauty industry by emphasizing the importance of nail care, improving customers' beauty care behavior, and contributing to increasing self-esteem.*

Method: *In particular, an experimental study was conducted using the 'Nail and Toenail Shape Improvement Method' using the researcher's patented reverse pinching technique on 18 customers with problematic nails (ingrown nails) to measure satisfaction, pain scale, stress, and self-esteem before and after care, and the results were verified using a paired sample t-test.*

Results: *The research results that summarize this study are as follows. The experimental study conducted in this study verified the effects of a nail and toenail shape improvement program targeting problematic toenails. As a result of applying this program, the satisfaction with nail care and self-esteem of customers with problematic toenails were improved, and pain and stress were reduced, which was a positive result. Therefore, it is thought that applying the nail and toenail shape improvement program to customers who need to manage problematic toenails suggested a new method of strengthening the technical expertise of nail shops and providing professional services.*

Conclusion: *In particular, as a result of applying the problematic toenail shape improvement program through experiments, it was confirmed that the effects of reducing pain and stress as well as increasing self-esteem and customer satisfaction were empirically effective, and therefore, it is suggested that professional nail shops also utilize the reverse pinching technique of this program for customers who need to manage problematic toenails.*

The significance of this study is that problematic toenail care leads to the strengthening of the expertise of nail beauty services and provides guidelines for establishing service strategies that consider internal factors.

Keywords: ***Nail Care Behavior, Problem Nails, Reverse Pinching Technique, Fingernail and Toenail Shape Improvement Program, Stress***

1. Introduction

Beauty is one of the most important concerns of modern mankind. In today's competitive society, 'appearance' is considered not only an aesthetic expression, but also an important medium to strengthen differentiation and competitiveness from others[1]. In a recent 'Survey on Appearance and Plastic Surgery' conducted on 1,500 adult men and women aged 19 or older, when asked about the importance of appearance, approximately 20% responded that it was 'very important'[2]. Along with changes in awareness, with the development and change of social structure, modern people are shifting their interest in health from disease treatment to disease prevention, health maintenance, and a holistic concept of psychological and emotional health[3][4]. As a result, the beauty industry is becoming increasingly specialized and diverse. This perspective is progressing in the direction of improving and caring for physical problems, and the beauty industry is becoming increasingly specialized and segmented in each field from basic cosmetic management to care, improvement, and prevention[5]. In addition, foot care and nail care are also among the management methods developed as part of such efforts, and are receiving significant attention[6][7].

The current beauty is not simply a pursuit of beauty, but rather a concept that has expanded to include the meaning of well-being, as a means for a healthy and beautiful life. This trend has evolved toward solving and improving personal physical problems, and the beauty industry has become increasingly specialized and diversified from simple aesthetic beauty to management, improvement, and prevention. Among the beauty industries, the nail industry has also expanded its marketability as customized nail care services tailored to each customer have become more diverse[8], and consumers are becoming aware of problematic nail care through the mass media and taking action to manage it. In addition, it has been reported that awareness of foot care is increasing as body exposure increases along with changes in lifestyle. Therefore, interest in foot care is increasing as well as hand care, and unlike in the past when the focus was mainly on art, the importance of foot health and care is currently being emphasized.

In particular, efforts to create beauty in feet are being made in various nail shops in Korea. When nail shops were first introduced in Korea, they were only targeted at certain classes such as women entering society, but now, demand is increasing not only among women but also among men, and the age groups are also diverse, ranging from those in their 20s to those in their 50s[9]. Problematic toenails commonly include both congenital and acquired toenails, and are considered to be discolored and deformed toenails caused by various leisure activities, lifestyle habits, long walks, incorrect walking habits, inappropriate shoe selection, and neglect of care, which can cause stress on the toenails[10]. Accordingly, stress about problem toenails is increasing in various classes. As a result, many people are visiting nail shops or related problem toenail specialty stores for this management. In fact, according to an insider working at a specialty store, about 40% of the visitors are men, and they mainly visit for toenail fungus, ingrown toenails, and callus management. In this way, not only beauty but also health is receiving a lot of attention. Problematic toenails can be caused by prolonged walking or poor walking habits while wearing narrow shoes such as dress shoes, and eventually lead to toenail deformation[11]. In addition, external impact from hiking shoes, golf shoes, soccer shoes, etc. worn during sports or leisure activities can cause toenail deformation. In particular, toenail deformation is affected by environmental factors in addition to external factors, unlike fingernails. In general, it is difficult to identify problems with feet or toenails because socks are worn, and since they are areas that are insensitive to itching and pain, they often only become apparent when they progress to toenail deformities. In particular, discoloration and deformation of toenails are often ignored or neglected due to lack of awareness, and they often worsen to serious conditions. However, if toenails in an abnormal state are left untreated, they can stop growing and cause psychological problems, not just discomfort.

There are various types of problem toenails, but the most common symptoms are toenail fungus and ingrown toenails (Kim, 2010). The most representative form of problem toenails is onychomycosis, known to the general public as ingrown toenails. According to statistics from the Health Insurance Review & Assessment Service, it is a common lifestyle disease that more than 200,000 people visit hospitals for treatment every year (Medi Consumer News, 2021). The correct term is ingrown toenail, and it refers to the phenomenon in which the nail groove at the edge of the toenail is pressed or compressed, causing the toenail to dig into the flesh. It is also called ingrown nail, onychocryptosis, or onuchocrypeosis, a common toenail disease (Ministry of Education, 2015). Ingrown toenails are mainly caused by the following factors. First, when the toenail is cut too short or rounded, second, when the shape of the toenail is deformed due to neglect of toenail fungus, third, when wearing the wrong shoes such as high heels or small sneakers, fourth, chronic damage to the toenail due to trauma or exercise, fifth, when the natural curvature of the toenail becomes severe due to obesity or aging, and sixth, when it is genetic. Ingrown toenails form calluses in the nail grooves, causing pain, skin wounds, bacterial infections, and sometimes even suppuration. It is well known that toenails occur from the thumb to the little finger, and they occur a lot because the big toenail supports 60% of the body weight when walking. In modern society, many people wear uncomfortable shoes to enjoy social events or daily activities while enduring discomfort in their feet, which leads to poor posture, which accumulates foot-related fatigue and tends to cause various diseases. It can affect not only aesthetic issues but also general health, mental health, social function, and even self-confidence in appearance[12][13]. The reasons for wearing uncomfortable shoes and maintaining poor posture while enduring discomfort in the feet are very diverse. The social atmosphere that emphasizes fashion and appearance, and the influence of media, advertisements, and social media cause some people to choose a certain style of shoes, and the high importance of appearance or fashion can soon result in sacrificing comfort. In addition, in order to meet expectations at special events or gatherings or feel social pressure, they may endure discomfort, choose uncomfortable shoes or maintain bad posture for a special style or image in the media, or endure discomfort as a means of self-expression to emphasize their individuality or style through a specific style of shoes[14].

Treatment of problematic toenails is not only treatment but also essential for health awareness (Helfand, 1986), and can have a negative impact on the quality of life related to aesthetic aspects, so continuous and consistent management is necessary. Therefore, it is important to solve this by not only providing treatment but also raising health awareness, and it is important to prevent foot problems and maintain healthy feet and posture by wearing appropriate shoes and taking care of feet[15].

Problematic toenails can cause stress[16]. Stress can be simply viewed as the sum of emotions, especially anxiety and threats, that people feel in situations that are difficult to handle psychologically or physically. Stress caused by problematic toenails can be largely divided into psychological and physical parts. First, psychological stress can be said to be a feeling of psychological shame or embarrassment due to problematic toenails, and physical stress can be said to be a feeling of psychological anxiety or discouragement due to problematic toenails. These feelings can be seen as a feeling of frustration that occurs when actions cannot be taken due to factors other than one's own will, which can cause stress.

In addition to external care for discolored and deformed toenails, it can be said that a professional role that includes internal care that considers the customer's psychology is important. While the current problematic toenails have only confirmed satisfaction or fragmentary emotions, this study aims to conduct a general survey on problematic toenails and to determine the effectiveness of methods for customers with actual problematic toenails.

The cases of problem nail improvement presented in this paper are actual cases managed directly by the researcher, and the difference in visual changes is shown through photos before and after management along with the management period. Visual evidence showing such distinct changes not only shows the actual effect of nail care on problematic nails, but also serves as data proving the positive impact and changes on the quality of life, and it can be seen that these changes are especially important for customers with problematic nails. It emphasizes the importance of a professional approach to nail health and beauty, and demonstrates the actual impact of professional care on problematic nails to prove the effectiveness of nail care services. Humans experience stress due to various physiological, psychological, social, and environmental stimuli, and when the duration and intensity of stress experienced at this time exceeds the limit, it can progress to a disease state[17]. People experience stress at all stages of life from birth to death, regardless of age or gender. In modern society, stress is considered a very serious problem, and many people are exposed to various diseases due to it, and in particular, stress is closely related to major chronic diseases such as cardiovascular disease and cancer, which are the main causes of death in modern people. Therefore, this study also aims to examine how actual nail care behavior affects stress.

This study aims to empirically analyze the effects of the 'Method for Improving the Shape of Fingernails and Toenails' using the reverse pinching technique for which the researcher of this paper has applied for a patent, on the changes in customer satisfaction, pain scale, stress, and self-esteem for customers with problematic toenails. To this end, a paired t-test comparing before and after the experiment was conducted, and the experimental method, tools used, order, and before-and-after comparison photos were presented together to confirm the empirical effects of the application.

2. Theoretical Background

2.1. Nail care behavior

Nail care behavior means that the expected good image or effect of nail care behavior changes mood or emotion. In this study, nail care behavior is defined as all services that maintain and protect healthy and beautiful nails, such as cuticle management, exfoliation, and length adjustment, and maintain the shape of nails and maintain cleanliness and hygiene, coloring, gel nails, art design, wrapping, special nail care management (problem nail care), self-care, etc. Health is not simply defined as a 'state of absence of disease', but is a more comprehensive concept of physical, mental, and social well-being, and does not simply refer to a state of absence of disease or discomfort, but rather a concept of positive well-being through harmonious balance in various aspects such as quality of life, social interaction, satisfaction, and stability. Healthy nails require consideration of various aspects in addition to disease. In other words, healthy nails (or toenails) are defined as those that are free of disease, physically and aesthetically satisfactory, and do not have a negative impact on daily life mentally or socially[18].

Nails perform various functions in our body. Nails protect the tips of the hands and toes from the outside, and fingernails help with fine tasks such as distinguishing touch, scratching the skin, and picking up and manipulating small objects. They also perform functions of defense, attack, and decoration. Nails even perform functions such as assisting walking. In particular, nail toenails contribute greatly to the beauty of hands and feet.

2.2. Problem nail management

Problem nails refer to toenails with lesions that cause deformation of the nail due to internal factors such as deterioration of nutritional status or health, or external damage such as incorrect nail management, lifestyle habits, and chemical products[19]. In this study, problematic toenails refer to various conditions affecting toenails, including ingrown toenails, toenail fungus, thick toenails, split toenails, deformed toenails, and abnormal growth, and are defined as toenails that can cause discomfort, pain, or health and cosmetic problems, affect comfort, and are in various states that deviate from the normal state of toenails. Among the beauty industries, the nail sector is rapidly increasing its marketability as customized nail care services for each individual customer are increasing. In particular, consumers are recognizing the importance of maintaining and managing toenail health through various mass media, and as the importance of awareness of toenail care is further emphasized, the importance and interest in managing problematic toenails due to discoloration and deformation are gradually increasing. This can be caused by various factors, including congenital or acquired problematic toenails, and consumers' awareness of this is also increasing, and beauty experts are providing services to improve toenail health by considering the toenail condition and lifestyle patterns of each consumer[20]. As customized nail care services for each customer increase, the market size of the beauty industry, especially the beauty sector, is expanding. The causes of consumer problems are related to leisure activities, lifestyle habits, long walks, inappropriate shoe selection, and lack of care. These causes put a strain on the toenails, and as a result, stress due to discoloration and deformation of the toenails increases. Accordingly, consumers are more interested in toenail problems, and are recognizing the importance of toenail discoloration and deformation through various media.

A healthy toenail is a state in which the surface has a translucent pink color and contains about 10-18% of moisture, making it elastic enough not to tear or break easily. On the other hand, a problematic toenail is a state in which a problem exists. A state in which the nail bed is separated or lifted, a state in which the surface of the nail body is uneven, sunken, broken, deformed, with white spots, or discolored to yellow or green are all defined as 'problematic toenails.' In other words, it shows that various symptoms that appear on toenails all appear as problematic toenails. Based on previous studies, problematic toenails refer to various conditions affecting toenails, including ingrown toenails, toenail fungus, thick toenails, splitting toenails, deformed toenails, and abnormal growth. These problematic toenails can often cause discomfort, pain, or health and cosmetic problems, affect comfort, and can be defined as toenails in various states that deviate from the normal toenail state.

2.3. Self-esteem

Self-esteem is a belief in oneself and the belief that one has the ability to overcome basic difficulties encountered in the course of life. It is connected to recognizing that one is a valuable being, believing that one has the right to claim what one needs and wants, and believing that one has the right to enjoy the results of one's efforts and that one can be happy on one's own[12]. Self-esteem is defined as related to personal value judgment[21], and self-esteem represents a positive or negative attitude toward oneself, and is defined as an individual's judgment or conscious evaluation of oneself[9].

2.4. Stress

Stress is a phenomenon that occurs due to an imbalance between an individual's perceived needs and their ability to respond to them, and it focuses on evaluation and reevaluation in the cognitive process. This stress is one of the life phenomena experienced in daily life, and the factors that cause stress include external environmental conditions and various internal stimuli. Stress is an individual's adaptive response to excessive physical and psychological demands, and it represents a state of physical and psychological tension to cope with a perceived threat to oneself.

3. Research Methods

3.1. Method for improving the shape of fingernails and toenails using the reverse pinching technique

3.1.1. Method

This is a method for changing the shape of fingernails and toenails for beauty purposes using the reverse pinching technique using silk wraps[22]. The purpose is to provide a 'method for improving the shape of fingernails and toenails' that can manage fingernails and toenails healthily and cleanly. It is a method that can return deformed fingernails and toenails to their normal shape or change them to a desired shape, and uses silk wrap, a type of wrap applied to natural nails that is soft and flexible and has silk fabric properties. It is used for the purpose of repairing, extending the length, strengthening, and protecting damaged, broken, torn, weakened, and thin natural nails, and changing the shape when they are dug in or rolled, helping maintain health and appearance. The reverse pinching technique is a type of wrap applied to natural nails, and it is an important technique that can change the shape of fingernails and toenails when they are dug in or rolled out by using silk fabric with soft and flexible characteristics and silk wrap that can repair, extend, strengthen, and protect damaged, broken, torn, weakened, and thin nails, and can help maintain health and appearance.

3.1.2. Research subjects

This experiment was conducted on 18 men and women who agreed to the study among customers with ingrown toenails who use J Nail Specialty Shop in Yongin City. The subjects were asked to fill out a questionnaire before and after the experiment to confirm the effect of the 'Method for Improving the Shape of Nails and Toenails' using the reverse pinching technique on satisfaction after the management of problematic toenails, and to determine the effect of this management on pain, stress, and self-esteem related to toenails. The experiment was conducted by applying the 'Method for Improving the Shape of Nails and Toenails' developed and patented by the researcher when managing problematic toenails. The description of the specific application order and method of this technique using silk wrap is important information on how it is applied and effective in the actual field, and this detailed application process will provide practical guidelines to professionals in the field of nail beauty, thereby improving professionalism and service quality and contributing to technological development in the field.

3.2. Experimental sequence

This experiment applied the 'Method for Improving the Shape of Fingernails and Toenails'.

The experimental sequence is described in detail and was written directly by the researcher based on the sequence of the 'Method for Improving the Shape of Fingernails and Toenails' using the reverse pinching technique in the patent application.

1) Clean and dry the toenails: Before starting the reverse pinching technique, clean and wipe the toenails to remove foreign substances and check if they are well dried.
2) Use a skin disinfectant to clean the toenails you want to manage.
3) Clean the cuticles and remove water and oil so that the silk wrap can adhere properly when attached.
4) Use a sanding buffer to smooth out any uneven or rough surfaces.
5) Check if the toenails are curled and use clippers to trim the length of the toenails.
6) Remove as much moisture as possible from the natural toenails and the surrounding area.
7) Check the curve of the natural nail that has grown in, and use wrapping scissors to cut the silk wrap and prepare it.
8) Cut the sports tape and attach it to the outer flesh of the natural nail, pulling it toward the floor so that the hidden nail can be seen well.
9) Using the manager's thumbnail (or curette), slightly lift the natural nail that has grown in, and then cut the hidden nail hidden inside.
10) Hold the cut silk wrap with tweezers and cover it with the fixed natural nail, pressing it with your hand to attach it.
11) Use your thumb to use the reverse pinching technique so that the silk wrap faces away from the nail plate.
12) Apply a small amount of nail glue to the natural nail with the silk wrap attached.
13) Apply filler powder quickly before the glue hardens, making sure that no air bubbles form.
14) Repeat the process of applying glue and filler powder until it reaches a certain thickness.

15) Once the thickness is complete, use a glue dryer to spray a small amount on the glued area from about 10-15cm away and let it dry quickly.
16) Before the glue hardens, lift the natural nail using the reverse pinching technique to check the shape change and fix it.
17) Polish the glue that has become rough by filing or drilling.
18) If the hardness of the natural nail that has been dug in and dried is severe, repeat the above process but go up a little more.
19) If both sides are dried together, it is better to do the left and right sides separately.
20) Once the process using silk, filler powder, and glue is complete, file or drill the entire surface to smooth it out.
21) Apply glue and glue dryer to the entire surface and fix it firmly.
22) Once the shape is complete, cut the fan-shaped toenails on the sides with nippers to create the original shape of the toenails.
23) Place a flexible glass fiber reinforced plastic over the nail so that the nail can be maintained and restored without re-growing, and attach it with glue.
24) Use a polishing buffer to file the nail so that it looks smooth and healthy.
25) Use cuticle oil, etc. to keep the nail and surrounding skin moist.

3.3. Research design and data analysis

To determine whether the management of problematic nails using the 'Method for Improving Nail and Toenail Shape' is effective in improving nail care satisfaction, pain, stress, and self-esteem, a paired sample t-test was conducted comparing the pre-test and post-test.

The statistical analysis above was conducted at a significance level of 5% to determine statistical significance.

3.4. Hypothesis

Hypothesis 1. The application of the 'Method for Improving Nail and Toenail Shape' using the reverse pinching technique will have empirical effects.

Hypothesis 1-1. Satisfaction with nail care will be higher after management than before management of problematic nails.
Hypothesis 1-2. Pain will be lower after management than before management of problematic nails.
Hypothesis 1-3. Stress will be lower after management than before management of problematic nails.
Hypothesis 1-4. Self-esteem will be higher after management than before management of problematic nails.

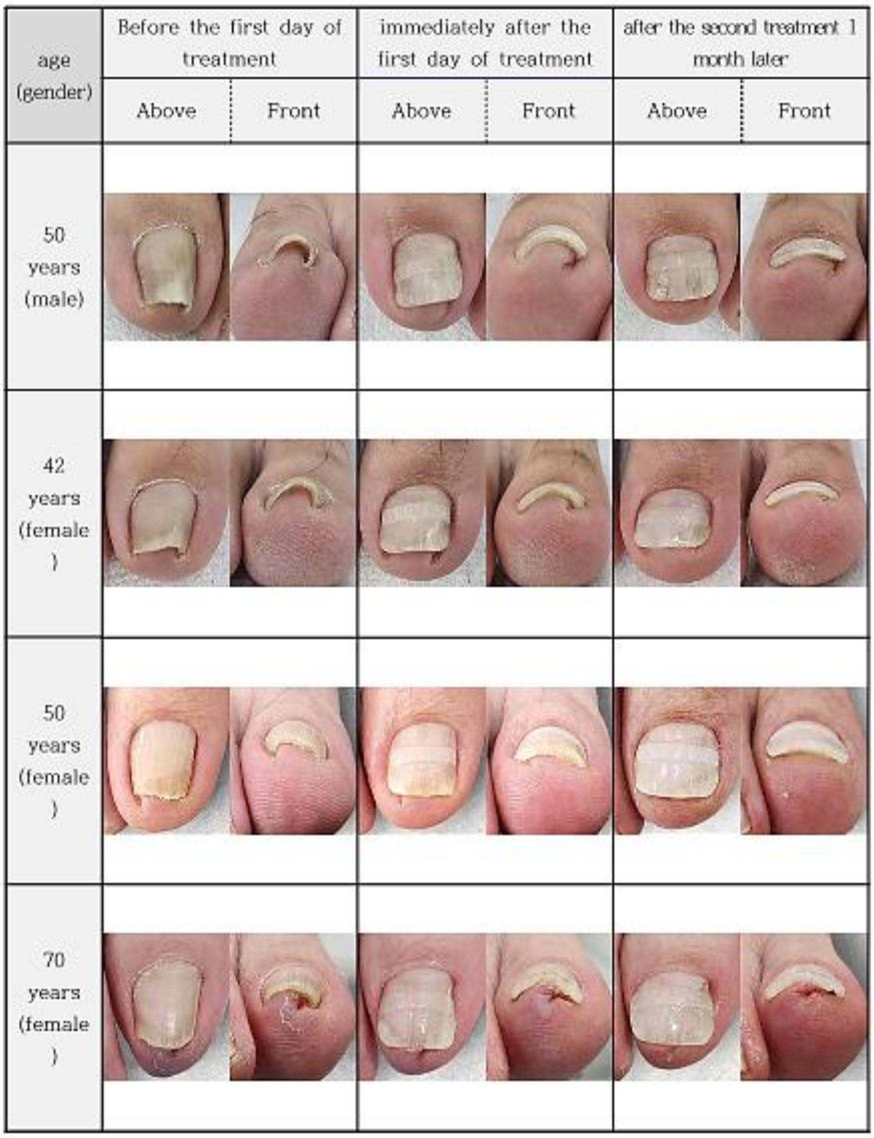
4. Research Results

4.1. Before and after comparison photos

The subjects of this study were 18 men and women who were customers with ingrown toenails who used J Nail Specialty Shop in Yongin City and agreed to the study. The first questionnaire was filled out before the treatment on the day, and the second questionnaire was filled out after a month later.

The photos were taken from the front as above, and the photos after the second treatment were provided after the second questionnaire was filled out. All photos of this process are as shown in <Figure 1>.

Figure 1. Before and after comparison photos.



4.2. Paired sample t-test analysis

To determine whether the problematic nail management using the 'Nail and Toenail Shape Improvement Method' is effective in improving nail management satisfaction, pain, stress, and self-esteem, a paired sample t-test was conducted comparing the pre-test and post-test.

Satisfaction with nail management increased statistically significantly after management ($M=4.59$) compared to before management ($M=3.67$) ($t=-4.099$, $p<.001$), and pain decreased statistically significantly after management ($M=1.17$) compared to before management ($M=7.67$) ($t=20.588$, $p<.001$). Stress was statistically significantly reduced after management ($M=1.49$) compared to before management ($M=3.77$) ($t=10.510$, $p<.001$), and self-esteem was statistically significantly increased after management ($M=4.58$) compared to before management ($M=2.85$) ($t=-6.558$, $p<.001$). Therefore, it can be said that problematic nail management using the 'nail and toenail shape improvement method' has the effect of improving nail management satisfaction and self-esteem, and reducing pain and stress. The effectiveness verification is as shown in <Table 1>, and the summary of the effectiveness verification results is as shown in <Table 2>.

The application of the 'Method for Improving the Shape of Fingernails and Toenails' using the reverse pinching technique had a positive (+) effect on the empirical application effect. It was shown that the satisfaction and self-esteem of fingernails and toenails were higher after the management than before the management of problematic toenails, and pain and stress were shown to be reduced after the management.

Table 1. Verification of the effectiveness of problem nail management using fingernail and toenail shape improvement methods.

Item	Measurement time	N	Mean	Standard deviation	t	p
Satisfaction with nail care	before	18	3.67	1.10	-4.099^{***}	<.001
	after	18	4.59	0.65		
Pain	before	18	7.67	1.33	20.588^{***}	<.001
	after	18	1.17	0.38		
Stress	before	18	3.77	0.92	10.510^{***}	<.001
	after	18	1.49	0.44		
Self-esteem	before	18	2.85	1.01	-6.558^{***}	<.001
	after	18	4.58	0.54		

Note: * $p<.05$ ** $p<.01$ *** $p<.001$.

Table2. Summary of the results of the verification of the effectiveness of problem nail management.

	Hypothesis	Result
1	Satisfaction with nail care will be higher after treatment than before treatment.	Adopted
2	Pain will be lower after treatment than before treatment.	Adopted
3	Stress will be lower after treatment than before treatment.	Adopted
4	Self-esteem will be higher after treatment than before treatment.	Adopted

5. Conclusions

The application of the 'Method for Improving the Shape of Fingernails and Toenails' using the reverse pinching technique had a positive (+) effect on the empirical application effect. The satisfaction and self-esteem of fingernails and toenails were higher after the management than before the management of problematic toenails, and the pain and stress were lower after the management.

The beauty industry does not simply decorate the appearance, but also directly contributes to the psychological stability and self-esteem of individuals, and in particular, fingernail beauty management is positioned as a very important part of giving external self-confidence to such customers.

This study conducted an experiment using subjects with problematic toenails among nail beauty management and studied whether it affected their stress, pain scale, satisfaction, and self-esteem. The results of this study are as follows. The application of the 'Method for Improving the Shape of Fingernails and Toenails' using the reverse pinching technique had a positive (+) effect on the empirical effect. After the management of problematic toenails, both satisfaction with nail care and self-esteem increased, and pain and stress both decreased, showing positive changes in various variables. These results are similar to the previous study that management using acrylic sculptures was effective for symptoms, and are in line with the fact that silk management had a positive effect on awareness and satisfaction and reduced pain. There are various causes of problematic toenails, such as fungal infection or ingrown toenails[23][24][25], but they all cause pain and stress[26]. As such, this study shows that the problematic toenail management program is effective for customers with actual problematic toenails, and it is expected that it can be applied to other customers in the future. This suggests a new method that allows customers with problematic toenails to receive sufficient satisfaction and pain management through professional nail shops.

Based on the above research results, the discussion is as follows.

Through this study, the empirical effect of the problematic toenail improvement program was investigated and important results were derived. This program showed positive effects on psychological variables such as stress and self-esteem in addition to the simple symptom relief effect. In this way, it can be seen as significant in that the program for managing problematic toenails not only improved symptoms but also showed great changes in the individual's psychological well-being and self-esteem.

We confirmed the effectiveness of management for customers with actual problematic toenails, and by studying whether the services provided by professional stores affect the psychology of customers, we expect that it will contribute to increasing the expertise of problematic toenail management in the current nail care market, provide empirical data that will help academic understanding and development in this field, promote the development of the nail care field, and be used as important basic data for developing better services and technologies.

Through this, we place the significance of the study on the fact that it has established guidelines for the development of nail beauty services and establishing service strategies that consider internal factors, and we expect that it will contribute to a deeper understanding of various aspects related to nail beauty management and the development of effective services.

The limitations of this study are, first, that it did not compare the control group. Since these problematic toenails do not disappear pain or improve shape on their own without care or treatment, we did not conduct a control group study. In the future, additional research is needed on people who manage problematic toenails. Second, in addition to physical methods, integrated research is needed that attempts psychological relaxation and pain relief using essential oils [27][28]. In addition, we propose a study that investigates more comprehensive and practical psychology and thoughts by conducting interviews or qualitative research in addition to pain questions on customers who actually receive a problematic toenail management program[29].

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7. Appendix

7.1. Authors contribution

	Initial name	Contribution
Lead Author	JB	-Set of concepts ☑ -Design ☑ -Getting results ☑ -Analysis ☑ -Make a significant contribution to collection ☑ -Final approval of the paper ☑
Corresponding Author*	EC	-Corresponding ☑ -Play a decisive role in modification ☑ -Significant contributions to concepts, designs, practices, analysis and interpretation of data ☑ -Participants in Drafting and Revising Papers ☑ -Someone who can explain all aspects of the paper ☑

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Exploring the Perception and Attitude of Managers and Users Regarding the Use of Facial Skin Measurement Devices: Using the Focus Group Interview Technique

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Abstract

Purpose: *In this study, in order to find out how beauty tech convergence technology is applied in the field, we conducted in-depth investigations using focus group interviews to explore the perceptions and attitudes of managers and users regarding the use of facial skin measurement devices.*

Method: *The research participants were 16 people, 4 each from S City and G Province, selected through a purposeful sampling method among managers and users who use facial skin measurement devices according to the period of use. As a research method, content analysis was conducted through repeated comparative analysis according to the qualitative research procedure of focus group interviews. And, based on their experience using the facial skin measurement device, the administrators and users were divided into four groups, and the data was segmented using transcription work, open coding, and axial coding.*

Results: *As a result of the study, it was confirmed that there were 12 themes and 93 common contents between themes and groups, and it appeared in 4 areas: 'Opinions on facial skin measurement devices', 'Perception of facial skin measurement device usage experience', 'Attitudes of managers and users on facial skin measurement devices', and 'Individual opinions on facial skin measurement devices'. Finally, the themes derived through the integrated analysis were reorganized, and thematic analysis was specified, and an integrated model was presented based on the results of the focus group interviews.*

Conclusion: *Korean society, which is experiencing a super-aging era, is expected to show high interest in appearance management behavior regardless of age, and the utilization of facial skin measurement devices is expected to increase. However, in the field, there are still various trial and error and side effects due to technical adaptation problems that have not been systematized. In this regard, this study conducted a vivid language verification of how facial skin measurement devices are used in the skin care field. It is expected that the results of this study will be used as basic data for research on the utilization of various smart beauty devices in the future.*

Keywords: ***Facial Skin Measurement Device, Perception, Attitude, Focus Group Interview, Smart Beauty Shop***

1. Introduction

The economic and social improvement of Korean society and the development of medical technology have led to an increase in average life expectancy, and appearance management is recognized as an important competitive edge regardless of age and gender. Such personal and social evaluation of appearance is becoming an opportunity to increase self-confidence through social interaction and increase the possibility of success. However, various concerns are also increasing[1][2]. To solve these concerns, along with the development of cosmetics, smart beauty equipment that incorporates self-care functions has become a necessity for modern people, and the need for continuous development is also required[3][4].

Modern smart beauty services are specifically measurable, action-oriented, and realistic, and they refer to all beauty management behaviors that establish and implement rational and specific plans, and when they are eco-friendly, economically efficient, and available to everyone, the word smart beauty can be defined[5][6][7]. In Korea, skin care centers are being converted into smart beauty shops in response to the demands of the times. In other words, it has changed from a place that provides a limited form of simple service to a place where individually customized services are provided that reflect the opinions of users through active and positive communication between managers and users using smart beauty equipment[8][9][10].

Smart Beauty Shop refers to a beauty space that has evolved to respond to the needs of users who have evolved from 'Smartsumers' to 'Consuneers' by minimizing time and space constraints and enabling self-management using smart beauty equipment and providing personalized services[11]. With the development of cutting-edge technology, smart beauty equipment has evolved into a smart hub that provides personalized information and a means of communication to satisfy the needs of users who have changed from 'Smartsumers' to 'Consuneers', and at the same time, individual 'On-demand' services have become possible. As smart equipment is combined with existing beauty technology, it provides diverse content beyond the fragmented part of service provision centered on managers and can transmit the user's service experience via email. If the beauty care user experience is the entire process from the time of reservation to the end of skin care service, a smart beauty shop based on IoT technology is a platform that can even consider providing personalized services to potential visitors[3][12][13].

The facial skin measurement device mentioned in this study refers to a skin measurement device that can objectively measure and evaluate the skin condition of customers in a short period of time in a smart beauty shop. In Korea, it was mainly used as hospital equipment in the past, but after 2020, it was gradually introduced to skin care rooms, and it became possible to objectively measure skin conditions that are difficult to determine with the eyes in a short period of time and store them in pictures to quantify them. The facial skin measurement device can be said to be a device that precisely analyzes and measures elements such as pores, pigments, sebum, wrinkles, porphyrin ratio, dark circles, moisture, redness, gloss, skin tone, and UV pigmentation using three light sources (normal light, polarized light, and ultraviolet light) and suggests customized skin care methods for each individual[14][15].

Therefore, in this study, focus group interviews were conducted to explore the perceptions and attitudes of managers and users regarding the use of facial skin measurement devices in smart beauty shops, and the research data was analyzed in depth and objectively. Focus group interviews are a qualitative research method in which interview participants freely share their opinions on a specific topic and derive results. In addition, it is convenient to approach matters regarding experiences or opinions that have limitations because it has the advantage of being able to expect interaction between research subjects while confirming their awareness and attitudes regarding the research topic[16][17][18][19][20].

This study organized themes through repeated comparative analysis of open coding and axial coding of the interview contents of research participants, and identified the structural form of the awareness and attitude of managers and users regarding the use of facial skin measurement devices by dividing themes and areas. Therefore, the results of this study will provide an opportunity to confirm specific and factual content regarding this.

2. Research Methods

2.1. Research participants

The number of research participants was 4 groups, and the participants were designated as managers and users of facial skin measurement devices located in S city and G province in Korea. In the case of managers, the target group was female directors of smart beauty shops, and among the directors who are experts in the relevant field and beginner directors, the managers who manage customers using facial skin measurement devices were selected. In the case of users, the target group was customers who use the skin care room of the manager who participated in the survey, and new and long-term users who have experience in consultation and management using facial skin measurement devices were selected.

The participants were divided into each group and the size of the group was selected based on the focus group interview guidelines by the researcher. Considering the general characteristics of the research participants, the interview participants who could well represent both sides of the perception and attitude exploration of the use of facial skin measurement devices were selected. As shown in <Table 1>, the groups were divided into expert and beginner groups, and users and managers were divided into subgroups. The general characteristics of the participants are as follows.

Table 1. General characteristics of study participants.

Program	Classification	No.	Gender	Age	Management period
Expert	User Ⓐ	1	Male	40s	For 5 years
		2	Female	40s	For 8 years
		3	Female	20s	For 5 years
		4	Female	30s	For 4 years
	Administrator Ⓑ	1	Female	40s	For 27 years
		2	Female	50s	For 12 years
		3	Female	30s	For 10 years
		4	Female	40s	For 13 years
Beginner	User Ⓒ	1	Male	30s	For 1 years
		2	Female	40s	For 1 years
		3	Female	40s	For 1 years
		4	Female	40s	For 1 years
	Administrator Ⓓ	1	Female	20s	For 1 years
		2	Female	30s	For 2 years
		3	Female	40s	For 2 years
		4	Female	40s	For 1 years

2.2. Data collection

The collection period for this research data is from September 2024 to October 2024. After the researcher explained the purpose of the study through interviews with each group, the interview content was explained and the interview was conducted. The collected interview data utilized the transcripts recorded and recorded and the notes written by the researcher while conducting the interviews. Before conducting the focus group interviews, the researcher created an interview guide considering previous research and expert opinions to organize the questionnaire in accordance with the purpose of the study. The interview questionnaire was modified and structured based on the questionnaire used in Na(2023)'s study to suit this study [21].

After that, preliminary interviews were conducted with managers and users who had experience using facial skin measurement devices, and during the process, the questions that were not smooth or did not meet the purpose were revised and supplemented. The final questionnaire was restructured through a meeting of experts with doctoral degrees or higher who had written papers related to focus group interviews. The number of group interviews was decided to conduct re-interviews in four groups if the measurement results were short or did not meet the standard. Since awareness and attitude toward facial skin measurement devices are significant processes for both users and managers regarding the development of the smart beauty industry and efficient equipment use behavior, it was decided to conduct two interviews considering the situation.

Before the interview, the participants were explained the concept of awareness and exploration of the use of facial skin measurement devices by managers and users, and the interview process was explained in detail in accordance with the purpose of the study. During the interview, they were informed that they could freely express their opinions, that they could stop or refuse the interview at any time if they wanted, and that the researcher could intervene or mediate during the process. The content of the interview was recorded, and the participants were anonymous, and the interview content was kept confidential and used only for research purposes. The time and place of the interview were determined by collecting the participants' opinions as much as possible, considering their comfort. The recording and transcription of the data were done using the function of the smartphone application Naver Clova, and the voices of the research participants were immediately converted into text. <Table 2> below is a summary of the questions from the focus group interview

Table 2. General characteristics of study participants.

No.	Question order		Question content
1	Opening		① Please briefly introduce yourself. ② Please tell us about the management period using the facial skin analyzer.
2	Introduction		① What do you think the facial skin analyzer does? ② Do you think that skin measurement consultation using the facial skin
3	Transition		① Were there any differences between the interview content conducted to check the skin condition and the content evaluated using the facial skin analyzer? ② Is there a difference in reliability between skin condition confirmation through consultation and skin condition confirmation using the facial skin analyzer?
4	Main questions	Cognition	① Do you think that consultation regarding skin measurement and evaluation using the facial skin analyzer is effective? - If it is effective, what changes are there? - If it is not effective, what is the reason? ② Do you think that consultation regarding skin measurement and evaluation using the facial skin analyzer is helpful for management satisfaction and continuous management?
		Attitudes	① Please tell us what you are satisfied with and what you are dissatisfied with regarding consultation regarding skin measurement and evaluation using the facial skin analyzer. ② Would you recommend consultation and management using a facial skin measurement device?
5	Closing		① Do you think it is necessary to check your skin condition using a facial skin measurement device? ② If you have any suggestions based on your experience checking your skin condition using a facial skin measurement device, please let us know.

2.3. Data analysis

Focus group interview is a process of freely revealing common and different contents among each group of research participants through interaction to confirm how their perceptions and attitudes regarding the research topic are expressed. The researcher collected data from research participants in accordance with the important elements of data analysis by Krueger & Casey (2009): systematicity, verifiability, sequentiality, and continuity. The researcher approached the data in the following way, considering emotions such as repetitive tendencies, specific patterns, frequency and intensity, and special reactions[16][22].

First, in order to read the overall feeling of the research participants' perceptions and attitudes, one more researcher was invited to participate, and the final content was analyzed and revised through review to avoid any possible biased analysis. Second, in order to analyze the meaning of the interview content of the research participants, each person reviewed and summarized the interview content, and if there was an additional explanation, the frequency of the response was considered, and meaningful data was collected while reviewing the mutual data, and efforts were made to convey the meaning of the interview content of the research participants as an accurate description of the meaning structure and topic within the concept and topic. Third, in order to comprehensively analyze the research participants' cognition and attitude, the data was analyzed using open coding and axial coding, which is a task to structure the final results of the research participants' cognition and attitude regarding the use of the facial skin measurement device. Fourth, in order to distinguish the subject, topic, and area of the interview data, a process of revision and review was conducted through a meeting of experts with doctorates or higher who had conducted similar research with various experiences[23][24].

In order to verify the reliability and validity of this study, Lincoln & Guba (1985) stated that all research should have truth value, applicability, consistency, and neutrality. Patton (2002) emphasized that validity and reliability are related to the entire research process in quantitative and qualitative research, and that validity and reliability cannot be applied separately in qualitative research. Therefore, this study applied credibility, transferability, dependability, and confirmability[25][26]. In the open coding process of data analysis, the raw data extracted from the focus group interview content was classified into categories through an iterative process of decomposing and combining words and sentences. If similarities were found during the classification process, they were revised, and irrelevant information was reclassified. In the axial coding process, the content grouped into subject areas was finally classified into areas again.

3. Research Results

3.1. Integrated analysis of focus group interviews

The results of the group interview on the perception and attitude of users and managers of smart beauty shops toward the use of facial skin measurement devices were comprehensively confirmed through open coding and axial coding through repeated comparative analysis into 12 themes and 93 themes and common contents between groups in 4 areas.

The subcategories of the interview contents were distinguished by indicating the groups as expert users Ⓐ, expert managers Ⓑ, novice users Ⓒ, and novice managers Ⓓ, and the parts that the four groups talked about in common were classified separately as common views.

<Table 3> below is a diagram of the integrated analysis of the participant focus group interviews.

Table 3. Integrated analysis of participant focus group interviews.

Area	Topic	Subcategory
		ⒶExpert User ⒷExpert Administrator ⒸBeginner User ⒹBeginner Administrator
Opinions on facial skin measurement devices	Positive view(8)	• Facial skin measurement devices are a must-have item in most skin care centers these days ⒸⒹ
		• It is essential for systematic management ⒶⒸⒹ
		• feels like a hospital ⒸⒹ
		• You can receive the measurement results personally ⒶⒸ
		• I often do self-measurements on my mobile phone, so I think it is essential for skin care centers Ⓐ
		• It gives me a sense of trust even for the first time ⒶⒸⒹ
		• Accurate management is achieved through numerical results ⒶⒸⒹ
		• All successful skin care centers have facial measurement devices ⒶⒸⒹ
	◎ Common: It precisely assesses even parts that cannot be confirmed with the naked eye, and allows comparative analysis before and after management, which increases the efficiency of consultation, and is also useful for the promotional effect of the facial skin measurement device itself.	
	Negative view(8)	• I didn't like washing my face even when I only had a consultation ⒹⒸ
		• My self-esteem dropped when I saw pictures of my skin condition Ⓒ
		• I trust clinical experience more than machines ⒶⒷ
		• If my skin condition is worse than I thought, I consider going to a hospital Ⓒ
		• I have doubts about the effectiveness of the purchase because of the high cost Ⓑ
		• If I see a lot of money for improvement after seeing the measurement results, I give up Ⓒ
		• I felt burdened when they forced me to use a management program during the consultation after the measurement results ⒶⒸ
		• I don't like having pictures of my face left behind Ⓐ
	◎ Common: Measurement results were different when re-measured even in the same space, and were meaningless if there was no accurate understanding of the equipment.	
Area	Topic	ⒶExpert User ⒷExpert Administrator ⒸBeginner User ⒹBeginner Administrator
Perceptions of experience using facial skin analyzers	High reliabilty(12)	• The management process is proven with photos ⒸⒹ
		• There is unconditional reliability regarding the measuring equipment Ⓒ
		• It is possible to form a consensus for consultation even with someone you are seeing for the first time ⒷⒹ
		• Program recommendations based on data are possible ⒶⒹ
		• Recommended care is possible based on the skin results measured each time ⒸⒹ
		• The standard for normal skin standardized with big data is presented Ⓑ
		• Accurate skin measurement of my skin is performed ⒸⒹ
		• Accurate consultation can be provided regardless of the manager ⒶⒸⒹ
		• Skin condition is also shown in photos ⒶⒹ
		• The difference in contour can be confirmed Ⓐ
		• It is trustworthy because of advertisements ⒸⒹ
		• It is easy to buy cosmetics Ⓒ
	◎ Common: The measurement results are documented and the skin condition can be visually distinguished, so it is possible to understand the condition of my skin by age and receive reliable recommendations for personalized care programs and products.	

	Low reliability(9)	• No consideration of individual genetic and environmental differences Ⓑ
		• There are differences in interpretation of results depending on the manager ⒶⒷ
		• Even if it is the same equipment, it cannot be said to be the same as a hospital ⒶⒸⒹ
		• I do not trust it after learning that the basic setting values can be adjusted for each equipment ⒶⒷⒹ
		• Negative experiences from other places have an effect Ⓐ
		• The numerical value of the machine cannot represent everything about the skin Ⓑ
		• Hair is mistaken for wrinkles ⒶⒷⒹ
		• There are negative experiences with machine errors Ⓐ
		• The measurement results come out differently depending on the influence of lighting ⒶⒹ
	◎ Common: Results vary depending on the measurement environment, and negative opinions are held when there is no accurate understanding of the equipment.	
	Positive effect(9)	• You can predict your future skin condition ⒶⒷ
		• If the measurement results are better than the satisfaction you feel, you think it is cost-effective management Ⓒ
		• Efficient skin care is possible based on today's skin results ⒸⒹ
		• When using a measurement program, it increases the manager's expertise ⒸⒹ
		• Personalized management is possible ⒸⒹ
		• It helps increase sales ⒶⒷⒸ
		• No need to spend unnecessary money Ⓒ
		• You end up recommending it to people around you ⒶⒸⒹ
		• The moment when you measure your skin during management is the most anticipated ⒶⒹ
	◎ Common: It can serve as a communication role between administrators and users, and management satisfaction is high because management results can be shared.	
	Negative effect(8)	• If the satisfaction level is worse than what I feel, I am confused about which result is correct ⒶⒷ
		• I felt uncomfortable when my face was shown without my consent Ⓒ
		• If there is no improvement in the measurement result, I give up the treatment or change to a different treatment location ⒶⒸ
		• If there is a machine error, my expectations are lowered overall ⒶⒸⒹ
		• It is difficult to interpret the measurement result ⒶⒷⒸⒹ
		• Management skills are more important than the measurement result ⒶⒷ
		• If the measurement result is below the standard, I feel like I am being forced to use various programs Ⓒ
		• The atmosphere during the consultation for the measurement result was suffocating Ⓐ
	◎ Common: Expert clinical experience is more reliable than measurement results, and interpretation of measurement results may vary due to the absence of manuals or guides.	
Area	Topic	ⒶExpert User ⒷExpert Administrator ⒸBeginner User ⒹBeginner Administrator
Attitudes of administrators and users toward facial skin	Selective behavior(11)	• Prioritize visiting the management office unconditionally Ⓒ
		• Customized programs are suggested, so there is a dependency on data on expertise ⒸⒹ
		• It can show skin conditions more professionally ⒶⒹ
		• Proves the efficiency of management ⒶⒹ

measurement devices		• Essential for accurately identifying skin conditions ⒶⒸⒹ
		• Essential equipment in the smart era. ⒸⒹ
		• Necessary for home care sales strategies after programs according to skin conditions Ⓓ
		• Necessary to increase expertise and reliability ⒶⒷⒹ
		• Given priority in selection when conditions are the same Ⓒ
		• Necessary for reliable consultation in the case of first meetings ⒶⒹ
		• It is possible to share management results between managers and users ⒷⒸ
	◎ Common: When conditions are similar, it is a priority for choosing a skin care center, and it was chosen because it provides reliable consultation at the first meeting, all management results can be documented, and can be exchanged between the manager and the user.	
	Persistence(5)	• Promotional effects increase new inflow ⒷⒹ
		• Satisfaction with management increases Ⓒ
		• Loyal customers are possible without a facial skin measurement device when forming a bond ⒶⒷ
		• Confidence as a professional increases with the results of skin measurement ⒷⒹ
		• There are no cases of receiving skin management because of a facial skin measurement device Ⓐ
	◎ Common: Since the management results are documented, it can be linked to continuous management, and efforts are made to enter the normal skin category, which leads to loyal customers.	
	Sales related(6)	• Get recommended new programs ⒸⒹ
		• Interested in additional care based on photo results ⒶⒹ
		• Good for purchasing customized home care ⒸⒹ
		• Helps attract new customers with promotional effects ⒶⒸⒹ
		• Get connected through referrals from acquaintances ⒸⒹ
		• I learned about skin problems I didn't know about ⒶⒸⒹ
	◎ Common: As visualized data is naturally managed and improved, it stimulates beautiful desires, which leads to additional sales and continuous management.	
Area	Topic	ⒶExpert User ⒷExpert Administrator ⒸBeginner User ⒹBeginner Administrator
Individual opinions on facial skin measurement devices	Guide(5)	• It would be nice to have consistent guidelines for interpreting measurement results ⒶⒹ
		• We need techniques to reduce the margin of error for parts that change depending on the surroundings ⒶⒷⒹ
		• It would be nice to have detailed instructions for use ⒷⒹ
		• We need instructions that even non-experts can use to interpret measurement results ⒷⒹ
		• It would be nice to have basic guidelines for the surroundings Ⓓ
	◎ Common: It would be good if there was a detailed explanation of the cosmetic ingredients or the program.	
	Consulting technique(6)	• Techniques for program recommendation and home care sales are influential ⒶⒸⒹ
		• There should know various management methods according to the recommended program Ⓑ
		• You should be aware of the diversity of measurement results depending on the environment ⒸⒹ
		• Regular training from the measurement equipment company is necessary ⒷⒹ
		• There should be data on exceptional situations of measurement results Ⓓ
		• Consultation on measurement results considering individual genetic characteristics is necessaryⒷ

	◎ Common: Consultation on measurement results that take into account personal genetic characteristics is required, and prior knowledge on measurement results, programs, and cosmetic ingredients is required.	
	Other(6)	• It is necessary as a sub-equipment for accurate skin measurement Ⓑ
		• It is necessary to provide education on various management programs according to the recommended program ⒸⒹ
		• It would be good if it were possible to suggest commercial products based on the measurement results when selling home care Ⓓ
		• It would be good if it were possible to accurately measure skin condition without washing the face ⒸⒹ
		• It would be good if the skin condition measurement screen could be selectively opened ⒷⒸⒹ
		• It would be good if it were a small size ⒷⒹ
	◎ Common: There is a need for continuous and diverse data provision on facial skin measurement devices.	

3.2. Analysis of focus group interviews by area

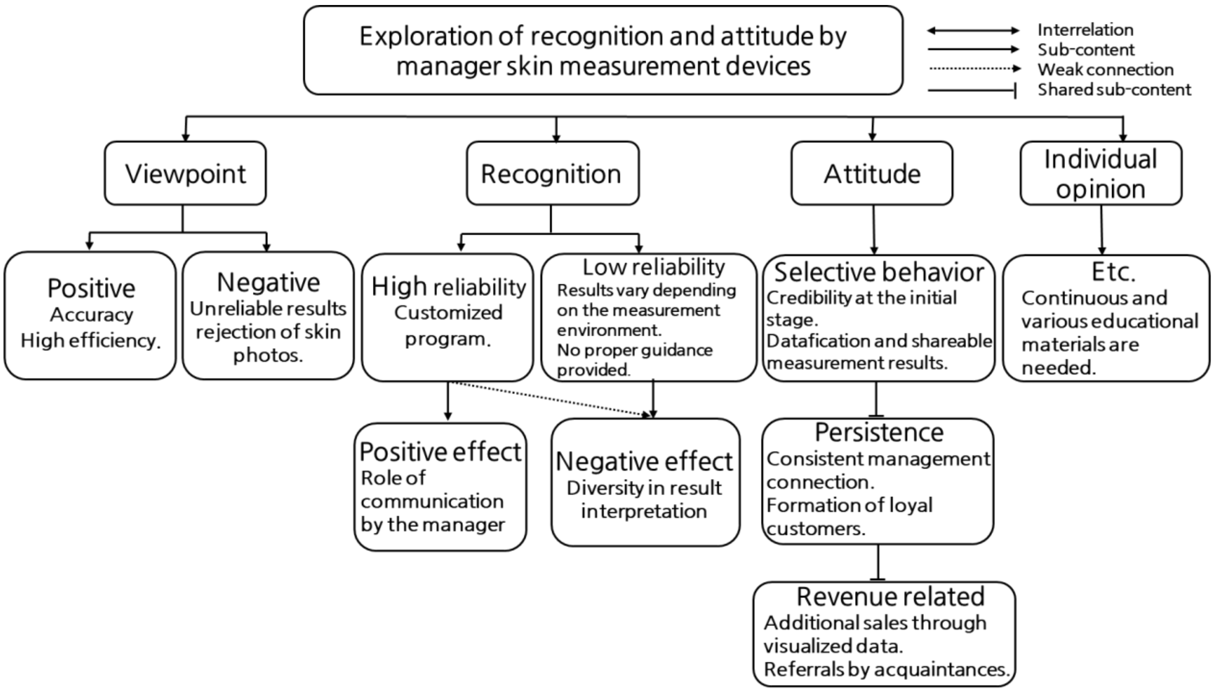
The first area of the analysis derived from the focus group interview on the awareness and attitude of managers and users regarding the use of facial skin analyzers is the ‘Opinions on facial skin analyzers’ section, which states that skin care centers need accurate skin measurement for skin improvement and that measuring and consulting the current skin condition using a facial skin analyzer is positive in terms of personalized efficient management and cost. A minority of opinions state that self-measurement is possible with a mobile phone, but all skin care centers that are good at using specialized equipment have facial skin analyzers. On the other hand, there are opinions that it is inconvenient to have to wash your face first and measure within a certain amount of time for skin measurement, and that if you have skin problems, you may feel uncomfortable because you may feel uncomfortable about seeing your own skin condition on the screen and excessively recommending management programs or showing the measurement photos to others without consent.

The second area, ‘Awareness of the experience of using a facial skin measurement device’, had the most opinions about the reliability of the fact that the measurement results were documented and visualized. The measurement data allowed participants to see the process of their skin condition improving, and the facial contour management also quantified the face getting smaller. Some research participants absolutely supported the big data advertising slogan in TV commercials, so they thought that if the reliability was high, it would be associated with a positive effect, and it would be cost-effective management, and there would be no need to worry about being ripped off, which would lead to introductions to those around them, which would also help increase sales. However, there were also opinions that the numerical results could be artificially manipulated to make the skin look better, and that the machine’s limitations were that it recognized hair, acne patches, and skin temporarily reddened by the temperature difference between indoors and outdoors as flushing, which made them unreliable. Although they trusted the device, they talked about the negative effects, saying that when they showed their measured facial condition to others without their consent, they felt negative emotions regardless of the high reliability, and when the measured results were different from the perceived satisfaction, they felt suspicious.

The opinions on the third area, ‘Attitudes of Managers and Users Regarding Facial Skin Analyzers’, are about selective behavior regarding the use of facial skin analyzers, continuity of management, and increased sales due to them. Some said that they only select skin care centers with facial skin analyzers because they are essential equipment for beauty shops these days and are necessary for strategic management in the smart era. In the case of novice managers, there were opinions that it is important to increase expertise and provide services using equipment along with data in the areas of program or home care sales consultation, the importance of personalized management for each individual, and the trend of the smart era. However, it was pointed out that if they rely too much, they may be insensitive to their own subjective symptoms when judging their skin condition, or they may provide consultations that do not consider their internal health conditions that cannot be quantified due to excessive reliance on data. As they saw the improved measurement results, they chose to continuously manage their appearance to become more beautiful or maintain their current state, which naturally led to an increase in sales, and as managers and users communicated with each other through the measurement results, it helped build trust, which easily led to conversion to long-term customers, and the promotional effect of the facial skin measurement device led to an increase in new or referred customers, which in turn led to sales.

The fourth area, 'Individual opinions on facial skin measurement devices', is about the lack of guidance or explanations on the machine when using facial skin measurement devices, and most of the content is simply written from the manager's perspective, so there is a lack of explanations for customers, so customers cannot see the materials themselves, and so they are considering reselling or using them properly despite purchasing expensive equipment. Since the equipment guide is too formal and not very helpful for actual use, it would be very helpful for consultations if it were produced from the perspective of skin physiology, and regular or irregular education should be provided to update new skin-related information or cosmetics information, and if measurement result explanation materials for users are provided on SNS, they can interpret their own measurement results anywhere. A detailed guide booklet and user manual that can be viewed anywhere will affect the quality of consultations, and this will create trust between users and managers, which will have various positive effects. In addition, since the machine equipment is expensive and bulky, there were opinions about that part.

Figure 1. An integrated model based on the results of focus group interviews.



As such, the themes derived from the four areas were interrelated and had a complementary effect on each other, and positive views created reliable perceptions and positive attitudes, while individual opinions became reasons to change negative views, perceptions, and attitudes. The integrated model of the focus group interview on the awareness and exploration of managers and users regarding the use of facial skin measurement devices in each group was organized as in <Figure 1> based on the interview contents of the research participants.

4. Conclusion and Suggestions

In Korea, with the confirmation of the Ministry of Health and Welfare's guidelines for the use of skin care devices in 2023, the use of smart beauty equipment in skin care rooms has become freely allowed, and beauty tech has been gradually spreading widely in skin care rooms since 2024. Accordingly, this study conducted a study through focus group interviews to explore the awareness and attitudes of managers and users regarding the use of facial skin measurement devices for accurate skin measurement, which is the most important factor in satisfaction with the use of skin care rooms, which are places for maintaining and improving beauty. The results of this study were derived from five contents: opinions on facial skin measurement devices, awareness of facial skin measurement device use experience, necessity of facial skin measurement devices, attitudes of managers and users regarding facial skin measurement devices, and individual opinions on facial skin measurement devices.

Currently, smart beauty shops are becoming widespread in Korean society, and as positive feedback from visitors regarding beauty equipment and personal purchases increase, the use of beauty equipment in skin care centers is emerging as an essential element. Since skin care centers are places where people come to maintain and improve their skin, it is very important to accurately identify the skin condition of users. Therefore, the use of facial skin measurement devices is becoming more widespread. On the other hand, there are also cases where expensive equipment required for skin care centers is not being used or negative perceptions and attitudes are being formed. Although social demands and national support are aimed at a convergence of smart beauty shop services, it has been found that in the absence of systematic and diverse educational programs and the absence of even equipment guide education, and in the current reality where only distribution through companies is in a hurry, expensive equipment is either dormant or there is a lack of confidence and negative perceptions due to incorrect use.

The incorporation of smart beauty measurement equipment allows the use of scientific personalized methods in the process of improving personal beauty, and provides effective results by presenting data programs, shifting the form of service from manager-centered to user-centered, and by providing it in stages, it reduces differences of opinion by deriving advantages and disadvantages at each stage, thereby increasing satisfaction and reaching efficient management results. Although the skin measurement stage in a skin care center occupies an important proportion in the big picture of effective skin care, its importance has been excluded due to the performance of the functional aspect, but the use of measurement equipment using the Internet of Things, cloud, computer, big data, and artificial intelligence using ICT has played an important role in customer satisfaction and increasing sales in terms of the convenience of measurement for managers and the delivery of accurate personalized measurements for users[27][28][29].

The introduction of facial skin measurement equipment has been recognized as a key element in increasing the efficiency and satisfaction of information sharing and management of users, which in turn leads to changes in users' perception and attitude in recommending subsequent revisits and additional management. Since the user's satisfaction with smart beauty shop management leads to revisits and additional sales, it is important to conveniently and specifically check useful, personalized, reliable results and practical information for effective skin management in a short period of time. In order to satisfy value, the use of facial skin measurement equipment provides customized information for each customer, as well as recommendations for management programs and the ease of selecting home care products. As a result of systematically providing data measurement, reliability is also strengthened. Therefore, the smartening of beauty services is essential for new consumer demands, smart technology experience, and trials, and is an important element in providing practical information for increased sales [30][31][32][33].

This study is a qualitative research result of inductive analysis using focus group interviews. In future research, quantitative research is needed to compare the pros and cons of the perception and attitude of managers and users regarding the use of facial skin measurement devices. Through the results of this study, various and realistic opinions were confirmed. It is expected that this content will be used as positive data in the smart beauty equipment service area in the future.

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6. Appendix

6.1. Author's contribution

	Initial name	Contribution
Lead Author	SK	-Set of concepts ☑ -Design ☑ -Getting results ☑ -Analysis ☑ -Make a significant contribution to collection ☑
Corresponding Author*	CL	-Final approval of the paper ☑ -Corresponding ☑ -Play a decisive role in modification ☑
Co-Author	HW	-Significant contributions to concepts, designs, practices, analysis and interpretation of data ☑ -Participants in Drafting and Revising Papers ☑ -Someone who can explain all aspects of the paper ☑