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A Study on the Effects of Shampoo and Scalp Serum on Scalp and Hair Loss Improvement Made with Defined Cell Culture Media 4

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***Abstract*—** This study was conducted to investigate the scalp and hair loss improvement effects of shampoo and scalp serum prepared with defined cell culture media 4 (DCCM4). There were 21 subjects who participated in the study, using the products twice a day for 12 weeks, a total of 168 times and checked the scalp. The scalp tone, scalp elasticity, scalp pores, hair thickness, and hair number were analyzed, and scalp treatment was performed 12 times a week with shampoo and scalp serum produced by definitive cell cultures media 4. Therefore, in total, the effect of shampoo and scalp serum produced with defined cell culture media 4 is significant, and the effect is significant for all hair loss types and all scalp types.

keyword-Defined Cell Culture Media 4 Shampoo, Defined Cell Culture Media 4 Scalp serum, Hair Loss, Scalp care, Anti-aging scalp cosmetic, Cosmetics, DCCM4, Cosmetic

I. INTRODUCTION

The hair loss population is increasing in various ways regardless of age and gender not only in Korea but also all over the world. Hair loss is the loss of more than 100 hairs per day. It is a state in which thin vellus hairs are in place. As a result, more and more people are suffering from stress. In modern society, interest in hair loss is increasing because men and women feel that it is important to manage their appearance as social activities become more active. This is because abundant hair is a way to express one's individuality and express oneself in social activities such as dating, marriage, and employment. On the other hand, I think that having no hair can instill negative perceptions from others. As a result, unstable emotions such as depression, social phobia, and loss of self-confidence may be formed, resulting in difficulties in social life.

People with hair loss make a lot of effort to overcome hair loss or improve their self-confidence through supplementation and improve their external image. Due to the increase in the hair loss

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population, the hair loss market is growing rapidly every year, and management methods to supplement hair loss are also diversified. There are many ways to supplement and care for hair loss. You can spray heukchae, purchase hair loss shampoo or hair loss ampoule for home care, receive a scalp clinic, or have a wig and hair extension surgery. There are hair transplants, oral medicine, Propecia, topical medicine Minoxidil, and SMP (Scalp Micro Pigmentation), a semi-permanent makeup treatment that is hot these days.

Looking at the trend of hair loss treatment or related patent applications so far, it is used as a natural material with fewer side effects from the viewpoint that the treatment is long-term. Many studies have been conducted to evaluate the clinical efficacy of the hair growth promoting effect by conducting animal experiments and clinical trials. As experimental methods used for hair growth, prevention of hair loss, and hair research, in vivo evaluation using laboratory animals and in vitro evaluation using hair follicle cells and tissue culture are mainly used. In the 1980s, as the culture method of dermal papilla cells and outer root sheath cells, which are the core cells constituting hair follicles, was developed, research on the differentiation mechanism in hair follicles became active. It showed the possibility of being used as a useful evaluation model for research such as. Accordingly, using biochemical and molecular biological experimental methods, studies on the identification of various growth factors or genes related to hair growth, study on the mechanism of action, and drug search are being actively conducted.. Currently, efficacy evaluation and clinical trials using laboratory animals are mainly used to verify the actual effects of drugs in vivo. This is because in order to prove the efficacy of hair restorers, efficacy tests using animals must be performed prior to conducting clinical trials. In human hair, the rate of cell division of hair follicles, the degree of atrophy of hair follicles, and the growth activity of hair follicles appear differently according to the cycle of each hair. Therefore, an efficacy test considering this should be performed. According to the Ministry of Food and Drug Safety, animal tests using rats confirmed the effect of promoting the transition from the telogen to the anagen phase (anagen induction effect) and the effect of delaying the transition from the anagen phase to the anagen phase (catagen inhibition or anagen prolongation). He said that the effect of hair growth could be evaluated.

About 10 types of definitive cell culture fluids that can culture animal and human cells manufactured with ingredients permitted as raw materials for cosmetics have been developed and are listed in the International Cosmetic Ingredients Collection. Among them, Defined Cell Culture Media 4 (DCCM4) is a medium prepared by combining inorganic salts, vitamins, amino acids, lipids, and energy sources permitted as raw materials for cosmetics, and serum and growth factors are added to DCCM4. As a result of culturing skin stem cells, there is also a study confirming that vigorous cell proliferation is maintained over a long period of time.

There is a paper that studies the possibility of using DCCM4 as a cosmetic composition by observing that the characteristics of skin cells are expressed in the markers on the surface of cultured cells. In addition, a study has reported that cosmetics made with DCCM4 are effective in soothing irritated skin by rapidly reducing erythema caused by cosmetic procedures using a fine multiwheel acupuncture needle. In addition, studies have shown that cosmetics made of DCCM4 as a composition show excellent anti-aging effects in moisturizing and wrinkle improvement on the skin of hairless mice that induced photoaging.

According to previous research on DCCM4, “DCCM4 can be used as a new material for manufacturing anti-aging cosmetics of various formulations, and when used as a substitute for purified water used as a moisture base for functional cosmetics, the effect of anti-aging cosmetics can be further enhanced. mass production and quality control will be possible, so it will be

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possible to create a high value-added industry in the cosmetic field." said.

In addition, the stability of the definitive cell culture medium 4 was confirmed when the stability was evaluated by the cytotoxicity test through MTT assy and the cell culture test method. In addition, when the migratory ability and proliferative ability of skin cells were measured, the effectiveness of skin cell regeneration and skin activity was also confirmed. In addition, it is a liquid product made with the definitive cell culture medium 4 using photoaging animal model hair mice as a key material. Microbiological test, osmotic pressure, ph, fragrance, and cosmetic appearance were analyzed to determine the amount of erythema, moisture level, and anti-wrinkle anti-aging. It has been found to be very useful as a cosmetic composition. However, human application tests conducted on human skin are very insignificant. In particular, no study has been conducted so far on the effect of repetitive cosmetic treatment for the purpose of improving the condition of the aged scalp and preventing hair loss and hair growth in humans.

In this clinical study, shampoo (Jihye's Tree Shampoo 01-04) and Serum (Jihye's Tree (05,07)) formulated with safe defined cell culture medium 4 were applied to the human body to improve aging scalp, prevent hair loss, and promote hair growth. The purpose is to propose basic data to report whether there is.

1.2 research model

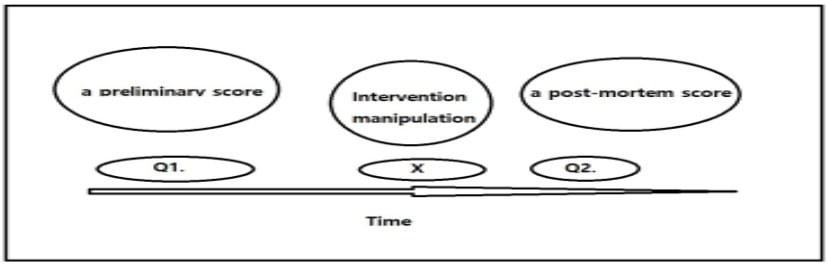

Figure 1. Research model

1.3. research hypothesis

The research hypothesis was designed as follows.

1. Hair loss scalp will have a difference in scalp color after using shampoo and scalp serum prepared with Defined Cell Culture Media 4 (DCCM4).
2. Hair loss scalp will have a difference in scalp elasticity after using shampoo and scalp serum prepared with Defined Cell Culture Media 4 (DCCM4).
3. The hair loss scalp will have a difference in scalp sebum status after using shampoo and scalp serum prepared with Defined Cell Culture Media 4 (DCCM4).
4. Hair loss scalp will have a difference in the state of scalp pores after using shampoo and scalp serum prepared with Defined Cell Culture Media 4 (DCCM4).
5. Hair loss scalp will have a difference in hair thickness after using shampoo and scalp serum prepared with Defined Cell Culture Media 4 (DCCM4).
6. Hair loss scalp will have a difference in the number of hairs after using shampoo and scalp serum prepared with Defined Cell Culture Media 4 (DCCM4).

II. SUBJECT AND METHOD

1 Research subjects and program execution process

This study selected 21 men and women who wished to participate in the scalp hair loss program among the subjects who voluntarily visited a specialized scalp hair loss management office because of current hair loss or scalp problems living in Wangsimni and nearby areas, Seongdong-gu, Seoul. After using shampoo and serum (Jihye's Tree 01, 02, 03, 04 Shampoo, Serum 05, 07) prepared with DCCM4 and natural aroma extracts for 12 weeks (weeks), the effect was investigated. Scalp and hair loss management was conducted 12 times in total, 4 times a month based on a total of 3 months, and clinical data were derived at an average interval of once a month. Through pre-management counseling, the subject's general information, lifestyle and health status, and scalp and hair condition were identified through interviews. Through diagnostic photos before treatment.

Clinical subjects were selected and a treatment program was designed. Therefore, the subjects who understood the purpose of this study and agreed to the experiment were managed for 12 weeks. After the end of the treatment program for each clinical subject, the scalp and hair loss conditions were compared before and after through diagnosis photos. And through clinical measurement of both subjects, after using cosmetics made with Defined Cell Culture Media 4 (DCCM4) and natural aroma extracts, the effect of improving scalp hair loss according to hair loss scalp regeneration was significant. Compare the results with photos. did

2 Diagnosis of scalp hair loss

In this experiment, sometech HairSys, a scalp hair analysis program, was used to measure the change in scalp condition, The process of scalp change was photographed at 100x magnification using Digital Scope to check the improvement of the scalp, and the shampoo and serum (Jihye's Tree Shampoo and Serum) manufactured by DCCM4 were photographed before, after, 4 weeks, 8 weeks, and 12 weeks after use. did

3. Home care management program prescription

Shampoo method: When shampooing, wet the scalp and hair sufficiently with lukewarm water and apply Wisdom Tree shampoo to the entire scalp. Use Jihye's tree Shampoo 01 and 04 alternately in the morning, and Jihye's tree Shampoo 02 and 03 alternately in the evening. After shampooing and towel drying, apply Jihey's Tree 05 Ampoule on the top of the head and M-shaped scalp in the morning and evening, and apply Jihye's tree 07 Serum all over the scalp. When using the ampoule, an appropriate amount was applied so as not to flow, and rubbing with finger prints was prescribed.

4. Scalp and hair loss treatment program

Among the Jihye's Tree programs, a special scalp hair loss management program was performed once a week according to the condition of the scalp.

Special scalp care

1) First, Jihye's Tree(JT), started massage by stimulating acupuncture points to circulate the shoulders and scalp, and massaged for 5 to 10 minutes.

2) Apply Jihye's Tree(JT) 06 Scalp Scaling Serum, which contains natural extracts of menthol, to the entire scalp with a cotton swab.

3) Steam the scalp for 5 to 10 minutes.

4) Blend the seaweed pack and aroma and apply to the scalp for 10 minutes.

5) Shampoo and massage the scalp with 01 JT Shampoo.

6) It circulates the scalp and sterilizes the scalp with infrared rays, while drying the scalp with cold wind from an 80% hair dryer.

7) Irradiate the infrared rays to the abdomen and at the same time insert JT05 onto the scalp

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through the nebulizer.
8) Manage lymphatic circulation with aroma therapy.
9) Irradiate the problem area with a sterilized laser.
10) Have them drink water or tea and urinate in the toilet.
4.1.Investigation items: In general, sex, age, blood type, hair loss years, treatment experience and treatment method were investigated, shampoo used, number of shampoos, type of hair loss, family history, shampoo, sleeping time, medical history, alcohol, cigarette status, stress The presence or absence and scalp self-diagnosis were investigated.
4.2. Evaluation: The process of scalp change was photographed at 100x magnification using a digital scope, and the improvement effect was evaluated by comparing the normal scalp and DCCM4 before, after 4 weeks, after 8 weeks, and after 12 weeks of use. When a normal scalp is photographed at 100x magnification using a digital scope, the scalp tone is clear, bluish white or milky white, and has appropriate elasticity and is smooth. The distance between the pores is constant, and the pores are open in a clean state without waste or foreign substances around the pores. The number of hairs in one pore is 2 to 3 or more, and there should be about 16 to 18 hairs in one screen. You can see the difference in thickness for each hair as there are hairs in the growth phase, degeneration phase, and resting phase at the same time without empty pores.

5. Statistical data analysis

SPSS 23.0 was used as a program for statistical processing to evaluate the significance of the study results. Frequency analysis of general characteristics and self-diagnosis and mean and standard deviation of all collected data were calculated. From the viewpoint that the higher the score of the study group, the better, T-test was also conducted, and chi-square test and ANOVA were also used for categorical variables.

III. RESEARCH RESULTS AND CONSIDERATIONS

[Table 1] Verification results of the research hypothesis

division	theory	Selection Whether
Hypothesis 1	If patients with alopecia use the shampoo and scalp serum (,JT Shampoo, JT Scalp Serum) manufactured by the Defined Cell Culture Media 4, the condition of the scalp tone will be different after the experiment.	selection
Hypothesis 2	If patients with alopecia use the shampoo and scalp serum (JT Shampoo, JT Scalp Serum) manufactured by the Defined cell culture media 4, there will be a difference in the elasticity of the scalp after the experiment.	selection
Hypothesis 3	If patients with alopecia use the shampoo and scalp serum (JT Shampoo, JT Scalp Serum) manufactured by the Defined cell culture media 4, the sebum condition will be different after the experiment	selection
Hypothesis 4	For alopecia patients, if you use the shampoo and scalp serum (JT Shampoo, JT Scalp Serum) manufactured by the Defined cell culture media 4, the pore condition will be different after the experiment.	selection
Hypothesis 5	For patients with alopecia, if the shampoo and scalp serum (JT Shampoo, JT Scalp Serum) prepared by the Defined cell culture media 4 are used, the thickness of the hair will be different after the experiment.	selection
Hypothesis 6	For alopecia patients, if the shampoo and scalp serum (JT Shampoo, JT scalp serum) prepared by the Defined cell culture media 4 are used, the number of hairs will be different after the experiment.	selection

[Table 2] Frequency analysis of general characteristics

variable	division	frequency (persons)	ratio(%)

sex	male	9	42.9
	female	12	57.1
age	under 20	0	0.0
	20s	5	23.8
	30s	5	23.8
	40s	6	28.6
	50s	4	19.0
	60s	1	4.8
married	not married	13	61.9
	married	8	38.1
occupational type	professional profession	5	23.8
	student	2	9.5
	office job	3	14.3
	the commercial service industry	8	38.1
	administrative position	0	0.0
	housewife	2	9.5
	housewife8etc	1	4.8
blood type	A	8	38.1
	B	7	33.3
	AB	1	4.8
	O	5	23.8
Motivation for visiting	search on the Internet	12	57.1
	email	0	0.0
	a credit card coupon	0	0.0
	a newspaper/magazine	0	0.0
	sign	5	23.8
	introduced	4	19.0
Year of hair loss	within a month	4	19.0
	Less than three years	9	42.9
	more than five years	7	33.3
	un knowingness	1	4.8
Hereditary	none	8	38.1
	yes	13	61.9
sleeping hours	5hours	3	14.3
	6hours	4	19.0
	7hours	4	19.0
	8hours	3	14.3
	irregular	7	33.3
drinking	yes	8	38.1
	none	13	61.9
smoking	yes	2	9.5
	none	19	90.5
stressed	hight	8	38.1
	middle	11	52.4
	low	2	9.5
disease	none	11	52.4
	inflammation and acne	1	4.8
	an atopicdermatitis	2	9.5
	hypothyroidism	2	9.5

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	Disk stenosis	1	4.8
	High blood pressure & diabetes	1	4.8
	Depression and panic disorder	2	9.5
	poverty of blood	1	4.8
Shampoo that you use	General Products	16	76.2
	professional shampoo	5	23.8
Shampoo count of per day	once a day	16	76.2
	twice a day	2	9.5
	once every two days	3	14.3
scalp treatment experience	yes	9	42.9
	no	12	57.1
enjoy meat and greasy food	yes	10	47.6
	no	11	52.4
been on a serious diet	yes	5	23.8
	no	16	76.2
been irregular life	yes	10	47.6
	no	11	52.4
worry a lot and get angry often	yes	7	33.3
	no	14	66.7
can't relieve stressing my daily life	yes	7	33.3
	no	14	66.7
often feel tired and neck and back muscles are stiff	yes	17	81.0
	no	4	19.0
drinking a alcohol	yes	1	4.8
	no	20	95.2
smoking	yes	0	0.0
	no	21	100.0
have a lot of heat in head and sweat	yes	4	19.0
	no	17	81.0
scalp is prickly sensitive and red	yes	10	47.6
	no	11	52.4
usually use a lot of hair products	yes	4	19.0
	no	17	81.0
get a perm and dye hair often	yes	6	28.6
	no	15	71.4
Recently hair has become thin and weak	yes	14	66.7
	no	7	33.3
scalp is oily and smells bad	yes	5	23.8
	no	16	76.2
When washes hair or wakeup, hair is falls out	yes	15	71.4
	no	6	28.6
Type of Alopecia	AA	2	9.5
	FPA	11	52.4
	MPA	8	38.1
Type of Scalp	DRY	17	81.0
	DRY OILY	2	9.5
	OILY	2	9.5

As a result of frequency analysis on general characteristics and self-diagnosis in this study, the sex of alopecia patients was 12 female (57.1%) and 9 male (42.9%). There were 2 more females and the age of patients with alopecia was 40s 6 (28.6%), 20s 5 (23.8%), 30s 5 (23.8%), 50s 4 (19.0%), 60s 1 (4.8%) appeared as 40s, 20s, 30s, 50s, 60s appeared in that order. As for whether the alopecia patients were married, 13 (61.9%) were not married and 8 (38.1%) were married. There were 5 more unmarried patients. The occupational type of patients with alopecia was the commercial service industry 8 (38.1%), professional profession 5 (23.8%), office job 3 (14.3%), student 2 (9.5%), housewife 2 (9.5%), housewife 8 etc 1 person (4.8%).

Blood type of alopecia patients was A 8 (38.1%), B 7 (33.3%), O 5 (23.8%), AB 1 (4.8%). Motivation for visiting of patients with alopecia was search on the Internet 12 (57.1%), sign 5 (23.8%), and introduced 4 (19.0%). Year of hair loss in alopecia patients was less than three years in 9 patients (42.9%), more than five years in 7 patients (33.3%), within a month 4 patients (19.0%), and unknowingness in 1 patient (4.8%). Hereditary showed yes with 13 (61.9%) and none with 8 (38.1%). Sleeping hours were irregular: 7 people (33.3%), 6 hours 4 people (19.0%), 7 hours 4 people (19.0%), 5 hours 3 people (14.3%), 8 hours 3 people (14.3%). Drinking was none (13 people). (61.9%), yes 8 (38.1%). Smoking was none 19 (90.5%), yes 2 (9.5%).

Stressed was middle 11 (52.4%), hight 8 (38.1) %), low 2 (9.5%).The disease was none (11 patients (52.4%)), an atopic dermatitis (2 patients) (9.5%), hyperthyroidism (2 patients) (9.5%), depression and panic disorder (2 patients) (9.5%), inflammation and acne (1 patient (4.8%)), disk. stenosis 1 (4.8%), High blood pressure & diabete 1 (4.8%), poverty of blood 1 (4.8%). For Shampoo that you use, General shampoo 16 (76.2%), professional shampoo 5 (23.8%). Shampoo count per day was 16 people (76.2%) once a day, 3 people (14.3%) once every two days, and 2 people (9.5%) twice a day. Scalp treatment experience was no 12 people (57.1%), Yes 9 people (42.9%). Enjoy meat or greasy food, no 11 people (52.4%), yes 10 people (47.6%).Be on a serious diet, no 16 people (76.2%), yes 5 (23.8%). Been irregular in one's life was no 11 (52.4%), yes 10 (47.6%).worry a lot and get angry often was no 14 (66.7%), yes 7 14 people (66.7%), yes 7 people (33.3%) for can't relieve stressing my daily life. (81.0%), no 4 people (19.0%). to drink a lot no 20 people (95.2%), yes 1 person (4.8%). to smoke a lot no 21 people (100.0%). Have a lot of heat in head and sweat was no 17 (81.0%), yes 4 (19.0%). scalp is prickly sensitive and red was no 11 (52.4%), yes 10 (47.6%).usually use a lot of hair products was no 17 people (81.0%), yes 4 people (19.0%). get a perm and dye my hair often no 15 people (71.4%), yes 6 (28.6%) appeared. Recently hair has becom For e thin and weak, 14 (66.7%) yes and 7 (33.3%) no. For scalp is oily and smells bad, 16 (76.2%) no and 5 (23.8%) yes. When washes hair or wakeup my hair is gone, 15 (71.4%) yes and 6 (28.6%) no. Type of Alopecia was FPA (Female Patton Alopecia) 11 (52.4%), MPA (Male Patton Alopecia) 8 (38.1%), AA (Alopecia Areata) 2 (9.5%).Type of Scalp was found in DRY 17 (81.0%), DRY OILY 2 (9.5%), and OILY 2 (9.5%).

1. Elapsed after 4 weeks

1 and 6 are categorical variables, but a T-test was also conducted because it was necessary from the viewpoint that the higher the score, the better.

[Table 3] Comparison of conditions before and after 4 weeks of using DCCM4

		N	M	SD	t-value	p
Tone of the scalp	Before use DCCM4	21	2.05	0.80	-8.771	0.000***
	After use DCCM4 4weeks	21	3.00	0.77		
Elasticity	Before use DCCM4	21	2.48	0.75	-3.286	0.004**

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of the scalp	After use DCCM4 4weeks	21	2.90	0.77		
Sebm status	Before use DCCM4	21	3.71	0.78	3.873	0.001**
	After use DCCM4 4weeks	21	3.14	0.57		
Pore conditions	Before use DCCM4	21	2.52	0.51	-3.162	0.005**
	After use DCCM4 4weeks	21	2.86	0.48		
Thickness of hair	Before use DCCM4	21	2.52	0.60	-3.627	0.002**
	After use DCCM4 4weeks	21	3.00	0.63		
Number of hair	Before use DCCM4	21	2.62	0.50	1.000	0.329
	After use DCCM4 4weeks	21	2.52	0.51		

* p<0.05 ** p<0.01 *** p<0.001

In order to see what changes occur when patients with alopecia use the shampoo and serum (Jihye's Tree shampoo and serum) manufactured by Disk stenosis, the condition before and after 4 weeks of use of DCCM4 was compared and analyzed, and the results were [Table 3]. The scalp of tone increased from an average of 2.05 (SD=0.80) before use to 3.00 (SD=0.77) after use, which was a statistically significant result.(t=-8.771, p<.001). Scalp elasticity increased from an average of 2.48 (SD = 0.75) before use to 2.90 (SD = 0.77) after use, which was a statistically significant difference.(t=-3.286, p<.01). Sebum condition decreased from an average of 3.71 (SD=0.78) before use to 3.14 (SD= 0.57) after use, which was a statistically significant difference.(t=3.873, p<.01). Pore condition increased from an average of 2.52 (SD = 0.51) before use to 2.86 (SD = 0.48) after use, which was a statistically significant result.(t=-3.162, p<.01). Hair thickness increased from an average of 2.52 (SD=0.60) before use to 3.00 (SD=0.63) after use, which was a statistically significant result.(t=-3.627, p<.01). The number of hairs decreased from an average of 2.62 (SD=0.50) before use to 2.52 (SD=0.51) after use, but there was no statistically significant difference. (t=1.000, p>.05).

2. Elapsed after 8 weeks

[Table 4] Comparison of conditions before and after 8 weeks of using DCCM4

		N	M	SD	t-value	p
Scalp tone	Before use DCCM4	21	2.05	0.80	-12.205	0.000***
	After use DCCM4 8weeks	21	3.76	0.70		
Elasticity of the scalp	Before use DCCM4	21	2.48	0.75	-7.176	0.000***
	After use DCCM4 8weeks	21	3.52	0.75		
Sebm status	Before use DCCM4	21	3.71	0.78	4.183	0.000***
	After use DCCM4 8weeks	21	3.05	0.22		
Pore conditions	Before use DCCM4	21	2.52	0.51	-10.247	0.000***
	After use DCCM4 8weeks	21	3.52	0.60		
Thickness of hair	Before use DCCM4	21	2.52	0.60	-8.027	0.000***
	After use DCCM4 8weeks	21	3.71	0.72		
Number of hair	Before use DCCM4	21	2.62	0.50	3.990	0.001**
	After use DCCM4 8weeks	21	2.10	0.44		

* p<0.05 ** p<0.01 *** p<0.001

In order to determine what kind of change occurs when patients with alopecia use shampoo and serum (Jihye's tree, (JT) shampoo, serum) manufactured with definitive cell culture medium 4, the condition before and after 8 weeks of use of DCCM4 was compared and analyzed. The result

is shown in [Table 4].

The scalp tone increased from an average of 2.05 (SD=0.80) before use to 3.76 (SD=0.70) after use, which was a statistically significant result (t=-12.205, p<.001).

Scalp elasticity increased from an average of 2.48 (SD=0.75) before use to 3.52 (SD=0.75) after use, which was a statistically significant difference (t=-7.176, p<.001). Sebum condition decreased from an average of 3.71 (SD=0.78) before use to 3.05 (SD=0.22) after use, which was a statistically significant difference (t=4.183, p<.001). Pore condition increased from an average of 2.52 (SD=0.51) before use to 3.52 (SD=0.60) after use, which was a statistically significant result (t=-10.247, p<.001). Hair thickness increased from an average of 2.52 (SD=0.60) before use to 3.71 (SD=0.72) after use, which was a statistically significant result (t=-8.027, p<.001). The number of hairs decreased from an average of 2.62 (SD = 0.50) before use to 2.10 (SD = 0.44) after use, which was a statistically significant result (t = 1.000, p <.01).

In order to determine what changes occur when patients with alopecia use shampoo and serum (Jihye's tree, (JT)shampoo Serum) manufactured with definitive cell culture medium 4, the condition before and after 12 weeks of use of DCCM4 was compared and analyzed, and the results were As shown in [Table 5]. The scalp color increased from an average of 2.05 (SD=0.80) before use to 4.48 (SD=0.60) after use, which was a statistically significant result (t=-18.623, p<.001). Scalp elasticity increased from an average of 2.48 (SD=0.75) before use to 4.29 (SD=0.78) after use, which was a statistically significant difference (t=-13.784, p<.001). In order to determine what changes occur when patients with alopecia use shampoo and serum (Jihye's tree, (JT)shampoo Serum) manufactured with definitive cell culture medium 4, the condition before and after 12 weeks of use of DCCM4 was compared and analyzed, and the results were As shown in [Table 5]. The scalp color increased from an average of 2.05 (SD=0.80) before use to 4.48 (SD=0.60) after use, which was a statistically significant result (t=-18.623, p<.001). Scalp elasticity increased from an average of 2.48 (SD=0.75) before use to 4.29 (SD=0.78) after use, which was a statistically significant difference (t=-13.784, p<.001). Sebum condition decreased from an average of 3.71 (SD=0.78) before use to 3.05 (SD=0.22) after use, which was a statistically significant difference (t=4.183, p<.001). Pore condition increased from an average of 2.52 (SD=0.51) before use to 4.33 (SD=0.80) after use, which was a statistically significant result (t=-13.784, p<.001). Hair thickness increased from an average of 2.52 (SD=0.60) before use to 4.43 (SD=0.75) after use, which was a statistically significant result (t=-12.464, p<.001). The number of hairs decreased from an average of 2.62 (SD = 0.50) before use to 1.38 (SD = 0.59) after use, which was a statistically significant result (t = 8.101, p <.001).

3. Elapsed after 12 weeks

[Table 5] Comparison of conditions before and after 12 weeks of using DCCM4

		N	M	SD	t-value	p
Scalp tone	Before use DCCM4	21	2.05	0.80	-18.623	0.000***
	After use DCCM4 12weeks	21	4.48	0.60		
Elasticity of the scalp	Before use DCCM4	21	2.48	0.75	-13.784	0.000***
	After use DCCM4 12weeks	21	4.29	0.78		
Sebm status	Before use DCCM4	21	3.71	0.78	4.183	0.000***
	After use DCCM4 12weeks	21	3.05	0.22		
Pore conditions	Before use DCCM4	21	2.52	0.51	-13.784	0.000***
	After use DCCM4 12weeks	21	4.33	0.80		

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Thickness of hair	Before use DCCM4 Thickness of hair	21	2.52	0.60	-12.464	0.000***
	After use DCCM4 12weeks	21	4.43	0.75		
Number of hair	Before use DCCM4	21	2.62	0.50	8.101	0.000***
	After use DCCM4 12weeks	21	1.38	0.59		

* p<0.05 ** p<0.01 *** p<0.001

4. Scalp chi-square test

[Table 6]

variable	division	entire	Before use DCCM4 Scalp tone			χ^2(p)
			dark red	redness	light pink	
After use DCCM4 4weeks Scalp tone	Red	6(28.6)	5(83.3)	0(0.0)	1(16.7)	χ^2= 31.139 p= 0.000***
	light pink	9(42.9)	1(11.1)	8(88.9)	0(0.0)	
	White	6(28.6)	0(0.0)	0(0.0)	6(100.0)	
After use DCCM4 8weeks Scalp color	light pink	8(38.1)	5(62.5)	2(25.0)	1(12.5)	χ^2= 13.125 p= 0.011*
	White	10(47.6)	1(10.0)	6(60.0)	3(30.0)	
	bluish white	3(14.3)	0(0.0)	0(0.0)	3(100.0)	
After use DCCM4 12weeks Scalp color	light pink	1(4.8)	1(100.0)	0(0.0)	0(0.0)	χ^2= 10.965 p= 0.027*
	White	9(42.9)	5(55.6)	3(33.3)	1(11.1)	
	bluish white	11(52.4)	0(0.0)	5(45.5)	6(54.5)	
entire		21(100.0)	6(28.6)	8(38.1)	7(33.3)	

* p<0.05 ** p<0.01 *** p<0.001

Looking at the overall results of scalp color before using DCCM4, out of a total of 21 (100.0%), 6 dark red (28.6%), 8 red (38.1%), and 7 light pink (33.3%) appeared as. As a result of the cross-analysis between scalp tone before and after using DCCM4, a significant relationship was found between scalp color before and after DCCM4 use and scalp tone after 4 weeks of DCCM4 use (χ^2=31.139, p <0.001). In the 'dark red' group before use, 'red' was the highest with 5 (83.3%), and in the 'red' group before use, 'light pink' appeared with 8 (88.9%), which was very high compared to other groups. Before use, it was confirmed that 'white' was very high with 6 people (100.0%) in the 'light pink' group. A significant relationship was also found between scalp tone before DCCM4 use and scalp tone after 8 weeks of DCCM4 use (χ^2=13.125, p<0.05). In the 'dark red' group before use, 'light pink' was the highest with 5 (62.5%), and 'white' was also found with 1 (10.0%). In the ‘red’ group before use, 6 (60.0%) were ‘white’, which was relatively high. Before use, in the 'light pink' group, it was confirmed that 'blue white' was very high with 3 people (100.0%). A significant relationship was also found between scalp tone before DCCM4 use and scalp tone after 12 weeks of DCCM4 use (χ^2=10.965, p<0.05). In the 'dark red' group before use, 'white' was 5 (55.6%) and 'light pink' was 1 (100.0%). Before use, the 'red' group was relatively high with 5 (45.5%) of 'blue and white' and 3 (33.3%) of 'white'. Before use, in the 'light pink' group, it was confirmed that 'blue white' was relatively high with 6 (54.5%).

5. Number of hair chi-square test

[Table 7]

variable	division	entire	Before use DCCM4 Number of hair		χ^2(p)
			12 or more 16 or less	5 or more 11 or less	
After use DCCM4 4weeks Number of hair	12 or more 16 or less	10(47.6)	7(70.0)	3(30.0)	χ^2= 8.240 p= 0.004**
	5 or more 11 or less	11(52.4)	1(9.1)	10(90.9)	
After use DCCM4 8weeks Number of hair	More than 17 and less than 20	1(4.8)	1(100.0)	0(0.0)	χ^2= 1.710 p= 0.425
	12 or more 16 or less	17(81.0)	6(35.3)	11(64.7)	
	5 or more 11 or less	3(14.3)	1(33.3)	2(66.7)	
After use DCCM4 12weeks Number of hair	More than 17 and less than 20	14(66.7)	7(50.0)	7(50.0)	χ^2= 6.159 p= 0.046*
	12 or more 16 or less	6(28.6)	0(0.0)	6(100.0)	
	5 or more 11 or less	1(4.8)	1(100.0)	0(0.0)	
전체		21(100.0)	8(38.1)	13(61.9)	

* p<0.05 ** p<0.01 *** p<0.001

Looking at the total response results of Number of hair before using DCCM4, 12 or more and 16 or less 8 (38.1%) out of a total of 21 (100.0%), 5 or more and 11 or less 13 (61.9) %) appeared. As a result of the cross-analysis between the number of hairs before and after using DCCM4, there was a significant relationship between the number of hairs before using DCCM4 and the number of hairs after 4 weeks of using DCCM4 (χ^2= 8.240, p<0.01) . Before use, in the '12 or more and 16 or less' group, '12 or more and 16 or less' was very high at 7 (70.0%), and before use, '5 or more and 11 or less' group had '5 or more 11 Less than or less' was relatively high with 10 people (90.0%). There was no significant relationship between the number of hairs before using DCCM4 and the number of hairs after 8 weeks of using DCCM4 (χ2=1.710, p>0.05). There was a significant relationship between the number of hairs before using DCCM4 and the number of hairs after 12 weeks of using DCCM4 (χ^2= 6.159, p<0.05). Before use, in the 'more than 12 but less than 16' group, 1 person (100.0%) 'more than 5 and less than 11' and 7 (50%) of the 'more than 17 and less than 20' group. Before use, in the group of 'more than 5 and less than 11', 7 people (50.0%) had 'more than 17 and less than 20' and 6 (100.0%) had 'more than 12 and less than 16'.

6. Analysis according to Alopecia type (analysis of variance)

Regardless of the Alopecia type, shampoos and serums prepared with the definitive cell culture medium 4 (DCCM4) were analyzed to be effective.

Depending on the Alopecia type, there is no difference at each period, so it can be seen that the shampoo is effective in all types regardless of the Alopecia type.

For reference, the Number of hair part is significant, but it is a categorical variable converted into a continuous variable.

1) before treatment

variable	division	N	M	SD	F-value	p
Before use DCCM4	AA	2	2.00	1.41	0.317	0.732

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Scalp tone	FPA	11	2.18	0.75		
	MPA	8	1.88	0.83		
Before use DCCM4 Elasticity of the scalp	AA	2	2.00	1.41	1.447	0.261
	FPA	11	2.73	0.79		
	MPA	8	2.25	0.46		
Before use DCCM4 Sebum status	AA	2	3.00	1.41	1.485	0.253
	FPA	11	3.64	0.67		
	MPA	8	4.00	0.76		
Before use DCCM4 Pore conditions	AA	2	2.50	0.71	2.273	0.132
	FPA	11	2.73	0.47		
	MPA	8	2.25	0.46		
Before use DCCM4 Thickness of hair	AA	2	2.50a	0.71	3.999	0.037*
	FPA	11	2.82a	0.40		
	MPA	8	2.13a	0.64		
Before use DCCM4 Number of hair	AA	2	2.50	0.71	1.865	0.184
	FPA	11	2.45	0.52		
	MPA	8	2.88	0.35		

* $p<0.05$

As a result of analyzing the difference according to the type of Alopecia, before use DCCM 4 Scalp color did not show a significant difference at the significance level of 0.05 ($p>0.05$). Looking at the response average, AA was 2.00, FPA was 2.18, and MPA was 1.88, respectively. Before use DCCM4 Elasticity of the scalp showed no significant difference at the significance level of 0.05 ($p>0.05$). Looking at the response average, AA was 2.00, FPA was 2.73, and MPA was 2.25, respectively. Before use DCCM4 Sebum status showed no significant difference at the significance level of 0.05 ($p>0.05$). Looking at the response average, AA was 3.00, FPA was 3.64, and MPA was 4.00, respectively. Before use DCCM4 Pore conditions showed no significant difference at the significance level of 0.05 ($p>0.05$). Looking at the response average, AA was 2.50, FPA was 2.73, and MPA was 2.25, respectively. Before use DCCM4 Thickness of hair showed a significant difference at the significance level of 0.05 ($p<0.05$). Looking at the response average, AA was 2.50, FPA was 2.82, and MPA was 2.13, respectively. Before use DCCM4 Number of hair did not show a significant difference at the significance level of 0.05 ($p>0.05$). Looking at the response average, AA was 2.50, FPA was 2.45, and MPA was 2.88, respectively.

2) After 4week

[Table9]

variable	division	N	M	SD	F-value	p
Before use DCCM4 Scalp tone	AA	2	2.00	0.00	2.208	0.139
	FPA	11	3.18	0.75		
	MPA	8	3.00	0.76		
Before use DCCM4 Elasticity of the scalp	AA	2	2.00	0.00	1.863	0.184
	FPA	11	3.09	0.70		
	MPA	8	2.88	0.83		
Before use DCCM4 Sebum status	AA	2	2.50	0.71	1.493	0.251
	FPA	11	3.18	0.60		
	MPA	8	3.25	0.46		
Before use DCCM4	AA	2	3.00	0.00	1.618	0.226

Pore conditions	FPA	11	3.00	0.45		
	MPA	8	2.63	0.52		
Before use DCCM4 Thickness of hair	AA	2	2.50	0.71	1.269	0.305
	FPA	11	3.18	0.60		
	MPA	8	2.88	0.64		
Before use DCCM4 Number of hair	AA	2	3.00a	0.00	9.772	0.001**
	FPA	11	2.18b	0.40		
	MPA	8	2.88a	0.35		

* p<0.01

As a result of the difference analysis according to the Type of Alopecia, after use DCCM4, 4 weeks Scalp tone did not show a significant difference at the significance level of 0.05 (p>0.05). Looking at the average, AA was 2.00, FPA was 3.18, and MPA was 3.00, respectively. After use DCCM4 4weeks Elasticity of the scalp did not show a significant difference at the significance level of 0.05 (p>0.05). Looking at the response average, AA was 2.00, FPA was 3.09, and MPA was 2.88, respectively. After use DCCM4 4 weeks, Sebum status showed no significant difference at the significance level of 0.05 (p>0.05).Looking at the response average, AA was 2.50, FPA was 3.18, and MPA was 3.25, respectively. After use DCCM4 4weeks, Pore conditions showed no significant difference at the significance level of 0.05 (p>0.05). Looking at the response average, AA was 3.00, FPA was 3.00, and MPA was 2.63, respectively. After use DCCM4 4 weeks, Thickness of hair did not show a significant difference at the significance level of 0.05 (p>0.05). Looking at the response average, AA was 2.50, FPA was 3.18, and MPA was 2.88, respectively. After use DCCM4, 4weeks Number of hair showed a significant difference at the significance level of 0.05 (p<0.05). Looking at the response average, AA was 3.00, FPA was 2.18, and MPA was 2.88, respectively.

3) 8 weeks later

[Table 10]

variable	division	N	M	SD	F-value	p
Before use DCCM4 Scalp tone	AA	2	3.00	0.00	1.790	0.195
	FPA	11	3.73	0.65		
	MPA	8	4.00	0.76		
Before use DCCM4 Elasticity of the scalp	AA	2	3.00	0.00	0.890	0.428
	FPA	11	3.45	0.69		
	MPA	8	3.75	0.89		
Before use DCCM4 Sebum status	AA	2	3.00	0.00	0.429	0.658
	FPA	11	3.09	0.30		
	MPA	8	3.00	0.00		
Before use DCCM4 Pore conditions	AA	2	3.00	0.00	1.755	0.201
	FPA	11	3.73	0.65		
	MPA	8	3.38	0.52		
Before use DCCM4 Thickness of hair	AA	2	3.00	0.00	1.539	0.242
	FPA	11	3.91	0.70		
	MPA	8	3.63	0.74		
Before use DCCM4 Number of hair	AA	2	3.00a	0.00	10.217	0.001**
	FPA	11	2.09b	0.30		
	MPA	8	1.88b	0.35		

* p<0.01

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As a result of the difference analysis according to Type of Alopecia, after use DCCM4 8weeks Scalp tone did not show a significant difference at the significance level of 0.05 (p>0.05). Looking at the response average, AA was 3.00, FPA was 3.73, and MPA was 4.00, respectively. After use DCCM4 8weeks Elasticity of the scalp did not show a significant difference at the significance level of 0.05 (p>0.05). Looking at the response average, AA was 3.00, FPA was 3.45, and MPA was 3.75, respectively. After use DCCM 4 8weeks Sebum status showed no significant difference at the significance level of 0.05 (p>0.05). Looking at the response average, AA was 3.00, FPA was 3.09, and MPA was 3.00, respectively. After use DCCM 4 8weeks Pore conditions showed no significant difference at the significance level of 0.05 (p>0.05). Looking at the response average, AA was 3.00, FPA was 3.73, and MPA was 3.38, respectively. After use DCCM4 8weeks Thickness of hair did not show a significant difference at the significance level of 0.05 (p>0.05). Looking at the response average, AA was 3.00, FPA was 3.91, and MPA was 3.63, respectively. After use DCCM4 8weeks Number of hair showed a significant difference at the significance level of 0.05 (p<0.05). Looking at the response average, AA was 3.00, FPA was 2.09, and MPA was 1.88, respectively.

4) after 12 weeks

[Table 11]

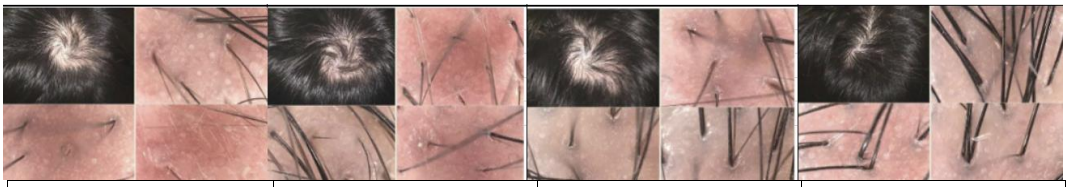
variable	division	N	M	SD	F-value	p
Before use DCCM4 Scalp tone	AA	2	4.00	0.00	0.867	0.437
	FPA	11	4.45	0.69		
	MPA	8	4.63	0.52		
Before use DCCM4 Elasticity of the scalp	AA	2	3.50	0.71	1.308	0.295
	FPA	11	4.45	0.69		
	MPA	8	4.25	0.89		
Before use DCCM4 Sebum status	AA	2	3.00	0.00	0.429	0.658
	FPA	11	3.09	0.30		
	MPA	8	3.00	0.00		
Before use DCCM4 Pore conditions	AA	2	3.00b	0.00	5.169	0.017*
	FPA	11	4.64a	0.67		
	MPA	8	4.25ab	0.71		
Before use DCCM4 Thickness of hair	AA	2	3.50	0.71	3.257	0.062
	FPA	11	4.73	0.65		
	MPA	8	4.25	0.71		
Before use DCCM4 Number of hair	AA	2	2.50a	0.71	9.354	0.002**
	FPA	11	1.09b	0.30		
	MPA	8	1.50b	0.53		

* p<0.05, * p<0.01

As a result of the difference analysis according to the Type of Alopecia, after use DCCM4 12weeks Scalp tone did not show a significant difference at the significance level of 0.05 (p>0.05). Looking at the response average, AA was 4.00, FPA was 4.45, and MPA was 4.63, respectively. After use DCCM4 12weeks Elasticity of the scalp did not show a significant difference at the significance level of 0.05 (p>0.05). Looking at the response average, AA was 3.50, FPA was 4.45, and MPA was 4.25, respectively. After use DCCM4 12weeks Sebum status showed no significant

difference at the significance level of 0.05 (p>0.05). Looking at the response average, AA was 3.00, FPA was 3.09, and MPA was 3.00, respectively. After use DCCM4 12weeks Pore conditions showed a significant difference at the significance level of 0.05 (p<0.05). Looking at the response average, AA was 3.00, FPA was 4.64, and MPA was 4.25, respectively. After use DCCM4 12weeks Thickness of hair did not show a significant difference at the significance level of 0.05 (p>0.05). Looking at the response average, AA was 3.50, FPA was 4.73, and MPA was 4.25. After use DCCM4 12weeks Number of hair showed a significant difference at significance level 0.05 (p<0.05). Looking at the response average, AA was 2.50, FPA was 1.09, and MPA was 1.50, respectively.

Figure 2. AA Alopecia areata before treatment 4 weeks, 8 weeks, 12 weeks after photos



before treatment	After 4 weeks	After 8 weeks	After 12 weeks

Figure 3. Before FPA female hair loss treatment after 4 weeks, 8 weeks, and 12 weeks photos

before treatment	After 4 weeks	After 8 weeks	After 12 weeks

Figure 4. MPA male hair loss treatment before treatment, after 4 weeks, after 8 weeks, after 12 weeks Photos

before treatment	After 4 weeks	After 8 weeks	After 12 weeks

7. Difference analysis according to type of scalp

Regardless of the scalp type, shampoos and serums prepared with DCCM4 were analyzed to be effective.

Since there is no difference in each period according to the scalp type, it can be seen that the shampoo is effective in all types regardless of the scalp type.

1) Treatment

variable	scalp type	N	M	SD	F-value	p
Before use DCCM4 Scalp tone	DRY	17	2.00	0.79	0.326	0.726
	DRY OILY	2	2.50	0.71		

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	OILY	2	2.00	1.41		
Before use DCCM4 Elasticity of the scalp	DRY	17	2.47	0.80	0.002	0.998
	DRY OILY	2	2.50	0.71		
	OILY	2	2.50	0.71		
Before use DCCM4 Sebum status	DRY	17	3.65	0.79	1.161	0.336
	DRY OILY	2	4.50	0.71		
	OILY	2	3.50	0.71		
Before use DCCM4 Pore conditions	DRY	17	2.53	0.51	0.005	0.995
	DRY OILY	2	2.50	0.71		
	OILY	2	2.50	0.71		
Before use DCCM4 Thickness of hair	DRY	17	2.53	0.62	0.003	0.997
	DRY OILY	2	2.50	0.71		
	OILY	2	2.50	0.71		
Before use DCCM4 Number of hair	DRY	17	2.59	0.51	0.652	0.533
	DRY OILY	2	3.00	0.00		
	OILY	2	2.50	0.71		

* p<0.05 ** p<0.01 *** p<0.001

As a result of the difference analysis according to the type of scalp, before use DCCM4 Scalp tone showed no significant difference at the significance level of 0.05 (p>0.05). Looking at the response average, DRY was 2.00, DRY OILY was 2.50, and OILY was 2.00, respectively. Before use DCCM4 Elasticity of the scalp showed no significant difference at the significance level of 0.05 (p>0.05). Looking at the response average, DRY was 2.47, DRY OILY was 2.50, and OILY was 2.50, respectively. Before use DCCM4 Sebum status showed no significant difference at the significance level of 0.05 (p>0.05). Looking at the response average, DRY was 3.65, DRY OILY was 4.50, and OILY was 3.50, respectively. Before use DCCM4 Pore conditions showed no significant difference at the significance level of 0.05 (p>0.05). Looking at the response average, DRY was 2.53, DRY OILY was 2.50, and OILY was 2.50, respectively. Before use DCCM4 Thickness of hair showed no significant difference at the significance level of 0.05 (p>0.05). Looking at the response average, DRY was 2.53, DRY OILY was 2.50, and OILY was 2.50, respectively. There was no significant difference in Before use DCCM4 Number of hair at the significance level of 0.05 (p>0.05). Looking at the response average, DRY was 2.59, DRY OILY was 3.00, and OILY was 2.50, respectively.

2) 4 weeks later

[Table 13]

variable	scalp type	N	M	SD	F-value	p
Before use DCCM4 Scalp tone	DRY	17	2.94	0.75	0.440	0.651
	DRY OILY	2	3.50	0.71		
	OILY	2	3.00	1.41		
Before use DCCM4 Elasticity of the scalp	DRY	17	2.88	0.78	0.874	0.434
	DRY OILY	2	3.50	0.71		
	OILY	2	2.50	0.71		
Before use DCCM4 Sebum status	DRY	17	3.12	0.60	0.441	0.650
	DRY OILY	2	3.50	0.71		

	OILY	2	3.00	0.00		
Before use DCCM4 Pore conditions	DRY	17	2.88	0.49	0.647	0.535
	DRY OILY	2	2.50	0.71		
	OILY	2	3.00	0.00		
Before use DCCM4 Thickness of hair	DRY	17	2.88	0.60	1.643	0.221
	DRY OILY	2	3.50	0.71		
	OILY	2	3.50	0.71		
Before use DCCM4 Number of hair	DRY	17	2.53	0.51	0.005	0.995
	DRY OILY	2	2.50	0.71		
	OILY	2	2.50	0.71		

As a result of the difference analysis according to the type of scalp, after use DCCM4 4weeks scalp tone showed no significant difference at the significance level of 0.05 ($p>0.05$). Looking at the response average, DRY was 2.94, DRY OILY was 3.50, and OILY was 3.00, respectively. After use DCCM4 4weeks Elasticity of the scalp did not show a significant difference at the significance level of 0.05 ($p>0.05$). Looking at the response average, DRY was 2.88, DRY OILY was 3.50, and OILY was 2.50, respectively. After use DCCM4 4weeks Sebum status showed no significant difference at the significance level of 0.05 ($p>0.05$). Looking at the response average, DRY was 3.12, DRY OILY was 3.50, and OILY was 3.00, respectively. After use DCCM4 4weeks Pore conditions did not show a significant difference at the significance level of 0.05 ($p>0.05$). Looking at the response average, DRY was 2.88, DRY OILY was 2.50, and OILY was 3.00, respectively. After use DCCM4 4weeks Thickness of hair did not show a significant difference at the significance level of 0.05 ($p>0.05$). Looking at the response average, DRY was 2.88, DRY OILY was 3.50, and OILY was 3.50, respectively. After use DCCM4 4weeks Number of hair did not show a significant difference at the significance level of 0.05 ($p>0.05$). Looking at the response average, DRY was 2.53, DRY OILY was 2.50, and OILY was 2.50, respectively.

3) 8 weeks later

[Table 14]

variable	division	N	M	SD	F-value	p
Before use DCCM4 Scalp tone	DRY	17	3.65	0.61	1.532	0.243
	DRY OILY	2	4.50	0.71		
	OILY	2	4.00	1.41		
Before use DCCM4 Elasticity of the scalp	DRY	17	3.47	0.80	0.422	0.662
	DRY OILY	2	4.00	0.00		
	OILY	2	3.50	0.71		
Before use DCCM4 Sebum status	DRY	17	3.06	0.24	0.107	0.899
	DRY OILY	2	3.00	0.00		
	OILY	2	3.00	0.00		
Before use DCCM4 Pore conditions	DRY	17	3.53	0.62	0.003	0.997
	DRY OILY	2	3.50	0.71		
	OILY	2	3.50	0.71		
Before use DCCM4 Thickness of hair	DRY	17	3.65	0.70	0.367	0.698
	DRY OILY	2	4.00	0.00		
	OILY	2	4.00	1.41		

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Before use DCCM4 Number of hair	DRY	17	2.12	0.49	0.107	0.899
	DRY OILY	2	2.00	0.00		
	OILY	2	2.00	0.00		

As a result of the difference analysis according to the type of scalp, after use DCCM4 8weeks scalp tone showed no significant difference at the significance level of 0.05 (p>0.05). Looking at the response average, DRY was 3.65, DRY OILY was 4.50, and OILY was 4.00, respectively. After use DCCM4 8weeks Elasticity of the scalp did not show a significant difference at the significance level of 0.05 (p>0.05). Looking at the response average, DRY was 3.47, DRY OILY was 4.00, and OILY was 3.50, respectively. After use DCCM4 8weeks Sebum status showed no significant difference at the significance level of 0.05 (p>0.05). Looking at the response average, DRY was 3.06, DRY OILY was 3.00, and OILY was 3.00, respectively. After use DCCM4 8weeks Pore conditions did not show a significant difference at the significance level of 0.05 (p>0.05). Looking at the response average, DRY was 3.53, DRY OILY was 3.50, and OILY was 3.50, respectively. After use DCCM4 8weeks Thickness of hair did not show a significant difference at the significance level of 0.05 (p>0.05). Looking at the response average, DRY was 3.65, DRY OILY was 4.00, and OILY was 4.00, respectively. After use DCCM4 8weeks Number of hair showed no significant difference at the significance level of 0.05 (p>0.05). Looking at the response average, DRY was 2.12, DRY OILY was 2.00, and OILY was 2.00, respectively.

4) 12 weeks later

variable	division	N	M	SD	F-value	p
Before use DCCM4 Scalp tone	DRY	17	4.41	0.62	0.844	0.446
	DRY OILY	2	5.00	0.00		
	OILY	2	4.50	0.71		
Before use DCCM4 Elasticity of the scalp	DRY	17	4.24	0.75	0.998	0.388
	DRY OILY	2	5.00	0.00		
	OILY	2	4.00	1.41		
Before use DCCM4 Sebum status	DRY	17	3.06	0.24	0.107	0.899
	DRY OILY	2	3.00	0.00		
	OILY	2	3.00	0.00		
Before use DCCM4 Pore conditions	DRY	17	4.29	0.85	0.099	0.907
	DRY OILY	2	4.50	0.71		
	OILY	2	4.50	0.71		
Befor euse DCCM4 Thickness of hair	DRY	17	4.41	0.80	0.020	0.980
	DRY OILY	2	4.50	0.71		
	OILY	2	4.50	0.71		
Before use DCCM4 Number of hair	DRY	17	1.35	0.61	0.092	0.913
	DRY OILY	2	1.50	0.71		
	OILY	2	1.50	0.71		

As a result of analyzing the difference according to the type of scalp, after use DCCM4 12weeks scalp tone did not show a significant difference at the significance level of 0.05 (p>0.05). Looking at the response average, DRY was 4.41, DRY OILY was 5.00, and OILY was 4.50, respectively. After use DCCM4 12weeks Elasticity of the scalp did not show a significant difference at the significance level of 0.05 (p>0.05). Looking at the response average, DRY was 4.24, DRY OILY

was 5.00, and OILY was 4.00, respectively. After use DCCM4 12weeks Sebum status showed no significant difference at the significance level of 0.05 ($p>0.05$). In terms of response averages, DRY was 3.06, DRY OILY was 3.00, and OILY was 3.00. After use DCCM4 12weeks Pore conditions showed no significant difference at the significance level of 0.05 ($p>0.05$). Looking at the response average, DRY was 4.29, DRY OILY was 4.50, and OILY was 4.50, respectively. After use DCCM4 12weeks Thickness of hair did not show a significant difference at the significance level of 0.05 ($p>0.05$). Looking at the response average, DRY was 4.41, DRY OILY was 4.50, and OILY was 4.50, respectively. After use DCCM4 12weeks Number of hair did not show a significant difference at the significance level of 0.05 ($p>0.05$). Looking at the response average, DRY was 1.35, DRY OILY was 1.50, and OILY was 1.50, respectively.

Figure 5. Photos before DRY treatment, after 4 weeks, 8 weeks, and 12 weeks of treatment

Before treatment	After 4 weeks	After 8 weeks	After 12 weeks

Figure 6. Photos before DRY and OILY treatment, after 4 weeks, 8 weeks, and 12 weeks of treatment

Before treatment	After 4 weeks	After 8 weeks	After 12 weeks

Figure 7. Photos before OILY treatment, after 4 weeks, 8 weeks, and 12 weeks of treatment

Before treatment	After 4 weeks	After 8 weeks	After 12 weeks

V. Conclusion

This study was conducted to investigate the scalp and hair loss improvement effects of shampoo and scalp serum prepared with DCCM4. Twenty-one subjects participated in the study, and used the product twice a day for 12 weeks, a total of 168 times. In addition, DCCM4 was used for scalp management once a month, and scalp photographs were taken before use and 4 weeks, 8 weeks, and 12 weeks after use to analyze scalp tone, scalp elasticity, scalp pores, hair thickness, and

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number of hairs. Scalp management was performed 12 times a week with the shampoo and scalp serum produced in the defined cell culture medium 4. The results of the study are as follows. First, the scalp tone increased from 2.05 (SD=0.80) to 3.00 (SD=0.77) on average 4 weeks after using the shampoo and scalp serum prepared with DCCM4, which was a statistically significant result (t=-8.771, p<.001). Scalp elasticity increased from an average of 2.48 (SD=0.75) to 2.90 (SD=0.77) before use, showing a statistically significant difference (t=-3.286, p<.01). Sebum condition averaged 3.71 (SD=0.77) before use. 0.78) to 3.14 (SD=0.57) after use, which showed a statistically significant difference (t=3.873, p<).01. The stomatal condition increased from an average of 2.52 (SD=0.51) before use to 2.86 (SD=0.48) after use, showing a statistically significant result (t=-3.165, p<.01). Hair thickness increased from an average of 2.52 (SD=0.60) before use to 3.00 (SD=0.63) after use, which was a very statistically significant result (t=-3.627, p<.01). The number of hairs decreased from an average of 2.62 (SD=0.50) before use to 2.52 (SD=0.51) after use, but there was no statistically significant difference (t=1.000, p>).05. However, both 8 and 12 weeks had statistically significant or very significant differences. Second, since most of the pattern hair loss (AA), female hair loss (FPA), and male hair loss (MPA) do not differ by period depending on the type of hair loss, DCCM4 produces shampoo and scalp serum for all types regardless of the type of hair loss. It can be seen that this is effective. Third, there was no difference between dry scalp (DRY), oily scalp (OILY), and combination scalp (DRY OLY), and it was analyzed that shampoo and scalp serum prepared with DCCM4 were effective regardless of all scalp types. Therefore, the effects of the shampoo and scalp serum produced with the defined cell culture medium 4 as a whole are significant, and the effects are significant for all hair loss types and all scalp types. Therefore, this clinical study found that it has the effect of improving aging scalp, preventing hair loss, and promoting hair growth by applying shampoo (Jihye's tree Shampoo JT01, JT02, JT03, JT04) and scalp serum (Jihye's tree serum JT05, JT07) mixed with safe defined cell culture media 4.

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AUTHOR'S INTRODUCTION

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