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The Effects of Combined Exercise and Scalp Care on the Scalp and Hair Condition of Male with Alopecia

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Abstract

Background/Objectives: The purpose of this study was to provide basic data for preventing and improving hair loss in men in their 20s by analyzing how combined exercise and scalp care program affect one's hair condition(scalp sebum, water retention, transepidemal water loss(TEWL), scalp temperature, hair density, and hair thickness) for 12 weeks.

Methods/Statistical analysis: The group participating in the combined exercise program conducted a combined exercise program once for 80 minutes with 3 days of exercise frequency per week for 12 weeks. The scalp management program was conducted for 20 minutes once a week for 12 weeks. After pre-diagnosis, scalp condition was measured and followed by scaling, hair damage prevention mineral pack, manual technique, shampoo for cleaning, and nutrition supply for hair root strengthening. In addition, a 2-way ANOVA was conducted to verify the effect on each group. The significance level was verified at .05.

Findings: The combined exercise and scalp care program for 12 weeks did not show any interaction effect on the scalp oil content, water retention, transepidemal water loss(TEWL), and scalp surface temperature in the hair condition of men with hair loss in their 20s, but had an interaction effect on the density and thickness of hair appear.

Improvements/Applications: The combined exercise and scalp care program performed in this study showed positive effects on hair density and thickness, which confirmed the possibility of early prevention and improvement of initial hair loss.

***Keywords*:** Male with Alopecia, Combined Exercise, Scalp Care, Hair density, Hair thickness, Scalp condition**.**

1. Introduction

In the past, hairstyle was one of the ways to show ones' identity or power, but today it has a psychological function that gives people confidence by securing their flaws and highlighting their strengths or charming points[1]. In general, hair grows from 0.3 to 0.4 mm per day and 10 to 15 cm per year, and aging starts to begin from women's age 40 and men's age 35[2]. Alopecia refers to a condition in which hair is normally lost at a site where it normally exists, and mainly occurs in the head, and is classified into various types such as female pattern alopecia, male pattern alopecia, and alopecia areata. Androgenetic alopecia is the most common alopecia known to occur regardless of gender, and male hormone problems and genetic predisposition are known as androgenetic alopecia's main factors. Apart from that, alopecia areata develops due to autoimmune reactions and idiopathic environmental or genetic causes[3,4]. Alopecia refers to the abnormal absence of hair in areas where hair should be normally, and hair loss occurs due to various causes such as genetic, DHT, drug treatment, oxidative stress, hormonal changes, diet, eating disorders, and environmental pollution[5,6]. Normally, 50-100 pieces of hair fall out a day, but hair loss refers to a condition which shows 50-400 pieces of hair falling out a day[7]. It is estimated that there are more than 10,000,000 people who are suffering from hair loss in Korea, and that the population is increasing every year. This rapid growth of hair loss population has extended the market size of hair loss care market, and now the market size is about 4 trillion won. Due to this trend, interest in scalp scare methods is gradually increasing and so does its market size[8]. The causes of hair loss can be largely divided into hereditary reasons and non-hereditary reasons. The hereditary alopecia mainly occurs in men, and is influenced by dihydrotestosterone (DHT), and a non-genetic disorder is an over-immune reaction caused by inflammation and oxidation[9,10]. In the past, the cause of hair loss was considered to be aging and genetic factors, but now hair loss is caused by various causes - such as diet, stress, and bad eating habits, other diseases, childbirth, irregular life pattern, and excessive chemical use[11]. On the other hand, aerobic exercise induces more important improvements in cardiorespiratory fitness and myocardial metabolic variables, while resistance exercise mainly affects muscle strength and has a favorable effect on body composition[12]. Moreover, combined exercises performed to satisfy the effects of both aerobic and resistance exercises may have additional effects and are recommended for the prevention of cardiovascular disease in all patients, including obese patients[13,14], improving muscle

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function and physical activity[15]. Considering the positive effects that exercise affecting our body, exercise might affect scalps and hair conditions in a positive way as well. However, there is no studies which investigates how exercise affects scalp and hair conditions(scalp sebum, water retention, transepidemal water loss(TEWL), scalp temperature, hair density, and hair thickness). Therefore, the purpose of this study is to provide basic data for preventing and improving hair loss in men in their 20s by analyzing how combined exercise and scalp care program affect one's hair condition(scalp sebum, water retention, transepidemal water loss(TEWL), scalp temperature, hair density, and hair thickness) for 12 weeks.

2. Materials and Methods

2.1. Subject of study

The purpose of this study was to investigate how combined exercise and scalp care effects one's hair condition in men in their 20s. For this purpose, 36 men who were suffering from hair loss were chosen as participants, and were divided into four groups 9 participants for combined exercise group, 9 for scalp care group, 9 for combined exercise and scalp care group, and 9 for control group<Table 1>.

Table1: Physical Characteristic of Subjects (M±SD)

Group	N	Age (yr)	Height (cm)	Weight (kg)	Fat (%)
CEG	9	26.55± 5.00	173.38± 6.88	71.22± 7.17	20.32± 6.38
SCG	9	26.33± 2.39	174.88± 3.37	77.95± 7.17	23.64± 6.12
CESCG	9	25.62± 1.59	174.95± 3.69	73.03± 6.38	18.63± 5.55
CG	9	24.50± 5.70	170.75± 6.11	69.46± 5.98	18.11± 4.33

*CEG: Combined Exercise Group, SCG: Scalp Care Group
CESCG: Combined Exercise x Scalp Care Group, CG: Control Group

2.2. Treatment program

In order to analyze the effects of 12 weeks of combined exercise and scalp care on physiological variables, the study measured body composition, maximum muscle strength test (1RM), maximum exercise load test (HRmax), and scalp and hair condition as a pre-test for the participants. Combined exercise program group underwent the combined exercise program for 12 weeks, three times a week and 80 minute a time. Pre-training was conducted on each movement of aerobic and resistance exercises with light loads, and it was conducted for two weeks, two times a week. The scalp management program group's participants underwent the scalp care program for 12 weeks, once a week for 20 minutes. After pre-diagnosis, scalp condition was measured and the scalp therapy included the whole process of scaling, hair damage prevention mineral pack, manual technique, shampoo for cleaning, and nutrition supply for hair root strengthening. The exercise group only performed complex exercises and scalp care group only performed scalp care, while the complex exercise and scalp care group performed both exercise and scalp care. The control group did not perform any of the previously mentioned activities and continued their daily life with their same life pattern. The post-test was conducted in the same way, at the same time as the pre-test for 12 weeks. The scalp condition was measured by the researcher to minimize the data error of the measurement value, after stabilizing for 2-3 hours after morning shampoo by using the same shampoo agent<Table 2>, <Table 3>.

Table 2: Combined Exercise Program

Category	Type	Methods	
Warm-up (10min)	Stretching	Upper & Lower body stretching	
Exercise (60min)	Resistance exercise/ (30min)	Shoulder, Chest, Arm, back	Shoulder press, Lat full Down, Bench press, Triceps Extension, dumbbell Curl 10rep/2set ~ 15rep/3set
		Abdomen, Waist	Sit-up, Leg Raises, 10rep/2set ~ 15rep/3set Back Extension
		Leg	Leg press, Leg Extension, Leg curl, Squat

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			10rep/2set ~ 15rep/3set
	Aerobic exercise/ Treadmill(30min)	Aerobic exercise with walk (60~75% HRmax in 3 times a week)	
Cool-down (10min)	Stretching	Upper & Lower body stretching	

Table 3: The Scalp Care Program

Contents	Time	Frequency
Scaling / Mineral Pack	5min	One per week
Manual technic	5min	
Shampoo	5min	
Nutritional supply	5min	

2.3. Measurement method

The hair density of the experimental group was measured by setting the position of the central part of the head of the experimental group. After measuring the number of hairs in an area of 0.25cm^2, four times the corresponding value were indicated when showing the hair density. The thickness of hair was measured by using a scalp diagnostic program, and additionally the scalp sebum, water retention, transepidemal water loss(TEWL), and scalp surface temperature were examined by using each Probe (Water retention, tewameter, sensor for condition).

2.4. Data analysis

SPSS 21.0 was used as the representative statistical program of this study. Two-way repeated ANOVA was conducted to verify the average difference between each group and the time. All statistical significance levels were set at $p<.05$.

3. Results

3.1. Changes of the Scalp sebum

Scalp sebum secretion increased after 12 weeks in the combined exercise group, combined exercise and scalp care group, and control group, while sebum secretion of scalp care group decreased <Table 4>.

3.2. Changes of the Scalp Water retention

Water retention decreased after 12 weeks in the combined exercise group, combined exercise and scalp care group, scalp care group, and control group<Table 4>.

3.3. Changes of the TEWL

Combined exercise group decreased in TEWL, but the remaining three groups - scalp care group, combined exercise and scalp care group, and control group's TEWL increased after 12 weeks <Table 4>.

3.4. Changes of the Surface temperature

The change in surface temperature of scalp increased only in the combined exercise and scalp care group, and the other three groups did not show any difference <Table 4>.

3.5. Changes of the Hair density

Hair density respectively increased in scalp care group and combined exercise and scalp care group <Table 4>.

3.6. Changes of the Hair thickness

The change in hair thickness increased in scalp care group and combined exercise and scalp care group <Table 4>.

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Table 4: The Result of Scalp and Hair condition

Factor	Group	Pre	Post	P
Scalp Sebum ($\mu g/cm^2$)	CEG	44.75± 32.45	46.37± 18.74	Group*period: .574 Group: .030* Period: .881
	SCG	52.66± 37.37	36.88± 26.69	
	CESCG	42.00± 26.95	47.37± 10.43	
	CG	72.37± 37.94	77.37± 31.01	
Scalp Water retension (AU)	CEG	78.48± 23.54	73.18± 16.87	Group*period: .961 Group: .573 Period: .280
	SCG	85.98± 24.42	80.05± 18.02	
	CESCG	74.16± 23.96	73.47± 14.92	
	CG	74.17± 21.72	69.68± 17.39	
Scalp TEWL($g/h/cm^2$)	CEG	41.28± 22.75	38.17± 19.56	Group*period: .742 Group: .563 Period: .468
	SCG	44.08± 24.75	45.84± 19.69	
	CESCG	39.26± 23.73	50.28± 25.74	
	CG	32.67± 15.67	36.31± 18.54	
Scalp temperature (℃)	CEG	35.07±.85	35.04±.65	Group*period: .683 Group: .193 Period: .799
	SCG	34.63±.71	34.62±.92	
	CESCG	31.63±.63	34.83±.50	
	CG	35.42±.80	34.90±.78	
Hair density (cm^2)	CEG	23.12± 2.85	22.37± 1.99	Group*period: .001*** Group: .042 Period: .001***
	SCG	19.44± 2.45	24.11± 2.14	
	CESCG	23.25± 2.54	26.37± 1.59	
	CG	23.12± 2.85	23.81± 2.48	
Hair density (mm)	CEG	127.00±15.73	125.75±11.98	Group*period: . 001*** Group: .246 Period: .071
	SCG	106.77±13.59	132.33±11.80	
	CESCG	127.50±14.01	144.87± 8.88	
	CG	127.00±15.73	125.75±11.98	

*CEG: Combined Exercise Group, SCG: Scalp Care Group
CESCG: Combined Exercise x Scalp Care Group, CG: Control Group

4. Discussion

In this study, based on the results of the analysis to investigate the effects of complex exercise and scalp care program treatment on the scalp and hair condition of men with hair loss in their twenties, the following discussion will be conducted.

The causes of hair loss are known to include genetic factors, stress, infection, androgen hormone dissymmetry, blood circulation disorders, nutritional imbalance and drug use[16]. According to gender, family history and number of hair dyeing had significant effect on male alopecia, while family history, birth experiences, number of hair dyeing, number of perms, and hair dryer use affected females suffering from alopecia[17].

The number of patients with alopecia in Korea increased from 166,000 in 2007 to 194,000 in 2011, which shows about 28,000 people increased within 4 years (17.0%). The total medical expenditure increased from 10 billion won in 2007 to 15.7 billion won in 2011- showing that 4.6 billion won increased within 5 years - and the average annual growth rate was 10.3%[18].

According to the Korea Health Insurance Review and Assessment Service[19], the hair loss population in the 20s is increasing year by year, and 44.8% of patients in their 20s and 30s visited hospital and got hair loss treatments. Furthermore, patients in their twenties has increased by 705% when compared to 2012. These hair loss problems are occurring not only in adults over 40, but also in young people in their teens and twenties, which have more serious consequences compared to older people.

In this study, scalp sebum showed a significant increase after 12 weeks in the combined exercise group, the combined exercise and scalp care group, and the control group while the scalp care group showed sebum decrease. It was mainly because scalp care program has brought the scalp oil and dead skin removal to participants' scalp, meanwhile combined exercise has increased scalp oil through making physiological stimulation to scalp. These results not only

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matches with study by Han[20] which proved that the scalp oil content statistically differed before and after aerobic exercise, but also is consistent with the research results of Han[21] who explained increase regular exercise and active male hormones caused excessive sebum secretion, resulting in oily scalp. Therefore, it is judged that complex exercises and scalp care programs would have effects on the scalp condition of men with hair loss.

A previous study on how scalp care affects hair and scalp condition[20,22,23] showed the control of sebum secretion due to scalp management and scalp acupuncture massage brought pore cleanness and pore size change, and ultimately had positive effects on preventing hair loss, and the water retention also increased as the exercise intensity increased.

However, compared to Wells[24]'s findings that shows heat dissipation capability depends on gender, the reason for the decrease in all four groups in this study is believed to be due to differences in the subject's scalp type, and making measurements after the end of the program, rather than measuring immediately after combined exercise and scalp care. Therefore, the health of scalp and hair is thought to be kept through continuous care, considering seasonal effects and individual scalp types, along with providing regular programs for a long period of time rather than temporary effects.

In this study, the combined exercise group showed a decrease in scalp transepidemal water loss(TEWL), but the remaining three groups- scalp care group, combined exercise and scalp care group, and control group showed an increase after 12 weeks. TEWL decrease in the combined exercise group happened mainly because sweat and oil that occured after exercise supplied moisture to the participants' scalp. It shows the same result and stance with Oh's study[25]. Therefore, in the case of the combined exercise group, it was confirmed that the amount of transepidemal water loss(TEWL) of the scalp was reduced through exercise.

In this study, the change of the scalp surface temperature increased only in the combined exercise and scalp care group, and there was no difference in the other three groups. Therefore, in this experiment, the scalp surface temperature was not measured immediately after treatment. Instead, it was checked after a short break considering the facts that scalp temperature can go up and down right after exercise and treatment of scalp care program. The reason for this is that temporary changes do not affect the hair, so it is judged that the results were different from previous studies since a short time break was happened between treatments and actual time checking the scalp temperature.

In this study, the hair density increased in the scalp care group, and the combined exercise and the scalp care group. This was mainly because scalp care and exercise helped to keep hair roots clean. Combined exercise program provided adequate physical activity for 12 weeks and a scalp care program also helped the participants to get regular treatments. Therefore, although the hair density did not show a significant effect in the initial stage, it is thought that it can help prevent early hair loss when appropriate physical exercise and regular scalp care programs are performed considering the period.

In this study, the change in hair thickness increased in the scalp care group and combined exercise, and scalp care group. It was mainly due to the scalp care program, which keeps the pores and scalp clean and ultimately maximizes blood circulation on the scalp. The scalp condition of people showing hair loss symptoms in this study were generally bad – were red and sensitive, and the pores were blocked by sebum and dead skin cells. Furthermore, the hairs were thin and weak. However, after 12 weeks, scalps of the participants were clear and clean, and we were able to see some new hairs growing. Therefore, it was proved that hair and scalp condition and health highly depend on managements including care and treatments. Therefore, proper exercise[26] and scalp care is needed to maintain or improve hair's biological and aesthetic function.

5. Conclusion

As a result of examining, comparing, contrasting and analyzing the effects of complex exercise and scalp care program on scalp and hair condition, the following conclusions were drawn. The combined exercise and scalp care program for 12 weeks did not show any interaction effect on the scalp oil content, water retention, transepidemal water loss(TEWL), and scalp surface temperature in the hair condition of men with hair loss in their 20s, but had an interaction effect on the density and thickness of hair. Therefore, there was a significant difference in hair density between the groups before and after 12 weeks. Within groups, 1) the scalp care group and 2) the scalp care and the combined exercise group showed a significant difference. Differences between groups for hair thickness showed significant differences before and after 12 weeks as well. Within groups, there was an increase in the scalp care group, the scalp care group, and the combined exercise group. To sum up the above, for 12 weeks, for men with hair loss, complex exercise and scalp care did not show significant differences in changes in scalp sebum, scalp water retention, transepidemal water loss(TEWL), and scalp surface temperature, but showed in changes in hair density and thickness in two groups 1) scalp care group and 2) scalp care and complex exercise group. It has proved that the combined exercise and scalp care performed showed positive effects on the density and thickness of the hair. The combined exercise and scalp care program performed in this study showed positive effects on hair density and thickness, which proved the possibility of early prevention and improvement of initial hair loss. Based on this, various exercise and scalp care programs should be presented to the hair loss patients who have external effects on the body, and studies should be continuously conducted. Furthermore, exercise and scalp care programs should be actively developed and used by applying various methods, intensity and frequency to prevent hair loss on the initial stage.

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