



ISSN: 2586-6036

JWMAAP website: <http://accesson.kr/jwmap>

doi: <http://dx.doi.org/10.13106/jwmap.2025.vol8.no6.41>

# A Study on the Effectiveness of Shampoo Containing Tea Tree Oil in Improving Sensitive Scalps

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Received: November 05, 2025. Revised: December 09, 2025. Accepted: December 09, 2025.

## Abstract

**Purpose:** This study aims to investigate whether shampoo containing tea tree essential oil is effective in improving problematic scalp. **Methodology:** Nine adult men and women with sensitive scalp were used once a day for 28 days by mixing sensitive shampoo and tea tree essential oil in a 9:1 ratio. Areas where inflammation and erythema appeared after use of the product were regularly used by scalp experts as scalp diagnostic devices to diagnose improvement. The Likert 5-point scale was applied to the satisfaction of improving the sensitive scalp of the subjects. **Results:** Inflammation was the highest after the experiment, followed by erythema, scalp overall improvement, cleanliness, itching, and heat sensitivity. Among them, inflammation and erythema showed  $t=2.87$  ( $p=0.021$ ) and  $t=3.00$  ( $p=0.017$ ), respectively, confirming that tea tree essential oil significantly improved sensitive scalp condition. **Conclusions:** Therefore, Shampoo products with tea tree essential oils have been shown to be very effective in improving erythema and inflammation of sensitive scalp.

**Keywords :** Sensitive scalp, Shampoo, Teatree essential oil

**JEL Classification Code :** I10, I11, I19

## 1. Introduction

In today's modern society, living conditions have become convenient due to economic development and the acceleration of urbanization. However, due to the resulting pollution and stress of various environments, it is changing from a healthy scalp to a sensitive scalp (Kim, 2008). Therefore, it is important to use shampoo suitable for the sensitive scalp as it changes to a sensitive scalp.

Contamination around the scalp and pores caused by secretions such as sebum, sweat, and dead skin cells secreted by the human body causes scalp damage, inhibits

scalp breathing, blocks pores, inhibits nutrient absorption, and hinders the growth of newborns. It also causes bacterial growth, dandruff proliferation, and erythema inflammation, causing scalp and hair loss and hair loss (Kim, 2005). In particular, the residue of alkaline chemicals that occurs when perm waves and dyeing are frequently performed causes scalp and hair follicles, and drug-induced hair loss, hyperkeratosis, erythema, inflammation, itching, etc. (Kim, 2008).

The most basic way of managing the scalp is cleaning through shampoo. Recently, there is a trend to use vegetable natural extracts rather than products containing the synthetic chemicals parabens, sulfates, and silicone.

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This is because it is more eco-friendly in terms of skin irritation and environment, and has a positive effect on the benefits of herbal-based shampoo such as scalp irritation relief, antioxidation, and moisturization (Sang, et al, 2023).

Natural essential oils have various chemical components, which have antibacterial properties against bacteria and viruses, and relieve various skin-related diseases, which are known to respond to allergies such as skin inflammation and atopic dermatitis (Ha et al., 2003). Among them, (*Melaleuca alternifolia*, Tea-tree) oil has various ingredients such as cineol, cymene, terpinene, and sabinene, including pinene, and has long been reported to be effective in treating herpes, including anti-inflammation, immune promotion, and skin regeneration such as acne and scar removal (Kim et al., 2022). It contains terpineol-4, cineol, cymene, and squiterpenes, which have sterilizing and moisturizing effects on the skin, and is also reported to have characteristics such as acne inflammation relief, dandruff treatment, pain relief, and depression relief (Park, 2005; Kwon, 2017; Ji, 2019). As such, research on tea tree oil is being actively conducted, but research on problematic scalp is still insufficient. In addition, the majority of shampoos on the market are regular shampoos and slightly acidic shampoos, and scalp shampoos exclusively for sensitivity containing natural essence oil are not on the market

Therefore, the study aims to provide consumers with safer and more effective scalp health solutions and basic data by verifying whether tea tree essential oil has a positive effect on improving the sensitive scalp and whether a sensitive scalp improvement shampoo containing tea tree oil, a natural ingredient, can be used as a hair cosmetic material.

## 2. Literature Review

### 2.1. A Sensitive Scalp

Sensitive scalp is a scalp condition in which an environment is created that can cause dermatitis by reacting sensitively to environmental changes and allergies to external irritating substances. Based on the diagnostic device, the scalp appears red erythema as a whole, and capillaries appear in several places on the screen as if it were congestion due to blood circulation disorders. Inflammation can easily occur, and in serious cases, it may lead to hair loss (Moon, 2003; Seong, 2014).

Sensitive scalp can be observed on any scalp, such as dry, oily, or dandruff scalp, and it may be accompanied by itching due to weak resistance to bacterial and viral penetration. If stress, fatigue, innate factors, and dry scalp are left unattended for a long time, when physical rhythm or balance is broken, before and after menstruation and

postpartum are the cause (Kim et al. 2011), the scalp should be cleaned with a shampoo that is less irritating, and frequent chemical procedures, which are the main causes of sensitivity, should be refrained from improving stress.

### 2.2. Shampoo

The purpose of shampoo is to cleanse the hair while stimulating the scalp to promote hair growth (Yang, 2010). In the case of the scalp, there are dirt from the inside caused by secretions from sweat glands or sebaceous glands, and dirt from the outside, such as hair cosmetics or dust in the atmosphere. When these stains are stuck, bacteria multiply and decomposition of sebum and organic matter is promoted, resulting in unpleasant odors and itching due to the metabolic by-products. If it gets worse, pores are blocked and the function of the mother's papilla decreases, hindering the normal development of hair. Therefore, shampoo is used to clean the scalp and hair and to control the condition of the head (Kim et al., 2006). When drying after shampooing, lower the heat with a cold air dryer rather than a warm air dryer, and refrain from scratching even if the scalp is itchy. In addition, it is good to get enough sleep while refraining from drinking and smoking (Lee, 2013).

### 2.3. Tea-Tree oil

The Teatree scientific name is *Malaleuca alternifolia*, is of the Myrtaceae family, is native to Australia, and is extracted by steam distillation (Oh, 2000). The main characteristics of tea tree oil are effective in removing bacteria, viruses, fungi, vaginitis, etc., and are evenly used in all dermatological areas such as boils, rash relief, function to soothe sunburned skin, burns, acne, warts, and dandruff, and anti-infections and immune improvement effects have been reported (Park, 2005; Kwon, 2017; Ji, 2019).

The British Medical Journal announced that tea tree has been proven to have 20 times more bactericidal and disinfecting effect than alcohol (Oh, 2002; Park, 2004; Kim, 2012; Bae, 2020). Antimicrobial performance is also achieved by the interaction of the components that make up tea tree oil, but it is known that tea tree oil has antibacterial performance due to its main component, Terpinene 4-ol (Kwon, 2017).

## 3. Subjects and Methods of Research

### 3.1. Subjects and Duration of the Study

From October 10, 2025 to November 6, 2025, this study was conducted in 12 subjects diagnosed with problematic scalp such as erythema, inflammation, itching, and burning sensation by scalp experts. Those who understood and agreed to the contents of the experiment were tea tree essential oil, sensitive shampoo without irritation or allergies, and without excessive UV exposure.

However, during the experimental period, three people who did not visit each week or did not comply with the proposed product usage standards were eliminated, and the final results were analyzed for nine people(EUIRB 2025-054).

### 3.2. A Method of Research

In this study, used a 9:1 mixture of Company A's sensitive scalp shampoo and tea tree essential oil using Company B's scalp diagnostic device. And considering the scalp turnover cycle of 28 days, we shampooed once a day for 4 weeks, and measured erythema and improvement using a scalp diagnostic device..

The measurement method was to use a product mixed with sensitive shampoo and tea tree essential oil once a day for 4 weeks after using it on the subject to check for improvement in erythema, inflammation, and itching, and scalp improvement was measured once a week 3 hours after use of the product. The measurement site measured the same area of the subject's scalp for each week with the most severe symptoms of erythema and inflammation

The post-experiment scalp condition improvement questionnaire was reconstructed by the researcher based on the preceding papers of Kim(2008) and Jeon(2014) with two general characteristics and six post-experiment satisfaction questions for the subjects.

**Table 1.** Research Method

Research method
Selection of experimental subjects (n=9)
↓
Pre-experimental measurements
Measurement of scalp condition (erythema and inflammation)
↓
Experimental order
Using lukewarm water, scalp wet for a minute
↓
Squeeze 5-7 ml of shampoo into the palm of your hand
↓
Bubble for 5 minutes and organize with your hands
↓
Rinse thoroughly with lukewarm water
↓
Dry the scalp using a natural or dryer
↓
scalp diagnostic measurement

### 3.3. Materials and Tools

For the sensitive scalp shampoo, AMOS PROFESSIONAL's Green Tea Active Shampoo and DoTERRA's 60209476 Tea Tree Essential Oil were used. Blending mixed shampoo and tea tree essential oil in a 9:1 ratio using a homomixer. The homomixer was manufactured by HMZ-30DN of Pong Lim Co. The scalp diagnostic machine was measured using BOMTECH's scalp and hair diagnostic device A-ONE TAB.

**Table 2.** Research Materials(Tools)

Material	Details	Brand/Origin
Shampoo	Green Tea Active Shampoo	AMOS PROFESSIONA/Korea
Essential oil	Tea Tree Essential Oil	DoTERRA/USA
HomoMixer	HMZ-30DN	Pong Lim Co./Korea
Scalp Analyzer	A-ONE TAB	BOMTECH Co./Korea

### 3.4. Data Analysis

The SPSS V.24 program was used to analyze the data in this study. The degree of scalp improvement was diagnosed by a scalp expert after seeing the measured photo data, and after the subject's experiment, a Likert scale of 5 points was conducted for the measurement of the scalp improvement, and t-test were conducted to determine the difference in the degree of scalp improvement.

## 4. The Results of a Study

### 4.1. Changes in Scalp Erythema and Inflammation

As a result of using the product containing tea tree essential oil, it was confirmed that the scalp erythema symptom was alleviated in subjects 1, 3, 8, and 9. In particular, in subjects 3 and 8, the erythema was improved to the extent that the scalp condition was close to normal. In subjects 2 and 7, the improvement of erythema was not significant, but the improvement was almost invisible. As a result of the inflammation improvement analysis, it was gradually improved from the 2nd and 3rd weeks of the experiment, and in subject 7 who was severely inflamed, it was greatly improved at the 3rd week, and it can be seen that the improvement was not confirmed at the 4th week <Table 3>. Therefore, sensitive scalp shampoo containing

tea tree essential oil is effective in improving erythema and inflammation of the scalp, and it can be used as a cosmetic

material for hair improving the sensitive scalp.

<Table 3>. The scalp Erythema before and after

Case	Prior to the experiment	one week	two week	three week	four week
1 (22 years feale)					
2 (25 years male)					
3 (25 years Female)					
4 (26 years male)					
5 (28 years male)					
6 (24 years Male)					
7 (23 years Female)					
8 (22 years Female)					
9 (24 years Female)					

## 4.2. Investigate the Improvement Effect after the Experiment

In this study, the subjective improvement satisfaction of 9 subjects was evaluated after applying the scalp condition improvement program. There were a total of 6 questions in the questionnaire, and scalp cleanliness, erythema, fever, inflammation, itchiness, and scalp condition improvement were investigated.

For the measurement, the average score was calculated by evaluating the response to each question on a 5-point Likert scale, and a comparative t-test was conducted before and after the experiment to confirm the effect of improving the scalp health of the subject. As a result of the analysis, the degree of improvement of the sensitive scalp was the highest in inflammation (M=4.11), followed by erythema (M=4.00), overall scalp improvement (M=3.56), cleanliness (M=3.00), itchiness (M=2.56), and heat sensation (M=2.44) ( $p < 0.05$ ).

Among them, in the case of inflammation and erythema,  $t=2.87$  ( $p=0.021$ ) and  $t=3.00$  ( $p=0.017$ ), respectively, indicating that tea tree oil was significant in improving the sensitive scalp condition <Table 4>.

**Table 4.** Investigate the improvement effect after the experiment

Category of Scalp condition	M	SD	t	p
Cleanliness	2.56	1.33	-1.00	.347
Erythema	3.56	1.33	1.25	.247
Heat sensation	4.00	1.00	3.00	.017*
Inflammation	3.00	1.73	0.00	1.00
Itchy	2.44	1.42	-1.17	.276
Improvement of scalp condition	4.11	0.93	2.97	.021*
Total	3.24	1.40	1.35	.213

\* $p < 0.05$

## 5. Conclusions and Suggestions

This study was conducted for 16 days with nine adult men and women in their 20s to confirm the effect of shampoo containing tea tree essential oil on improving erythema and inflammation of sensitive scalp. As a result of the experiment, after using shampoo containing tea tree oil, there was a tendency to improve the symptoms of sensitive scalp erythema and inflammation, suggesting that tea tree oil's antibacterial and anti-inflammatory properties may have had a positive effect on scalp health. In particular, it can be inferred that tea tree oil can contribute to the control of the scalp's immune response, given that the erythema and inflammatory reactions, which are common in

sensitive scalp, have decreased.

However, this study has several limitations. First, since the subjects of the study are all limited to their 20s, it is difficult to analyze differences by age group, and the representativeness of the sample is insufficient to generalize the study results. Second, the study period is as short as 16 days, making it difficult to verify the continuous effect during long-term use. Third, it is difficult to secure statistical significance because the number of participants is very small, with 9 people, and there is a possibility that individual differences greatly influenced the results. These limitations need to be supplemented in subsequent studies.

Future studies need to secure more diverse age groups and sufficient number of samples, and verify the continuous effectiveness and safety of tea tree essential oils through long-term follow-up experiments for at least four weeks.

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