

Pilot Study of the Efficacy and Safety of Nail Gel Containing *Artemisia abrotanum* Extract and Glycerin in the Treatment of Nail Plate Surface Abnormality

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ABSTRACT

Objective: This study investigated the efficacy and safety of a nail gel containing glycerol and *Artemisia abrotanum* extract in treating nail plate surface abnormalities.

Methods: The nail gel was painted over the total nail surface of selected nails twice daily. All the nails were evaluated at the proximal and central parts using the Visiometer® system and according to transonychia water loss (TOWL) at baseline, and at the 2nd and 8th weeks of treatment.

Results: In total, 19 patients with a mean age of 50.6 years old were enrolled on the study, with 50 nails studied. Sixty percent of the patients showed significant clinical improvement, as determined by the total agreement between two treatment-blinded dermatologists. Regarding the visiometer system, a significant reduction in the SER value (roughness) of the nail plates was found at the 2nd week, while at the 8th week, the surface and volume values were found to be significantly decreased from baseline and also from the values at the 2nd week. There was a significant improvement in the Rku (smoothness) value at the 8th week compared to baseline. The mean TOWL at both the 2nd and 8th weeks were statistically decreased from baseline. No side effects were detected.

Conclusion: This nail gel containing glycerol and *Artemisia abrotanum* extract provided benefits in terms of improvements in the nail surface texture and water retention in patients with nail surface abnormalities.

Keywords: *Artemisia abrotanum* extract; Glycerin; nail gel; nail surface abnormality (Siriraj Med J 2021; 73: 204-208)

INTRODUCTION

The nail plate is a unit of the nail with a transparent hard and resilient character. Its shape, curvature, thickness, and surface vary depending on the location of the nail (toenail or fingernail), age, and other external factors, such as certain diseases or even the season.¹ Nail plate surface abnormalities can occur after any condition affecting the nail matrix.² The most common types of

nail plate surface abnormalities include a pitting nail, longitudinal ridging, and transverse ridging, also called Beau's lines.³

Nail gel is a product used to coat the nail surface. It is frequently used to varnish nail surfaces for cosmetic aspects.⁴ Aside from that, this product also assists in improving brittle nails or ingrown toenails.^{5,6} A study by Nanda et al. showed the benefit of patients with nail

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plate surface abnormalities applying a nail gel to cover superficial nail plate abnormalities, such as a pitting nail, trachyonychia, and onychoschizia.⁷

The main ingredients in nail gels used in the cosmetic field are ethyl cyanoacrylate and polymethyl-methacrylate monomers, which have been reported to cause allergic contact dermatitis in some patients.⁸ In therapeutic nail gels for treating nail plate surface abnormalities, these substances are typically replaced by substances with a moisturizing effect or antifungal and/or antibacterial effects.

From a review of the literature, one study reported concerns about the safety of substances extracted from *Artemisia abrotanum* leaf that are used in the spice industry and that have been added in cosmetic products.⁹ However, reports about the efficacy of *Artemisia abrotanum* in treating nail plate surface abnormalities in Asian populations are limited. Consequently, this study aimed to investigate the efficacy of *Artemisia abrotanum* extract using subjective and objective measurements as well as the safety of nail gel containing glycerol (a natural moisturizing factor and moisturizer)¹⁰⁻¹⁴ and *Artemisia abrotanum* extract (essential oils with antifungal and/or antibacterial effects)¹⁵⁻¹⁷ in treating nail plate surface abnormalities.

MATERIALS AND METHODS

This prospective study was conducted at Siriraj Hospital, Mahidol University, Thailand. The protocol was approved by the Siriraj Institutional Review Board (Si 372/2015) and registered with ClinicalTrials.gov (No. NCT02582762). In total, 20 patients with abnormalities of the nail plate surface of one or more nails that had persisted for more than 3 months, and who were aged at least 18 years old, were enrolled and asked to complete informed consent. The exclusion criteria were patients who had an allergy to any of the product ingredients, a severe medical condition, nail infection, pregnancy, lactation, or a history of manicure or nail polish application within the previous 1 month, or a history of biotin or zinc supplementation within the previous 3 months. The patient's demographic data and the abnormal characteristics of their nail surfaces were recorded. The number of selected nails per person varied from 1–3 nails. The patients were instructed to apply over-the-counter (OTC) nail gel products that consisted of aqua, glycerol, dimethicone, PEG-40 hydrogenated castor oil, 1,5-pentanediol, propylene glycol, carbomer, sodium hydroxide, and *Artemisia abrotanum* extract, and that had been approved by the Thai Food and Drug Administration, twice daily on the nail with the surface abnormalities. The nail gel

was painted over the total area of the nail surface as a single layer by swiping the brush in a straight line from the proximal part of the nail to the distal part. All the selected nails were evaluated at the proximal and central parts of the nail using the Visiometer® system (Courage + Khazaka Electronic GmbH, Cologne, Germany) and according to transonychia water loss (TOWL) using the Tewameter® TM 300 system (Courage + Khazaka Electronic GmbH, Cologne, Germany) at baseline, and at 2 weeks and 8 weeks after treatment. We did not evaluate the distal part of the nail because this could be disturbed by external causes, such as trauma to the nail. Patients were asked to rate their satisfaction with the nail improvement by completing a 6-item questionnaire covering aspects such as visible nail improvement and quality of life, scoring each question from 0 to 5 (0 = very dissatisfied, 1 = dissatisfied, 2 = somewhat dissatisfied, 3 = somewhat satisfied, 4 = satisfied, 5 = very satisfied) at 2 weeks and 8 weeks after initiating treatment. Two-blinded dermatologists assessed random photographs of the nails taken with the Visiometer® and interpreted the results as: no improvement, improved, or worsened.

Descriptive statistics were used to describe the demographic data. Associations between categorical variables were analyzed by Chi-square test or Fisher's exact test. Continuous variables were analyzed by Student's t-test or Mann-Whitney U test. Repeated measures ANOVA was used to evaluate the changes in the nail plate surface abnormalities. The Wilcoxon signed-rank test was used to evaluate the changes in the questionnaire scores. The kappa statistic was used to evaluate the inter-observer reliability between the two blinded dermatologists. A p -value ≤ 0.05 was considered statistically significant. All the statistical analyses were performed using SPSS for Windows version 18.0 (SPSS, Inc., Chicago, IL, USA).

RESULTS

In total, 20 patients were initially enrolled in the study, but one was excluded because follow-up proved too difficult. Thus, a total of 19 healthy patients, comprising 15 women and 4 men, with a mean age (standard deviation [SD]) of 50.6 (11.5) years old, were included in the analysis. The mean (SD) frequency of hand washing was 8.8 (2) times per day. The characteristics of the surfaces of the 50 nails tested in the study are shown in [Table 1](#).

Physicians' assessments

From photographs taken by the Visiometer® comparing the tested nails at baseline and at the 8th week after treatment, 60% of the nails showed a significant improvement, as observed by the two blinded dermatologists ([Figs 1 and 2](#)).

TABLE 1. Nail characteristics of all the patients.

Nail characteristics	N (%)
Linear	39 (78)
Transverse groove	1 (2)
Transverse ridging	5 (10)
Longitudinal groove	0
Longitudinal ridging	33 (66)
Onychoschizia	0
Pits	17 (34)
Trachyonychia	0
Pitting nail	17 (34)
Scale	0
Others	2 (4)
Brittle nail	2 (4)

Central part

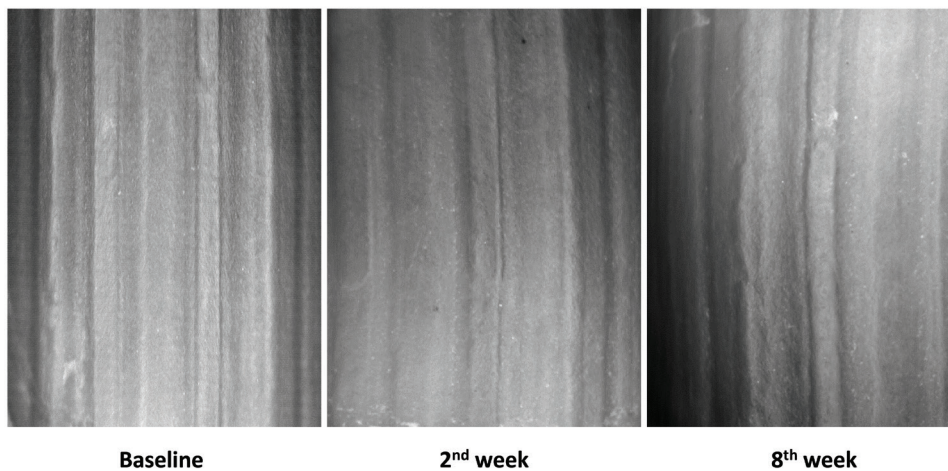


Fig 1. The nail surface at the central part at baseline, and at the 2nd week and 8th week

Proximal part

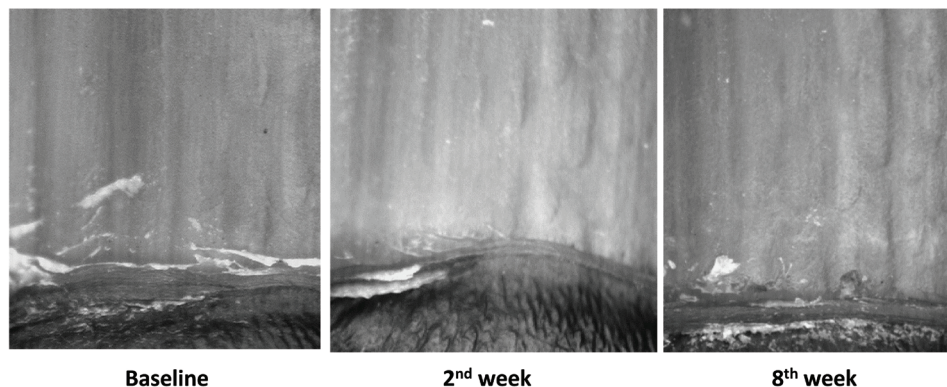


Fig 2. The nail surface at the proximal part at baseline, and at the 2nd week and 8th week

The inter-observer reliability between the two blinded dermatologists was consistent ($K = 0.855$, $p < 0.001$). No side effects were observed.

Patients' assessments

According to the patients' satisfaction levels of their nail plate improvement, there was a significant increase in the total satisfaction scores at the 8th week (24.8 ± 3.8) compared to at the 2nd week (20.7 ± 3.6) with $p < 0.001$.

Bioengineering assessment

Regarding the visiometer system, a significant reduction in the SER (roughness) value was found at the 2nd week for the central part of the nail ($p = 0.025$; Fig 3a). At the 8th week, the surface value was significantly decreased from both baseline and from the 2nd week in the central area ($p < 0.001$ and $p < 0.001$; respectively; Fig 3b), while the smoothness value (Rku) was significantly decreased from baseline and from the 2nd week in the proximal and central areas ($p = 0.028$ and $p = 0.027$; respectively; Fig 3c). There was a significant improvement in the surface smoothness at the 8th week compared to baseline ($p = 0.044$). Regarding the TOWL values, the mean TOWL values at the 2nd week and 8th week were

both statistically decreased from baseline ($p < 0.001$ and $p < 0.001$; respectively; Fig 3d).

DISCUSSION

This study demonstrated the efficacy of nail gel containing glycerol and *Artemisia abrotanum* leaf extract for improving the nail surface texture and water retention in patients with nail plate surface abnormalities, especially those with pitted or linear lesions. The improvement was found to be noticeable at 2 weeks after the initial application and could be maintained for up to 2 months without any side effects. In addition, this nail gel was also found to be satisfactory by the patients in terms of the treatment's overall aspects (clinical outcomes and application).

In terms of the nail rehydration effect, the high potential of glycerol for restoring stratum corneum hydration and assisting the skin barrier function is well known,¹⁰⁻¹⁴ and this concurred with the significant decline in the TOWL values found in our study. Although the mechanism remains unknown, one theory is that glycerol may be absorbed, leading to the formation of complex glycerolipid-like compounds.¹¹

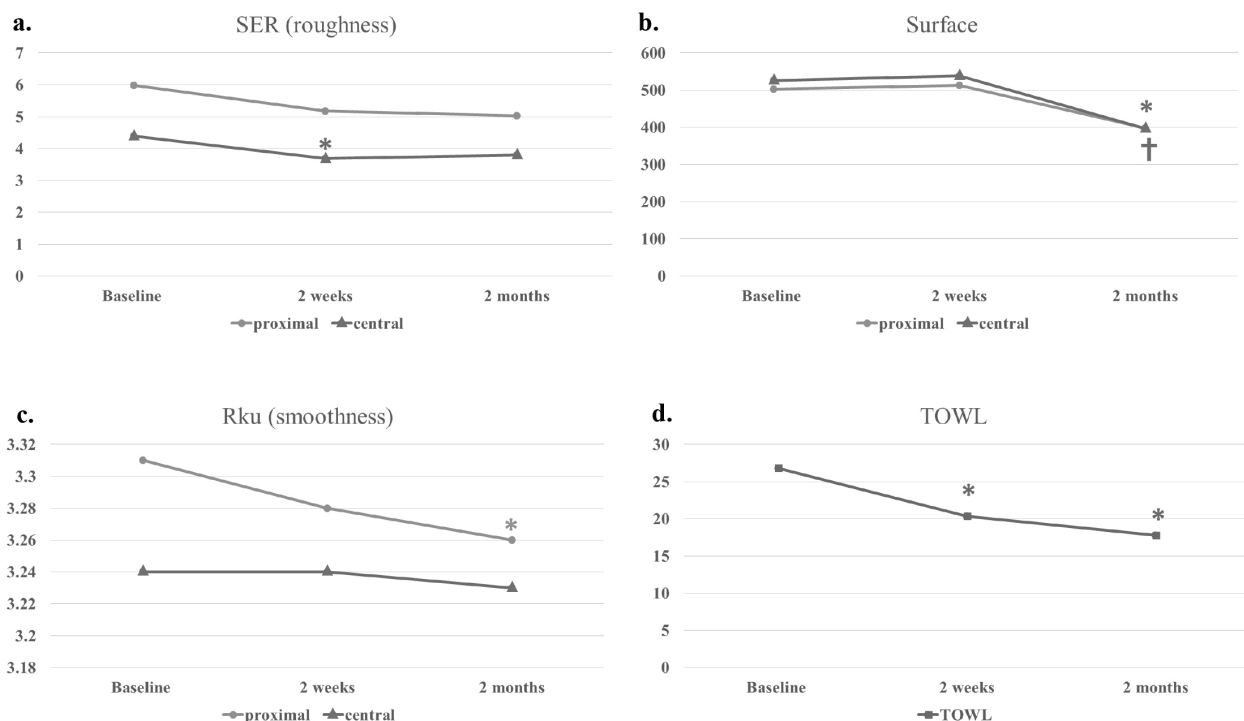


Fig 3. Bioengineering assessments using the Visiometer® and Tewameter® systems at baseline, and at the 2nd and 8th weeks of treatment: (a) SER values, (b) Surface values, (c) Rku values, and (d) TOWL values.

*Significant difference from baseline. †Significant difference from the 2nd week.

Abbreviations: SER, roughness; Rku, smoothness; TOWL, transonychia water loss

Artemisia abrotanum leaf extract is a volatile oil containing 1, 8-cineole, linalool, davanone, thujyl alcohols; favonols; tannins, cafeic acid; and coumarins.¹⁸ Several studies have reported the usefulness of the various properties of *Artemisia abrotanum* leaf extract, including for prophylactic and therapeutic management in allergic rhinitis and its antimicrobial effect against *Malassezia* spp., *Candida albicans*, and *Staphylococcus aureus*.¹⁵⁻¹⁷ However, the mechanism of how it assists stratum corneum hydration and how it can improve the nail surface need to be further elucidated.

There are several limitations in this study to note. This study was a pilot study with a limited sample size and a predominantly female population. Further study with a larger and more mixed population is required. Since this study period was 2 months in total, prolonged follow-up to demonstrate the long-term efficacy of the nail gel treatment remains to be investigated.

In conclusion, the efficacy and safety of nail gel containing glycerol and *Artemisia abrotanum* leaf extract were investigated for the first time. It was found that the gel provided benefits in improving the nail surface texture and water retention in patients with nail surface abnormalities. However, further studies are required to describe the mechanism of action and to confirm its long-term efficacy and safety.

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Conflict of interest: None declared

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