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Original Article

A randomized controlled trial of topical tea tree preparation for MRSA colonized wounds

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ABSTRACT

Background: The prevalence of MRSA (Methicillin-resistant *Staphylococcus aureus*) colonized wounds in home care residents is expected to grow continuously as a result of the substantial proportion of older people requiring institutionalized care due to chronic disease and declining functional status, which contribute to more frequent skin breakdown and wound formation. Tea tree oil has been claimed to have anti-bacterial, analgesic and anti-inflammatory effects that have been suggested in many in-vitro studies to have good efficacy against MRSA. The aims of this study were to evaluate the effectiveness of 10% topical tea tree preparation to eradicate MRSA and to ascertain its influence on wound healing for MRSA-colonized wounds.
Methods: It was a randomized controlled trial, single-blind study. Those with stage II or above MRSA-colonized wounds and who had given their informed consent formed the sample. The determined sample size was based on the effect size of our previous pilot study, which was 0.46. Five outcome measurements were taken for the MRSA bacterial count and wound healing condition at baseline and at 1-week intervals during the 4-week dressing intervention period.
Results: Thirty-two participants were recruited from two non-government nursing homes, 16 in the control group and 16 in the tea tree oil group. The control group residents received routine saline gauze dressing, while the tea tree oil group residents received the 10% topical tea tree preparation dressing. In the tea tree oil group, all chronic wounds that had previously been delayed in healing were healed within 28 days without adverse reaction. MRSA was also completely eradicated in 14 (87.5%) out of 16 wounds in the group receiving the 10% topical tea tree preparation.
Conclusion: The 10% topical tea tree preparation was effective in reducing the quantity of colonized MRSA in and promoting healing of chronic wounds among elderly.

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1. Introduction

Older people who are institutionalized are particularly susceptible to MRSA infection due to their chronic illness, multiple exposures to antibiotics, and the presence of invasive indwelling devices leading to debilitation, immobility and compromised immune response [1,2]. Wound chronicity is a commonly found health problem among these residents. It constitutes a well known risk for MRSA colonization [3].

Two critical factors have been considered that make MRSA colonized wounds particularly prevalent in nursing home residents. The first factor is related to the wound. MRSA has the ability to disrupt the normal wound healing process, leading to prolonged wound healing. The second factor relates to persistent wound carriage with MRSA, which serves as a reservoir for MRSA infection. The relationship between colonization and the development of infection is complex. Wertheim and colleagues estimated the risk of infection in colonizers is 2–12 times higher than in those who are not colonized with *Staphylococcus aureus* [4]. In the context of nursing homes, Capitano reported that MRSA colonized residents were up to 6 times more likely to develop infection than non-colonized patients [5]. The risk of infection associated with MRSA colonization in chronic wounds might be even greater. Over time, there have been frequent reports of MRSA wounds being a source for other MRSA nosocomial infections, leading to the occurrence of bacteremia, endocarditis, and osteomyelitis [6–8]. For example, Manzur et al. demonstrated a strong and independent association between MRSA bloodstream infections and admission from nursing homes [9]. Therefore, to control the spread of MRSA from colonized residents in nursing homes, attempts must be made to eradicate MRSA wound carriage.

Over the past three decades, tea tree oil has been claimed to have anti-bacterial, analgesic and anti-inflammatory effects against MRSA [10–12]. Small human trials utilizing tea tree oil in wounds suggested that it might be effective as a topical therapy for chronic wounds such as diabetic ulcers, osteomyelitis, pressure ulcers and other wounds [13–15]. The scientific evidence to support this claim, however, has yet to be further substantiated. To this end, the research team developed a topical tea tree oil dressing model, put it into action and evaluated its effectiveness for MRSA eradication and wound healing enhancement.

2. Design and method

This was a randomized controlled trial, single-blind study. The recruited participants were randomly assigned to either the control or Tea Tree Oil (TTO) group with the Principal Investigator being blind to the allocation. The study included the followings:

(1) Formulation of a 10% topical tea tree oil preparation as a topical therapy for older people with MRSA colonized wounds
(2) Evaluation of the possible adverse reactions to the formulated 10% topical tea tree oil preparation
(3) Evaluation of the efficacy of 10% tea tree oil preparation for eradication of MRSA and improvement in the healing of MRSA colonized wounds.

2.1. *Topical tea tree oil formulation*

The product used in this study was an oil-miscible 10% v/v tea tree oil solution packaged in 30 ml light-resistant glass bottles. The pure 100% tea tree oil was ordered from the NOW Foods Company (Bloomingdale, U.S.A.), certified by Quality Assurance International with the international standard ISO4730 [16]. A medical grade paraffin oil acting as the solvent was then used to dilute the pure 100% tea tree oil in the laboratory of the Hong Kong Polytechnic University. The topical tea tree oil preparation was prepared at 10% tea tree oil to 90% paraffin oil and its composition is listed below (Table 1).

As the chemical compositions of tea tree oil are sensitive to light, the formulated topical tea tree preparation was then put into a light-resistant glass bottle immediately. All equipment used in the preparation of the studied product had undergone the complete procedure of sterilization using an autoclave machine (Autoclave Tauttnauer Model 2540EK, U.S.A.).

2.2. *Sampling*

The study was conducted in two non-governmental organization (NGO) nursing homes. They are supported and run by two major charity groups in Hong Kong, the Yuen Yuen Institutes and the Evangelical Lutheran Church of Hong Kong. The one under the Yuen Yuen Institute contains around 150 beds for permanent residents and a few places in the day care centre. The other one, run by the Evangelical Lutheran Church of Hong Kong, contains approximately130 beds. The research team applied to these homes following the approval by the Human Subjects Ethics Sub-committee of The Hong Kong Polytechnic University. With their approval, recruitment of residents commenced using the following criteria.

2.2.1. *Inclusion criteria*

The inclusion criteria were having open chronic wounds with positivity in MRSA wound culture. The chronic wound in this

Table 1 – The chemical composition of the studied formulated 10% topical tea tree oil preparation.

Component	Study tea tree oil (%)
Terpinen-4-ol	≥30
γ-Terpinene	10–28
α-Terpinene	5–13
1,8-Cineole	≤15[3]
Terpinolene	1.5–5
ρ-Cymene	0.5–12
α-Pinene	1–6
α-Terpineol	1.5–8
Aromadendrene	Traces – 7
δ-Cadinene	Traces – 8
Limonene	0.5–4
Sabinene	Traces – 3.5
Globulol	Traces – 3
Viridiflorol	Traces – 1.5
Paraffin oil	90