WHAM evidence summary: Effectiveness of tea tree oil in managing chronic wounds

Emily Haesler, PhD, P Grad Dip Adv Nurs (Gerontics), BN, Fellow Wounds Australia[1,2,3]
Keryln Carville, PhD, RN, STN Cred), CF, Fellow Wounds Australia[1,4]

CURTIN HEALTH INNOVATION RESEARCH INSTITUTE | Curtin University

1. Adjunct Professor, Curtin Health Innovation Research Institute, Wound Healing and Management (WHAM) Collaborative, Curtin University, Perth, Australia
2. Adjunct Associate Professor, Australian Centre for Evidence Based Aged Care, La Trobe University, Melbourne, Australia
3. Honorary Senior Lecturer, Australian National University Medical School, Australian National University, Canberra, Australia
4. Silver Chain

CLINICAL QUESTION

What is the best available evidence on the use of tea tree oil preparations in managing chronic wounds?

SUMMARY

Tea tree oil is an essential oil traditionally used for its antibacterial and anti-inflammatory properties. *Level 5* evidence from bench research[1-7] has demonstrated that tea tree oil has activity against bacteria, fungi and viruses. There is minimal evidence exploring the clinical use of tea tree oil in reducing promoting healing in chronic wounds. *Level 1* evidence[8] demonstrated reduction of MRSA colonisation and improvement in wound assessment scores. *Level 3* evidence[9] reported reduction in wound size; however, MRSA colonisation did not decrease and most participants required commencement of antibiotic therapy. *Level 4* evidence[10, 11] reported successful wound bed granulation[10] and complete healing[10, 11]. This limited evidence was insufficient to make a graded recommendation on the use of tea tree oil to promote healing in chronic wounds. However, the studies reported that no adverse events occurred. Tea tree oil products might be used to treat chronic wounds in clinical contexts in which there is no access to contemporary antimicrobial agents.

CLINICAL PRACTICE RECOMMENDATIONS

All recommendations should be applied with consideration to the wound, the person, the health professional and the clinical context.

There is insufficient evidence on the effectiveness of topical tea tree oil products to make a graded recommendation on their use in promoting healing in chronic wounds.

SOURCES OF EVIDENCE

This summary was conducted using methods published by the Joanna Briggs Institute (JBI)[12-16]. The summary is based on a systematic literature search combining search terms related to chronic wounds with terms related to tea tree oil. Searches were conducted in Embase, Medline, Global Health, and Allied and Complementary Medicine databases, and in the Hinari database for low-and middle-income countries. Evidence published up to July 2021 in English was eligible. Studies were assigned a level of evidence (see Table one) based on JBI's hierarchy[12-16]. Recommendations are made based on the body of evidence and are graded according to the system reported by JBI[12-16].

Table 1: Sources of evidence and the level

Level 1 Evidence	Level 2 Evidence	Level 3 Evidence	Level 4 Evidence	Level 5 Evidence
Experimental Designs	**Quasi-experimental Designs**	**Observational – Analytic Designs**	**Observational – Descriptive Studies**	**Expert Opinion/ Bench Research**
1.c RCTs[8]		Level 3.e Observational study without a control group[9]	4.c Case series[10] 4.d Case studies[11,17]	5.c Bench research[1-7]

BACKGROUND

Tea tree oil is an essential oil derived from an Australian native plant, *Melaleuca alternifolia*[1, 4, 18]. Essential oils are plant-based oils that contain high concentrations of plant extracts. Crushed tea tree leaves were used as a traditional remedy by Aboriginal people, prepared as a poultice for treating skin lesions[4, 19]. The formulation of contemporary tea tree oil, made by steam distillation of the leaves[19, 20], is regulated by international standards that define its chemical composition with respect to 14 primary components[7, 21]. Most variations of tea tree oil contain over 100 active components.

Tea tree oil preparations are used to treat superficial skin conditions (e.g., insect bites, head lice and dandruff)[4, 21] and has been shown to have some efficacy in eradicating methicillin-resistant *Staphylococcus aureus* (MRSA) in nasal infections[22] and topical skin infections[23]. Topical tea tree oil preparations are also used in wound management, to achieve a range of outcomes including reduction in inflammation, control of local wound infection and to facilitate wound debridement[17].

CLINICAL EVIDENCE

Findings from bench research on tea tree oil

A review reported on 17 *in vitro* studies that demonstrated susceptibility of a wide range of bacteria, including *E. coli, K. pneumoniae, S. epidermidis, S. pyogenes* and MRSA to tea tree oil at 1 to 2% concentration. *In vitro* studies reported in the review also demonstrated that tea tree oil has anti-fungal and anti-viral activity[7] (*Level 5*).

Additional bench research adds to this evidence base, reporting tea tree oil's efficacy in eradication *S. aureus*[1, 3, 6] and MRSA[2], including in samples taken from lower limb wounds[6]. Minimum inhibitory concentration, which is the lowest concentration of an antimicrobial that will inhibit the growth of microorganisms, is reported as between 0.2%[6] and 0.5%[2]. One in vitro study demonstrated that tea tree oil formulations maintained adequate antimicrobial activity when combined with alcohol and surfactants[3] (*Level 5*).

An animal study also provided evidence that application of tea tree oil to an acute wound could improve stages of wound healing[4] (*Level 5*).

Effectiveness in promoting chronic wound healing

The evidence on tea tree oil for promoting chronic wound healing comes from small trials that primarily used low level research designs and were at a moderate-to-high risk of bias.

In an RCT (n = 32)[8], people with chronic wounds confirmed via wound culture to be MRSA positive[8] received either a wound dressing impregnated with 10% tea tree oil or a control non-adherent wound dressing. Analysis of weekly wound cultures showed statistically significantly ($p < 0.01$) lower viable counts of MRSA associated with tea tree oil treatment from week one to final analysis four weeks after commencing treatment. Complete eradication of MRSA was achieved by week four of treatment for 87.5% of wounds. There was also a statistically significant difference ($p < 0.001$) in weekly scores on the PUSH wound assessment tool, favouring the tea tree oil group[8] (*Level 1*).

In an uncontrolled pilot trial (n = 12)[9], people with wounds confirmed as being MRSA-colonised but not showing clinical signs and symptoms of local wound infection were selected for treatment with a tea tree oil wound cleansing solution. Participants were withdrawn from the study if they subsequently required antibiotic therapy. All the wounds in the study remained MRSA-colonised at the time of trial completion (n = 2) or withdrawal (n = 10). However, 66.7% of wounds had a reduction in wound area at the time of withdrawal from the study compared to baseline[9] (*Level 3*).

In a case series analysis (n = 10)[10], gangrenous lower limb wounds were treated with tea tree oil applied as a spray three times daily. Treatment was initially administered until the wound bed was granulating and appropriate for application of a split skin graft. In 100% of wounds, granulation occurred within 2 to 3 weeks, achieving a clinical condition appropriate for grafting. Tea tree oil treatment continued for 1 to 2 weeks following grafting. Complete wound healing was achieved within eight weeks for 100% of wounds[10] (*Level 4*).

In a report of three case studies[17], a hydrogel dressing impregnated with 4% tea tree oil was used to treat chronic wounds. Wound dressings were changed every 1—5 days based on wound depth. All wounds were described as healing well when the patient was discharged. The lack of formal outcome measure reporting and the use of a range of concurrent wound treatments prevented conclusions being made about the efficacy of tea tree oil in this report[17] (*Level 4*). Another report on a single case study[11] described progression to complete wound healing over a period of approximately eight weeks for a lower limb wound that had been assessed as requiring amputation. Tea tree oil-soaked gauze dressings were applied daily until complete epithelialisation was achieved[11] (*Level 4*).

CONSIDERATIONS FOR USE

- Use tea tree oil with composition that meets the relevant international standard (ISO4730)[20] that dictates the composition of the product. Tea tree oil can be prepared for use in a variety of different formulations. The product reported in the Level 1

study[8] above was prepared in the laboratory by diluting 100% tea tree oil to a concentration of 10% tea tree oil and 90% paraffin oil. In other studies, tea tree oil was been impregnated in a wound dressing[8, 17], applied as a spray[10], and used as a cleansing agent[9].

- In clinical studies in which tea tree oil was applied directly to chronic wounds, adverse events were not observed[8, 10, 11, 17]. However, in other contexts mild adverse effects have been associated with topical application of tea tree oil. From ten clinical studies in which a tea tree oil product was applied to broken skin (e.g., dermatitis, acne and tinea), five reported mild irritation as an adverse effect[7]. In studies reporting application of tea tree oil to intact skin, mild sensitivity reactions were reported in a small proportion of people,[7, 21] with sensitivity rates higher for products with higher tea tree oil concentrations[21].
- Tea tree oil is reported to have a pleasant odour when used in wound products[17] and a laboratory study demonstrated the oil is effective in reducing general malodour[5].
- Clinical studies conducted in Australian tertiary hospitals reported that tea tree oil products were a cost effective treatment option for chronic wound management[10, 17].

CONFLICTS OF INTEREST

The author declares no conflicts of interest in accordance with International Committee of Medical Journal Editors (ICMJE) standards.

ABOUT WHAM EVIDENCE SUMMARIES

WHAM evidence summaries are consistent with methodology published in

Munn Z, Lockwood C, Moola S. The development and use of evidence summaries for point of care information systems: A streamlined rapid review approach, Worldviews Evid Based Nurs. 2015;12(3):131-8.

Methods are provided in detail in resources published by the Joanna Briggs Institute as cited in this evidence summary. WHAM evidence summaries undergo peer-review by an international review panel. More information on the website: http://WHAMwounds.com

WHAM evidence summaries provide a summary of the best available evidence on specific topics and make suggestions that can be used to inform clinical practice. Evidence contained within this summary should be evaluated by appropriately trained professionals with expertise in wound prevention and management, and the evidence should be considered in the context of the individual, the professional, the clinical setting and other relevant clinical information.

PUBLICATION

This evidence summary has been published in:

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