

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

Keywords tea tree oil, melaleuca, essential oil, wound infection, chronic wound

For referencing Haesler E and Carville K. WHAM evidence summary: effectiveness of tea tree oil in managing chronic wounds. WCET® Journal 2021;41(3):44-47

DOI <https://doi.org/10.33235/wcet.41.3.44-47>

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 research¹⁻⁷ 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* evidence⁸ demonstrated reduction of MRSA colonisation and improvement in wound assessment scores. *Level 3* evidence⁹ 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 granulation¹⁰ 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.

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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 hierarchy¹²⁻¹⁶. Recommendations are made based on the body of evidence and are graded according to the system reported by JBI¹²⁻¹⁶.

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 infections²² and topical skin infections²³. 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 debridement¹⁷.

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 activity⁷ (Level 5).

Additional bench research adds to this evidence base, reporting tea tree oil's efficacy in eradication *S. aureus*^{1, 3, 6} and MRSA², including in samples taken from lower limb wounds⁶. 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 surfactants³ (Level 5).

An animal study also provided evidence that application of tea tree oil to an acute wound could improve stages of wound healing⁴ (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. A summary of the studies is presented in Table two.

In an RCT (n = 32)⁸, people with chronic wounds confirmed via wound culture to be MRSA positive⁸ 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 group⁸ (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 baseline⁹ (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

Table 1. Levels of evidence

Level 1 evidence: Experimental designs	Level 2 evidence: Quasi-experimental designs	Level 3 evidence: Observational – analytic designs	Level 4 evidence: Observational – descriptive studies	Level 5 evidence: Expert opinion / bench research
1.c randomised blinded trials (RCT) ⁸		3.e Observational study without a control group ⁹	Level 4.d Case series ¹⁰ Level 4.d Case study ^{11, 17}	5.c Bench research ¹⁻⁷

Table 2. Summary of clinical evidence for topical tea tree oil products

	Level of evidence	Type of chronic wound	Tea tree oil product	Reported clinical outcomes
Lee et. al., 2014 ⁸	Level 1.c	Pressure ulcers/injuries and lower limb ulcers confirmed as MRSA-positive	Non-adherent wound dressing impregnated with 10% tea tree oil	Reduction in score on PUSH wound assessment tool Eradication of MRSA established via wound culture No adverse events
Edmonson et. al., 2011 ⁹	Level 3.e	Primarily chronic wounds, all of which confirmed as MRSA-positive	Wound cleansing solution of 3.3% tea tree oil	Reduction in wound area No change in MRSA status No adverse events
Sherry et. al., 2003 ¹⁰	Level 4.c	Gangrene of the lower limb in people with diabetes mellitus and advanced vascular disease	Water-based tea tree oil spray delivering a dose of 1 mg per spray	Achievement of wound bed granulation adequate to apply split skin graft Wound healing at 8 weeks
Culliton, 2011 ¹¹	Level 4.d	Chronic low extremity wound	Gauze impregnated with 10% tea tree oil	Complete wound healing at approximately 8 weeks
Webber, 2011 ¹⁷	Level 4.d	Stage IV pressure injuries, necrotic ulcers and wounds requiring surgical debridement and closure	Hydrogel wound dressing impregnated with 4% tea tree oil	No formal objective outcome measures reported

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 wounds¹⁰ (Level 4).

In a report of three case studies¹⁷, 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 report¹⁷ (Level 4). Another report on a single case study¹¹ 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 achieved¹¹ (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 study⁸ 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 spray¹⁰, and used as a cleansing agent⁹.
- 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 effect⁷. 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 concentrations²¹.
- Tea tree oil is reported to have a pleasant odour when used in wound products¹⁷ and a laboratory study demonstrated the oil is effective in reducing general malodour⁵.
- 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 outlined 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 multidisciplinary Expert Reference Group. More information: <https://healthsciences.curtin.edu.au/healthsciences-research/research-institutes-centres/wceihp/>.

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.

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