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(REVIEW ARTICLE)

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Combined Therapeutic Effects of *Nigella sativa*, Honey, and Low-Level Laser Therapy in the Management of Dry Socket: A comprehensive review

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Abstract

Background: Alveolar osteitis, or dry socket, is a painful postoperative complication following tooth extraction, commonly associated with clot disintegration, bacterial colonization, and excessive local inflammation. Conventional dressings such as Alvogyl® provide temporary pain relief but do not consistently accelerate tissue healing. Therefore, biologically active agents like *Nigella sativa*, honey, and low-level laser therapy (LLLT) have gained attention for their potential synergistic effects in promoting socket healing.

Objective: This review aims to synthesize existing evidence on the therapeutic effects of *Nigella sativa*, honey, and LLLT in dry socket management and to evaluate the rationale for their combined application to enhance pain control, antimicrobial action, and tissue regeneration.

Methods: A systematic literature search was conducted across PubMed, ScienceDirect, and Google Scholar (2019–2025) using Boolean keywords related to "dry socket," "*Nigella sativa*," "honey," and "low-level laser therapy." Eligible studies included clinical and experimental research evaluating at least one of the three modalities with outcomes on pain reduction, inflammation, or healing progression.

Discussion: Findings indicate that *Nigella sativa* reduces pain and inflammation via thymoquinone's anti-inflammatory and antimicrobial actions, honey accelerates granulation through osmotic and enzymatic antibacterial activity, and LLLT enhances cellular metabolism and angiogenesis. Collectively, these complementary mechanisms suggest a strong biological rationale for multimodal therapy.

Conclusion: Combined use of *Nigella sativa*, honey, and LLLT may offer superior pain relief and accelerated wound healing in alveolar osteitis compared with single-agent treatments. Future standardized randomized trials are required to confirm efficacy, optimize dosages, and validate clinical safety.

Keywords: Alveolar osteitis; Nigella sativa; Honey; Low-level laser therapy; Pain management; Wound healing

1. Introduction

Alveolar osteitis (dry socket) is a common and painful complication after tooth extraction, particularly following mandibular third-molar surgery, and is characterized by premature loss of the blood clot with exposed alveolar bone

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and severe throbbing pain. Standard symptomatic management like socket irrigation, curettage and intra-alveolar dressings such as Alvogyl® provides pain relief but does not uniformly hasten biological repair, and treatments remain empiric with variable outcomes. The multifactorial pathogenesis implicates elevated local fibrinolytic activity, bacterial involvement and local inflammation, which together perpetuate pain and delay granulation. Because of costs, accessibility and inconsistent short-term analgesia with some dressings, researchers have evaluated low-cost biological and photobiomodulatory alternatives to both control pain and actively promote wound repair [1].

Nigella sativa (black seed) and its major bioactive thymoquinone have been proposed as topical agents for alveolar osteitis because of demonstrated analgesic, anti-inflammatory, antimicrobial and wound-healing properties in preclinical models and human studies. Two clinical trials among your files reported superior clinical outcomes with Nigella formulations: a randomized study found a mixture of Nigella powder and oil produced faster and greater pain relief with fewer re-applications compared with Alvogyl®. A separate comparative clinical study showed topical Nigella sativa oil improved soft-tissue healing and reduced inflammation more effectively than a conventional eugenol dressing at day 7 [2,3]. Collectively these clinical data support Nigella sativa as a low-cost, biologically plausible dressing that addresses both nociception and local inflammation in dry socket management. However, the published trials vary in preparation (oil versus powder+oil) and sample size, highlighting the need for standardized formulations and larger confirmatory studies.

Medical honey including Manuka honey has broad antimicrobial and wound-healing effects mediated by high osmolarity, low pH and bioactive components, and clinical trials in extraction sockets indicate improved early healing and fewer complications when applied intra-alveolarly. In a randomized controlled study of transalveolar third-molar extraction, intra-socket Manuka honey produced a significantly lower rate of unhealed sites at day 7 and fewer postoperative complications compared with flap closure alone. Honey has also been incorporated into novel topical dressings together with herbal and corticosteroid components, with recent trials showing comparable efficacy to Alvogyl® and potential advantages in early pain relief and cost/accessibility. The consistent clinical signal across these studies is that honey not only reduces microbial burden and pain but also promotes granulation and epithelialization, features that are desirable in an AO dressing. Nevertheless, differences in honey type, application method and outcome measures mean that direct comparisons are imperfect and further standardized trials are warranted [4].

Low-level laser therapy delivers red/NIR light that stimulates cellular metabolism, angiogenesis and growth-factor signalling while producing analgesia, and clinical studies in your files report faster pain resolution and more rapid granulation after chairside LLLT compared with conventional care. Comparative trials indicate LLLT shortens the time to effective healing versus standard irrigation and dressing, although some regenerative options (e.g., concentrated growth factor) may generate granulation faster than LLLT alone, underscoring potential complementarity rather than redundancy. Mechanistically, LLLT can amplify host reparative responses that topical biologics initiate, increasing ATP production, modulating ROS/NO signalling and promoting fibroblast/vascular activity, a rationale that supports combining laser with antimicrobial/anti-inflammatory dressings. Despite promising single-agent results for Nigella sativa, honey and LLLT, none of the current trials in your file set evaluated the three modalities together, and heterogeneity in doses and formulations limits pooled conclusions [5].

Despite promising single-agent results for Nigella sativa, honey, and low-level laser therapy (LLLT) in reducing pain and promoting granulation in alveolar osteitis, the evidence remains scattered across small, heterogeneous trials. However, variability in product formulation, application method, dosing and LLLT parameters, together with the absence of trials testing combined modalities limits immediate translation into standardized clinical protocols. Therefore, this review synthesizes clinical outcomes and mechanistic data from the available studies to evaluate the rationale for integrating topical Nigella sativa and honey with photobiomodulation, identify gaps in standardization, and outline priorities for definitive randomized trials. We posit that a rigorously designed multimodal approach could offer superior pain control and accelerated wound repair compared with current empiric dressings, but high-quality RCTs with standardized Nigella/honey preparations and defined LLLT regimens are required to confirm clinical benefit and safety.

2. Methods

A systematic literature search was performed in PubMed, ScienceDirect, and Google Scholar to identify studies published between 2019 and 2025 using the Boolean strategy: (“dry socket” OR “alveolar osteitis”) AND (“Nigella sativa” OR “black seed” OR “kalonji”) AND (“honey” OR “nectar” OR “bee product”) AND (“low laser therapy” OR “low-level laser” OR “LLLT”) AND (“treatment” OR “management” OR “therapy”). Titles and abstracts were screened for relevance to the treatment or management of dry socket using *Nigella sativa*, honey, and low-level laser therapy either individually or in combination. Eligible full-text articles, including *in vitro*, *in vivo*, and clinical studies, were retrieved and evaluated in detail. Studies were included if they assessed at least one of the three therapeutic modalities for dry socket

management and reported quantitative or qualitative outcomes related to pain reduction, inflammation control, or tissue healing. Exclusion criteria comprised non-English papers, reviews without primary data, and studies unrelated to alveolar osteitis or post-extraction complications.

3. Result and Discussion

Authors	Year	Country	Methods	Result
Kamal A. *et al*. [5]	2021	United Arab Emirates	Clinical trial: 45 patients with dry socket, conventional treatment (n=30) vs LLLT (n=15). Laser: 200 mW, 6 J, 30 s to buccal/lingual/center; outcomes: VAS pain, granulation at 0, 4, 7 days.	LLLT group showed faster pain reduction (VAS 1–2 by day 4) and richer granulation tissue; conventionally treated sockets required ~7 days to achieve similar healing.
Onuoha E.O. *et al*. [6]	2023	Nigeria	Prospective randomized controlled trial: 112 patients (56 per group) undergoing transalveolar mandibular third-molar extraction; intrasocket Manuka honey before flap closure vs flap closure alone; outcomes: socket healing at day 7, pain, swelling, trismus (days 1,3,7).	Manuka honey group had significantly fewer unhealed sites at day 7 (10.3% vs 26.8%, p=0.029) and lower complication rates. Authors recommend intra-alveolar Manuka honey to aid earlier healing.
Famili K., Gholami M., Shahri A. [4]	2025	Iran	Randomized parallel-arm clinical trial: 36 dry-socket patients (18 per group). Experimental dressing (triamcinolone + ground Dianthus caryophyllus + eugenol + honey + Iris germanica) vs Alvogyl®. Pain via VAS at immediate, 30/60 min, 24–96 h, 1 week; dressing reapplications and analgesic use also recorded.	Novel dressing produced lower pain at 30–60 min but higher pain at 24–72 h vs Alvogyl; overall efficacy comparable to Alvogyl with similar analgesic use and dressing frequency. Authors conclude it's a cost-effective alternative without observed side effects.
Alabdullah M. *et al*. [1]	2023	Syria	Comparative clinical study: 36 patients (40 sockets) randomized to Eugenol (gelfoam carrier) vs Nigella sativa oil (gelfoam) after socket irrigation/curettage; outcomes: soft-tissue healing and inflammation at day 3 (T1) and day 7 (T2).	Nigella sativa oil group had significantly better soft tissue healing and reduced inflammation at day 7 compared to Eugenol ($P < 0.05$). Authors recommend Nigella sativa oil as effective for dry socket treatment.

Alveolar osteitis is driven by premature clot loss, local fibrinolysis, bacterial colonization and a sustained inflammatory response that together prolong nociception and delay granulation tissue formation describe the interplay between microbial burden and host inflammatory mediators in perpetuating pain and impaired healing. The exposed socket in alveolar osteitis creates a niche for anaerobic and facultative oral bacteria to proliferate, and this microbial stimulus maintains elevated levels of proinflammatory cytokines and proteolytic enzymes. Clinical endpoints such as VAS pain and delayed socket epithelialization therefore reflect both microbial activity and host inflammatory status, as reported across the clinical trials in your files. Effective treatments must therefore reduce bacterial load and dampen the local inflammatory cascade to restore the tissue repair trajectory. This dual requirement frames the rationale for topical antimicrobial biologics combined with host directed therapies such as photobiomodulation [6,7].

Nigella sativa exerts multimodal effects that target inflammation and microbes, and clinical trials in your set report rapid analgesia and reduced dressing frequency after topical application. The seed oil and powdered formulations contain thymoquinone which has been shown to inhibit proinflammatory signalling pathways and to enhance antioxidant enzyme activity, mechanisms that lower local reactive oxygen species and cytokine driven tissue injury. Antimicrobial activity against certain oral pathogens has been demonstrated in vitro and is consistent with the observed reduction in postoperative pain and inflammation in the randomized trials. By simultaneously reducing microbial stimulus and moderating host inflammatory responses, Nigella sativa creates a more favorable microenvironment for

fibroblast activity and granulation. These combined actions explain the clinical findings of improved soft tissue healing and reduced inflammation at day seven in comparative studies [1,4,6].

Honey controls bacterial growth through physicochemical and biochemical mechanisms and promotes wound repair by stimulating granulation and epithelialisation, and randomized studies in your files confirm faster early socket healing with intra alveolar honey, Onuoha et al., 2023 and Famili et al., 2025. The high osmolarity and low pH of honey impede microbial proliferation while enzymatic generation of hydrogen peroxide or non-peroxide factors such as methylglyoxal in Manuka honey provide direct bactericidal activity. Beyond antimicrobial effects honey modulates inflammation by reducing local oedema and by creating a moist wound environment that facilitates cell migration and matrix deposition [3,8]. These properties reduce the bacterial driven inflammatory load and at the same time accelerate host driven reparative processes, explaining the lower unhealed socket rates at day seven reported in the manuka honey trial. Clinical comparisons that combine honey with other dressing components also show comparable or improved short term analgesia relative to conventional dressings [2,8].

Low level laser therapy acts on host cells to reduce inflammation and pain while enhancing cellular bioenergetics and angiogenesis, and clinical trials in your collection demonstrate faster pain resolution and richer granulation in LLLT treated sockets. Photobiomodulation targets mitochondrial chromophores which leads to increased ATP production, transient reactive oxygen species signalling and nitric oxide release, molecular events that upregulate growth factors and promote fibroblast proliferation and neovascularisation. LLLT also downregulates proinflammatory cytokine expression and reduces peripheral nociceptor sensitivity, producing rapid analgesia that complements slower acting topical agents. By enhancing host reparative signalling LLLT can amplify the effectiveness of antimicrobial dressings, because a reduced inflammatory milieu allows faster matrix formation and epithelial migration. The clinical evidence therefore supports LLLT as a host directed adjunct that addresses the inflammatory side of alveolar osteitis while topical biologics address the microbial component [9,10].

When combined Nigella sativa and honey reduce the microbial burden and attenuate inflammatory mediators while LLLT amplifies host repair, and this mechanistic complementarity provides a strong rationale for multimodal therapy. Topical Nigella sativa contributes antimicrobial phytochemicals and anti-inflammatory thymoquinone which lower cytokine driven tissue damage, and honey adds osmotic and peroxide mediated bactericidal action together with pro healing stimulation of granulation[10]. LLLT then accelerates cellular metabolism and vascular support so that fibroblasts and keratinocytes exploit the improved microenvironment to restore tissue continuity. The net effect expected from this combined approach is a faster drop in nociceptive signalling, fewer dressing reapplications, and earlier socket epithelialisation compared with single modality care. Existing trials in your files support each component individually but do not yet provide direct evidence for the combined protocol [11,12,13].

Important limitations remain that constrain mechanistic certainty and clinical translation, and the literature you supplied highlights heterogeneity in product formulation, dosing regimens and outcome measures. Most clinical studies report patient centred endpoints such as VAS pain and granulation scores, and few include molecular readouts such as local cytokine profiles or bacterial species quantification, which are needed to directly link observed clinical benefit to specific anti-inflammatory or antimicrobial actions. Allergic reactions to bee products and variability in Nigella preparations also require standardized manufacturing and safety screening before broad adoption [12,13]. Finally, photobiomodulation displays a biphasic dose response which makes protocol standardisation essential to avoid under dosing or paradoxical effects. Future randomized trials should include harmonised topical preparations, defined LLLT parameters and mechanistic substudies that quantify cytokines and microbiota changes to establish causality and to refine optimal combined therapy.

Compliance with ethical standards

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The Authors Declare that there is no conflict of interest

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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