

Role Of Essential Oils in Alleviating Pain and Anxiety in Children During Dental Procedures: A Literature Review

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ABSTRACT

Benzodiazepines (BZDs) are commonly used for sedation and anxiety management, but their side effects, including dependence, drowsiness, and cognitive impairment, raise concerns. As a result, natural alternatives like Chamomile (*Matricaria chamomilla*), Lemon Balm (*Melissa officinalis*), Lavender (*Lavandula angustifolia*), Valerian Root (*Valeriana officinalis*), and Passionflower (*Passiflora incarnata*) are gaining attention for their anxiolytic and sedative properties. Chamomile contains apigenin, a flavonoid that binds to GABA receptors, promoting relaxation. Lemon Balm enhances GABA activity, reducing stress and nervousness. Lavender, particularly in aromatherapy, has demonstrated anxiolytic effects comparable to low-dose benzodiazepines. Valerian Root modulates GABAergic activity, improving sleep and relaxation without the risk of dependence. Passionflower has been studied for its role in reducing preoperative anxiety and enhancing calmness without deep sedation. This literature review highlights that herbal remedies can offer a natural, safer, and non-addictive alternative to BZDs for mild to moderate sedation, especially in dental procedures.

Keywords: Essential oils, Aromatherapy, Anxiolytic effects, Non-pharmacological management.

INTRODUCTION

Dental fear and anxiety (DFA) refers to a range of negative emotional response that patients may experience in relation to dental treatment. DFA continues to be one of the most significant challenge that is faced by dentists, particularly when treating children ^[1]. It affects approximately 10% to 23.9% of children, which indicates that nearly one in four paediatric patients may experience this condition ^[2,3]. Dental anxiety usually often leads to the avoidance of dental visits, which may in turn result in poor oral hygiene and an increased risk of developing more serious oral health problems over time ^[4]. In children, the fear of pain can escalate anxiety levels, making dental visits more stressful which often leads to non-cooperative behaviour ^[5,6]. Managing such patients is more demanding and time-consuming for paediatric dentists because it often involves significant behavioural challenges ^[2]. Various sensory stimuli in the dental setting can trigger anxiety, such as the sight of needles, the sound and appearance of the dental

drill, and the distinctive smell of materials like eugenol and dentine cuttings ^[1,7].

To address DFA, many pharmacological and non-pharmacological approaches have been proposed ^[8]. Techniques such as hypnosis, behaviour modification, and audio-visual distraction have shown effectiveness in reducing anxiety in paediatric patients ^[9]. However, when these methods are not effective, sedation or general anaesthesia might become necessary for children who exhibit extreme fear or lack of cooperation ^[10]. Aromatherapy has recently emerged as a promising alternative and a non-drug approach for anxiety and pain management in dental settings ^[11]. The therapeutic use of aromatic oils dates back to ancient Egyptian and Chinese civilizations ^[12]. Aromatherapy utilizes essential oils. These are compounds that are derived from plants and are administered via inhalation, oral ingestion or topical application to provide therapeutic effects such as anxiolytic effects, analgesic effects, antidepressant, and rejuvenating benefits ^[13,14].

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The olfactory system is directly linked to the brain's emotional centres, specifically the limbic system, which makes aromatherapy a unique and powerful method for reducing anxiety and influencing mood [15]. In recent years, many studies have showed the effectiveness of aromatherapy, especially through inhalation and as a non-pharmacological method which reduces anxiety in both medical [16,17] and dental settings [9,18,19]. The aroma or scent from essential oils stimulate the sense of smell, which is closely linked to the limbic system which is also an area of the brain associated with emotion, memory, and hormone regulation [12].

Essential oils can be administered in various different ways which include oil-infused cloths or cotton balls, nasal sticks or patches, oxygen masks, aroma sticks and tabs, or even through room diffusers [11,14]. These delivery methods offer an ease of application and flexibility in the clinical settings, which also supports their use as a complementary tool in paediatric dentistry. This literature review aims to assess the effectiveness of essential oils in reducing dental anxiety in paediatric patients. It also highlights the potential of aromatherapy as a non-pharmacological, cost-effective, and a low-risk strategy to manage anxiety and discomfort during dental treatments. With their proven benefits in the dental practice, essential oils emerge as a promising alternative to conventional sedation methods and pharmacological approaches in paediatric dentistry.

Essential Oils in Dentistry

Historical & Cultural Use in Relaxation and Sedation

Essential oils (EOs) are concentrated plant extracts which were historically used across many cultures for their ritual, medicinal, and relaxation purposes such as baths, inhalations, and massages. In 20th century, aromatherapy became a complementary therapy in medicine, which reduced anxiety, also improved mood, and supported relaxation in perioperative, oncologic, and palliative settings. Recently, even dentistry has adopted these practices to manage procedural anxiety, given that inhaled aromas are simple, non-invasive, and usually well accepted by patients. (20,21)

Mechanism of Action: Olfactory Stimulation and Anxiolytic Pathways

The mechanism of action starts when Volatile molecules bind to the olfactory receptors, with signals being transmitted via the olfactory bulb to the limbic system which are the amygdala, hippocampus, hypothalamus, thalamus, which then regulate emotional, memory, and autonomic responses. This pathway can reduce sympathetic tone and increase parasympathetic activity, also lower the cortisol release, and influence physiologic measures such as heart rate and blood pressure. (20)

Certain essential oil constituents like linalool in lavender, demonstrate pharmacodynamic activity in experimental models, which include GABAergic modulation and glutamate receptor interactions. These effects may contribute to anxiolysis and sedation beyond olfactory stimulation, although strong clinical evidence in humans remain limited. (15)

Paediatric Considerations

- **Age sensitivity:** Infants or very young children have an immature respiratory and dermal barrier, which makes them more vulnerable. The use of essential oils is generally discouraged in those who are under the age of 2–3 years. (22)
- **Allergic or irritant risks:** Risks such as Contact dermatitis or bronchospasms may also occur, especially in asthmatic children. (22)
- **Endocrine concerns:** Case reports for example the prepubertal gynecomastia also raise caution about repeated exposure, even though their causality remains uncertain. (22)
- **Systemic effects & interactions:** Inhalation is typically safe at low doses, but ingestion or a very concentrated topical use may cause systemic absorption and drug interactions, ingestion should also be strictly avoided (22)

Practical Paediatric Guidance for Dental Clinics (21)

- Prefer **diffusion or inhalation** at low concentrations over topical use.



- Screen children for **asthma or allergies** and also obtain **parental informed consent**.
- Avoid the use of essential oils in **infants** and also use it with caution in children under above 3 years of age.
- Use **well-studied oils** such as *Lavandula angustifolia* with a **short pre-procedural exposure**.
- Monitor **physiologic signs** such as Heart rate, SpO₂ and **behavioural responses** the application.

Essential Oils Relevant to Sedation in Paediatric Dentistry

Lavender (*Lavandula angustifolia*)

Lavender is the most extensively studied essential oil in the field of paediatric dentistry. Many randomized controlled trials have shown that lavender aromatherapy significantly reduced the preoperative dental anxiety, heart rate, and salivary cortisol levels in paediatric dental patients who underwent restorative or dental extraction procedures ^{(19),(23)}. Its major constituents or components such as linalool and linalyl acetate, are said to act via modulation of GABAergic neurotransmission and the limbic system which results in anxiolytic and sedative effects ⁽²⁴⁾. The Delivery is usually through inhalation, either through diffusion in the operatory or dental setting or cotton balls that are placed near the child or face masks before and during the treatment. Children usually tolerate lavender aroma well, and the parental acceptance is also high. Overall, lavender shows the **strongest evidence among all the essential oils which are used specifically in paediatric dentistry**.

Citrus Oils (Sweet Orange, Bergamot, Lemon)

Sweet orange oil is the second most investigated essential oil in paediatric dentistry. Inhalation of sweet orange during treatment has shown to significantly reduce salivary cortisol levels, pulse rate, and observed anxiety scores that were measured using Venham's and Frankl's scales when compared with controls ⁽²⁵⁾. Children exposed to citrus aromas usually exhibit more relaxation and better cooperation. While bergamot has demonstrated anxiolytic potential in adult dental and medical

studies, paediatric evidence is limited. Lemon oil has anecdotal benefits but is not yet supported by strong clinical evidence in dentistry. Delivery methods are like the ones used in lavender, which are usually through room diffusion or inhalers. Evidence for citrus oils is promising in school-aged children but remains based on a very small or very little studies or population ^(25,26).

Chamomile (*Matricaria recutita* / *Chamaemelum nobile*)

Chamomile has a long history of use as a mild sedative in children, largely due to its flavonoid apigenin, which binds to benzodiazepine receptors. Though direct paediatric dental trials are limited, chamomile aromatherapy has been associated with reduced pre-procedural anxiety and improved sleep quality in paediatric medicine ⁽²⁷⁾. In dentistry, its use has been primarily via inhalation, but robust evidence in clinical dental settings is still but strong evidence from clinical dental point of view still remains limited.

Peppermint (*Mentha piperita*)

Peppermint is more often studied for its effects on alertness, nausea control, and analgesia rather than sedation. In paediatric dental trials, peppermint has occasionally been tested as a calming fragrance, but it has also shown **mixed results** such as some children reported that it felt more refreshing rather than anxiolytic ⁽²³⁾. Additionally, menthol vapours are very strong and may cause airway irritation or laryngospasm in very young children, which makes peppermint less suitable for sedation purposes.

Ylang-Ylang and Valerian Root

Both ylang-ylang (*Cananga odorata*) and valerian root (*Valeriana officinalis*) have been studied in adult populations for their anxiolytic and sedative properties. Though, the evidence in paediatric dentistry is negligible. Valerian is typically administered orally in the form of capsules or teas, which is not practical or safe in a dental setting, while ylang-ylang has shown calming effects in adults but it still lacks data in paediatric dental patients ^(24, 15).

Delivery Methods in Paediatric Dentistry



Aromatherapy via inhalation is the **most common and practical method** for administering essential oils in paediatric dentistry. Delivery options include diffusion in the operatory or clinical setting, placing oil-soaked cotton balls near the paediatric dental patient, or using inhalation strips or masks. This approach is non-invasive, safe, and also well accepted by children ^(19,25). Topical or oral administration is rarely used in dentistry due to the concerns about dosage, safety, and the risk of adverse reactions specially in children. Thus, **aromatherapy still remains the gold standard** for essential oil delivery in paediatric dental practice.

CONCLUSION

Essential oils, particularly lavender, offers an effective, safe, and non-pharmacological method which reduces dental anxiety and improves cooperation in paediatric dental patients. Inhalation is the most preferred delivery method, due to its ease of use and high patient acceptance. Even though citrus and chamomile oil shows promising effects, further research is needed to confirm their efficacy in the Paediatric dental population. Aromatherapy also proves to be a low cost and low-risk alternative, which also enhances the overall dental experience for paediatric dental patients.

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