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Terapia cognitiva conductual vs terapias físicas no farmacológicas para el control del dolor en ortodoncia. Revisión de literatura

Cognitive behavioral therapy vs. non-pharmacological physical therapies for pain management in orthodontics. A Literature Review

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Palabras claves:
Ortodoncia, dolor, manejo del dolor, terapia cognitiva conductual, tratamiento, no farmacológico.

Resumen

Introducción. En ortodoncia, el dolor representa una experiencia frecuente y negativa para los pacientes sometidos a tratamiento con aparatos dentales. La Terapia Cognitiva Conductual (TCC) y las terapias físicas no farmacológicas han emergido como enfoques prometedores para el control del dolor en ortodoncia. **Objetivo.** Revisar la información actualizada sobre la efectividad de la terapia cognitiva conductual y las terapias físicas no farmacológicas en el control del dolor durante el tratamiento ortodóntico. **Metodología.** Estudio narrativo, documental y descriptivo, se realizó una búsqueda selectiva en bases de datos obtenidas del DeCS y Mesh incluyendo *PubMed, Lilacs, Cochrane y Google Academic*, utilizando palabras clave y operadores booleanos. Resultados. Se reviso un total de 30 estudio. Tanto la TCC como las terapias físicas no farmacológicas, como la fisioterapia, acupuntura, fototerapia LED y vibraciones mecánicas, son efectivas en la reducción del dolor ortodóntico. La TCC mejora la gestión del dolor mediante la reestructuración cognitiva, relajación y entrenamiento en habilidades de afrontamiento. Las terapias físicas alivian el dolor mediante la modulación fisiológica directa**. Conclusión.** La combinación de la TCC y terapias físicas no farmacológicas puede ofrecer un enfoque integral y efectivo para el manejo del dolor en pacientes ortodónticos. Estas técnicas pueden elevar el bienestar general de los pacientes, reducir la dependencia de analgésicos y asegurar la continuidad y el éxito del tratamiento ortodóncico. **Área de estudio general:** Odontología. **Área de estudio específica:** Ortodoncia. **Tipo de estudio:** Revisión bibliográfica.

Keywords:
Orthodontics, pain, pain management, cognitive behavioral therapy, treatment, non-pharmacological.

Abstract

Introduction. In orthodontics, pain represents a frequent and negative experience for patients undergoing treatment with dental appliances. Cognitive Behavioral Therapy (CBT) and non-pharmacological physical therapies have emerged as promising approaches for pain management in orthodontics. objective. To review updated information on the effectiveness of cognitive behavioral therapy and non-pharmacological physical therapies in managing pain during orthodontic

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treatment. Methodology. A narrative, documentary, and descriptive study was conducted using a selective search performed in databases obtained from DeCS and MeSH, including PubMed, LILACS, Cochrane, and Google Academic, using keywords and Boolean operators. Results. Thirty studies were reviewed. Both CBT and non-pharmacological physical therapies, such as physical therapy, acupuncture, LED phototherapy, and mechanical vibrations, are effective in reducing orthodontic pain. CBT improves pain management through cognitive restructuring, relaxation, and coping skills training. Physical therapies relieve pain through direct physiological modulation. Conclusion. The combination of CBT and non-pharmacological physical therapies may offer a comprehensive and effective approach to pain management in orthodontic patients. These techniques can enhance patients' overall well-being, reduce dependence on pain medications, and ensure continuity and success of orthodontic treatment. General area of study: Dentistry. Specific area of study: Orthodontics. Type of study: Literature review.

Introduction

Discomfort caused by orthodontic treatments is a major concern for patients and dental professionals.(1). This pain, which may be experienced during and after orthodontic appliance adjustment procedures, often leads to a decrease in the patients' overall well-being and can negatively affect their adherence to treatment.(23). Effective management of orthodontic pain is critical to ensuring a more comfortable and successful treatment experience, various non-pharmacological strategies have been explored for pain management, including cognitive behavioral therapy (CBT) and various physical therapies.(4, 5).

CBT is a psychological technique widely used to address different types of pain, both chronic and acute. In the case of orthodontic pain, it is based on the idea that thoughts and emotions can modify the perception of pain. CBT trains patients to manage pain through methods such as cognitive restructuring, relaxation, and the development of coping skills.(6, 7).

On the other hand, non-pharmacological physical therapies during orthodontic treatments, such as physiotherapy, acupuncture, specific exercises and chewing gum have also been shown to be beneficial for pain management. These interventions may act

through physiological mechanisms to decrease inflammation, as well as improve circulation and release endorphins, which may contribute to pain reduction. In the orthodontic context, these therapies may offer an alternative or complement to traditional pharmacological treatments, which often come with undesirable side effects.(8, 9).

Due to the need to identify effective interventions that can optimize patient experience and improve patient compliance, this review has been undertaken. Since pain management is an essential component of successful orthodontic treatment, it is critical to evaluate and synthesize the existing evidence in order to provide evidence-based recommendations. This review aims to fill the gap in the current literature by providing a comprehensive comparison of these two non-pharmacological approaches and helping to guide future research and clinical practice in orthodontics.

Methodology

The research work is a narrative, descriptive and documentary bibliographic review carried out by searching and selecting scientific research documents on the use of cognitive behavioral therapy (CBT) and non-pharmacological physical therapies for the management and reduction of pain in orthodontics. The information was collected through a selective search of scientific articles in indexed databases, including PubMed and Google Academic, using keywords based on the Medical Subject Headings (MeSH) and the Health Science Descriptors (DeCs) portal. The keywords used included "Cognitive Behavioral Therapy," "CBT," "Physical Therapy Modalities," "Pain Management," "Orthodontics," among others, combined with logical operators (AND and OR) to build specific exploration algorithms, as detailed below:

- *((“Cognitive Behavioral Therapy” OR “CBT”) OR (“Non-Pharmacological Therapy” OR “Physical Therapy”)) AND (“Pain Management”) AND (“Orthodontics”)*(Table 1).

Table 1. *Configuring repository search*

Repository	Search structure using logical operators
PUBMED	(non-pharmacological) AND (treatment) AND (fixed orthodontic.)
LILACS	(treatment) AND (non-pharmacological) AND (orthodontics.)
COCHRANE	(alternatives) AND (non-pharmacological) AND (control pain) AND (orthodontic.)
GOOGLE ACADEMIC	(non-pharmacological pain) OR (control fixed orthodontic)

To ensure the relevance and quality of the studies considered in the review, the following eligibility criteria were established:

Inclusion criteria

- Original cross-sectional research articles (descriptive and analytical), bibliographic reviews and systematic reviews.
- Studies published between 01/01/2019 and 15/05/2024.
- Articles in English and Spanish.

Exclusion criteria

- Publications on websites that lack scientific character.
- Studies that do not address topics related to the research.
- Sources of articles that do not allow full access to the text.
- Expert opinions.
- Book chapters or thesis.

Article selection was carried out in several stages, starting with the reading of titles and abstracts to identify potentially relevant studies, followed by a detailed review of the full text of the selected articles; bibliographic management was carried out using Mendeley software.

This methodology ensures a thorough and rigorous compilation of the existing literature on CBT and non-pharmacological physical therapies for pain control in orthodontics, providing a solid basis for the synthesis of results and the obtaining of evidence-based conclusions.

Results

For this review, a total of 261 articles were collected from PubMed, 1 from Lilacs, 1 from the Cochrane Library, and 22 from Google Academic, totaling 285 studies. In a first screening, the 285 articles were retained; then, duplicate bibliographies were removed, resulting in 243 articles. After reviewing all records, 10 studies that did not meet the selection criteria were excluded, leaving 30 articles suitable for this literature review. Figure 1 shows the flow chart of the search and study selection process:

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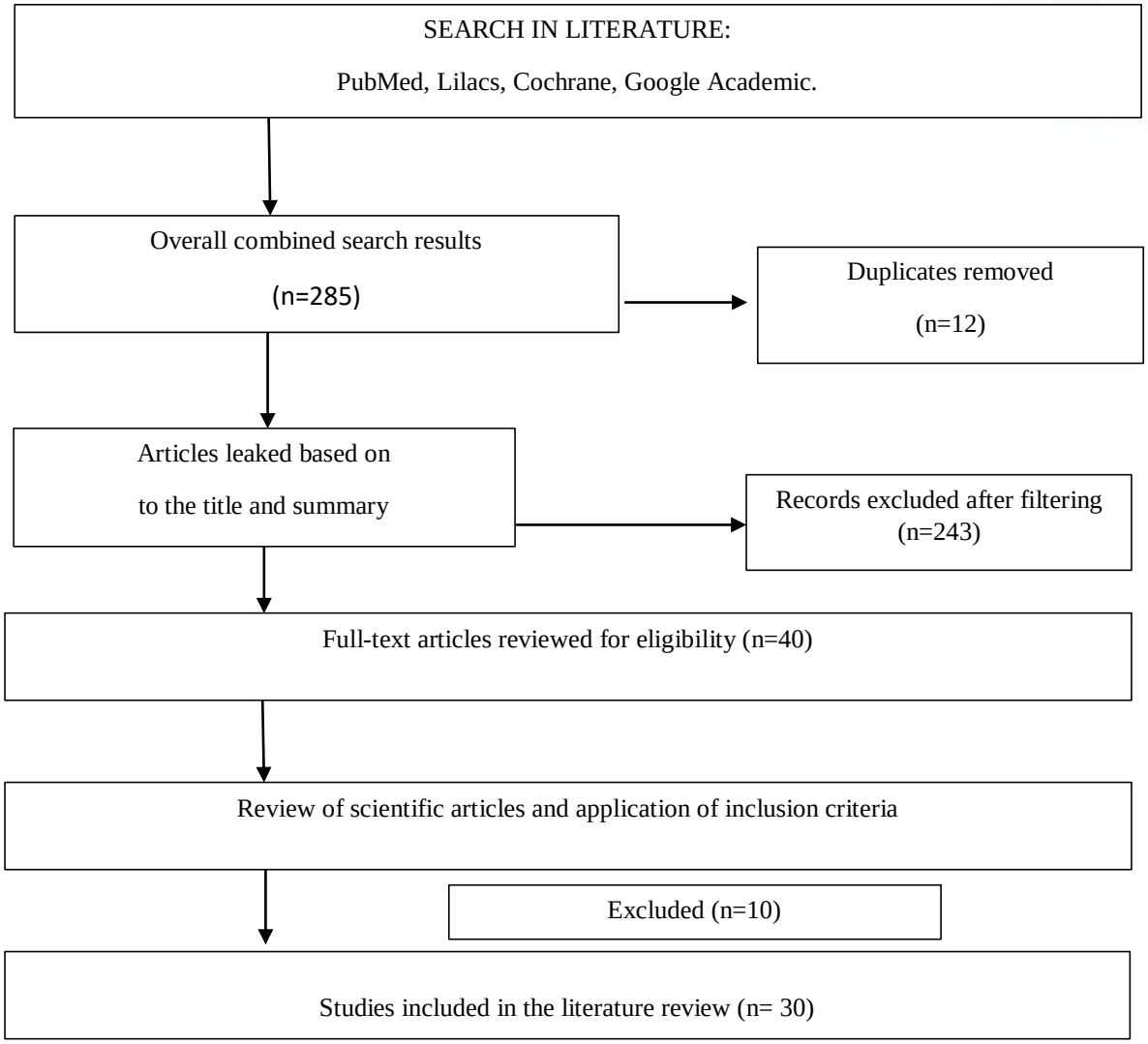

Figure1.*Flowchart of the study selection process*

This review included 9 systematic review articles (30%), 6 cross-sectional studies (20%), 6 randomized clinical trials (20%), 5 case-control studies (16.7%) and 4 literature reviews (13.3%) (Figure 2).

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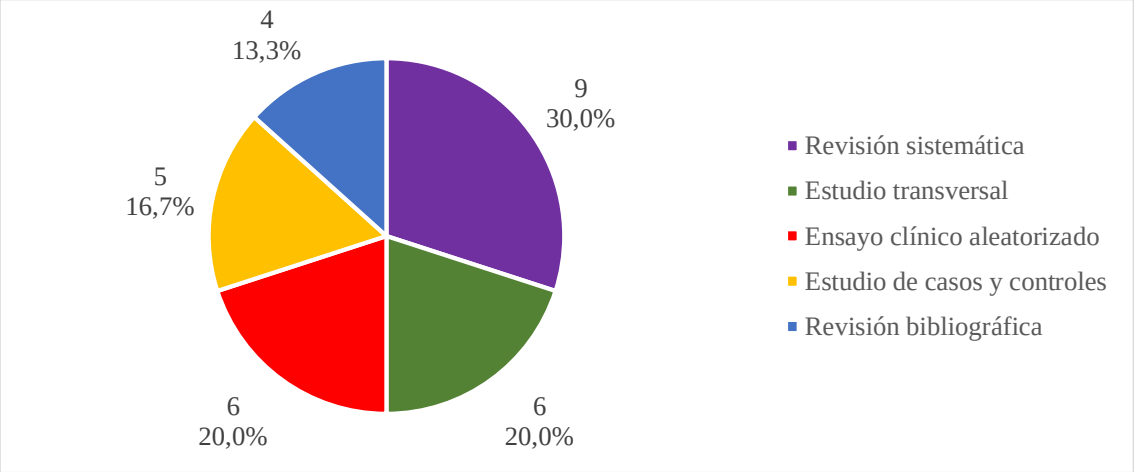

Figure2.*Distribution of selected research by type of research*

Orthodontic pain is an unpleasant sensory and emotional experience commonly reported by patients undergoing treatment with dental appliances, such as braces. This pain can manifest as constant or acute discomfort, and usually occurs after periodic adjustments of the appliances due to the pressure exerted on the teeth and periodontal tissue. The level of pain can range from mild discomfort to intense pain, negatively impacting the quality of life and well-being of patients. Orthodontic pain not only influences patient comfort, but can also impact their adherence to treatment, potentially affecting the efficacy and final results of the treatment. Understanding and properly managing pain associated with orthodontic treatment are essential to optimize the patient experience and ensure treatment success.(8, 10, 11).

During orthodontic treatment, pain is a common experience that may lead some patients to stop the procedure early, resulting in the loss of the expected benefits. Although painkillers are often recommended to mitigate pain, an effective non-pharmacological solution could reduce the risks associated with the side effects of medications. In addition, it would provide a safe alternative that would make it easier for patients to complete their orthodontic treatment more comfortably and successfully.(12).

Orthodontic pain originates mainly due to the application of mechanical forces necessary to move teeth to their desired positions. These forces exert pressure on periodontal tissues causing an inflammatory response, one of the main causes of pain experienced by patients.(13).

Orthodontic pain usually occurs within a few hours after the activation of orthodontic appliances, such as brackets and wires, and may last for several days. Patients often report pain when chewing, tooth sensitivity, and pain in the soft tissues of the mouth. The intensity of the pain may vary depending on individual factors such as pain tolerance, the amount of force applied, and the technique used by the orthodontist.(14).

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Tooth movements in orthodontics are the result of the controlled application of forces on the teeth to correct malpositions and achieve proper occlusion. This process involves several phases, starting with the application of forces that generate pressure and tension on the periodontal tissues. Pressure on the side of the tooth that moves towards the bone causes bone resorption, while tension on the opposite side favors the formation of new bone. This bone modification is essential for tooth movement, but it is also the main cause of pain, due to the inflammatory response and the activation of pain receptors in the affected tissues.(14).

Cognitive Behavioral Therapy (CBT)

CBT is a psychological approach that seeks to recognize and alter negative thought patterns and behaviors that generate emotional and psychological problems. CBT is based on the premise that thoughts, emotions and behaviors are interrelated, and that by modifying dysfunctional thoughts and behaviors, emotional well-being can be significantly improved and symptoms such as anxiety and pain can be reduced.(5)CBT is applied in different areas, among which the following stand out:

Cognitive restructuring

Cognitive restructuring, a key CBT technique, involves identifying irrational or distorted thoughts and replacing them with more realistic and positive ones. This method enables patients to adopt a more balanced and less negative perspective on their experiences and symptoms. In the context of orthodontic pain, cognitive restructuring can help patients better manage their perception of pain and reduce anxiety associated with orthodontic procedures.(15).

- *Relaxation*

Relaxation techniques are tools used in CBT to reduce physical and emotional tension. These techniques include deep breathing exercises, meditation, and progressive muscle relaxation. Relaxation is effective in decreasing stress response and pain perception, providing patients with practical methods to manage their discomfort during orthodontic treatment.(16).

- *Coping skills training*

Coping skills training teaches patients practical strategies for managing difficult situations and associated stress. These skills may include problem-solving, time management, and techniques for confronting negative thoughts. In the context of orthodontic pain, coping skills training can empower patients to better manage their pain and adhere to treatment, improving their ability to meet the challenges of the orthodontic process.(17).

- *Music with alpha binaural beats (BBM)*

The technique of music with binaural alpha beats (BBM) involves playing specific sounds that create a frequency difference between the left and right ears, inducing a brain frequency in the alpha range (8-12 Hz). These beats can promote a state of relaxation and reduce the sensation of pain. It has been observed that, in orthodontic patients, listening to music with BBM after the initial placement of orthodontic appliances has been shown to significantly reduce both the sensory and psychological aspects of pain, thus improving the treatment experience and increasing patient comfort.(18).

Non-pharmacological physical therapies

Pain management in orthodontics can significantly benefit from the use of non-pharmacological therapies, which offer alternatives or complements to conventional drug-based treatments. These therapies focus on physical and behavioral methods that can relieve pain without the side effects associated with painkillers. Prominent options include physical therapy, acupuncture, specific exercises, and the use of chewing gum. These interventions not only seek to reduce the perception of pain, but also improve the overall well-being of orthodontic patients throughout treatment, promoting greater adherence and satisfaction with the therapeutic process.(19, 20).

- *Physiotherapy*

Physiotherapy is widely used for pain management through techniques that include specific exercises, massages, and physical modalities such as the application of different temperatures (heat or cold). Thus, in the orthodontic context, physiotherapy can help relieve muscle tension and induce improved mobility, which can reduce the perception of pain associated with the use of dental appliances. In addition, physiotherapy can encourage better postural alignment and healthy oral habits, contributing to the patient's overall well-being.(19).

- *Acupuncture*

Acupuncture, an ancient practice of Chinese medicine, involves inserting fine needles into specific points on the body to balance energy flow and relieve pain. Research has shown that this technique can be effective in reducing dental and orthodontic pain by stimulating the release of endorphins and improving blood circulation. This non-pharmacological therapy offers an alternative or complement to conventional treatments, with the potential to optimize patient comfort during orthodontic procedures.(21).

- *Specific exercises*

Specific exercises designed to relieve orthodontic pain may include stretching and strengthening exercises for the facial and jaw muscles. These exercises contribute to reducing muscle tension and improving jaw function, which can decrease the pain and discomfort associated with braces. Regular implementation of these exercises can improve a patient's ability to manage pain and increase their adherence to orthodontic treatment.(17).

- *Chewing Gums*

The use of chewing gum as a non-pharmacological therapy for orthodontic pain control relies on chewing stimulation, which can help increase blood flow in the oral region and reduce the sensation of pain. Chewing gum can also provide a physical distraction that helps relieve discomfort. However, it is important to select sugar-free gum to avoid additional dental problems. This simple intervention can be easily integrated into the patient's daily routine as an additional pain management strategy.(22).

- *Laser therapy*

Low-level laser therapy, also known as LLLT (Low-Level Laser Therapy), is a type of irradiation that emits energy at a low intensity, thus avoiding an increase in temperature in the tissues. This non-pharmacological approach has anti-inflammatory and analgesic properties, which facilitates the control of orthodontic pain. A notable advantage of this therapy is its ability to stimulate the proliferation of fibroblasts, macrophages, lymphocytes and endothelial cells, in addition to releasing growth factors and promoting collagen production. It also improves microcirculation and vasodilation, releases neurotransmitters and promotes the regeneration of blood vessels, nerves and endothelial tissue. These effects allow the laser to directly attack the cause of inflammation during orthodontic treatments. In addition, low-level laser therapy stabilizes the neuronal membrane potential, blocking the transmission of pain signals and standing out for its effectiveness in the management of orthodontic pain.(23 - 26).

- *LED phototherapy*

LED phototherapy has emerged as a promising option in the management of pain associated with orthodontic treatment. This technique uses low-intensity LED lights that do not raise tissue temperature, thus avoiding the risk of thermal damage. LED phototherapy exerts anti-inflammatory and analgesic effects, promoting cell proliferation and the release of various growth factors, which facilitates tissue repair and tissue regeneration. In addition, it improves microcirculation and vasodilation, increasing the supply of oxygen and nutrients to the affected areas. The release of neurotransmitters and the stabilization of neuronal membrane potential contribute to reducing the transmission

of pain signals. These benefits make LED phototherapy an effective and safe tool for managing orthodontic pain, improving patient comfort and promoting better adherence to treatment.(24, 27).

- *Mechanical vibrations*

Mechanical vibration therapy involves the application of low-frequency vibrations to teeth and supporting structures to mitigate pain related to orthodontic treatment. In this method, a vibrating device is placed in the patient's mouth, usually over orthodontic appliances, to generate vibrations for a specific period of time. These vibrations help to decrease pain perception by interfering with pain signals transmitted to the brain and by promoting relaxation of periodontal tissues. Vibrations can also stimulate blood circulation and improve nutrient distribution, which facilitates the adaptation of teeth to new positions and can speed up the process of tooth movement.(28 - 30).

After reviewing the selected studies, the main results obtained are presented below:

Table 2.*Main results obtained in the review*

Author (year)	Type of study	Main results
Febriannavisha et al. (2024)(5)	Qualitative-descriptive cross-sectional study	Most dentists (53%) preferred a combination of non-pharmacological and pharmacological methods to manage orthodontic pain. The most preferred non-pharmacological methods were psychological approach, behavioural management and telephone follow-up (63%), while the most commonly used pharmacological methods were prescription of mefenamic acid and paracetamol (49%).
Argueta-Figueroa et al. (2022)(19)	Systematic review	The efficacy of nonpharmacological interventions was moderate in the short term and variable in the long term for pain reduction in patients with temporomandibular disorders. Acupuncture, laser therapy and physiotherapy were reported as potentially useful for pain relief, although consistency and long-term follow-up across studies was lacking.
Da Silva & Capelli Jr. (2021)(22)	Randomized clinical trial	The chewing gum group experienced more pain relief than the ibuprofen and acetaminophen groups when biting at T3 and T4. Chewing gum may be a nonpharmacologic alternative for orthodontic pain relief at 2 and 3 days after initial archwire placement.
Bezerra et al. (2022)(24)	Longitudinal randomized clinical trial	LED phototherapy and laser therapy were effective in reducing the level of pain after the tooth separation process compared to the control group, with significantly lower pain levels in the LED and laser groups from T2 to T4.

Table 2.*Main results obtained in the review (continuation)*

Author (year)	Type of study	Main results
Matys et al. (2020)(26)	Randomized controlled clinical trial	635 nm diode laser therapy achieved a significant reduction in pain compared to the control group (p = 0.0237). In contrast, ozone therapy did not show a significant decrease in pain compared to the control (p = 0.8040) and laser (p = 0.1029) groups. No differences in pain perception were found between patients with crowded teeth and those without crowding in either group.
Celebi et al. (2019)(28)	Randomized clinical trial	No significant differences were observed between laser therapy and mechanical vibration. However, the mechanical vibration group had consistently lower VAS pain scores compared to the low-intensity laser therapy and control groups at all measurement points. Further clinical trials were recommended to obtain more definitive conclusions.
Celebi (2022)(29)	Randomized clinical trial	There were no significant differences in Visual Analogue Scale scores between the gum and mechanical vibration groups at any measurement point. Mean pain scores were relatively lower in the mechanical vibration group, but there was no significant effect on clinically relevant orthodontic pain relief.
Aly et al. (2023)(18)	Randomized clinical trial	The effects of music with alpha binaural beats (BBM), music without binaural beats (placebo) and no music (control) on orthodontic pain were compared. The BBM group showed a significant reduction in pain compared to the control by the end of the first week. However, there were no significant differences in pain between the BBM and placebo groups.
Al-Hanbali et al. (2024) (20)	Systematic review and meta-analysis	Low-level laser therapy (LLLT) was shown to be effective in reducing pain after retractor placement, with a standard mean difference of 13.79 mm at 6 hours and 23.34 mm at 24 hours. Ibuprofen also had a significant effect on pain relief at 6 and 24 hours compared with placebo. No significant differences in pain control were found between ibuprofen and acetaminophen. Naproxen showed lower visual analogue scale pain scores at 6 hours. The quality of the evidence ranges from moderate to weak.

The reviewed studies reveal that non-pharmacological therapies offer promising approaches to orthodontic pain management, albeit with variations in their efficacy and consistency. Physical therapies, such as LED phototherapy and laser therapy, demonstrated significant pain reduction in several randomized clinical trials.(24, 26)Chewing gum also emerged as a viable alternative, showing greater pain relief compared to other methods in specific studies.(22)However, the consistency and long-term follow-up of these results varied, highlighting the need for additional studies to confirm these findings.

On the other hand, psychological and behavioral interventions were preferred by a majority of dentists in the study by Febriannavisha et al. (2024) (5), reflecting a trend

towards combined approaches that integrate diverse non-pharmacological methods. Music with alpha binaural beats (BBM) also showed a significant reduction in pain, suggesting an additional benefit in the use of innovative technologies for orthodontic pain management.(18)Taken together, these results suggest that a multidimensional approach combining physical, technological, and behavioral therapies may offer more comprehensive and effective pain relief for orthodontic patients.

Conclusions

- Cognitive behavioral therapy (CBT) and nonpharmacological physical therapies have been shown to be effective approaches for pain management and reduction in orthodontic patients. CBT, with its focus on cognitive restructuring, relaxation, and coping skills training, addresses the emotional and psychological aspects of pain, while physical therapies, such as physiotherapy, acupuncture, LED phototherapy, and mechanical vibration, provide relief through direct modulation of the physiological response to pain.
- The reviewed studies indicate that a combination of non-pharmacological and pharmacological methods is preferred by many dentists to manage orthodontic pain, highlighting the importance of a comprehensive approach. Interventions such as chewing gum and music with alpha binaural beats have been shown to be effective alternatives, offering significant pain reduction and improving the treatment experience.
- The integration of CBT and non-pharmacological physical therapies may provide a more holistic approach to appropriately managing pain in orthodontics, reducing reliance on painkillers and improving treatment adherence. It is critical that future studies continue to explore these strategies to establish more effective and personalized clinical protocols.
- Although there is scientific evidence supporting the effectiveness of CBT in other pain contexts, its specific application in orthodontics has not yet been sufficiently explored.
- In summary, adequate management of orthodontic pain through non-pharmacological methods can significantly contribute to improving the general well-being of patients, ensuring continuity of treatment and leading to better therapeutic outcomes.

Conflict of interest

The authors declare that they have no conflicts of interest.

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