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REVIEW

Management of Pre-Infiltration Anxiety with Local Anesthetic in Pediatric Dental Treatments: A Systematic Review of Randomized Controlled Trials

Manejo de la ansiedad pre-infiltración de anestésico local en tratamientos dentales pediátricos: revisión sistemática de ensayos clínicos aleatorizados

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ABSTRACT

Dental anxiety is one of the main reasons why children fear visiting the dentist, making it essential to have a variety of methods to properly manage the patient. One of the procedures that generates the highest anxiety in children is the infiltration of local anesthetic prior to any dental treatment. The aim of this study was to evaluate the management of anxiety in pediatric patients before the infiltration of local anesthetics. A systematic review of randomized clinical trials published between 2017 and 2024 was conducted in the Medline/PubMed, Europe PMC, Scopus, and Web of Science databases using the search strategy: "Pediatric dentistry AND Dental Anxieties AND Local Anesthesia AND Pain AND Management." A total of 93 studies were identified, and after applying eligibility criteria, 4 studies were analyzed. The results showed that distraction techniques using virtual reality and psychological therapies were more effective in managing anxiety in children both in the short and long term. In conclusion, virtual reality stands out for its immersive capacity and immediate effectiveness, while cognitive-behavioral therapy offers a more sustained approach over time to reduce dental fear. These interventions provide valuable tools for optimizing anxiety management in pediatric dentistry and improving the pediatric patient's experience.

Keywords: Pediatric Dentistry; Dental Anxiety; Local Anesthesia; Pain; Management.

RESUMEN

La ansiedad dental es una de las principales razones por la que los niños temen visitar al odontólogo, por lo que es importante tener una variedad de métodos para realizar un correcto manejo del paciente. Uno de los procedimientos que genera mayor ansiedad en niños es la infiltración del anestésico local previo a cualquier tratamiento dental. El objetivo de este estudio fue evaluar el manejo de la ansiedad en pacientes pediátricos, previo a la infiltración de anestésico local. Se realizó una revisión sistemática de estudios clínicos aleatorizados publicados, entre los años 2017 a 2024, en las bases de datos Medline/Pubmed, Europe PMC, Scopus y Web of Science, con la estrategia de búsqueda "Pediatric dentistry AND Dental Anxieties AND Local Anesthesia AND Pain AND Management". Se registraron 93 estudios de los cuales, después de aplicar los

criterios de elegibilidad, se analizaron 4; cuyos resultados demostraron que técnicas de distracción con realidad virtual y terapias psicológicas fueron más efectivas para manejar la ansiedad en niños tanto a corto como a largo plazo. En conclusión, la realidad virtual destaca por su capacidad de inmersión y efectividad inmediata, mientras que la terapia cognitivo-conductual ofrece un enfoque más sostenido en el tiempo para reducir el miedo dental. Estas intervenciones proporcionan herramientas valiosas para optimizar el manejo de la ansiedad en odontopediatría y mejorar la experiencia del paciente pediátrico.

Palabras clave: Odontología Pediátrica; Ansiedad Dental; Anestesia Local; Manejo del Dolor.

INTRODUCTION

Managing anxiety in pediatric dentistry, particularly during local anesthesia (LA) administration, represents a significant challenge for both professionals and patients. Dental anxiety has been identified as one of the primary reasons why children avoid visiting the dentist, which can have severe long-term consequences for their oral health.[1] LA administration is a critical procedure to ensure pain-free dental treatments; however, the infiltration process is one of the most common sources of fear and anxiety in children. A negative experience associated with perceived pain during anesthetic infiltration can lead to trauma, adversely affecting a child's willingness to undergo future dental treatments.[2,3,4,5,6,7]

Various studies have highlighted the importance of addressing fear and anxiety related to dental procedures through non-pharmacological approaches. Several management techniques have been explored as complementary tools to reduce pain,[3,8] with distraction emerging as one of the most effective methods. By diverting the child's attention from painful or distressing stimuli, passive distraction techniques—such as the use of audiovisual devices—have demonstrated a significant reduction in anxiety and perceived pain during dental procedures. These devices allow children to focus on visual or auditory stimuli rather than dental intervention. Additionally, playful camouflage techniques have been developed to conceal the syringe or carpule, with the "crocodile" cover being a notable example. This approach minimizes the visual impact of the needle, helping to alleviate fear and anxiety.[2,3,9]

Behavioral modification strategies have also proven beneficial in managing pediatric dental anxiety. Techniques such as the "tell-show-do" method, in which the dentist explains the procedure in simple terms before performing it, along with needle concealment and the hand-eye-mouth technique, have been effective in reducing anticipatory anxiety.[10,11] Furthermore, integrating games or magic tricks into dental visits has been well received by parents, who favor these methods over more invasive or pharmacological interventions.[9]

The management of anxiety in children is not solely confined to behavioral or distraction techniques. In certain cases, hypnosis has been proposed as an additional tool to modify pain perception and reduce anxiety associated with dental procedures. Hypnosis has demonstrated effectiveness in various pediatric clinical settings, and when combined with conventional behavioral management techniques, it has contributed to enhancing the child's overall experience during local anesthesia administration.[12,13,14]

The impact of these strategies extends beyond reducing anxiety during treatment; they also foster a more positive experience, ultimately leading to the immediate success of the procedure and greater willingness to seek dental care in the future.[15] Therefore, the objective of this study is to evaluate anxiety management in pediatric patients prior to local anesthetic infiltration.

METHOD

Design

This review was conducted based on the Cochrane Handbook for Systematic Reviews of Interventions, in accordance with the *Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)* guidelines.[16,17]

Eligibility Criteria

Study eligibility was determined using the P.I.C.O.S acronym methodology (Participants, Intervention, Comparison, Outcome and Study design), considering the following inclusion criteria:

P: Pediatric patients require local anesthetic infiltration.
I: Cognitive-behavioral techniques for anxiety management.
C: Virtual reality for anxiety management.
O: Heart rate, oxygen saturation, and self-reported anxiety, pain, and fear scores.
S: randomized controlled trials (RCTs) with variable intervention durations

Data Sources and Search Strategy

An electronic search was conducted between 2017 and 2024 in the following databases: Medline via PubMed

(https://pubmed.ncbi.nlm.nih.gov/), Scopus (https://www.scopus.com/home.uri), Web of Science (https://clarivate.com/login/), and Europe PMC (https://europepmc.org/). The initial search was performed in March and updated in October 2024. The search strategy was developed using Medical Subject Headings (MeSH) terms: "Pediatric Dentistry", "Dental Anxieties", "Local Anesthesia", "Pain", and "Management", combined with the Boolean operator "AND." The following search strategy was applied across all databases: "Pediatric Dentistry AND Dental Anxieties AND Local Anesthesia AND Pain AND Management".

Additionally, methodological filters were applied: "full text" in Europe PMC, "Open Access" in Web of Science, and "English language" in Scopus and Web of Science.

Study Selection and Data Collection

Titles, abstracts, and full texts of the selected articles were independently reviewed by two researchers. A third reviewer resolved any disagreements regarding article inclusion. The data extraction and synthesis process focused on the following information: lead author, study design, year of publication, study objective, and conclusions.

Methodological Quality Assessment

The methodological quality of the included studies was evaluated using the Risk of Bias 2 (ROB 2) tool developed by the Cochrane Collaboration. [18] This tool assesses and classifies potential biases in randomized controlled trials across five key domains: (D1) the random sequence generation process, (D2) deviations from assigned interventions, (D3) missing outcome data, (D4) outcome measurement, and (D5) selection of reported Outcomes. The risk of bias and quality of evidencewere assessed independently by two researchers and discrepancies were resolved by a third reviewer, who acted as an arbitrator.

RESULTS

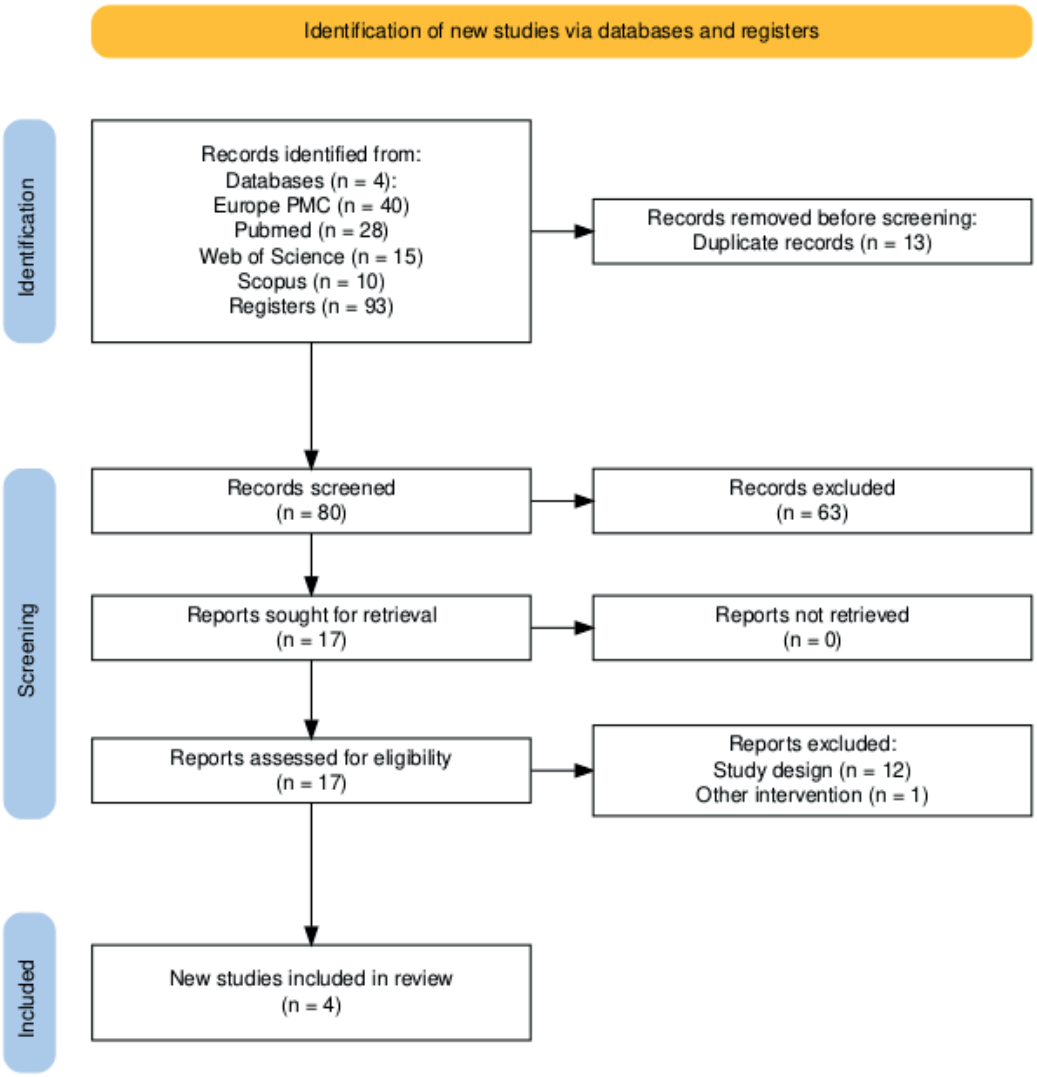

Figure 1. Search diagram
Source: Own elaboration based on the PRISMA checklist.[16]

As shown in figure 1, a total of 93 records were identified across all databases. After removing 13 duplicates, an additional 63 records were excluded following title, abstract, and keyword screening due to their lack of relevance to the study objective. This process resulted in 17 potentially eligible articles.

The full-text assessment of these 17 studies led to the exclusion of 13 articles: 12 were excluded due to a different study design,[3,9,15,19-27] and 1 was excluded due to a different type of intervention.[28] Ultimately, only 4 articles were included in the qualitative análisis.[1,12,13,29]

Table 1 shows the characteristics of the four studies analyzed,[1,12,13,29] whose objectives were to compare different techniques for anxiety management and determine which are more effective. Among these techniques, we found auditory distraction, 2D and 3D audiovisual distraction, magic tricks, internet-based cognitive behavioral therapy, and hypnosis. Among these techniques, it was observed that 2D and 3D audiovisual distraction showed significant differences in managing anxiety during local anesthesia infiltration. However, cognitive-behavioral therapy and hypnosis, combined with conventional techniques, also proved to be a good alternative.

Table 1. Main characteristics of the included studies

Authors	Intervention	Objective	Conclusión
Khandelwa[l(1)]	Auditory distraction	Compare and evaluate the effectiveness of various distraction techniques in the treatment of pediatric dental patients.	The auditory distraction technique is a simple, passive, and non-invasive behavioral management method that can be used alternatively for managing anxious pediatric patients.
Schibbye[12]	Internet-based cognitive behavioral therapy	Test if internet-based cognitive behavioral therapy guided by a therapist with parental support could reduce fear, enabling children and adolescents with dental or injection phobia to receive dental treatment.	Internet-based cognitive behavioral therapy is an effective treatment for dental phobia and injection fear in children and adolescents, as it reduces anxiety and allows patients to voluntarily accept dental treatment.
Ramirez-Carrasco[13]	Hypnosis combined with conventional techniques.	Assess the effectiveness of hypnosis combined with conventional behavior management techniques during anesthetic infiltration.	Hypnosis combined with conventional behavior management techniques reduces heart rate during anesthetic infiltration, suggesting an improvement in the control of anxiety and pain through hypnotherapy.
Henna [29]	Auditory, audiovisual, virtual distraction, and stress ball.	Evaluate and compare the effectiveness of different behavior management techniques during the administration of injectable local anesthetics with minimal pain and anxiety perception in children.	Virtual reality was the most effective method for relieving anxiety and pain experienced by pediatric patients.

Figure 2 provides a detailed breakdown of the five ROB 2 dimensions for each study, highlighting areas of methodological strength and potential bias. The four analyzed studies were assessed using the ROB 2 tool, which evaluates the risk of bias in randomized clinical trials across five key domains: randomization process, deviations from intended interventions, missing outcome data, outcome measurement, and selection of reported results. The studies by Khandelwal et al.[1] and Schibbye et al.[12] demonstrated a low overall risk of bias, exhibiting a robust methodology with effective control across all evaluated dimensions. In contrast, Ramirez-Carrasco et al.[13] presented some uncertainty regarding missing outcome data, as they did not fully disclose the reasons for exclusion or the methods employed to handle missing data. Meanwhile, Henna et al.[29] showed uncertainty in deviations from intended interventions and outcome measurement, indicating potential sources of bias that could compromise the validity of their conclusions.

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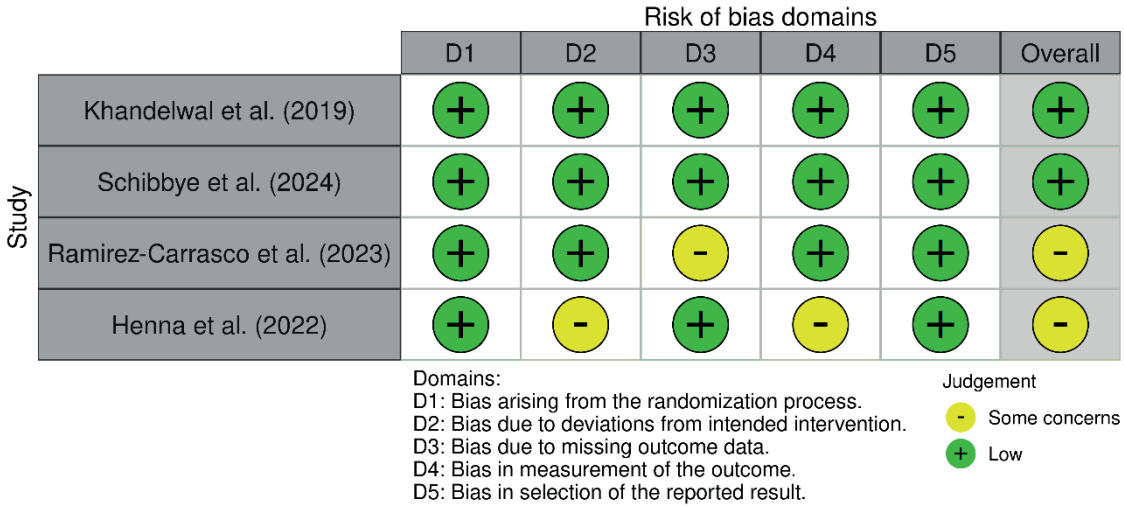

Figure 2. Assessment and methodological evaluation of the included studies
Source: Own elaboration based on the works of Khandelwal et al.,[1] Schibbye et al.,[12] Ramirez-Carrasco et al.,[13] Henna et al.,[29]

DISCUSSION

This systematic review aims to evaluate the management of anxiety in pediatric patients prior to local anesthesia infiltration. Managing anxiety and pain during pediatric dental procedures has been a significant challenge for both the dentist and the patient. In particular, the infiltration procedure is crucial to ensuring painless treatments; however, the sensation of pain, discomfort, and distress during infiltration remains the primary cause of anxiety in children visiting the dentist.[1,2,3]

The analyzed studies present diverse yet complementary approaches to addressing this issue, highlighting the importance of integrating innovative techniques alongside traditional methods. The tell-show-do method has been used to modify behavior, and the hand-eye-mouth technique, which involves concealing the syringe, is also a commonly employed option. Audiovisual distraction techniques, frequently used in dental consultations, have proven effective in managing general anxiety. These techniques, which can be installed on the dental chair or ceiling, stand out for their simplicity and ease of implementation in clinical settings. However, audio-only techniques, such as playing music through headphones, have shown to be less effective, suggesting that combining them with visual stimulation may be more effective in achieving meaningful distraction.[1,2,4,22]

Hypnosis, when combined with conventional behavior management techniques, has shown limited effectiveness, evidenced by a marginal reduction in heart rate variability without significant differences in other anxiety and pain measures.[4,13] In contrast, audiovisual techniques, especially those incorporating virtual reality headsets, have proven significantly more effective in reducing both anxiety and pain compared to previous distraction methods. The immersion provided by virtual reality places the child in a completely different environment, allowing for a deeper distraction than simple audio techniques.[2,22,29,30,31]

On the other hand, internet-based cognitive-behavioral therapy has been shown to be an effective intervention for reducing dental fear and anxiety in children and adolescents, with significant results suggesting its potential as an accessible and useful tool to avoid pharmacological behavioral management methods in clinical settings. This option stands out for its ability to offer continuous and guided psychological support, which is particularly beneficial for patients facing specific phobias related to dental care.[3,8,12]

The comparison between these techniques highlights some key aspects. While internet-based CBT can provide a long-term solution by addressing the root cause of dental anxiety,[12] distraction techniques such as virtual reality offer immediate relief during the procedure. [22,29] Hypnosis, although useful for some patients, appears to have a less predictable impact and may be more effective as a complementary strategy in behavioral management.[3,13]

Overall, the reviewed studies reinforce the idea that non-pharmacological techniques can be valuable in managing anxiety in children during local anesthesia administration. Virtual reality emerges as the most promising tool for effective distraction, while internet-based cognitive-behavioral therapy offers an accessible approach for managing phobias.[1,12,13,29,30,31]

CONCLUSIONS

Virtual reality stands out for its immersive capacity and immediate effectiveness, while cognitive-behavioral

therapy offers a more sustained approach to reducing dental fear. These interventions provide valuable tools for optimizing anxiety management in pediatric dentistry and improving the pediatric patient's experience. Future research should explore the combination of these techniques to maximize their effectiveness.

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CONFLICT OF INTERESTS

The authors declare that there are no conflicts of interest.

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