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Managing Pediatric Dental Anxiety: A Narrative Review of Psychosocial and Clinical Determinants

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ABSTRACT: Dental anxiety in children presents a persistent challenge in pediatric dentistry, affecting both oral health outcomes and access to care. This narrative review aims to synthesize current evidence on the psychosocial, clinical, and systemic factors contributing to pediatric dental anxiety, while identifying effective non-pharmacological interventions. A comprehensive literature search was conducted using databases such as PubMed, Scopus, and Google Scholar, targeting peer-reviewed studies published in the last 10 to 15 years. Selection criteria emphasized empirical studies involving children aged 0 to 18, with a focus on behavioral traits, parental influences, clinical procedures, and environmental design. The review identified parental anxiety, previous traumatic experiences, and neurodiverse conditions as critical psychosocial determinants. Clinical elements, including dentist attire, communication style, and clinic aesthetics, were also found to significantly affect anxiety levels. Non-pharmacological strategies such as audiovisual distraction, cognitive-behavioral therapy, and the Tell-Show-Do method demonstrated high efficacy in managing dental fear. Furthermore, systemic factors such as access to pediatric specialists, policy integration, and school-based education play pivotal roles in shaping care outcomes. The evidence underscores the necessity for multi-level interventions involving parents, clinicians, and policymakers.
In conclusion, addressing pediatric dental anxiety requires holistic strategies that integrate behavioral techniques, environmental adaptations, and institutional support. Future research should prioritize culturally sensitive, scalable interventions and longitudinal evaluations to ensure equitable, long-term improvements in pediatric oral healthcare.

Keywords: Pediatric Dental Anxiety, Non-Pharmacological Intervention, Behavioral Management, Sensory Adaptation; Parental Influence, Dental Fear, Oral Health Disparities.

INTRODUCTION

Dental anxiety among children is a persistent and globally recognized concern that significantly affects both individual well-being and public health outcomes. Defined as an excessive and irrational fear related to dental procedures, dental anxiety poses a substantial barrier to effective oral healthcare utilization. Across various settings, it manifests as behavioral avoidance, psychological distress, and

disrupted treatment processes in clinical dental environments. Recent global estimates suggest that approximately 10% to 20% of children exhibit symptoms of dental anxiety, though prevalence varies significantly across regions and socio-economic groups (Fux-Noy et al., 2023; Grisolia et al., 2020). A systematic review by Prakash et al. (2025) further specifies that preschool-aged children demonstrate the highest rates at 36.5%, followed by older children at 25.8%, and adolescents at 13.3%. This variation underscores the necessity of age-sensitive, culturally informed interventions to mitigate dental anxiety and its ramifications(Prakash et al., 2025)

The relevance of this issue extends beyond psychological discomfort. Dental anxiety critically influences health-seeking behaviors, particularly the tendency to avoid or delay dental visits. This avoidance often results in untreated dental conditions, including caries and periodontal disease, which can detrimentally impact children's overall health, development, and educational performance (Aldafaai et al., 2023; Mangalekar et al., 2023). According to the American Academy of Pediatric Dentistry, this issue disproportionately affects socioeconomically disadvantaged populations, thereby exacerbating existing health inequities (Cadillo-Ibarra et al., 2022). Consequently, addressing dental anxiety is not only an individual health imperative but also a broader public health priority.

The etiology of pediatric dental anxiety is multifactorial, involving a dynamic interplay of psychological, familial, and systemic variables. Parental anxiety, for example, has been consistently identified as a crucial determinant in the transmission of dental fear to children (Cadillo-Ibarra et al., 2022; Daneshvar & Azizi, 2021). Modeling theory posits that children internalize emotional responses from caregivers; thus, anxious parents inadvertently cultivate fear in their children by expressing discomfort or apprehension during dental visits (Petrović et al., 2024). These social learning mechanisms are especially potent in early childhood, where observational learning shapes cognitive and emotional development.

In addition to familial influences, individual child temperament and past dental experiences play critical roles in shaping dental anxiety. Children characterized by high emotional sensitivity or fearfulness are more susceptible to anxiety in novel or uncomfortable settings, including dental clinics (Petrović et al., 2024). Moreover, negative experiences, such as painful procedures or perceived mistreatment, can condition children to associate dental care with fear, establishing a cycle of avoidance and escalating anxiety (Alabduljabbar et al., 2023). This cyclicity often results in uncooperative behavior, further complicating treatment and reinforcing apprehension (Gao et al., 2021).

Systemic and environmental factors also contribute significantly to dental anxiety. Socioeconomic status, accessibility to dental care, and the nature of dental environments have all been implicated. Lower-income families often experience structural barriers, such as limited transportation, long wait times, and lack of preventive care, which heighten the probability of dental issues and, by extension, anxiety (Alazmah et al., 2024; Aldafaai et al., 2023). Physical aspects of dental settings—unfamiliar smells, sounds, and instruments—can provoke anxiety, especially in children unacquainted with the environment. Interventions such as virtual reality, engaging visual aids, and child-friendly design elements have shown potential in ameliorating these stressors (Alabduljabbar et al., 2023; Bagher et al., 2023).

Cultural perceptions surrounding dental care further influence the development and manifestation of dental anxiety in children. Beliefs about pain, authority, and medical procedures vary across societies, affecting attitudes toward healthcare providers and the perceived acceptability of dental visits (Berlin-Broner & Levin, 2024; JÚNIOR et al., 2021). For instance, in cultures where dental pain is normalized or downplayed, children may not receive adequate reassurance or support, thereby increasing their anxiety. Thus, culturally tailored strategies are essential to ensure effective communication, reduce fear, and foster trust between dental professionals and pediatric patients (Erić et al., 2025).

Despite growing awareness, substantial challenges persist in addressing pediatric dental anxiety. First, a notable deficit exists in standardized, evidence-based interventions. Although behavioral strategies such as tell-show-do and distraction techniques have demonstrated efficacy, their application varies significantly across clinical contexts, often lacking systematic evaluation (Chandran et al., 2024; Padmanabhan et al., 2023). Furthermore, limited training among dental professionals in psychological management of pediatric patients exacerbates the difficulty in implementing effective care.

Second, gaps remain in the integration of parental involvement and child-centered care approaches. While research affirms the influence of parental attitudes on children's dental experiences, strategies to educate and support parents in managing their own and their children's anxiety remain underdeveloped (Zhuge et al., 2023). Additionally, existing studies often overlook vulnerable populations, such as children with special healthcare needs, whose sensory sensitivities and behavioral challenges necessitate tailored interventions (Hussein & Akşit-Bıçak, 2022; Wu et al., 2023).

There is a critical need to synthesize current knowledge on the psychosocial and clinical dimensions of pediatric dental anxiety. While numerous studies highlight isolated interventions or focus on specific populations, few provide an integrative perspective encompassing familial, individual, cultural, and systemic factors. Addressing this gap will aid in constructing comprehensive models of care and informing future intervention strategies.

This narrative review aims to analyze and consolidate findings from contemporary literature concerning the psychosocial determinants and clinical consequences of dental anxiety in children. It examines the interplay of parental influence, individual temperament, socio-cultural context, and environmental design on the development and progression of anxiety. Furthermore, the review evaluates existing intervention strategies and their efficacy in different demographic and clinical settings.

The scope of this review encompasses pediatric populations aged 3 to 17 years across diverse geographical and cultural settings. Particular attention is paid to variations by age, gender, socioeconomic background, and healthcare accessibility. By mapping the existing literature and identifying knowledge gaps, the review seeks to propose directions for future research and inform the development of holistic, inclusive interventions tailored to the nuanced needs of anxious pediatric dental patients.

METHOD

This study employed a narrative review approach to systematically examine the psychosocial and clinical aspects of dental anxiety in pediatric populations. A comprehensive literature search was conducted across three major academic databases: PubMed, Scopus, and Google Scholar. The search targeted studies published between 2010 and 2024 to capture the most current developments and trends in pediatric dentistry. Strategic search methodologies were applied using a combination of predetermined keywords and Boolean operators to ensure specificity and comprehensiveness in literature retrieval.

The search string incorporated key terms such as "dental anxiety," "pediatric," "children," "management," "intervention," "treatment," "parental anxiety," "psychosocial factors," "behavioral therapy," "virtual reality," and "anxiety reduction techniques." Boolean operators were used to refine search parameters: for instance, the string ("dental anxiety" OR "dental fear") AND ("pediatric" OR "children") AND ("management" OR "intervention" OR "treatment") was applied to retrieve studies that addressed a combination of anxiety terminology, pediatric focus, and intervention strategies. Filters within each database, such as article type, publication date, and peer-reviewed status, were also utilized to enhance the relevance and reliability of selected literature.

The inclusion criteria encompassed peer-reviewed articles involving children aged 0 to 18 years and those analyzing dental anxiety through empirical or theoretical lenses, including cross-sectional studies, randomized controlled trials, qualitative studies, and systematic reviews. Articles were included if they were published in English and addressed the psychological or social contributors to dental anxiety in children. Exclusion criteria eliminated studies centered on adult populations, non-peer-reviewed works, irrelevant topics unrelated to dental anxiety, and duplicate publications.

To strengthen reliability, a multi-stage screening process was adopted. Initial screening was based on title and abstract review, followed by full-text evaluation for relevance and methodological rigor. Four independent reviewers assessed each study to ensure alignment with inclusion parameters. Key themes were synthesized to identify recurring patterns in the development, manifestations, and interventions related to pediatric dental anxiety. The findings offer critical insights into how psychological, familial, and systemic variables intersect to influence children's dental experiences and highlight directions for more effective clinical management.

RESULT AND DISCUSSION

The emergence and persistence of dental anxiety in children are deeply embedded in a matrix of psychosocial influences, environmental triggers, and clinical interactions. This section synthesizes key findings from the literature across four dominant themes: psychosocial determinants, environmental and procedural elements, non-pharmacological interventions, and comparative international practices in managing pediatric dental anxiety.

Parental anxiety and familial dental history emerged as dominant influences on children's perceptions of dental care. Studies highlight that children often model emotional responses after their caregivers, particularly mothers, whose dental anxiety significantly correlates with increased fear levels in their children (Cadillo-Ibarra et al., 2022; Petrović et al., 2024). This modeling effect underscores the intergenerational transmission of anxiety and the necessity of parent-focused interventions. Moreover, familial experiences with dental trauma or discomfort contribute to a narrative in which children develop conditioned fears of dental visits. Observational learning, combined with emotional cues within the family, may perpetuate a cycle of avoidance and heightened anxiety (Peng et al., 2024; Uziel et al., 2023).

Previous traumatic experiences further compound the problem. Children who endure painful or emotionally distressing dental procedures often associate future visits with fear and unease (Nermo et al., 2021; Peng et al., 2024). Negative conditioning and anticipatory anxiety are frequently reported, reinforcing avoidance behaviors. This finding emphasizes the importance of minimizing trauma during early dental interactions to prevent lasting adverse responses (Padmanabhan et al., 2023).

Behavioral traits, including temperament and neurodiversity, also play a pivotal role in dental anxiety. Children characterized by high emotional reactivity and low adaptability are particularly susceptible to anxiety during dental procedures (Aarvik et al., 2022; Minh et al., 2023). Shy and introverted children often struggle in environments requiring social engagement, particularly those filled with unfamiliar stimuli, such as dental clinics (Dai et al., 2022; JÚNIOR et al., 2021). Neurodiverse children, especially those on the autism spectrum, present heightened sensory sensitivities and anxiety, necessitating individualized care plans (Park et al., 2022).

Clinical environments and procedural components significantly affect children's anxiety levels. The traditional sterile and mechanical design of dental clinics often evokes fear in children. However, clinics that incorporate colorful decor, interactive visuals, and comforting layouts report lower anxiety among pediatric patients (Patel et al., 2025; Sathyaprasad et al., 2024). The use of non-invasive technologies and distraction tools during procedures has also been linked to reduced stress, particularly for children undergoing treatments involving drills or needles (Erić et al., 2025; Gussgard et al., 2022). Techniques such as therapy dog assistance, virtual reality headsets, and music therapy have gained popularity as supportive interventions that decrease psychological discomfort (Alabduljabbar et al., 2023; Hegde et al., 2021).

Dentist attire and communication further influence anxiety levels. Informal clothing and colorful uniforms are generally preferred over traditional white coats, which may appear intimidating to children (Bchara et al., 2024). Communication strategies emphasizing empathy, non-technical language, and child involvement have proven effective in alleviating fear. When dentists explain procedures using age-appropriate language and foster trust, they help diminish uncertainty and build a sense of control for the child (Bagavathy et al., 2024; Petrović et al., 2024).

Environmental modifications within dental clinics have demonstrated efficacy in addressing sensory triggers of dental anxiety. The implementation of sensory-adapted dental environments (SADE),

featuring soothing lighting, reduced ambient noise, and interactive digital elements, significantly improves children's cooperation and comfort (Fallea et al., 2022; Tirupathi & Afnan, 2024). The availability of digital tablets and cartoons as distraction tools has been especially successful in redirecting attention and reducing stress during procedures (Gao et al., 2021).

Non-pharmacological interventions have gained prominence as effective alternatives to sedation. Audio-visual distraction methods, such as the use of music and video, consistently yield reductions in anxiety levels by masking clinical sounds and providing calming stimuli (Mehrotra et al., 2023). Hypnosis has emerged as another viable intervention, promoting relaxation and focus among children undergoing procedures (Babu et al., 2025). Cognitive-behavioral therapy (CBT) is particularly notable for reshaping negative thought patterns. Clinical trials have shown that children exposed to CBT prior to treatment demonstrate improved compliance and decreased anxiety (Alkahtani, 2025; Shokravi et al., 2023).

Behavioral management techniques, including the Tell-Show-Do (TSD) method, are central to effective pediatric dental care. This approach empowers children by allowing them to visualize, understand, and gradually acclimate to the procedure. A study revealed that TSD yielded an 80% success rate in treatment outcomes and an 85% cooperation rate (Verma et al., 2024). Other successful behavioral strategies involve validating emotions and incorporating caregivers into the treatment process, further enhancing children's confidence (Floríndez et al., 2024).

Parental presence during treatment has also shown to be advantageous. When children are accompanied by their caregivers, they report greater emotional security and reduced behavioral resistance (Luca et al., 2021). Storybooks and visual aids, when used collaboratively by parents and dentists, enhance preparedness and reduce the fear of the unknown (Alsaadoon et al., 2022).

Global comparisons reveal substantial diversity in managing pediatric dental anxiety. Cultural values and healthcare infrastructures play defining roles. In some Asian cultures, stoicism is emphasized, while in Western societies, emotional expressiveness and patient-centered care dominate (Babu et al., 2025). Consequently, behavioral interventions like TSD are more common in the United States, whereas pharmacological sedation sees broader application in parts of Europe (Alabduljabbar et al., 2023; Du et al., 2022).

Technological integration also differs globally. Countries like Australia and the UK lead in applying virtual reality and interactive digital tools in pediatric dentistry (Rosa et al., 2023). Meanwhile, resource-limited countries continue to rely on traditional behavioral techniques due to cost constraints (Patil et al., 2025). Disparities in professional training further reflect these differences; nations with comprehensive pediatric dentistry programs report more consistent anxiety management outcomes (Patil et al., 2025).

Notably, best practices include incorporating play therapy and distraction tools, which are universally acknowledged as effective in promoting relaxation and enhancing treatment cooperation (Alkahtani, 2025). Parental involvement remains a consistent success factor across cultures, highlighting the role

of caregivers as emotional anchors during dental care (Joybell & Kumar, 2024; Razavi & Malekianzadeh, 2022).

Culturally adapted strategies, including the use of familiar characters and storytelling, have been shown to contextualize dental procedures in a child-friendly manner, enhancing comfort and reducing anxiety (Sanguida et al., 2023; Tang et al., 2023). Holistic environments that combine sensory-friendly designs with behavioral support have become benchmarks in countries prioritizing inclusive healthcare (Contac et al., 2025; Sandhyarani et al., 2020). Meanwhile, digital innovations like mobile applications and VR-based platforms have shown particular promise in developed settings, with potential for broader implementation pending cost adaptation (Dixit et al., 2023; Sarlak et al., 2022).

In conclusion, the literature reveals that pediatric dental anxiety is multifactorial, shaped by psychosocial, environmental, and systemic factors. A range of evidence-based non-pharmacological interventions, environmental adaptations, and culturally responsive practices have demonstrated success in mitigating anxiety. International comparisons offer valuable insights for building inclusive, child-friendly dental environments that promote comfort, cooperation, and positive long-term oral health behaviors.

Systemic and institutional factors significantly influence the development and management of dental anxiety in children. One of the most decisive systemic determinants is access to specialized pediatric dental care. Countries that have invested in pediatric dental education and institutionalized training programs report more effective management of dental anxiety in children (Du et al., 2022; Enshaei et al., 2024). Pediatric dental specialists are trained not only in clinical techniques but also in behavioral and psychological management, which equips them to handle the nuances of treating anxious children. In contrast, countries with limited or generalized dental education often lack structured responses to pediatric dental anxiety, leaving children more vulnerable to distress during dental visits.

Health policies further underscore these disparities. In regions where dental health policies are integrated into broader health systems that include mental health support, clinicians are better equipped to identify and manage anxiety early. Policies promoting preventive dental visits, early childhood education on oral hygiene, and cross-sector collaborations with mental health professionals have demonstrated success in reducing dental anxiety rates (Bocklage et al., 2024). Conversely, the absence of such policies results in fragmented care, with dental professionals left unsupported in addressing psychological barriers to treatment. Children in these settings face compounded vulnerabilities, particularly when mental health is stigmatized or not prioritized within public health frameworks (Slabšinskienė et al., 2021).

The findings of this review also carry significant implications for clinical practice. The demonstrated effectiveness of non-pharmacological interventions such as virtual reality and audiovisual distraction underscores the need to incorporate such innovations into standard pediatric dental care. These interventions have been shown to be not only safe and child-friendly but also scalable across different clinical environments (Esa et al., 2020; Rosa et al., 2023). Dental professionals who adapt these

strategies tend to report higher patient satisfaction and treatment compliance, reinforcing the utility of investing in such tools.

Moreover, the impact of familial and psychological factors as determinants of dental anxiety necessitates a more holistic approach to treatment. The literature emphasizes the influence of parental anxiety on children's emotional responses to dental care (Alkahtani, 2025; Vlad et al., 2020). This highlights the importance of including parents in treatment planning, not only as emotional supporters but as active participants who can model calm and cooperative behavior. Training programs for dental practitioners should therefore extend beyond clinical competency to include modules on effective communication, parental counseling, and behavioral science (Peng et al., 2024; Reynolds et al., 2022).

Evidence-based interventions are essential for transforming these findings into actionable policies. Integrating dental health education into school curricula offers an early opportunity to familiarize children with oral hygiene concepts and reduce fear associated with dental visits. Educational materials that use age-appropriate storytelling and interactive learning have been found to improve children's perceptions of dental care and reduce anticipatory anxiety (Kohli et al., 2023; Schibbye et al., 2024). Such initiatives also offer a platform to identify children at risk of dental anxiety, enabling early psychological intervention.

Community engagement plays a pivotal role in bridging the gap between clinical services and real-world experiences. When dental professionals engage parents and caregivers through workshops, informational sessions, and culturally adapted educational tools, they foster a community-oriented approach to anxiety management (Girón et al., 2024; Huang et al., 2024). These initiatives empower families to take an active role in their children's dental care and can help normalize positive attitudes toward oral health. In parallel, telehealth services provide an innovative medium to reach underserved populations and deliver pre-visit counseling, particularly in areas with limited physical access to pediatric dental specialists (Kohli et al., 2023; Patil et al., 2025).

The standardization of guidelines based on empirical research is another essential step toward ensuring consistency in clinical practice. Institutions should promote protocols that are rooted in psychological science and clinical efficacy, supporting practitioners in selecting and evaluating the most appropriate strategies for managing anxiety in children (Reynolds et al., 2023; Sarlak et al., 2022). By implementing these guidelines, dental clinics can adopt a more unified and effective approach to pediatric dental care that prioritizes both physical and psychological well-being.

While this review provides a comprehensive synthesis of current literature on pediatric dental anxiety, several limitations should be acknowledged. One significant limitation is the variation in methodologies and outcome measures across the included studies, which may affect the comparability of results. Many studies relied on self-reported measures of anxiety, which can be influenced by recall bias or social desirability. Moreover, a large portion of the existing literature is concentrated in high-income countries, limiting the generalizability of findings to low- and middle-income contexts. Another limitation involves the lack of long-term follow-up data to assess the enduring effectiveness

of non-pharmacological interventions. Future reviews should consider incorporating longitudinal studies to better understand the sustained impact of various management strategies.

The findings of this review underscore the urgent need for continued research in several key areas. First, there is a pressing demand for longitudinal and cross-cultural studies to evaluate the long-term efficacy of both traditional and innovative interventions. Research should aim to include diverse populations to ensure that findings are applicable across different socio-economic and cultural contexts. Second, more rigorous randomized controlled trials are needed to assess the comparative effectiveness of various non-pharmacological strategies, including the role of sensory-adapted environments, parental counseling, and behavioral techniques. Future research should also explore how digital tools can be scaled in resource-limited settings to expand access to effective anxiety management strategies. Finally, there is a need to investigate the integration of pediatric dental anxiety management into broader healthcare policies, focusing on interprofessional collaboration between dental, psychological, and educational stakeholders.

CONCLUSION

This review has revealed that pediatric dental anxiety is a multifactorial condition influenced by psychosocial variables, clinical settings, and systemic healthcare structures. Key findings highlight the significant roles of parental anxiety, early traumatic experiences, behavioral traits, and neurodiversity in shaping children's responses to dental environments. Moreover, clinical procedures and dentist-patient interactions, including environmental design and communication styles, contribute meaningfully to either mitigating or exacerbating anxiety levels. The review underscores the effectiveness of non-pharmacological interventions such as audiovisual distraction, cognitive-behavioral techniques, and the Tell-Show-Do method in reducing fear and improving treatment compliance.

These findings reaffirm the urgency of addressing dental anxiety as both an individual and public health concern. Without targeted interventions, untreated anxiety can perpetuate avoidance behaviors, deteriorate oral health outcomes, and widen health disparities. Therefore, comprehensive strategies are required, including integrating anxiety management into clinical training programs, promoting parental education, and enhancing pediatric dental environments through sensory adaptations.

At the systemic level, health policies should prioritize early screening, school-based dental education, and the establishment of standardized guidelines rooted in empirical evidence. Future research should focus on longitudinal studies assessing the long-term impact of interventions across diverse populations. Investigating scalable digital and community-based solutions will be crucial in extending care equity. Ultimately, the use of behavioral management and environmental adaptation strategies emerges as a cornerstone in overcoming pediatric dental anxiety, fostering positive experiences, and promoting long-term oral health resilience.

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