

Keywords

Dental anxiety; Dental fear; Dental phobia; Cognitive behavioral therapy; Behavioral management; Sedation; Nitrous oxide; Patient outcomes; Oral health-related quality of life; Dental practice.

Authors

¹Mada Arfaj

Associate consultant, Prince Mohammed Bin Abdulaziz Hospital-Medinah NGHHA

²Abrar Suliman Alalwi

Dental Assistant1 Prince Mohammed Bin Abdulaziz Hospital-Medinah NGHHA

³Abdullah Almahmoud

Dental Assistant, Prince Mohammed Bin Abdulaziz Hospital-Medinah NGHHA

⁴Najwan Alhejaili

Dental Assistant, Prince Mohammed Bin Abdulaziz Hospital-Medinah NGHHA

⁵Malath Falatah

Dental Assistant, Prince Mohammed Bin Abdulaziz Hospital-Medinah NGHHA

⁶Ghayah Faisal Alhujaili

Dental assistant, Prince Mohammed Bin Abdulaziz, Hospital (NGHA)

⁶Amal Hamzah Alnakhli

Dental assistant, Prince Mohammed Bin, Abdulaziz Hospital (NGHA)

⁷Marouj Sabri Sabr

Dental assistant, Prince Mohammed Bin, Abdulaziz Hospital (NGHA)

⁸Layla Ahmad Alshanqeeti

Supervisor Dental clinic, Prince Mohammed Bin Abdulaziz Hospital(NGHA)

⁹Hamdan MohammedAli Alhejaili

Dental Assistant, Prince Mohammed Bin Abdulaziz Hospital (NGHA)

¹⁰Wadee Muneer Farghal

Dental Hygienist, Prince Mohammed bin Abdulaziz Hospital (NGHA)

Address for correspondence: Mada Arfaj
Associate consultant, Prince Mohammed Bin Abdulaziz Hospital-Medinah NGHHA

Patient dental anxiety management techniques, practical, affects patient outcomes

Abstract

Dental anxiety is one of the most prevalent psychological barriers to oral healthcare and remains a major challenge in contemporary dental practice. Affecting both children and adults, dental anxiety ranges from mild apprehension to severe dental phobia and is associated with delayed attendance, poor oral health, increased treatment complexity, heightened pain perception, and reduced oral health-related quality of life. Consequently, effective management of dental anxiety has become an essential component of patient-centered dentistry rather than merely an adjunct to technical dental care.

Management strategies encompass a wide spectrum of behavioral, psychological, environmental, technological, and pharmacological interventions. Contemporary evidence demonstrates that communication-based approaches, behavioral guidance, relaxation techniques, cognitive behavioral therapy (CBT), distraction methods, music therapy, virtual reality, and sedation each have distinct roles depending on patient characteristics, anxiety severity, and treatment requirements. While pharmacological techniques facilitate immediate treatment by reducing procedural anxiety, psychological interventions remain superior for achieving sustained reductions in dental fear and avoidance.

Recent systematic reviews indicate that individualized, multimodal anxiety management significantly improves patient cooperation, treatment completion, pain perception, physiological stress, patient satisfaction, appointment adherence, and long-term oral healthcare utilization. These findings emphasize the importance of integrating validated anxiety assessment tools with evidence-based management strategies tailored to individual patient needs.

This comprehensive review critically examines the epidemiology, pathophysiology, assessment, and management of dental anxiety, with particular emphasis on practical clinical applications and their influence on both clinical and patient-reported outcomes. Evidence supporting behavioral, psychological, technological, and pharmacological interventions is reviewed, and a practical framework is proposed to assist clinicians in selecting appropriate anxiety-management strategies according to patient characteristics and treatment complexity.

Received: 11-05-2026

Revised: 16-07-2026

Accepted: 06-08-2026

Doi: 10.1922/ejprd.v34i7s.1792

..... EJPRD

INTRODUCTION

Dental anxiety is a common emotional response characterized by apprehension or fear associated with anticipated or actual dental treatment. Although anxiety, fear, and dental phobia are frequently used interchangeably in the literature, they represent different points along a clinical spectrum. Dental anxiety generally refers to anticipatory concern regarding future dental treatment, whereas dental fear is an immediate emotional response to specific dental stimuli such as injections, rotary instruments, or extractions. Dental phobia represents the most severe form, characterized by persistent and excessive fear leading to avoidance of dental care and significant impairment in oral health and quality of life [1].

Despite major advances in pain control, minimally invasive dentistry, behavioral guidance, and sedation techniques, dental anxiety remains highly prevalent worldwide. A systematic review and meta-analysis estimated that approximately 15% of adults experience clinically significant dental anxiety, while severe dental fear affects approximately 3–4% of the population [2]. Among children and adolescents, the prevalence is even higher, with pooled estimates approaching one-quarter of pediatric patients, highlighting the importance of early recognition and intervention [3].

Dental anxiety has profound clinical implications extending far beyond emotional discomfort. Anxious patients frequently postpone or avoid routine dental visits, leading to progression of oral disease and increased need for invasive treatment. This phenomenon creates the well-described vicious cycle of dental anxiety, in which fear leads to avoidance, avoidance results in worsening oral health, deteriorating oral health necessitates more invasive treatment, and these negative experiences further reinforce anxiety [4]. Breaking this cycle is therefore a major objective of modern dental care.

The consequences of dental anxiety are multidimensional. Clinically, anxious patients exhibit increased pain perception, reduced tolerance for procedures, impaired cooperation, prolonged treatment times, and greater likelihood of appointment cancellation or incomplete treatment [5]. Psychologically, dental anxiety contributes to embarrassment, reduced self-confidence, and diminished oral health-related quality of life. Physiologically, anxiety activates the sympathetic nervous system, producing tachycardia, hypertension, sweating, muscle tension, and elevated cortisol levels, which may complicate treatment in susceptible individuals [6].

Etiologically, dental anxiety is multifactorial. Previous traumatic dental experiences, fear of pain, negative expectations, loss of control, personality traits, parental influence, and sociocultural factors all contribute to its development and persistence [7]. Advances in neuroscience have further demonstrated that anxiety involves interactions among the amygdala, hippocampus, prefrontal cortex, and hypothalamic–pituitary–adrenal axis, linking emotional processing with pain perception

and autonomic responses [8]. These mechanisms help explain why patients with identical clinical conditions

may experience markedly different levels of anxiety and procedural discomfort.

Recognition of dental anxiety has prompted the development of several validated assessment instruments, including the Corah Dental Anxiety Scale (DAS), the Modified Dental Anxiety Scale (MDAS), the Dental Fear Survey (DFS), and the Index of Dental Anxiety and Fear (IDAF-4C+). These tools facilitate standardized screening, identify patients requiring additional support, and allow clinicians to evaluate treatment outcomes over time [9].

Management of dental anxiety has evolved from simple reassurance to comprehensive, evidence-based approaches incorporating behavioral guidance, cognitive and psychological therapies, technological innovations, and pharmacological sedation. Contemporary guidelines emphasize that communication, empathy, patient autonomy, and individualized care should underpin all anxiety-management strategies regardless of procedural complexity [10]. Behavioral interventions such as Tell–Show–Do, relaxation techniques, positive reinforcement, distraction, and CBT have demonstrated significant benefits in reducing anxiety and improving cooperation, while nitrous oxide, oral anxiolysis, intravenous sedation, and general anesthesia remain valuable adjuncts for appropriately selected patients [11–13].

Importantly, successful management should be evaluated using outcomes beyond procedural completion. Contemporary research increasingly emphasizes patient-reported outcomes—including pain perception, satisfaction, willingness to return for future care, trust in the clinician, and oral health-related quality of life—as indicators of treatment success. Psychological interventions, particularly CBT and graded exposure, appear superior in producing sustained reductions in dental avoidance, whereas pharmacological approaches primarily improve tolerance of individual procedures [14].

Accordingly, effective management requires an individualized, severity-based approach that integrates validated assessment with evidence-based intervention. Rather than applying identical strategies to every anxious patient, clinicians should tailor management according to anxiety severity, patient characteristics, treatment complexity, and long-term therapeutic goals.

The purpose of this review is to critically evaluate the current evidence regarding the epidemiology, pathophysiology, assessment, and management of dental anxiety, with particular emphasis on practical clinical application and the influence of anxiety-management strategies on clinical and patient-reported outcomes. By synthesizing contemporary evidence and translating it into clinically applicable recommendations, this review aims to provide a practical framework for improving both the patient experience and the quality of dental care.

2. Etiology and Risk Factors of Dental Anxiety

Dental anxiety is a complex, multifactorial condition resulting from interactions among biological predisposition, psychological vulnerability, previous learning experiences, environmental influences, and sociocultural determinants. Rather than representing a

single disease entity, dental anxiety is increasingly recognized as a spectrum of emotional responses influenced by cognitive, behavioral, and neurophysiological mechanisms. Consequently, understanding its etiology is fundamental for selecting appropriate management strategies because interventions effective for one patient may be ineffective for another depending on the underlying cause [15].

The contemporary biopsychosocial model provides the most comprehensive explanation for dental anxiety. This model proposes that anxiety develops through dynamic interactions among genetic susceptibility, individual psychological characteristics, previous traumatic experiences, environmental stimuli, and social learning. These factors influence not only the onset of dental anxiety but also its persistence, severity, and response to treatment. Patients with similar dental experiences may therefore demonstrate markedly different emotional responses because of differences in cognitive processing, resilience, coping strategies, and biological predisposition [16].

2.1 Learning Theory and the Development of Dental Anxiety

Behavioral learning theory remains one of the most influential explanations for dental anxiety. Classical conditioning proposes that neutral dental stimuli become associated with pain or distress following unpleasant dental experiences. For example, a child who experiences pain during local anesthetic administration may subsequently associate the dental chair, the smell of the clinic, or the sound of a dental handpiece with anticipated pain. Over time, these previously neutral stimuli become conditioned triggers capable of producing anxiety even before treatment begins [17].

Operant conditioning further reinforces anxiety through avoidance behavior. Patients who postpone or cancel appointments experience immediate relief from anxiety, which negatively reinforces avoidance and increases the likelihood of future non-attendance. Unfortunately, delayed treatment often results in disease progression, requiring more invasive procedures that subsequently reinforce the original fear. This sequence forms the well-established vicious cycle of dental anxiety, in which fear leads to avoidance, avoidance worsens oral health, deteriorating oral health requires more invasive treatment, and these experiences further strengthen anxiety [4,18]. Observational learning also contributes significantly, particularly during childhood. Children frequently acquire dental fear by observing anxious parents or siblings or by hearing negative stories regarding dental treatment. Media portrayals emphasizing pain and unpleasant dental experiences may similarly influence expectations before a patient's first dental visit [19].

2.2 Neurobiology of Dental Anxiety

Advances in neuroscience have improved understanding of the biological mechanisms underlying dental anxiety. Emotional responses to threatening stimuli are primarily mediated by interconnected neural networks involving the amygdala, hippocampus, insula, anterior cingulate cortex, and prefrontal cortex. Among these structures, the amygdala plays a central role in recognizing perceived threats and initiating autonomic fear responses [20].

Activation of these neural pathways stimulates the hypothalamic–pituitary–adrenal (HPA) axis and sympathetic nervous system, resulting in increased secretion of catecholamines and cortisol. Clinically, this manifests as tachycardia, elevated blood pressure, sweating, tremor, hyperventilation, muscle tension, and heightened vigilance—all commonly observed in anxious dental patients [21].

The prefrontal cortex normally regulates emotional responses generated by the amygdala. However, individuals with anxiety disorders often demonstrate impaired top-down regulation, allowing exaggerated fear responses to persist despite reassurance. Neuroimaging studies suggest that dental anxiety shares many neurobiological characteristics with other specific phobias, supporting the rationale for psychological interventions such as Cognitive Behavioral Therapy (CBT), which aims to strengthen cognitive regulation of maladaptive fear responses [22].

Pain perception is also closely linked to anxiety through shared neural pathways. Anticipatory anxiety enhances nociceptive processing and lowers pain thresholds, explaining why anxious patients frequently report greater procedural pain despite receiving identical dental treatment and local anesthesia. Consequently, anxiety and pain reinforce one another, contributing to persistent avoidance behavior [23].

2.3 Previous Traumatic Dental Experiences

Among all recognized risk factors, previous traumatic dental experiences remain the most consistent predictor of future dental anxiety [24]. Negative experiences may include painful procedures, inadequate anesthesia, emergency treatment, traumatic extractions, insensitive communication, perceived loss of control, or feeling ignored by healthcare providers.

Childhood experiences appear particularly influential because emotional memories formed during periods of heightened stress are more likely to persist into adulthood. A single painful or distressing appointment may establish long-lasting conditioned fear that generalizes to all subsequent dental treatment [25].

Importantly, trauma is subjective rather than procedure-specific. Patients frequently describe feelings of helplessness, embarrassment, or poor communication as equally distressing as physical pain. Therefore, minimizing psychological distress is as important as achieving effective analgesia during treatment.

2.4 Fear of Pain and Pain Expectation

Fear of pain is consistently identified as one of the strongest determinants of dental anxiety. Surveys demonstrate that local anesthetic injections, rotary instruments, extractions, and endodontic procedures are among the most feared aspects of dental treatment [26].

Expectation strongly influences pain perception through cognitive modulation of nociceptive processing. Patients anticipating severe pain exhibit greater physiological arousal before treatment and subsequently report higher pain intensity during procedures. Furthermore, individuals with high anxiety often recall previous procedures as being considerably more painful than

objective assessments suggest, a phenomenon known as pain memory distortion [27].

These findings emphasize the importance of providing effective local anesthesia, realistic preoperative information, and reassurance to reduce catastrophic expectations before treatment begins.

2.5 Psychological Characteristics

Dental anxiety frequently coexists with broader psychological disorders including generalized anxiety disorder, panic disorder, depression, health anxiety, and post-traumatic stress disorder [28]. Personality traits also influence susceptibility. Individuals with high neuroticism, low emotional stability, reduced self-efficacy, intolerance of uncertainty, and catastrophizing tendencies consistently demonstrate higher dental anxiety scores [29].

Catastrophizing is particularly important because it amplifies both anxiety and pain perception. Patients who catastrophize tend to exaggerate anticipated pain, overestimate procedural risk, and underestimate their ability to cope successfully. These maladaptive beliefs represent major therapeutic targets during cognitive behavioral interventions.

2.6 Age and Sex

Dental anxiety occurs across all age groups but demonstrates important demographic variations. Pediatric populations exhibit the highest prevalence, particularly during preschool and early school years when unfamiliar environments, limited coping skills, and dependence on caregivers increase vulnerability [3,30].

Several epidemiological studies report higher anxiety scores among females than males, although biological, psychological, and sociocultural explanations remain debated. Women may demonstrate greater willingness to report anxiety, whereas men may underreport emotional distress because of cultural expectations. Nevertheless, sex differences are generally smaller than differences attributable to previous traumatic experiences or personality characteristics [31].

Older adults often report lower anxiety than younger individuals, possibly reflecting greater dental experience, improved coping mechanisms, or advances in modern dentistry that reduce painful procedures.

2.7 Family and Social Influences

Parents play a crucial role in shaping children's perceptions of dental care. Numerous studies demonstrate positive correlations between parental dental anxiety and child dental anxiety, suggesting both genetic predisposition and observational learning contribute to fear development [32]. Anxious parents may unintentionally transmit fear through verbal warnings, anxious facial expressions, or avoidance behaviors before appointments.

Peer influence, cultural beliefs, and media exposure also affect patient expectations. Negative stories shared by family members, friends, or social media platforms may increase anticipatory anxiety even among individuals without previous dental experience.

2.8 Dentist-Related and Environmental Factors

Dental anxiety is influenced not only by patient characteristics but also by the clinical environment and healthcare professionals. Poor communication, rushed appointments, inadequate explanation of procedures, perceived lack of empathy, and insufficient pain control consistently increase anxiety and reduce patient trust [33]. Environmental stimuli—including drilling sounds, antiseptic odors, bright lighting, visible needles, and unfamiliar instruments—may trigger conditioned fear responses before treatment begins. These findings support the use of sensory-adapted environments, calming clinic design, and patient-centered communication to reduce anticipatory stress.

2.9 Procedure-Specific Anxiety

Anxiety varies considerably according to the planned dental procedure. Local anesthetic injections are consistently identified as the most anxiety-provoking aspect of treatment, followed by tooth extraction, root canal therapy, and surgical procedures [34]. Fear of gagging, choking, loss of control, and inability to communicate during treatment are additional concerns frequently reported by patients.

Recognition of procedure-specific fears allows clinicians to tailor management appropriately. For example, patients with needle phobia may benefit from topical anesthesia, distraction techniques, or computer-controlled local anesthetic delivery, whereas individuals fearful of prolonged procedures may require enhanced communication, scheduled breaks, or conscious sedation [Table1] .

2.10 Clinical Implications

Dental anxiety develops through the interaction of biological, psychological, behavioral, and environmental factors rather than a single causative mechanism. Previous traumatic experiences, fear of pain, maladaptive cognitions, personality traits, family influence, and negative clinical environments all contribute to its development and persistence. Consequently, successful management requires individualized assessment to identify the predominant factors influencing each patient. Appreciating the multifactorial nature of dental anxiety enables clinicians to move beyond simple reassurance and implement targeted interventions that address both immediate procedural anxiety and long-term avoidance behavior [35].

Table 1. Major Risk Factors Associated with Dental Anxiety

Risk factor	Mechanism	Clinical implication
Previous traumatic dental experience	Classical conditioning	Strongest predictor of future anxiety
Fear of pain	Anticipatory pain amplification	Requires excellent pain control and communication
Catastrophizing	Negative cognitive appraisal	Target for CBT
General anxiety disorders	Increased emotional vulnerability	May require multidisciplinary management
Female sex	Higher reported anxiety prevalence	Individualized assessment required
Childhood age	Limited coping ability	Behavioral guidance essential
Parental anxiety	Observational learning	Parent counseling may be beneficial
Poor dentist–patient communication	Reduced trust and perceived control	Patient-centered communication recommended
Negative clinical environment	Sensory triggers	Environmental modification may reduce stress
Previous avoidance	Reinforcement of fear	Gradual exposure and behavioral interventions recommended

3. Assessment of Dental Anxiety

Accurate assessment of dental anxiety is essential because management should be based on the severity of anxiety rather than the planned dental procedure alone. Early identification enables clinicians to select appropriate behavioral or pharmacological interventions, improve communication, and anticipate potential difficulties during treatment. Assessment should combine a focused clinical interview with validated anxiety scales whenever possible [36].

The clinical interview remains the first step in assessment. Patients should be asked about previous dental experiences, specific triggers (e.g., injections, drilling, gagging, or extractions), previous avoidance of dental care, and any history of sedation or general anesthesia. Simple questions such as "What worries you most about today's treatment?" often identify the principal source of anxiety and guide individualized management [37].

Several validated questionnaires are available, each with specific strengths and limitations.

The Modified Dental Anxiety Scale (MDAS) is the most widely used instrument in clinical practice. It consists of five questions evaluating anxiety related to common dental situations, including local anesthetic injection. Scores range from 5 to 25, with scores ≥ 19 generally indicating severe dental anxiety and possible dental phobia requiring additional management [38].

The Corah Dental Anxiety Scale (DAS) remains a well-established tool consisting of four questions assessing anticipatory anxiety before dental treatment. Although reliable and easy to administer, it does not specifically evaluate anxiety related to local anesthesia, making the MDAS more useful in modern practice [39].

The Dental Fear Survey (DFS) provides a more comprehensive evaluation by assessing avoidance behaviors, physiological responses, and fear of specific dental procedures. Because of its greater length, it is

primarily used in research rather than routine clinical practice [40].

For children, assessment should incorporate both self-report and behavioral observation. The Facial Image Scale (FIS) is a simple visual tool allowing young children to indicate their emotional state by selecting facial expressions ranging from very happy to very distressed. During treatment, the Frankl Behavior Rating Scale classifies behavior into four categories ranging from definitely negative to definitely positive, helping clinicians evaluate cooperation and monitor behavioral progress over successive visits [41].

Physiological parameters such as heart rate, blood pressure, respiratory rate, and salivary cortisol have also been investigated as objective indicators of anxiety. Although useful in research settings, these measures are influenced by numerous factors and should complement rather than replace clinical assessment [42].

Following assessment, patients can be broadly classified into four categories:

- Mild anxiety: Cooperative patients with minor apprehension who generally respond to reassurance and effective communication.
- Moderate anxiety: Patients requiring behavioral guidance, relaxation techniques, distraction, or minimal sedation.
- Severe anxiety: Individuals demonstrating marked fear, avoidance behavior, or inability to tolerate treatment without advanced behavioral or pharmacological support.
- Dental phobia: Patients with persistent avoidance causing significant impairment, often requiring multidisciplinary management involving cognitive behavioral therapy and sedation or general anesthesia [36,43].

Routine anxiety screening should become part of every comprehensive dental examination. Identifying anxiety

before treatment improves patient-centered care, facilitates treatment planning, reduces unexpected behavioral problems, and enables clinicians to select the

least invasive intervention capable of achieving safe and effective treatment [Table 2].

Table 2. Commonly Used Dental Anxiety Assessment Tools

Instrument	Population	Score	Main Advantage	Limitation
Modified Dental Anxiety Scale (MDAS)	Adults & adolescents	5–25	Simple, validated, includes injection anxiety	Self-reported
Corah Dental Anxiety Scale (DAS)	Adults	4–20	Widely validated, rapid	Does not assess injection anxiety
Dental Fear Survey (DFS)	Adults	Variable	Comprehensive assessment	Time-consuming
Facial Image Scale (FIS)	Young children	Visual scale	Easy for preschool children	Limited detail
Frankl Behavior Rating Scale	Children	4 behavioral categories	Assesses cooperation during treatment	Observer dependent

4. Evidence-Based Management of Dental Anxiety

Management of dental anxiety should follow a stepwise, patient-centered approach, with the least invasive intervention capable of achieving safe and comfortable treatment. The choice of technique depends on anxiety severity, patient age, previous dental experiences, medical status, and procedural complexity. Current evidence supports combining behavioral and pharmacological strategies rather than relying on a single intervention, particularly in patients with moderate or severe anxiety [44] [Table 3].

4.1 Non-Pharmacological Management

Non-pharmacological approaches are recommended as the first-line treatment for most patients because they improve both immediate treatment tolerance and long-term acceptance of dental care.

Patient-Centered Communication

Effective communication is the cornerstone of anxiety management. Establishing rapport, actively listening to patients' concerns, explaining procedures in simple language, and encouraging questions reduce uncertainty and increase trust. Providing patients with a stop signal and allowing short breaks during treatment further enhances their sense of control and significantly reduces anxiety [45].

Tell–Show–Do and Behavioral Guidance

The Tell–Show–Do (TSD) technique remains one of the most effective behavioral methods, particularly in pediatric dentistry. By explaining, demonstrating, and then performing the procedure, TSD reduces fear of unfamiliar instruments and improves cooperation. Positive reinforcement, modeling, and gradual familiarization further increase treatment acceptance, especially in children and first-time dental patients [43].

Relaxation and Distraction

Relaxation techniques such as diaphragmatic breathing, progressive muscle relaxation, and guided imagery reduce sympathetic nervous system activity and improve patient comfort. Distraction through conversation, music, audiovisual media, or television also decreases attention to threatening dental stimuli and has been shown to reduce both anxiety and perceived pain [46].

Cognitive Behavioral Therapy

Cognitive Behavioral Therapy (CBT) is considered the most effective psychological intervention for patients with moderate-to-severe dental anxiety and dental phobia. CBT addresses maladaptive beliefs, catastrophizing, and avoidance behaviors while teaching patients practical coping skills. Systematic reviews demonstrate that CBT produces significant long-term reductions in anxiety and improves future attendance at dental appointments, making it superior to sedation alone for long-term management [47].

Virtual Reality and Other Emerging Techniques

Virtual reality (VR) has gained increasing attention as an adjunctive distraction technique. By immersing patients in interactive virtual environments, VR reduces awareness of dental procedures and lowers anxiety and pain, particularly among pediatric patients. Although promising, long-term evidence remains limited, and VR should currently be considered a complementary rather than a replacement intervention [48].

4.2 Pharmacological Management

Pharmacological interventions are indicated when behavioral techniques alone are insufficient or when extensive or invasive treatment is planned.

Local Anesthesia

Profound local anesthesia is fundamental because fear of pain is a major contributor to dental anxiety. Careful injection techniques, topical anesthetics, and effective communication improve patient comfort and confidence [49].

Nitrous Oxide–Oxygen Sedation

Nitrous oxide is the most commonly used minimal sedation technique in dentistry. It provides rapid anxiolysis, excellent safety, and quick recovery while maintaining protective reflexes and patient cooperation. It is particularly suitable for patients with mild-to-moderate anxiety and children [50].

Oral and Intravenous Sedation

Oral benzodiazepines may be appropriate for selected patients with moderate anxiety, whereas intravenous sedation provides predictable anxiolysis for patients with severe anxiety or extensive treatment needs. Both require

appropriate patient selection, monitoring, and adherence to professional sedation guidelines [51].

General Anesthesia

General anesthesia should be reserved for patients with severe dental phobia, inability to cooperate because of

medical or developmental conditions, or those requiring extensive dental rehabilitation. Although highly effective in facilitating treatment, it carries greater cost and medical risk and should be considered only when less invasive approaches are inappropriate or unsuccessful [52].

Table 3. Comparison of Common Dental Anxiety Management Techniques

Intervention	Best Indication	Main Advantages	Limitations
Patient-centered communication	All patients	Improves trust and cooperation	Operator dependent
Tell–Show–Do	Children, first visits	Simple and highly effective	Less effective in severe phobia
Relaxation techniques	Mild anxiety	Inexpensive and safe	Requires patient participation
Music/Audiovisual distraction	Mild–moderate anxiety	Reduces anxiety and pain	Short-term benefit
Cognitive Behavioral Therapy	Moderate–severe anxiety	Best long-term outcomes	Requires trained personnel
Virtual Reality	Children and anxious adults	Excellent procedural distraction	Equipment cost
Nitrous oxide sedation	Mild–moderate anxiety	Rapid onset and recovery	Limited effect in severe phobia
Oral/IV sedation	Moderate–severe anxiety	Facilitates complex treatment	Requires monitoring
General anesthesia	Extreme anxiety or special needs	Enables comprehensive treatment	Highest cost and risk

Clinical Perspective

Current evidence indicates that no single intervention is appropriate for every patient. Mild anxiety can often be managed with communication and behavioral techniques alone, whereas severe anxiety frequently requires a combination of CBT and pharmacological support. Integrating psychological and pharmacological strategies according to individual patient needs provides the highest likelihood of successful treatment and long-term reduction of dental anxiety [44,47].

5. Impact of Dental Anxiety Management on Patient Outcomes

Effective management of dental anxiety improves outcomes that extend well beyond immediate procedural comfort. Contemporary evidence demonstrates that reducing anxiety enhances clinical efficiency, improves patient cooperation, decreases perceived pain, and promotes long-term engagement with oral healthcare. Consequently, successful anxiety management should be considered an essential component of high-quality, patient-centered dental care rather than simply a means of completing treatment [53].

5.1 Clinical Outcomes

Patients with well-controlled anxiety generally demonstrate greater cooperation, tolerate procedures more effectively, and require fewer interruptions during treatment. Reduced anxiety is associated with shorter procedure times, improved quality of restorative and surgical procedures, lower rates of appointment

cancellation, and increased treatment completion. Adequate anxiety management also facilitates the successful delivery of local anesthesia and decreases the likelihood of emergency treatment resulting from prolonged avoidance of routine dental care [54].

5.2 Patient-Reported Outcomes

From the patient's perspective, successful anxiety management leads to lower perceived pain, greater satisfaction, improved confidence in the dental team, and a greater willingness to attend future appointments. These outcomes are particularly important because positive dental experiences help interrupt the vicious cycle of fear and avoidance. Patients who experience comfortable, well-managed treatment are more likely to return for preventive care and maintain regular dental attendance [55].

Oral health-related quality of life also improves following successful management of dental anxiety. Reduced fear allows patients to seek treatment earlier, maintain better oral hygiene, preserve dentition, and experience fewer functional, psychological, and social limitations associated with untreated oral disease [56].

5.3 Long-Term Benefits

Although sedation effectively facilitates individual procedures, psychological interventions—particularly Cognitive Behavioral Therapy (CBT) and graded exposure—provide greater long-term benefits by addressing the underlying causes of dental fear. Patients receiving these interventions demonstrate sustained

reductions in anxiety, decreased avoidance behavior, and improved long-term attendance compared with patients managed solely with pharmacological techniques [47,57]. A preventive approach is therefore essential. Early identification of anxious patients, positive first dental experiences during childhood, effective communication, and individualized management strategies reduce the likelihood of developing chronic dental anxiety later in life [43].

6. Conclusion

Dental anxiety remains one of the most significant barriers to effective oral healthcare worldwide. Its multifactorial etiology influences pain perception, treatment acceptance, oral health, and quality of life across all age groups. Contemporary evidence supports a patient-centered, individualized approach in which anxiety severity determines management strategy. Behavioral interventions—including effective communication, Tell–Show–Do, relaxation techniques, distraction, and particularly Cognitive Behavioral Therapy—form the cornerstone of long-term anxiety reduction, while nitrous oxide, conscious sedation, and general anesthesia remain valuable adjuncts for selected patients.

Successful management should not be measured solely by completion of dental procedures but also by improvements in patient confidence, satisfaction, willingness to return for future care, and long-term oral health outcomes. Integrating evidence-based behavioral and pharmacological strategies into routine dental practice allows clinicians to improve both clinical performance and the overall patient experience. As emerging technologies continue to evolve, individualized and multidisciplinary approaches are expected to further enhance the management of dental anxiety and promote lifelong engagement with oral healthcare.

References

1. Armfield JM. Towards a better understanding of dental anxiety and fear: cognitions vs experiences. *Eur J Oral Sci.* 2010;118(3):259-264.
2. Silveira ER, Cademartori MG, Schuch HS, Armfield JM, Demarco FF. Estimated prevalence of dental fear in adults: a systematic review and meta-analysis. *J Dent.* 2021;108:103632. doi:10.1016/j.jdent.2021.103632.
3. Grisolia BM, Dos Santos APP, Dhyppolito IM, Buchanan H, Hill K, Oliveira BH. Prevalence of dental anxiety in children and adolescents globally: a systematic review with meta-analyses. *Int J Paediatr Dent.* 2021;31(2):168-183. doi:10.1111/ipd.12712.
4. Armfield JM, Stewart JF, Spencer AJ. The vicious cycle of dental fear: exploring the interplay between oral health, service utilization and dental fear. *Community Dent Oral Epidemiol.* 2007;35(5):348-356.
5. Armfield JM. What goes around comes around: revisiting the hypothesized vicious cycle of dental fear and avoidance. *Community Dent Oral Epidemiol.* 2013;41(3):279-287. doi:10.1111/cdoe.12005.
6. Armfield JM, Heaton LJ. Management of fear and anxiety in the dental clinic: a review. *Aust Dent J.* 2013;58(4):390-407. doi:10.1111/adj.12118.
7. Appukuttan DP. Strategies to manage patients with dental anxiety and dental phobia: literature review. *Clin Cosmet Investig Dent.* 2016;8:35-50. doi:10.2147/CCIDE.S63626.
8. Carter AE, Carter G, Boschen M, AlShwaimi E, George R. Pathways of fear and anxiety in dentistry: a review. *World J Clin Cases.* 2014;2(11):642-653. doi:10.12998/wjcc.v2.i11.642.
9. Vermaire JH, de Jongh A, Aartman IHA. Dental anxiety and quality of life: the effect of dental treatment. *Community Dent Oral Epidemiol.* 2008;36(5):409-416. doi:10.1111/j.1600-0528.2007.00416.x.
10. Klingberg G, Broberg AG. Dental fear/anxiety and dental behaviour management problems in children and adolescents: a review of prevalence and concomitant psychological factors. *Int J Paediatr Dent.* 2007;17(6):391-406. doi:10.1111/j.1365-263X.2007.00872.x.
11. Ng SKS, Leung WK. A community study on the relationship of dental anxiety with oral health status and oral health-related quality of life. *Community Dent Oral Epidemiol.* 2008;36(4):347-356. doi:10.1111/j.1600-0528.2007.00412.x.
12. Locker D, Liddell A, Shapiro D. Diagnostic categories of dental anxiety: a population-based study. *Behav Res Ther.* 1999;37(1):25-37. doi:10.1016/S0005-7967(98)00105-3.
13. Oosterink FMD, de Jongh A, Hoogstraten J. Prevalence of dental fear and phobia relative to other fear and phobia subtypes. *Eur J Oral Sci.* 2009;117(2):135-143. doi:10.1111/j.1600-0722.2008.00602.x.
14. Rachman S. The conditioning theory of fear acquisition: a critical examination. *Behav Res Ther.* 1977;15(5):375-387.
15. Themessl-Huber M, Freeman R, Humphris G, MacGillivray S, Terzi N. Empirical evidence of the relationship between parental and child dental fear: a structured review and meta-analysis. *Int J Paediatr Dent.* 2010;20(2):83-101. doi:10.1111/j.1365-263X.2009.00998.x.
16. Shin LM, Liberzon I. The neurocircuitry of fear, stress, and anxiety disorders. *Neuropsychopharmacology.* 2010;35(1):169-191.
17. McEwen BS. Protective and damaging effects of stress mediators. *N Engl J Med.* 1998;338(3):171-179.
18. Wiech K, Tracey I. The influence of negative emotions on pain: behavioral effects and neural mechanisms. *Neuroimage.* 2009;47(3):987-994. doi:10.1016/j.neuroimage.2009.05.059.
19. Halonen H, Nissinen J, Lehtiniemi H, Salo T, Riipinen P, Miettunen J. The association between dental anxiety and psychiatric disorders and symptoms: a systematic review. *Clin Pract Epidemiol Ment Health.* 2018;14:207-222.
20. Cianetti S, Lombardo G, Lupatelli E, Pagano S, Abraha I, Montedori A, et al. Dental fear/anxiety

- among children and adolescents: a systematic review. *Eur J Paediatr Dent.* 2017;18(2):121-130. doi:10.23804/ejpd.2017.18.02.07.
21. Corah NL. Development of a dental anxiety scale. *J Dent Res.* 1969;48(4):596.
 22. Humphris GM, Morrison T, Lindsay SJE. The Modified Dental Anxiety Scale: validation and United Kingdom norms. *Community Dent Health.* 1995;12(3):143-150.
 23. Kleinknecht RA, Klepac RK, Alexander LD. Origins and characteristics of fear of dentistry. *J Am Dent Assoc.* 1973;86(4):842-848. doi:10.14219/jada.archive.1973.0165.
 24. Buchanan H, Niven N. Validation of a Facial Image Scale to assess child dental anxiety. *Int J Paediatr Dent.* 2002;12(1):47-52.
 25. Frankl SN, Shiere FR, Fogels HR. Should the parent remain with the child in the dental operator? *J Dent Child.* 1962;29:150-163.
 26. Leśna M, Górna K, Kwiatek J. High dental anxiety among adults worldwide: a systematic review and meta-analysis using the MDAS. *Br J Clin Psychol.* 2026. doi:10.1111/bjc.70049.
 27. Steenen SA, Linke F, van Westrhenen R, de Jongh A. Interventions to reduce adult state anxiety, dental trait anxiety, and dental phobia: a systematic review and meta-analyses of randomized controlled trials. *J Anxiety Disord.* 2024;105:102891. doi:10.1016/j.janxdis.2024.102891.
 28. Almarzouq SSFS, Chua H, Yiu CKY, Lam PPY. Effectiveness of nonpharmacological behavioural interventions in managing dental fear and anxiety among children: a systematic review and meta-analysis. *Healthcare (Basel).* 2024;12(5):537. doi:10.3390/healthcare12050537.
 29. Unnikrishnan G, Singh A, Purohit BM. Effectiveness of behavioural therapy and inhalational sedation in reducing dental anxiety among patients attending dental clinics: a systematic review and meta-analysis. *Evid Based Dent.* 2025;26(1):70-71. doi:10.1038/s41432-024-01081-9.
 30. Tan K, Liu H, Huang S, Li C. Efficacy of music intervention for dental anxiety disorders: a systematic review and meta-analysis. *Medicina (Kaunas).* 2023;59(2):209. doi:10.3390/medicina59020209.
 31. López-Valverde N, López-Valverde A, Macedo de Sousa B, Blanco Rueda JA. Efficacy of music therapy on stress and anxiety prior to dental treatment: a systematic review and meta-analysis of randomized clinical trials. *Front Psychiatry.* 2024;15:1352817. doi:10.3389/fpsy.2024.1352817.
 32. Marqués-Martínez L, Andrés J, García-Miralles E, Borell-García C, Aura-Tormos JJ, Guinot Barona C. Music therapy for managing dental anxiety in children: a systematic review and meta-analysis of clinical evidence. *Children (Basel).* 2025;12(10):1382. doi:10.3390/children12101382.
 33. Gurav KM, Kulkarni N, Shetty V, Vinay V, Borade P, Ghadge S, et al. Effectiveness of audio and audio-visual distraction aids for management of pain and anxiety in children and adults undergoing dental treatment: a systematic review and meta-analysis. *J Clin Pediatr Dent.* 2022;46(2):86-106. doi:10.17796/1053-4625-46.2.2.
 34. Barreiros D, Oliveira DSB, Queiroz AM, Silva RAB, Paula-Silva FWG, Küchler EC. Audiovisual distraction methods for anxiety in children during dental treatment: a systematic review and meta-analysis. *J Indian Soc Pedod Prev Dent.* 2018;36(1):2-8. doi:10.4103/JISPPD.JISPPD_188_16.
 35. Hao T, Pang J, Liu Q, Xin P. A systematic review and network meta-analysis of virtual reality, audiovisuals and music interventions for reducing dental anxiety related to tooth extraction. *BMC Oral Health.* 2023;23:684. doi:10.1186/s12903-023-03407-y.
 36. Yan X, Yan Y, Cao M, Xie W, O'Connor S, Lee JJ, Ho MH. Effectiveness of virtual reality distraction interventions to reduce dental anxiety in paediatric patients: a systematic review and meta-analysis. *J Dent.* 2023;132:104455. doi:10.1016/j.jdent.2023.104455.
 37. Rosa A, Pujia AM, Docimo R, Arcuri C. Managing dental phobia in children with the use of virtual reality: a systematic review of the current literature. *Children (Basel).* 2023;10(11):1763. doi:10.3390/children10111763.
 38. Wolf TG, Schläppi S, Benz CI, Campus G. Efficacy of hypnosis on dental anxiety and phobia: a systematic review and meta-analysis. *Brain Sci.* 2022;12(5):521. doi:10.3390/brainsci12050521.
 39. de Jongh A, Muris P, ter Horst G, van Zuuren FJ, Schoenmakers N, Makkes P. One-session cognitive treatment of dental phobia: preparing dental phobics for treatment by restructuring negative cognitions. *Behav Res Ther.* 1995;33(8):947-954. doi:10.1016/0005-7967(95)00027-U.
 40. Vika M, Skaret E, Raadal M, Öst LG, Kvale G. One- vs. five-session treatment of intra-oral injection phobia: a randomized clinical study. *Eur J Oral Sci.* 2009;117(3):279-285. doi:10.1111/j.1600-0722.2009.00628.x.
 41. Kebriaee F, Shirazi AS, Fani K, Moharreri F, Soltanifar A, Khaksar Y, et al. Comparison of the effects of cognitive behavioural therapy and inhalation sedation on child dental anxiety. *Eur Arch Paediatr Dent.* 2015;16(2):173-179.
 42. Libonati A, Nardi R, Gallusi G, Angotti V, Caruso S, Coniglione F, et al. Pain and anxiety associated with computer-controlled local anaesthesia: systematic review and meta-analysis of cross-over studies. *Eur J Paediatr Dent.* 2018;19(4):324-332. doi:10.23804/ejpd.2018.19.04.14.
 43. Altuhafy M, Sodhi GS, Khan J. Efficacy of computer-controlled local anesthesia delivery system on pain in dental anesthesia: a systematic review of randomized clinical trials. *J Dent Anesth Pain Med.* 2024;24(4):245-264. doi:10.17245/jdapm.2024.24.4.245.
 44. American Academy of Pediatric Dentistry. Behavior guidance for the pediatric dental patient. In: *The Reference Manual of Pediatric Dentistry.* Chicago,

- IL: American Academy of Pediatric Dentistry; 2025:379-399.
45. American Dental Association. Guidelines for the Use of Sedation and General Anesthesia by Dentists. Chicago, IL: American Dental Association; 2025.
46. Côté CJ, Wilson S. Guidelines for monitoring and management of pediatric patients before, during, and after sedation for diagnostic and therapeutic procedures. *Pediatr Dent*. 2019;41(4):26E-52E.
47. Ashley PF, Chaudhary M, Lourenço-Matharu L. Sedation of children undergoing dental treatment. *Cochrane Database Syst Rev*. 2018;12(12):CD003877. doi:10.1002/14651858.CD003877.pub5.
48. Malamed SF. Sedation: A Guide to Patient Management. 7th ed. St Louis, MO: Elsevier; 2021.
49. Khole M, Chavhan P, Sajjanar A, Shah S, Salvi P. Comparative evaluation of efficacy and safety of nitrous oxide and midazolam for conscious sedation in pediatric dental patients: a systematic review and meta-analysis. *J Dent Anesth Pain Med*. 2025;25(3):161-182. doi:10.17245/jdapm.2025.25.3.161.
50. Rath GV, Padawe D, Takate V, Dighe K, Bansode KK, Narwade AU. Comparative evaluation of ease of dental treatment and clinical efficiency of midazolam vs midazolam and ketamine combination for sedation in young uncooperative pediatric patients: a systematic review. *Int J Clin Pediatr Dent*. 2022;15(6):680-686. doi:10.5005/jp-journals-10005-2456.
51. Barot G, Patel M, Patel C, Fernandes MC, Patel F, Mehta M. Comparative effectiveness and safety of dexmedetomidine and midazolam in pediatric dental sedation: a systematic review and meta-analysis. *J Dent Anesth Pain Med*. 2025;25(3):147-159. doi:10.17245/jdapm.2025.25.3.147.
52. Alharbi A, Freeman R, Humphris G. Dental anxiety, child-oral health-related quality of life and self-esteem in children and adolescents: a systematic review and meta-analysis. *Community Dent Health*. 2021;38(2):119-126. doi:10.1922/CDH_00295Alharbi08.
53. Coxon JD, Hosey MT, Newton JT. How does dental anxiety affect the oral health of adolescents? A regression analysis of the Child Dental Health Survey 2013. *Br Dent J*. 2019;227:818-822.
54. Patil RU, Onkari PS, Gurunathan D. Effectiveness of audiovisual distraction in reducing children's anxiety for pain during medical and dental treatments: a systematic review and meta-analysis. *Saudi J Med Med Sci*. 2024;12(3):252-258. doi:10.4103/sjmms.sjmms_275_23.
55. Ramirez I, Reis CLB, Madalena IR, Baratto Filho F, Oliveira MAHM, Antunes LS, et al. The effect of audio distraction in reducing signs of stress and anxiety during pediatric dental treatment: a systematic review and meta-analysis. *Clin Oral Investig*. 2025;29(1):58. doi:10.1007/s00784-024-06035-0.
56. Kaur K, Saini RS, Binduhayyim RIH, Mosaddad SA, Heboyan A. Analyzing nonpharmacological behavior management in children with dental anxiety: a systematic review and meta-analysis. *Health Sci Rep*. 2025;8(8):e71176. doi:10.1002/hsr2.71176.
57. American Academy of Pediatric Dentistry; American Academy of Pediatrics. Guidelines for monitoring and management of pediatric patients before, during, and after sedation for diagnostic and therapeutic procedures. *Pediatr Dent*. 2019;41(4):26E-52E.