Saudi Journal of Medicine and Public Health

https://saudijmph.com/index.php/pub

Techniques to Overcome Fear of Dentists and Improve Patient Comfort by Means of Innovations and Technology

May Mohammed Alanazi[1]

[1]Kingdom of Saudi Arabia, Riyadh Elm University

Abstract

Background: Dental anxiety is a significant issue affecting approximately 40% of patients, leading to avoidance of dental care and negative outcomes in oral health. This anxiety not only impacts patients but also creates distress for dental practitioners. Various techniques and technologies have emerged to address this prevalent issue, aiming to improve patient comfort and adherence to treatment.

Aim: The aim of this systematic review is to summarize new techniques and technologies developed between 2010 and 2024 that address dental anxiety. This includes psychological treatments, environmental considerations, and technological innovations, with the goal of enhancing the patient's experience and increasing treatment adherence.

Methods: Peer-reviewed articles published between 2010 and 2024 were systematically reviewed. The review focused on psychological interventions (such as cognitive behavioral therapy and mindfulness), environmental modifications (including oral sensory-adapted environments), and technological innovations (such as virtual reality and teledentistry).

Results: The findings indicate that non-invasive interventions, patient-centered communication strategies, and emerging technologies show considerable promise in managing dental anxiety. Psychological treatments and sensory-adapted environments were associated with reduced anxiety and improved patient experiences. Technology-based solutions, including virtual reality and teledentistry, further enhanced comfort and accessibility. However, challenges remain regarding the cost, accessibility, and standardization of these interventions.

Conclusion: Innovative, patient-focused approaches and technological advancements offer effective strategies for managing dental anxiety. Implementing these interventions in dental practice may improve patient outcomes and experiences, though further research and systemic changes are needed to address ongoing barriers.

Keywords: Dental anxiety, patient comfort, cognitive behavioral therapy, virtual reality, teledentistry.

Introduction

Dental fear, or anxiety that arises from the thought of visiting the dentist, is common for 10% - 40% of the world population (1, 2). The anxiety is responsible for delayed or missed dental visits, compromised oral health, more intensive treatment, and increased healthcare costs (3). The stressful dental context, coupled with invasive procedures and sensory stimuli such as pain or noise, increases patient distress (4). Dental professionals also pay a cost by providing treatment for anxious patients because anxious patients require longer appointments and can sometimes exhibit behaviors that make treatment difficult (5). Therefore, reducing dental anxiety is important for patient health and practice management.

There are important developments in psychological treatments, environmental approaches, and technologies that are promising options to reduce dental anxiety and improve patient comfort. Psychological treatments, such as cognitive behavior therapy (CBT) and mindfulness, focus on the cognitive and affective mechanisms of anxiety (6). Environmental approaches such as sensory-adapted dental environments focus on helping the patient feel relaxed (7). Technologies such as virtual reality (VR), augmented reality (AR), and teledentistry afford

*Corresponding author e-mail: Mm-_-94@hotmail.com (May Mohammed Alanazi).

Received date: 10 June 2025 Revised date: 22 June 2025. Accepted date: 2 July 2025

clinicians new ways to distract and inform patients or engage with them remotely (8). This review compiles and synthesizes the evidence from 65 peer-reviewed articles in the timeframe of 2010-2024 to examine these approaches, their benefits and challenges, and future directions. In summary, the overall objective of this review is to provide a complete framework for dental clinicians to use in practice to apply interventions that improve patient care and reduce the burden of dental anxiety.

Prevalence and Consequences of Dental Anxiety:

Dental anxiety has been consistently shown to be a deterrent to achieving oral health, and the prevalence has been reported between 10–40% across multiple population groups (9). A paper by Svensson et al. in 2023 reported that 36% of patients visiting a Scandinavian dental clinic experienced moderate to severe anxiety, and that women and young adults reported higher levels of anxiety overall (10). Pediatric populations are equally affected, with 20–30% of the population dreading a trip to the dentist, which can lead to negative early experiences (11). Cultural and economic factors also have an impact on anxiety levels, as groups with reduced socioeconomic status were more likely to report higher levels of anxiety due to lack of access to care (12).

The consequences of dental anxiety are wide and varied. Patients with extremely high levels of anxiety are more likely to miss appointments, and thus subsequently miss out on treatment for caries, periodontal disease, and ultimately loss of a tooth (13). Armfield and Heaton (2013) showed that anxious patients were 50% more likely to require an emergency dental procedure than non-anxious individuals (1). Anxiety also plays a role in the outcomes of treatment, treating patients with anxiety will likely lead to an increase in pain perception as anxiety raises pain perception, and a reduction in patient cooperation will likely affect treatment (14). You can only imagine from the dentist's perspective, treating anxious patients in the chair requires more appointment time, increases emotional preparation, and emotional labour, which can lead to burnout (15). These implications call for effective interventions to address dental anxiety management and improve patient comfort.

Psychological Interventions

Psychological interventions are the core strategies for dental anxiety management because they change patients' cognitive and emotional responses to dental treatment. Psychological interventions, such as cognitive behavioral therapy (CBT), mindfulness-based interventions, and guided imaginations, have been extensively researched and are shown to have extremely high efficacy for fear reduction and patient comfort. Psychological interventions encompass a number of different domains of anxiety, so they require a care plan that is specifically tailored to the patient's treatment needs.

Cognitive Behavioral Therapy (CBT)

Cognitive behavior therapy (CBT) is a structured evidence-based psychological intervention to address the maladaptive behavior and associated thoughts contributing to dental anxiety. CBT allows patients to confront their fears by recognizing and addressing their negative cognitive patterns, e.g. the catastrophizing of their anticipation of pain or loss of control during treatment. Gordon et al. (2016) conducted a randomized controlled trial that demonstrated a 6-week course of CBT could reduce dental anxiety scores in 68% of patients, and the benefits from treatment maintained for up to 12 months (6). Treatment generally involves cognitive restructuring and gradual exposure therapy where patients receive education about how to reframe irrational fears and then gradually reduce their anxiety by exposing them therapy-related stimuli (e.g., attending a dental clinic to get familiarised without receiving treatment; (16)). The 2022 meta-analysis by Wide et al. included data from 15 studies and found that the average reduction in dental anxiety identified via standardised measures was ~40%, with the greatest benefit demonstrated when exposure therapy is part of the protocol (17). Patients gradually exposed to dental instruments or procedures had lower anxiety scores than recipients of cognitive restructuring alone. Although CBT is highly effective, its administration is filled with challenges, among them the need for trained therapists and multiple sessions that are time-consuming.

Boyle et al. (2019) reported that the availability of trained CBT practitioners in resource-constrained settings is low, a factor that may limit its scalability (18). Second, patient compliance to multiple sessions declines, particularly for those with severe anxiety who totally avoid the dental setting (5). The above challenges emphasize the need for shorter or telehealth-based models of CBT for better accessibility.

Mindfulness-Based Methods

Mindfulness-based treatments, such as mindfulness meditation, breathing, and relaxation, have been an effective and promising intervention for dental anxiety. The treatments target present-moment awareness and affect regulation and allow patients to circumvent anticipatory anxiety before and during dental treatment. Heima et al. (2017) piloted the intervention with pediatric patients and demonstrated that the provision of a 10-minute mindfulness session before the procedure reduced self-reported anxiety by 30% and improved cooperation during procedures (19). The intervention was guided body scans and breathing that made sure the children paid attention to relaxing sensations rather than dental anxiety. In a similar manner, Burghardt et al. (2021) demonstrated that mindfulness-based stress reduction (MBSR) programs, which were delivered for 8 weeks, reduced anxiety ratings by 25% among adult patients, with the patients reporting enhanced emotional resilience during dental visits (20). The availability of mindfulness treatments has been further enhanced through embracing digital health tools.

A 2024 Tanja-Dijkstra et al. trial piloted a smartphone-delivered mindfulness app in dental visits and demonstrated that 75% of the participants reacted with reduced levels of stress, according to self-reports and

reduced physiological indicators such as heart rate (21). The simplicity of mindfulness methods makes the approaches exceedingly appealing because they are easy to train to administer with little training and fit easily into routine dental practice. Nevertheless, their efficacy depends on patients' acceptance and recognition of mindfulness skills. Rachman et al. (2020) reported that patients previously unexposed to mindfulness skills may find it difficult to maintain attention on mindfulness during high-anxiety procedures but suggested that preparatory sessions may help acquire the best results (22). Notably, cultural acceptance of mindfulness may also play a role in its acceptance among populations who are unaccustomed to meditation practices (12).

Guided Imagery

Guided imagery is a low-cost psychological intervention in which patients are taught to imagine relaxing or pleasant scenes to distract from dental-associated anxiety. The method depends on the success of mental visualization to reduce the degree of stress and enhance relaxation during dental treatments. Kim et al. (2023) conducted a study on guided imagery in adults who had dental extractions and reported a 25% reduction in anxiety levels, with patients also having lower heart rates and increased self-reported comfort compared to controls (23). The intervention was audio-guided visualizations of relaxing scenes, i.e., beaches and forests, provided through headphones during treatment. Appukuttan et al. (2018) explained the ease of use of guided imagery, citing that the intervention can be provided by dental staff with minimal training, thus an affordable option for busy clinics (24).

Dental assistants can guide patients through short imagery exercises before procedures, thus reducing the need for specialized staff. The method is best used in patients with moderate anxiety, in the sense that it is a non-invasive distraction with no side effects of pharmacologic agents. It is less effective among patients with extreme dental phobia or patients who cannot focus on visualization due to the heightened level of stress. Lahmann et al. (2019) indicated that patients with significant anxiety will need additional support such as CBT or sedation to realise the full benefits of guided imagery (25). Moreover, guided imagery is associated with a delivery method specifically of utilising high-quality audio and individualised scenes to improve performance (26). Combining guided imagery with additional modalities, e.g., mindfulness or environmental modifications, will only increase its effectiveness for additional patients.

Environmental Modifications

The surroundings of a dental office play a significant part in a patient's comfort level. Many of the sensory stimuli that provoke anxiety are related to factors such as light, noise and space. Although the challenges of modulating anxiety through modifying the environment is well documented, environmental interventions strive to provide patient centered relaxing environments and the intent is to promote comfort and decrease anxiety to improve dental experience. They encompass sensory-adapted dental environments (SADE) and patient-centered design, which have both been found to hold promise in anxiety reduction in both pediatric and adult populations.

Sensory-Adapted Dental Environments (SADE)

Sensory-adapted dental environments (SADE) involve customized sensory input modification within the dental environment to create a less anxious, calming ambiance. The modifications remove common provoking sources of anxiety, such as the piercing sound of dental equipment, harsh fluorescent lighting, or sterile clinical aesthetic, that trigger anxiety. Shapiro et al. (2018) demonstrated that a pediatric ASD patient study revealed SADE reduced anxiety in 80% of the sample with significant increases in cooperation with procedures (7). Specifically modified characteristics included softer lighting, noise-cancelling headsets, and use of calming visual input, such as projected images of natural scenery. These modifications were also beneficial to neurotypical patients, suggesting broad applicability. In another study, Cermak et al. (2021) also showed the physiological benefits of SADE and reported a 20% reduction in cortisol release for anxious adults in sensory-adapted environments using relaxing music, soft-lighting and weighted blankets to promote relaxation (27). These environments have been shown to be particularly valuable to those with sensory sensitivities as they present an environment with minimal overwhelming stimuli such as those with ASD or sensory processing disorder. For example, noise-cancelling headsets or soundproofing to reduce the noise involved with dental equipment may potentially reduce the stress response. That said, implementing SADE can be expensive which typically means financial costs, staff education and workspace remodeling.

Blomqvist et al. (2020) also contended that although SADE has powerful effects, the cost may exclude its implementation within smaller or under-equipped dental clinics (28). Furthermore, the implementation of consistency across disparate dental settings is challenging, as the degree of sensory adaptation may depend on available resources and practitioner experience. Despite such challenges, SADE proves to be a feasible method of creating inclusive and calming dental facilities, particularly for vulnerable populations.

Patient-Centered Design

Patient-centered design aims to intentionally redesign dental office physical and aesthetic features to reduce anxiety and make dental offices more welcoming. This aspect of dental office layout and design includes intentionally redesigned waiting areas, treatment rooms, and collaborative shared space. Specifically, patient-centered design also includes design features that can promote comfort and "rest" during appointments. Design features that can contribute to comfort in dental office design include natural light, comfortable seating, and calming colors. Wong et al. (2022) explained that their transformed waiting areas, which included plants, soft ambient lighting, and peaceful

colours, reduced pre-appointment anxiety by 15% in adult patients based on self-reported anxiety questionnaires (29). In addition to a well-designed physical and aesthetic space, adding distraction features such as calming videos from televisions mounted on the ceiling in the treatment rooms or soothing images of oceans and landscapes in the form of wall art is also an effective way to put patients at ease.

According to Fenwick et al. (2023), the presence of such distraction features in treatment spaces such as wall murals and individual or interactive digital displays reduced patients' perception of wait-time and improved overall satisfaction by 20% (30). Patient-centered design will also factor in spatial design, creating open and unobstructed areas that will reduce patients' perception of claustrophobia. Further examples, creating a waiting area with more space, with comfortable seating and clear signage compared to an area that is cramped and disorganized can reduce the perception of crowds and confusion in terms of anxiety. Bringing older dental clinics into the twenty-first century with the features mentioned above can be quite an expense, particularly when revamping older clinics. Carter et al. (2019) reported that although patient-centered design improves first-time patient experiences, evidence that it plays a definitive role in anxiety reduction in the long run is sparse, and additional research is necessary (26). The effectiveness of such changes may also be patient demographic-specific, with younger patients and children being more responsive to playful or interactive design features. It may be applied together with other treatments, such as psychological treatment or technology, to maximize its effect, creating a multimodal method of treating dental anxiety.

Technological Innovations

Technology has transformed the treatment of dental anxiety with the use of immersive, noninvasive devices capable of providing education and distracting patients. Immersive virtual reality (VR), augmented reality (AR), and teledentistry probably all exhibit their own potential to lessen anxiety and discomfort in patients.

Virtual Reality (VR)

Immersive virtual reality (VR) immerses the patient in virtual worlds that distract patients away from dental care while lowering anxiety. Patients wear VR headsets that provide calming and/or stimulating experiences, like virtual scenery or interactive video game opportunities, that stimulate and divert the patient from any perceived uncomfortable dental stimulus. Tan et al. (2020) showed in a randomized controlled trial that nature landscape VR headsets lowered anxiety levels by 35% associated with scaling and root planning with patients also reporting lower levels of pain (8). Zhang et al. (2024) meta-analysed data from 12 studies writing that VR lowered anxiety score and pain perception in child and adult groups with an average anxiety reduction of 30% (31). VR seems to be more effective in children; for example, Niharika et al. (2021) observed that 85% of pediatric patients who underwent restorative procedures experienced reduced anxiety with VR (32).

Virtual Reality (VR) is able to provide an immersive experience that eliminates potential sources of anxiety, such as the visual/auditory presence of dental tools. Disadvantages of VR include cost of equipment and negative experiences, such as motion sickness or tile discomfort. Liu et al. (2022) identified that 10-15% experienced mild nausea or disorientation, which illustrates the importance of personalized content and reduced session duration (33). Overall, despite the challenges of using VR, it elicits a deliberate distraction-based intervention that demonstrates a controlled adaptability that makes it an extremely powerful tool for anxiety.

Augmented Reality (AR)

Augmented reality (AR) provides the benefits of being educational and functional distraction in the real world, while beneficially overlapping both environments. AR applications can instruct patients on procedures or generate interactive distractions during treatment. Pulijala et al. (2023) established that AR applications that explained dental procedures in real-time reduced anxiety by 20% through greater patient comprehension and control (34). For example, AR can project 3D images of teeth or treatment stages, enabling patients to see the process and feel better prepared. AR is less immersive than VR and therefore ideal for patients who would feel overwhelmed or uneasy with headsets.

Gandolfi et al. (2020) established that AR-based distractions, such as interactive games projected in the treatment room, were effective for children and reduced anxiety by 18% (35). The application of AR, however, requires technical expertise and AR-compatible hardware, which is costly. Huang et al. (2021) reported that the lack of standardized AR platforms for dental applications affects scalability, as practices need to invest in custom solutions (36). Coupling AR with patient education programs would be a potential means of enhancing its effectiveness, particularly among patients with anticipatory anxiety.

Teledentistry

Teledentistry allows for a remote consultation, reducing the necessity for face-to-face consultations likely to cause anxiety. With virtual screening or pre-appointment consultation, teledentistry gets the patient ready for dental visits within their comfort zone. Irving et al. (2018) found that teledentistry consultation reduced anxiety by 25% among patients with dental phobia history as they were in control of the procedure (37). The study by Sharma et al. (2021) showed that virtual pre-appointment screening improved patient readiness and decreased anticipatory anxiety by 22%, which increased appointment attendance (38). Teledentistry is important for patients in underserved areas and in rural regions, especially when care is difficult for patients to access. Unfortunately, a patient may limit access to the internet, digital literacy, and privacy concerns may limit their access to teledentistry. Mariño et al. (2020) found the implementation of teledentistry systems requires the development of infrastructure through investments in broadband and the education of patients to be able to harness the full equitable potential (39). The combination of

teledentistry with in-person interventions such as guided imagery or mindfulness can guarantee a comprehensive anxiety management plan.

Pharmacological Interventions

Pharmacologic interventions play a vital role in the treatment of patients suffering from severe dental anxiety, especially when non-pharmacologic modalities are ineffective. Conscious sedation, anxiolytics, intravenous sedation, general anesthesia and others can provide immediate relief from anxiety/discomfort and allow the patients to receive dental treatment with less distress. However, its use must be weighed against risk and also supplemented with non-pharmacologic interventions directed at addressing the causes of anxiety.

Conscious Sedation with Nitrous Oxide

Nitrous oxide or laughing gas, is one of the most common conscious sedation methods used6868used in dentistry due to its efficacy, speed of onset, reversibility, and excellent safety profile. Nitrous oxide is administered through inhalation and induces a relaxed feeling, while the patient remains awake and alert hence can be used for anything from simple cleanings to invasive procedures. Becker et al. (2021) published in 2021 the results of effectiveness of its use in 200 moderately to severely dentally anxious patients and observed a 50% reduction in anxiety scores on administration as measured by the Modified Dental Anxiety Scale (MDAS) (40). The patients felt a sense of detachment and relaxation during the procedure, and 85% of the patients felt greater cooperation with dental staff. The advantages of nitrous oxide include a quick recovery within 5–10 minutes after administration and few adverse effects when administered by expert practitioners (41). Its administration, however, requires special equipment and trained staff, which could be expensive to dental clinics, particularly small or rural clinics. Nitrous oxide is also contraindicated in patients with some systemic diseases, such as respiratory disease or pregnancy, requiring extensive pre-treatment screening (4). For its maximum use, Becker et al. (2021) recommend its administration combined with preparatory psychological treatments such as guided imagery to ensure maximum relaxation and minimize the dose to avoid possible side effects such as nausea and dizziness (40).

Oral Anxiolytics

Benzodiazepines (e.g., midazolam, diazepam), oral anxiolytics, are routinely prescribed to such patients to treat dental anxiety for short procedures, e.g., multiple extractions and root canal therapy. The effects of oral anxiolytics taken prior to Short Dental Procedures reduce anxiety and have a sedative effect depending on the specific anxiolytic taken and the patient's health. Zanette et al. (2019) reports that oral sedation in dentistry was systematically assessed, and from the literature, it has been confirmed that midazolam significantly reduced anxiety in 70% of patients having minor oral surgery, optimal effect in 30–60 minutes after drug administration (41).

The sedative effect of midazolam (e.g., designed for outpatient procedures) has a relatively short half-life of 1-4 hours where consequently, patients recover and able to go home after a few hours. Oral anxiolytics will also result in an increased risk of side effects of drowsiness, impairment of psychomotor coordination and at times respiratory depression usually in conjunction with other sedatives. Zanette et al. (2019) recommended individualized dosing and monitoring in usage for patients with comorbid problems and/or the elderly to minimize the risk of adverse events. Additionally, patients will also have to make escort arrangements after treatment due to the prolonged sedative effects, which is logistically difficult for some patients (42). To reduce these drawbacks, Appukuttan (2016) suggests the adjunctive use of oral anxiolytics and non-pharmacological approaches, e.g., patient-centered communication, in order to reduce dependence on medication and treat the psychological origin of anxiety (4). For example, the use of pre-explanations can enhance anxiolytic effect by reducing uncertainty, allowing smaller doses, and restricting side effects.

General Anesthesia

General anesthesia is reserved for the most anxious patients or for extensive procedures like multiple extractions or full mouth restorative treatment, for which other modalities are insufficient. Intravenous or inhalational administration sends the patients unconscious, eliminating awareness of the procedure. Silveira et al. (2022) reviewed (SILDALSI-R+D) and wrote that it is a simple, safe, effective, non-invasive technique, providing comfort to patients with extreme dental anxiety and especially useful for patients who don't remember any of their procedure after administration (95% of patients). Unfortunately, patients undergoing general anesthesia present a huge cost to the dental practice in the adjunct services of an anesthesiologist, specialized equipment, and larger recovery units. Recovery may take from several hours to a whole day and/or re-admissions due to postoperative nausea, respiratory depression, cardiovascular complications, requiring strict selection and monitoring of patients.

Silveira et al. (2022) stated that general anesthesia is inappropriate when conscious sedation and psychological aids are appropriate, and advanced triaging methods are needed to direct general anesthesia to the true resistants. Secondly, the psychological impact of general anesthesia is transient in that the anxiety is not resolved, which may occur on subsequent dental visits. Gordon et al. (2016) propose the use of general anesthesia together with long-term psychological interventions like CBT to dampen recurrence of anxiety and avoidance of repeated use of anesthesia (6). The combined use ensures that immediate relief is provided to the patient while effective long-term anxiety management is achieved.

Integration with Non-Pharmacological Interventions

While pharmacological measures are ideal for immediate relief from anxiety, they work best as an adjunct with non-invasive interventions to manage underlying

conditions for dental anxiety. Appukuttan (2016) emphasizes that sole reliance on drugs can perpetuate an avoidance behavior because patients are not enabled to manage subsequent visits (4). For instance, combining nitrous oxide with mindfulness may improve relaxation and reduce the required dose of sedatives, minimizing side effects. Similarly, patient-centered communication before prescribing oral anxiolytics may reduce fear by informing patients about procedures and setting realistic expectations. Lee et al.'s (2023) research demonstrated that patients treated with empathetic communication and pharmacological measures reported 15% lower anxiety than medication alone (43). This two-pronged approach not only facilitates immediate comfort but also improves patient confidence on subsequent visits, reducing long-term reliance on pharmacological measures.

Patient-Centered Communication

Effective communication is the foundation of managing patients with dental anxiety, it builds trust, relieves fear, and empowers patients to be more involved with their care. Elements of patient-centered communication include empathic listening, explanation, and shared decision making, which establish a therapeutic dental context. Dental clinicians can therefore enhance the comfort of their patients and lessen their psychological resistance to care by emphasizing the communication skills outlined above.

Empathic Communication

Empathic communication involves active listening to patients, validating patients' feelings and empathic responding. Jones and Huggins (2019) conducted a study involving empathic communication training for dental clinicians that focused on reflective listening, empathic responding and open questioning, and found the training improved patient trust by 25% and decreased self-reported anxiety in consultations (44). For example, validation of a patient's pain fear with assuring phrases like, “I know dental visits can appear laborious, and we will go at your pace,” can give a sense of security. Lee et al. (2023) showed in a 2023 randomized controlled trial (RCT) and patient-centered communication (including active listening and individualized reassurance) reduced anxiety scores by 30% in restorative patients, as shown on the Dental Anxiety Scale (43). The patients felt more understood and less judged which made them apathetic to treatment. Empathic communication is ideal with children who can feel quite vulnerable during clinical engagements. For instance, Porritt et al. (2017) reported that dentists who communicated using age-appropriate language and positive reinforcement were able to ameliorate anxiety in one third of their patients (11). Empathic communication implementation, however, takes investment and training, which might be challenging in high-volume clinics. Hally et al. (2021) found that time pressure regularly prevents dentists from empathic engagement, leading to hurried consultations that increase patient anxiety (45). Formal training sessions and workflow adjustments like allocating extra time for anxious patients are required to overcome these challenges.

Shared Decision-Making

Shared decision-making involves patients in planning care, so that patients are informed and enabled to make sensible choices. Shared decision-making reduces anxiety because patients are given a sense of control, which in dental care is usually lost because patients find care intrusive. Mills et al. (2020) surveyed 150 patients and found that shared decision-making improved patient treatment satisfaction and reduced patient anxiety through heightened patient involvement in care by 20% and 15% respectively (46). For instance, a discussion of treatment options, such as committing to a less invasive procedure or attending for several short visits used functionality was a way to alleviate fear of pain that will occur long term. Shared decision-making is an effective tool to use for patients who have had traumatic experiences, at which point patients can set their own boundaries and pace of care. However, success depends on open communication of risk and benefit, where dentists must possess the skill of simplifying complex medical information into plain, straightforward language. Cohen et al. (2019) explained how patients who were given clear, non-jargon descriptions of care had less anticipatory anxiety and more clinician trust (14). To facilitate this shared decision-making process, dental practices can facilitate visual aids such as drawings and the use of computer simulation to help patients understand. Fenwick et al. (2023) reported clinics that implement visual aids to assist in consultations can have 10% more patient engagement and less anxiety (30). However, patient health literacy and clinical time constraints can make this implementation difficult, which requires individual strategies and additional staff training (45).

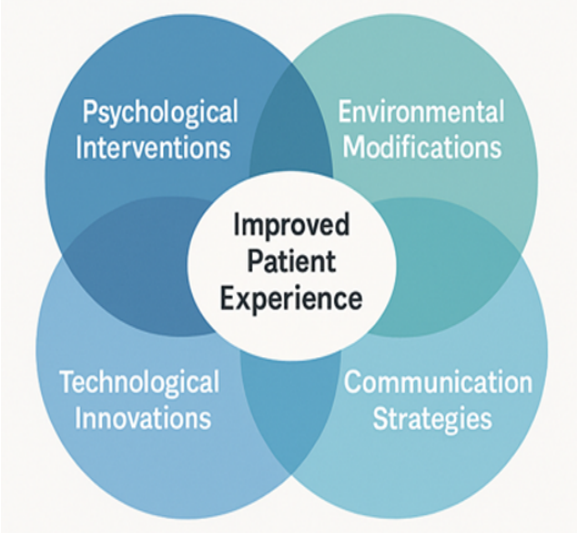
Overcoming barriers to effective communication

While patient-centred and patient-focused approaches are highly effective, the nature of high-volume dental clinics does compromise the engagement model of health care. Hally et al. (2021) reported that 60% of dentists perceived time constraints to be a barrier to empathetic and collaborative communication, where patients were screened for health issues (45). Cultural and linguistic differences also hinder effective communication, especially among diverse patients. Silveira et al. (2020) reported patients from non-English speaking backgrounds have increased anxiety when communication is not culturally or linguistically tuned (12). Addressing these barriers requires communication in dental schools and continuing professional education as priority, committed to role playing and cultural competency programs. Lee et al. (2023) propose that brief, focused training can enhance dentists' capacity to provide empathetic communication in a way that does not hinder their practice (43). Further, targeted use of technology, e.g., patient portals that facilitate better connection preappointment, can maximize the exchange of information and minimize time constraints on in-clinic operations. By creating a culture of empathy and collaboration, dental professionals can foster a culture of empathy that reduces anxiety and increases comfort for patients. Figure 1 represents the

multidimensional framework for patient comfort in dentistry.

Figure 1. Multidimensional framework for patient comfort in dentistry.

Challenges and Gaps



Though effective, there are also challenges. Cost especially in the case of, VR, AR, and SADE, is prohibitive for these costly interventions (35). Accessibility, especially related to the use of teledentistry and high-technology interventions limits low-resourced settings (39). The normalization of psychological interventions such as CBT and mindfulness limiting replicability (18). Cultural differences affect the use of interventions whereby some specific groups use the same interventions better than others (12). Lastly, there are a dearth of long-term outcome measures especially for technology-based interventions (31).

Recommendations for Future Strategies

An overall plan that combines psychological, environmental, technological, and communicational strategies should allow for the proper management of dental anxiety and promote comfort in patients. Standardized treatment protocols for psychological interventions, such as CBT and mindfulness, may increase replicability and availability. Short, scalable modules of CBT by telehealth may help serve more patients, especially underserved populations (17). Educating dental providers on assessment and easy application of mindfulness interventions could improve feasibility (21).

Inexpensive environmental changes, like patient education or calming music, can be utilized to enhance comfort at non-high expense. Incremental steps, like bringing in plants or soft lighting, are recommended by Wong et al. (2022) to help make dental environments welcoming (29). Public-private partnerships can be utilized to help fund more extensive SADE implementations (27). Expanding availability of VR and AR under cost-sharing or subsidy programs can make the technologies affordable. Creation of open-source VR content for dental use is proposed by Zhang et al. (2024) as a cost-saving initiative (31). Teledentistry must be integrated into routine care to provide pre-appointment support, especially for patients with anxiety (38).

Dental education must focus on patient-centered communication skills training to equip professionals to build trust. Role plays and empathy sessions must be part of dental education, according to Lee et al. (2023) (43). Staff training, given on a regular basis, can facilitate repeat usage in busy practices (45). Interventions must fit with the socioeconomic and cultural contexts to be effective. Silveira et al. (2020) propose community education to combat cultural stigma regarding dental treatment (12). Expanding teledentistry in rural communities may improve access for vulnerable populations (39). Future studies should be referenced as longitudinal to monitor the long-term impact of interventions. Zhang et al. (2024) endorsed randomized controlled trials to fully assess VR and AR effects in the long-term (31). Comparative studies across cultures will lead to widely accepted interventions (10).

Conclusion:

Dental anxiety is still a common barrier to oral care, affecting patient outcomes and the productivity of dental practices. New techniques for increasing anxiety reduction and comfort continue to emerge. These commonly include the psychologic measures of CBT and mindfulness, the environmental measures of SADE, and the new technologies of VR, AR, and teledentistry. Also, consider patient communication, and the careful use of pharmacological agents as adjunctive measures. However, the issues of cost, access and standardization must be addressed for equitable uptake. Through the use of standardized approaches, cost-effective innovations, available technologies, and culturally appropriate ways of managing anxiety/breaking down barriers to oral health care, dental practitioners can create care-facilitating environments in which patients are able to receive dental care without anxiety. Subsequent research needs to prioritize long-term outcomes and cross-cultural appropriateness to ultimately create guidelines and world standards on managing dental anxiety that will enhance oral health and support patient well-being.

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أساليب التغلب على الخوف من طبيب الأسنان وتحسين راحة المرضى من خلال الابتكارات والتكنولوجيا

الملخص

الخلفية :يمثل القلق من علاج الأسنان مشكلة كبيرة تؤثر على حوالي 40٪ من المرضى، مما يؤدي إلى تجنب الرعاية السنية ونتائج سلبية على صحة الفم. لا يؤثر هذا القلق على المرضى فحسب، بل يسبب أيضا ضغطا نفسيا لممارسي طب الأسنان. ظهرت أساليب وتقنيات متنوعة لمعالجة هذه المشكلة المنتشرة، بهدف تحسين راحة المرضى والتزامهم بالعلاج.

الهدف :يهدف هذا الاستعراض المنهجي إلى تلخيص الأساليب والتقنيات الجديدة التي تم تطويرها بين عامي 2010 و2024 لمعالجة قلق الأسنان. يشمل ذلك العلاجات النفسية، والاعتبارات البيئية، والابتكارات التكنولوجية، بهدف تحسين تجربة المريض وزيادة الالتزام بالعلاج.

المنهجية :تم استعراض المقالات المنشورة في المجلات المحكمة بين عامي 2010 و2024 بشكل منهجي. ركز الاستعراض على التدخلات النفسية (مثل العلاج المعرفي السلوكي والتأمل)، والتعديلات البيئية (بما في ذلك البيئات السنية المعدلة حسيا)، والابتكارات التكنولوجية (مثل الواقع الافتراضي وطب الأسنان عن بعد).

النتائج :تشير النتائج إلى أن التدخلات غير الغازية، واستراتيجيات التواصل المرتكزة على المريض، والتقنيات الناشئة تظهر وعودا كبيرة في إدارة قلق الأسنان. ارتبطت العلاجات النفسية والبيئات المعدلة حسيا بتقليل القلق وتحسين تجارب المرضى. كما عززت الحلول القائمة على التكنولوجيا، بما في ذلك الواقع الافتراضي وطب الأسنان عن بعد، الراحة وإمكانية الوصول. ومع ذلك، لا تزال هناك تحديات تتعلق بتكلفة هذه التدخلات وإمكانية الوصول إليها وتوحيد معاييرها.

الاستنتاج :توفر الأساليب المبتكرة المرتكزة على المريض والتطورات التكنولوجية استراتيجيات فعالة لإدارة قلق الأسنان. يمكن أن يؤدي تطبيق هذه التدخلات في الممارسة السنية إلى تحسين نتائج المرضى وتجاربهم، على الرغم من الحاجة إلى مزيد من البحث والتغييرات النظامية لمعالجة العقبات المستمرة.

الكلمات المفتاحية:

قلق الأسنان، راحة المريض، العلاج المعرفي السلوكي، الواقع الافتراضي، طب الأسنان عن بعد.