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Effect of Virtual Reality on Dentophobia

[1]Suyog Pote, BDS, MSHM, California State University, Los Angeles

[2]Shrushti Shah, BDS, MPH, STATinMED Research LLC, Los Angeles

[3]Ashvi Patel, BDS, Goregaon Dental Centre, Mumbai

[4]Aishwarya Sonawane, MHM, BDS, California State University, Los Angeles

Corresponding Author: Suyog Pote, BDS, MSHM, California State University, Los Angeles.

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Abstract

Objective: This systematic review aims to investigate the efficacy of Virtual Reality Exposure Therapy (VRET) in reducing dentophobia and enhancing the dental experience among diverse patient populations.

Methodology: A thorough search of randomized clinical trials (RCTs) involving VRET in the context of dentophobia was conducted. Inclusion and exclusion criteria were applied, and the PRISMA statement guidelines were followed during literature selection. Fourteen studies met the inclusion criteria.

Results: Across the reviewed studies, a significant reduction in anxiety levels was consistently observed when dental procedures were conducted using VR technology. Patients, including both children and adults, reported enhanced dental experiences and high levels of satisfaction with the use of VR. Notably, the positive effects of VRET persisted over several months. Gender-specific differences in the response to VR interventions were also explored, with a more pronounced impact observed among specific gender groups, particularly women.

Conclusion: VR technology shows promise in reducing dentophobia and improving dental experiences. Further research should optimize VR interventions, evaluate long-term impacts, and explore gender-tailored approaches and evaluate the cost-effectiveness of integrating VR into dental practice.

Keywords: VRET, VR Technology, PRISMA.

Introduction

Dentophobia, also known as odontophobia, is defined as the fear of dental interventions that originates from the wrong assumption that these interventions are harmful and dangerous [1].

The highest and the lowest prevalence rates of dentophobia are observed among people aged 15 - 33 and 55 - 65 years, respectively. Epidemiological studies have also indicated that 20 - 30% of people have fear of dental treatments, which can cause problems. Dentophobia can reduce the number of regular visits to

dentists and endanger the oral health of people. When avoidance, anxiety prediction, or distress evidently interfere with one's normal routine, job functionality, social activities, or social relationships in frightening situations or cause substantial fear of dental interventions, this complication can be defined as dentophobia or dental anxiety [1].

Patient anxiety is one of the factors that affect the dentist's ease of work as well as the patient's peace of mind and his/her understanding of pain. Different methods have been used to reduce patient anxiety during treatment [2]. One of the new techniques of reducing distress is to distract the patient's senses from the environment using various methods and techniques, including music, sound, and image [2].

In recent years, there has been an increase in behavioral research in virtual reality (VR) and virtual world. VR refers to a human–computer interface that enables the user to interact dynamically with the computer-generated environment. In contrast to the less complex audiovisual (AV) distraction, VR uses sophisticated systems such as head-mounted, wide field-of-view; three-dimensional displays (HMDs) and motion sensing systems that measure the user's head and hand positions [3].

An advantage of Virtual Reality Exposure Therapy (VRET) is that the clients face the computer-generated (virtual) counterpart of their fearful stimuli in a gradual and controlled manner at their own pace, and under the privacy of the therapist's office [4]. Moreover, VRET may also be safer, less embarrassing, and cost-effective therapy compared to reproducing a real-world situation as in in vivo exposure [5]. Presence in VR is measured subjectively with questionnaires or objectively with physiological measures [e.g., heart rate (HR), body posture, skin conductance level] [6].

Video modeling is an effective tool for behavior changing; it has been used in medicine, sport and other fields. It is used extensively with autistic children and children with anxiety. Video modeling could be effective for dental anxiety reduction [7].

The aim of this systematic review is to assess the effectiveness of Virtual Reality Exposure Therapy (VRET) in reducing dentophobia and enhancing the dental experience. This review will examine existing randomized clinical trials to evaluate the impact of VRET on patients undergoing dental procedures and provide insights into the potential of VR technology in addressing dental anxiety.

Methodology

We selected randomized clinical trials (RCTs) of VRET in dental phobia using the search strategy described below. A thorough literature search was undertaken using the PubMed database to extract the articles on the role of virtual reality, its effectiveness, and future aspects. The reference lists of all retrieved articles were hand-searched.

We used the following search terms: ‘‘VRET,’’ ‘‘virtual reality and dental phobia,’’ ‘‘virtual reality and exposure,’’ ‘‘virtual reality and phobia,’’ ‘‘virtual reality and dental anxiety,’’ ‘‘virtual reality and generalized phobia,’’ ‘‘virtual reality and dental treatment,’’ and ‘‘virtual reality and dentistry.’’ We also searched the references from the recent randomized control trials, meta-analysis, and systematic reviews on the topic.

The inclusion criteria were randomized allocation of the subjects in the experimental conditions; studies with human subjects; studies regarding the efficacy of VRET in dental phobia; the existence of at least one VRET condition and one control condition (classical evidence-based intervention or waitlist); studies reporting original empirical findings; studies published in peer-reviewed

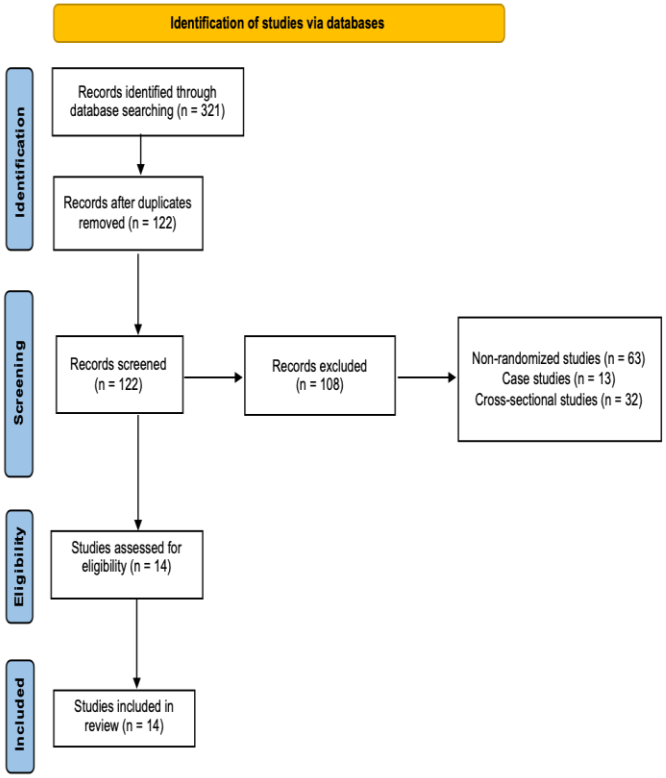
journals; and studies written in English. The exclusion criteria were as follows: not enough data to calculate the effect sizes; nonclinical population; case studies; book chapters; dissertations; and less than 10 participants in the VRET group. When there were several publications on the same project, the most up-to-date or the most complete report of the study was selected, and other versions were excluded. Studies that were limited to describing the feasibility or technical evaluation of a certain system were also excluded.

All the citations that were imported into the bibliographic software Mendeley were double-checked, and duplicates were eliminated. Excel spreadsheets (Microsoft Office 2019®, MS, Redmond, WA, USA) were used to assess each publication. The following information was gathered using a standardized form: (1) authors' names and publication year; (2) study design; (3) study goal; (4) methods; (5) main findings; and (6) conclusions. The PRISMA statement rules were followed during the literature selection procedure.

Results

A total of 321 potentially relevant articles were identified. After removing duplicates, titles and abstracts of the remaining articles were screened and further identified as potentially meeting the inclusion criteria. Following a thorough securitization of the full-text articles, 14 studies fully met the inclusion criteria and were included in this review (see Figure 1).

Figure 1: Flowchart of the study selection process. PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analyses)



The systematic review examined 14 studies investigating the role of virtual reality (VR) interventions in addressing dentophobia, an irrational fear of dental procedures. These studies spanned various age groups, geographical locations, and dental treatments, providing valuable insights into the potential of VR technology to alleviate dental anxiety.

The characteristics of included studies are shown in Table 1. Among the fourteen studies, two were case control studies, one pilot clinical trial and rest all randomized control trials. The studies were conducted in different countries: three in Iran [2, 3, 4], three in Malaysia [5, 6, 7], two in the USA [11, 12], one each in the UK [8], Israel [1], Finland [9], Germany [10], India [13] and Italy [14] reflecting the global nature of the phenomenon under study.

One consistent outcome across the reviewed studies was a notable reduction in anxiety levels among patients. This outcome held true for both children and adults [1, 2,

3, 4, 5, 6, 7, 8, 9, 10, 11, 12], signifying the effectiveness of VR interventions in mitigating dental anxiety.

High levels of patient satisfaction emerged as another shared outcome, with children, parents, and clinicians expressing contentment with the use of VR technology during dental procedures [1]. This suggests that VR has the potential to improve the overall dental experience.

Patients consistently reported an enhanced dental experience, including increased enjoyment and reduced distress during procedures when VR technology was utilized [12].

Children exposed to VR during dental procedures exhibited higher satisfaction levels [1]. In the study conducted in Iran adults reported that VR exposure therapy significantly decreased dentophobia [2]. Moreover, the use of VR eyeglasses effectively reduced pain perception and state anxiety in dental patients [4]. Notably, VR led to a significant reduction in dental anxiety and behavioral avoidance [5,6]. The positive effects of VR on dentophobia were also found to persist over several months [10]. Gender differences were observed, with VR having a more substantial impact on reducing dentophobia in specific gender groups [9].

Collectively, these studies provide compelling evidence of the consistent impact of VR interventions in reducing dentophobia across diverse populations and dental procedures. The shared outcomes underscore the potential of VR technology in enhancing the dental experience, reducing anxiety, and ultimately improving patient outcomes. These findings contribute to the growing body of evidence supporting innovative techniques for addressing dentophobia.

Discussion

A consistent and notable outcome observed in the reviewed studies was the significant reduction in anxiety levels among patients who underwent dental procedures with the aid of VR technology. Dentophobia, a widespread issue, often leads to dental avoidance, impacting oral health negatively. The ability of VR interventions to reduce anxiety holds promise in mitigating this challenge, encouraging patients to seek dental care more regularly.

Previous research has also highlighted the efficacy of VR in reducing anxiety in various medical and therapeutic contexts [2,5,10]. This is not surprising, as VR creates an immersive environment that distracts the individual from the real world, providing a sense of control and relaxation [7]. VR exposure therapy, in particular, allows individuals to confront their fears gradually, enhancing the efficacy of the intervention [10].

Another positive outcome shared across the studies was the high level of satisfaction expressed by patients, parents, and clinicians when VR technology was incorporated into dental treatments [1]. This suggests that VR interventions not only reduce anxiety but also enhance the overall dental experience.

High levels of patient satisfaction can have several implications. Firstly, it may encourage individuals who previously avoided dental care due to anxiety to consider regular dental check-ups [8]. Secondly, it can lead to a more pleasant and efficient clinical environment, making dental practitioners' work more comfortable [1]. Therefore, the use of VR in dental care has the potential to be a win-win situation for both patients and dental professionals.

An intriguing finding in some of the studies was the persistence of the positive effects of VR interventions over several months [10]. This duration of effectiveness is a promising aspect of VR interventions, as it suggests that the benefits extend beyond the immediate dental procedure.

These findings encourage further research to explore the long-term impacts of VR interventions and to determine the duration of their effectiveness. Longitudinal studies could investigate whether patients who experience reduced dentophobia through VR interventions continue to seek dental care regularly. This information is critical for assessing the lasting impact of VR on oral health outcomes.

Video modeling, as highlighted in the introduction, emerged as a valuable tool for behavior modification in the context of dentophobia. Shah et al. (2018) showcased the effectiveness of audiovisual distraction eyeglasses, which was found to be equally effective as the Tell-Play-Do (TPD) technique in reducing child anxiety levels [13]. This outcome suggests that VRET is not the sole VR approach to mitigating dentophobia, and variations like audiovisual distractions can also play a crucial role in reducing anxiety in dental settings.

Gender-specific effects of VR interventions were also evident, with a more pronounced impact on reducing dentophobia observed in specific gender groups, particularly women [9]. Understanding these gender-specific effects is essential for tailoring VR interventions to individual needs and preferences.

Gender differences in the response to VR interventions might be due to variations in how men and women experience and express dental anxiety. These findings suggest the need for gender-tailored interventions, where VR content or strategies are designed to be more effective for specific gender groups.

While VR interventions have demonstrated their effectiveness, future research should focus on optimizing the types of VR interventions used in dental settings. This includes exploring the most effective VR devices, content, and methods for delivering VR therapy [9].

Optimizing VR interventions can enhance the overall effectiveness of the technique and its impact on dentophobia reduction. Additionally, it's essential to consider the preferences of different age groups and cultural backgrounds when designing VR interventions.

As VR technology continues to advance, it is essential to assess the cost-effectiveness of implementing VR interventions in dental practice. Understanding the economic implications of incorporating VR into dental care can guide decisions about its widespread adoption.

Cost-effectiveness analysis can provide valuable insights into the financial feasibility of using VR interventions in dental settings. Factors such as the initial investment in VR equipment, maintenance costs, and potential savings through increased patient compliance should be considered.

In summary, the collective evidence suggests that VR has the potential to be a valuable tool in reducing dentophobia in both children and adults, enhancing the dental experience, and improving patient outcomes. These positive findings open doors for further research to optimize VR interventions, understand their long-term effects, explore gender-specific responses, and assess their cost-effectiveness. By addressing these aspects, dental practitioners can harness the full potential of VR technology to reduce dentophobia and improve oral health outcomes.

However, it is important to acknowledge the limitations of the studies included, such as variations in study designs, patient populations, and dental procedures, which may introduce heterogeneity. More high-quality randomized clinical trials with larger sample sizes and consistent outcome measures are needed to further confirm the effectiveness and scope of VRET in dental anxiety management. Future research should also

explore the long-term effects of VRET and its cost-effectiveness in dental practice to ensure its sustainable implementation.

Conclusion

In conclusion, the findings from this systematic review underscore the substantial potential of VR technology in reducing dentophobia among diverse patient populations. By reducing anxiety levels, improving the overall dental experience, and promoting behavioral cooperation, VR emerges as a versatile tool for dental practitioners. The longevity of these effects, the suitability for children, and the adaptability to different dental procedures make VR a promising avenue for addressing the prevalent issue of dental anxiety. However, it is imperative to continue exploring the optimization of VR interventions and their long-term impacts, as well as considering the cost-effectiveness of integrating VR technology in dental practice.

Reference

1. Ram D, Shapira J, Holan G, Magora F, Cohen S, Davidovich E. Audiovisual video eyeglass distraction during dental treatment in children. Quintessence Int. 2010;41(8):673-679.
2. Majidi E , Manshaee G . Effects of Virtual Reality Exposure Therapy on Dentophobia in Clients of Dental Offices in Isfahan, Tehran, and Shahrekord (Iran). Iran J Psychiatry Behav Sci. 2021;15(4):e115684. doi: 10.5812/ijpbs.115684.
3. Birang E, Yaghini J, Birang R, Zohary M. Effect of Virtual Reality During Periodontal Treatment of Patients with Anxiety. J Res Dent Maxillofac Sci. 2019; 4 (1) :9-15
4. Asl Aminabadi N, Erfanparast L, Sohrabi A, Ghertasi Oskouei S, Naghili A. The Impact of Virtual Reality Distraction on Pain and Anxiety during Dental Treatment in 4-6 Year-Old Children: a Randomized Controlled Clinical Trial. J Dent Res Dent Clin Dent Prospects. 2012;6(4):117-124. doi:10.5681/joddd.2012.025
5. Gujjar KR, Sharma R, Jongh AD. Virtual Reality Exposure Therapy for Treatment of Dental Phobia. Dent Update. 2017;44(5):423-435.
6. Gujjar, K., Van Wijk, A., Sharma, R., & De Jongh, A. (2018). Virtual Reality Exposure Therapy for the Treatment of Dental Phobia: A Controlled Feasibility Study. Behavioral and Cognitive Psychotherapy, 46(3), 367-373.
7. Raghav, K., Van Wijk, A., Abdullah, F. et al. Efficacy of virtual reality exposure therapy for treatment of dental phobia: a randomized control trial. BMC Oral Health 16, 25 (2016). https://doi.org/10.1186/s12903-016-0186-z
8. Al-Namankany, A., Petrie, A. & Ashley, P. Video modeling and reducing anxiety related to dental injections – a randomized clinical trial. Br Dent J 216, 675–679 (2014).
9. Lahti S, Suominen A, Freeman R, Lähteenoja T, Humphris G. Virtual Reality Relaxation to Decrease Dental Anxiety: Immediate Effect Randomized Clinical Trial. JDR Clinical & Translational Research. 2020;5(4):312-318.
10. Doering S, Ohlmeier MC, de Jongh A, Hofmann A, Bisping V. Efficacy of a trauma-focused treatment approach for dental phobia: a randomized clinical trial. Eur J Oral Sci. 2013;121(6):584-593. doi:10.1111/eos.12090
11. Arias MC, McNeil DW. Smartphone-based exposure treatment for dental phobia: a pilot randomized clinical trial. J Public Health Dent. 2020;80(1):23-30. doi:10.1111/jphd.12340
12. Padrino-Barrios C, McCombs G, Diawara N, De Leo G. The use of immersive visualization for the

control of dental anxiety during oral debridement. American Dental Hygienists' Association. 2015 Dec 1;89(6):372-7.

13. Shah U, Bhatia R. Effectiveness of Audiovisual Distraction Eyeglass Method Compared to Tell-Play-do Technique Among 4–7-year-old Children: ARandomized Controlled Trial. Int J Oral Care Res 2018;6(2):1-7.
14. Atzori, B., Lauro Grotto, R., Giugni, A., Calabrò, M., Alhalabi, W.S., & Hoffman, H.G. (2018). Virtual Reality Analgesia for Pediatric Dental Patients. Frontiers in Psychology, 9.

Legend Tables

Table 1: Characteristics of included studies.

Author and Year	Location	Children Values(Ma, n, Ar)	Adult Values(Ma, n, Ar)	Study Design	Dental Procedure	VR Device Equipment	Measuring Scales			Outcome - Effectiveness
							Dental Anxiety	Pain	Other	
Ram et al. (2010) [1]	Israel	Ma = Case Group (8.0 ±1.84) Control Group (6.1 ± 1.42) n = 120 Ar = 5-10		Case Control Study	Restorative treatment (including direct restorations), crowns, root canals, extractions	AV wireless eyeglasses with earphones	VAS		Houpt Behavior Rating Scale, Frankl Behavior Rating Scale	Two Groups: Study Group (AVD Glasses) and Control Group (Nitrous Oxide). Behavior of the case group (AVD sessions), as assessed by the Houpt scale and Frankl scale at the initial examination, was better than that of the control group. Mean VAS ratings for children in the case group, their parents, and the clinician were high between 2 treatment sessions.
Majidi et al. (2021) [2]	Iran		Ma = Experimental Group (36.72 ± 5.23) Control Group (37.24 ± 6.52) n = 30 Ar = 25-40	Case Control Study	Dental examination, local anesthesia, restorative treatment	Samsung Gear 360 Camera (2017 Edition), and HTC VIVE Pro Virtual Reality Headset	MDAS			Two Groups: Experimental Group and Control Group. Virtual reality exposure therapy effectively decreased dentophobia in clients of dental offices in the experimental group.
Birang et al. (2019) [3]	Iran		Ma = 31±7.4 n = 14 Ar = 24-38	Randomized Control Trial	Scaling and root planing (SRP)	Eyeglasses (Carl Zeiss 1963, Germany), Monitoring Device (Cardioset SR110, Iran)	DAS-R	VAS		Two Groups: Test Group and Control Group. There was a significant difference in the patient's pulse rate and stress during SRP between the test and control groups. Moreover, the patients' anxiety was significantly reduced by using eye glasses (test group) during SRP.
Asl Aminabadi N et al (2012) [4]	Iran	Ma = Group 1 (5.18 ± 0.67) Group 2 (5.65 ± 0.71) n = 117 Ar = 4-6		Randomized Control Trial	Fluoride therapy, restorative treatment	VR device (i-glasses 920HR Ilixco, Inc. Menlo Park, CA, USA)	MCDAS(f)	WBF-S		Two Groups: Group 1 (with VR distraction) and Group 2 (without VR distraction). There was a significant decrease in pain perception and state anxiety scores with the use of virtual reality eyeglasses during dental treatment.

Gujjar KR et al. (2017) [5]	Malaysia	Ma = Patient 1 - 56 Patient 2 - 24 n = 2 Ar = 24-56		Randomized Control Trial	Sitting passively on the dental chair (no tools), inspection of the oral cavity using mouth mirror, introduction of an injection, introduction of drill without sound, introduction of drill with sound	Oculus Development Kit-2 Head Mounted Device	MDAS, DFS, VAS-A		SUDS, VRS, Behavior Test	VRET resulted in a notable reduction of various self-reported dental anxiety scores.
Gujjar et al. (2018) [6]	Malaysia	Ma = Nr n = 10 Ar = Nr		Randomized Control Trial	Sitting passively on the dental chair (no tools), inspection of the oral cavity using mouth mirror, introduction of an injection, introduction of drill without sound, introduction of drill with sound	Head-Mounted Device, Heart Rate (HR) wristband	MDAS, DFS, VAS-A		BAT, SUDS	Two Groups: VRET condition and an IP control condition. VRET was associated with a significant reduction in state anxiety, dental trait anxiety, and behavioral avoidance. VRET is a safe and acceptable treatment for dental phobia with no apparent increase in patients' heart rate.
Kumar Raghav et al. (2019) [7]	Malaysia		Ma = VRET Group (25.3) IP Group (23) n = 30 Ar = 18-50	Randomized Control Trial	Dental examination, local anesthesia, restorative treatment, extraction	Oculus Development Kit 2 Head Mounted Display	MDAS, Dental Fear Survey, VAS		SUDS, VRS, BAT, Dental Phobia Checklist	Two Groups: VRET condition and an IP control condition. VRET was associated with a significantly greater decrease in dental anxiety and behavioral avoidance compared to those who received IP as intervention. Six months after VRET, 85% of patients had lost their dental phobia diagnosis.

Al-Namankany et al. (2014) [8]	United Kingdom	Ma = Test Group (9.15) Control Group (9.07) n = 68 Ar = 6-12		Randomized Control Trial	Basic dental treatment	Video modeling	ACDAS, VAS			Two Groups: Test Group and Control Group. Children in the test group had significantly less anxiety after watching the video than children in the control group throughout the subsequent dental procedure; in particular at the time of the LA administration.
Lahti S et al. (2020) [9]	Finland		Ma = 52.5 (Total) VRR Group (51.8) TAU Group (53.3) n = 277 Ar = 18+	Randomized Control Trial	Basic, special, or emergency dental care; general anesthesia, x-ray	Samsung Gear VR Headset and a Samsung Galaxy S7 Mobile Phone (attached to the virtual headset) for the MelloVR application.	MDAS, Anticipatory Dental Anxiety (MDAS items 1 and 2), Treatment-related Dental Anxiety (MDAS items 3 to 5)			Two Groups: VRR Group and TAU Group. Total and anticipatory dental anxiety decreased more in the VRR group than the TAU group in patients of a primary dental care clinic. In women, dental anxiety decreased more in VRR than TAU. Anticipatory dental anxiety decreased more in VRR than TAU in both men and women.
Doering et al.(2013) [10]	Germany		Ma = EMDR Group (41.69±14.93) Waitlist Control Group (40.20±10.39) n = 31 Ar = 25-60	Randomized Control Trial	Inspection of the oral cavity using two dental mirrors, probing dental pockets, dental scaling	Eye Movement Desensitization and Reprocessing (EMDR)	DAS, Dental Fear Survey, Behavior Test, Dental Attendance (1 year follow-up)		HADS, IES-R, DES	Two Groups: EMDR Intervention Group and Waitlist Control Group. EMDR was associated with significant reductions of dental anxiety and avoidance behavior as well as in symptoms of PTSD. After 1 yr, 83.3% of the patients were in regular dental treatment.
Arias MC et al. (2020) [11]	USA		Ma = Treatment Group (28.2) Control Group (24.1) n = 36 Ar = 18+	Randomized Control Trial	Dental examination	Exposure videos on their smartphone	Dental Fear Survey BAT, SUDS		AARP	Two Groups: Treatment Group and Control Group. Treatment group reported lower self-reported anxiety and decreased cardiac reactivity at the post-assessment compared with the pre-assessment; no change in anxiety was found for the control condition from pre- to post-assessment.
Padrino-Barrios et al. (2015) [12]	USA		Ma = 29.96±7.8 n = 30 Ar = 18-51	Randomized Control Trial	Dental examination, oral hygiene information, prophylaxis	Portable Immersive Visualization (IV) Vuzix iWear AV 920 video eyewear	CDAS-R		Calmness Scale	Two Groups: Group A used IV eyewear during the first one-half of the appointment (right side of the mouth) and Group B used IV eyewear during the second one-half of the appointment (left side of the mouth). Both treatment groups experienced a decrease in anxiety levels from pre to post IV treatments. Decrease in mean calmness scores (Group A and B) from pre-IV treatment to post-IV treatment. Significant correlation

										between calmness and gender; females reported higher levels of anxiety than men before and after IV treatment.
Shah et al. (2018) [13]	India	Ma = Nr n = 50 Ar = 4–7		Randomized Control Trial	Dental examination, oral hygiene information, prophylaxis, restorative treatment	AV distraction eyeglasses	CBC-AS, VS, FIS		Frankl Behavior Rating Scale	Two Groups: Group I AVD technique and Group II TPD technique. TPD technique was equally effective as distraction by AV glasses on child anxiety levels and increased the cooperative behavior during dental treatment. Difference between group 1 and 2 observed was statistically non-significant.
Atzori et al. (2018) [14]	Italy	Ma = 13.20±2.39 n = 5 Ar = 11-17		Pilot Study, Clinical Trial	Restorative treatment, extraction	Oculus Rift DK2 and CV1 virtual reality goggles		GRS		Patients reported significantly lower "worst pain" and "pain unpleasantness," and had significantly more fun during VR, compared to a comparable dental procedure with No VR. Using VR patients reported a "strong sense of going inside the computer-generated world," without side effects. The dentist preferred having the patients in VR.

N, Participant number; Ma, Mean age years; Ar, Age range years; Nr, Not reported; VR, Virtual Reality; AV, Audiovisual; AVD, Audiovisual Distraction; VAS, Visual Analogue Scale; VAS-A, Visual Analogue Scale-Anxiety; MDAS, Modified Dental Anxiety Scale; DAS-R, Dental Anxiety Scale-Revised; DAS, Dental Anxiety Scale; MCDAS(f), Faces version of the Modified Child Dental Anxiety Scale; W–BFS, Wong–Baker Faces Scale; DFS, Dental Fear Scale; SUDS, Subjective Units of Distress Scale; VRS, Verbal Rating Scales; BAT, Behavioral Avoidance Test; ACDAS, Abeer Children Dental Anxiety Scale; HADS, Hospital Anxiety and Depression Scale; IES-R, Impact of Event Scale-Revised; DES, Dissociative Experiences Scale; BAT, Behavioral Avoidance Test; AARP, Abbreviated Acceptability Rating Profile; CDAS-R, Corah's Dental Anxiety Scale-Revised; CBC-AS, Chhota Bheem Chutki Anxiety Scale; VS, Venham Scale; FIS, Facial Image Scale; GRS, Graphic Rating Scale (GRS) Questionnaire; PTSD, Post-Traumatic Stress Disorder; TPD, Tell-Play-Do; VRR, Virtual Reality Relaxation; TAU, Treatment as Usual; IP, Informational Pamphlet; VRET, Virtual Reality Exposure Therapy.