Nonpharmacological Behavior Guidance for Children During Preventive Dental Visits: A Systematic Review—Part 1

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Abstract: *Purpose:* To assess the effectiveness of nonpharmacological behavior guidance interventions used for a child undergoing preventive dental visits. *Methods:* Databases: Ovid MEDLINE, PsycINFO (EBSCOhost), Embase, and Cochrane Library, were searched from 1946 to February 2022, for randomized clinical trials (RCTs) comparing effectiveness of basic and advanced nonpharmacological techniques rendered during a preventive visit including examination, prophylaxis, fluoride application and radiographs. Workgroup (WG) identified moderate-to-high quality systematic reviews (SRs) published on hypnosis, audiovisual distraction, and parental presence/ absence; and decided to exclude these interventions from current SR to avoid duplication. The primary outcome measures for the studied interventions included reduction in anxiety, fear, pain, and improvement in cooperative behavior. Eight authors determined the included RCTs, performed data extraction, and assessed the risk of bias. Standardized Mean Difference calculation and assignment of quality of evidence by Grading of Recommendations Assessment, Development and Evaluation approach were done. *Results:* Fifteen articles qualified for analysis from 219 screened articles. WG found studies evaluating effectiveness of pre-visit preparation and in-office strategies rendered pre- or during treatment such as positive imagery, communication, modeling, tell-show-do, magic tricks, mobile applications, positive reinforcement, and sensory adapted dental environment. The certainty of evidence ranged from Very low to Moderate and the magnitude of effect varied from trivial to a large change in the desired outcomes. *Conclusions:* Most basic nonpharmacological behavior guidance techniques showed trivial to small reduction in self-reported anxiety and/or improvement in behavior, with mobile application and modeling showing large effects in reduction of anxiety based on some rating scales. Systematic Review Registration Number: PROSPERO: CRD42022314723. *(Pediatr Dent 2023;45(3):181-96.E16-E19)* Received December 20, 2022 | Last Revision March 9, 2023 | Accepted March 16, 2023

KEYWORDS: SYSTEMATIC REVIEW; DENTAL CARE FOR CHILDREN; DENTAL ANXIETY, BEHAVIOR MODIFICATION; PREVENTIVE DENTISTRY

Early establishment of a dental home can provide the much-needed foundation for preventive education and oral health care. At the center of the dental home is the continuum of interaction involving the dentist, dental team, patient, and

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Supplemental material available in the online version.

caregiver/parent,[1] which extends beyond communication and education to ensuring the safety of all involved during the delivery of oral health care. Guidance of child behavior is essential to this dynamic for establishing communication, alleviating dental fear and anxiety, promoting a positive attitude toward oral health care, and building a trusting relationship to provide quality oral health care in a comfortable, safe, and effective manner.[2]

Beginning with the first American Academy of Pediatric Dentistry (**AAPD**) Behavior Conference in 1988, the AAPD has prioritized the formulation of guidelines for what was once "a set of techniques and skills that have been passed down by word of mouth and in case reports".[3] This conference and the two subsequent symposia in 2003 and 2013 have provided guidelines that are foundational for the training of general dentists, specialists and allied oral health care professionals involved in the care of children.[4,5] The AAPD best practice statement entitled "Behavior Guidance for the Pediatric Dental Patient" is a strong initial step in outlining the range of techniques that may be utilized.[2]

Since children exhibit multiple expressions of development (physical, intellectual, emotional, and social) and a range of personality attitudes and temperaments, dentists need a diverse armamentarium of various behavior guidance techniques to meet the evolving needs of the individual child while also being tolerant and flexible in the implementation of the techniques.[2,6] Nonpharmacologic behavior guidance techniques vary and have evolved due to societal pressures, parenting styles, parental acceptance, and emerging outcomes-based behavioral research.[3,7] Application of behavior guidance strategies

are primarily empirical and can be influenced by the dentists' training, geographic region of practice, and level of experience.[8] Despite the efforts of the AAPD and other independent investigators, there is limited available evidence on the effectiveness of different nonpharmacologic guidance techniques. Furthermore, the available evidence is complicated by the varying demographic and cultural conditions of the study populations and the interventions under investigation.

This is the first in a series of three systematic reviews that specifically address nonpharmacological behavior guidance techniques in children during preventive and/or treatment dental visits. When considering dental preventive visits, most are performed with the dentist and staff employing the basic behavior guidance fundamental to the provision of oral health care in the pediatric population. Although noninvasive, preventive visits and their associated procedures can be distressing to a subset of patients and evidence-based nonpharmacologic behavior guidance techniques are needed to aid clinical decision making. The purpose of this systematic review is to evaluate randomized clinical trials on nonpharmacologic behavior guidance techniques for children undergoing preventive dental care and assess the certainty of evidence for the use of these techniques.

Methods
This systematic review was registered in the Prospective Register of Systematic Reviews (PROSPERO) under the number CRD42022314723 and adhered to the reporting guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) Statement.[9,10] It was decided to separate the systematic review on nonpharmacological behavior guidance strategies into three categories: nonpharmacological behavior guidance for 1) children during preventive visits such as examination, prophylaxis, fluoride varnish, and radiographs; 2) children undergoing dental treatment such as sealants, dental restorations with or without local anesthesia, and simple surgical procedures; and 3) children with special health care needs during preventive or treatment visit. After systematic search of literature, the authors found five[11-15] existing moderate to high quality as assessed by AMSTAR 2 (A MeaSurement Tool to Assess systematic Reviews) Tool (Bruyère Research Institute, Ottawa, Ontario, Canada)[16] systematic reviews published in the last five years on parental presence/absence, hypnosis, preparation, traditional distraction techniques such as counterstimulation, camouflaging of syringe, suggestion, mirror and conversation, toys, book's/children's story and technology-based distraction techniques such as audio distraction/music, audiovisual distraction, virtual reality glasses, and smart phones/tablets for healthy children undergoing preventive and treatment visits. Due to vastness of the topic, it was decided not to duplicate the effort and focus on the remaining contemporary basic and advanced nonpharmacological behavior guidance techniques for the purposes of this systematic review.

Study question and selection criteria
The PICOS (Population, Intervention, Comparison, Outcomes, and Study design) guiding this review was defined as P—children and adolescent undergoing a preventive visit (exam, prophy, fluoride varnish, radiographs); I—pre/post-visit preparation, in office nonpharmacological behavior guidance techniques such as communication (verbal/nonverbal), positive imagery, direct observation/modeling, desensitization, distraction using technology and magic tricks, tell-show-do and its

modifications, ask-tell-ask, voice control, positive reinforcement, memory restructuring, bio-feedback relaxation, breathing relaxation, combined therapies, animal assisted therapy, sensory adapted dental environment, cognitive behavior therapies, picture exchange communication system, and protective stabilization, when used individually or in combination; C—no behavior guidance (inactive control), or other behavior guidance techniques (active control); O—self-reported (child or parent), physician (dentist)-rated, and physiologically assessed cooperative behavior, anxiety/fear/phobia, pain, and treatment completion; and S—restricted to randomized clinical trials. All studies that employed any form of nonpharmacological behavioral guidance techniques on pediatric patients were included.

The exclusion criteria were as follows: 1) studies that employed pharmacological behavior guidance technique alone; 2) Observational studies, review articles, letters to the editors, book chapters, opinion articles, editorials; and 3) articles published in non-English languages.

Search strategy
The detailed search strategies for each database were developed with the help of two dental school librarians (MAW, LW) who included MeSH terms and important synonyms. The initial search was conducted in four databases including Ovid MEDLINE, PsycINFO (EBSCOhost), Embase, and Cochrane Library. Literature search was also conducted to identify grey literature in this topic, and this included ProQuest Dissertations and Google Search. The reference lists from the included studies were hand searched to identify any relevant studies. The final and updated search was conducted on February 2, 2022, by the research project manager (RW). Covidence (Covidence, VIC, Australia) systematic review management software was used to search and manage the articles (see **Supplemental Electronic Data—sFigure**). A total of 65 RCTs were included for analysis in the three parts of the systematic review (Figure 1).

Study selection and data extraction process
Eight reviewers (VD, JJ, AM, MW, JT, CL, MM, EG) were involved in the study selection process. The reviewers were trained and calibrated to conduct data selection and extraction using the Covidence software (Covidence, VIC, Australia). Following this, the reviewers independently selected the studies in two phases. In the first phase, the articles were screened and included based on the title and abstract. In phase two, shortlisted articles were subjected to full text screening. Any discrepancy in the selection of articles was resolved with consensus after discussion among the reviewers. A data extraction form was developed containing the following information: name of the authors, year of publication, country, study design and setting, sample size, age, sex, dental treatment provided, behavior guidance technique used, assessment criteria based on self-reported, physician rated or physiological measurement for anxiety/fear, cooperative behavior, or pain. The reviewers independently extracted data and met for final consensus on each study. The final data was categorized and tabulated by an independent reviewer (CC).

Data synthesis
A unique feature of behavior guidance research is that the studies use different rating scales to report the effect of an intervention (nonpharmacological behavior guidance technique) on outcomes such as cooperative behavior (also referred to as cooperativeness or cooperation), anxiety, fear, and phobia, and
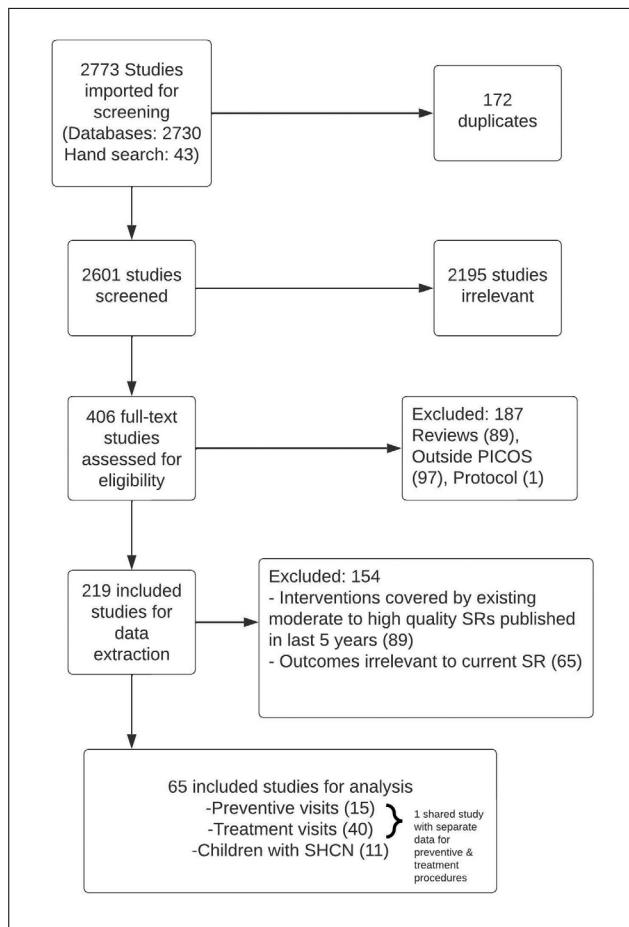
Figure 1. PRISMA flowchart.

Flowchart contents:

2773 Studies imported for screening (Databases: 2730 Hand search: 43) → 172 duplicates

2601 studies screened → 2195 studies irrelevant

406 full-text studies assessed for eligibility → Excluded: 187 Reviews (89), Outside PICOS (97), Protocol (1)

219 included studies for data extraction → Excluded: 154 - Interventions covered by existing moderate to high quality SRs published in last 5 years (89) - Outcomes irrelevant to current SR (65)

65 included studies for analysis
-Preventive visits (15)
-Treatment visits (40)
-Children with SHCN (11)
} 1 shared study with separate data for preventive & treatment procedures

pain. The measurement scales can be self-reported (child or caregiver-self report), physician/provider/dentist rated, or population. As a first step, the workgroup (**WG**) assessed the level of appropriateness of scales/tools used to measure cooperative behavior, fear/anxiety, and pain in the included studies. On careful review of the content provided in its original development/validation publication and a review of the literature describing or utilizing the instrument/scale, each included scale was categorized for its appropriateness for the studied outcome as "most appropriate", "acceptable", or "least appropriate" (Appendix 1). Information from Cohen et al.[17] was used for additional guidance on assessment of pain instruments. Based on this predetermined appropriateness of scales, the importance of each outcome in relation to clinical decision making was then assessed to be critical, important, or not important and noted in Appendix 2, and in Appendix 1 in Parts 2 and 3.

For purposes of analysis, an outcome was defined specific to the rating scale used. The key outcomes included improvement in cooperative behavior, and the reduction in pain, anxiety, and fear as measured by a specific rating scale. For example, improvement in cooperative behavior evaluated using Frankl Behavior Rating Scale (FBRS) and a physiologic scale such as Heart Rate (HR) were analyzed as two separate outcomes. Due to the complex nature of the data, there were multiple outcomes reported depending on the rating scales used.

Considering the variation in units of measurement for each outcome, the authors decided to calculate the standardized mean difference (**SMD**) to measure the effect in a standardized manner. The mean difference divided by standard deviation (**SD**) yields respective SMD. The SD used is either of the control group (Glass' delta) or the pooled SD (Cohen's d)[18]. A SMD of 0.2-0.5 represented small effect, 0.5-0.8 represented moderate effect, and values greater than 0.8 represented a large effect. When SMD is 0, there is no difference between the interventions. When there was insufficient data in the original article to calculate the SMD, the effect of the intervention was deemed trivial if the article reported no statistical significance and deemed small if the article reported significant result. To communicate the findings of the systematic reviews using clinically informative statements, the size of estimate interpreted from SMD's was categorized as large effect, moderate effect, small important (statistically significant) effect, or trivial effect (small unimportant or statistically nonsignificant or no effect).[19] Overall, the certainty of evidence was reported to communicate results of the systematic review.

For meta-analysis with continuous outcomes, random-effects models with inverse-variance method were used to obtain pooled mean difference (**MD**) and SMD along with 95 percent confidence interval (**CI**). All meta-analyses were performed using RevMan 5.2.1 software (Cochrane, London, UK).

Certainty of the evidence
The certainty of evidence helps the WG determine the overall confidence on the observed effect of an intervention, and this was assessed using the Grading of Recommendations, Assessment, Development and Evaluation (**GRADE**) criteria[20] by two independent reviewers. Disagreements, if any, were resolved by consensus with an independent reviewer. GRADE-pro software (McMaster University, Hamilton, Ontario, Canada) was used to assess the overall certainty of evidence of each included outcome based on the following criteria: risk of bias (**ROB**), inconsistency, indirectness, imprecision, and publication bias. ROB, inconsistency, indirectness, and imprecision were noted as "not serious", "serious", or "Not serious". At times when it was not possible to compute a single estimate of effect for a given outcome, the narrative summary was utilized to assess the certainty of evidence.[21]

ROB of randomized clinical trials were assessed using ROB2 (Revised Cochrane Risk of Bias) tool[22]. This assessment tool contains six domains namely, bias arising from the randomization process, bias due to deviations from intended interventions, bias due to missing outcome data, bias in measurement of the outcome, and bias in selection of the reported result (Figures 2 and 3).

Inconsistency was judged based on the I^2 value of the heterogeneity of the studies in the meta-analysis and assigned as: not serious (I^2 equals zero to 30 percent); serious (I^2 equals 35 to 65 percent); and Not serious (I^2 equals greater than 75 percent).

Indirectness of evidence was judged as: not serious if the evidence directly compared the interventions, population, or outcomes; serious if the findings did not apply to the population; and Not serious if an indirect comparison was made.

Imprecision to detect a small effect (0.2 SMD), 200 subjects per group (400 in total) was determined to be the optimal information size (**OIS**). Therefore, the OIS/sample size used for determination of imprecision was as follows:
a. **Not serious:** sample size more than 400 in total (two groups) and significant (confidence intervals do not cross the null value).
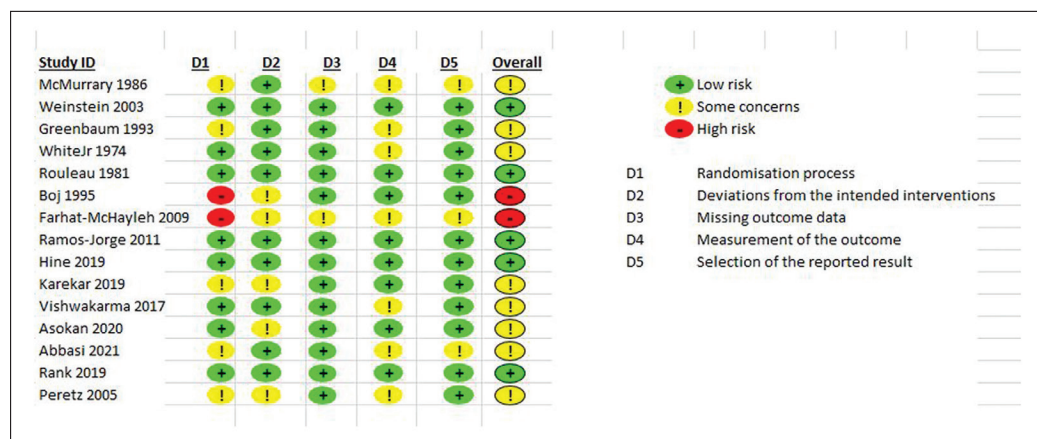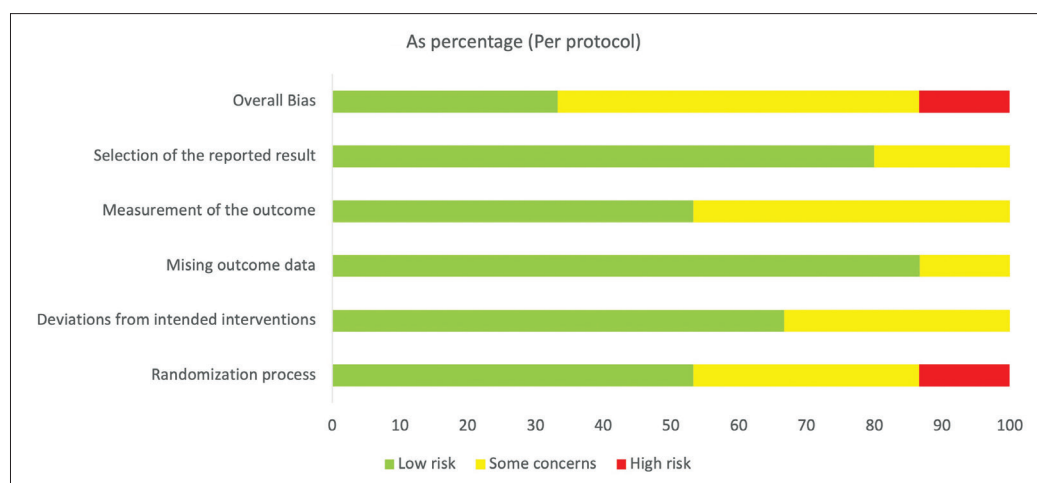
Figure 2. Risk of bias among included studies.

Figure 3. Risk of Bias summary plot.

physician-report rating scales (i.e., assessment tools completed by the researcher or dentist, dental hygienist, or other operators). The included studies were conducted in Australia, Brazil, Canada, India, Israel, Lebanon, Pakistan, Spain, and the United States. The children included in these studies ranged from three to 12 years old, and study samples ranged with respect to children's previous dental experience and level of anxiety. The nonpharmacological behavior guidance approaches studied were used to facilitate preventive care visits including examination, oral prophylaxis, radiographs, and fluoride application.

Pre-visit preparation/ modeling conducted in non-clinical setting

Two randomized clinical trials[25,28] conducted in Australia and United States (**U.S.**) tested the effect of a filmed model demonstrating coping strategies and the guided rehearsal of these strategies. One study assessed the reduction of self-reported dental anxiety, physiologic arousal, and behavioral disturbance during dental examination[25] and the other study assessed effect of video modeling of nitrous oxide administration and local anesthesia injection in reducing pre-existing dental fear[28]. For both studies, the videos were presented in a school setting. The included children were nine-12 years old with baseline anxiety reflected by Pictorial Dental Anxiety Score (**PDAS**) 15 or higher[25] and seven-nine years old with an average Children's Fear Survey Schedule-Dental Subscale (CFSS-DS) of 14.7[28]. McMurray et al.[25] used PDAS and HR to measure reduction in dental anxiety and Dental Anxiety Index (DAI) to measure behavioral disturbance during a dental examination provided at school. Weinstein et al.[28] used Visual Analog Scale (**VAS**) to measure reduction in dental fear after the video behavior interention, but no dental procedure was attempted for the subjects. As determined by the SMD, Weinstein et al.[28] reported a small reduction in dental fear measured by VAS (Appendix 3). This outcome was deemed to be critical by the WG (Appendix 2). The certainty of evidence of this study was downgraded by one level for imprecision. Overall, the GRADE assessment was determined as Low certainty of evidence. It was not possible to compute SMD for the other study;[25] however, it reported a trivial effect on reduction in anxiety as measured by PDAS and HR, which were both deemed critical outcomes by the WG. It also reported a trivial effect on reduction in behavioral disturbance as measured by DAI, which was deemed critical by the WG. The certainty of evidence of this study was downgraded by one level each

b. **Serious:** less than 400 in total (two groups) and not significant (confidence intervals cross the null value).
c. **Not serious:** less than 100 (two groups) and not significant.

Publication bias was to be determined for an outcome with more than 10 articles.

Results

Description of studies

The team identified fifteen randomized clinical trials[23-37] that studied the effect of various nonpharmacological behavior guidance methods on anxiety reduction and behavior modification for children undergoing preventive dental care in a clinical setting (Appendix 2). The identified studies focused on behavior guidance methods such as pre-visit strategies, communication (nonverbal) strategies, direct observation/modeling, tell-show-do and its modifications, distraction, and positive reinforcement. There were no studies identified by the team related to ask-tell-ask or protective stabilization that met the inclusion criteria. The effectiveness of a behavior guidance intervention was measured in the included studies as reduction in pain, reduction in anxiety/fear/phobia, improvement in cooperative behavior including reduction in time taken to sit on the dental chair. Outcomes were assessed using various physiologic measures, self- and parent-report instruments, and

for ROB and imprecision. Overall, the GRADE assessment was determined as Very low certainty of evidence.

Positive pre-visit imagery in dental office

One randomized clinical trial[31] conducted in Brazil tested the effect of positive pre-visit imagery (i.e., photos of positive dental situations such as a child smiling in the dental chair) on dental anxiety during dental examination. A group of 70 children, aged four-11 years, with low dental anxiety were included. The study used VPT to measure the reduction in dental anxiety during dental examination. As determined by the SMD, the study reported a trivial effect on reduction in dental anxiety measured by VPT (Appendix 3). The outcome was deemed to be Important by the WG (Appendix 2). The certainty of evidence of this study was downgraded by one level due to imprecision. Overall, the GRADE assessment was determined as Low certainty of evidence.

Nonverbal communication

One randomized clinical trial[26] conducted in the U.S. studied the effect of nonverbal communication in reducing dental fear-related emotions and behaviors by comparing a reassuring pat on the arm compared to no touch. The included children were 3.5-10 years old with pre-existing dental fear. The study used Self-Assessment Manikin score (SAM) to measure the reduction in dental fear-related emotion during oral examination and an observer-rated Behavior Profile Rating Scale (**BPRS**) to measure the improvement of fear-related behavior during the examination. As determined by the SMD, the study reported trivial effect on reduction in all three independent dimensions of dental fear related emotion by SAM (Appendix 3). The outcomes were deemed to be critical by the WG (Appendix 2). It was not possible to compute SMD for the BPRS score for cooperative behavior; however, it reported a small reduction in fidgeting behavior in children older than 7 compared to children younger than seven as measured by BPRS, which was deemed a critical outcome by the WG. The certainty of evidence of this study was downgraded by one level each for ROB and for imprecision. Overall, the GRADE assessment was determined as Very low certainty of evidence.

Direct observation/modeling

Six randomized clinical trials [23,24,27,30,34,35] representing five different countries (Canada, India, Lebanon, Spain, and two from the U.S.) explored the effects of direct observation/modeling during a preventive clinical visit including various combinations of examination, radiographs, oral prophylaxis, and/or fluoride application. The included participants varied in age ranges, with three studies limited to the preschool stage from three-six years[24,27,34], one study limited to the school age stage from six-11 years,[35] and two studies spanning both stages with subjects ranging in age from four-11 years[23,30]. Three studies specifically focused on subjects with no previous exposure to the dental environment[24,27,34], one selected for subjects with at least two dental visits with disruptive behavior[23], and the remaining two [30,35] did not specify prior dental experience. For the basic behavior guidance intervention, two studies compared live modeling with control,[23,30] three compared video/photo modeling with control[24,27,34], and the remaining study[35] compared multiple groups (combination of live modeling, video modeling, control).

Four studies used operator/observer ratings of the subject's cooperative behavior to indicate the effect of the intervention.[23,] [24,27,34] As determined by the SMD, Hine et al.[34] reported a large improvement in cooperative behavior in video modeling compared to control, watching children's cartoons (Appendix 3). This outcome was deemed to be critical by the WG (Appendix 2).

The other three SMD values for improvements in cooperative behavior could not be computed and were noted to be of small or trivial effect. (Appendix 3) The certainty of evidence was downgraded by two levels for imprecision in all four studies and by one or two levels for ROB in two studies.[27,34] Overall, the GRADE assessment was determined as Low[24,34] or Very Low[23,27] certainty of evidence (Appendix 3).

Three studies focused on reduction in anxiety as an outcome.[27,30,35] All three used physiologic measures (HR)[27,30,35] and one also used the self-reported Facial Image Scale (**FIS**)[35]. While the outcome of reduction in anxiety was deemed as a critical outcome to assess, the SMDs were either considered of trivial effect[35] or could not be computed[27,30] (Appendices 2 and 3). The certainty of evidence was downgraded by two levels for imprecision in all three studies evaluating reduction in anxiety and by one or two levels for ROB. Overall, the GRADE assessment was determined as Very low certainty of evidence (Appendix 3).

Tell Show/ Play Do (TSD/ TPD) and its modifications

Three randomized controlled trials (**RCTs**)[32,35,37] conducted in India and Pakistan that tested the effectiveness of TSD or TPD compared to other behavior guidance techniques (modeling and mobile dental application) during a preventive visit. The included children were five-11 years old with no previous dental experience. The studies used HR, FIS, and Venham Scale (**VS**) to measure reduction in anxiety during the preventive visit. HR and FIS were deemed to be critical by the WG, whereas VS was deemed to be important (Appendix 2). Vishwakarma et al.[32] compared TPD to live modeling and reported a small reduction in dental anxiety in the TPD group measured by HR, FIS and VS as determined by SMD (Appendix 3). In Karekar's study,[35] TSD was compared to both filmed and live modeling, and reduction in anxiety was measured by FIS and HR. The reduction in anxiety measured by HR favored both modeling techniques compared to TSD, and the effect was considered large, while the reduction in anxiety measured by FIS outcome favored TSD, and the effect was trivial. Abbasi et al.[37] compared TSD to no behavior guidance techniques and reported a trivial effect on reduction in dental anxiety between two groups measured by HR and FIS. All three studies had some concern in the ROB assessment, and the certainty of evidence was downgraded for ROB and imprecision. Overall, the GRADE assessment was determined as Very low[32,35] and Low[37] certainty of evidence for the reduction of anxiety as measured by FIS, HR, and Venham Scale[32] (Appendix 3).

Magic tricks

Two randomized clinical trials[29,36] conducted in Israel and India, respectively tested the effectiveness of TSD (control), distraction with a "magic trick", and a mobile dental application[36] on children's dental anxiety [36] and on children's readiness to receive radiographs[29] or a prophylaxis treatment[36] measured by the time it took to sit in the dental chair[29] or to enter the treatment area[36]. The magic trick consisted of a magic book in which pictures could be erased magically and drawn again[29] or an acrylic thumb light that could "magically" appear and reappear[36]. The children were aged three-six years old with high

dental anxiety and no previous dental history[36] or displayed refusal behavior at the first examination[29]. The time from beginning of the session to sitting on a dental chair[29] and the time from end of behavior guidance technique until the child was ready to enter the treatment area[36] were measured. Children's cooperation was measured by the Frankl Behavior Rating Scale (FBRS)[29], and the Chotta Bheem-Chutki (**CBC**) Scale was used to measure reduction in anxiety at the completion of a prophylaxis treatment using an ultrasonic scaler[36]. In one study[36] all three groups (TSD, mobile dental application, and magic trick) showed significant reduction in the anxiety score when compared to baseline, with no difference between the groups; the SMD was not computable but the reduction in anxiety was determined as small. The children in the mobile application group were ready to accept dental treatment significantly faster than the other two groups; however, the effect was trivial, and this outcome was rated as of limited importance. In the other study[29], children in the magic trick group showed more cooperative behavior, though this effect was trivial and SMD could not be computed, and for time taken to sit on the dental chair, the SMD showed a large reduction in the magic trick group and more radiographs could be taken. This outcome was rated as important by the WG. Both studies had some concerns in the ROB assessment. For all outcomes, the certainty of evidence was downgraded by one level for ROB and by two levels because of imprecision. Overall, the GRADE assessment was determined as Very low certainty of evidence (Appendices 2 and 3).

Technology (mobile dental applications) based distraction
Two randomized clinical trials[36,37] conducted in India and Pakistan, respectively tested effectiveness of mobile dental applications (Little Lovely Dentist application) during preventive visits (oral prophylaxis and fluoride application). The included children were ages six-11 years old with no previous dental history[37] and ages four-five years old with high dental anxiety[36]. The studies used HR[37], CBC Scale[36], and FIS[37] to measure reduction in anxiety during the preventive visit. As determined by the SMD, one of the studies[37] reported a small reduction in anxiety measured by physiologic method (HR) and a large reduction in anxiety as measured by FIS when a mobile application was used compared to no intervention control (Appendix 3). Both outcomes were deemed to be critical by the WG (Appendix 2). The same study[37] also reported a small reduction in anxiety using HR and a large reduction in anxiety using FIS for mobile application intervention when compared to the TSD group. The certainty of evidence of this study was downgraded by one level each for ROB and for imprecision. Overall, the GRADE assessment was determined as Low certainty of evidence. It was not possible to compute SMD for the second study;[36] however, it reported a trivial effect on reduction in anxiety compared to the TSD group as measured by CBC Scale, which was deemed as an important outcome by the WG. They also measured readiness of the child to accept dental treatment in seconds and found a small reduction in time for the mobile application group compared to the TSD group. The certainty of evidence of this study was downgraded by one level for ROB and by two levels because of imprecision. Overall, the GRADE assessment was determined as Very low certainty of evidence (Appendices 2 and 3).

Positive reinforcement
One randomized clinical trial[33] conducted in Brazil studied children receiving a positive reinforcement award after dental care. A group of 306 children ages four-six years with no previous dental experience were selected and divided into two groups, control and experimental. Children were evaluated over two dental visits. The clinic examination and dental prophylaxis took place during the first visit and on the second visit, all participants received the necessary dental care. A projective test using self-reported VPT was applied before and after treatment, and after positive reinforcement. The award after dental care decreased anxiety in preschool children at the second visit in the reception room before any dental treatment. The study also found that girls in the experimental group showed less anxiety than boys during the second visit. The study had low concerns in the ROB assessment. Overall, the GRADE assessment was determined as Moderate certainty of evidence (Appendices 2 and 3).

Discussion
Summary of the main results
The systematic review included 15 RCTs that investigated the effect of nonpharmacological behavior techniques such as previsit preparation, positive imagery, communication, modeling, TSD, magic tricks, technology-based distraction, and positive reinforcement on dental anxiety and behavior in children during a preventive visit, which included examination, prophylaxis, fluoride varnish and radiographs. Unfortunately, due to the limited research available, the effect of nonpharmacological interventions could not be segregated for different age groups and the effect of cultural and social moderators could not be analyzed uniformly across the interventions.

While preparing a child for a preventive dental visit could have a positive effect on behavior and anxiety, the existing literature is inconclusive. The effect of positive pre-visit imagery using photos was not significantly different from the effect of neutral images in reducing the level of dental anxiety.[31] However, the limitations of the study were due to adoption of a single outcome measurement which was only based on dental examination and children's low level of manifested dental anxiety prior to dental visit. In contrast, Fox and Newton[38] found a significant reduction in dental anxiety for children who received positive images prior to dental treatment and concluded that viewing positive images of dentistry and dentists resulted in short-term reductions in anticipatory anxiety in children. However, changes in dental anxiety prior to and after treatment were not assessed. A similar study, performed on a population sample of different age (eight-12 years) found no reduction in anxiety by FIS after reading a pamphlet that contained child-friendly dental information.[39]

Based on the findings obtained for pre-visit modeling, pre-operative video guidance may be useful in reduction of dental anxiety in children who express either a higher level of fear or those children who suffer from needle phobia.[25,28] As suggested, this approach represents a coaching model, which both parents and dental staff can use in preparing highly fearful children for the upcoming visit.[34] Since the contemporary children have been widely exposed to electronic devices, different options of combining modeling techniques with electronic gadgets (such as videos and interactive mobile applications) have shown promising results in decreasing anxiety in children undergoing preventive treatment and dental examination.[5,37] A significant limitation in interpreting the results is

due to children not being actively involved in the dental procedure, for example, being silent observers in the modeling process by just watching the video and not having any interaction with the dental staff. For both articles in this review, an 'out-of-office' location served as the site in performing the modeling technique in which children were asked to watch the video outside the dental setting.[25,28] For children with baseline self-reported fear due to either higher level of general fear, or anxiety resulting from previous negative medical/dental experiences, video modeling may be particularly beneficial. In addition, the reported ROB and imprecision, including outdated results, may represent limitations for consistent recommendation in contemporary clinical practice.

Overall, based on the present findings, pre-visit preparation with video modeling or positive pictures of dental treatment is feasible, as it can be easily implemented and is cost-effective. In medicine the efficacy of psychological pre-procedure preparation and peer modeling for children and adolescents undergoing invasive procedures is well documented.[40] As such, it can be considered a useful behavior guidance technique, and may be more beneficial for children who exhibit a higher level of dental anxiety. VPT may be used as a measurement, but could only be recommended in younger children, particularly preschool and very young school children. Therefore, further research is mandatory to support these assumptions.

Communicating with children requires a basic understanding of the cognitive development of the child such as the use of appropriate vocabulary to orient the patient to the dental setting and to teach the child the important aspects of the visit. Multiple previous studies have shown that tell-show-do (**TSD**) has been universally employed by providers. TSD has been accepted as a basic communicative technique in behavior guidance and is considered integral to treating children.[8,29,41] No studies have evaluated improvement in behavior as an outcome, and only one study compared the effectiveness of TSD to no technique[37] finding a trivial effect on anxiety in children aged six-11 years. The children had a relatively low baseline FIS score at 2.60; hence, a larger reduction may be possible in a group with higher anxiety. However, Karekar et al.[35] compared TSD with modeling in children aged seven-nine years with high anxiety (FIS score of approximately 4.5) and found little change in the FIS score from before the preventive visit to the completion of the visit. The authors proposed that TSD may be more beneficial for reducing anxiety in younger children compared to older, school-aged children[35]; however, this has yet to be determined by research. Despite the modest quantity of evidence for its effectiveness, TSD is often the 'control group' for studies evaluating other behavior techniques. It has been widely adopted by providers and has high parental acceptance.[42-44]

Another technique widely used and accepted by parents is positive reinforcement. Positive reinforcement can occur in several modalities including specific praise for cooperative behaviors as well as an award or prize. The results of this study suggest beneficial impact of rewards in decreasing anxiety particularly in preschool children, as the practice of offering gifts may positively affect the child's behavior pattern. Many children appear tense after operative dental procedures and can become happy when receiving a reward in the form of verbal reinforcement and/or gifts.[45] Since reinforcement is given after a desired behavior is completed, children do need to have the cognitive development to understand contingency and that the prize is contingent on the cooperative behavior. Though the study in this review showed a small positive effect, it should be emphasized that this study was accomplished among low-income children; therefore, the results may have limited generalizability for pediatric populations from varying socioeconomic backgrounds.

Two studies examined the effect of a magic trick in young children, and while both articles showed a positive effect on shortening the time to gain the child's cooperation in entering the treatment area, sitting on the dental chair, and accepting more radiographs, the evidence was of Very low quality. The two articles were not comparing the same magic technique, and the technique could be considered a form of distraction. In addition, one of the studies focused more on children identified as "strong-willed", distinguishing the study population from the more typical fearful child. Nonetheless, one of the authors postulated that creating a sense of awe engages a different part of the brain and might help the child relax.[29] While no robust evidence exists for its effectiveness, as a form of distraction, magic could help in shortening the time to gain a child's cooperation and create a sense of relaxation in the child. Practitioners may choose to implement the technique at their discretion as it would be simple to use and neither time- nor cost-prohibitive.

Two studies[36,37] evaluated the effectiveness of mobile dental applications and used the same application, Little Lovely Dentist developed by Tenlogix Games available on the android platform, which included various activities such as restorations, sealants, and playful explanations of oral hygiene methods. The use of a mobile application is a form of technology distraction. Various forms of distraction have been reported to be beneficial in reducing anxiety for dental treatment in other systematic reviews.[46-48] The benefit of this virtual experience is distraction and desensitization through exposure to the sounds and process of the procedures. While it could be beneficial in reducing anxiety, no study measured improvement in cooperative behavior as an outcome. Incorporating mobile devices into clinical practice is more costly than other techniques. In the future, providers may find benefit from interactive mobile healthcare applications that can assist children with various aspects of dental treatment. For example, a recent randomized clinical trial showed positive results of an application designed to help adults with needle phobia.[49] Future studies of mobile applications may find such applications useful for guiding behavior in pediatric patients and should examine their effects on both anxiety and behavior.

A recent systematic review of basic behavior guidance techniques (**BGT**) included 36 studies examining effects of BGTs on anxiety and behavior for any type of dental treatment, differing from the current review which examines outcomes for a preventive visit. However, similar results in reduction of anxiety were found for modeling and technological distraction.[46] Results of the current review suggests that BGTs such as magic trick, and positive imagery are promising and can be used to manage dental anxiety and improve patient's behavior as they offer different forms of distraction. They can offer comfort and occupy the child's attention, thus potentially minimizing negative emotions.

Overall completeness of the evidence

The quality of each randomized clinical trial included in this systematic review was assessed using the GRADE evidence (Appendix 3). Out of 15 randomized trials, two studies had high risk, five studies had low risk, and eight studies had some concerns. Based on GRADE, the overall certainty of evidence of individual outcomes ranged from Very low to Moderate (Figures 2 and 3).

Potential bias in the review process / strengths and weaknesses
The process for this series of three systematic reviews was characterized by several strengths. First, the methodology followed the Cochrane Handbook for Systematic Reviews of Interventions for the included RCTs. Second, study selection, data extraction and risk of bias assessment were each performed independently by at least two authors. Third, the GRADE criteria, whenever possible, were used to assess the certainty of the evidence. This review focused on the effectiveness of behavior guidance techniques in healthy children with a specific focus on preventive visits. The identified outcomes were categorized as critical, important, or not important. These categories were based on predetermined criteria to assess appropriateness of the rating scale and were developed by the WG through expert consensus, which was one of the strengths of this review (Appendix 1). Furthermore, SMDs were computed, when possible, to estimate the effect of various nonpharmacological interventions on the identified outcome. Children in need of restorative/surgical dental treatment visits and children with special health-care needs were excluded in this review as it might skew the outcome. However, the findings for those target groups are presented in separate papers.

The complexity of data presented in 15 clinical trials involving multiple behavior guidance techniques, assessment criteria for fear, anxiety, pain, behavior, and rating tools for each domain posed a great challenge for the WG to make an appropriate assessment. The wide variety in outcome assessment instruments used in the included studies was a major limitation to determining whether a behavior guidance technique was effective. The variety of scales used across the many outcome variables of interest introduced significant variability in and complexity of the data synthesized and summarized. This variability and complexity, as well as the validity of the instruments, limited the ability to critically appraise the evidence and to compare studies to offer general conclusions. However, the WG attempted to compile the information in the clinical trials in a systematic way, adhering to the recommendations set forth by PRISMA guidelines. Prior to the start of the study, the WG convened to understand the role of each examiner in the systematic review process. The examiners were then trained and calibrated. Based on the volume of the data, eight examiners were paired to conduct selection and extraction of the data and were assigned specific topics on behavior guidance. Any disagreement in the above process was resolved using independent examiners. The data were then gathered for statistical interpretation. Because the present review included only randomized clinical trials,

the number of studies found for each technique was limited, except for modeling, and thus, it was not possible to compare the effectiveness of the techniques in greater depths, particularly across age groups. Another weakness in this SR is related to the low quality of evidence of the primary studies.

Implications for research
In the current review, several ambiguities were identified in the rating scales utilized in the clinical trials. Only validated rating scales for change in behavior/cooperativeness, anxiety, pain, fear/phobia must be employed. For effective assessment of the outcome, it is recommended to perform pre-procedure and post-procedure evaluation using the same behavior rating criteria. When possible, the data must include mean, standard deviation, and SMD or other appropriate measures to show the effect size. The age, sex, race, baseline behavior, and the health status of the child must be clearly defined. Good quality prospective studies are recommended focusing on different behavior guidance techniques, preferably RCTs. The RCTs must conform to the Consolidated Standards of Reporting Trials (CONSORT) reporting guidelines.[10,50]

Conclusions

1. The certainty of evidence for the effectiveness of a variety of nonpharmacological behavior guidance techniques in reducing anxiety, fear, pain and improving child behavior/cooperation during a dental preventive visit is classified as mostly low or Very low, mainly due to the imprecision of the studies.
2. Most of the basic nonpharmacological behavior guidance techniques such as TSD, positive imagery, distraction (magic tricks), positive reinforcement show some trivial to small effect on reduction in self-reported anxiety and/or improvement in cooperative behavior, with mobile application and modeling showing some large effects.

Acknowledgments

References after Appendix.

Appendices

Appendix 1.	APPROPRIATENESS OF ASSESSMENT TOOLS USED TO MEASURE PAIN, FEAR/ANXIETY, AND COOPERATIVE BEHAVIOR*		
	Most appropiate	**Acceptable**	**Least appropiate**
Pain*†‡§	Visual Analog Scale (VAS, >2y)	Wong-Baker Faces Pain Rating Scale (3-18y)	Frankl Behavior Rating Scale (FBRS)
	Faces Pain Scale-Revised (FPS-R, 4-16y)	Face, Legs, Activity, Cry, and Consolability Scale (FLACC, 8-16y)	
	Observational Scale of Behavioral Distress (OSBD, 2-20y)	Respiratory Rate/pattern	
	Child-Adult Medical Procedure Interaction Scale, and its short form (CAMPIS, 2-13y)	Skin conductance	
	Procedure Behavior Checklist (PBCL, 3-18y)		
	FLACC (2m-7y)		
	Heart Rate		
	Blood Pressure		
	Oxygen Saturation		
Fear/ anxiety **†‡§	Children's Fear Survey Schedule-Dental Subscale, and its short form (CFSS-DS, 6-12y)	Children's Fear Survey Schedule-Dental Sub- scale, Parent Version (CFSS-DS-P, 4-12y)	Modified Houpt Behavior Rating Scale
	Modified Child Dental Anxiety Scale-Faces (MDAS(f), 8-12y)	Venham Picture Test (VPT, 3-12y)	
	Dental Fear Survey (DFS, >10y)	Behavior Profile Rating Scale (BPRS, 2-12y)	
	Facial Image Scale (FIS, 5-12y)	Chotta Bheem-Chutki Scale (4-12y)	
	Pictorial Dental Anxiety Scale (PDAS)	Frankl Behavior Rating Scale (FBRS)	
	VAS, >2y	OSBD	
	Abeer Children Dental Anxiety Scale (ACDAS, >5y)	Children's Dental Behavior Rating Scale (CDBRS)	
	Fear Thermometer	Veerkamp's 'Anxiety and Cooperation Scale'	
	State-Trait Anxiety Inventory for Children (STAI-CH, >8y)	Venham's 'Global Anxiety and Behavior Scale'	
	Self-Assessment Manikin (SAM)	Acceptance/completion of treatment	
	Dimensions of Anxiety Index (DAI)/ Dental Operating Rating Scale		
	Behavior Avoidance Test (BAT)		
	Heart Rate, Pulse Rate		
	Skin Conductance		
	Palmar Sweat Index		
	Peripheral Skin Temperature		
Cooperative behavior ** †‡§	FBRS	PBCL	
	Modified Houpt Behavior Rating Scale	Acceptance/completion of treatment	
	BPRS	Categorization of patient verbalizations (positive/ negative)	
	Allard & Stokes' continuous observation system		
	Frequency count of well-defined target behavior		

* Pain assessment instruments rated as well-established in the Cohen et al.[17] review was categorized as "Most appropriate;" those rated as approaching well-established were categorized as "Acceptable." Pain assessment instruments not included in the Cohen et al.[17] review was categorized based on content provided in the original development/validation publication for each instrument and a review of the literature describing or utilizing the instrument. This list of assessment tools is not necessarily exhaustive, though it includes all instruments used in studies included in this systematic review.

** For fear/anxiety and cooperative behavior assessment instruments, each was categorized based on content provided in its original development/validation publication and a review of the literature describing or utilizing the instrument. This list of assessment tools is not necessarily exhaustive, though it includes all instruments used in studies included in this systematic review.

† Where relevant, and where published data are available, the age ranges for which each tool is validated are listed parenthetically.

‡ Instrument titles listed here are those used in the original development/validation publication for the corresponding instrument, when available; otherwise, the most used title for the instrument is listed. Veerkamp's 'Anxiety and Cooperation Scale' and Venham's 'Global Anxiety and Behavior Scale' include two scales each (i.e., anxiety and cooperation/behavior scales) that can be administered jointly or independently. For Venham's 'Global Anxiety and Behavior Scale,' the anxiety scale is also referred to as "Venham's Anxiety Rating Scale" and "Venham's Clinical Anxiety Scale (VCAS);" the behavior scale is also referred to as "Venham's Behavior Rating Scale" and "Venham's Clinical Cooperation Scale (VCCS)."

§ Study-specific (i.e., non-validated, unpublished) scales are not included.

Appendix 2.	PREVENTIVE VISITS CHARACTERISTICS OF INCLUDED STUDIES*					
Author, year, country	**Study design**	**Sample size, gender, age**	**Dental treatment provided**	**Behavior related intervention and control groups**	**Outcome assessed****	**Summary of results**
Behavior guidance for pediatric dental patients requiring preventive procedures such as an exam, prophy, x-rays						
1. Pre-visit preparatory strategies- rendered at home/non-clinical setting						
a. Modeling (video, direct observation)						
McMurray, 1986, Australia[25]	RCT	80 children (boys 40, girls 40), children with moderate to high dental anxiety (15 or higher on PDAS) Ages: 9-12 years	Received oral examination / screening	Pre-visit preparation: - Video modeling: coping strategies while undergoing simulated dental treatment & - Homework assignment: Coping condition sessions on coping skills practice at home Placebo video: dental hygiene, unrelated to dental treatment & - Homework assignment: dietary log	Dental anxiety: - Physician rated: DAI to measure behavioral disturbance (Critical) - Self-reported: PDAS (Critical) - Physiologic: Pulse rate (Critical)	The coping condition was effective in reducing self-reported anxiety and in effecting a change of locus of control toward greater internality.
Weinstein, 2003, USA[28]	RCT	80 children (boys 29, girls 51), public school children with an average Dental Fear Score of 14.7 Ages: 7-9 years	Behavior intervention via video implemented in school setting (not during dental treatment) with no dental procedure involved	Dental related video of nitrous oxide administration and local anesthesia injection Control: Non-dental related video	Dental fear: - Self-reported: Dental Fear Scale derived from CFSS-DS (Critical: used for pre-intervention assessment) - Self-reported: VAS (Critical: used for pre- and post-intervention assessment)	In the intervention group, there was a significant fear reduction from pre- to post-intervention, while this was not found for the control group. Children with higher pre-existing levels of fear benefited more from the intervention than children with lower levels of pre-existing fear.
2. In-office behavior modification strategies						
a. Positive pre-treatment imagery						
Ramos-Jorge 2011, Brazil[31]	RCT	70 children (boys 36, girls 34) Ages: 4-11 years [M=7.5, SD=2.5]	Received oral examination/ screening	Pre-treatment presentation of positive dental images Control: Neutral images	Dental anxiety: - Self- reported: VPT (Important)	Positive dental images had no significant impact on reducing dental anxiety.
b. Communication (verbal and nonverbal)						
Greenbaum, 1993, USA[26]	RCT	38 (Control vs. Reassuring touch) children with dental fear (determined by the dental fear scale, and self-assessment manikin score) Ages: 3.5 to 10 years	Received oral examination	Reassuring touch (pat on the upper arm for 10 seconds twice during visit) Control: No touch	Behavior: - Physician rated: BPRS (Critical) Dental fear: - Physician rated: Dental Fear Scale derived from CFSS-DS [pre-op assessment] (Critical); - SAM score [Displeasure vs. Pleasure / Arousal vs. Calmness / Submission vs. Dominance] / (Critical)	Children who received reassuring touch reported greater pleasure but less dominance than children not touched post-treatment, based on self-assessment manikin scores. Based on BPRS, fidgeting behavior was observed in only older children aged 7 and 10 years.
c. Direct observation/modeling rendered before or during dental treatment						
White Jr, 1974, USA[23]	RCT	15 girls with prior disruptive behavior during dental treatment on at least two occasions that would have required GA to complete dental procedures Ages: 4-8 years	Received oral examination/ screening	Pre-treatment preparation with modeling (observing a model undergoing six dental sessions: toothbrush instruction, oral exam, prophy, fluoride, injection and restorative procedure)/Control 1: no model, only observing the dentist and assistant naming and manipulating the instruments involved in those six dental sessions. Control 2: no model, no observation	Behavior: - Physician rated at completion of the dental procedure (Critical) - Physician rated by simple approach behavior score (1-walked down the hall to 7-allowed operative) or Modified approach behavior score (2 points for completed alone, 1 point for accompanied by family when completing each task)/ (Important) - Physician rated by determining presence of avoidance behavior (Important)	There was a significant difference in simple approach behavior scores between the model conditioning group and the control group with no observation experience (Control 2); there was not a significant difference in simple approach behavior scores between the model conditioning group and the girls who only observed the dentist and assistant manipulating the instruments (Control 1). There was a significant difference in avoidance behavior scores between the modeling group and the Control 2 group.

* Abbreviation in this table: BPRS=Behavior Profile Rating Scale, CFSS-DS=Children's Fear Survey Schedule-Dental Subscale, DAI=Dimensions of Anxiety Index, FBRS=Frankl Behavior Rating Scale, FIS=Facial Image Scale, HR=Hear rate, PDAS=Pictorial Dental Anxiety Scale, RCT=Randomized clinical trial, SAM= Self-assessment manikin, TSD=Tell-show-do, TPD=Tell-play-do, VAS=Visual Analogue Scale, VPT=Venham Picture Test.

** Outcomes (measured tool/scale and the level of importance of the outcome): Cooperative behavior, fear/anxiety, & pain, as assessed by a specific rating scale; Mode of administration of the scale used: Physiologic, Self-reported (patient/caregiver), Physician (provider/dentist) reported. Each outcome was categorized as Critical, Important, or Not important for clinical decision making, which was determined based on appropriateness of the ranking scale (Appendix 1).

Appendix 2.	CONTINUED*					
Author, year, country	Study design	Sample size, gender, age	Dental treatment provided	Behavior related intervention and control groups	Outcome assessed**	Summary of results
Behavior guidance for pediatric dental patients requiring preventive procedures such as an exam, prophy, x-rays						
2. In-office behavior modification strategies						
c. Direct observation/modeling rendered before or during dental treatment						
Rouleau, 1981, Canada[24]	RCT	38 (boys 22, girls 16) children who had no prior exposure to a dental situation Ages: 4-6 years [M=5]	- Received oral examination/ screening and prophy/fluoride varnish	Pre-treatment preparation: Pre-exposure to dental environment (staff, space, and dental instruments) Group 1: one filmed pre-exposure Group 2: two filmed pre-exposures Group 3: one direct/in-person exposure Control: No pre-exposure, video unrelated to dentistry	Behavior: - Physician rated: by FBRS (Critical) - Categorization of patient verbalizations. Physician rated by number of positive and negative verbalizations during the dental treatment (Important) - Frequency count of well-defined target behavior. Physician rated by number of agitated behaviors emitted during the dental treatment/ (Critical)	Non-significant difference in behavior scores between all 4 groups.
Boj, 1995, Spain[27]	RCT	28 preschool children who were not previously exposed to dentist Ages: 3-4 years [M=3.5]	- Received oral examination, x-ray, prophy, fluoride varnish	Pre-treatment preparation with video modeling Control: No pre-visit preparation	Behavior: - Physician rated: by Modified Melamed's behavioral rating scale (Important) - Dentist's subjective evaluation (1-poor to 5-excellent) (Important) Dental anxiety: - Physiologic by HR (Critical)	The video modeling group showed better behavior based on dentist's evaluation and a significantly lower heart rate than the control group. Modified Melamed's Scale was not a sensitive measurement of behavior in this study; however, the scores showed a trend for better behavior in the experimental group, but not statistically significant.
Farhat-McHayleh, 2009, Lebanon[30]	RCT	155 children with no pre-assessed anxiety score Ages: 5 to 9 years	- Received oral examination and prophylaxis	3 Groups: - Live Modeling with mother - Live modeling with father - TSD	Anxiety: Physiologic by HR (Critical)	Children who underwent live modeling with mother demonstrated lower heart rate compared to those who underwent live modeling with father or tell-show-do technique by dentist.
Hine, 2019, USA[34]	RCT	40 (boys 24, girls 16) children in their first visit to the clinic Ages: 3-6 years [experimental group: M=4.5; control group: M=4.7]	- Received oral examination, x-ray, prophy, fluoride varnish	Pre-treatment preparation: - Video modeling: procedures associated with exam Control: Popular children's cartoon	Behavior: - Physician rated by direct observation of event (Critical) - Physician rated by behavior scale [1-uncooperative to 6-cooperative] (Important)	Treatment group had a significantly lower mean percentage of intervals in which disruptive behavior was observed compared with the control group. Subjective rating scales revealed significantly higher ratings of cooperation for the treatment group from the dentist and the dental assistant.
Karekar, 2019, India[35]	RCT	63 children with no baseline assessment Ages: 7-9 years	- Received oral examination, x-ray, prophy, fluoride	3 Groups: - Live Modeling, Filmed modeling Control: Tell-show-do	Anxiety: - Self-reported by FIS (Critical); - Physiologic by Heart rate (Critical)	For dental examination and prophylaxis, children who viewed filmed modeling showed significantly higher FIS score and lower heart rate compared to conventional TSD and live modeling
d. TSD and its modifications such as tell-play do, magic tricks, mobile dental application						
Vishwakarma, 2017, India[32]	RCT	98 healthy children (57 boys, 41 girls) Ages: 5-7 years	- Prophylaxis	TPD (a modified version of TSD) in playroom (20 mins) Live modeling in clinical cabin (20 mins)	Anxiety: - Physiologic by HR (Critical) - Self-reported by FIS (Critical) - Physician-reported by VPT (Important)	Large reduction in HR with TPD, significant reduction using other scales such as FIS, VPT
Asokan, 2020, India[36]	RCT	60 children with high dental anxiety Ages: 4-5 years	- Prophylaxis	Groups: - Distraction with acrylic thumb light (magic trick) - Mobile dental application (Little Lovely Dentist) - Control: TSD	Dental Anxiety: - Self-reported by Chotta Bheem-Chutki Scale/ (Important)	Distraction using a thumb light, mobile dental application and TSD showed significant reduction in median anxiety scores. Amongst all methods, mobile dental application showed highest reduction in the anxiety score.

  * For abbreviations in table see opposite page.
  ** Outcomes (measured tool/scale and the level of importance of the outcome): Cooperative behavior, fear/anxiety, & pain, as assessed by a specific rating scale; Mode of administration of the scale used: Physiologic, Self-reported (patient/caregiver), Physician (provider/dentist) reported. Each outcome was categorized as Critical, Important, or Not important for clinical decision making, which was determined based on appropriateness of the ranking scale (Appendix 1).

Appendix 2.	CONTINUED*					
Author, year, country	Study design	Sample size, gender, age	Dental treatment provided	Behavior related intervention and control groups	Outcome assessed**	Summary of results
Behavior guidance for pediatric dental patients requiring preventive procedures such as an exam, prophy, x-rays						
2. In-office behavior modification strategies						
d. TSD and its modifications such as tell-play do, magic tricks, mobile dental application						
Peretz, 2005, Israel[29]	RCT	70 children with strong-willed behavior (loud refusal to enter the room and/or refusal firmly to sit in the dental chair despite their parents' request) Ages: 3-6 years	- Sitting on dental chair, x-ray	Distraction with magic trick (magic book) Control: TSD	Behavior: - Physician-rated by FBRS (Critical) - Duration: Mean time till sitting on the chair (Important)	Children in magic trick group showed more cooperative behavior (Frankl 3 or 4), sat faster on dental chair, and more radiographs could be taken.
Abbasi, 2021, Pakistan[37]	RCT	160 children (boys, 79, girls 81) with no previous dental history Ages: 6-11 years	- Prophylaxis and fluoride varnish	Pre-treatment preparation: Group 1: Mobile app (Little Lovely Dentist) Group 2: Dental video songs No preparation: Group 3: TSD Control: No behavior technique used	Dental anxiety: - Physiologic by HR (Critical) - Self- reported by FIS (Critical)	Little Lovely dentist mobile app was found to be the most effective in decreasing the level of dental anxiety with dental video songs showing a similar effect.
e. Positive reinforcement						
Rank, 2019, Brazil [33]	RCT	306 children Ages: 4-6 years Both genders participated but the number of boys/ girls not reported	- Received oral examination and prophylaxis	Positive reinforcement Control: No reinforcement	Anxiety: - Self-reported by VPT (Important)	Positive reinforcement (awarding colorful balloon) resulted in decreased anxiety in the 2nd visit, but this was only observed in girls. Boys showed no difference in the anxiety score.

  * Abbreviation in this table: BPRS=Behavior Profile Rating Scale, CFSS-DS=Children's Fear Survey Schedule-Dental Subscale, DAI=Dimensions of Anxiety Index, FBRS=Frankl Behavior Rating Scale, FIS=Facial Image Scale, HR=Hear rate, PDAS=Pictorial Dental Anxiety Scale, RCT=Randomized clinical trial, SAM= Self-assessment manikin, TSD=Tell-show-do, TPD=Tell-play-do, VAS=Visual Analogue Scale, VPT=Venham Picture Test.

 ** Outcomes (measured tool/scale and the level of importance of the outcome): Cooperative behavior, fear/anxiety, & pain, as assessed by a specific rating scale; Mode of administration of the scale used: Physiologic, Self-reported (patient/caregiver), Physician (provider/dentist) reported. Each outcome was categorized as Critical, Important, or Not important for clinical decision making, which was determined based on appropriateness of the ranking scale (Appendix 1).

Appendix 3.	RESULSTS AND CERTAINTY OF EVIDENCE: NONPHARMACOLOGICAL BEHAVIOR GUIDANCE FOR PREVENTIVE VISITS*							
No. participants (no. of studies)	Risk of bias	Inconsistency	Indirectness	Imprecision	Publication bias	Overall certainty of evidence	Standardized mean difference (SMD)	Interpretation of results**
Outcomes related to pre/post visit preparatory strategies rendered at home/nonclinical setting								
Modeling								
Improvement in cooperative behavior (assessment method –DAI) during preventive visit –Pre-visit video tape and placebo tape								
80 (1 RCT)[25]	Some concerns	Not serious	Not serious	Very serious	NA	**Very low**	Incomputable	**Trivial**
Reduction in anxiety (assessment method PDAS) during preventive visit–Pre-visit video tape and placebo tape								
80 (1 RCT)[25]	Some concerns	Not serious	Not serious	Very serious	NA	**Very low**	Incomputable	**Trivial**
Reduction in anxiety (assessment method Pulse rate) during preventive visit –Pre-visit video tape and placebo tape								
80 (1 RCT)[25]	Some concerns	Not serious	Not serious	Not serious	NA	**Very low**	Incomputable	**Trivial**
Reduction in fear (assessment method VAS) during preventive visit –Pre-visit video tape and placebo tape rendered at School								
80 (1 RCT)[28]	Low	Not serious	Not serious	Very serious	NA	**Low**	-0.4 (-0.77, 00.06)	**Small**
Outcomes related to behavior modification strategies at dental office before or during dental treatment								
Positive imagery (pre-treatment intervention at dental office)								
Reduction in anxiety (assessment method–Heart rate [HR]) during preventive visit –positive imagery vs. control								
70 (1 RCT)[31]	Low	Not serious	Not serious	Very serious	NA	**Low**	0.03 (-0.42, 0.50)	**Trivial**

  * For abbreviations in table see opposite page.

 ** SMD's was categorized as large effect, moderate effect, small important (statistically significant) effect, or trivial effect (small unimportant or statistically non-significant or no effect).

Appendix 3. CONTINUED*								
No. participants (no. of studies)	Risk of bias	Inconsistency	Indirectness	Imprecision	Publication bias	Overall certainty of evidence	Standardized mean difference (SMD)	Interpretation of results**
Outcomes related to behavior modification strategies at dental office before or during dental treatment								
Non-verbal communication								
Reduction in emotion related to fear (assessment method Treatment emotion–arousal/ calmness-SAM) during preventive visit–Nonverbal Communication strategy (reassuring touch vs. no touch)								
38 (1 RCT)[26]	Some concerns	Not serious	Not serious	Very serious	NA	**Very low**	0.16 (-0.48, 0.89)	**Trivial**
Reduction in emotion related to fear (assessment method Treatment emotion–displeasure/pleasure-SAM) during preventive visit–Nonverbal Communication strategy (reassuring touch) vs. no touch								
38 (1 RCT)[26]	Some concerns	Not serious	Not serious	Very serious	NA	**Very low**	0.55 (-0.09, 1.19)	**Trivial**
Reduction in emotion related to fear (assessment method Treatment emotion–Submission/dominance-SAM) during preventive visit–Nonverbal Communication strategy (reassuring touch vs. no touch)								
38 (1 RCT)[26]	Some concerns	Not serious	Not serious	Very serious	NA	**Very low**	-0.04 (-0.67, 0.60)	**Trivial**
Improvement in behavior related to fear (assessment method BPRS) during preventive visit–Nonverbal communication strategy (reassuring touch vs. no touch)								
38 (1 RCT)[26]	Some concerns	Not serious	Not serious	Very serious	NA	**Very low**	Incomputable†	**Small**
Direct observation/Modeling (live, video)								
Improvement in cooperative behavior (assessment method–Physician rated behavioral checklist) during preventive visit –live modeling vs. control								
15 (1 RCT)[23]	Some concerns	Not serious	Not serious	Very serious	NA	**Very low**	Incomputable†	**Small**
Improvement in cooperative behavior (assessment method–Physician rated behavioral checklist) during preventive visit –live modeling vs. control								
38 (1 RCT)[24]	Low	Not serious	Not serious	Very serious	NA	**Low**	Incomputable	**Trivial**
Improvement in cooperative behavior (assessment method – Modified melamed's behavioral rating scale) during preventive visit- video modeling vs. control								
28 (1 RCT)[27]	High	Not serious	Not serious	Very serious	NA	**Very low**	Incomputable	**Trivial**
Reduction in anxiety (assessment method–HR) during preventive visit- video modeling vs. control								
28 (1 RCT)[27]	High	Not serious	Not serious	Very serious	NA	**Very low**	Incomputable†	**Small**
Reduction in anxiety (assessment method–HR) during preventive visit- live modeling (mother vs. father)								
155 (1 RCT)[30]	High	Not serious	Not serious	Very serious	NA	**Very low**	Incomputable	**Trivial**
Improvement in cooperative behavior (assessment method – Physician rated disruptive behavioral) during preventive visit –video modeling vs. control								
40 (1 RCT)[34]	Low	Not serious	Not serious	Very serious	NA	**Low**	1.76 (1.03, 2.49)	**Large**
Reduction in anxiety (assessment method–HR) during preventive visit (prophylaxis)–video modeling vs. live modeling								
63 (1 RCT)[35]	Some concerns	Not serious	Not serious	Very serious	NA	**Very low**	-0.14(-0.74, 0.46)	**Trivial**
Reduction in anxiety (assessment method–FIS) during preventive visit (prophylaxis)–video modeling vs. live modeling								
63 (1 RCT)[35]	Some concerns	Not serious	Not serious	Very serious	NA	**Very low**	0 (-0.60, 0.60)	**Trivial**
Tell-Show-Do (TSD) or Tell-Play-Do (TPD)								
Reduction in anxiety (assessment method–FIS) during preventive visit (Oral Prophylaxis)–TPD vs. live modeling								
98 (1 RCT)[32]	Some concerns	Not serious	Not serious	Very serious	NA	**Very low**	Incomputable†	**Small**
Reduction in anxiety (assessment method–VPT) during preventive visit (Oral Prophylaxis)–TPD vs. live modeling								
98 (1 RCT)[32]	Some concerns	Not serious	Not serious	Very serious	NA	**Very low**	Incomputable†	**Small**
Reduction in anxiety (assessment method–HR) during preventive visit (Oral Prophylaxis)–TPD vs. live modeling								
98 (1 RCT)[32]	Some concerns	Not serious	Not serious	Very serious	NA	**Very low**	0.45 (-0.85, -0.05)	**Small**
Reduction in anxiety (assessment method–HR) during preventive visit (prophylaxis)–live modeling vs. TSD								
63 (1 RCT)[35]	Some concerns	Not serious	Not serious	Very serious	NA	**Very low**	-0.66(-1.28, -0.04)	**Large**
Reduction in anxiety (assessment method–HR) during preventive visit (prophylaxis)–video modeling vs. TSD								
63 (1 RCT)[35]	Some concerns	Not serious	Not serious	Very serious	NA	**Very low**	-0.78 (-1.4, -0.16)	**Large**
Reduction in anxiety (assessment method–FIS) during preventive visit (prophylaxis)–video modeling vs. TSD								
63 (1 RCT)[35]	Some concerns	Not serious	Not serious	Very serious	NA	**Very low**	0.58 (-0.02, 1.20)	**Trivial**

* Abbreviations in this table: BPRS=Behavior Profile Rating Scale, CFSS-DS=Children's Fear Survey Schedule-Dental Subscale, DAI=Dimensions of Anxiety Index, FBRS=Frankl Behavior Rating Scale, FIS=Facial Image Scale, HR=Hear rate, PDAS=Pictorial Dental Anxiety Scale, RCT=Randomized clinical trial, SAM=Self-assessment manikin, VAS=Visual Analogue Scale, VPT=Venham Picture Test.

** SMD's was categorized as large effect, moderate effect, small important (statistically significant) effect, or trivial effect (small unimportant or statistically non-significant or no effect).

† SMD incomputable, but results assessed as significant in the original study.

Appendix 3.	CONTINUED*							
No. participants (no. of studies)	Risk of bias	Inconsistency	Indirectness	Imprecision	Publication bias	Overall certainty of evidence	Standardized mean difference (SMD)	Interpretation of results**
Outcomes related to behavior modification strategies at dental office before or during dental treatment								
Tell-Show-Do (TSD) or Tell-Play-Do (TPD)								
Reduction in anxiety (assessment method–FIS) during preventive visit (prophylaxis)–live modeling vs. TSD								
63 (1 RCT)[35]	Some concerns	Not serious	Not serious	Very serious	NA	**Very low**	0.53 (-0.08, 1.14)	**Trivial**
Reduction in anxiety (assessment method–HR) during preventive visit–TSD vs. control								
80 (1 RCT)[37]	Some concerns	Not serious	Not serious	Serious	NA	**Low**	0.10 (-0.33. 0.54)	**Trivial**
Reduction in anxiety (assessment method–FIS) during preventive visit (prophylaxis)–TSD vs. control								
80 (1 RCT)[37]	Some concerns	Not serious	Not serious	Serious	NA	**Low**	-0.19 (-0.63, 0.24)	**Trivial**
Magic tricks								
Reduction in anxiety (assessment method–Chotta Bheem-Chutki Scale) during preventive visit–Magic trick vs. TSD								
60 (1 RCT)[36]	Some concerns	Not serious	Not serious	Very serious	NA	**Very low**	Incomputable	**Trivial**
Readiness to accept dental treatment in seconds during preventive visit–Magic trick vs. TSD								
60 (1 RCT)[36]	Some concerns	Not serious	Not serious	Very serious	NA	**Very low**	Incomputable	**Trivial**
Reduction in anxiety (assessment method–Chotta Bheem-Chutki Scale) during preventive visit–Magic trick vs. mobile app								
60 (1 RCT)[36]	Some concerns	Not serious	Not serious	Very serious	NA	**Very low**	Incomputable	**Trivial**
Readiness to accept dental treatment in seconds during preventive visit–Magic trick vs. mobile app								
60 (1 RCT)[36]	Some concerns	Not serious	Not serious	Very serious	NA	**Very low**	Incomputable†	**Small**
Improvement in cooperative behavior (assessment method–Frankl Behavior Rating Scale) during preventive visit–Magic trick vs. TSD								
70 (1 RCT)[29]	Some concerns	Not serious	Not serious	Very serious	NA	**Very low**	Incomputable	**Trivial**
Improvement in cooperative behavior (assessment method–Time till sitting on the chair) during preventive visit (including x-rays)–Magic trick vs TSD								
70 (1 RCT)[29]	Some concerns	Not serious	Not serious	Very serious	NA	**Very low**	-0.86 (-1.35, -0.37)	**Large**
Technology-based distraction (Mobile application)								
Reduction in anxiety (assessment method–Chotta Bheem Chutki Scale) during preventive visit–Mobile app vs. TSD								
60 (1 RCT)[36]	Some concerns	Not serious	Serious	Very serious	NA	**Very low**	Incomputable	**Trivial**
Readiness to accept dental treatment in seconds during preventive visit–Mobile app vs. TSD								
60 (1 RCT)[36]	Some concerns	Not serious	Not serious	Very serious	NA	**Very low**	Incomputable†	**Small**
Reduction in anxiety (assessment method–HR) during preventive visit–Mobile app vs. TSD								
80 (1 RCT)[37]	Some concerns	Not serious	Not serious	Serious	NA	**Low**	-0.46 (-0.90, 0.01)	**Small**
Reduction in anxiety (assessment method–FIS) during preventive visit–Mobile app vs. TSD								
80 (1 RCT)[37]	Some concerns	Not serious	Not serious	Serious	NA	**Low**	-0.85 (-1.30, -0.39)	**Large**
Reduction in anxiety (assessment method–HR) during preventive visit–Mobile app vs. control								
80 (1 RCT)[37]	Some concerns	Not serious	Not serious	Serious	NA	**Low**	-0.41 (-0.85, 0.03)	**Small**
Reduction in anxiety (assessment method–FIS) during preventive visit–Mobile app vs. control								
80 (1 RCT)[37]	Some concerns	Not serious	Not serious	Serious	NA	**Low**	-0.93 (-1.39, -0.05)	**Large**
Positive reinforcement (reward)								
Reduction in anxiety (assessment method–VPT) at follow-up preventive visit–positive reinforcement (post-treatment award vs. no award)								
306 (1 RCT)[33]	Low	Not Serious	Not Serious	Serious	NA	**Moderate**	Incomputable†	**Small**

 * Abbreviations in this table: BPRS=Behavior Profile Rating Scale, CFSS-DS=Children's Fear Survey Schedule-Dental Subscale, DAI=Dimensions of Anxiety Index, FBRS=Frankl Behavior Rating Scale, FIS=Facial Image Scale, HR=Hear rate, PDAS=Pictorial Dental Anxiety Scale, RCT=Randomized clinical trial, SAM=Self-assessment manikin, VAS=Visual Analogue Scale, VPT=Venham Picture Test.

** SMD's was categorized as large effect, moderate effect, small important (statistically significant) effect, or trivial effect (small unimportant or statistically non-significant or no effect).

 † SMD incomputable, but results assessed as significant in the original study.

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Supplemental Electronic Data—Figure

sFigure. Search Strategy

Systematic Review Search Strategies – Non-pharmacological interventions for Dental Anxiety in Children

Primary Investigator: Dr. Vineet Dhar
Search developed by Mary Ann Williams, MSLS and Lauren Wheeler, MLIS
Maintained by Rachel Wedeward, MLIS, AHIP

Total Articles: 2,773
Total Duplicates: 172
Total Articles After Deduplication: 2,601
Hand Searching

November 7, 2022 – **1 article**
November 1, 2022- **3 articles**
March 20, 2021- **4 articles**
May 13, 2021 – 9 citations provided; 1 deleted as it was a duplicate; **Total entered: 8**
June 2, 2021- 2 articles
Sept. 13, 2021 - 24 citations provided; 3 deleted as they were duplicates; **Total entered: 22**
Feb. 25, 2022 – **2 articles**
October 15, 2022- **1 article**

Total Hand Searching: 43 articles
Final search run on March 19, 2021; Update of Ovid Medline & PsycINFO and Embase done on 2/22/22 and 3/2/2022

Total Database Searching:
Total references on March 19, 2021: **2631** references.
Updates of Ovid Medline & PsycINFO and Embase added **98** total references on 2/22/22 and 3/2/2022

Total following de-duplication: **2,599** references
Delivery Method: Covidence
Filters / Limits: Language - English Language; Age Groups - Children & Adolescents;
Ovid Medline & PsycINFO updated on 2/22/22 by Mary Ann Williams

Ovid MEDLINE(R) 1946 to March 17, 2021– 2332 references retrieved on 3/19/2021
Update on 2/22/22 retrieved **76** references

  1 Dental Care for Children/ or Pediatric Dentistry/ (8195)
  2 exp Child/ or adolescent/ or (child* or adolescen* or youth* or teen* or preteen* or pre-teen* or pediatric* or paediatric*).ti,ab. (3441906)
  3 Dental Care/ (21653)
  4 exp Oral Surgical Procedures/px [Psychology] (704)
  5 exp dentistry/px (5716)
  6 Dentist-Patient Relations/ (8140)
  7 Dentists/ or Dental assistants/ (22345)
  8 (dental or dentist$ or mouth$ or tooth or teeth).ti,ab. (395563)
  9 3 or 4 or 5 or 6 or 7 or 8 (413388)
 10 Dental anxiety/ (2725)
 11 Anxiety/ or Anxiety disorders/ (114845)
 12 pain/ or acute pain/ or facial pain/ or pain, postoperative/ or pain, procedural/ (183998)
 13 exp Fear/ (34283)

14   Anticipation, Psychological/ (2415)

15   Stress, Psychological/ (124093)

16   exp Child behavior/ (24485)

17   Child behavior disorders/ (20467)

18   Problem Behavior/ (2516)

19   (Anxiet$3 or anxious$ or apprehensive$ or fear$ or fright$ or phobi$2 or panic$1 or pain or odontophobia$ or stress or anticipation or ((disrupt$ or problem) adj3 (behavior or behaviour)) or (Child adj (behavior or behaviour))). ti,ab. (1381869)

20   10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 (1534355)

21   Behavior control/ (1819)

22   Cooperative behavior/ (44337)

23   Patient compliance/ (58665)

24   exp Behavior Therapy/ (78258)

25   Psychotherapy/ (54757)

26   communication/ or exp negotiating/ or nonverbal communication/ (96050)

27   exp Verbal Behavior/ (44199)

28   exp Adaptation, Psychological/ (129982)

29   Trust/ (10260)

30   imitative behavior/ (4530)

31   Hypnosis, Dental/ (468)

32   exp Mind-Body Therapies/ (51493)

33   exp Reinforcement, Psychology/ (55678)

34   exp Behavior Control/ (13738)

35   virtual reality/ (2572)

36   21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 (579931)

37   (Non-pharmacologic$2 or non pharmacologic$2 or ((behavior or behaviour) adj (therap$3 or control)) or ((cooperative or cognitive or imitative) adj (behavior or behaviour)) or (Compliance or Psychotherapy$3 or Desensitization)).ti,ab. (170293)

38   (Relaxation or imagery or ((color$ or colour$ or music$ or play$) adj6 therap$) or ((non-verbal or nonverbal) adj2 communicat$) or Aromatherap$3 or Adaptation).ti,ab. (264381)

39   (Hypnosis or hypnotherap$ or ((restrain$3 or immobili3$ or restrict$4 or hold$3) and physical$) or (rapport or trust or voice or reinforcement or mind-body or mind body or virtual reality) or (cognitiv$ adj6 (intervention$1 or therap$3 or treatment$1 or technique$1 or behaviour$1 or behavior$1)) or ((behavior$1 or behaviour$1) adj6 (intervention$1or therap$3 or treatment$1 or technique$1))).ti,ab. (189649)

40   ((auditory and distract$4) or (audiovisual$1 adj6 distract$43) or ((visual$ or music$2 or verbal) adj6 distract$4) or ((color$ or colour$ or music$ or play$) adj6 therap$3) or (verbal adj6 encourag$4) or positive reinforce$4 or (reward$15 or reassur$) or (tell show do or show tell do) or ((non-verbal or nonverbal) adj2 communicat$) or hand-over-mouth or breathing exercise$).ti,ab. (77263)

41   37 or 38 or 39 or 40 (658346)

42   ("8909478" or "19422751" or "4274318" or "2226384" or "23211912" or "23635898" or "31496566" or "17935597" or "7364700" or "27378545").ui. (9)

43   1 and 10 (404)

44   1 and 36 (554)

45   1 and 41 (420)

46   2 and 10 (1566)

47   2 and (dental or dentist$ or mouth$ or tooth or teeth).ti. and 20 and 36 (745)

48   2 and (dental or dentist$ or mouth$ or tooth or teeth).ti. and 20 and 41 (558)

49   43 or 44 or 45 or 46 or 47 or 48 (2570)

50   limit 49 to english language (2332)

PsycINFO (EBSCOhost) - 52 references retrieved on 3/19/2021
Updated 2/22/22 – **1** reference retrieved

1. DE "Dental Health" OR DE "Dental Treatment" OR DE "Dental Surgery" OR DE "Dental Surgery" OR TI (dental OR dentist) OR AB (dental OR dentist)

2. DE "Anxiety Disorders" OR DE "Generalized Anxiety Disorder" OR DE "Panic Attack" OR DE "Panic Disorder" OR DE "Phobias" OR DE "Acrophobia" OR DE "Agoraphobia" OR DE "Claustrophobia" OR DE "Ophidiophobia" OR DE "School Phobia" OR DE "Social Phobia" OR DE "Separation Anxiety Disorder" OR DE "Anxiety" or DE "Panic" OR DE "Fear" OR TI (anxiety OR anxious OR fear# OR fright OR phobia# OR panic OR odontophobia#) AND AB (anxiety OR anxious OR fear# OR fright OR phobia# OR panic OR odontophobia#)}

3. DE "Hypnosis" OR DE "Behavior Modification" OR DE "Anxiety Management" OR DE "Cognitive Behavior Therapy" OR DE "Acceptance and Commitment Therapy" OR DE "Cognitive Processing Therapy" OR DE "Prolonged Exposure Therapy" OR DE "Cognitive Therapy" OR DE "Relaxation Therapy" OR DE "Progressive Relaxation Therapy" OR DE "Stress Management" OR DE "Coping Behavior" OR DE "Coping Style" OR DE "Stress and Coping Measures" OR DE "Treatment Process and Outcome Measures" OR DE "Therapeutic Processes"

4. 1 AND 2 AND 3

5. 4 and English Language

6. 5 and (childhood birth -12 yrs OR adolescence 13-17 yrs)

Embase – **231** references retrieved on 3/17/2021
21 references retrieved of 3/2/2022
Single-line search run in "Results" tab of Embase.com interface:

(((('child'/exp OR 'adolescent'/exp OR 'juvenile'/de OR (child* OR teen* OR adolescent OR youth* OR juvenile* OR preteen* OR pre-teen* OR pediatric* OR paediatric*):ti,ab) **AND** ('dentist'/exp OR 'dentistry'/exp OR 'dental medicine': ti,ab OR 'paediatric dentistry':ti,ab OR 'pediatric dentistry':ti,ab)) **AND** ('dental anxiety'/exp OR 'anxiety'/de OR 'anxiety disorder'/exp OR 'phobia'/exp OR 'panic'/de OR 'pain'/exp OR 'jaw pain'/de OR 'face pain'/de OR 'postperative pain' OR 'procedural pain'/de OR 'fear'/exp OR 'anticipation'/de OR 'mental stress'/exp OR 'child behavior'/exp OR 'behavior disorder'/exp OR 'adolescent behavior'/exp OR 'problem behavior'/de) **AND** ('dental anxiet*':ti,ab OR 'dental fear*':ti,ab OR anxiet*:ti,ab OR 'anxiety disorder*':ti,ab OR phobia*:ti,ab OR ((phobic NEAR/3 (anxiet* OR 'anxiety disorder*' OR fear* OR neuros* OR reaction*)):ti,ab) OR ((panic NEAR/3 (disorder* OR attack*)):ti,ab) OR (((acute OR deep OR lightning OR nocturnal OR 'treatment related' OR mandibular OR maxillary OR face OR facial OR postoperative OR 'post operation' OR procedural) NEAR/3 pain):ti,ab) OR ((pain NEAR/3 (response* OR syndrome*)):ti,ab) OR 'face neuralgia':ti,ab OR 'facial neuralgia':ti,ab OR facialgia:ti,ab OR 'paroxysmal facial pain':ti,ab OR fear*: ti,ab OR anticipation:ti,ab OR 'psychological stress*':ti,ab OR 'mental stress*':ti,ab OR 'psychologic* stress*':ti,ab OR 'psycho-social stress*':ti,ab OR (((child OR infant OR adolescent* OR problem) NEAR/3 (behaviour* OR behavior*)):ti,ab) OR (((behavior* OR behaviour*) NEAR/3 (disturbance* OR aberration* OR disorder* OR disturbance* OR crisis)):ti,ab) OR beurobehavioral:ti,ab OR manifestation*:ti,ab)) AND ('alternative medicine'/exp OR 'aromatherapy'/ de OR 'autogenic training'/de OR 'behavior therapy'/exp OR 'behavioral control' OR 'breathing exercises'/exp OR 'cognitive behavioral therapy'/exp OR 'color therapy'/de OR 'cooperation'/exp OR 'coping behavior'/exp OR 'desensitization (psychology)'/exp OR 'guided imagery'/de OR 'holistic dentistry'/exp OR 'hypnosis'/de OR 'imitation'/ de OR 'interpersonal communication'/exp OR 'communication'/exp OR 'music therapy'/de OR 'nonverbal communication'/exp OR 'patient compliance'/exp OR 'phyiscal restraint' OR 'play therapy'/de OR 'problem behavior'/ de OR 'psychotherapy'/exp OR 'relaxation training'/de OR 'trust'/de OR 'verbal communication'/exp OR 'virtual reality'/ de OR (('alternative medicine*':ti,ab OR (((adherance OR compliance) NEAR/3 (patient* OR therap* OR treatment*)):ti,ab) OR (((behavior* OR behaviour*) NEAR/3 (training OR treatment* OR therap*)):ti,ab) OR ((relaxation NEAR/3

Figure continued on the next page.

(method* OR technics OR technique* OR therap* OR training*)):ti,ab) OR (('mind body' NEAR/3 'relaxation techniques'):ti,ab) OR 'alternative dentistry':ti,ab OR 'alternative therap*':ti,ab OR 'anaesthetic hypnosis':ti,ab OR 'anesthetic hypnosis':ti,ab OR aromatherap*:ti,ab OR 'autogene training*':ti,ab OR 'autogenic training*':ti,ab OR 'autogenous training*':ti,ab OR 'behavior thera*':ti,ab OR 'behavioral control':ti,ab OR 'behaviour control':ti,ab OR 'behavoural problem*':ti,ab OR 'breathing exercise*':ti,ab OR 'breathing therap*':ti,ab OR cbt:ti,ab OR 'chest physical therap*':ti,ab OR 'chest physiotherap*':ti,ab OR 'cognitive behavioral therap*':ti,ab OR 'color therap*':ti,ab) AND chromotherap*:ti,ab) OR 'color* light therap*':ti,ab OR 'colored phototherap*':ti,ab OR 'colour therap*':ti,ab OR communication:ti,ab OR ((complementary NEAR/3 (dentistry OR medicine OR therap*)):ti,ab) OR cooperation:ti,ab OR cooperativ*:ti,ab OR ((cooperative NEAR/3 (behavior OR behaviour)):ti,ab) OR coping:ti,ab OR ((coping NEAR/3 (abilit* OR behavior OR behaviour OR mechanism* OR strateg*)):ti,ab) OR 'dental hypnosis':ti,ab OR desensitisation:ti,ab OR desensitization:ti,ab OR 'differential reinforcement*':ti,ab OR disclosure*:ti,ab OR 'food reinforcement*':ti,ab OR ((guided NEAR/3 imagery):ti,ab) OR 'hand over mouth':ti,ab OR helpfulness:ti,ab OR 'helping behavior':ti,ab OR 'helping behaviour':ti,ab OR 'holistic dentistry':ti,ab OR 'holistic psychotherap*':ti,ab OR hypnogenesis:ti,ab OR hypno*:ti,ab OR 'hypnotical suggestion':ti,ab OR imitation:ti,ab OR 'imitative behavior':ti,ab OR 'imitative behaviour':ti,ab OR 'interpersonal communication':ti,ab OR jocotherapy:ti,ab OR 'katathym imaginative psychotherap*':ti,ab OR 'mechanical restraint*':ti,ab OR 'mental healing':ti,ab OR mesmerism:ti,ab OR 'mind body technique*':ti,ab OR 'mind body therap*':ti,ab OR 'mind-body therap*':ti,ab OR 'multiple psychotherap*':ti,ab OR 'music therap*':ti,ab OR narration:ti,ab OR 'non pharmacologic*':ti,ab OR 'non verbal communication':ti,ab OR 'non-pharmacologic*':ti,ab OR ((nonverbal NEAR/3 (behaviour OR behavior OR communication OR test)):ti,ab) OR 'patient compliance':ti,ab OR 'physical restraint':ti,ab OR 'play group therap*':ti,ab OR 'play therap*':ti,ab OR 'polarity therap*':ti,ab OR 'positive cooperat*':ti,ab OR 'positive reinforcement*':ti,ab OR ((problem NEAR/3 (behavior* OR behaviour*)):ti,ab) OR problembehavior:ti,ab OR ((psychologic NEAR/3 (desensitisation OR desensitization OR adaptation)):ti,ab) OR 'psychotherapeutic processes':ti,ab OR 'psychotherapeutic training':ti,ab OR psychotherap*:ti,ab OR 'psychotherapy imagery':ti,ab OR radiaesthesia:ti,ab OR radiesthesia:ti,ab OR 'reinforcement schedule':ti,ab OR reinforcement*:ti,ab OR 'relxation training':ti,ab OR 'respiration exercise':ti,ab OR 'respiration therapy':ti,ab OR 'respiratory exercise':ti,ab OR 'respiratory physiotherapy':ti,ab OR 'social reinforcement':ti,ab OR 'socioenvironmental therapy':ti,ab OR 'teach-back communication':ti,ab OR 'therapeutic cults':ti,ab OR trust:ti,ab OR 'truth disclosure':ti,ab OR 'unconventional dentistry':ti,ab OR 'variable interval':ti,ab OR reinforcement:ti,ab OR 'verbal communication':ti,ab OR 'verbal reinforcement':ti,ab OR 'virtual reality':ti,ab OR 'wordless comunication':ti,ab))

Cochrane Library (WileyOnline; Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials, Cochrane Methodology Register) – 16 references retrieved on 3/19/2021
0 references retrieved on 2/22/2022
Using Search Manager in Advanced Search:
1. MeSH descriptor: [Dentists] explode all trees
2. MeSH descriptor: [Dentistry] explode all trees
3. "dental medicine" OR "paediatric dentistry" OR "pediatric dentistry"
4. #1 OR #2 OR #3
5. "dental anxiety" OR phobia OR fright OR odontophobia
6. #4 AND #5
7. "cognitive behavior therapy" OR "coping behavior" OR "relaxation therapy" OR "stress management" OR "anxiety management" OR "non pharmacological" OR hypnosis
8. #6 AND #7
9. children OR child OR adolescent
10. #8 AND #9