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Association of Child Temperament with Dental Anxiety and Cooperative Behavior during Dental Care: A Systematic Review

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ABSTRACT

Background: Child temperament may be associated with dental anxiety and cooperative behavior during pediatric dental care. However, evidence regarding the associations of specific temperament dimensions with these two distinct outcomes remains inconsistent across studies. ***Objective:*** To systematically synthesize evidence on the associations between child temperament and two distinct outcomes: dental anxiety and cooperative behavior during dental care among children aged 3–12 years. ***Methods:*** PubMed, Scopus, Web of Science, and ScienceDirect were searched on September 4, 2026. Eligible studies assessed child temperament and dental anxiety and/or cooperative behavior using validated instruments. Study selection, data extraction, and risk-of-bias assessment were performed by one reviewer. The Joanna Briggs Institute Critical Appraisal Checklist for Analytical Cross-Sectional Studies was used, and findings were synthesized narratively. ***Results:*** Six cross-sectional studies involving 854 children were included. Two studies reported associations between child temperament and dental anxiety. In one study, emotionality and shyness were positively correlated with dental anxiety, whereas activity and sociability showed inverse correlations in unadjusted analyses, and only emotionality remained significant in the adjusted model. In another study, children classified as having a difficult temperament had higher dental anxiety scores than those with an easy temperament. Regarding cooperative behavior, findings varied across temperament dimensions, although shyness remained associated with uncooperative behavior in one multivariable analysis (OR = 1.288; 95% CI: 1.022–1.624). In one study, dental fear was associated with poorer cooperation in unadjusted analyses but was not statistically significant after adjustment. ***Conclusion:*** Current evidence suggests potential associations between specific child temperament characteristics and dental anxiety or cooperative behavior during dental care. However, findings remain inconsistent across studies, and the available evidence is limited by cross-sectional designs and methodological heterogeneity. Temperament assessment cannot currently be recommended as a stand-alone tool for predicting children's dental anxiety or cooperative behavior.

Keywords: child temperament; cooperative behavior; dental anxiety; pediatric dentistry; systematic review

INTRODUCTION

Temperament refers to individual differences in reactivity and self-regulation that emerge early in life and remain relatively stable across situations.[1] The Thomas and Chess model derived nine behavioral dimensions from parental interviews and classified most children into *easy*, *difficult*, and *slow-to-warm-up* profiles, whereas the Buss and Plomin model simplified these into four heritable traits: *emotionality*, *activity*, *sociability*, and *shyness,* later operationalized in the Emotionality, Activity Sociability Temperament Survey (EAS).[10] Recent psychometric research in preschool cohorts has confirmed this four-factor structure and its stability over time,[1] and screening studies show that parent-reported temperament can identify children at risk of later emotional difficulties.[2]

Dental anxiety is a common concern in pediatric dentistry and may negatively affect children's emotional responses, cooperation, and willingness to undergo dental treatment. Various behavioral management approaches, including audiovisual and audio distraction, have been investigated to reduce anxiety and improve children's responses during dental procedures.[33] Dental pain is another important factor affecting children's experiences of oral healthcare. It may negatively influence children's daily activities, including sleeping, eating, concentrating at school, and participating in social activities. These consequences highlight the importance of considering children's emotional and behavioral responses during dental care.[34]

Dental anxiety refers to apprehension about dental care that arises before or during a procedure in the absence of a direct threat.[3] A 2024 meta-analysis in early-childhood samples placed the pooled prevalence well above one in four preschool children, with wide variation across countries and instruments.[4] Children display it through crying, clinging to parents, refusing to open their mouths, and avoiding the treatment room; negative expectations formed at an initial visit tend to carry over to subsequent visits.[5] Cooperative behavior refers to a child's observed willingness to accept instructions and tolerate procedures, and is most often assessed using the four-level scale introduced by Frankl and colleagues in 1962.[30] The two constructs overlap without being interchangeable; a recent instrument review noted that anxiety scales and behavior-rating scales capture different layers of the same clinical episode.[6,7]

Understanding factors associated with children's dental anxiety and cooperative behavior may help pediatric dentists provide individualized behavior guidance.[31] Children's responses during dental care are influenced by developmental characteristics, previous dental experiences, anxiety, treatment-related factors, and the clinical environment.[31,32] Temperament may represent an additional individual characteristic associated with these responses, although its clinical relevance remains uncertain.[32]

Prior dental research supports this hypothesized direction. Two reviews published in 2023 concluded that dental fear is associated with fearfulness and negative emotionality, while behavior-management problems are associated with hyperactivity and impulsivity, suggesting partly distinct temperamental antecedents for the two outcomes; both reviews also underscored the small number of primary studies and the wide variety of methods used.[10,11]

Research on the broader set of predictors continues to place temperament alongside caries experience, prior dental treatment history, and parental anxiety.[12,13,14]

Previous reviews have examined associations between child temperament, dental fear, and behavior management problems. Nevertheless, the associations of specific temperament dimensions with dental anxiety and cooperative behavior remain insufficiently differentiated. These outcomes are related but distinct: anxiety reflects emotional responses to dental care, whereas cooperation reflects observable behavior during clinical procedures. Variations in temperament instruments, age groups, treatment settings, and adjustment for confounders make the existing findings difficult to compare. This review therefore synthesizes studies published from 2020 onward to examine the associations between child temperament and (1) dental anxiety and (2) cooperative behavior in children aged 3–12 years. The contribution of this review is an outcome-specific synthesis of temperament dimensions, with adjusted and unadjusted findings distinguished when available.

MATERIALS AND METHODS

Design and review question

This systematic review was reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines. The protocol was not prospectively registered. The review addressed two primary questions: (1) Is child temperament associated with dental anxiety during pediatric dental care? and (2) Is child temperament associated with cooperative behavior during pediatric dental care? The association between dental anxiety and cooperative behavior was also examined as a secondary finding when reported. The review questions were structured using the Population, Exposure, Comparison, Outcomes, and Study Design (PECOS) framework.

TABLE 1: PECOS framework.

Element	Criteria applied in this review
Population	Children aged 3–12 years receiving dental examination or treatment
Exposure (E)	Child temperament assessed using a validated instrument
Comparison (C)	Different temperament dimensions, scores, or categories
Outcomes (O)	Dental anxiety and/or cooperative behavior
Study Design (S)	Analytical observational studies reporting relevant association data

TABLE 2: Inclusion and exclusion criteria.

Inclusion	Exclusion
Children subjects aged 3–12 years	Samples exceeding the 3–12-year range without age-specific data
Temperament assessed with a validated instrument	Temperament inferred from an unvalidated or self-devised measure
Dental anxiety or cooperative behavior assessed with a validated instrument in a dental context	Outcomes assessed outside a dental context

Inclusion	Exclusion
Analytical observational studies, including cross-sectional, cohort, and case-control studies, reporting extractable association data relevant to the review questions.	Studies using other designs or lacking extractable association data, including case reports, narrative reviews, editorials, letters, and conference abstracts without complete data.
Full text available, published in a peer-reviewed journal	Full text unavailable
General pediatric patient population	Samples limited to autism spectrum disorder, intellectual disability, or syndromic conditions

Data extraction

Data were extracted by one reviewer from each included study. Extracted variables included author, publication year, country, study design, sample size, participant age and sex distribution, temperament assessment instruments and dimensions, dental anxiety and cooperative behavior measures, and relevant statistical findings. Effect estimates, confidence intervals, p-values, and variables included in adjusted analyses were recorded when reported. Adjusted and unadjusted associations were distinguished. Information not reported in the original studies was recorded as "Not Reported" (NR) without estimation or imputation.

Search Strategy and Study Selection

A systematic literature search was conducted in PubMed, Scopus, Web of Science, and ScienceDirect on September 4, 2026. The search strategy combined Medical Subject Headings (MeSH) terms, where applicable, and free-text keywords using Boolean operators (AND/OR). The main search concepts included child temperament and its dimensions, dental anxiety, dental fear, pediatric populations, and cooperative behavior during dental treatment. The search strategy included the following terms: (("Temperament" [MeSH Terms] OR temperament [Title/Abstract] OR "child temperament" [Title/Abstract] OR emotionality [Title/Abstract] OR activity [Title/Abstract] OR sociability [Title/Abstract] OR shyness [Title/Abstract]) AND ("Dental Anxiety" [MeSH Terms] OR "dental anxiety" [Title/Abstract] OR "dental fear" [Title/Abstract] OR "dental phobia" [Title/Abstract]) AND ("Child" [MeSH Terms] OR "Child, Preschool" [MeSH Terms] OR child* [Title/Abstract] OR pediatric* [Title/Abstract] OR paediatric* [Title/Abstract])) OR (("Dental Anxiety" [MeSH Terms] OR "dental anxiety" [Title/Abstract] OR "dental fear" [Title/Abstract]) AND ("Cooperative Behavior" [MeSH Terms] OR "Child Behavior" [MeSH Terms] OR cooperat* [Title/Abstract] OR behavior [Title/Abstract] OR behaviour [Title/Abstract]) AND ("Child" [MeSH Terms] OR "Child, Preschool" [MeSH Terms] OR child* [Title/Abstract] OR pediatric* [Title/Abstract]) The search strategy was adapted to the indexing systems and search functions of each database. Reference lists of relevant systematic reviews were also manually screened to identify additional potentially eligible primary studies.

Risk of bias

The methodological quality of the six included studies was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Analytical Cross-Sectional Studies. The eight items addressed inclusion criteria, participants and setting, exposure measurement, condition measurement, confounding identification and management, outcome measurement, and statistical analysis. Each item was classified as Yes, No, or Unclear according to the information reported in the primary study. Item-level assessments are presented in Table 3. The number of Yes ratings is descriptive and was not used as a validated overall risk-of-bias category. Critical appraisal was performed by one reviewer; independent duplicate appraisal was not undertaken.

TABLE 3: Results of the JBI Critical Appraisal Checklist for Analytical Cross-Sectional Studies.

Included study	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Mehrabkhani et al., 2024[17]	Y	Y	U	Y	Y	N	Y	Y
Bahrololoomi et al., 2023[18]	Y	Y	Y	Y	Y	Y	Y	Y
Juárez-López et al., 2022[19]	Y	Y	U	Y	Y	N	Y	Y
Lim et al., 2024[20]	Y	Y	U	Y	Y	Y	Y	U
Janeshin and Habibi, 2021[21]	Y	Y	Y	Y	U	N	Y	U
Thamilvanan et al., 2024[22]	Y	Y	U	Y	U	N	Y	U

JBI checklist items

Q1: Were the criteria for inclusion in the sample clearly defined?; Q2: Were the study subjects and the setting described in detail?; Q3: Was the exposure measured in a valid and reliable way?; Q4: Were objective, standard criteria used for measurement of the condition?; Q5: Were confounding factors identified?; Q6: Were strategies to deal with confounding factors stated?; Q7: Were the outcomes measured in a valid and reliable way?; Q8: Was appropriate statistical analysis used?

Abbreviations: Yes = criterion satisfied; No = criterion not satisfied; Unclear = insufficient information to determine whether the criterion was satisfied.

The JBI critical appraisal identified methodological limitations across the six included studies (Table 3). Two studies (Bahrololoomi et al. and Lim et al.) reported multivariable regression strategies addressing potential confounding (Q6: Yes), whereas four did not adequately address confounding in their primary association analyses (Q6: No). Statistical analysis was rated Yes in three studies and Unclear in three (Lim et al., Janeshin and Habibi, and Thamilvanan et al.) because inconsistencies or incomplete reporting prevented a definitive judgment. An Unclear rating does not demonstrate that the statistical method was incorrect. Limitations in the reporting of temperament measurement were also identified. No study was excluded solely on the basis of the appraisal.

Data synthesis

A narrative synthesis was conducted because the included studies differed in temperament constructs, assessment instruments, outcome measures, and statistical approaches. Findings were organized into three categories: (1) associations between child temperament and dental anxiety, (2) associations between child temperament and cooperative behavior, and (3) associations between dental anxiety and cooperative behavior, when reported.

RESULTS

Study selection

The database search identified 782 records (PubMed, n = 334; Scopus, n = 74; ScienceDirect, n = 210; Web of Science, n = 164). After 248 duplicates were removed, 534 titles and abstracts were screened and 428 were excluded (not relevant to the topic, n = 312; population not eligible, n = 56; review, case report, or commentary, n = 60). Of the 106 reports sought for full-text retrieval, 18 could not be retrieved, including a study by Seraj and colleagues assessing temperament, anxiety, and cooperation in 70 Iranian children aged 4–10 years that appeared highly relevant to the review question. The remaining 88 reports were assessed for eligibility, and 82 were excluded (did not meet the inclusion criteria, n = 34; wrong outcome, n = 18; wrong study design, n = 12; not in English, n = 8; full text unavailable, n = 10), leaving six studies for synthesis.[17–22] Figure 1 shows the selection flow and reasons for exclusion.

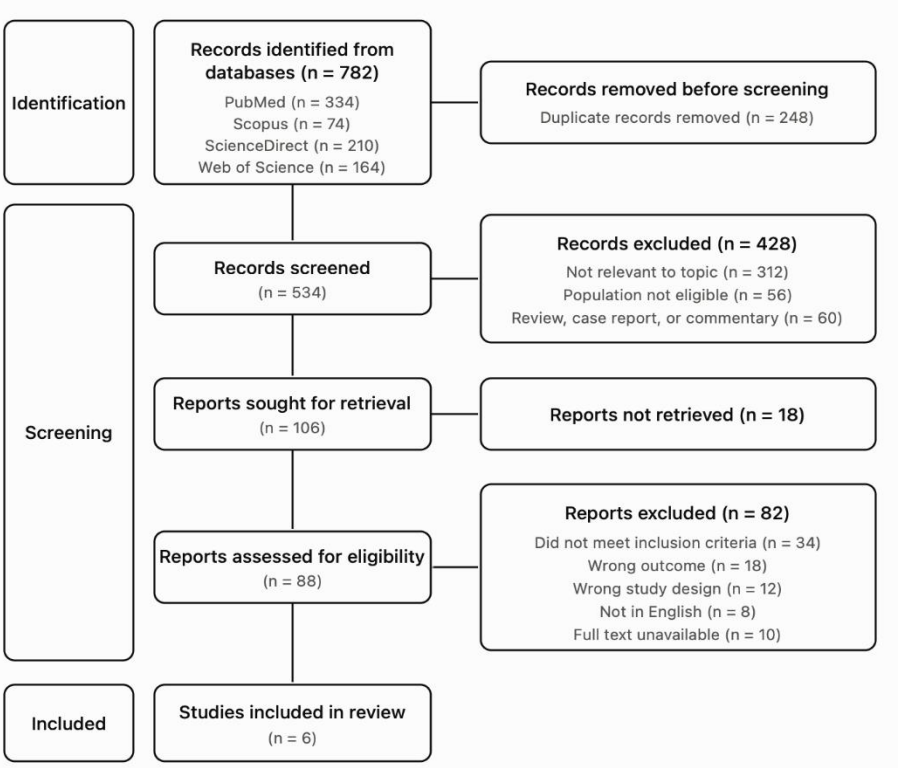


FIGURE 1: PRISMA 2020 flow diagram of study selection.

Characteristics of included studies

Together, the six studies involved 854 children in Iran (three studies), Mexico, South Korea, and India, with sample sizes ranging from 100 to 199 and publication years from 2021 to 2024. All reported age ranges fell within the 3-to-12-year limit, and age-stratified analyses were uncommon: Bahrololoomi and colleagues reported temperament–anxiety correlations separately for ages 6–7 and 8–11 years, and Juárez-López and colleagues compared temperament scores between children aged ≤5 and 6–10 years, whereas the remaining studies did not stratify their temperament analyses by age. Four studies measured temperament with the EAS,[18,19,20,22] one with the Children's Behavior Questionnaire,[21] and one with the Persian version of the Malhotra Temperament Schedule.[17] Cooperative behavior was assessed with the Frankl scale in four studies[19,20,21,22] and with the Venham Clinical Cooperation Scale in one study.[17] Dental anxiety was measured with the CFSS-DS in two studies,[17,20] the MCDAS in one study,[18] and the Venham Clinical Anxiety Scale in one study.[17]

TABLE 4: Characteristics of included studies.

Author, year	Country	Design	n	Age	Temperament instrument	Anxiety instrument	Cooperation instrument	Procedure setting
Mehrabkhani et al., 2024[17]	Iran	Cross-sectional	103 (39 M, 64 F)	4–6 years (mean 59.33 ± 7.17 months)	Malhotra Temperament Schedule (Persian)	CFSS-DS; Venham Clinical Anxiety Scale	Venham Clinical Cooperation Scale	Fluoride therapy, local anesthetic injection, and cavity preparation/drilling; assessment across treatment stages.
Bahrololoomi et al., 2023[18]	Iran	Cross-sectional, descriptive-analytic	152 (73 M, 79 F)	6–11 years	EAS	MCDAS	NR	Dental treatment-related assessment; specific procedures: NR.
Juárez-López et al., 2022[19]	Mexico	Cross-sectional, observational	140 (42% M, 58% F)	3–10 years (mean 5 ± 2.1 years in abstract; SD 2.4 in Results)	EAS	NR	Frankl Behaviour Rating Scale	Second appointment: caries removal and restoration (composite or stainless-steel crown, no pulpal therapy) of one or two molars under infiltrative anesthesia with rubber dam; 15–40 min.
Lim et al., 2024[20]	South Korea	Cross-sectional	100 (47 M, 53 F)	4–12 years	EAS	CFSS-DS (child); Corah Dental Anxiety Scale (guardian)	Frankl Behaviour Rating Scale	Pediatric dental hospital setting; dental fear, temperament, caries experience, and previous dental treatment experience assessed. Specific procedure during observation: NR.
Janeshin & Habibi, 2021[21]	Iran	Cross-sectional, descriptive-analytic	199 (215 reported in Results)	3–7 years	Children's Behavior Questionnaire (CBQ)	NR as a separate dental-anxiety instrument; fear assessed as a temperament dimension	Frankl scale	Routine pediatric dental treatment at a dental clinic; specific clinical procedures: NR.
Thamilvanan et al., 2024[22]	India	Cross-sectional	160 (84 M, 76 F)	6–9 years (mean 7.8 years in abstract; 8.9 in Results)	EAS	NR	Frankl Behaviour Rating Scale	Dental clinic setting; first dental visit with intraoral examination for caries using deft and DMFT indices (predominantly noninvasive procedures). Specific operative procedure: NR.

Note: CFSS-DS, Children's Fear Survey Schedule–Dental Subscale; DAS, Dental Anxiety Scale; EAS, Emotionality Activity Sociability Temperament Survey; MCDAS, Modified Child Dental Anxiety Scale; NR, not reported.

Temperament and dental anxiety

Two studies directly examined the association between child temperament and dental anxiety.[17,18] Mehrabkhani and colleagues found that mean CFSS-DS scores differed significantly across temperament types ($p = 0.001$), with the highest mean score in the difficult temperament group (35.33 ± 4.84) and the lowest in the easy temperament group (25.17 ± 7.70). Venham Clinical Anxiety Scale scores also differed across temperament types during fluoride application ($p = 0.013$), local anesthetic injection ($p = 0.001$), and cavity preparation ($p = 0.029$). Sociability was significantly associated with anxiety at all three treatment stages ($p = 0.040$, 0.025, and 0.001, respectively).[17]

Bahrololoomi and colleagues reported positive correlations between dental anxiety scores and emotionality ($r = 0.203$; $p = 0.012$) and shyness ($r = 0.232$; $p = 0.004$). In contrast, activity ($r = −0.175$; $p = 0.031$) and sociability ($r = −0.161$; $p = 0.048$) were inversely correlated with dental anxiety. Their regression model explained 10% of the variance in dental anxiety scores, with emotionality being the only temperament dimension that remained statistically significant in the regression analysis.[18] In that model, shyness ($p = 0.241$), activity ($p = 0.437$), and sociability ($p = 0.596$) were not significant after adjustment for age, sex, and maternal age and education. In the age-stratified analysis, only shyness was significantly correlated with anxiety at 6–7 years ($r = 0.354$; $p = 0.003$).[18]

Temperament and cooperative behavior

Five studies contributed data to this section.[17,19,20,21,22] Mehrabkhani and colleagues reported differences in Venham cooperation scores across temperament types during fluoride application ($p = 0.038$), injection ($p = 0.001$), and cavity preparation ($p = 0.027$), with the difficult group the least cooperative; however, no single trait was significant at the fluoride-application stage.[17] Impulsivity was significantly associated with cooperation during injection ($p = 0.001$) and with anxiety during drilling ($p = 0.033$).[17] Juárez-López and colleagues found higher emotionality and activity scores in children rated negative or definitely negative on the Frankl scale ($p < 0.01$), while sociability and shyness did not differ between groups; age was inversely correlated with behavior (rho = −0.245; $p = 0.001$).[19]

Lim and colleagues found higher shyness scores in the uncooperative group (6.74 ± 1.92 vs 5.51 ± 2.24; $p = 0.005$), and in multivariable logistic regression only shyness remained significant (OR 1.288; 95% CI 1.022–1.624; $p = 0.032$), while negative emotionality was no longer significant (OR 1.199; $p = 0.097$); combined caries experience also predicted uncooperativeness (OR 1.147; 95% CI 1.003–1.312; $p = 0.045$).[20] Janeshin and Habibi reported higher fear ($p = 0.008$) and anger ($p = 0.004$) scores in children rated completely negative, and higher inhibitory control ($p = 0.003$) and perceptual sensitivity ($p = 0.001$) in children rated completely positive.[21] Janeshin and colleagues also found no significant differences in shyness ($p = 0.224$), activity level ($p = 0.200$), or impulsivity ($p = 0.097$) across behavior categories.[21] Thamilvanan and colleagues reported significant differences in temperament scores across Frankl categories for all three EAS categories (E: F = 26.34, $p = 0.001$; A: F = 8.32, $p = 0.001$; S: F = 1006.2, $p = 0.0001$). The E score was highest in definitely positive children (3.32 ± 0.22) and lowest in negative (2.72 ± 0.31) and definitely negative (2.74 ± 0.20) children; the S score was highest in definitely negative children (4.56 ± 0.18), and the A score was lowest in negative children (2.80). The paper does not clearly define the S category (sociability versus shyness), and several reported values were internally inconsistent, so these results should be interpreted cautiously. A separate correlation between S and deft scores in positive-behavior children ($r = 0.393$; $p = 0.004$) concerned caries rather than the review outcomes.[22]

Dental anxiety and cooperative behavior

Two studies addressed this association.[17,20] Lim, and colleagues found a mean CFSS-DS score of 45.26 ± 13.49 in uncooperative children compared with 34.51 ± 13.51 in cooperative children ($p < 0.0001$), and fear category was associated with cooperation category ($\chi^2 = 5.107$; $p = 0.024$).[20] However, after adjustment for temperament and caries experience, CFSS-DS no longer predicted cooperation (OR 2.448; 95% CI 0.953–6.290; $p = 0.063$), and 19 of the 40 children (47.5%) with high fear scores remained cooperative. Mehrabkhani and colleagues described a concordant pattern between anxiety and cooperation without reporting a direct correlation coefficient (NR).[17]

TABLE 5: Summary of Associations Between Child Temperament Dimensions and Dental Anxiety or Cooperative Behavior.

Temperamental Characteristic	Dental anxiety	Cooperative behavior	Studies
Emotionality	Positive association ($r = 0.203$; $p = 0.012$); remained significant in the adjusted model ($p = 0.029$)	Negative behavior more frequent ($p < 0.01$); not significant after adjustment (OR 1.199; $p = 0.097$)	Bahrololoomi 2023[18]; Juárez-López 2022[19]; Lim 2024[20]
Shyness	Positive association ($r = 0.232$; $p = 0.004$); not significant in the adjusted model ($p = 0.241$)	Associated with uncooperative behavior after adjustment (OR 1.288; 95% CI 1.022–1.624); null in Janeshin 2021[21] ($p = 0.224$)	Bahrololoomi 2023[18]; Lim 2024[20]; null in Juárez-López 2022[19] and Janeshin 2021[21]

Temperamental Characteristic	Dental anxiety	Cooperative behavior	Studies
Sociability	Inverse association (r = −0.161; p = 0.048); not significant in the adjusted model (p = 0.596)	Conflicting: significant during injection and cavity preparation (p = 0.040; 0.016), null in another study (p = 0.345)	Bahrololoomi 2023[18]; Mehrabkhani 2024[17]; null in Lim 2024[20] and Juárez-López 2022[19]
Activity	Inverse association (r = −0.175; p = 0.031); not significant in the adjusted model (p = 0.437)	Conflicting: higher in negative behavior (p < 0.01) versus null (p = 0.291)	Bahrololoomi 2023[18]; Juárez-López 2022[19]; null in Lim 2024[20]
Impulsivity	Positive association during drilling (p = 0.033)	Associated with poorer cooperation during injection (p = 0.001); null in Janeshin (p = 0.097)	Mehrabkhani 2024[17]; null in Janeshin 2021[21]
EAS categories E, A, S (Thamilvanan)	Not assessed	Significant differences across Frankl categories (E: p = 0.001; A: p = 0.001; S: p = 0.0001); interpretation limited by inconsistencies in reporting.	Thamilvanan 2024[22]
Temperament type (difficult)	Higher CFSS-DS scores than easy temperament (35.33 ± 4.84 vs. 25.17 ± 7.70; p = 0.001).	Lower cooperation across fluoride application, injection, and cavity preparation (p = 0.038, 0.001, and 0.027, respectively).	Mehrabkhani 2024[17]

Note: CFSS-DS = Children's Fear Survey Schedule-Dental Subscale; OR = odds ratio; CI = confidence interval; EAS = Emotionality-Activity-Sociability.

The association between dental anxiety and cooperative behavior was examined as a secondary outcome. The findings from the two studies reporting relevant information are summarized separately in Table 6. Although higher dental anxiety was associated with poorer cooperation in unadjusted analyses in one study, the association was not statistically significant after adjustment. The other study reported corresponding patterns of anxiety and cooperation without a direct association estimate.

TABLE 6: Association Between Dental Anxiety and Cooperative Behavior During Pediatric Dental Care.

Study	Dental anxiety assessment	Cooperative behavior assessment	Main findings
Lim et al., 2024	CFSS-DS	Frankl Behaviour Rating Scale	Higher anxiety scores in uncooperative than cooperative children (45.26 ± 13.49 vs. 34.51 ± 13.51; p < 0.0001). Association was not statistically significant after adjustment (OR = 2.448; 95% CI: 0.953–6.290; p = 0.063).
Mehrabkhani et al., 2024	Venham Clinical Anxiety Scale	Venham Clinical Cooperation Scale	Dental anxiety and cooperative behavior showed corresponding patterns across temperament groups and treatment stages. However, the study did not report a direct effect estimate for the association between dental anxiety and cooperative behavior.

Note: CFSS-DS = Children's Fear Survey Schedule–Dental Subscale; OR = odds ratio; CI = confidence interval. These results represent secondary findings and should not be interpreted as evidence of a causal relationship.

DISCUSSION

The findings of this systematic review suggest that associations between child temperament and dental anxiety or cooperative behavior vary according to the temperament dimension and outcome assessed. Emotionality showed an association with dental anxiety in one multivariable analysis, whereas shyness remained associated with uncooperative behavior in another. Nevertheless, these findings were not consistently replicated across the included studies. Differences in temperament constructs, outcome measures, and adjustment for potential confounders limit the strength of the evidence and prevent identification of a temperament dimension that is consistently associated with both outcomes.

The findings from Mehrabkhani and colleagues require a distinction between temperament types and individual temperament dimensions. Cooperation scores differed significantly across temperament types at all three treatment stages: fluoride application (p = 0.038), local anesthetic injection (p = 0.001), and cavity preparation (p = 0.027).[17]

However, when individual temperament dimensions were examined, significant associations with cooperation were observed during injection and cavity preparation, whereas no temperament dimension was significantly associated with cooperation during fluoride application.[17] Thus, the overall differences between temperament groups were present at all three stages, while associations involving specific temperament dimensions varied according to the procedure. In addition, nearly half (19 of 40; 47.5%) of the children with high dental fear scores in the Korean study remained cooperative during treatment.[20] This finding illustrates that dental fear does not invariably lead to uncooperative behavior.

These findings are broadly consistent with two earlier reviews suggesting that dental fear and anxiety may be associated with fearfulness and negative emotionality, whereas behavioral management problems may be associated with impulsivity and hyperactivity.[10],[11] The persistence of shyness after adjustment in the study by Lim and colleagues[20] is consistent with reports that shy children may experience greater difficulties with behavioral regulation in clinical settings.[10] Jain and colleagues, who studied preschool children attending their first dental visit, also reported associations between temperament and children's anxiety and behavior.[23] Recent reviews of risk factors for children's behavior during dental care have likewise considered age and temperament among the relevant factors.[12],[13] Nevertheless, the limited number of studies and differences in temperament instruments and outcome measurements prevent firm conclusions about which temperament dimensions are most consistently associated with each outcome.

Evidence from Indonesian pediatric dental populations remains limited within the scope of this review. Previous studies have examined dental anxiety, sociodemographic characteristics, and anxiety-management interventions, but these do not directly address the associations between temperament and the two outcomes examined here. Further research in Indonesian pediatric dental settings is warranted to assess whether the associations reported in other populations are also observed locally.

One possible biological explanation for the observed associations involves individual differences in threat processing and behavioral inhibition. Children with greater behavioral inhibition may differ in the way they respond to unfamiliar or potentially threatening situations and may be more susceptible to anxiety.[9] However, the included studies did not directly investigate the neurobiological mechanisms underlying the observed associations. A first restorative dental visit may expose children to several unfamiliar stimuli simultaneously, including the clinical environment, dental instruments, sounds, and potentially uncomfortable procedures. One possible explanation is that children with greater emotional reactivity may experience distress more readily, which may manifest as crying, withdrawal, or resistance during treatment.

A complementary psychological explanation concerns the regulation of emotional responses. Janeshin and Habibi reported higher inhibitory control among children exhibiting positive behavior.[21] This finding is consistent with the proposition that effortful control may influence how reactive temperament characteristics are expressed in behavior.[10] Children who experience anxiety may nevertheless cooperate when they can regulate their emotional responses or respond positively to the clinical environment. This possibility may help explain why some children with high dental fear scores remained cooperative in the study by Lim and colleagues.[20] Future studies examining both emotional reactivity and self-regulation may therefore provide a more comprehensive understanding of children's responses during dental treatment.

From a clinical perspective, parent-reported temperament assessments, such as the Emotionality Activity Sociability (EAS) Temperament Survey, may provide preliminary information about individual differences in children's emotional and behavioral characteristics. However, the current evidence does not establish that temperament scores can reliably predict an individual child's dental anxiety or cooperation. Temperament should therefore be considered one contextual factor among several, rather than a stand-alone predictive tool. Clinicians may use information about temperament alongside the child's developmental characteristics, anxiety, previous dental experiences, treatment needs, and family context when planning communication and behavior guidance. The findings do not justify determining the need for sedation or general anesthesia on the basis of temperament alone.

This review has several limitations. The protocol was not prospectively registered, and study selection, data extraction, and critical appraisal were conducted by a single reviewer, increasing the risk of selection and assessment errors. All included studies were cross-sectional, precluding causal or temporal conclusions. Differences in temperament instruments, age ranges, clinical procedures, outcome measures, and statistical analyses prevented meaningful quantitative pooling. Only two studies reported strategies for addressing confounding, and some primary reports contained inconsistent participant or statistical data. Restriction to English-language publications and failure to retrieve potentially relevant reports may have introduced selection bias. These limitations reduce confidence in the consistency and generalizability of the associations.

Future research should examine temperament, dental anxiety, and cooperative behavior in the same pediatric samples using clearly defined and validated instruments. Studies should report results by age group or recruit children within narrower age ranges to help distinguish age-related effects from temperament-related associations.

Multivariable analyses should consider relevant factors, including age, dental caries experience, previous dental experiences, and parental dental anxiety. Researchers should also report effect estimates with confidence intervals and distinguish unadjusted from adjusted analyses to facilitate comparison across studies and possible future meta-analysis. Prospective studies that assess temperament before dental treatment and subsequently evaluate anxiety and cooperation across dental visits would help clarify the temporal relationships among these variables. Finally, research involving Southeast Asian populations, including Indonesian children, is needed to assess the applicability of existing findings across different cultural and clinical settings.

CONCLUSION

The available cross-sectional evidence suggests that some temperament characteristics may be associated with dental anxiety or cooperative behavior during pediatric dental care, but the direction and strength of these associations differ across studies and outcomes. Emotionality and shyness were associated with the respective outcomes in individual adjusted analyses; these findings have not been consistently replicated. Given methodological heterogeneity and incomplete control of confounding, temperament assessment should not be used alone to predict anxiety or cooperation. Prospective studies with standardized measures and appropriately adjusted analyses are needed.

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