Research Article

Evaluation of The Influence of Maternal Anxiety And Dental Environment on Children During Dental Appointment- A Systematic Review

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ABSTRACT

Background: Maternal fear of dentistry has been postulated to influence the behavioral and physiological responses of children during dental treatment. Psychological status of the mother, dental environment characteristics, and control over behavior can all contribute to the degree of anxiety, co-operation level, and general treatment success of a child. But the degree and frequency of such an influence in different clinical situations remain to be extensively evaluated.

Methods: Systematic review of the impact of maternal anxiety about dentistry and operatory environmental factors on pediatric patient behavior and anxiety was done. The review incorporated nine original studies of mother-child dyads, including observational studies and randomized controlled trials. Data for the assessment measure of maternal anxiety, thresholds for anxiety, type and timing of dental procedures, behavior management techniques, measures of child anxiety, and strategies of statistical modeling were gathered. Quantitative and qualitative syntheses were performed.

Results: Across majority of the 9 included studies, maternal anxiety was measured mainly with Corah's Dental Anxiety Scale or its modifications, but in one study, the State-Trait Anxiety Inventory was applied. The cut-offs for maternal anxiety varied, from DAS ≥13 to categorized forms of mild, moderate, and severe. Anxiety and behavior of children were evaluated using validated questionnaires, such as the Facial Image Scale, CFSS-DS, Venham Picture Test, and Frankl Behavior Scale. Quantitative analysis revealed a significant correlation between maternal anxiety and elevated child anxiety ($p < 0.05$ in 7/9 studies), heightened physiological stress responses (e.g., elevated heart rate), and reduced cooperation of children during dental treatment. A randomized trial revealed a significant decrease in maternal and child anxiety following pre-appointment counseling ($p < 0.01$). Another study also illustrated how maternal anxiety was a predictor for worse outcomes for oral health, such as a higher prevalence of untreated or missing teeth ($p < 0.05$). The statistical methods applied were Pearson's and Spearman's correlations, Chi-square tests, Poisson regression, and generalized linear models, which confirmed consistent relationships even in spite of methodological differences.

Conclusion: This review demonstrated a consistent positive correlation between maternal dental fear and higher levels of child anxiety and noncompliance behavior during dental treatment. The use of anticipatory counseling as an intervention was seen to be effective in decreasing these effects. However, the variability of assessment tools, anxiety cutpoints, and measures of behavior requires cautious interpretation and emphasizes the value of standardization in future clinical studies.

Keywords: Maternal anxiety, pediatric dental behavior, dental fear, child cooperation, dental environment, behavior management, anxiety scales.

INTRODUCTION

Dental fear is a significant psychological barrier to the effective use of oral health care services and the compliance with treatment, particularly in child populations [1]. Dental fear in children is typically multifactorially acquired, relying on cognitive development, earlier traumatic experiences with dentistry, temperament, and family and environmental factors [2,3]. Parental influence—most importantly, that of the mother's emotional condition—has universally been identified as a central predictor of anticipatory fear and behavioral response in a child receiving dental treatment [4]. Mother-child dyads are especially vulnerable in this context, as the mother's traditionally central role as carer and emotional moderator during earlier developmental phases [5]. Maternal anxiety has been revealed in many studies to affect child levels of dental fear and cooperation, especially when such anxiety is specifically dental-setting related [6]. Such a relationship can either take place directly by imitation through modeling and social learning or indirectly, by the child's physiological and psychological entrainment with the emotion state of the caregiver [7].

Maternal dental fear has the potential to produce adverse behavioral consequences in children such as uncooperativeness, heightened physiological stress reactions, and intolerance to dental treatment [8]. Maternal anxiety also possesses the ability to affect a child's dental health pattern through avoidance, delayed treatment,

or failure to attend preventive visits [9]. Notably, children whose mothers have high dental fear scores have been reported to have increased heart rates, lower behavioral ratings, and heightened fear perceptions while undergoing dental treatment [6,10]. Apart from individual psychological variables, several dental environmental variables—such as operatory design, visual or auditory stimulus, sedation process, and caregivers' presence during therapy—also contribute to the determination of a child's behavioral outcomes [3,11]. Such variables have the capability to interact with maternal fear and suppress or enhance the child's stress reactions. For instance, the presence of an anxious parent during dental treatment increases child distress, but systematic parental preparation or environment distraction-based changes reduce anxiety-related consequences [4,8].

Despite an ever-growing number of investigations into maternal anxiety and its effect on pediatric dental behavior, the literature is very heterogeneous with regard to methodology, outcome measures, and exposure assessment [1,5]. Only a few studies employ standardized psychometric assessment instruments to assess maternal dental anxiety, and others employ general trait-anxiety inventories [7,10]. Child anxiety is assessed using diverse methods, i.e., observational rating scales, physiological measures, or self-report inventories, generating variability in effect estimation [6,9]. Moreover, the roles of modifiable environmental interventions in the dental operatory—e.g., anticipatory guidance, audiovisual aids, or modeling behavior—have not been well described in association with maternal–child emotional interactions [2,11]. Heterogeneity in study design, participant inclusion criteria, and analytical procedures has hindered the formulation of a common understanding of maternal psychological states and the dental environment and their interaction in determining child outcomes [3,5].

As there is potential for the findings to influence the provision of pediatric dental care and interventions to parents, there is a need to conduct a critical appraisal of the existing clinical literature regarding the effects of maternal dental anxiety and environmental variables on children's behavior in the dental setting. This systematic review, therefore, will seek to synthesize evidence that investigate the effects of maternal anxiety and dental environment variables on behavioral and physiological reactions in pediatric patients undergoing dental visits.

MATERIALS AND METHODS

Eligibility Criteria

The PECOS framework applied in this review was created and recorded in a systematic manner based on the PRISMA 2020 guidelines [12]. Patient/Population (P) was mother-child dyads seeking dental consultations. Exposure (E) was maternal dental-specific anxiety and other dental environmental determinants, e.g., operatory layout, audiovisual distraction, sedation use, parent presence. Comparator (C) was low maternal anxiety dyads or differing dental-environmental conditions (e.g., parent presence vs. absence, counseling vs. non-counseling). Outcomes (O) were constructed to measure child anxiety, behavioral compliance, physiological stress reactions, and treatment completion. Study design (S) utilized original clinical trials, randomized and non-randomized, and prospective and retrospective cohort studies

Inclusion criteria were specifically defined for population, exposure, outcome, and study design. Included studies were mother-child dyads in which maternal dental anxiety was assessed during a dental consultation, together with at least one pediatric dental outcome, behavioral or physiological, which was objectively assessed. The pediatric population was between birth and adolescence. Only prospective, retrospective, cross-sectional or randomized clinical trial study methodologies were included; case reports, in vitro studies, animal studies, and only qualitative studies were excluded. No language restrictions were used.

Database Search Protocol

Database searching was conducted in 6 electronic databases—MEDLINE (searched through PubMed), Embase, Web of Science, Cochrane CENTRAL, Scopus and CINAHL—using Boolean, as well as MeSH relevant, terms. The search terms were tailored to every database to maintain sensitivity and specificity. All database searches were undertaken from inception till May 2025 2025, with syntax customized as necessary for each individual database.

Data Extraction Protocol

Data extraction was conducted by two independent reviewers using a pre-specified template on Excel. The extracted variables included study characteristics (author, year, country, design, sample size, age, sex, follow-up), maternal variables (anxiety assessment tool, timing), child-related variables (behavioral or physiological outcome measures, assessment tool and timing), dental environmental modifiers, intervention details, statistical methods, result measures (effect size, p-value, confidence interval), and study-level observations. Consensus adjudication and pilot testing ensured consistency for the resolution of discrepancies.

Bias Assessment Protocol

Risk of bias was established with the JBI systematic review checklist [13]. Two reviewers separately assessed studies. The domains assessed included selection bias, confounding, intervention classification, deviations, missing outcomes, measurement bias, and selective reporting. Judgments were rated as low, moderate, serious, or critical risk based on tool specifications. Reviewer calibration minimized subjectivity. Final bias ratings guided sensitivity analyses and interpretation.

RESULTS

544 records were identified through extensive electronic database searching (Figure 1). 39 duplicate records were excluded, leaving 505 unique entries screened. No records were removed using automated software or for any reason at this point. All 505 records were attempted to be retrieved at full-text level, of which 47 were inaccessible due to paywall restrictions. The remaining 458 full-text articles were deemed eligible for consideration. 117 were excluded as case reports, 172 were excluded as literature reviews, and 160 were excluded as irrelevant to the topic. Finally, 9 studies [14-22] met all the inclusion criteria and were included within the qualitative synthesis.

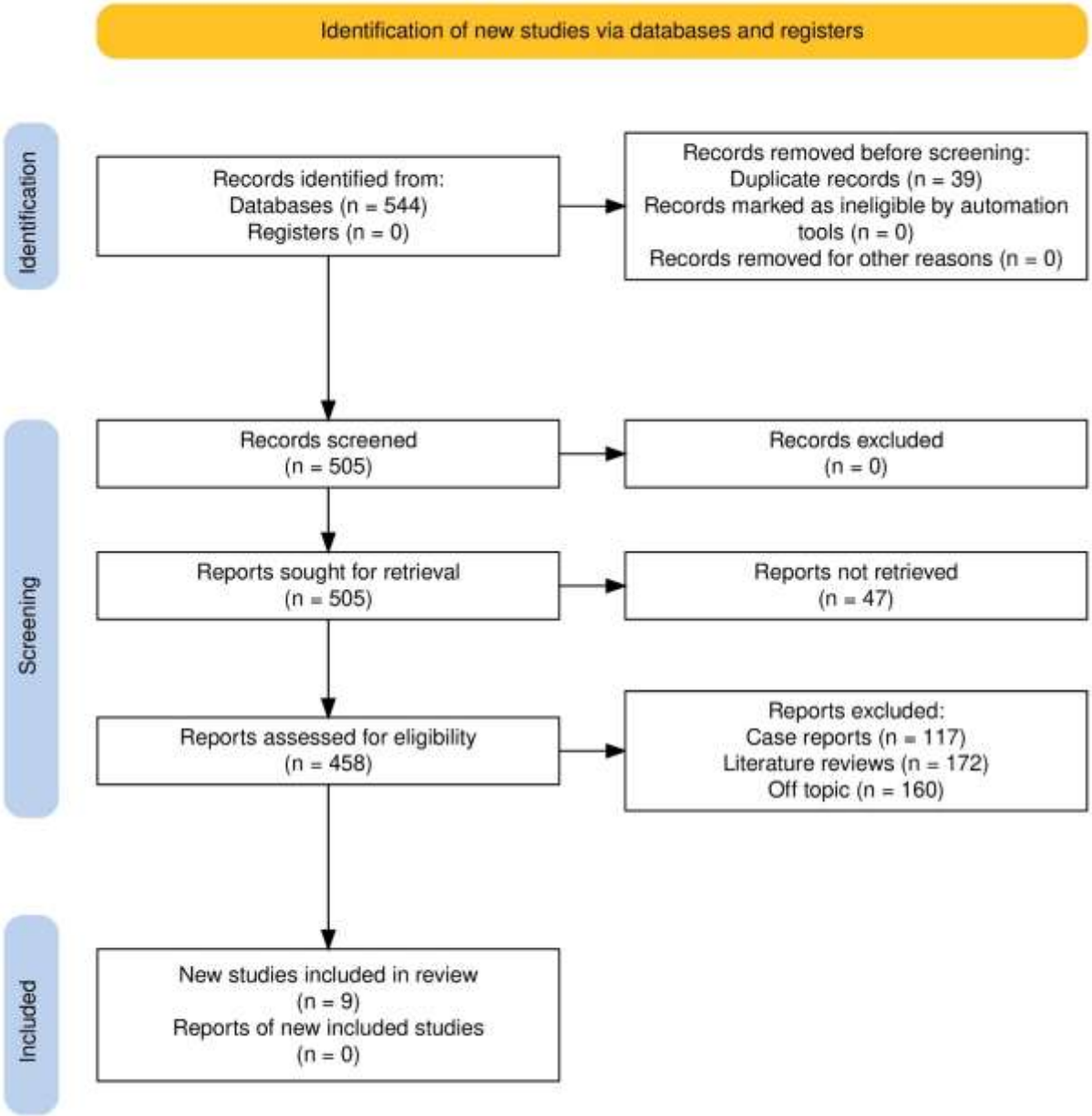

Figure 1: Study selection process for the review

Assessment of Risk of Bias

Risk assessment of bias revealed varying levels of methodological quality of the nine included studies (Figure 2). Three studies showed a low risk of bias across all aspects, thus were rated as methodologically sound [16,17,22]. These studies systematically followed well-defined review questions, adequate inclusion criteria, transparent search strategies, transparent documentation of critical appraisal and data extraction processes, and employed adequate synthesis methods. Four studies showed a moderate risk in five or more aspects, showing issues of vagueness in their search strategies, critical appraisals, or proposals for future research in their inclusion criteria [14,15,18,20]. The last two studies showed a mix of low and moderate risk in various aspects, showing a generally acceptable level of methodological quality overall, although some limitations were noted in publication bias assessment and synthesizing transparency [19,21]. These results showed a general agreement in the clarity of review questions and inclusion criteria, as well as finding variability noted in appraisal, reporting, and synthesizing methodologies among the body of evidence.

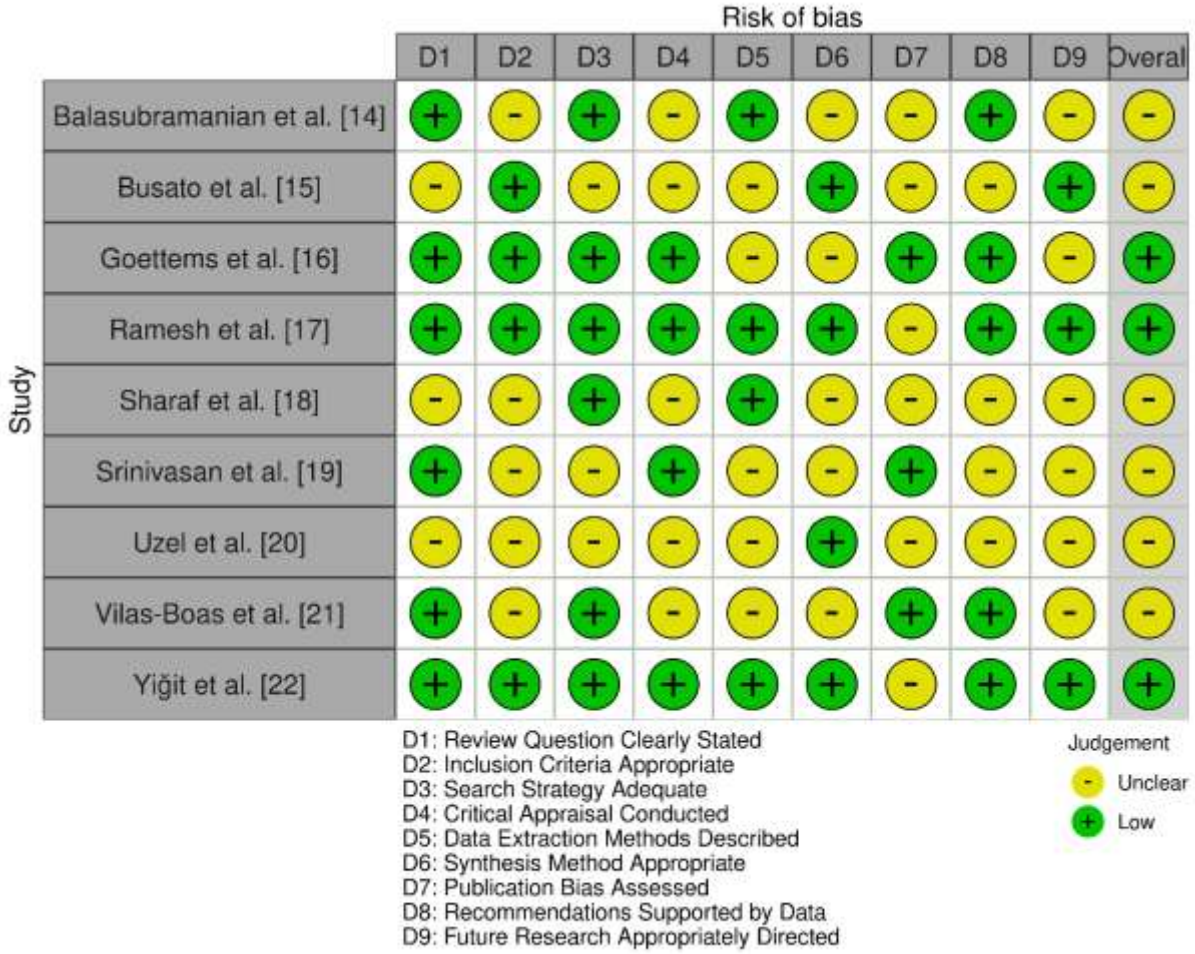

Figure 2: Bias assessment process for the review.

Demographic Variables Assessed (Table 1)

The articles included in this review were publications from the years 2012 [16] to 2025 [18], with most published after 2017 [14,15,17,19-22], and thus showing a recent rise in scholarly interest on maternal anxiety and child dental outcomes. Geographically, the articles were focused in the low- and middle-income countries, with Brazil [15,16,21] and India [14,17,19] contributing the largest number of studies, followed by Turkey [20,22] and Syria [18], thus showing regional bias towards South America and South Asia. Methodologically, the highest number of articles used cross-sectional study designs [14-16,18-21], while just two used randomized controlled trial methodologies [17,22], thus limiting the scope for making causal inferences.

Sample sizes varied widely, ranging from 40 [15] to 608 [16], with some studies reporting participant numbers between 100 and 227 [14,17,19,21], thus showing differences in statistical power and generalizability. The pediatric populations that were studied had a wide variation in development from early childhood to adolescence, with mean or modal ages reported varying between 2 and 15 years [14,16,17,19-22], thus introducing heterogeneity due to differences in age-related behaviors. The gender distribution, where reported,

seemed to be approximating roughly equal between the various studies, with ratios of 102:125 [14], 29:31 [18], 56:44 [19], 187:183 [20], 46:54 [21], and 84:76 [22]; however, some studies did not report sex-based data [15-17], thus limiting the scope for sex-specific analyses.

Table 1: Demographic Variables Assessed

Author	Year	Location	Study design	Sample size	Mean age (years)	Male: Female ratio
Balasubramanian et al. [14]	2018	Mangalore, Karnataka, India	Cross-sectional	227	4.5	102:125
Busato et al. [15]	2017	Passo Fundo, Brazil	Cross-sectional	40	NA	NA
Goettems et al. [16]	2012	Pelotas, Brazil	Cross-sectional	608	2-5	NA
Ramesh et al. [17]	2024	Sullia, Karnataka, India	RCT	100	4-9	NA
Sharaf et al. [18]	2025	Damascus, Syria	Cross-sectional	60	6-12	29:31
Srinivasan et al. [19]	2022	Tamil Nadu, India	Cross-sectional	100	6-8 and 12-15	56:44
Uzel et al. [20]	2022	İzmir, Turkey	Cross-sectional	370	7-8 and 11-12	187:183
Vilas-Boas et al. [21]	2017	Salvador, Brazil	Cross-sectional	100	6-11	46:54
Yiğit et al. [22]	2022	Usak, Turkey	RCT	160	4-8	84:76

Technical Characteristics Assessed (Table 2)

Across the studies reviewed, the major emphasis was on mother anxiety in mother-child dyads [14-19,21-22], but one study only considered children, based on indirect maternal data [20]. The measures employed to determine anxiety were mostly versions of the Corah Dental Anxiety Scale, viz. standard, modified, and brief versions [14-16,18-21]. Only two studies, however, employed other validated scales, viz. the State-Trait Anxiety Inventory (STAI) [17] and the Modified Corah Dental Anxiety Scale [22]. Cutpoints for anxiety differed among studies; some employed scores of ≥13 to characterize high anxiety [14,20-22], while others employed mild to severe categories based on stratified cutoffs [16-19,21]. Such variation in threshold definitions is a demonstration of a lack of standardization in maternal anxiety measurement, which would impact comparative result interpretation.

The spectrum of dental treatments performed on children encompassed routine inspections and clinical assessments [14-16,18,20-21], and more invasive procedures like prophylaxis, local anesthetic and operative restorative treatments [15,17,19,22], a spectrum of procedural intensity in different settings. To measure anxiety and child behavior outcomes, a variety of measures were employed including the Facial Image Scale [14,18], the Childrenś Fear Survey Schedule (CFSS-DS) [17,20], the Venham Picture Test [15,17,21], the Frankl Behavioral Scale [21,22], and physiological measures like heart rate [22]. These measures were used either during treatment sessions [14-16,18,20,22], at multiple timepoints including pre-treatment assessments [21], or over follow-up sessions [17,19], and thus temporal variation in outcome measurement. Parent presence was mentioned as a variable in all but one of the studies [14,15,17,19,22], with one study incorporating manipulation of this condition in an interventional study design [22], while other studies did not mention parent presence during procedures [16,18,20-21]. Behavior management strategies were reported in detail only in two studies—anticipatory parental guidance [17] and Tell-Show-Do technique [19], while other studies did not mention behavior interventions, restricting inferences on mitigation strategies in addition to anxiety assessment [14-16,18,20-22].

Statistical models used to describe the associations between maternal anxiety and child behavior were bivariate methods, such as Chi-square tests and t-tests [14,15,18,21] and Spearman's and Pearson's coefficient-based correlation analyses [17,18,19]. In addition, the analysis was further extended to more advanced multivariate models, such as Poisson regression [16] and generalized linear models [22]. The variance in statistical modeling methods not only reflected a broad-based analysis strategy but also reflected variability in the capacity to adjust confounding variables and interaction effects across the studies.

Table 2: Technical Variables Assessed

Author	Groups assessed	Maternal anxiety tool	Anxiety threshold	Type of procedure	Child anxiety/behavior tool	Time of outcome	Parent present	Behavioral management	Statistical model	Conclusion
Balasubramanian et al. [14]	Mother-child dyads	Corah's DAS	DAS ≥13 (high anxiety)	Dental examination (dmft)	Facial Image Scale	During care	Yes	NA	Chi-square test, Student's t-test	Maternal anxiety associated with higher missing and fewer restored teeth; child anxiety associated with missed appointments and higher missing teeth
Busato et al. [15]	Mother-child dyads	Corah Scale	NA	Local anesthesia	Venham Picture Test	During care	Yes	NA	Chi-square	Maternal anxiety significantly influenced child's anxiety
Goettems et al. [16]	Mother-child dyads	Corah's DAS	Low (≤11), Mod (12-14), High (≥15)	Dental exam	ECOHIS	During treatment	NA	NA	Poisson regression	Low maternal education and irregular visits associated with low child dental care use
Ramesh et al. [17]	Mother-child dyads	STAI	Mild (0-24), Mod (25-49), Severe (50-75)	Dental procedures	CFSS-DS, Venham Pictorial Test	Baseline and 6 months follow-up	Yes	Anticipatory guidance	Chi-squared, Spearman's rank correlation	Pre-appointment counseling significantly reduced maternal and child anxiety
Sharaf et al. [18]	Mother-child dyads	Modified Dental Anxiety Scale	Mild (5-10), Moderate (11-18), Severe (>19)	Dental examination	Facial Image Scale	During treatment	NA	NA	Spearman's rho, Chi-square	Significant relationship between maternal and child dental anxiety
Srinivasan et al. [19]	Mother-child dyads	Corah Dental Anxiety Scale	Low <9, moderate 9-12, high 13-14, severe 15-20	Routine dental treatment	DFSS-SF (Children's Fear Survey Schedule)	First and second dental visit	Yes	Tell-Show-Do (TSD)	Pearson's correlation	Maternal anxiety strongly correlated with child fear; significant reduction after TSD

Uzel et al. [20]	Children	Corah Dental Anxiety Scale	≥13 indicates anxiety	Dental examination	CFSS-DS, Corah DAS	During treatment	NA	NA	ANOVA, Chi-square, t-test	Maternal anxiety significantly affected child anxiety in younger age group (7-8 yrs)
Vilas-Boas et al. [21]	Mother-child dyads	Corah Anxiety Scale	≤4 none, 5-8 low, 9-12 moderate, ≥13 high	Prophylaxis, clinical exam	Venham Picture Test, Frankl Scale	Before and during treatment	NA	NA	Fisher's exact test, chi-square	Significant correlation between maternal and child anxiety; influenced child behavior
Yiğit et al. [22]	Parent-child dyads	Modified Corah Dental Anxiety Scale	≥15 indicates anxiety	Restorative procedures	Wong–Baker Faces Scale, Frankl scale, Pulse oximeter	During treatment	Yes/No	Parent presence management	Logistic regression, generalized linear model	High maternal anxiety negatively impacted child's behavior and increased heart rates during procedures

DISCUSSION

The psychosocial influence of parents, specifically maternal dental anxiety, has become the focus of heightened interest in the pediatric dentistry community because of its strong influence on children's emotional and behavioral responses to dental care. Young children are especially vulnerable to internalizing or learning maternal anxiety through psychological processes such as emotional contagion, behavioral imitation, or physiological co-regulation since they are highly reliant on care-givers for social cues [23]. Empirical work has proven that this psychosocial influence may enhance sympathetic nervous system activity in children, leading to behavioral resistance, heightened pain sensitivity, and non-cooperation during dental treatment [24]. In fact, maternal anxiety not only influences a child's immediate behavioral responses to dental care but also contributes to the formation of their long-term dental attitudes and subsequent oral health-seeking behavior in the future, potentially maintained through negative conditioning and reinforcement patterns [25].

The study by Balasubramanian et al. [14] established an association between high levels of maternal anxiety and adverse dental outcome in children, where increased missing teeth incidence and reduced incidence of filled teeth and elevated child anxiety were noted. This result concurred with the observed behavioral correlations of Busato et al. [15], Sharaf et al. [18], Srinivasan et al. [19], Vilas-Boas et al. [21], and Yiğit et al. [22], each of which reported a statistically significant positive correlation between maternal and child dental anxiety. Whereas Busato et al. [15] constructed maternal anxiety as a potent predictor of child anxiety at anesthetic induction, the research failed to consider the extrapolation of such results to physiological or longitudinal effects on behavior. Yiğit et al. [22], however, introduced evidence that children presented with elevated heart rates and uncooperative behaviors upon maternal anxiety presentation, thus necessitating a more holistic approach to behavioral and physiological paradigms. Goettems et al. [16] affirmed the contribution of maternal anxiety but proceeded to contextual variables, including maternal education and irregular dental visits, as the main determinants of children's restricted utilization of dental services, thus realizing partial thematic coherence but difference in focus.

Ramesh et al. [17] introduced a divergence from observational research in being an intervention by design randomized controlled trial, showing that anticipatory guidance reduced maternal and child anxiety over time. The result is thematically consonant with the causal associations posited in research by Sharaf et al. [18] and Srinivasan et al. [19]; however, the latter research was observational and hence did not offer interventional evidence. Uzel et al. [20] performed a new analysis of maternal anxiety's effect by age of children and reported significance only in younger children aged 7 to 8 years. The finding concurred with previous research, in that it

suggested an age-moderated effect. Vilas-Boas et al. [21] and Sharaf et al. [18] also found the same correlation but did so without temporal stratification or control of behavior modifiers. The studies overall presented in a consistent manner maternal dental anxiety as a strong predictor of adverse behaviors and anxiety in children in dental sessions, though variations were found in the analytical interest (e.g., physiological outcomes, longitudinal effect, or interventional approaches). In contrast, only Goettems et al. [16] performed the association by situating it more in the realm of socioeconomic mediators than so much immediate behavioral outcomes.

Additionally, the situational context under which a procedure is performed acts as a bidirectional mediator of its association with maternal anxiety. Environmental influences, ranging from the spatial arrangement of the clinic to sensory input in the form of visual and auditory stimulation, care provider attitude, and parents' presence during the procedure, can perpetuate or buffer a child's emotional reactivity, depending on the caregiver's expressed emotions [26]. Parent accompaniment, for example, can be reassuring if the care provider evinces a calm emotional expression; however, it can be counterproductive if the care provider shows overt distress or anticipatory anxiety, which can perpetuate heightened perception of threat by the child [27]. The latter is especially the case in younger children, who are lacking in cognitive and emotional competencies to differentiate between perceived and actual threats and hence tend to rely heavily on caregiver evaluation for the regulation of their emotions [28]. In these situations, maternal anxiety can both be an immediate cause and an exacerbating factor of procedural distress in children.

In addition to behavioral transmission, maternal dental anxiety has also been linked to a series of biological indicators of stress in children, including increased salivary cortisol responses, increased heart rates, and hyperventilation episodes, which together constitute an integrated psychophysiological response [29]. Empirical investigations have utilized objective physiological measures of child distress, including heart rate and electrodermal activity, to test the hypothesis that anxious mothers have more anxious children, who show increased autonomic response to dental treatment independent of treatment invasiveness [30]. This underscores the need for a dual assessment protocol, combining both behavioral observation and physiological measurement, to obtain a multifaceted understanding of anxiety transmission in the mother-child dyad [31].

The broader sociocultural environment also plays an important role in determining maternal anxiety and its attendant sequelae. Maternal education, history of dental trauma, socioeconomic status, and cultural view of oral hygiene all contribute to heterogeneity in the manifestation of anxiety and coping strategies [32]. Mothers from populations with limited access to preventive dental visits, for example, or populations subjected to repeated exposure to dental anxiety-provoking stories are likely to exhibit higher anticipatory dental anxiety, which in turn can be transferred to children [33]. Additionally, low health literacy can prevent a mother from having complete understanding of procedural information or regulating emotional reactions and therefore elevate the child's distress [34]. Behavioral management strategies, including anticipatory guidance, modeling, and cognitive-behavioral therapy, have been speculated as effective interventions toward preventing intergenerational transmission of dental anxiety.

Empirical reports indicate that with coping skills, procedural knowledge, and psychoeducational information, mothers can be helped to reduce treatment-related anxiety while also enhancing children's emotional readiness and cooperative behavior [35]. In addition, interventions performed within clinical practice targeting both environmental modifications (e.g., visual distractors and sound) and caregiver support (e.g., guided relaxation or parent instruction) are crucial for the promotion of pediatric outcomes during dental treatment [36].

Towards this end, the interdependence of maternal anxiety and children's dental behavior must be considered bidirectional and multidimensional and subject to psychosocial, physiological, and environmental contributions. To further this understanding, future studies must focus on longitudinal study designs that take into account not only the immediate conduct of treatment but also the long-term consequences of maternal anxiety on children's overall oral health and healthcare utilization. Finally, the development of a standardized protocol for the measurement of anxiety with validated psychometric and physiological indices is required for enabling comparisons among studies and evaluating the efficacy of multiple interventions.

Limitations

The main limitations of this review were defined by the dominance of cross-sectional study designs, which precluded causal inferences, and heterogeneity of maternal anxiety levels and child behavioral assessment, hence limiting comparability between the studies. In addition, few of the studies adjusted for confounding variables like socioeconomic status, parental education, and prior dental experience, which may have influenced maternal and child outcomes. Moreover, the failure to use consistent reporting on behavioral management strategies further constrained the interpretation of findings.

CONCLUSION

Maternal dental anxiety was found to be a clinically important predictor of elevated levels of pediatric dental anxiety and behavioral dysregulation during dental treatment. There were consistent correlations, but methodological heterogeneity between studies highlighted the need for more standardized and longitudinal studies to replicate these results and inform directed interventions.

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