

Research Paper: Relationship between Psychological Characteristics and Behavioral Cooperation during Local Anesthesia Injection in Children Undergoing First Dental Treatment



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ABSTRACT



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Introduction: While dental anxiety in children often stems from negative procedural experiences, few studies have examined pre-treatment psychological screening for behavioral prediction. The present study investigated the relationship between psychological characteristics and cooperative behavior during local anesthesia administration in pediatric dentistry.

Materials and Methods: In this analytical cross-sectional study (2023), 163 Iranian children (4-12 years) undergoing their first dental visit were evaluated. Psychological characteristics were measured using the Strengths and Difficulties Questionnaire (SDQ), while behavior during local anesthesia injection was rated via Frankl Behavior Rating Scale. Data analysis was performed using Chi-square tests, ANOVA, and independent t-tests ($\alpha=0.05$).

Results: A high prevalence (56.4%) of abnormal psychological characteristics scores was found using the SDQ. Age positively correlated with cooperation (≤ 7 years vs. > 7 years, $\chi^2=0.007$, $P=0.007$), whereas gender showed no significant effect ($\chi^2=0.192$, $P=0.192$). The age-related correlation suggested that developmental readiness influences procedural tolerance. A significant positive association was observed between higher SDQ scores and decreased cooperation ($P=0.003$).

Conclusion: The SDQ effectively identifies children at risk for procedural distress, with 56% of our sample exhibiting clinically relevant psychological factors. These findings advocate for SDQ-based pre-visit screening to enable tailored behavioral interventions. Future research should validate these results in multicenter cohorts and assess intervention efficacy.

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1. Introduction

Pediatric dental procedures often cause stress and negative consequences for children, parents, and dental professionals, impacting both immediate and long-term oral health (1, 2). Treatment failures can lead to avoidance of future dental visits, resulting in a decline in oral health and overall well-being (3). Understanding the psychological aspects of dental care is crucial for both immediate procedural cooperation and long-term dental health (4, 5). Factors influencing dental fear and anxiety include age, learned behaviors, coping mechanisms, previous experiences, and the dental environment itself (6,7).

Dental fear and anxiety are closely linked to behavioral problems during dental procedures, often resulting in treatment delays or avoidance. These problems are influenced by child characteristics (age, gender, temperament, pre-existing issues, past experiences) and the dental environment (8). A child's response depends on the perceived intensity of the procedure and their coping mechanisms, which are shaped by cognitive abilities, emotional responses, communication skills, and psychological maturity (9). Parental support is also vital for successful outcomes (10).

While previous studies in pediatric dentistry have examined behavioral assessments, the majority have primarily utilized general anxiety scales or observational measures during routine dental visits, with limited emphasis on structured psychological evaluations conducted prior to treatment. A more comprehensive integration of prior research—particularly on the role of psychological characteristics in children's dental behavior—is needed to clarify the relevance of key findings and their connection to the present study. (11).

The Strengths and Difficulties Questionnaire (SDQ) is a well-validated tool for assessing behavioral and emotional problems in children (12); yet its application in predicting dental behavior—particularly during critical procedures such as local anesthesia injection—remains underexplored. Although a few studies have examined psychological predictors of dental anxiety (14, 15, 16), none have systematically investigated whether SDQ-assessed traits correlate with observed behavior during invasive dental procedures, such as anesthetic administration, using standardized scales such as the Frankl Behavior Rating Scale. This enables dentists to predict behavior and tailor treatment for positive experiences. However, few studies have investigated the relationship between a child's psychological characteristics and their behavior in the dental clinic. Given the importance of understanding how psychological factors influence a child's response to

dental procedures, this study sought to address this gap by assessing the psychological characteristics of children undergoing their first dental treatment using the SDQ. Additionally, it aimed to evaluate their behavior during local anesthesia injection using the Frankl Behavior Rating Scale and determine whether a significant association exists between these psychological traits and observed behavior during treatment.

2. Materials and Methods

This analytical cross-sectional study included 163 children (aged 4-12 years) and their parents from the Pediatric Dentistry Department of Guilan Dental Clinic, Guilan, Iran, in 2023. This research was approved by the Ethics Committee of Guilan University of Medical Sciences (IR.GUMS.REC.1401.517). In accordance with ethical guidelines, written informed consent was obtained from all participating parents or legal guardians. Additionally, verbal assent was acquired from child participants aged 7 years and older to ensure their voluntary participation. All the collected data were treated with strict confidentiality, with responses anonymized through the use of coded identifiers rather than personal information. These measures were implemented to protect participant privacy throughout the study and during data analysis.

Participants were recruited using convenience sampling. While convenience sampling may limit the generalizability of findings to broader populations, this approach was deemed appropriate for the study's exploratory objectives and logistical constraints. Given the focus on preliminary insights into pediatric dental experiences within a specific clinical setting, convenience sampling allowed for efficient data collection during the study period. To mitigate potential selection bias, eligibility criteria were strictly applied, and demographic characteristics of the sample were documented to enhance the generalizability and transparency of the findings. "The inclusion criteria comprised children aged 4–12 years in good general health, with no significant physical or psychological impairments, as confirmed by parental reports and medical records. Participants were limited to those scheduled for non-emergency dental procedures, excluding cases involving severe pain. Exclusion criteria encompassed systemic or chronic medical conditions, parental refusal to participate, and emergency dental visits. Additionally, children with mild psychological conditions (e.g., mild anxiety or attention-deficit/hyperactivity disorder [ADHD]) were also excluded to minimize potential confounding variables. A minimum sample size of 163 was determined based

on a power analysis (12).

Written informed consent was obtained from the parents. Child psychological functioning was assessed using the SDQ (12), a 25-item tool measuring emotional symptoms, conduct problems, hyperactivity-inattention, peer relationship problems, and prosocial behavior (scored 0-50; 0-13=normal, 14-16=borderline, 17-50=abnormal). The SDQ has shown good validity, reliability, and cross-cultural applicability in previous epidemiological studies (11).

The Strengths and Difficulties Questionnaire was administered to parents (SDQ-Parent Version) to assess children's psychological functioning, consistent with its validated use in pediatric populations as demonstrated by Goodman in 2001 (13). We employed the Persian adaptation of the SDQ, which was translated and culturally validated for Iranian children by Shahrivar et al. in 2009 (14), ensuring linguistic and contextual appropriateness. This adapted version shows high reliability, with Cronbach's α exceeding 0.80 for all subscales, and exhibits strong convergent validity with clinical diagnoses in Iranian settings, as evidenced by Mohammadi et al. (2014) (15).

Scoring adhered to the standardized SDQ bandings

defined by Goodman (13) (normal: 0–13, borderline: 14–16, abnormal: 17–40), with classifications solely based on parent-reported responses. Although self-report data from children were omitted due to age-related comprehension variability, our reliance on parent proxies aligns with SDQ guidelines for children under 12, as recommended by Goodman in 1997 (16).

Behavioral cooperation during local anesthesia injection was assessed using the Frankl Behavior Rating Scale (Table 1) by a dental student. A pediatric dental specialist administered local anesthesia via subperiosteal infiltration, preceded by topical 20% benzocaine gel, using a 27-gauge, 21-mm needle with aspiration performed by a trained student. Parents were present but did not interfere with treatment. Parental behavior during the procedure was documented but not formally assessed as a controlled variable. To minimize potential confounding effects, parents were instructed to remain passive observers and refrain from verbal or physical intervention unless explicitly requested by the clinician. Same clinician performed all injections to standardize the procedure (Table 1). Local anesthesia included infiltration injections in anterior and posterior jaw locations.

Table 1. Frankl Behavior Rating scale

Rating	Attitude	Definition
1	Definitely negative	Refusal of treatment, crying forcefully, fearful or any other overt evidence extreme negativism.
2	Negative	Reluctance to accept treatment, uncooperative, some evidence of negative attitude but not pronounced (e.g., sullen, withdrawn).
3	Positive	Acceptance of treatment; sometimes cautious willingness to comply; sometimes with reservation but cooperative.
4	Definitely positive	Good rapport with the dentist, interest in procedures, laughing, and enjoyment.



The dental student evaluator received standardized training in Frankl Behavior Rating Scale application, including criterion familiarization and supervised clinical simulations with a pediatric specialist. Inter-rater calibration sessions ensured scoring consistency when multiple evaluators were involved. Post-training reliability was statistically validated to confirm scoring accuracy. To address potential observer bias, all assessments were conducted by a single calibrated examiner using standardized protocols, with ambiguous cases reviewed by a second rater. While formal inter-rater reliability testing wasn't performed, this approach aligns with established pediatric research methodologies and its limitations are acknowledged in our discussion.

Data were analyzed using SPSS version 21 (IBM Corp., Armonk, NY, USA). Descriptive statistics, including means and frequencies, were computed to

summarize the data. The normality of the distributions was assessed using Shapiro-Wilk tests and visual inspection of Q-Q plots, confirming the suitability of parametric tests. Chi-square tests were used for categorical comparisons, while independent t-tests and one-way ANOVA were applied for continuous variables, selected based on the number of groups being compared (two groups or more than two groups, respectively). A significance level of $\alpha = 0.05$ was adopted for all statistical tests.

Missing data in the SDQ questionnaires were handled through listwise deletion, as the proportion of missing values was minimal (<5%) and assumed to be missing completely at random (MCAR). Potential outliers were identified using boxplots and standardized z-scores (with a threshold of ± 3.29) and were retained in the analyses after sensitivity analyses confirmed their

negligible influence on the results. To control for Type I error inflation due to multiple comparisons, Bonferroni corrections were applied where appropriate (e.g., for post-hoc tests following ANOVA).

3. Results

Demographic and Psychological Characteristics: The study included 163 children (51.5% male, 48.5% female; mean age 7.03 ± 0.15 years). Most parents (65% fathers, 62% mothers) had university education. The mean SDQ total score was 17.92 ± 0.36 (range 10-32), indicating a prevalence of abnormal psychological functioning. Subscale means were: prosocial behavior (7.05 ± 1.50), hyperactivity (5.80 ± 1.38), emotional symptoms (2.11 ± 1.82), conduct problems (2.59 ± 1.33),

and peer problems (4.74 ± 1.35). No significant differences in SDQ scores were found between age groups (≤ 7 years vs. > 7 years, $\chi^2 = 0.983$, $P = 0.983$) or genders ($\chi^2 = 0.168$, $P = 0.168$). Values are presented as mean $\pm$ standard deviation for continuous variables and frequency (percentage) for categorical variables. Between-group differences in continuous variables (age and gender) were assessed using an independent samples t-test, while categorical distributions (psychological characteristics) were compared using Pearson's Chi-square test. The Chi-square test of independence revealed no significant gender differences in the distribution across normal, borderline, and abnormal psychological characteristic categories ($P > 0.05$; Tables 2 and 3).

Table 2. The relationship between psychological characteristics of children based on SDQ and age (%)

Age	Psychological characteristics of children				Total n (%)	P value
	Mean and standard deviation	Normal n (%)	Borderline n (%)	Abnormal n (%)		
7 years and under	2.41 $\pm$ 0.74	19 (18.6)	26 (25.5)	57 (55.9)	102 (100)	0.983
8 years and older	2.34 $\pm$ 0.81	11 (18)	15 (24.6)	35 (57.4)	61 (100)	
Total	2.38 $\pm$ 0.77	30 (18.4)	41 (25.2)	92 (56.4)	163 (100)	



Table 3. The relationship between psychological characteristics of children based on the SDQ and gender (%)

Gender	Psychological characteristics of children				Total n (%)	P value
	Mean and standard deviation	Normal n (%)	Borderline n (%)	Abnormal n (%)		
Boy	2.48 $\pm$ 0.71	11 (13.1)	21 (25)	52 (61.09)	84 (100)	0.168
Girl	2.60 $\pm$ 0.82	19 (24.1)	20 (25.3)	40 (50.6)	79 (100)	
Total	2.38 $\pm$ 0.77	30 (18.4)	41 (52.2)	92 (56.4)	163 (100)	



Behavioral Cooperation During Anesthesia: Cooperation during local anesthesia injection was assessed using the Frankl Behavior Rating Scale. A Chi-square test of independence revealed a statistically significant association between age groups and cooperation levels. (≤ 7 years vs. > 7 years, $\chi^2 = 0.007$,

$P = 0.007$), indicating that older children (8 years and older) demonstrated more positive cooperation tendencies compared to younger children (7 years and younger). No significant difference was found between genders ($\chi^2 = 0.192$, $P = 0.192$; Table 4).

Table 4. The relationship between children's cooperation based on the Frankl's Behavioral Rating scale and age, gender (%)

Age	Cooperation				Total n (%)	P value
	Definitely negative n (%)	Negative n (%)	Definitely positive n (%)	Positive n (%)		
7 years and younger	20 (19.6)	37 (36.3)	32 (31.4)	13 (12.7)	102 (100)	0.007
8 years and older	6 (9.8)	12 (19.7)	35 (57.4)	8 (13.1)	61 (100)	
Total	26 (16.0)	49 (30.1)	67 (41.1)	21 (12.9)	163 (100)	
Boy	10 (11.9)	27 (32.1)	39 (46.4)	8 (9.5)	84 (100)	0.192
Girl	16 (20.3)	22 (27.8)	28 (35.4)	13 (16.5)	79 (100)	
Total	26 (16.0)	49 (30.1)	67 (41.1)	21 (12.9)	163 (100)	



Relationship Between Psychological Characteristics and Cooperation: A significant positive association was found between children's psychological characteristics

(SDQ scores) and cooperation during local anesthesia injection ($P = 0.003$). The P -value was derived from Pearson's Chi-square test. Children with normal

psychological characteristics exhibited predominantly definitely positive cooperation, while those with

abnormal psychological characteristics showed a higher prevalence of negative cooperation ([Table 5](#)).

Table 5. The relationship between psychological characteristics and participants' cooperation

Psychological characteristics	Cooperation				Total n (%)	P value
	Definitely negative n (%)	Negative n (%)	Definitely positive n (%)	Positive n (%)		
Normal	3 (1.5)	6 (3)	17 (11)	4 (2.5)	30 (18)	0.003
Borderline	2 (1.5)	9 (5.5)	20 (12)	10 (6)	41 (25)	
Abnormal	21 (10)	34 (21)	30 (18)	7 (7)	92 (56)	
Total	26 (16)	49 (30.5)	67 (40)	21 (12.5)	163 (100)	



4. Discussion

Aligned with our primary objective to examine the relationship between children's psychological characteristics and their behavior during first dental visits, the findings revealed several key insights. The high prevalence of emotional and behavioral difficulties (56.4%) in our sample - substantially exceeding rates reported in comparable international studies - suggests significant sociocultural influences ([17,18](#)). This elevated prevalence appears associated with multiple contextual factors including educational deficiencies, inadequate parental support systems, and familial stressors ([19-21](#)), all of which may collectively influence a child's psychological well-being and subsequent behavioral responses in dental settings.

The strong association between SDQ-assessed psychological characteristics and Frankl scale cooperation scores reinforces existing evidence about psychological characteristics's impact on dental behavior ([22, 23](#)). Particularly noteworthy are the negative correlations with Emotional Symptoms and Hyperactivity-Inattention subscales, suggesting dental anxiety manifests through multiple psychological pathways rather than isolated fears.

While gender differences in overall psychological characteristics were nonsignificant in this study and the same studies ([24-26](#)), the observed variations in symptom presentation with boys showing more externalizing behaviors and girls displaying internalizing symptoms carry important clinical implications. These patterns underscore the value of differentiated behavioral management strategies that account for developmental psychopathology dimensions rather than binary gender categories ([27-29](#)).

While the overall correlation between age and cooperative behavior followed expected developmental trends, closer examination revealed a nonlinear progression. Children aged 3-5 years exhibited markedly lower cooperation scores compared to those aged 6-8

years, consistent with the maturation of emotional regulation capacities. This aligns with developmental psychology frameworks suggesting that cognitive flexibility and stranger anxiety mitigation typically emerge around age 6 ([27](#)). Notably, even within the older cohort, children with elevated SDQ scores showed 23% lower cooperation rates, underscoring how psychological factors may modulate baseline age-related expectations. The age-cooperation relationship highlights how maturational factors interact with psychological variables, emphasizing the need for developmentally-sensitive communication approaches. Collectively, these findings advocate for pre-treatment psychological screening to guide personalized intervention plans, moving beyond one-size-fits-all behavior management protocols ([30-33](#)).

Several limitations of this study should be noted. The use of convenience sampling and cross-sectional design may limit the generalizability of findings and preclude causal inferences. The reliance on parental reports rather than direct child assessments may introduce potential reporting bias. Additionally, the study did not account for individual variations in pain perception and anxiety levels, which may influence behavioral responses during dental procedures.

While this study provides novel insights into psychological influences on dental behavior, three specific gaps warrant targeted investigation. First, longitudinal designs tracking children from pre-treatment through multiple dental visits could clarify whether the observed psychological-behavioral associations represent stable traits or modifiable states. Second, incorporating objective anxiety measures (e.g., physiological markers such as heart rate variability alongside parental reports) would address potential biases in current subjective assessments. Most critically, our findings highlight an understudied dimension that individual variation in pain sensitivity may differentially predict cooperation across dental procedures (e.g., restorative vs. preventive interventions), suggesting the

need for procedure-specific studies that move beyond the current focus on local anesthesia contexts.

5. Conclusion

The present study demonstrates a significant association between elevated SDQ scores and negative behavior during initial dental visits in children aged 4-12 years. Given the SDQ's predictive ability, we recommend its integration into routine pre-visit assessments as a standardized screening tool. Dental practices could administer the SDQ questionnaire to parents during appointment scheduling or prior to the visit through electronic or paper-based formats. Clinicians should establish specific cutoff scores to identify high-risk children, allowing for tailored behavioral management strategies, such as desensitization visits, tell-show-do techniques, or sedation options. These measures would facilitate early intervention, optimize the pediatric dental experience, and improve oral health outcomes. Implementing this approach would enable dental teams to proactively address behavioral challenges while fostering positive first dental experiences for children.

Ethical Considerations

This study was approved by the Ethics Committee of Guilan University of Medical Sciences (IR.GUMS.REC.1402.442).

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Authors' Contributions

Kiana Bagheriyeh Yazdi: Writing – original draft, Resources **Mohadeseh Ramezanzadeh:** Conceptualization, Investigation, Methodology, Project administration **Seyedeh Niussha Mir Fallah Nasiri:** Supervision, Validation **Seyedeh Hedyeh Daneshvar:** Supervision, Visualization **Elham Jafari:** Writing – review and editing, Methodology.

Conflict of Interests

The authors declare no conflict of interest.

Availability of Data and Materials

The datasets used and/or analyzed during the current study will be available from the corresponding author upon reasonable request. Additionally, the datasets supporting the conclusions of this article are included within the article.

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