




Parenting Styles and Sedation Efficacy in Pediatric Dental Care; A Study in Uncooperative Children Aged 4 to 6 Years: Structural Equation Modeling Approach

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Abstract

Background: Behavioral problems in children contribute significantly to non-compliance and lack of cooperation with dentists. This study aimed to assess the impact of parenting styles on the success of conscious sedation with midazolam in uncooperative children aged 4 to 6 years.

Methods: This short-term longitudinal study included ninety-six children aged 4-6 years who were classified as uncooperative according to the Frankl Behavior Rating Scale (Frankl I, II), requiring pulp treatment and Stainless-Steel Crown (SSC) restoration. Midazolam was orally administered at 0.25 mg/kg. Parents completed the Parental Stress Dental Questionnaire (PSDQ), Strengths and Difficulties Questionnaire (SDQ), and Children's Fear Survey Schedule-Dental Subscale (CFSS-DS). Treatment began at least thirty minutes post-drug administration. Vital signs were monitored using a pulse oximeter. Sedation effectiveness was assessed with the Houpt scale at local anesthesia injection (T0), cavity preparation (T1), restoration (T2), and treatment conclusion (T3). Statistical analysis used Kruskal-Wallis and Mann-Whitney U tests ($P < 0.05$).

Results: Most parents (69, 71.9%) had an authoritative parenting style, while 10 (10.4%) were authoritarian, and 17 (17.7%) were permissive. Authoritative parenting is associated significantly with sedation success ($P = 0.001$) and reduced dental fear ($P = 0.008$). Conversely, authoritarian ($P = 0.031$) and permissive ($P = 0.001$) parenting styles are associated with sedation failure. Authoritarian parenting is associated positively with increased dental fear ($P = 0.001$). No significant association was found between permissive parenting style and dental fear ($P > 0.05$). No significant association existed between behavioral problems and parenting styles ($P > 0.05$). There was no significant association observed between permissive parenting style and dental fear ($P = 0.279$). Similarly, no significant associations were found between behavioral problems and specific parenting styles: authoritative ($P = 0.625$), authoritarian ($P = 0.050$), and permissive ($P = 0.522$).

Conclusion: Understanding parenting styles aids in predicting conscious sedation success with midazolam and assisting in managing uncooperative children during dental procedures.

Keywords: Parenting, Conscious Sedation, Midazolam, Pediatric Dentistry

Conflicts of Interest: None declared

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Introduction

Behavior management problems (BMP) in children pose significant challenges for dental practitioners due to patient

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↑What is “already known” in this topic:

Behavioral issues in children complicate dental procedures due to non-compliance. Parenting styles influence children's behavior towards dental care. Midazolam is used for sedation during treatments, but its effectiveness varies based on factors including parenting styles and dental fear.

→What this article adds:

It explores how parenting styles affect midazolam's success in managing uncooperative children during dental procedures. Authoritative parenting predicts sedation success and reduced dental fear. This highlights the importance of considering parenting styles in predicting sedation outcomes and managing uncooperative behavior in pediatric dentistry.

non-compliance (1). The prevalence of BMP among children aged 4 to 14 has been reported as 5.1% (2, 3). Different methods are used to control BMP in pediatric dentistry, including pharmacological methods such as sedation and general anesthesia, which are employed in cases where basic behavioral management methods such as effective communication prove ineffective (4).

Mild to moderate sedation methods are employed in clinics to address non-cooperative behavior in some children, aiming to alleviate stress and enable effective communication for behavior management (5, 6). Midazolam sedation has emerged as a safe and efficient approach for managing uncooperative pediatric patients (7), with factors such as psychological issues, emotions, fear, and parenting style potentially influencing its success (8, 9).

While numerous studies have explored the impact of parenting styles on children's behavior during dental treatments (10, 11), research specifically investigating their influence on sedation outcomes remains limited within pediatric dentistry (12). Various scales are used to assess parenting styles. One tool utilized for this purpose is the Parenting Style and Dimensions Questionnaire (PSDQ), created by Robinson et al. (13, 14). This questionnaire is grounded in Baumrind's typology, evaluating authoritative, authoritarian, and permissive styles through self-reporting. The original version of PSDQ comprised 62 items, which has been reduced to 32 items in its updated version (15).

To the best of our knowledge, only one published study has examined the relationship between parenting styles and sedation success, reporting a positive correlation between authoritative parenting style and increased cooperation of children undergoing nitrous oxide sedation (12).

Given the scarcity of research on the impact of parenting styles on sedation outcomes, the current study aims to investigate the influence of parenting styles on the success of midazolam sedation in uncooperative children aged 4 to 6.

Methods

Study design and participant

This short-term longitudinal research was conducted on 96 un-cooperative children (Frankl I, II), aged 4 to 6, classified as ASA I health status, among attendees of Tehran Azad University of Medical Sciences Faculty of Dentistry who were previously candidates for sedation and required pulp therapy and stainless-steel crowns. Children with the presence of mental health issues, familial history of allergy to benzodiazepines and presence of post-traumatic stress disorder (PTSD) were excluded from this study.

Questionnaires

Parenting styles and dimensions questionnaire (PSDQ)

The Iranian version of The Parenting Styles and Dimensions Questionnaire (PSDQ-32) was employed in this study (14). The PSDQ is a condensed form consisting of 32 items, each assessed on a five-point Likert scale ranging from 1 (never) to 5 (always). Mothers completed the questionnaire following the provided instructions, and the predominant parenting style was identified. This questionnaire classifies parenting into three categories: authoritarian, authoritative, and permissive (14, 16).

Children's Fear Survey Schedule-Dental Subscale (CFSS-DS)

The Iranian version of The Children's Fear Survey Schedule-Dental Subscale (CFSS-DS) was utilized in this study (17). Originally developed by Cuthbert and Melamed, the questionnaire consists of 15 items (18). Each item is rated on a scale from one to five, ranging from "not afraid at all" to "very much afraid." The total score ranges from 15 to 75, with a score of 38 or higher indicating clinical dental fear. This scale is effective in differentiating between individuals with high and low levels of dental fear, and its reliability and validity have been extensively established (19).

Strengths and Difficulties Questionnaire (SDQ)

The Iranian version of the Strengths and Difficulties Questionnaire (SDQ) was employed in this study (20). The SDQ functions as a screening tool for identifying psychological and behavioral issues and classifying behavior into child strengths and difficulties (21). Respondents evaluate each of the 25 items as 'not true,' 'somewhat true,' or 'certainly true.' Higher total or subscale scores (excluding prosocial behavior) suggest a heightened risk of problems, although lower scores do not necessarily exclude issues (22). The questionnaire categorizes behavior into four main categories: emotional symptoms, conduct problems, hyperactivity, and peer problems, while also assessing prosocial behavior. Each item is scored from 0 to 2 based on the respondent's selection, with the total score ranging from 0 to 40. Higher scores indicate an increased likelihood of behavioral or emotional difficulties, with subscale scores ranging from 0 to 10. The prosocial subscale also ranges from 0 to 10, with higher scores indicating stronger positive behaviors. It's essential to interpret the scores cautiously and in conjunction with clinical judgment, as the SDQ provides insights into potential areas of concern but does not offer a diagnostic assessment (23).

Procedure

The treatment was carried out at one of the Dental Clinics affiliated with Tehran Azad University. After obtaining written consent from the guardians, questionnaires were distributed, and parents were provided with instructions on how to fill them out. They were completed before the commencement of treatment. All treatments were conducted by a post-graduate student of pediatric dentistry (MG).

Midazolam medication, at a dose of 0.25 mg/kg (with a maximum child weight of 25 kg), was orally administered along with an equal volume of orange juice by a pediatric dentist under the supervision of an anesthesiologist. Treatment began at least half an hour after medication administration or upon observing sedation signs (including dizziness and drowsiness). Vital signs, such as heart rate and oxygen saturation level, were continuously monitored and observed by an anesthesiologist using a pulse oximeter at baseline and during treatment. If there was non-cooperation, medication rejection, or immediate nausea, the treatment was canceled and rescheduled for another session. The patient waited for half an hour for the medication to take effect before treatment commenced and upon observing sedation signs.

During the treatment, parents were present as silent observers. Topical anesthesia was applied for 2 minutes using cotton rolls. A topical anesthesia gel containing 20% benzocaine under the trade name Dentonics, manufactured by Masterdent, and a local anesthesia injection containing 2% lidocaine under the trade name Persocaine with epinephrine 1/80000, manufactured by Daroupakhsh, Iran, were used. An injection dose of up to 4 mg/kg was considered. The injections were administered using the infiltrative technique in the upper and lower jaws. The treatment was performed by a post-graduate student of pediatric dentistry (MG), and the sedation assessment was conducted by a pediatric dentistry specialist (KS) during local anesthesia injection (T0), cavity preparation (T1), restoration (T2), and at the end of treatment (T3) based on the Houpt scale.

Sample size

Based on Moharrami's results, using the G.E.E prediction option, the sample size was determined using Minitab software, considering $\alpha = 0.05$, $\beta = 0.20$, and $R = 1$. The minimum required sample size was determined to be 85 samples. We opted to recruit 96 participants, a number slightly exceeding our original target, to accommodate potential attrition during data collection resulting from participant withdrawal or unforeseen circumstances.

Data analysis

The data distribution was evaluated using the Shapiro-Wilk test, histograms, and box plots, as well as measures of skewness and kurtosis. Since the data distribution was non-normal, nonparametric equivalents of the T-test and ANOVA tests, namely the Mann-Whitney U test and the Kruskal-Wallis test, were used.

The study employed descriptive statistics to summarize continuous data using mean and standard deviation, while discrete data were summarized using frequency and percentage. The main outcome variable of interest was sedation success. There were eight predictors in the study, namely age, sex, parents' education, parenting style, dental fear, children's behavioral problems, and time points of the

study, including T0 (Injection time), T1 (Cavity preparation), T2 (Tooth restoration), and T3 (Treatment end), as well as vital signs including pulse rate and SpO₂. Due to high collinearity between the mother's and father's parenting styles, only the mother's parenting style was included in the models.

Considering the existing causal pathways between variables to achieve the ultimate goal (Houpt score at discharge), Structural Equation Modeling (SEM) was conducted using Stata 17 software to analyze these pathways. The conceptual pathways were as the following hypotheses (Figure 1). Only significant pathways were subjected to final modeling (Figure 2). For each pathway, beta and standardized beta coefficients were reported. Due to the small sample size, bootstrapping was not used.

H1: authoritative → houpt 0 min → houpt discharge

H2: authoritative → CFSS score → houpt 0 min → houpt discharge

H3: authoritative → SDQ result → houpt 0 min → houpt discharge

Total effect: authoritative → houpt discharge

Results

In this study, 96 children aged 4 to 6 years with a mean age of 4.58 ± 0.448 were examined. The participants included 53 boys (55.2%) and 43 girls (44.8%).

71.9% of children had authoritative parents, 10.4% had authoritarian parents, and 17.7% had permissive parents. 26% of children had dental fear, and 32.3% of children had severe behavioral problems. The highest frequency of behavioral problems (40%) was observed in the authoritarian parenting style, while the lowest frequency of behavioral problems (29.4%) was observed in the permissive parenting style. The Physiologic responses are shown in Table 1.

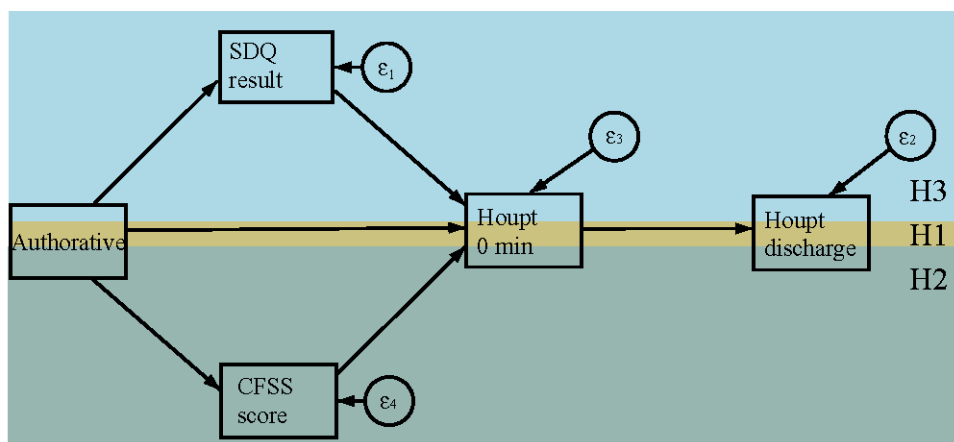


Figure 1. Conceptual graph of the SEM hypotheses H1, H2 and H3 in different background colors (Khaki, gray and light blue, respectively)

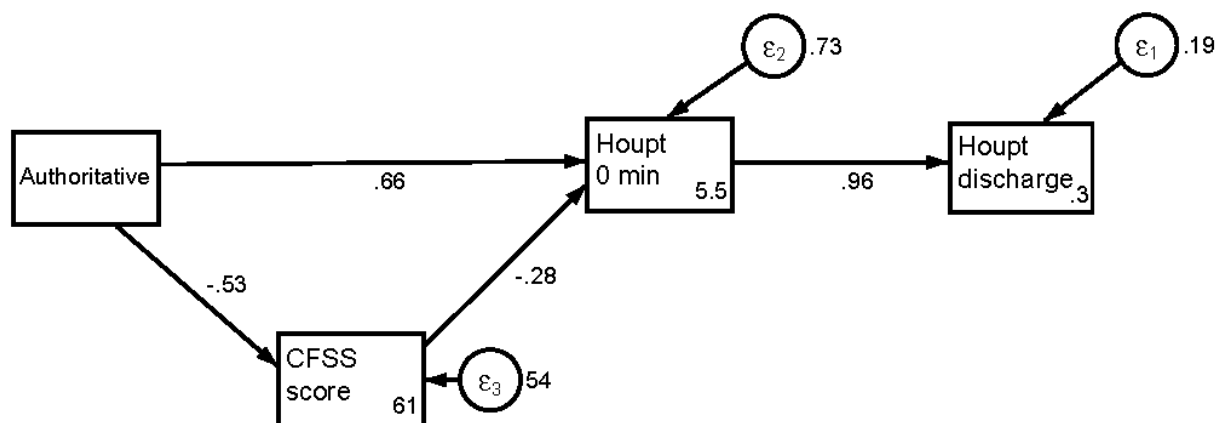


Figure 2. SEM Diagram. Numbers on the pathways indicate the standardized beta coefficients of the paths. Numbers at the top and bottom of the variables indicate the distance from the origin. Numbers next to circles indicate the error variance.

Houpt behavior rating scale

The authoritative parenting style was significantly associated with acceptable behavior ($P = 0.001$), while both the authoritarian ($P = 0.031$) and permissive parenting styles ($P = 0.001$) were associated with unacceptable behavior (Table 2).

CFSS-DS

The authoritative parenting style was significantly associated with the absence of dental fear ($P = 0.008$), while the authoritarian parenting style was significantly associated with dental fear ($P = 0.001$). No association was found between the permissive parenting style and dental fear (Table 3).

SDQ

No association was found between parenting styles and the total SDQ or its domains ($P > 0.05$) (Table 4).

Based on available logic, the initial hypothesis suggested that parenting styles may influence the Houpt score at baseline through three pathways: 1) a direct pathway, 2) via the mediation of fear score, and 3) via the mediation of child behavioral score. Subsequently, the SEM model was designed to reveal that only the first two pathways were statistically significant, resulting in the exclusion of pathway 3 from the model.

Furthermore, multiple regressions demonstrated that there were no significant confounders in these pathways, meaning either their effect on both independent and dependent variables (according to the fork pattern) was not

Table 1. Physiological characteristics

	Variable	Mean±sd	Min	Max
SpO ₂	Baseline	96.65±1.87	88	100
	0 min	96.54±2.72	76	100
	15 min	95.92±9.13	9	100
	30 min	97±1.61	90	100
	Discharge	97.82±1.28	92	99
HR	Baseline	102.80±20.43	5	140
	0 min	104.89±20.26	56	155
	15 min	105.76±17.77	61	157
	30 min	106.22±15.76	71	153
	Discharge	103.37±15.40	72	143

SpO₂: Saturation of peripheral oxygen/ HR: heart rate

Table 2. Comparison of mean scores of Houpt between parenting styles

	Unacceptable Behavior	Acceptable Behavior	P-value
Authoritative Parenting	6.33	31.16	0.001
Authoritarian Parenting	16.83	12.36	0.031
Permissive Parenting	23.70	16.58	0.001

Acceptable overall behavior: Score 4, 5, 6
Unacceptable overall behavior: Score 1,2,3

Table 3. Comparison of mean scores of CFSS-DS between parenting styles

Parenting style	Dental fear		P-value
	No	Yes	
Authoritative Parenting	27.27	20.09	0.008
Authoritarian Parenting	11.30	18.03	0.001
Permissive Parenting	19.24	16.51	0.129

Table 4. Comparison of mean score of SDQ between parenting styles

	Total Difficulties		P-value
	Low	High	
Authoritative Parenting	24.52	25.87	0.629
Authoritarian Parenting	12.26	16.03	0.050
Permissive Parenting	18.73	17.58	0.521

Table 5. Structural Equation Modeling (SEM) for predicting the Houpt score at discharge using pathways leading to the Houpt score at baseline

Outcome / predictor	Beta Coefficient	Standardized beta coefficient	P-value	95% CI of beta coefficient
Houpt 0 min (injection)				
CFSS score	-0.052	-0.279	<0.001	-0.075, -0.028
Authoritative	2.360	0.664	<0.001	1.913, 2.807
Constant	5.485		<0.001	4.028, 6.942
R-square	0.715			
Houpt discharge				
Houpt 0 min	0.938	0.961	<0.001	0.884, 0.992
Constant	0.305		0.019	0.051, 0.559
R-square	0.923			
CFSS score				
Authoritative	-10.129	-0.528	<0.001	-13.387, -6.871
Constant	60.926		<0.001	58.164, 63.688
R-square	0.279			
Variance				
Var (e.Houpt 0 min)	0.729			0.549, 0.967
Var (e.Houpt discharge)	0.187			0.141, 0.248
Var (e.CFSS score)	53.615			40.404, 71.145

Chi-square test for goodness-of-fit: $P = 0.953$

Overall R-square: 0.659

Var: variance; e.: error

Table 6. Path analysis (direct, indirect, and total) based on SEM results

Pathway Outcome / predictor	Beta Coefficient	Standardized beta coefficient	P-value	95% CI of beta coefficient
Direct				
Houpt 0 min				
CFSS score	-0.052	-0.279	<0.001	-0.075, -0.028
Authoritative	2.360	0.664	<0.001	1.912, 2.807
Houpt discharge				
Houpt 0 min	0.938	0.961	<0.001	0.883, 0.992
CFSS score	No path			
Authoritative	No path			
CFSS score				
Authoritative	-10.129	-0.528	<0.001	-13.386, -6.871
Indirect				
Houpt 0 min				
CFSS score	No path			
Authoritative	0.524	0.147	<0.001	0.233, 0.814
Houpt discharge				
Houpt 0 min	No path			
CFSS score	-0.049	-0.268	<0.001	-0.07, -0.026
Authoritative	2.705	0.780	<0.001	2.285, 3.124
CFSS score				
Authoritative	No path			
Total				
Houpt 0 min				
CFSS score	-0.052	-0.279	<0.001	-0.075, -0.028
Authoritative	2.884	0.811	<0.001	2.468, 3.299
Houpt discharge				
Houpt 0 min	0.938	0.961	<0.001	0.883, 0.992
CFSS score	-0.049	-0.268	<0.001	-0.07, -0.026
Authoritative	2.705	0.780	<0.001	2.285, 3.124
CFSS score				
Authoritative	-10.129	-0.528	<0.001	-13.386, -6.871

statistically significant ($P > 0.1$), or they exhibited multicollinearity with each other ($VIF > 2$). Therefore, it was preferred not to include another variable in the model. The final pathway also indicated the effect of the Houpt score at baseline on the Houpt score at discharge, which was designed assuming an autoregressive pattern. Additionally,

this model was once designed to predict heart rate, but the hypothesized pathways were not significant.

In the constructed final model, all pathways were statistically significant ($P < 0.05$). This model demonstrated a very good fit, as the deviations of predicted values from the model's actual values were not significant ($P = 0.953$), and

the model was able to explain 65.9% of the variance in outcomes. The regression coefficients of each pathway are depicted (Table 5, Figure 1).

After running the model, in addition to the coefficients of direct pathways, the coefficients of indirect pathways and the total effects were also calculated as follows, and a summary of the results is presented (Table 6).

The largest total pathway includes the parenting style pathway to the Houpt score at discharge, indicating that the authoritative parenting style leads to a 2.705-point increase in the Houpt score at discharge over all possible pathways.

Discussion

Based on the findings of our study, a significant relationship was observed between authoritative parenting style and sedative success with midazolam based on the Houpt behavioral rating scale. At the same time, the other two parenting styles (authoritarian and permissive) were significantly associated with a lack of sedative success.

According to several studies in the field of psychology and child behavior, the authoritative parenting style is considered the most logical approach (24-27). Children of these parents are more adaptable, enforce rules better, and exhibit a greater ability to cope with critical and stressful situations (28).

Therefore, these children are better candidates for sedation and are more likely to cooperate sufficiently during sedation-based dental treatments. We used a SEM model to predict the variables influencing the success of midazolam sedation. According to this model, an authoritative parenting style was associated with a 34% increase in the probability of sedation success (Houpt mean score: 5.5 out of 6). Similar to our findings, Moharrami and colleagues reported that an authoritative parenting style is associated with successful sedation using nitrous oxide, which is fully compatible with our results in sedation with midazolam (12).

In our study, the sex of children and the level of education and occupation of parents were not found to be correlated with cooperative behaviors in children. Additionally, no association was observed between physiological responses, such as pulse rate and SpO₂, and behaviors, aligning with findings from previous research (12, 29, 30). This lack of correlation may be attributed to the independent nature of midazolam sedation, where vital signs do not reliably predict the behavior of children during brief dental procedures.

The relative frequency of dental fear in the examined children was 26%. There was higher dental fear in children with authoritarian parenting styles. Since the authoritarian parenting style has a direct correlation with the level of anxiety, stress, and depression in children and adolescents, it is logical to observe a significant relationship between dental anxiety and the authoritarian parenting style. Conversely, the authoritative parenting style, which is the most logical and balanced parenting style, had a significant relationship with the absence of dental fear in children. No significant relationship was observed between permissive parenting style and dental fear in children.

We assessed behavioral problems and strengths of children were assessed using the SDQ index. The SDQ index

covers four domains of emotional problems, conduct problems, hyperactivity/inattention, and peer problems, and includes a prosocial behavior subscale. In the domain of emotional problems, 18.75% of children were borderline and 13.3% clearly had problems. In the domain of conduct problems, 63.65% of children were borderline and 0.82% clearly had disorders. In the hyperactivity/inattention domain, 75.68% of children were borderline and 8% clearly demonstrated hyperactivity. Peer problems were observed in 75% of children borderline and in 29.7% clearly. Children's strengths were evaluated in the prosocial behavior domain, with 38.54% borderline and 42.60% clearly demonstrating strengths. Ultimately, according to the findings of the present study, 32.29% of children had behavioral problems based on the SDQ index.

The highest frequency of behavioral problems was observed in the authoritarian parenting style, with 40% of children with authoritarian parents experiencing behavioral disorders. This percentage was 9.31% in children with authoritative parents and 3.32% in children with permissive parents. A close to significant relationship ($P = 0.05$) was observed between authoritarian parenting style and the overall SDQ index. A completely significant relationship was observed between authoritarian parenting style and hyperactivity problems in children.

Given the unhealthy nature of authoritarian parenting style and its negative impact on children's mental health, the association between this parenting style and the observation of different levels of behavioral problems in children is predictable.

Heart rate and oxygen saturation were assessed at 15-minute intervals. Throughout the course of treatment, these physiological parameters remained within the normal range that was in line with other studies investigating oral midazolam sedation (12).

The power of the current study in examining the relationship between parenting and sedation success based on the Houpt scale, calculated by G*Power 3.1.9.7 software, was 88%. Given the high power of the study in investigating the correlation between parenting and sedation success, the results of the current study demonstrate with high confidence the superiority of authoritative parenting style in sedation success outcomes with midazolam medication. It also appears that parenting style, besides its direct effect on sedation success, also influences the level of children's dental fear, thereby emphasizing its importance in the success of sedation dentistry treatments. Due to the low prevalence of behavioral problems in society, a higher sample size is needed to further investigate the relationship between behavioral problems and sedation success in a more accurate and generalizable manner. However, concerning parenting styles, which was the main focus of this study, it seems that children of authoritative parents are more suitable candidates for sedation with midazolam.

Limitations

The study faced several hurdles. The sample size was small, with only a limited number of samples available. Despite being selected based on the Frankl scale, most individuals did not show personality problems. Moreover, the

majority of parents had a low socioeconomic status, which had a notable impact on their ability to complete the questionnaires.

Conclusion

Parenting style and dental fear in children can be used as the criteria for predicting the success of sedation with midazolam.

Authors' Contributions

MG and KS contributed to designing and implementing the research, ES provided insights for psychological assessment, and MG and KS conducted the analysis of results and manuscript writing.

Ethical Considerations

This study received approval from the Ethics Board of Tehran Azad University, Dental Branch (IR.IAU.DENTAL.REC.1402.033). Written informed consent and parental assent were obtained from all parents of the children participating in the study.

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The authors have no acknowledgments to declare for this research.

Conflict of Interests

The authors declare that they have no competing interests.

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