

Original Article

Analysis and Consideration of Factors for Predicting Cooperation Levels in Pediatric Dentistry

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Abstract

This study aimed to evaluate various factors related to cooperation levels in pediatric dentistry and determine their correlation with children's cooperation during dental treatments. This study included one hundred children and their guardians who visited the dental hospital at the Chonnam National University. Children and their guardians completed surveys regarding dental fear, dental caries experience, dental treatment experience, temperament, and guardians' dental anxiety, as well as the background characteristics of the children. Based on these data, factors associated with children's cooperation during dental treatment were investigated. Dental fear, caries experience during the primary and mixed dentition stages, and temperament traits such as shyness and negative emotionality significantly impacted children's cooperation during dental visits, with higher levels of these factors corresponding to lower cooperation. The extent of dental experience also modestly influenced children's cooperation, with higher levels of cooperation observed in children with greater dental experience. Additionally, children's dental fear was strongly correlated with guardians' dental anxiety, increasing as guardians' anxiety levels increased. Twelve-year-old children exhibited significantly lower levels of dental fear compared to other age groups, and regardless of cooperation levels, injections (shots) were identified as the primary factor inducing dental fear among the children. To improve children's cooperation in pediatric dentistry, strategies should focus on alleviating their fears and adopting an individualized approach that consider their oral health status and temperamental traits. [J Korean Acad Pediatr Dent 2024;51(3):229-244]

Keywords

Children's behavior, Cooperation, Dental fear, Temperament, Dental caries experience

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Introduction

The level of cooperation exhibited by children during dental visits is crucial for timely dental care and ongoing oral health maintenance. A lack of cooperation can lead to difficulties in receiving smooth examinations or treatments and foster negative memories of dental experiences, potentially causing an aversion to future dental visits[1]. Negative childhood dental experiences can cause fear in adulthood[2,3]. Consequently, eliciting good cooperation from children affects their oral health and development, and influences their perception of dental care in the long term, thereby significantly affecting their quality of life[4,5]. Therefore, understanding children's behaviors to enable a more positive reception of dental experiences is critical for pediatric dentists.

Efforts to understand the behavior and cooperation of children in dental settings have a long history. The literature suggests that factors influencing children's behavior during dental visits include age, maternal anxiety, socioeconomic status, medical history, and children's perceptions of dental issues. Generally, younger children tend to exhibit more negative behaviors, and maternal anxiety is closely linked to uncooperative behavior in children. Moreover, children from families with lower incomes and educational levels often face difficulties in receiving regular dental care, leading to noncooperative behavior when dental issues necessitate a visit. Previous unpleasant experiences also contributed to children's uncooperativeness in subsequent dental appointments, as did their awareness of their dental problems[6]. Furthermore, children's personalities and temperaments can influence their behaviors. Therefore, evaluating broader aspects, including personality and temperament, may allow for a more precise prediction of cooperation and foster a more positive atmosphere in clinical situations.

This study aimed to evaluate various factors, including age, sex, medical history, temperament, dental fear, and guardian anxiety, and explore the correlation between these factors and children's levels of cooperation during dental visits.

Materials and Methods

This study was approved by the Institutional Review Board (IRB) of Chonnam National University (approval no. CNUDH-2024-002).

1. Study Participants

This study included 100 children and their guardians who visited the Pediatric Dentistry Department of Chonnam National University Hospital between October 2023 and February 2024. The participants were children and their guardians who could communicate and visited the clinic for examinations or treatment. Children and guardians who were too young or had systemic diseases, making it difficult to respond to the questions, were excluded. Of the 100 participating children, 53 were female and 47 were male, aged 4 - 12 years.

2. Evaluation Measures and Survey Instruments

We collected the children's demographic information and medical histories; measured the number of decayed, missing, and filled teeth; and assessed dental cooperation during treatment. Surveys were conducted to evaluate dental fear, children's inherent temperament or personality, and guardians' anxiety about dentistry.

1) Demographic Information and Medical and Dental History

Data on the children's age, sex, sibling relationships, and previous dental or medical experiences were collected (Table 1).

2) Decayed-Missing-Filled-Teeth Index for Permanent and Primary Teeth (DMFT, dmft)

To assess children's experiences with caries, the number of decayed, missing, and filled teeth was recorded using clinical examinations and radiographic images (panoramic and periapical radiographs). A single researcher conducted all the assessments to maintain consistency. World Health Organization criteria were used to

diagnose dental caries.

3) Frankl's Behavior Rating Scale

Children's cooperation in dental clinics was assessed using the Franklin Behavior Rating Scale (FBRs)[7]. The Frankl scale rates children's behavior on four levels: 1 (very negative), 2 (negative), 3 (positive), and 4 (very positive). Evidence of refusal of treatment, strong crying, fear, or highly negative behavior scored 1, and acceptance of treatment but with a negative attitude and without clear cooperation scored 2. Acceptance of dental procedures with occasional cautious behavior and following instructions cooperatively scored 3, and excellent interaction with the dentist and evident enjoyment and interest in the treatment scored 4. Scores of 1 or 2 indicated a noncooperative group, whereas scores of 3 or 4 indicated a cooperative group.

4) Children's Fear Survey Schedule-Dental Subscale

The Children's Fear Survey Schedule-Dental Subscale (CFSS-DS), developed in 1982 by Cuthbert and Melamed[8], assesses children's fear of dental settings using 15 items rated from 1 (not afraid at all) to 5 (very afraid) (Table 2). The total score ranges from 15 to 75, with scores above 38 indicating high dental fear and scores below 38 indicating low dental fear. Although pediatric dentists typically administer the survey, guardians may assist children with communication difficulties in completing it. The usefulness of the guardians completing the CFSS-DS on behalf of their children was validated[9,10].

5) Emotionality Activity and Sociability Temperament Survey

The Emotionality Activity and Sociability Temperament Survey (EAS) is a parent-rated questionnaire that assesses children's intrinsic personality and temperament traits, including emotionality, activity, sociability, and shyness[11]. Each trait was evaluated using two questions with scores ranging from 1 (not at all characteristic) to 5 (very characteristic). Higher scores indicated a stronger presence of this characteristic (Table 3).

Table 1. Basic information survey on pediatric patients

Question	Options
Sibling relationship	
Does your child have siblings?	Yes / No
If yes, how many siblings does your child have?	Siblings: ____
What is your child's birth order?	1 st /2 nd /3 rd /4 th
Past dental history	
Has your child ever received dental treatment or examination at a dental clinic before?	Yes / No
If yes, how many times?	____ times
Past medical history	
Has your child ever been hospitalized or undergone surgery?	Yes / No

Table 2. Children's fear survey in dentistry (CFSS-DS)

Please write a score for fear regarding the following items. 1: Not scary at all. 2: Hardly scary. 3: Average. 4: A little scary. 5: Very scary.	
1. Dentists	()
2. Doctors	()
3. Injections (shots)	()
4. Having somebody examine your mouth	()
5. Having to open your mouth	()
6. Having a stranger touch you	()
7. Having somebody look at you	()
8. The dentist drilling	()
9. The sight of the dentist drilling	()
10. The noise of the dentist drilling	()
11. Having somebody put instruments in your mouth	()
12. Choking	()
13. Having to go to the hospital	()
14. People in white uniforms	()
15. Having the dentist clean your teeth	()

Table 3. EAS temperament survey

Please write a score in the parentheses next to the following sentences. 1: Not at all. 2: Not really. 3: Neutral. (Not sure.) 4: Slightly similar. 5: Very similar.		
Negative Emotionality	Gets upset easily	()
	Tends to be somewhat emotional	()
Activity	Is very energetic	()
	Is always on the go	()
Sociability	Makes friends easily	()
	Likes to be with people	()
Shyness	Tends to be shy	()
	Takes a long time to warm up to strangers	()

6) Corah's Dental Anxiety Scale

Developed by Corah in the late 1960s, the Dental Anxiety Scale (DAS) is used to assess dental anxiety[12] (Table 4). It comprises four items related to anxiety experienced in dental settings, rated from 1 to 5. A total score > 9 indicates high dental anxiety, whereas a score < 9 indicates low dental anxiety.

3. Statistical Methods

Data collected from surveys completed by children and their parents as well as evaluations by pediatric dentists were compiled using Excel. Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 29.0 (SPSS Inc., Chicago, IL, USA), with the significance level set at $p < 0.05$. Chi-square tests, Student's t-tests, and Fisher's exact tests were used to analyze the factors influencing children's cooperation during dental visits. For variables showing associations, binomial logistic regression analysis was performed to further analyze the relationships.

Results

1. Demographic Information and Medical and Dental History

Among the 100 children who participated in the study, 53 were female, and 47 were male. The age distribution ranged from 4 to 12 years, with specific counts of 14 aged

4 years, 9 aged 5 years, 9, 6 years, 16 aged 7 years, 13 aged 8 years, 11 aged 9 years, 8 aged 10 years, 8 aged 11 years, and 12 aged 12 years. There were 61 children (34 girls and 27 boys) in the cooperative group and 39 (19 girls and 20 boys) in the non-cooperative group. Regarding siblings, 15 were only children, whereas 85 had siblings: 13 only children, 39 first-borns, 34 second-borns, 12 third-borns, and 2 fourth-borns. Dental visits were numbered once for 8%, twice for 2 %, and three or more times for 90% of the children. Thirty-nine children had previous hospital admissions or surgeries, while 61 did not. Various guardians, including mothers, fathers, grandfathers, and grandmothers, accompanied their children (Table 5).

2. Factors Considered and Their Association with Cooperation

The chi-square test was used to analyze the association between children's cooperation and factors such as sex, birth order, total number of children, dental history, and medical history (Table 6). The association between the number of dental visits and the type of past dental treatment was determined using Fisher's exact test (Table 7). The association of cooperation in the dental setting with children's age, number of decayed, missing, and filled teeth (DMFT, dmft), fear of dental procedures (CFSS), children's temperament (EAS), and guardians' dental anxiety (DAS) was analyzed using Student's t-test (Table 6). The results indicated that factors showing differences between cooperative and non-cooperative children in-

Table 4. Dental anxiety scale (DAS)

Please write a score for dental anxiety regarding the following items. 1: Look forward, 2: No preference, 3: A little uneasy, 4: Afraid of unpleasantness, 5: Very frightened	
1. If you had to go to the dentist tomorrow, how would you feel about it?	()
Please write a score for dental anxiety regarding the following items. 1: Relaxed, 2: A little uneasy, 3: Tense, 4: Anxious, 5: Very anxious	
2. When you are waiting in the dentist's office for your turn in the chair, how do you feel?	()
3. When you are in the dentist's chair waiting while he gets his drill ready to begin working on your teeth, how do you feel?	()
4. You are in the dentist's chair to have your teeth cleaned. While you are waiting and the dentist is getting out the instruments which he will use to scrape your teeth around the gums, how do you feel?	()

Table 5. Demographic information of participants

Category	Total	
Gender	Male	47
	Female	53
Age group (years)	4 - 5	24
	6 - 7	25
	8 - 9	24
	10 - 11	15
	12	12
Level of cooperation	Cooperative	61
	Uncooperative	39
Sibling relationship	No siblings	13
	Has siblings	87
Birth order	Only child	13
	First-born	39
	Second-born	34
	Third-born	12
	Fourth-born	2
PDH	Yes	92
	No	8
PMH	Yes	39
	No	61
Number of visits	1 time	8
	2 times	2
	More than 3 times	90
Experience with dental treatment	No	3
	Only oral exam	12
	Received treatment	85
Types of dental treatments	Preventive treatment	29
	Restorative treatment	38
	Surgical treatment	7
	Orthodontic treatment	11

PDH: dental history (previous dental visits); PMH: medical history (previous hospital admissions or surgeries).

cluded the combined counts of decayed, missing, and filled teeth of primary and permanent teeth (dmft + DMFT), children's temperaments of "negative emotional-ity" and "shyness," and their dental fear (CFSS) (Table 8).

3. Association between the Caries Experience and Cooperation

Significant differences were found between coopera-

tive and non-cooperative children in the combined counts of decayed, missing, and filled primary and permanent teeth (dmft + DMFT) (Table 6, $t = -2.962$, $p < 0.01$). Logistic regression also indicated a significant association in decayed tooth counts, with cooperative children averaging 5.90 and non-cooperative children averaging 8.13 in decayed tooth counts, showing higher odds of non-cooperation with increasing 'dmft + DMFT' values (Table 9, odds ratio of 1.147, $p < 0.05$).

4. Association between Children's Inherent Temperament and Cooperation

A statistically significant relationship was found between the children's temperament evaluations (EAS) and cooperation. The shyness index showed a significant difference, with cooperative children averaging 5.51 and non-cooperative children averaging 6.74, indicating higher shyness scores among the latter (Table 8, $p < 0.01$). Multivariate logistic regression indicated that higher shyness scores significantly increased the odds of noncooperation (Table 9 and Table 10; OR > 1.288).

5. Association between Children's Dental Fear and Cooperation

Statistically significant differences were observed in the analyses of dental fear (CFSS) and cooperation. Cooperative children had an average CFSS score of 34.51 compared with 45.26 for non-cooperative children, indicating higher dental fear in the latter (Table 8, $p < 0.001$). Cross-analysis with the FBRS also showed significant results (Table 11). The proportion of children with low fear levels was higher in the cooperative group (68.90%) than in the non-cooperative group. Conversely, the proportion of children with high fear levels was higher in the uncooperative group (53.80%). This indicates that children with low fear levels tend to be more cooperative, whereas those with high fear levels tend to be more uncooperative.

Table 6. Results of the Chi-square test between various factors and the children's level of cooperation

Category		Uncooperative		Cooperative		<i>p</i> value
		n	%	n	%	
Gender	Male	20	51.3	27	44.3	0.493
	Female	19	48.7	34	55.7	
Total number of children	1	5	12.8	10	16.4	0.865
	2	23	59	35	57.4	
	3	10	25.6	13	21.3	
	4	1	2.6	3	4.9	
Birth order	Only child	4	10.3	9	14.8	0.854
	First-born	16	41	23	37.7	
	Second-born	12	30.8	22	36	
	Third-born	6	15.4	6	9.8	
	Fourth-born	1	2.6	1	1.6	
PDH	Yes	4	10.3	4	6.6	0.506
	No	35	89.7	57	93.4	
PMH	Yes	23	59	38	62.3	0.74
	No	16	41	23	37.7	

p value from the chi-square test.

PDH: dental history; PMH: medical history (previous hospital admissions or surgery).

Table 7. Results of the Fisher's exact test between various factors and the children's level of cooperation

Category		Uncooperative		Cooperative		<i>p</i> value
		n	%	n	%	
Number of visits	1 time	5	12.8	3	4.9	0.368
	2 times	1	2.6	1	1.6	
	More than 3 times	33	84.6	57	93.4	
Experience with dental treatment	No	6	15.4	6	9.8	0.059
	Only oral exam	30	76.9	55	90.2	
	Received treatment	3	7.7	0	0	

p value from Fisher's exact test.

Table 8. Results of the Student's t-test between various considerations and children's cooperation

Category	Uncooperative Mean ± SD	Cooperative Mean ± SD	<i>p</i> value	<i>t</i> value
Age	8.28 ± 2.52	7.18 ± 3.43	0.068	1.844
DMFT	2.16 ± 2.60	2.64 ± 4.08	0.518	-0.651
dmft	3.74 ± 3.48	5.49 ± 4.74	0.036*	-2.124
dmft + DMFT	5.90 ± 3.25	8.13 ± 4.24	0.004**	-2.962
CFSS	34.51 ± 13.51	45.26 ± 13.49	<0.0001***	-3.883
Negative emotionality	5.21 ± 2.32	6.26 ± 2.21	0.028*	-2.231
Activity	7.95 ± 2.09	7.51 ± 1.89	0.291	1.062
Sociability	7.92 ± 2.00	7.54 ± 1.86	0.345	0.95
Shyness	5.51 ± 2.24	6.74 ± 1.92	0.005**	-2.842
DAS	10.51 ± 3.16	10.82 ± 3.12	0.629	-0.484

p value, *t* value from Student's t-test; **p* < 0.05; ***p* < 0.01; ****p* < 0.001.

SD: standard deviation; DMFT: decayed, missing, and filled permanent teeth; dmft, decayed, missing, and filled deciduous teeth; CFSS: scale of children's fear of dental procedures; DAS: scale of dental anxiety of guardians.

Table 9. Logistic regression analysis results between children’s temperament, total number of teeth affected by dental caries (the combined total of primary and permanent teeth), dental fear, and cooperation

Category	OR	95% CI	<i>p</i> value
Negative emotionality	1.199	0.968, 1.487	0.097
Activity	0.879	0.668, 1.156	0.355
Sociability	1.045	0.792, 1.378	0.756
Shyness	1.288	1.022, 1.624	0.032*
dmft + DMFT	1.147	1.003, 1.312	0.045*
CFSS	2.448	0.953, 6.29	0.063

p value from multivariable logistic regression analysis; **p* < 0.05. OR: odds ratio; CI: confidence interval; dmft + DMFT: combined count of decayed, missing, and filled primary and permanent teeth; CFSS: scale of children’s fear of dental procedures.

6. Association between Experience with Dental Treatment, Types of Dental Treatments, and Cooperation

To understand the correlation between dental experience and cooperation level, a chi-square analysis was conducted. The results showed that the proportion of children who fell into the category of having treatment experience was higher in the cooperative group than in the uncooperative group, whereas the uncooperative group had a higher proportion of children with oral examination experience or no experience at all (Table 12, *p*

Table 11. Results of the Chi-square test between children’s dental fear and cooperation

Level of CFSS	Level of cooperation		Total
	Uncooperative	Cooperative	
Low CFSS	18	42	60
	46.20%	68.90%	60.00%
High CFSS	21	19	40
	53.80%	31.10%	40.00%
Total	39	61	100
	100.00%	100.00%	100.00%

p values from chi-square tests; $\chi^2 = 5.107$; *p* = 0.024. CFSS: Scale of Children’s Fear of Dental Procedures.

Table 10. Logistic regression analysis results between children’s temperament, number of deciduous teeth affected by dental caries, dental fear, and cooperation

Category	OR	95% CI	<i>p</i> value
Negative emotionality	1.199	0.971, 1.481	0.092
Activity	0.890	0.682, 1.162	0.392
Sociability	1.019	0.777, 1.337	0.89
Shyness	1.312	1.042, 1.651	0.021*
dmft	1.056	0.941, 1.185	0.354
CFSS	2.369	0.921, 6.097	0.074

p value from multivariable logistic regression analysis; **p* < 0.05. OR: odds ratio; CI: confidence interval; dmft: decayed, missing, and filled deciduous teeth; CFSS: scale of children’s fear of dental procedures.

> 0.05). However, the *p* value was 0.055, which was slightly higher than the commonly accepted significance level of 0.05. This suggests a potential correlation between cooperation levels and dental experience, although this correlation was statistically marginal.

Binary logistic regression analysis was conducted to analyze the relationship between the type of treatment performed at the time of evaluating the children’s cooperation levels and their cooperation. The results showed that children undergoing orthodontic treatment had a significantly higher likelihood of cooperation (Table

Table 12. Results of the Chi-square test between experience with dental treatment and cooperation

Experience with dental treatment	Level of cooperation		Total
	Uncooperative	Cooperative	
Only oral exam	6	6	12
	50.00%	50.00%	100.00%
Received treatment	30	55	85
	35.59%	64.71%	100.00%
No	3	0	3
	100.0%	0.00%	100.00%
Total	39	61	100
	39.00%	61.00%	100.00%

p values from chi-square tests; $\chi^2 = 5.793$; *p* = 0.055.

13; $p < 0.05$). In contrast, those who underwent surgical treatment had significantly lower cooperation levels than those who underwent orthodontic treatment (Table 13; $p < 0.05$). Restorative treatment showed a tendency towards lower cooperation compared with orthodontic treatment, but the difference was marginally significant. Preventive treatment also indicated a potential for lower cooperation levels than orthodontic treatment, but the difference was not statistically significant.

7. Independence among Variables

Further analysis revealed a significant correlation between the DAS and CFSS (Table 14, $p < 0.05$), suggesting that higher guardian dental anxiety was correlated with increased dental fear in children. No significant associations were found between the other independent variables.

Table 13. Logistic regression analysis results between types of dental treatments and cooperation

Types of dental treatments	OR	95% CI	p value
Orthodontic treatment	10.000	0.247, 4.358	0.028*
Preventive treatment	0.263	-3.549, 0.874	0.236
Restorative treatment	0.124	-4.244, 0.062	0.057
Surgical treatment	0.075	-5.133, -0.047	0.046*

p value from binary logistic regression analysis; * $p < 0.05$.
OR: odds ratio; CI: confidence interval.

Table 14. Results of the Independent t-test between children's dental fear and parents' dental anxiety

		CFSS	DAS
CFSS	ICC	1	0.224
	p value		0.025*
	N	100	100
DAS	ICC	0.224	1
	p value	0.025*	
	N	100	100

p value from the independent t-test; * $p < 0.05$.
ICC: interclass correlation coefficient; CFSS: scale of children's fear of dental procedures; DAS: scale of dental anxiety of guardians.

Meanwhile, the results of the binary logistic regression analysis on the age and fear levels of the children participating in the study showed that children aged 12 years had a 0.133 times lower probability of having high fear levels than the other age groups, and this was statistically significant (Table 15, $p < 0.032$).

8. Children's Dental Fear Factors

Analysis of the 15 items in the Children's Dental Fear Survey revealed that the highest fear scores were associated with anesthetic injections. This was followed by feelings of suffocation, having instruments placed in the mouth when the dentist used noisy tools, and discomfort from strangers touching them. The items associated with the least fear were seeing people with white coats and when nurses or dentists brushed their teeth. Children showed greater fear of dentists than doctors (Fig. 1). In examining the differences in the group results for the three most highly scored items that induce dental fear, it was found that in the cooperative group, the highest fears were "Injections (shots)," "Choking," and "Having a stranger touch you." In contrast, in the non-cooperative group, the highest fears were "Injections (shots)," "The dentist drilling," and "Having somebody put instruments in your mouth."

Table 15. Logistic regression analysis results between ages and children's dental fear

Age	OR	95% CI	p value
4 years old	1.500	0.534, 4.214	0.442
5 years old	0.190	0.029, 1.249	0.084
6 years old	0.190	0.029, 1.249	0.084
7 years old	0.519	0.124, 2.165	0.368
8 years old	0.571	0.127, 2.566	0.465
9 years old	0.556	0.115, 2.679	0.464
10 years old	1.667	0.240, 11.575	0.605
11 years old	0.222	0.033, 1.493	0.122
12 years old	0.133	0.021, 0.836	0.032*

p value from binary logistic regression analysis; * $p < 0.05$.
OR: odds ratio; CI: Confidence interval.

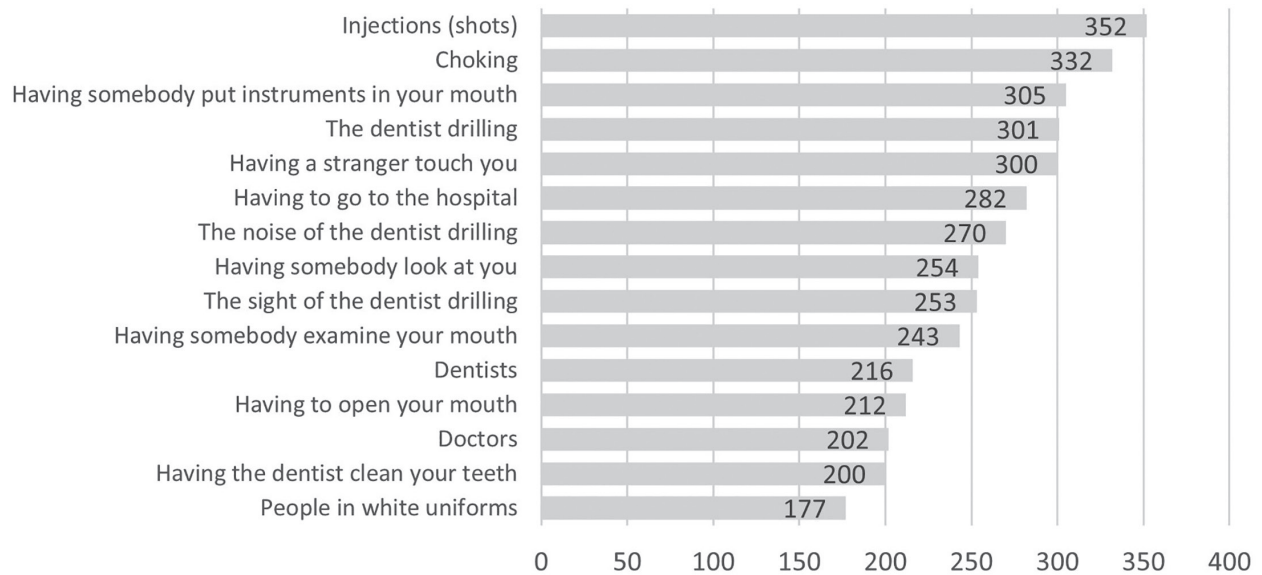


Fig. 1. Ranked factors on children's dental fear according to the result of CFSS-DS test. The numbers on the graph represent the total scores of the scale ratings for each item.

Discussion

Dentists treating children must fully understand the characteristics of young patients to foster cooperation during dental visits. This requires an assessment and understanding of children's inherent temperaments and personality traits. In this study, we considered children's personality traits, emotional characteristics, such as dental fear, and various other factors, including the extent of caries experience, sibling relationships, age, sex, frequency of visits, medical history, and guardians' dental anxiety.

The factors associated with children's cooperation during dental treatment in this study were dental fear (CFSS), the combined number of decayed, missing, and filled primary and permanent teeth (dmft +DMFT), and temperament traits of negative emotionality and shyness. The relationship between cooperation during treatment and dental fear revealed that children with less dental fear tended to cooperate more during dental visits. This finding aligns with the results of Alshoraim et al.[13] who reported that children with lower cooperation during dental examinations experienced greater fear than those

with higher cooperation. El-Housseiny et al.[14] reported similar findings with a statistically significant correlation between the degree of dental fear and cooperation, with higher dental fear correlating with lower cooperation.

Meanwhile, as shown in Table 11, 19 children (31.1%) in the group with high CFSS scores showed cooperative behavior. This suggests that some children, despite having a high level of fear of dentists, can exhibit cooperative behavior during treatment for various reasons. These reasons include parental encouragement, a trusting relationship with dentists, and positive dental experiences. A study on dental fear in children and adolescents reported that even children with high dental fear could cooperate under certain conditions. They stated that nonthreatening and friendly communication techniques, as well as empathetic dental professionals, could significantly reduce anxiety and induce cooperation. Additionally, the use of gradual exposure approaches and positive reinforcement has been shown to be effective in managing dental fear and improving cooperative behavior[15]. Another study addressed the impact of dental professionals' behavior on children's dental fear and behavior. According to previous studies, even children with high

dental fear can show cooperative attitudes in specific situations. This study emphasized that when dental professionals act understandingly and kindly, children's dental fear is significantly reduced. Furthermore, the use of positive reinforcement, the "tell-show-do" method, and the creation of a child-friendly environment were found to make children feel more comfortable and less fearful. These strategies suggest that managing dental fear can be effectively aided using these methods[16].

Furthermore, an analysis of the relationship between the number of decayed teeth and children's cooperation showed that the non-cooperative group had a higher number of decayed teeth. However, the number of decayed permanent teeth did not significantly affect the cooperation. This suggests that children who have received extensive dental treatment for caries exhibit less cooperative behavior during dental visits. This outcome can be interpreted as children who experience pain during dental treatments such as restoration or pulpectomy of the primary teeth showing lower cooperation. However, according to the results of the present study, there was no significant association between the number of decayed teeth and co-operation. Considering the outcomes of previous studies, these results can be interpreted as follows. First, as children grow, they develop both the physical and cognitive abilities to understand and practice oral hygiene on their own, having learned about the importance and habits of oral hygiene from home and school[17]. Second, the physical characteristics of primary teeth make them more susceptible than permanent teeth to external environments and substances. Therefore, the primary teeth are more prone to decay. Primary teeth have thinner enamel and are less mineralized than permanent teeth, making them less resistant to acid and bacterial attacks, thereby increasing the risk of caries[18,19]. Additionally, children's growth can contribute to increased cooperation in dental settings. As children grow, transition to permanent teeth, and mature psychologically and emotionally, the association between permanent tooth decay and cooperation may weaken. Another study reported that as children age and their emotional regulation improves, dental anxiety and

behavioral problems decrease[20]. Another study found that younger children (ages 4 - 6) tend to have higher anxiety and lower cooperativeness, whereas elementary school-aged children (ages 7 - 10) exhibit lower anxiety and higher cooperativeness[21]. Another study reported that dental anxiety and negative behaviors decrease with age, noting that higher anxiety is typically associated with younger children and linked to uncooperative behavior[22]. Meanwhile, a previous study on the relationship between dental anxiety and permanent tooth decay experience in adolescents found no association between dental anxiety and permanent tooth decay experience. This study focused on the relationship between the number of decayed teeth and cooperativeness in children, whereas the aforementioned studies dealt with dental anxiety as a variable. Therefore, a direct relationship between cooperativeness and the number of decayed teeth in children was not clearly observed. However, the results suggest that dental fear is significantly related to cooperation and should be considered together for a comprehensive understanding.

In a study by Prathima et al.[23], it was also reported that there was no correlation between dental fear and the DMFT (Decayed, Missing, and Filled Teeth) index or Gingival Index (GI) of permanent teeth among schoolchildren aged 6 to 12 years, and that dental fear scores tended to decrease with age. Taani et al.[24] conducted a study on adolescents aged 12 - 15 years and reported no correlation between general dental fear and dental caries or gingivitis in permanent teeth. Similarly, Wong et al.[25] reported that dental fear was not significantly related to the experience of dental caries among adolescents aged 12 - 18 years.

These factors can serve as directions for interpreting the results of this study. Recognizing the importance of the significant changes that occur at each stage of a child's growth, future retrospective studies based on follow-up examinations may yield important insights.

According to Kroniņa et al.[26], a child's dental experience is a factor that explains the variance in dental fear among children, with DMFT interpreted as an indicator of dental experience. Klingberg et al.[27] and Olak et

al.[28] also suggested that children with high dental fear exhibit a higher rate of caries. Armfield et al.[29] noted that the fear of dentistry leads children to avoid dental visits, consequently neglecting oral healthcare. Schuller et al.[30] stated that increased dental fear is correlated with reluctance to visit a dentist, potentially leading to higher rates of caries and tooth loss. These findings suggest that children with high dental fear exhibit less cooperation during dental treatment and that this lack of cooperation is associated with a higher rate of caries.

This study also explored the relationship between children's cooperation and their inherent temperament traits, negative emotionality, and shyness, finding that higher scores on these traits increased the likelihood of non-cooperation during dental procedures. This aligns with the findings of Gustafsson et al.[31] who suggested that children with high shyness scores tend to have behavioral regulation issues. Arnrup et al.[32] also reported that a child's fear and temperament, especially negative emotionality, play a crucial role in differentiating levels of cooperation. Juárez-López et al.[33] found that activity was associated with reduced cooperation among children, although this finding was not significant in the present study.

Our findings indicated that age, sex, sibling relationships, birth order, and past hospital experience were not significantly correlated with children's cooperation during dental procedures. This is consistent with the findings of Juárez-López et al.[33], who found no significant differences in behavior during dental treatment based on sex. However, this contrasts with the findings of Fazli et al.[34] who suggested that sex could be a helpful predictor of cooperation in a dental setting, with girls reportedly having higher levels of dental fear than boys. Considering these conflicting results, further research involving children from a broader range of sociocultural backgrounds is required.

Additionally, our study found no significant association between age and cooperation, which contradicts the findings of Juárez-López et al.[33] that children under the age of five tend to exhibit more negative behaviors. This discrepancy highlights the need for more extensive

research to identify specific age groups that exhibit particularly good or poor cooperation. However, the analysis of the correlation between the independent variables revealed that age was associated with the level of fear. Specifically, the likelihood of showing a high level of fear decreased as the age approached 12 years. This result is similar to those of previous studies, which indicated that dental fear decreases over time in children aged 9 - 12 years[35].

Regarding the influence of a child's upbringing or past hospital experiences, our findings suggest that these factors do not significantly impact a child's cooperation in dental settings, similar to results from Kroniņa et al.[36]. They noted that a child's medical experiences and socioeconomic factors do not explain the extent of dental fear. The study also observed that variability in birth order and number of siblings among participants might have affected the outcomes.

The analysis of the relationship between the type of past dental experience and cooperativeness in children (Table 12) indicated that children who had undergone dental treatment were more likely to be cooperative. Those who had only a dental check-up experience had an equal proportion of cooperative and uncooperative behaviors, while children with no dental experience were all uncooperative. This suggests that dental treatment experience may positively influence children's cooperation. Specifically, children with treatment experience were more likely to be cooperative, indicating that dental experience can enhance their cooperation during dental visits. According to a previous study, children with no prior dental visit experience were more likely to develop dental fear and had greater fear during the visit than those with prior experience[37]. This study reported that experience with dentists reduced children's fear and anxiety about dental pain.

Meanwhile, as shown in Table 12, 30 patients from the group with prior dental treatment were identified as uncooperative. These findings necessitate a more detailed analysis and interpretation of various factors affecting children.

Of these 30 children, 16 belonged to the group with

high levels of dental anxiety. Despite multiple visits, these children exhibited low levels of cooperation because of significant dental anxiety. High dental anxiety can cause children to experience heightened levels of anxiety and stress during dental procedures, which, in turn, can lead to a decrease in cooperation. This is consistent with the results reported earlier in this study, indicating that higher dental anxiety is significantly associated with lower cooperation levels.

Among children with low dental anxiety, those who were still non-cooperative appeared to be influenced by certain temperamental factors. The analysis revealed that nine of these children had a high level of negative emotionality and four had a high level of sensitivity. Given that high levels of these temperaments are associated with significantly lower cooperation, as previously reported in this study, it is plausible that these temperamental traits could be the primary factors contributing to low cooperation despite prior treatment. Children with high levels of negative emotionality may struggle with emotion regulation, leading to increased anxiety or negative reactions during treatment. Similarly, children with a high sensitivity may respond excessively to external stimuli, resulting in increased discomfort during dental procedures.

In contrast, one patient did not exhibit any clear factors that negatively affected cooperation. This suggests that the patient's previous dental experience was particularly negative, as indicated in previous research. Previous studies have shown that children's cooperation during dental treatment is significantly influenced by discomfort and pain, with initial painful treatments potentially leading to fear and uncooperative behavior in subsequent visits[37]. Another study emphasized the critical importance of the initial dental experiences, noting that painful and negative experiences can reinforce dental fear and cause uncooperative behavior, whereas positive and comfortable experiences can enhance cooperation and reduce dental anxiety[38]. Repeated negative experiences may exacerbate children's reluctance to visit dentists, ultimately resulting in reduced cooperation.

In conclusion, dental anxiety and children's tempera-

mental characteristics appear to be significant factors influencing cooperation. High dental anxiety and specific temperamental traits (negative emotionality and sensitivity) can serve as major contributors to uncooperative behavior, and negative past treatment experiences may contribute to decreased cooperation. This highlights the need for individualized approaches that consider these factors to improve cooperation and dental care outcomes in children.

Therefore, interpreting the results of this study based on previously reported findings, the equal proportion of cooperative and uncooperative behaviors in children who underwent only dental check-ups suggests that dental experiences can have varying effects on cooperativeness. In other words, extensive dental experience may help children adapt to the dental environment and increase cooperativeness through familiarity. However, the impact can vary depending on the nature of past experiences, potentially resulting in adverse effects.

Furthermore, in cases where children have no treatment or dental experience, they may experience fear and confusion because of their unfamiliarity with the dental situation. Additionally, uncooperative behavior in children within the dental environment can result from a combination of various factors. According to previous studies, the psychological state and behavior of children visiting the dentist are influenced by multiple factors, and not just a single one. It has been reported that the likelihood of experiencing fear and anxiety decreases with age[39]. Another study also observed that dental fear tended to decrease as age increased, suggesting that reactions can vary with age, even in the same dental environment[40]. This explains the variation in cooperativeness within groups of children categorized by type of dental experience, as children of different ages may be present in each group, leading to different levels of cooperativeness despite having similar experiences. The level of fear experienced in dental situations can differ depending on a child's age, even with the same level of dental experience. Moreover, it has been reported that children with untreated caries or those who had their first dental visit at a later age exhibit higher dental fear.

In other words, children who had not visited a dentist before but had experienced caries or who visited a dentist for the first time at an older age tended to experience greater fear[41].

Additionally, one study reported that children's cooperation improved with increased dental treatment experience[42]. This study explained that children's uncooperative behavior is due to anxiety about new experiences, which decreases as they become more familiar with the dental situation through repeated experiences. Therefore, the nature of dental experiences, whether positive or negative, can influence current cooperation. This highlights the importance of positive conditioning and experiences in dental treatment, suggesting that dentists should strive to minimize pain and discomfort to make children's treatment experiences as positive as possible.

It should also be noted that the sample sizes for each type of dental experience were not uniform. For the groups that underwent only checkups or had no dental experience, the sample sizes did not meet the required numbers calculated using G*Power 3.1. According to the GPower 3.1 calculations (effect size = 0.3, significance level = 0.05, power = 0.8), each group required approximately 29 samples. Therefore, further analyses with a larger sample size are necessary.

Although not addressed in this study, parenting style is a critical factor influencing children's cooperation. According to a previous study, parenting style is related to children's dental fear, with 8-year-old girls raised in an authoritative parenting style showing significantly higher dental fear than those raised in a permissive style. As children age, the influence of parenting style on dental fear decreases[43]. Other studies have reported that authoritative parenting styles are associated with positive behaviors during dental visits, while authoritarian and neglectful styles are linked to negative behavior[44]. Another study directly reported on children's cooperation and parenting styles, finding that children of authoritative parents were cooperative and exhibited positive behavior at the dentist, with lower caries rates, while children of permissive parents were uncooperative and exhibited negative behavior with higher caries rates[45].

Studies showing a direct relationship between fear and parenting style reported that an authoritarian parenting style is associated with reduced dental fear, whereas a permissive style increases dental fear[46]. Thus, most studies indicate that authoritative parenting styles are associated with positive behaviors in dental treatment, whereas permissive or authoritarian styles are linked to negative behaviors.

An increase in guardians' dental anxiety was correlated with an increase in children's dental fear, which is consistent with the findings of Coric et al.[47]. This suggests that the negative experiences shared by family members or friends can increase dental fear.

Meanwhile, an investigation into the factors causing dental fear among children revealed differences between the cooperative and uncooperative groups. Cooperative children were primarily concerned about physical discomfort and fear of unfamiliar environments, whereas uncooperative children were significantly influenced by physical sensations and dental treatment procedures. Therefore, it is important to apply tailored approaches to reduce dental fear in children. For cooperative children, efforts to create a friendly environment and to provide thorough explanations during treatment are necessary. Strategies to minimize noise and discomfort may be beneficial for uncooperative children.

Despite several limitations, including the demographics of children and guardians from Chonnam National University Pediatric Dentistry and the cross-sectional nature of the study, these findings provide insights into the factors affecting children's cooperation during dental treatment. Future longitudinal studies should include more diverse and evenly distributed samples to better understand these factors.

Conclusion

Children's cooperation during dental treatment is influenced by their inherent dental fear, personality traits (such as shyness and negative emotions), the number of decayed teeth during the primary and mixed dentition stages, guardians' dental anxiety, and their experience

with dental treatment.

Conflicts of Interest

The authors have no potential conflicts of interest to disclose.

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