

Original Article

Influence of temperament on children's cooperation during dental treatment

Maryam Mehrabkhani¹, Razie Khanmohammdi², Hosein Nematollahi¹, Nikoo Rajabi¹, Ali Gheidari¹

¹Dental Research Center, School of Dentistry, Mashhad University of Medical Sciences, Mashhad, Iran, ²Private Practice, Tehran, Iran

ABSTRACT

Background: The etiologies of childhood dental fear/dental behavior management problems have been extensively studied, especially the role of children's temperaments. This study aimed to evaluate the effect of temperament and its associated variables on the anxiety and cooperation level of preschool children in a dental clinic.

Materials and Methods: This cross-sectional study involved 103, 4–6-year-old patients (39 boys and 64 girls). The children's parents or guardians completed the Child Fear Survey Schedule (CFSS) Dental Subscale and the Malhotra temperament questionnaire before the treatment. Patients' anxiety and cooperation levels were then assessed through three distinct treatment stages of fluoride therapy, injection of local anesthesia, and drilling, by applying the Venham anxiety and clinical cooperation scales. The data were analyzed using analysis of variance, Mann–Whitney, Kruskal–Wallis, and Chi-square tests. The significance level of 0.05 was deemed relevant in the analysis.

Results: A significant correlation was established between the mean of CFSS and the variety of temperament ($P = 0.001$). Anxiety and uncooperative behavior during injection and drilling were strongly related to lower sociability scores. Furthermore, higher anxiety during the drilling stage was related to higher impulsivity scores.

Conclusion: The evaluation of children's anxiety and cooperation in dental clinics heavily relies on temperament and certain related factors, such as sociability. These variables serve as crucial benchmarks in understanding and assessing the psychological state of children during dental procedures.

Key Words: Anxiety, behavior management, dentistry, preschool children, temperament

Received: 24-Jan-2023
Revised: 08-May-2024
Accepted: 18-May-2024
Published: 21-Aug-2024

Address for correspondence:
Dr. Ali Gheidari,
Dental Research Center,
School of Dentistry,
Mashhad University of
Medical Sciences, Mashhad,
Iran.
E-mail: aligheidari71@
yahoo.com

INTRODUCTION

The etiology of childhood dental fear and behavior management problems has been investigated in several studies and the most important suggested factors are general emotional state, parental dental fear, past dental history, and experiences of pain.^[1] Limited clinical evidence has proposed the association between dental fear/anxiety and behavior management

problems with different temperaments. Seraj *et al.* showed a significant correlation between rhythmicity and anxiety during injection of local anesthesia. A correlation was also found between higher intensity of response/energy, poor cooperation of children during injection, and higher anxiety during cavity preparation.^[1,2] Furthermore, Janeshin and Habibi

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: Mehrabkhani M, Khanmohammdi R, Nematollahi H, Rajabi N, Gheidari A. Influence of temperament on children's cooperation during dental treatment. *Dent Res J* 2024;21:45.

Access this article online	
	Website: www.drj.ir www.drjjournal.net www.ncbi.nlm.nih.gov/pmc/journals/1480

found that the inhibitory control and perceptual sensitivity in children with completely positive behavior were significantly higher than in negative children.^[1]

The temperament refers to the relatively heritable configuration of developing traits appearing early in life with neurophysiological-based characteristics, which demonstrates consistency across situations and over time.^[1]

Thomas and Chess named nine temperament dimensions including activity, regularity, initial reaction, adaptability, intensity, mood, distractibility, persistence/attention span, and sensitivity based on parent interviews followed by questionnaires.^[3] They introduced a basic classification of child temperaments. Based on their study, most of the children (65%) could be categorized into three groups: easy, difficult, and slow-to-warm-up. Approximately, 35% of children could not be placed in any of them. Of that 65%, the prevalence of easy, difficult, and fearful (slow to warm up) temperaments was 40%, 10%, and 15%, respectively.^[4]

Klingberg and Broberg's findings suggest that temperamental factors are related to both dental behavior management and dental fear and anxiety problems but with different temperamental traits. In the meantime, general behaviors were mainly associated with dental behavior management problems. They discovered a close link between dental fear/anxiety and timidity, inhibitory behavior, and negative emotions, whereas behavioral problems exhibited an association with hyperactivity and impulsivity.^[5] Although a significant number of children may still feel anxious about dental visits, the utilization of psychology in dentistry empowers dentists to minimize the adverse emotions arising from painful or unfavorable encounters. Consequently, this approach enhances the overall tolerability of the dental procedure for young patients.^[2]

To determine the origin and mechanism of behavior management problems in pediatric dentistry, one should focus on temperament and its associated variables. Thus, the purpose of this study was to evaluate the association between the temperament and its relevant variables with the anxiety and cooperation level of preschool children in a dental setting.

MATERIALS AND METHODS

This cross-sectional study was conducted on 103, 4–6-year-old children (64 girls and 39 boys) selected from those referring to the Dental School of Mashhad University of Medical Sciences. Ethical approval was attained from the Ethics Committee of Mashhad University of Medical Sciences (IR.MUMS.REC.1391.902) along with written, informed consent signed by the parents or guardians. The inclusion criteria for studied children were the age range of 4–6, no systemic health problems, no psychological issues, no past dental experiences, and diagnosis of at least one carious primary mandibular molar requiring restoration or pulp treatment.

The Persian version of the Malhora Temperament Schedule that is adapted from Thomas and Chess's temperament questionnaire was used in this study.^[6]

The Malhotra questionnaire focuses on five main scales (sociability, impulsivity, energy, attention span, and regularity). Each scale was scored from 1 to 5, according to the intensity and frequency of a particular behavior; where 1 and 5 were the lowest and highest extremes, respectively, and 3 referred to the mean. An interview session lasting around 20 min was conducted with the aid of parents or guardians to complete the questionnaire. Furthermore, the Child Fear Survey Schedule Dental Subscale Questionnaire^[3] was completed by the child's parents or guardians before the dental treatment. The subscale consisted of 15 items, each scored from 1 to 5 according to the intensity of the child's fear, with 1 being "no fear at all" and 5 showing "extremely fearful." The final score thus ranged from 15 to 75.^[4]

In the next stage, during dental treatment, the patient's reactions, including their head, hand, and leg movements, were fully recorded using a camera (SONY, HDR-XR260E) placed in front of the dental unit. According to the video, cooperation and anxiety levels in prophylaxis, fluoride therapy, inferior alveolar nerve block injection (2% lidocaine with 1/100,000 epinephrine), and the first 3 min of drilling were measured by applying the Venham Clinical Anxiety Scale and the Venham Clinical Cooperation Scale, which were created for clinical assessment. The rationale behind choosing these four stages of dental treatment for the study was their potential to be perceived as a new stimulus by the child. The scoring system for each scale comprised six behavioral

levels, with scores ranging from 0 to 5. Higher scores indicated the poorer cooperation or more anxiety.^[5]

Two professionals individually reviewed the video footage of each patient and documented their levels of cooperation and anxiety during three stages: prophylaxis and fluoride therapy, anesthetic injection, and drilling. The experts then jointly reviewed the video clip and attempted to agree in the event of notable inconsistencies.

The analysis of variance (ANOVA) test was employed to analyze the disparity in the mean anxiety level based on temperament type. The Kruskal–Wallis test was utilized to examine the variation in anxiety and cooperation levels across different treatment stages among various temperament groups. The Mann–Whitney *U*-test was employed to compare the mean of different temperament variables based on gender. In addition, the Chi-square test was used to compare the level of cooperation and anxiety in different treatment stages between boys and girls. The correlation between variables was assessed using Spearman’s correlation test. The Kappa statistic was calculated for interexaminer reliability assessments and the statistical significance was set to 0.05.

RESULTS

A total of 39 boys (37.9%) and 64 girls (62.1%) with an average age of 59.33 ± 7.17 months were entered into the study. Among them, 54 were aged between 4 and 5 years, and 49 were 5 and 6 years old. The mean anxiety scores were as follows: “easy” group: 25.17 ± 7.70 , “slow to warm-up:” 25.96 ± 4.17 ; “difficult:” 35.33 ± 4.84 ; and the rest: 26.87 ± 6.75 . The ANOVA results indicated a conspicuous difference in anxiety levels among three temperament types ($P = 0.001$), with the “difficult” type exhibiting higher scores. In addition, the “difficult” group displayed the highest mean anxiety and uncooperative behavior scores (in fluoride therapy, injection, and drilling stages) [Table 1].

The Chi-square test revealed that there were no significant differences in the distribution rates based on gender and age. Boys and girls showed no disparity in their cooperation and anxiety scores. According to the findings from the Kruskal–Wallis analysis, there were significant differences in various variables during fluoride therapy and injection among individuals with different levels of anxiety. Specifically, sociability ($P = 0.04$), adaptability ($P = 0.029$), and activity level ($P = 0.026$) variables showed significant differences during fluoride therapy, whereas sociability ($P = 0.025$), intensity ($P = 0.020$), and regularity ($P = 0.048$) variables were significantly different during the injection. Moreover, during the drilling phase, sociability ($P = 0.001$), emotionality ($P = 0.033$), initial reaction ($P = 0.012$), adaptability ($P = 0.013$), and persistence ($P = 0.015$) variables exhibited significant differences [Table 2]. In terms of cooperation, sociability ($P = 0.040$), emotionality ($P = 0.001$), persistence ($P = 0.002$), and intensity ($P = 0.047$) variables showed significant differences during the injection, and sociability ($P = 0.008$), initial reaction ($P = 0.008$), persistence ($P = 0.007$), and mood ($P = 0.007$) variables affected cooperation during the drilling phase. Interestingly, no variables seemed to have an impact on the cooperation during fluoride therapy [Table 3].

DISCUSSION

Undoubtedly, the children’s tolerance threshold for treatment differs from the adults. Factors such as therapeutic circumstances, age, temperament, personality type, intellectual capacity, and degree of maturity can affect the children’s tolerance threshold. Furthermore, children are more vulnerable to fear and stimuli; so certain emotional as well as behavioral problems are more likely among them.^[7] Our study primarily intended to investigate

Table 1: The scores of the venham clinical anxiety level and the venham clinical cooperation level for different temperament types

Variables	The mean rank of temperament				Results of Kruskal–Wallis test
	Easy	Slow-to-warm-up	Difficult	Mixed	
Anxiety level during fluoride therapy	44.21	59.12	72.44	48.22	0.013
Cooperation level during fluoride therapy	50.07	45.29	65.89	54.59	0.038
Anxiety level during injection	39.71	53.35	86.33	52.0	0.001
Cooperation level during injection	40.93	48.63	90.44	53.29	0.001
Anxiety level during drilling	41.66	56.85	67.44	52.61	0.029
Cooperation level during drilling	43.07	52.96	67.28	54.19	0.027

Table 2: The scores of the venham clinical anxiety level for temperament variables during treatment stagest

Anxiety level	Treatment stage	The mean rank of temperament variables											
		Adaptability	Initial reaction	Sensitivity	Sociability	Persistence	Mood	Impulsivity	Intensity	Activity	Energy	Attention span	Regularity
Fluoride therapy	0	56.48	57.95	54.20	58.52	53.76	54.77	55.54	52.32	56.38	55.09	44.99	55.73
	1	46.67	45.75	50.39	44.97	48.38	49.61	46.58	50.69	46.94	48.19	59.86	46.50
	2	10.50	25.17	46.00	18.17	34.17	23.50	25.17	60.17	15.83	32.83	77.33	55.50
	3	84.00	54.50	33.25	57.50	80.50	53.25	75.75	68.25	88.75	82.75	72.00	24.25
	4	44.00	23.75	42.75	28.25	62.75	53.50	59.75	37.25	29.00	25.75	62.75	61.50
Injection	0	58.97	56.03	59.81	62.11	59.89	55.68	60.53	53.89	52.26	53.41	46.85	58.26
	1	44.46	49.23	46.88	34.44	47.63	49.38	46.32	43.77	51.34	46.66	56.77	52.32
	2	55.36	50.64	37.68	46.32	40.95	45.73	42.09	72.59	51.05	63.91	55.14	32.64
	3	47.17	44.83	49.00	44.83	43.83	68.17	48.33	42.83	48.17	43.17	64.50	32.83
	4	-	-	-	-	-	-	-	-	-	-	-	-
Drilling	0	11.00	12.50	61.50	12.00	6.00	7.00	4.00	101.50	89.00	100.0	26.50	15.50
	1	58.49	57.00	55.31	59.72	56.88	52.85	56.97	53.79	56.15	55.50	49.86	56.83
	2	41.88	47.56	46.11	41.64	39.69	50.31	40.64	49.98	43.11	45.97	56.11	44.98
	3	35.67	21.50	47.58	23.67	64.75	51.75	58.75	43.33	54.42	46.25	53.25	37.08
	4	-	-	-	-	-	-	-	-	-	-	-	-
Results of Kruskal-Wallis test	Fluoride	0.029	0.082	0.815	0.040	0.415	0.463	0.206	0.847	0.026	0.189	0.054	0.379
	Injection	0.119	0.528	0.124	0.023	0.079	0.307	0.055	0.020	0.802	0.197	0.419	0.048
	Drilling	0.013	0.012	0.33	0.001	0.015	0.923	0.033	0.641	0.123	0.297	0.615	0.080

Main domains are marked with bold letters

Table 3: The association between children's temperament variables and their cooperation levels during different stages of treatment

Treatment stage	Cooperation level	The mean rank of temperament variables												
		Adaptability	Initial reaction	Sensitivity	Sociability	Persistence	Mood	Impulsivity	Intensity	Activity level	Energy	Attention span	Regularity	
Fluoride therapy	0	52.70	54.25	52.75	54.18	52.19	54.92	53.18	50.65	51.68	51.31	51.48	52.99	
	1	44.32	42.04	51.46	41.36	45.25	33.89	40.36	60.0	51.96	55.57	50.79	48.57	
	2	84.0	54.50	33.25	57.50	80.50	53.25	75.75	68.25	88.75	82.75	72.0	24.25	
	3	-	-	-	-	-	-	-	-	-	-	-	-	
	4	44.00	23.75	42.75	28.25	62.75	53.50	59.75	37.25	29.00	25.75	62.75	61.50	
Injection	5	-	-	-	-	-	-	-	-	-	-	-	-	
	0	58.24	54.96	52.57	57.27	60.30	55.47	60.79	51.59	52.56	52.00	49.46	57.24	
	1	46.45	50.19	60.53	51.97	45.40	53.50	45.32	44.16	45.45	43.58	51.45	51.55	
	2	39.96	47.29	39.46	32.39	33.21	36.32	31.64	68.68	59.46	66.43	62.64	37.25	
	3	84.00	47.50	61.50	72.50	100.50	75.50	100.0	35.00	82.00	63.00	88.00	15.50	
Drilling	4	-	-	-	-	-	-	-	-	-	-	-	-	
	5	11.00	12.50	61.50	12.00	6.00	7.00	4.00	101.50	89.00	100.0	26.50	15.50	
	0	55.94	57.16	53.08	56.42	53.90	54.33	52.08	52.58	52.46	52.42	50.28	55.10	
	1	39.09	36.68	48.84	40.64	39.61	39.25	49.98	50.84	50.20	49.34	53.95	44.10	
	2	44.17	30.17	47.17	20.50	93.50	84.83	64.67	45.33	53.33	60.67	82.33	28.83	
Results of Kruskal-Wallis test	3	-	-	-	-	-	-	-	-	-	-	-	-	
	4	-	-	-	-	-	-	-	-	-	-	-	-	
	5	-	-	-	-	-	-	-	-	-	-	-	-	
	Fluoride	0.328	0.275	0.787	0.312	0.418	0.104	0.296	0.518	0.233	0.270	0.745	0.522	
	Injection	0.064	0.590	0.027	0.040	0.002	0.098	0.001	0.047	0.288	0.076	0.345	0.082	
Drilling	0.057	0.008	0.805	0.016	0.007	0.017	0.718	0.899	0.949	0.799	0.172	0.121		

Main domains are marked with bold letters

temperament and fear. A translated version of the Malhotra Questionnaire was used which includes nine items considered by Thomas and Chess. The distinct advantage of this questionnaire is its applicability to a wide age range of 4–14-year-old children from diverse socioeconomic backgrounds.^[8] According to our findings, “difficult” temperament showed higher anxiety levels ($P = 0.001$). Moreover, temperament was also directly related to cooperativeness during therapy sessions ($P < 0.05$). In other words, the difficult temperament showed low cooperation and high anxiety. Similarly, Schechter *et al.* stated that children with “difficult” temperaments displayed more anxiety symptoms during immunization compared to the easy children.^[9] Some researchers have pointed out a relationship between the child’s temperament, his/her response to pain, hospitalization, and sedation. Wallace documented that a higher dose of pain medication was administered to children with a high level of intensity of responsiveness during their hospitalization in comparison to the other children.^[10] Similarly, Aminabadi *et al.* also corroborated that negative behaviors are more frequently found in children with a higher difficult temperament scale.^[11] In our research, anxiety level during fluoride therapy was inversely associated with the sociability scale, whereas it exhibited a positive correlation with the activity level temperament variable. Nonetheless, the temperament variable was not correlated with the cooperation level throughout the fluoride therapy. Since it is the least invasive stimulus, perhaps it is not possible to assess the role of temperament variables in children’s cooperation. Cooperation in the first session of therapy seems to be dependent on the minors’ adaptability as well as sociability.^[7] The anxiety level was reflected in children’s activity level, temperament variable, and during fluoride therapy ($P = 0.026$). The findings also indicated that the anxiety level was strongly correlated with a decline in sociability and regularity scales as well as an increase in the intensity of response variable during dental local anesthesia injection. Furthermore, lack of cooperation during local dental anesthesia injection was significantly associated with an increase in the impulsivity scale and the intensity of response variable as well as a decrease in the sociability scale ($P < 0.05$). This implies that as children’s sociability scores decline, his/her communication with health-care staff will fail; thus, the unfavorable conditions will be less bearable. This finding is consistent with the study

of Seraj *et al.* They also found that more anxious and less cooperative children had lower sociability scores.^[12] In this study, higher levels of impulsivity increased the intensity of response to any possible stimuli (including pain), which was observed to be intensified by local anesthetic administration. Due to needle penetration and the subsequent bitter taste in the mouth, anesthetic administration is one of the most stressful stages in dental therapy.^[13,14] In the present study, the sociability temperament score inversely affected the anxiety levels during the drilling phase ($P < 0.05$). On the other hand, the impulsivity scale contributed to anxiety ($P < 0.05$). In addition, a positive correlation was observed between the sociability temperament scale and cooperation status during the drilling phase ($P < 0.05$). On the other hand, impulsivity exhibited a significant positive correlation with anxiety ($P < 0.05$). This stage can be extremely stressful due to the drilling cacophony, as well as water droplets spraying on the face, not to mention the unpleasant vibration.^[13] Given that the child may experience dental therapy for the first time, it must be noted that the response and adaptability are directly affected by the temperament as well. Sociability scores (such as initial reaction, adaptability, and intensity temperament variables) vary among the children with different levels of anxiety and cooperation during the drilling and injection phase. In this study, the sociability temperament scale inversely affected the anxiety level and lack of cooperation during the drilling and injection phases ($P < 0.05$). Arnrup *et al.* observed a statistically significant relationship between shyness and the dental fear.^[15] This is consistent with our findings as sociability and shyness separately indicate the children’s tendency and indifference during interaction with strangers. On the other hand, the children with low cooperation during the drilling and injection phases showed lower scores in sociability, which might be due to their poor communication abilities. The intensity of the reaction had a significant effect on the rise of anxiety among the children with low cooperation and high anxiety levels ($P < 0.05$) during injection. As hyperactive children can barely stop fidgeting even when seated, their lower threshold levels can be rationally explained.^[15] A positive correlation was also found between impulsivity and persistency and lack of cooperation during injection, as well as anxiety during drilling ($P < 0.05$). Similarly, Gustafsson *et al.* and Arnrup *et al.* detected a significant correlation between impulsivity and cooperation.^[7,15] Gender did

not seem to affect the cooperation and anxiety levels in the population enlisted in our study. Furthermore, it was not associated with the temperament. Mendoza-Mendoza *et al.* addressed the influence of gender on dental anxiety and reported no significant relationship between them.^[22] However, Gustafsson *et al.* revealed a significant gender-based difference in the outcome.^[7] In this regard, hormonal changes during puberty and socialization level are less tangible at younger ages.^[15] Fraone *et al.* stated that regardless of age, females exhibited more positive behavior during treatment. In comparison to boys, girls were calmer and struggled less.^[16] Similarly, Janeshin and Habibi found a better mean score of temperament in girls.^[1] Feine *et al.* reported that noxious heat stimuli in young females rated more intensely compared to males. This highlights the possibility of physiologic differences in nociceptive discrimination in males and females rather than a difference in emotional response.^[17] In this study, an upper age limit of 6 years was set to exclude the intervening parameters of schooling. Moreover, the minimum age limit of four can ensure temperament formation and consistency.^[18-20] According to Jean Piaget's intellectual development model, there is a preoperational stage between 3 and 6 years of age when the vocabulary expands, the attention span elongates, temptation resistance develops, and parents' absence can be tolerated. That is to say that the child reaches a mature and consistent behavior.^[21] The number of selected cases and the fact that our subjects were all selected from those referred to the dental school for treatment are important limitations of this study, so the findings cannot represent the entire general population. A more solid sampling method should be employed in future studies.

CONCLUSION

Within the limitations of this study, it can be concluded that the temperament type and its associated variables such as sociability, impulsivity, and regularity can determine the children's cooperation and anxiety levels in the dental clinic.

Acknowledgments

This article is designed and written based on the postgraduate specialty training thesis registered with No. 535 in the Dental School of Mashhad, Iran. We truly acknowledge the efforts of the Dental Research

Center as well as the Research Department of Mashhad University of Medical Sciences.

Financial support and sponsorship

This study was financially supported by Dental Research Centre, Research Department of Mashhad University of Medical Sciences.

Conflicts of interest

The authors of this manuscript declare that they have no conflicts of interest, real or perceived, financial or non-financial in this article.

REFERENCES

1. Janeshin A, Habibi M. The relationship between temperament and behavior in 3-7-year-old children during dental treatment. *Dent Res J (Isfahan)* 2021;18:12.
2. Folayan MO, Idehen E. Factors influencing the use of behavioral management techniques during child management by dentists. *J Clin Pediatr Dent* 2004;28:155-61.
3. Cuthbert MI, Melamed BG. A screening device: Children at risk for dental fears and management problems. *ASDC J Dent Child* 1982;49:432-6.
4. Folayan M, Kolawole K. A critical appraisal of the use of tools for assessing dental fear in children. *Afr J Oral Health* 2004;1:54-63.
5. Venham LL, Gaulin-Kremer E, Munster E, Bengston-Audia D, Cohan J. Interval rating scales for children's dental anxiety and uncooperative behavior. *Pediatr Dent* 1980;2:195-202.
6. Malhotra S. Manual of Malhotra's Temperament Schedule. Agra: National Psychological Corporation. 1988;305.
7. Gustafsson A, Broberg A, Bodin L, Berggren U, Arnrup K. Dental behaviour management problems: The role of child personal characteristics. *Int J Paediatr Dent* 2010;20:242-53.
8. Folayan MO, Idehen EE, Ufomata D. The effect of sociodemographic factors on dental anxiety in children seen in a suburban Nigerian hospital. *Int J Paediatr Dent* 2003;13:20-6.
9. Schechter NL, Bernstein BA, Beck A, Hart L, Scherzer L. Individual differences in children's response to pain: Role of temperament and parental characteristics. *Pediatrics* 1991;87:171-7.
10. Wallace MR. Temperament: A variable in children's pain management. *Pediatr Nurs* 1989;15:118-21.
11. Aminabadi NA, Puralibaba F, Erfanparast L, Najafpour E, Jamali Z, Adhami SE. Impact of temperament on child behavior in the dental setting. *J Dent Res Dent Clin Dent Prospects* 2011;5:119-22.
12. Seraj B, Khanmohammadi R, Karami S, Almasi F, Hamrah MH. The role of temperament in cooperation and level of anxiety in preschool and elementary school children in the dental office. *J Evol Med Dent Sci* 2021; Sep 20;10(38):3408-13.
13. Akyuz S, Pince S, Hekin N. Children's stress during a restorative dental treatment: Assessment using salivary cortisol measurements. *J Clin Pediatr Dent* 1996;20:219-23.
14. Koch G, Poulsen S. *Pediatric Dentistry: A Clinical Approach*. 2nd ed. Baski, UK: Blackwell Publishing Ltd.; 2009.

15. Arnrup K, Broberg AG, Berggren U, Bodin L. Lack of cooperation in pediatric dentistry – The role of child personality characteristics. *Pediatr Dent* 2002;24:119-28.
16. Fraone G, Wilson S, Casamassimo PS, Weaver J 2nd, Pulido AM. The effect of orally administered midazolam on children of three age groups during restorative dental care. *Pediatr Dent* 1999;21:235-41.
17. Feine JS, Bushnell CM, Miron D, Duncan GH. Sex differences in the perception of noxious heat stimuli. *Pain* 1991;44:255-62.
18. Bates JE, Wachs TD. *Temperament: Individual Differences at the Interface of Biology and Behavior*. Washington, D. C., United States: American Psychological Association; 1994.
19. Neisser U, Boodoo G, Bouchard TJ Jr., Boykin AW, Brody N, Ceci SJ, *et al.* Intelligence: Knowns and unknowns. *Am Psychol*. 1996 Feb; 51(2):77.
20. Rothbart MK. *Temperament in childhood: A framework*. Temperament in childhood. John Wiley and Sons. New Jersey. United States. 1989. p. 59-73.
21. Broeren S, Muris P. The relation between cognitive development and anxiety phenomena in children. *J Child Fam Stud* 2009;18:702-9.
22. Mendoza-Mendoza A, Perea MB, Yañez-Vico RM, Iglesias-Linares A. Dental fear in children: the role of previous negative dental experiences. *Clin Oral Investig*. 2015;19(3):745-51.