



Correlation of Digital Gaming Habit with Dental Anxiety and Cooperation of Pediatric Dental Patients

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ABSTRACT

Objectives: Using computers from a young age can affect cognitive development and social behavior of children. This study aimed to assess the effect of digital gaming habit on anxiety and behavior of children in a dental setting.

Materials and Methods: A total of 137 children between 4 to 6 years seeking their first dental treatment were selected for this cross-sectional study. In the first session, the children were familiarized with the dental setting. In the second session, the parents received a questionnaire regarding the digital gaming habit of their children to fill out. Then, the children underwent dental treatment. The behavior of children during the procedure was video-taped, observed, and scored according to the Frankl behavior rating scale (FBRS) and the Venham clinical anxiety scale (VCAS). Data were analyzed by the Pearson's correlation coefficient at 0.05 level of significance, and multiple linear regression-backward method at 0.1 level of significance.

Results: The mean score of the gaming questionnaire was 44.21 out of 100. The coefficient for the correlation of VCAS and FBRS scores with the gaming questionnaire score was 0.556 and -0.496, respectively. The FBRS and VCAS scores had no significant correlation with demographic variables ($P > 0.1$). But the gaming questionnaire score had a significant correlation with mothers' occupation ($P = 0.072$).

Conclusion: The present results revealed that digital gaming habit increased dental anxiety and negative behavior of children. It is imperative to educate the parents and children at the community level regarding selection of appropriate games and duration of playing.

Keywords: Dental Anxiety; Dental Care for Children; Pediatric Dentistry; Video Games

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INTRODUCTION

Dental fear and anxiety are common problems in pediatric dentistry that may result in avoidant behavioral reactions in some children [1]. Severe fear and anxiety can negatively affect the brain function of children [2] and increase the stress level and fatigue of

dental clinicians [3]. Therefore, behavioral control of children in dental visits and creating a pleasant experience and positive attitude for them are among the main goals of pedodontists [1]. It is also imperative to identify the factors related to fear and anxiety of children in dental setting and address them

during the treatment process. The parameters responsible for development of dental fear and anxiety in children can be divided into three main categories of personal factors such as level of cognitive development and personality trait of children, familial-environmental factors such as mother's anxiety and parenting style, and dental factors such as behavior of dental staff [4,5].

According to the dynamic diathesis-stress model, the social learning theory, and the displacement hypothesis, cognitive development of children affects their general anxiety and coping ability, and can determine their behavior in a social environment such as a dental setting [6,7]. Accordingly, children with higher trait anxiety more commonly experience state anxiety in dental office, and poorly respond to behavioral control techniques [8].

In today's modern world, use of electronic devices, such as watching television, computer use, and digital gaming since the early ages can affect cognitive development of children [9,10]. Long time screen exposure decreases social interactions and emotional relationship of children with parents and friends [11]. It also causes mood swings, intolerability, anger, aggressiveness, and depression in children when they are deprived from digital games. Many psychological studies have reported the adverse effects of the media on attention and concentration of children [12-21]. Thus, the World Health Organization considers excessive use of electronic devices as a mental health disorder to be covered by the governmental measures for its prevention and treatment [12].

Considering the effect of general anxiety and coping mechanisms of children on their dental anxiety, the correlation of media habits and digital gaming with dental anxiety and behavior of children has been studied [22-26]. In these studies, the effect of duration of using the media and electronic devices by children on their dental anxiety and behavior has been considered. The present study aimed to assess the effect of digital gaming on dental anxiety and behavior

of smaller (4-6-year-old) children, by considering different other aspects of daily activities of children such as their sleep, diet, oral hygiene, and family relations.

MATERIALS AND METHODS

This descriptive cross-sectional study was ethically approved by the ethics committee of Tehran University of Medical Sciences, Pardis International Campus (IR TUMS DENTISTRREC 1401 098). The sample size was calculated to be 123 children according to a study by Jamali et al. [26] assuming the correlation coefficient between the anxiety and total media time to be $r=0.25$, 95% confidence interval ($\alpha=0.05$), and study power of 80% ($\beta=0.2$) using one sample correlation feature of PASS 11. To increase the study power, 137 children were enrolled.

Designing of questionnaire:

To design the questions investigating digital gaming information, articles related to the media and gaming habits [27-33] were reviewed, and the important topics were extracted and formulated in questions. The questions were used to assess the digital gaming habit of children which covered the important aspects of the children's daily life such as duration of gaming, content of the game, sleep disorders, nutrition and diet, oral hygiene, quality of social relations, and level of dependence of children on gaming.

Accordingly, 28 questions were designed to cover the important topics. The questionnaire was then distributed among 10 pedodontists, statisticians, and psychologists to determine the necessity, relevance, clarity, and simplicity of each question. The content validity ratio and content validity index were calculated to analyze the opinion of the experts, and both values were found to be equal to 1. According to the opinion of the experts, some questions were omitted due to having similar content, and of 28 primary questions, 13 were used in the final questionnaire. Also, 5-point Likert scale answer choices of never, rarely, sometimes, most of the time, and always with scores 0 to 4, respectively, were considered for all questions. The acquired total score could range from 0 to 52 (Table 1). The scoring system of this questionnaire was such that higher scores. indicated improper

Table 1. Questionnaire used for the assessment of digital gaming in children

Number	Questions	Never	Rarely	Sometimes	Most of the time	Always
1	Is the time allocated by your child to digital gaming more than 8 hours/week (almost over 70 minutes daily)?					
2	Does your child want to spend a lot of money on buying games or console?					
3	Is the content of games war or violence?					
4	Does your child feel excited and thrilled when playing digital games?					
5	Is it difficult for your child to stop playing when you ask him to do so?					
6	Do you have to force him to quit playing?					
7	Does your child nag when not playing?					
8	Is your child's sleep routine deranged due to digital gaming or is not as regular as before?					
9	Does your child develop fatigue, backache, or headache due to digital gaming?					
10	Does your child forget his oral hygiene routine due to digital gaming?					
11	Does your child forget his meals due to digital gaming?					
12	Does your child spend less time exercising and playing due to digital gaming?					
13	Does your child prefer to have a digital gaming competition when his friends come over?					

gaming habits, and spending more time on gaming, and subsequent development of sleep disturbances, impaired nutrition and oral hygiene, and some degrees of dependence on gaming. In the next step, to assess the reproducibility of the questions, the questionnaire was administered among 15 parents, and they filled out the questionnaire twice within a 2-week interval. The

correlation coefficient was found to be >0.8 for each item. Internal consistency measured by Cronbach's alpha was 0.966.

Selection of samples:

The participants were selected from patients referred to the Department of Pediatric Dentistry of Tehran University of Medical Sciences. The children sought dental treatment for the first time and required

pulp treatment of similar primary first molars. They had no history of any systemic disease, hospitalization, or intake of psychiatric medications [1]. The parents were informed about the study objectives and were ensured that not participating in the study would have no effect on routine dental treatment of their children. Children whose parents were not willing to allow their participation in the study, those with dental infection or acute dental trauma, and children with severe disruptive behaviors in the first appointment or due to failed anesthesia and severe pain in the second appointment were excluded.

Treatment sessions:

In the first session, the children entered the operatory room with their mothers and underwent complete oral and dental examinations. Next, the tell-show-do behavioral technique was used to familiarize the children with the dental setting. In the second session scheduled on average one week after the first session, the parents received a questionnaire to fill out. The first part of the questionnaire included questions regarding demographic information (order of birth of the child, age, occupation, and level of education of mother, level of education of father, and family income), and the second part included questions regarding digital gaming habit of children.

After filling out the questionnaire by the parents, dental treatment of all children was performed by the same pedodontist. The treatment process included local anesthetic injection by the infiltration technique and pulp therapy of primary molars similarly for all children. Also, a video camera was placed out of sight of children and turned on by the assistant prior to the dental procedure to videotape the behavior of children during the procedure. The videos were watched by two pedodontists independently, and the anxiety and behavior of children during the anesthetic injection and during cavity preparation was scored by using the Venham clinical anxiety scale (VCAS) and the Frankl behavior rating scale (FBRs) [1]

(Tables 2 and 3), and the higher score was considered for statistical analysis.

The correlation between the VCAS and FBRs scores and also, the correlation of VCAS and FBRs scores with the gaming questionnaire score were analyzed by the Pearson's correlation coefficient and values <0.05 were considered statistically significant.

The correlation of VCAS and FBRs scores with demographic variables and also the correlation the gaming questionnaire score with variables were analyzed by the multiple linear regression-backward method and values <0.1 were considered statistically significant. The results were analyzed by SPSS version 25 (SPSS Inc., IL, USA).

RESULTS

According to the eligibility criteria, 137 children between 4-6 years were enrolled. Of 137 children, 59 (43.1%) were boys and 78 (56.9%) were girls. The mean age of the children was 5 years and 7 months (age range of 46 to 80 months). In terms of birth order, the children were divided into three subgroups. Of all, 77 (56.2%) were the first child, 52 (38%) were the second child, and 8 (5.8%) were the third child or more.

Tables 2 and 3 present the frequency of VCAS and FBRs scores of children, respectively. Statistical analysis showed a strong correlation between the VCAS and FBRs scores (-0.879). In other words, children who had lower FBRs, presented higher VCAS.

The mean gaming questionnaire score of children was 44.21 (range 0 to 98.08) out of 100.

The coefficient for the correlation of VCAS and the gaming questionnaire score was 0.556. This value was -0.496 for the correlation of FBRs score and the gaming questionnaire score.

These correlations were statistically significant ($P<0.001$). The effect of gaming questionnaire score on the VCAS score was greater than that on the FBRs score ($B=0.04$ and $P<0.001$ for the correlation with VCAS and $B=0.021$ and $P<0.001$ for the correlation with FBRs).

The VCAS and FBRs scores had no significant correlation with demographic variables ($P>0.1$). But the gaming questionnaire score had a significant correlation with mother's occupation ($r=0.154$, $P=0.072$) (Table 4).

Table 2. Frequency percentage of anxiety level in 4–6-year-old children under study according to the Venham clinical anxiety scale

Rating	Description	Frequency (percentage)
0	Relaxed: smiling, willing, able to converse, displays behavior desired by the dentist	25 (18.2%)
1	Uneasy: concerned, may protest briefly to indicate discomfort, hands remain down or partially raised. Tense facial expression, 'high chest'. Capable of cooperating	44 (32.1%)
2	Tense: tone of voice, questions and answers reflect anxiety. During stressful procedure, verbal protest, crying, hands tense and raised, but not interfering very much. Protest more distracting and troublesome. Child still complies with request to cooperate.	10 (7.3%)
3	Reluctant: pronounced verbal protest, crying. Using hands to try to stop procedure. Treatment proceeds with difficulty.	14 (10.2%)
4	Interference: general crying, body movements sometimes needing physical restraint. Protest disrupts procedure	27 (19.7%)
5	Out of contact: hard loud swearing, screaming unable to listen, trying to escape. Physical restraint required	17 (12.4%)

Table 3. Frequency percentage of the cooperation level of 4–6-year-old children under study according to the Frankl behavior rating scale

Rating	Description	Frequency (percentage)
1	Definitely Negative: Refusal of treatment, crying forcefully, fearful, or any other overt evidence of extreme negativism	25 (18.2%)
2	Negative: Reluctant to accept treatment, uncooperative, some evidence of negative attitude but not pronounced, sullen, withdrawn	39 (28.5%)
3	Positive: Acceptance of treatment, at times cautious, willingness to comply with the dentist, at times with reservation but patient follows the dentist's directions cooperatively.	41 (29.9%)
4	Definitely Positive: Good rapport with the dentist, interested in the dental procedures, laughing and enjoying the situation	32 (23.4%)

Table 4. Results of the regression analysis examining the relationship between the demographic variables and the study outcomes

Demographic factor	Unstandardized Coefficient B	β Partial Correlation Coefficient	P value
Child's age	0.253 (0.258)	0.092	0.285
Child's birth order	0.837 (3.867)	0.020	0.817
Child's gender	-5.479 (4.582)	- 0.080	0.352
Family income	0.028 (6.396)	0.002	0.984
Mother's occupation	7.143 (3.94)	0.154	0.072
Mother's age	-3.179 (5.808)	- 0.041	0.634
Mother's level of education	-5.737 (3.838)	- 0.063	0.463
Father's level of education	6.021 (3.819)	0.051	0.557

The mean and standard deviation of gaming questionnaire score in housewife mothers and working mothers were 93.6 ± 6.4) and 104.2 ± 9.7 , respectively. As it shows, the mean gaming questionnaire score of children with working mothers was averagely 7.143 units higher than that of children whose mothers were housewives.

DISCUSSION

In today's modern world, use of electronic devices and digital gaming has increased since young ages, as young as 14 months old [17]. The media serve as a double-edged sword. Although they can reinforce problem-solving thinking in children [27], they have negative effects which are concerning [17,28,29]. Evidence shows that use of electronic devices decreases physical activity, sleep duration and quality [30,31] and human interactions of children, and subsequently increases the stress level [17,29], anxiety disorders [14], tendency to solitude [16,19], anger [21] and poor educational performance in children [32,33]. The American Academy of Pediatrics recommends that children under the age of 2 years should not use any electronic media, and the use of electronic media by children over the age of 2 years should be limited to less than 2 hours/day. Nonetheless, evidence shows that almost two-thirds of children do not comply [28].

Children's behavior in dental setting is affected by attention deficit in children because of digital gaming. This topic has been addressed in several studies considering the duration of digital gaming [22-26]. This study was designed to assess this correlation by considering children's daily activities such as their sleep, diet, oral hygiene, social relations, and dependence on digital gaming. Smaller Children, aged 4-6 years, were chosen because the use of digital gaming by such young children has increased, and evidence shows that children between 4 to 6 years have the highest frequency of aggressive behaviors, and their behavioral control is more difficult than other age groups [1]. The behavior of children was videotaped during dental procedures, and the VCAS and FBRS were used to assess the level of anxiety and cooperation of children. The present results

revealed that children who scored higher in the gaming questionnaire had higher anxiety level and lower cooperation in dental setting. And the correlation of digital gaming habits with VCAS was greater than FBRS, which means that children with wrong gaming habits experience high level of anxiety in a dental setting even though they may cooperate; this finding may be due to higher general anxiety level of smaller children. The results of relevant previous studies [22,24-26] showed that the total time of exposure to TV and other electronic devices had significant correlations with dental anxiety and behavioral problems. The results of Deolia et al. [24] had a difference which showed that children's behavior in a dental setting was more affected than anxiety of children by the media usage. In these studies, only some of the questions were related to the type of media used, and the average time spent daily on media and daily activities of children such as their sleep, diet, oral hygiene, and family relations were not mentioned. In the present study, duration of digital gaming was included in the designed questionnaire which had not been paid attention in previous studies. In a study on children 10-12 years of age, Zarebidoki et al. [23] found no significant effect in this regard which can be due to the fact that they evaluated older children with higher level of cognitive development and cooperation.

The content of the games is another important topic that determines how gaming affects the behavior of children. The present results and those of Mobarek et al. [25] indicated that games with higher aggressive content have a more negative impact on children's behavior.

Alaki et al. [22] also evaluated some other parameters such as age of onset of gaming and number of available electronic devices. They reported that children who had access to a minimum of 5 electronic devices at home had higher levels of anxiety and behavioral problems during dental procedures. They attributed this finding to longer screen time. They added that children who had started gaming younger than 2 years of age had higher level of dental anxiety and uncooperative behavior during dental procedures. However, Mobarek et al. [25] reported that age of onset of use of electronic media was not an influential factor, and duration

of use/day and the aggressive content of the media were more important factors.

The results showed no significant difference between boys and girls in the digital gaming habit or behavior in dental setting, which was in agreement with the results of Zarebidoki et al. [23] Deolia et al. [24] digital gaming habits and behavior of children in a dental setting. Age, order of birth of children, financial status of the parents, availability of electronic equipment, level of education of the parents and their knowledge level about correct use of electronic devices by children, occupation of the parents, and the time they spend with their children are among other influential parameters in this regard. Although evaluation of the effect of demographic factors requires a larger sample and Jamali et al. [26]. Some other demographic factors appear to affect the size; they were analyzed in the present study by considering the study limitations. The financial status of the family had no significant effect on the digital gaming habit of children. It appears that digital gaming has become widespread, and involves children from all socioeconomic classes. Mobarek et al. [25] reported similar results. However, Jamali et al. [26] showed that socioeconomic status had a negative impact on digital gaming habit such that digital gaming habit had a lower frequency in children from lower socioeconomic classes. The results of the present study indicated no significant correlation between level of education of the parents and dental anxiety of children, which was in line with the results of Alaki et al. [22] and Jamali et al [26]. On the other hand, mother's occupation had a significant effect on the gaming questionnaire score, indicating that children of working mothers spent more time on digital gaming. Jamali et al. [26] and Zarebidoki et al. [23] concluded that higher educational level of fathers and spending less time with their children resulted in higher frequency of watching TV by the children.

This study considered different aspects of videogame effects by using a questionnaire on

young children. Future studies are recommended to assess a larger sample size and consider the effect of age of onset of gaming on children.

CONCLUSION

The present results confirmed the negative effect of improper digital gaming habit on dental anxiety and behavior of children. Thus, since the use of electronic media and devices is almost inevitable in today's world, it is imperative to educate the parents and children regarding selection of appropriate games and duration of gaming. Also, considering the ambiguities regarding the effect of personal and familial factors on digital gaming habits of children, education of the parents at the community level appears to be imperative.

CONFLICT OF INTEREST STATEMENT

None declared.

GENERATIVE AI IN SCIENTIFIC WRITING

None declared.

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