Exposure to Electronic Screens and Children's Anxiety and Behavior During Dental Treatment

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ABSTRACT

Purpose: The purposes of this study were to (1) assess the relationship between exposure time to electronic screens and children's anxiety and behavior manage ment problems during dental treatment; and (2) evaluate the effect of the underlying confounding factors.

Methods: A cross-sectional study of 95 five- to eight-year-old patients was conducted. The study consisted of two sessions, one week apart. During the first visit, the socioeconomic status of the family was assessed, and examination and preventive measures were performed. One of the parents was asked to report screen time use by the child over a one week period using a valid questionnaire. In the second visit, dental anxiety and behavior management problems were assessed using the Clinical Anxiety Rating Scale and Frankl Behavior Scale, respectively.

Results: Anxiety and behavior management problems during a dental visit were significantly correlated with the participant's total exposure hours to electronic screens. Exposure to violent media was significantly different between participants with and without behavior management problems. Boys showed a significant higher exposure to violent media than girls.

Conclusion: Anxiety and behavior problems in a dental visit correlate to total hours of exposure to electronic screens. Therefore, limiting a child's screen exposure should be considered. **(J Dent Child 2019;86(3):139-44)**

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Awareness of the importance of physical activity during childhood to prevent the development of noncommunicable diseases (NCD), such as diabetes, cardiovascular disease, cancer, overweight, and depression, is increasing worldwide.[1] According to the 2009 recommendations of the World Health Organization,[2] five- to 17-year-old children should have at least one hour daily of moderate to vigorous intensity physical activity.

Nowadays, children spend most of their free time watching television, playing video games, and surfing the internet, all considered sedentary behaviors.[3,4] Sedentary time is defined as "the behavior that requires little or no energy expenditure and occurs in a lying or sitting position."[5] It is considered a direct cause for multiple diseases in childhood, including diabetes and obesity.[6] Tremblay et al.,[7] in their systematic review of sedentary behavior and health indicators in school-aged children,

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found a strong relationship between high sedentary time and NCDs. One of the most important aspects of sedentary behavior is screen time (**ST**), which is the time spent by children watching TV or playing video games on a computer, tablet, or smartphone.[8] Heavy exposure time to electronic screens proved to have an effect on children's mental health, concentration span, and school performance.[9] Parkes et al.,[10] in their longitudinal study about the relationship between TV, electronic games, and children's psychological adjustment, stated that heavy ST, especially TV time, has an adverse effect on children's academic progress and mental and physical health. Moreover, other studies found an association between heavy exposure time to electronic screens and high rates of fear, anxiety, and negative emotions.[11,12] Therefore, the American Academy of Pediatrics (**AAP**) issued guidelines for exposure to electronic screens in order to limit their undesirable effect on children's health.[13]

Children's emotions can be evoked by the media they are exposed to, as they respond directly to emotionally-charged media content.[14] Violence can have a great impact on the psychological behavior of children.[15] Violence is considered a risk factor for aggression, behavioral changes, and development of anxiety-related disorders, which can lead to dental anxiety (**DA**) and behavior management problems (**BMP**).[14,16] The AAP created a new term, "healthy media diet," which suggests screen consumption in moderation and consuming more educational and less harmful content, taking into consideration the age of the consumer. [17]

DA is a common problem that may affect patient's management during a dental visit; it is one of the reasons why children often refuse to visit the dentist. It appears with anticipated threat situations that are not realistic. BMP, meanwhile, is related to realistic dental situations and is characterized by disruptive and uncooperative behavior, leading to delay of treatment or making it impossible to be completed.[16] Children with DA and BMP cannot be treated as a single entity, since their behavior depends on their parents and the surrounding environment.[18] Moreover, children's age, sex, and socioeconomic status (**SES**) might affect their behavior in the dental setting.[19] Livingstone et al.[20] and Krist et al.,[21] concluded that low SES was associated with high ST. On the other hand, Jamali et al.,[22] in their study about the relationship between Iranian children's media habits and their anxiety and behavior during dental treatment, concluded that children who came from low SES had significantly lower ST than children who came from middle and high SES. They also found that children with DA belonged to high and middle SES.

Exposure time to electronic screens may play a role in the psychology of children during dental treatment. Few studies have assessed if there is a relationship between children's DA/BMP during dental treatment and ST watching television (**TV**) and using smartphones. Therefore, the purpose of this study was to test whether screen time is related to children's anxiety and BMPs during dental treatment.

METHODS

The present cross-sectional study was carried out in the Department of Pediatric Dentistry and Dental Public Health, Alexandria University, Alexandria, Egypt, after the approval of the university's Research Ethics Committee. The estimated sample size was 95 patients with 80 percent power (type II error, 0.2) to detect a statistically significant difference of three percent between the children with anxiety, using a two-sided chi-square test with a confidence of 95 percent (two-sided type I error of 0.05) and to account for drop outs.[23]

All the participants enrolled in this study were five to eight years old, recruited in the outpatient clinic of the department by the principal investigator and presented with carious primary molars without pulpal involvement. They also had no previous experience of intraoral injections, which could adversely affect patient's behavior during treatment.[24] At least one of their parents had to be literate (i.e., able to read and write to read the questions, understand and write the answers)and willing to participate in the study. Medically compromised children, children with special needs, and children with previous hospitalization were excluded because past unpleasant experiences could make the child more afraid and have problems coping with stress.[25] Children with definitely negative behavior or with specific phobia related to dental setting were also excluded. The aim of the study was explained to the parent, and a signed informed consent was obtained prior to treatment. One of the parents was present and observed the sessions passively. This study consisted of two sessions, one week apart, and included two pediatric dentists (the operator and the researcher) from the Pediatric Dentistry and Dental Public Health Department of Alexandria University. The operator was the same for all participants to gain the patient's confidence and cooperation. The researcher passively observed the dental procedures and directly rated DA/BMP according to their scales. The researcher was trained before starting the study to ensure accuracy of the rating.

A pilot study of 10 participants was performed before starting the study, videotaped, and revised by the researcher and statistician to assess the intraexaminer reliability of the Clinical Anxiety Rating Scale (**CARS**)[26] and Frankl Rating Scale (**FRS**)[27] using a weighted Kappa test; the score was 85 percent for both CARS and FRS. Intraexaminer reliability was then assessed; these participants were not included in the study.

Socioeconomic status of the family was assessed using Fahmy and Elsherbini's scale,[28] as it is the most common and simple scale used in the field of health research in Egypt. It included parent's educational level, work, income, family size, crowding index, and sanitation. The possible total score is 46. Families with a score up to 38 were considered high SES; a score of 34.5 to 38 was middle SES; between 23 to 34.5 was low SES; and less than 23 was very low SES.

One of the participants' parents, usually the mother, was given a questionnaire that was developed based on previous studies[22,29,30] at the first visit. Questions included type of media used by the child (TV, smartphones, video games, computers); type of watched content, including violent or nonviolent (violent video games; violent sports like boxing and wrestling; movies and cartoons containing guns); exposure time to TV, smartphones, video games, and computers; and when the child started using media. Twenty participants were asked to answer the questionnaire as a pilot study to ensure the clarity of the Arabic translation of the questions. No changes were necessary and these participants were not included in the study.

Children's DA and BMP were recorded during the dental procedure at the second visit. Dental anxiety was evaluated using CARS.[26] Children with a score of four or five were categorized as having DA. Children's BMP were rated using FRS.[27] Children with a grade one or two behavior profile on the Frankl scale were categorized as having BMP.

During the first visit, a dental examination and fluoride application were performed to give the participant a positive expectation of the upcoming dental visit. During the second visit, the tell-show-do behavior management technique was used for all patients. All children enrolled in the study received an intraoral injection after topical anesthetic application (benzocaine 20 percent, Pharma Research Inc., Miami, Fla., USA). Teeth were isolated with a rubber dam. Each carious lesion was removed, and the proper restoration was accomplished. The whole procedure was completed within 15 to 20 minutes. The two visits were conducted by the same operator for all patients. Based on the rating criteria, the researcher passively observed and rated the children's DA and behavior during the treatment using CARS[26] and FRS,[27] respectively.

Data were analyzed using Statistical Package for the Social Sciences (SPSS) 25.0 software (IBM Corp., Armonk, N.Y., USA). Normality was checked using descriptive statistics, plots, and the Kolmogorov-Smirnov test. Data were analyzed using student's *t* test, the Mann-Whitney U test, Pearson's chi-square test, and Fisher's exact test. Multivariable logistic regression models were created, and odds ratio (**OR**) and 95 percent confidence intervals (**95% CI**) were calculated. The level of statistical significance was set at 0.05.

RESULTS

A total of 95 patients were enrolled in this study, with a mean age of 6.45±1.10 (standard deviation) years; boys represented 49.5 percent, and girls comprised 50.5 percent. According to the socioeconomic scale used, 43.2 percent of participants were of high SES, 26.3 percent were of middle SES, 23.2 percent were of low SES, and 7.4 percent belonged to very low SES. The participants used various types of media: 98.9 percent used TV; 85.3 percent used smartphones; 42.1 percent used a computer; and 21.1 percent used videogames. Participants exposed

Table 1. Dental Anxiety in Relation to Different Types of Media and Exposure to Violent Media

Variables		Dental anxiety N (%)		*P*-value (*P*<.05)
		No	Yes	
TV	No	1 (100)	0 (0)	1.00*
	Yes	72 (76.6)	22 (23.4)	
Computer	No	43 (78.2)	12 (21.8)	Chi-square $_{(df=1)}$=0.132† 0.71
	Yes	30 (75)	10 (25)	
Smartphone	No	12 (85.7)	2 (14.3)	0.51*
	Yes	61 (75.3)	20 (24.7)	
Video games	No	59 (78.7)	16 (21.3)	0.55*
	Yes	14 (70)	6 (30)	
Violent media exposure	No	51 (82.3)	11 (17.7)	Chi-square $_{(df=1)}$=2.942† 0.08
	Yes	22 (66.7)	11 (33.3)	

*** Fisher's exact test.** **† Pearson's chi-square test.**

Table 2. Behavior Management Problems in Relation to Different Types of Media and Exposure to Violent Media

Variables		Behavior management problems N (%)		*P*-value (*P*<.05)
		No	Yes	
TV	No	1 (100)	0 (0)	1.00*
	Yes	72 (76.6)	22 (23.4)	
Computer	No	42 (76.4)	13 (23.6)	Chi-square $_{(df=1)}$=0.023† 0.87
	Yes	30 (75)	10 (25)	
Smartphones	No	12 (85.7)	2 (14.3)	0.50*
	Yes	60 (74.1)	21 (25.9)	
Video games	No	59 (78.7)	16 (21.3)	0.24*
	Yes	13 (65)	7 (35)	
Violent media exposure	No	51 (82.3)	11 (17.7)	Chi-square $_{(df=1)}$=4.070† 0.04‡
	Yes	21 (66.7)	12 (33.3)	

*** Student's t test.** **† Mann-Whitney U test.**
‡ Statistically significant difference.

Table 3. Dental Anxiety/Behavior Management Problems in Relation to Electronic Screen Exposure Factors

Electronic screen exposure factors	Dental anxiety Mean±(SD)			Behavior management problem Mean±(SD)		*P*-value (*P*<.05)
	No	Yes		No	Yes	
Age at start of watching electronic screens	2.73±1.11	2.34±0.80	t=1.533[a] 0.12	2.75±1.11	2.30±0.80	t=1.778* 0.07
Total years of electronic screens exposure	3.81±1.56	3.83±1.42	t=0.052[a] 0.95	3.78±1.56	3.90±1.43	t=0.314* 0.75
Total hours of electronic screens exposure per day	3.17±1.83	6.72±2.14	$Z_{(MW)=}$4.596[b] <0.001*	3.10±1.75	6.78±2.10	$Z_{(MW)}$=5.721† <0.001‡

* Student's t test. † Mann-Whitney U test. ‡ Statistically significant difference.

to violent media comprised 34.7 percent. Using CARS, the percentage of DA among participants was 23.2 percent; the percentage of BMP using FRS was 24.2 percent.

There was no statistically significant difference in age, sex, and SES among participants with and without DA (*P*=0.14, *P*=0.95, *P*=0.49, respectively), nor for BMP (*P*=0.18, *P*=0.76, *P*=0.73, respectively).

The use of different types of media and exposure to violent media were not statistically significantly different between participants with and without DA (Table 1). For BMP in relation to different types of media, results did not show a statistically significant difference. However, exposure to violent media was statistically significantly different between participants with and without BMP (*P*=0.04; Table 2).

The relationship between sex, SES, and exposure to violent media showed that 66.7 percent of boys had a statistically significant higher exposure to violent media compared to girls (*P*=0.01). However, there was no significant relationship between SES and violent content (*P*=0.053).

Participants with DA/BMP had a statistically significantly higher total amount of exposure to electronic screens compared to those without DA/BMP (*P*<0.001, Table 3). The age when children started watching electronic screens and the total years of exposure to electronic screens were not statistically significant between participants with and without DA/BMP.

Multivariable logistic regression models were performed to ascertain the effect of sex, SES, total hours of electronic screen exposure, total years of electronic screen exposure, and exposure to violent media on the likelihood that the participants have DA and BMP. Results confirmed that DA increased with a rise in the total hours of exposure to electronic screens (OR=2.53; 95% CI = 1.63 to 3.93; *P*=0.001). The model correctly classified 91.6 percent of participants. The overall logistic regression model was statistically significant (chi-square $_{(df=7)}$ = 46.75; *P*<0.001).

Additionally, BMP increased with a rise in the total hours of exposure to electronic screens (OR = 2.64; 95% CI=1.69 to 4.130; *P*=0.001). The model correctly classified 92.6 percent of participants. The overall logistic regression model was statistically significant (chi-square $_{(df=7)}$ = 49.45; *P*<0.001).

DISCUSSION

This study aimed to assess the relationship between exposure time to electronic screens and children's DA/BMP during treatment and to evaluate if the underlying confounding factors (age, sex, SES, type of media used, and exposure to violent media) had an effect on DA and BMP. TV was the most used media type among participants followed by smartphones, as they are the most available media type at home and the easiest to use. Participants highly exposed to media were likely to have DA and BMP, with no significant difference among the various types of media used. This can be explained by Bandura's social learning theory,[31] which assumes that learning is based on responses to environmental stimuli. Based on this theory, prolonged exposure to media gives a negative model to children, leading to undesirable effects.[32]

Several studies have highlighted the undesirable effect of prolonged media exposure on the behavior, social life, academic progress, and psychological health of children.[10-12] Our findings also agree with Jamali et al.,[22] who found a statistically significant correlation between children's DA/BMP and daily amount of media use. Age and sex did not show any significant correlation with DA/BMP, which was in agreement with Parkes et al.[10] and Kilinç et al.[33] Moreover, SES did not show a significant difference among participants with and without DA/BMP, which agreed with Kroniņa et al.[34] On the other hand, Mishra et al.[35] and Jamali et al.[22] found that SES adversely affected a patient's behavior, with a significant correlation between SES and

children's DA. This variation in the results could be explained due to the different correlations used.

Exposure to violent media had no statistically significant correlation with DA in our study. However, it showed a significant correlation with BMP, as children learn violence via observation. Watching the behaviors of others may lead to aggression, desensitization to violence, and multiple behavior problems.[35] This result was in agreement with Coker et al.[36] A limitation of our study was that DA and BMP have multifactorial etiology; additionally, not all of these factors were included in this study due to the large number of variables. Furthermore, parents may have not recalled correctly when children started using screen time and may have not reported its amount accurately. Future studies should investigate other factors affecting DA/BMP. Within the limitation of the present study and based on the previous data, the hypothesis that exposure to electronic screen time affects children's DA and BMP was proven. Therefore, limiting children's time of exposure to electronic screens should be considered.

CONCLUSIONS

Based on the results of this study, the following conclusion can be made:

1. Although total hours of exposure to electronic screens were significantly correlated to children's anxiety and BMP during a dental appointment, it cannot be considered a direct cause, as DA/BMP have multi-factorial etiology.
2. Exposure to violent media had a negative effect on children's behavior; however, it did not show an effect on their anxiety.

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