Original Article

Investigating The Behavioral Changes In 3-6-Year-Old Children Receiving General Anesthesia For Dental Treatment

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Abstract

Introduction: General anesthesia is one of the ways to control the behavior of uncooperative and disabled children with dental fear. Also, the effect of general anesthesia on the dimensions of behavioral problems in children is still under question. Thus, the present study aims to investigate behavioral changes in 3-6-year-old children receiving general anesthesia for dental treatment.

Methods: This descriptive-analytical and cross-sectional study investigated 70 children aged 3 to 6 receiving anesthesia for dental treatments. The desired data were collected using the PBQ (Preschool Behavioral Questionnaire) and by the parents one day before the treatment and 40 days after the treatment. After collecting the data and entering them into Spss24 software, they were analyzed at a 5% error level using a t-test, paired t-test, and Pearson and Spearman correlation coefficients.

Results: In this study, 40 boys (57.1%) and 30 girls (42.9%) with a mean age of 4.036±0.98 years and a minimum age of 3 years, and a maximum age of 6 years participated. The results revealed a significant difference between children before and after general anesthesia regarding aggressiveness and inattention ($p=0.002$). However, no significant difference was observed between children's isolation during the studied times ($p=0.727$). No significant difference was observed between the two stages before and after applying anesthesia regarding tooth restoration and overall behavioral problems ($p>0.05$).

Conclusion: Anesthesia in non-cooperative children as a complication will increase behavioral disorders in children. Hence, it is better to use it only in children who do not cooperate enough for outpatient treatment.

Keywords: Behavioral problems, General anesthesia, Dental practices, Children.

INTRODUCTION

The hospital setting is stressful for children who undergo surgery (1). About 4 million children undergo surgery annually in the United States. Anesthesia for these children is a necessary part of a surgical procedure (2). Based on some studies, 16% to 34.4% of children experience at least one behavior disorder after surgery based on the criteria for grading behavioral disorders after hospitalization. These results change after surgery (2, 3). Postoperative pain as a factor predicting the development of behavioral disorders in children has been discussed among different researchers and conflicting reports have been presented in this regard (3, 1-5). From a demographic viewpoint and its impact on behavioral disorders, studies have revealed that younger age, urban life, and multiple children increase the rate of behavioral disorders. Having mothers without academic education reduces the negative impact on the child's general anxiety after the operation (3).

Another criterion, called CBCL (Children Behavioral Checklist), has been defined for the child's social skills and emotional-behavioral disorders. A high score in this criterion before operation directly affects the final score of behavioral disorders (6). A study conducted on two groups with a history of frequent hospitalizations with a difference in receiving or not receiving anesthesia revealed that both groups reported a high score of the CBCL criterion due to the chronicity of their disease, and there was no significant difference between the two groups (7). In a study conducted about D-Clinic and more hospitalizations (8), being hospitalized for more than two

nights after tonsillectomy surgery increased the possibility of developing behavioral disorders in children (1,9) Also, it was found that prescribing midazolam to reduce preoperative anxiety positively affect the behavioral disorders after surgery (10).

To prevent postoperative pain, which negatively affects behavioral disorders after general anesthesia in recent studies, a useful solution is to educate the parents and provide suitable analgesics for the child (3,11). Some studies have examined the type of surgery and its effect on the child's behavioral problems. They have shown that among the types of surgery performed, tonsillectomy causes more behavioral disorders in children after surgery (3). Also, even short-term anesthesia alone negatively affects the child's brain function and has harmful results on the development of the child's emotions, social behavior, and cognitive process. Patients who have received deeper anesthesia are more likely to show negative psychological consequences after the surgery (12). A study reported that children over 4 years of age who have received anesthesia in the dentist's office are more likely to receive anesthesia services and dental procedures than in hospital conditions. However, it is better not to receive multiple anesthesias due to the damage it brings to the child's learning (13, 14). Performing dental procedures under general anesthesia reduces the child's anxiety about subsequent visits to the dentist (15). Another study revealed that parents of children have a higher tendency to perform dental procedures under anesthesia for their children (16). The success of dental procedures under anesthesia is more than deep sedation (17).

Children's dentistry aims to prevent and treat oral diseases in children and adolescents as the basis of optimal oral health during their life. Maintaining the health of the oral environment and the patient's ability and motivation to use dental services are the two main ways to achieve this goal. Children and adolescents are greatly different regarding maturity, personality, mood, and emotions. Hence, they are different regarding vulnerability and ability to tolerate the conditions of dental treatment. Thus, pediatric dentists need a set of psychological solutions and methods to treat children with behavioral problems such as dental fear. A visit to the dentist is stressful for many children since it is accompanied by several factors that trigger stress, such as seeing an unfamiliar person, strange sounds and tastes, being forced to lie down on the dentist's chair, discomfort, and even pain. The child's non-cooperation and reactions are caused by the fear of common daily events in a dental office. Dental fear has been reported in about 5 to 20 percent of children (18).

Dental fear is a significant factor in causing health problems in children. It is considered one of the major problems in pediatric dentistry (20,19). Dental fear in children is one of the difficulties faced by families and the community of dentists, especially dentists who deal with children. The studies conducted in this regard have reported various variables for anxiety and dental fear in children. Some of them include maternal anxiety, awareness of dental problems, past dental experiences (21), unknown sounds, and strange and unfamiliar smells (22). Regardless of anxiety and fear, these feelings have consequences for the patient and the dentist, so dental anxiety can result in non-observing oral health (23) and the occurrence of problems such as pain, abscess, and loss of milky and permanent teeth. Anxiety, even at low levels, can cause irregular visits and a lack of follow-up (24). This anxiety causes many problems such as sleep disorder, negative thoughts, and low self-confidence (25). There are various techniques to control dental anxiety, such as using sedative and hypnotic drugs (26), behavior control methods (27), and a combination of both methods. Additionally, the use of aromatherapy methods has been effective in controlling anxiety in some cases (28). Several studies have been conducted regarding medical anesthesia. A significant number of these studies are related to receiving anesthesia in children. Studies have shown that it is necessary to be aware of the child's behavioral characteristics to provide dental services in this age group so the number of complications after dental procedures is greatly reduced.

Moreover, awareness of these behavioral characteristics minimizes non-cooperation during treatment in children undergoing anesthesia and they can manage their behavioral disorders more easily in the next visits to the dental treatment staff. Given what was stated, the present study investigated the behavioral changes in 3-6-year-old children receiving general anesthesia for dental treatment.

Methods

The present study was a cross-sectional and descriptive-analytical conducted on children receiving anesthesia at Dr. Torabinejad Dental Center in Isfahan in 2020-2021.

In this regard, 70 children were included in the study using the convenience sampling method based on the following inclusion and exclusion criteria:

-Inclusion criteria
1. The person is a new case (not received dental treatment or anesthesia until now)
2. Being 3-6 years old
3. Need dental treatment services (such as pulpotomy and stainless steel coating, tooth extraction, and restorative treatments)
4. The person should not undergo anesthesia again and should not be hospitalized during the 40 days of the study.
5. The person does not undergo dental treatments again during the 40 days of the study.
6. The child's parents should be with the child before receiving anesthesia until the child is conscious and be with him or her when the child wakes up.
- Exclusion criteria
1. The patient's parents are not willing to complete the questionnaire for some reason
2. The child has previously known behavioral disorders.
3. Any acute mental or physical injury (accident, death of relatives, etc.) in the last 30-40 days that has caused changes in the child's normal behavior and daily works
4. Referring for preventive treatments
5. Having a known genetic disease.
6. Having severe toothache and abscess
The code of ethics was received from the Ethical and Research Committee of Medical Sciences of Isfahan under the code of IR.MUI.RESEARCH.REC.1400.141. After obtaining the parents' consent for the research process, the PBQ (Preschool Behavioral Questionnaire) was completed one day before receiving anesthesia and the treatment process at Torabinejad Center. The informed consent to participate in the present study was completed in person on the day of receiving anesthesia and dental services. The reason for completing the PBQ questionnaire one day before receiving anesthesia and dental services was better cooperation of parents. Anesthesia was induced in children by injection of sodium thiopental, atracurium, and fentanyl, and anesthesia was maintained with O2/NO2 and Propofol. Since 40 days had passed after completing the initial questionnaire, parents were asked to answer the questionnaire questions again via phone. Parents were informed about the confidentiality of the information at each stage of completing the questionnaire.

Research tools

The patient's data collection form included the patient's age, gender, the time of the visit, the type of dentist's operation, and the PBQ (Preschool Behavioral Questionnaire). It was developed by Saatchi et al. in 2016. The preschool behavioral questionnaire includes 27 items. It is scored on a 3-point Likert scale, in which score 0 represents the option "never", score 1 represents the option "sometimes", and score 2 represents the option "most of the time". The higher score of the subject in this questionnaire means that he or she has more behavioral problems. The minimum score for behavioral problems is 0 and the maximum score for behavioral problems is 54. This questionnaire has three sections:
1- Aggressiveness
2- Inattention and childish behaviors
3- Isolation and anxiety
Finally, the results were analyzed at two descriptive and analytical levels. At the descriptive level, frequency distribution tables and related graphs were first drawn. At the inferential level, the analyses were performed using a t-test in SPSS 24 software.

Results

This study was conducted on a sample of 70 people to investigate and compare the behavioral problems of children receiving anesthesia in the age group of 3-6 years. The parents of the children completed the questionnaire in two stages, one day before receiving anesthesia and 40 days after receiving anesthesia. In this regard, 40 boys (57.1%) and 30 girls (42.9%) with a mean age of 4.036±0.98 years and a minimum age of 3 years, and a maximum age of 6 years participated.

Table 1-Comparison of the mean score of children's behavioral problems based on gender

Studied time	Gender	N	Mean	SD	t-test)p-value(
One day before receiving anesthesia	Boy	40	12.07	6.75	0.104
	Girl	30	12.36	6.89	
40 days after receiving anesthesia	Boy	40	14.29	7.67	0.145
	Girl	30	14.56	7.66	
Score changes on one day before and 40 days after receiving anesthesia	Boy	40	2.22	5.22	0.985
	Girl	30	2.2	6.17	

According to Table 1, the score of behavioral problems before receiving anesthesia in boys (12.07±6.75) was reported to be lower than that of girls (6.89±12.36). The t-test did not show a significant difference between the scores of behavioral problems before receiving anesthesia based on the gender of the children (p=0.104). Also, the score of children's behavioral problems 40 days after receiving anesthesia was reported to be higher in boys (14.56±7.67) than that in girls (7.66±14.56). The t-test did not show a significant difference between the scores of children's behavioral problems 40 days after receiving anesthesia based on their gender (p=0.145). Also, the changes in the score of behavioral problems 40 days after receiving anesthesia were the same among the boys (5.22±2.22) and the girls (6.17±2.2). Also, the t-test did not show a significant difference between the scores of children's behavioral problems 40 days after receiving anesthesia based on their gender (p=0.985(

Table 2- Relationship between children's behavioral problems score and age

Studied time	Age	N	Mean	SD	Pearson correlation coefficient	p-value
One day before receiving anesthesia	3	21	14.76	6.80	0.104-	0.393
	4	27	14.14	7.09		
	5	13	12.92	7.82		
	6	9	12.66	5.80		
40 days after receiving anesthesia	3	21	16.76	7.88	0.006	0.962
	4	27	15.29	7.69		
	5	13	16.53	8.15		
	6	9	16.55	8.03		
Score changes on one day before and 40 days after receiving anesthesia	3	21	2.00	4.73	0.135	0.263
	4	27	1.15	5.99		
	5	13	3.61	5.97		
	6	9	3.88	5.86		

The score of behavioral problems before receiving anesthesia in children aged 3 years (14.76 ± 6.80) was higher than in other ages. Also, the score of behavioral problems 40 days after receiving anesthesia in children aged 3 years (16.76 ± 7.88) was higher than in other ages. Pearson's correlation coefficient did not show a significant relationship between age (3 to 6 years), the score of behavioral problems the day before receiving anesthesia, the score of children's behavioral problems 40 days after receiving anesthesia, and the changes in the score of behavioral problems before receiving anesthesia and 40 days after receiving anesthesia (Table 2).

Table 3- The mean and standard deviation of children's aggressiveness, isolation, and inattention scores before and after general anesthesia

Variable	Studied time	N	Mean	SD	Paired t-test)p-value(
Aggressiveness	One day before receiving anesthesia	70	8.17	4.63	0.002
	40 days after receiving anesthesia	70	9.85	4.87	
Isolation	One day before receiving anesthesia	70	3.02	2.12	0.727
	40 days after receiving anesthesia	70	2.94	2.15	
Inattention	One day before receiving anesthesia	70	2.6	1.92	0.002
	40 days after receiving anesthesia	70	3.32	2.25	

Based on Table 3, a significant difference was observed between the two stages before and after receiving general anesthesia regarding aggressiveness and inattention of children based on the t-test. Children had a higher mean after anesthesia than before anesthesia (p=0.002). However, no significant difference was observed between the isolation scores of children in the studied times (p=0.727). In other words, there is no significant difference between the levels of isolation of children before and after anesthesia.

Table 4. Relationship between changes in the score of behavioral problems and the number of dental procedures

Type of dental surgery	Spearman's correlation coefficient	)p-value(
Pulpotomy, pulpectomy, and apexogenesis	0.126-	0.3
Stainless steel coating	0.052-	0.671
tooth extraction	0.005	0.964
Tooth filling	0.124-	0.308

Spearman's correlation coefficient showed no significant relationship between the number of dental procedures, including tooth extraction, pulpotomy, pulpectomy, apexogenesis, stainless steel coating, tooth filling, and behavioral problems in two stages before and after anesthesia (Table 4).

Table 5- Relationship between the changes in the scores of behavioral problems in two stages

Behavioral problems	Spearman's correlation coefficient	)p-value(
Total	0.008-	0.951
Aggressiveness	0.02	0.867
Anxiety and isolation	0.096-	0.431
Inattention	0.044-	0.718

According to Pearson's correlation coefficient, no significant relationship was observed between the total score of behavioral problems and the parameters of aggressiveness, anxiety, isolation, and inattention in the studied times (Table 5).

Discussion

The results suggest that the level of behavioral problems in children under the effect of general anesthesia was much higher compared to 40 days before receiving anesthesia. A significant difference was observed in this regard. Also, boys and girls showed the same level of behavioral problems before receiving anesthesia and 40 days after receiving anesthesia. Children's age did not affect the level of behavioral problems before receiving anesthesia and 40 days after receiving anesthesia. The parameters of children's behavioral problems evaluated in the present study included aggressiveness, isolation, and inattention. The level of aggressiveness and inattention of children increased significantly 40 days after receiving anesthesia compared to before receiving anesthesia. A significant difference was observed in this regard. However, no difference was observed between children's isolation and the level of behavioral problems before receiving anesthesia and 40 days after receiving anesthesia. Also, the type of dental surgery did not affect the children's behavioral problems.

In the study conducted by Khucheh et al. (29), behavioral changes (worsening of child's behavior) in children who received general anesthesia were more than in children who received regional anesthesia for surgery. The results revealed behavioral problems in children under general anesthesia were far worse than in other children. Therefore, the results of the present study are consistent with the results of the study conducted by Khucheh et al. However, some studies referred to differences in this regard. For example, the study by Katanemi et al. (30) found that boys show more behavioral problems since they are more exposed to various stresses. However, this study reported that the differences were not very significant. This study also reported that the positive behavioral changes may be due to the improvement in the children's medical conditions. The results of the present study are inconsistent with the results of the study conducted by Katanemi et al. since no significant difference was observed between the gender of children and the level of behavioral problems of children. Also, the performed dental procedures did not show a significant correlation with the children's behavioral problems. This difference might be due to the racial and age differences between the children examined in Katanemi's study and the present study. Based on Khucheh et al.'s studies (29), the behavior and mood of children who need hospitalization and general anesthesia for surgery worsened after surgery, which can be due to continued medical problems, being hospitalized in an unfamiliar environment, and pain.

Guney et al. (31) reported results inconsistent with the present study results. They concluded that there was no statistically significant difference between sedation methods in 3-5-year old children after treatment under general anesthesia. After intravenous sedation, dental anxiety decreased significantly. The reason for this difference in the results might be because Guney et al. examined two treatment groups of children who received two methods of intravenous sedation and general anesthesia, while children were evaluated before and after general anesthesia in the present study. Zhang et al. (32) also reported the effect of general anesthesia on children's IQ in their study and considered this treatment method effective in reducing children's IQ temporarily. Klaassen et al. (33) examined the quality of life regarding the oral and dental health of young children and dental fear after treatment under general anesthesia. They concluded that there is a significant difference between the two methods without anesthesia and general anesthesia regarding the reduction of dental fear and anxiety in children. They found that the children treated with general anesthesia had a lower level of anxiety and fear.

The results of the present study are inconsistent with the results of the studies conducted by Klaassen et al., Kaviani et al., Jabbari Far et al., and Eshghi et al. In the present study, only one group of children was investigated in two periods before and after general anesthesia. Dental practices at any level and stage negatively affect the children's mood and cause suffering and discomfort in them. However, general anesthesia will cause subsequent complications for the children. The effect of general anesthesia that has been confirmed in previous studies is due to the comparison with other children who are conscious in all stages of treatment and may have more anxiety. Fewer studies have investigated the general anesthesia method alone on the level of children's behavioral problems. It seems that the anesthesia procedures (including putting on a mask or the pain caused by the injection of anesthetic) temporarily increase the severity of behavioral problems after recovery and anesthesia are better for children who are definite cases of anesthesia and whose behavior cannot be controlled by other methods. Also, merely the number of teeth should not be an indication of anesthesia.

Conclusion

The results revealed that children had more behavioral problems after treatment using general anesthesia. A significant difference was observed between children before and after general anesthesia regarding the factors of aggressiveness and inattention. However, no significant difference was observed between them regarding the isolation factor in the studied times. Also, no significant difference was observed between the two stages before and after the application of anesthesia regarding tooth restoration and overall behavioral problems. Thus, it can be concluded that anesthesia in non-cooperative children will increase behavioral disorders in children. Hence, it is recommended to use it only in children who do not cooperate enough for outpatient treatment. It is recommended to conduct more studies on the same topic to more accurately investigate the effect of general anesthesia on the level of behavioral problems of children undergoing dental treatment.

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