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Reasons for Repeated General Anesthesia for Dental Treatments of Uncooperative Children

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ABSTRACT

Objectives: *In some cases, dental treatment of children under general anesthesia (GA) should be repeated due to treatment failures. This study evaluated the reasons leading to dental retreatment under GA in children under 12 years of age.*

Materials and methods: *In this retrospective study, the records of all children who underwent dental treatment under GA between 2011–2021 in Tabriz Dental Faculty Hospital, Iran, were collected. The records of children treated under GA for the second time or more were analyzed. Collected data included age at first treatment, mental and/or physical disabilities, type of treatments and participation in follow-up sessions. Data were analyzed using Stata SE version 17.*

Results: *In a group of 667 children who underwent general anesthesia for the first time (GA1), 41% (95% confidence interval [CI] 37.2%–44.9%) required retreatment. Among all age groups, 1-3-year-old children were more likely to require a second GA (GA2) compared to other age groups (all $P < 0.05$). Children with physical and mental disabilities were around eight times more likely to require a second GA ($P < 0.05$).*

Conclusion: *Younger age, mental and physical disabilities, no or irregular participation in follow-up sessions and treatments such as composite resin restorations or pulpotomy were factors influencing repeated dental treatments under general anesthesia.*

Keywords: age, disability, follow-up, general anesthesia, type of treatment.

INTRODUCTION

The Academy of Pediatric Dentistry defines early childhood caries (ECC) as the presence of one or more decayed, missing, or filled tooth surfaces in any primary tooth in a child 71 months old or younger (1).

Although the prevalence of dental caries in infants and children has decreased significantly in recent years, it is still one of the most common childhood diseases in many developed countries. The main etiology of ECC has not been determined (2); however, it is observed that the most affected children were living in socially and economically deprived areas and had a widespread

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infection with inappropriate eating habits, such as the frequent consumption of sweet foods and drinking milk from a milk bottle at night (2-4) .

Quick and definitive treatment of dental caries is recommended due to their damaging nature, the impact of maxillary anterior teeth on the esthetic appearance of a child (5), speech impairment, parafunctional habits, emotional problems and low self-confidence (6, 7).

The child's cooperation with the dentist is the main prerequisite for treatment. A child's lack of cooperation makes it very difficult for the dentist to perform the necessary dental treatment and ultimately decreases its success rate. To control such non-cooperative children, there are various methods which could increase their cooperation with or without medications (8-10).

Nowadays, general anesthesia (GA) plays a significant role in children's dental treatment. In addition, patients who are unable to cooperate during non-pharmacological interventions for behavior control due to their young age, mental disability or severe anxiety and fear of treatment procedures are candidates for undergoing GA for dental treatments (11-14).

In this method, since the dentist has complete control over the patient, longer treatments are possible compared to sedation with oral medications and nitrous oxide–oxygen. In addition, a completely pain-free state for the child negates the need for local anesthesia (15, 16).

In some cases, some time after subjecting a child to treatment under general anesthesia, the patient may need GA for dental procedures again and inevitably undergo dental treatments under GA several times within several months (17). Minimizing dental treatment failures is crucial due to the high cost and potential risk of general anesthesia; as a result, investigating the failure rate of restorations and other dental treatments is very important (17).

Based on data from previous studies, more than 50% of children who received dental treatment under GA need repeated treatment after 60 months (18). In addition, most of those studies have reported that children with special mental or physical impairments who received dental treatments under GA required repeated treatment under GA to a greater extent than others.

The age at the first dental treatment under GA is a significant factor affecting the repetition of children's dental treatments under GA. Sheller shows that the probability of repeating the subsequent treatment under anesthesia increases if the dental treatment under GA is performed at a younger age (17). Worthen and Mueller reported that 20% of the second dental treatments under GA in young children treated under anesthesia occurred a few months before the eruption of primary second molars, which occurred because they used to drink milk at night frequently (11). Various studies reported the need for repeated sessions of treatment under GA between 15.6 and 42 months, depending on the type of treatment under GA, not attending the follow-up sessions and child's age under two years at first treatment under GA (19-21).

Several studies have shown that the reasons for repeating dental treatments under GA could be divided into three categories (17), as follows: I) Patient-related reasons, including involvement of maxillary central incisors during the first general anesthesia; regular bottle-feeding; poor cooperation in the dental setting; and mental and physical impairments; II) Parents-related reasons, including parents who do not brush their children's teeth; poor socioeconomic status; and lack of dental visits for regular dental care; and III) Clinician-related reasons, including lack of follow-up of the patient by the medical system; lack of healthcare training by medical staff; and lack of more definitive dental treatments for patients under general anesthesia

Previous studies have shown that if pediatric dental treatments were comprehensive with regular follow-ups, the frequency of subsequent GA would be reduced. Due to inconsistency among studies, we investigated several important items such as child's age at first GA, physical-mental impairment, participation in follow-up sessions and type of treatments under GA in Tabriz Dental Faculty Hospital, Iran, for 10 years. ❑

MATERIALS AND METHODS

The present study evaluated the records of children who underwent dental treatments under GA between 2011–2021 in the Department of Pediatric Dentistry, Tabriz Faculty of Dentistry, Iran, and at least six months had passed since their treatment.

All patients recieved a comprehensive examination by an expert pedodontist with 10 years of experience. The examination procedure was

carried out on the dental unit using a dental explorer and mirror under the dental unit's light. Soft tissues of the oral cavity were examined to search for inflammation, redness, wound, fistula and abscess.

Study participants were assigned to two groups: a case group and a control one. The case group included patients who needed retreatment under GA and the control one comprised children who underwent a single treatment under GA.

Data regarding the age of the child at first GA, type of treatment and participation in dental follow-up sessions were collected from the children's records, followed by examination of the relationship between the above-mentioned items and the repetition of treatment under GA.

Statistical analyses

All analyses were conducted using Stata SE version 17 (Stata Corp., College Station, Texas 77845, USA). Data were expressed using frequencies (percentages) for categorical variables. Fisher's exact tests were used to compare the cases and controls across background variable categories. Binary logistic regressions using study groups (1: cases; 0: controls) were carried out for computing odds ratios (ORs). Goodness-of-fit for the model was assessed and confirmed by using the Hosmer-Lemeshow test. In addition, conditional logistic regressions were carried out for computing paired odds ratios (ORp) to assess the relationship between types of dental treatments and repeat dental treatments under GA. For those analyses, exact P-values were computed and P-values <0.05 were considered significant. ❑

RESULTS

The study results showed no significant differences in participants' age and gender between cases and controls (both $P > 0.05$). On the other hand, cases had significantly higher percentages of physical and mental disabilities than controls (49.6% *vs*. 30.2%); however, controls showed a significantly higher rate of participation in follow-up sessions (71.1% *vs*. 54.3%) (Table 1).

The results of logistic regression to assess the relationship between participants' profiles and the need to receive GA are summarized in Table 2. Based on age-related results, neither the trend test nor categories level tests showed a significant relationship of this variable with undergoing a GA (all $P > 0.05$). Also, there was no significant association between the gender of participants and the need to receive GA ($P > 0.05$). However, the chance to undergo a second GA was almost twice among patients with a physical and/or mental disability ($P<0.05$), while those who participated in follow-ups had around 50% less chance to need a second GA ($P<0.05$).

Table 3 summarizes the logistic regression results assessing the relationship between disability, age and follow-up, and repeated dental treatment under GA (having a second GA). There was a significant trend to have a lower chance of a second GA by age ($P < 0.05$), so rising each age category decreased the chance of the second GA

TABLE 1. Comparison of participants' profiles between cases and controls

Variables	Cases (n=276)		Controls (n=391)		P-value#
	Frequency	Percentage	Frequency	Percentage	
Age (years)					
1-3	120	43.5	167	42.7	
3-6	96	34.8	145	37.1	0.351
6-9	36	13.0	58	14.8	
9-12	24	8.7	21	5.4	
Gender					
Female	148	53.6	213	54.5	0.828
Male	128	46.4	178	45.5	
Physical and mental disabilities					
Yes	137	49.6	118	30.2	<0.001
No	139	50.4	273	69.8	
Refer to follow-up					
Yes	150	54.3	278	71.1	<0.001
No	126	45.7	113	28.9	

#Fisher's exact test; P-values for significant results are shown in bold.

TABLE 2. Logistic regression analysis of factors that affect the need for general anesthesia

Variables	OR (95% CI)	P-value
Age (years)	1.05 (0.89-1.25)[T]	0.565[T]
1-3	Reference	---
3-6	0.92 (0.65-1.31)	0.645
6-9	0.86 (0.54-1.39)	0.548
9-12	1.59 (0.85-2.99)	0.149
Gender		
Female	Reference	---
Male	1.03 (0.76-1.41)	0.828
Physical and mental disabilities		
Not have	Reference	---
Have	2.28 (1.66-3.14)	<0.001

OR: odds ratio for the effect size of relationship of factors with being case; CI: confidence interval; T: trend effect across ordered categories of variables.
P-values for significant results are shown in bold.

by 62%. In addition, age category level tests showed a significant decrease in the chance of experiencing a second GA compared to the 1–3 age group (all P <0.05), so that 3–6, 6–9, and 9–12 age categories had 58%, 87% and 93% lesser chance of repeated GA, respectively, compared to the 1–3 age group. In addition, participants with physical and mental disabilities were around eight times more likely to have a repeated GA (P <0.05). Furthermore, referring to follow-up was significantly correlated to a second GA (P <0.05).

Table 4 shows the comparisons of types of dental treatments under GA between cases and controls. According to our findings, controls had significantly more frequently received sealant therapy, pulpectomy and extraction (all P <0.05). However, the cases had composite resin restorations and pulpotomy (P <0.05). On the other hand, there were no significant differences in amalgam restoration and SSC (P >0.05).

TABLE 4. Comparison of types of dental treatments under general anesthesia between cases and controls

Variables	Cases (n=276)	Controls (n=391)	P-value[#]
Sealant therapy			
No	248 (89.9)	318 (81.3)	0.002
Yes	28 (10.1)	73 (18.7)	
Composite repair			
No	133 (48.2)	326 (83.4)	<0.001
Yes	143 (51.8)	65 (16.6)	
Amalgam restoration			
No	174 (63.0)	235 (60.1)	0.442
Yes	102 (37.0)	156 (39.9)	
SSC			
No	210 (76.1)	298 (76.2)	0.520
Yes	66 (23.9)	93 (23.8)	
Pulpotomy			
No	205 (74.3)	332 (84.9)	0.001
Yes	71 (25.7)	59 (15.1)	
Pulpectomy			
No	240 (87.0)	303 (77.5)	0.002
Yes	36 (13.0)	88 (22.5)	
Extraction			
No	221 (80.1)	283 (72.4)	0.023
Yes	55 (19.9)	108 (27.6)	

#Fisher's exact test
Data are expressed using n (%); P-values for significant results are shown in bold.

Considering the types of dental treatments and repeating of dental treatment under GA, the rate of composite resin restorations and pulpotomy was lower among participants who needed those procedures when experiencing the second GA (around 60% and 40% less, respectively). However, the associations were not significant for other types of dental treatments (all P >0.05) (Table 5). ❑

DISCUSSION

In recent years, pediatric dental treatments under GA have increased (22). Therefore, awareness of factors involved in the success rate of such treatments can improve the survival of den-

TABLE 3. Results of logistic regression assessing the relationship between disability, age and follow-up, and repeat dental treatment under general anesthesia

Variables	First GA	Second GA (for cases only)			
	Cases (n=276)	Yes	No	OR (95% CI)	P-value[#]
Age (years)				0.38 (0.28-0.52)[T]	<0.001[T]
1-3	120 (43.5)	96 (80.0)	24 (20.0)	Reference	---
3-6	96 (34.8)	60 (62.5)	36 (37.5)	0.42 (0.23-0.77)	0.005
6-9	36 (13.0)	12 (33.3)	24 (66.7)	0.13 (0.05-0.29)	<0.001
9-12	24 (8.7)	5 (20.8)	19 (79.2)	0.07 (0.02-0.19)	<0.001
Physical and mental disabilities					
No	139 (50.4)	30 (27.5)	109 (72.5)	Reference	---
Yes	137 (49.6)	93 (67.9)	44 (32.1)	7.68 (4.47-13.18)	<0.001

GA: general anesthesia; OR: odds ratio; CI: confidence interval;
T: trend effect across ordered categories of variables.
Data are expressed using n (%).
P-values for significant results are shown in bold.

TABLE 5. Results of conditional logistic regression assessing the relationship between types of dental treatments and repeat dental treatment under general anesthesia

Variables	First GA	Second GA	ORp (95% CI)	Exact P-value
Sealant therapy				
No	248 (50.9)	239 (49.1)	Reference	---
Yes	28 (43.1)	37 (56.9)	1.32 (0.79-2.24)	0.321
Composite repair				
No	133 (37.9)	218 (62.1)	Reference	---
Yes	143 (71.1)	58 (28.9)	0.41 (0.29-0.55)	<0.001
Amalgam restoration				
No	174 (52.9)	155 (47.1)	Reference	---
Yes	102 (45.7)	121 (54.3)	1.19 (0.90-1.56)	0.228
SSC				
No	210 (50.6)	205 (49.4)	Reference	---
Yes	66 (38.2)	91 (61.8)	1.38 (0.99-1.92)	0.055
Pulpotomy				
No	205 (46.7)	234 (53.3)	Reference	---
Yes	71 (62.8)	42 (37.2)	0.59 (0.39-0.88)	0.008
Pulpectomy				
No	240 (51.9)	222 (48.1)	Reference	---
Yes	36 (40.0)	54 (60.0)	1.50 (0.97-2.35)	0.073
Extraction				
No	221 (50.7)	215 (49.3)	Reference	---
Yes	55 (47.4)	61 (52.6)	1.11 (0.76-1.63)	0.643

GA: general anesthesia; ORp: paired odds ratio; CI: confidence interval.
Data are expressed using n (%); P-values for significant results are shown in bold.

tal treatments and reduce the possibility of repeating them.

This study showed that 41% of all children who received general anesthesia (GA1, n=665) needed retreatment under GA. Previous studies reported a wide variation in frequency of patients requiring a second general anesthesia (GA2) procedure, ranging from 1% to 76% (23-26).

In addition, 1–3-year-old children were more likely to undergo GA2 compared to other age groups, with 120 of those subjects requiring GA2 for dental treatments. However, Schorth *et al* (27) reported that the average age of children at first GA was not significantly different from that of subjects who underwnt GA twice or more.

Concerning the effect of participation in follow-up sessions on subsequent need for dental treatment under GA, our study showed a significant difference between those who returned for dental follow-up and subjects who did not, which was in accordance with a similar study that reported an about four times higher risk of needing pediatric dental treatment under GA among children who did not attend follow-up sessions (14). Several studies investigated the importance of initial follow-up and frequent periodic visits after dental treatments under GA. Sheller *et al* (17) reported that referral for initial evaluation two weeks after the first GA was significantly lower than the control group (7% *vs*. 43%) for subjects requiring repeat treatment within two years after GA, which was a significant percentage.

Concerning the type of dental treatment and its effect on repeating treatment under GA, our study showed that composite resin restorations were significantly more frequent in the group requiring repeated treatment (143 cases). The higher technical sensitivity of restorative methods and a greater need for oral hygiene with parental supervision decreased the use of composite resin in pediatric restorative treatments under second GA. Therefore, the composite is recommended at a lower rate in restorative treatment under GA of children with extensive caries. According to a similar study, sealant therapy under GA was not performed very frequently, and its frequency was decreasing.

The present study showed that the number of extracted teeth in individuals treated under GA for the second time was not statistically significant from the number of extractions during the second GA, indicating a similar success rate for this definitive treatment. Therefore, if there is a possibility of retreatment after the first GA, it is better to consider a more definitive treatment, such as the extraction of a primary tooth with a poor prognosis, to reduce subsequent recurrences and the need for a second GA. Guidry *et al* reported that patients who received more composite resin treatments and less tooth extractions during the first GA session needed a second GA to a greater extent (26).

In addition, Osullivav and Curzon (28) reported that amalgam and composite resin restorations had a higher failure rate than SSCs (29% *vs*. 3%, respectively). A comparison of our results with those of other studies showed that restoring posterior primary teeth with SSCs under GA was the preferred method because this type of treatment may lead to a decrease in repeated treatment under GA.

Our study showed that patients in 1–3-year-old age group and those with physical and mental disabilities had more probability to undergo a second GA.

Follow-up visits were associated with a lower rate of repeat GA. It shows the importance of regular dental check-ups after the first definitive treatment under GA. Our findings also suggested that there were significant differences between the types of dental procedures received by cases

and controls. Sealant therapy, pulpectomy and extraction were more commonly performed in the control group, while composite resin restorations and pulpotomy were more frequently used in the case group. ❑

CONCLUSION

The present study shows that younger age, lack of dental follow-ups and type of dental treatment are influential factors for repeating dental treatments under general anesthesia. ❑

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Ethics approval and consent for participation: This study was conducted in accordance with the Declaration of Helsinki (2013) and approved by the Ethical Committee of the Tabriz University of Medical Sciences, Iran (Ethical code: IR.TBZMED.REC.1397.305).

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