Clinical Article

Assessment of Parental Tooth-brushing Following Instruction With Single-headed and Triple-headed Toothbrushes

Yoel S. Telishevesky, DMD[1] • Liran Levin, DMD[2] • Malka Ashkenazi, DMD[3]

Abstract: ***Purpose:*** *The purpose of this study was to evaluate the effect of toothbrush design on the ability of parents to effectively brush their children's teeth.* ***Methods:*** *Parents of children (mean age=5.1±0.75 years old) from 4 kindergarten schools were randomly assigned to receive instruction in brushing their children's teeth using a manual single-headed toothbrush (2 schools) or a triple-headed toothbrush (2 schools). The parents' ability to brush their children's teeth was evaluated according to a novel toothbrush performing skill index (Ashkenazi Index), based on 2 criteria: (1) placement of the toothbrush on each tooth segment to be brushed ("reach"); and (2) completion of enough strokes on each segment ("stay"). One month after instruction, tooth-brushing ability was re-evaluated and plaque index of the children's teeth was assessed.* ***Results:*** *One month after instruction, parents using the triple-headed toothbrush received significantly higher scores on the tooth-brushing performance index (~86%), than did those in the single-headed group (~61%; P=.001). The plaque index was significantly higher in the single-headed group (0.97±0.38) vs the triple-headed group (0.72±0.29; P<.01). The tooth-brushing performance index correlated negatively with the plaque index (P<.01).* ***Conclusions:*** *A triple-headed toothbrush promotes more consistent tooth-brushing by parents than does a single-headed toothbrush. (Pediatr Dent 2012;34:331-6) Received February 15, 2011 / Last Revision June 19, 2011 / Accepted June 21, 2011*

KEYWORDS: PREVENTION, PREVENTIVE MEASURES, ORAL HYGIENE, DENTAL PLAQUE, TOOTHBRUSHING

Meticulous plaque removal on a daily basis is important to prevent caries and gingival and periodontal diseases.[1,2] Most adults and children, however, brush only the buccal and occlusal surfaces, while the lingual surfaces remain neglected.[3] Moreover, young children generally do not have good hand-eye coordination, and the frequency, duration, and consistency of their tooth-brushing is even less than that of adults.[4,5] Therefore, children often need their parents' assistance to brush their teeth.

The manual triple-headed toothbrush (Dr. Barman "Superbrush," Dentaco AS, Haukeland, Norway; Figure 1) was designed to simultaneously clean the lingual, buccal, and occlusal tooth surfaces. Two separate studies found this toothbrush to be superior to the single-headed toothbrush in reducing plaque and gingival and bleeding indices in normal and handicapped 4- to 15-year-olds.[6,7] In a third study, results from brushing with the triple-headed toothbrush were similar to those with the single-headed toothbrush.[8] Although brushing children's teeth is a complicated task that requires the cooperation of parents and children, as well as good hand-eye coordination, the ability of parents to follow instructions and to effectively brush their children's teeth has not been evaluated.

Currently, the most accepted method for evaluating correct and effective tooth-brushing is examination of the negative outcome variables of poor performance, such as presence of plaque, caries, and gingival and periodontal diseases.[6-11] These indices, however, do not elucidate the specific problems involved in tooth-brushing nor indicate the best approach for improving outcomes. Accumulation of plaque can result from poor tooth-brushing due to: lack of hand-eye coordination; brushing too few tooth segments; not brushing each segment for enough time; or not brushing teeth at all.[12] Furthermore, the correlation between gingivitis and dental plaque that has been reported in adults[13-15] has not been detected in children.

Studies evaluating tooth-brushing performance usually assessed the total duration of tooth-brushing[13,16,17] and/or tooth-brushing performance in only a few segments of the arch.[16-18] Detailed evaluation of patients at follow-up appointments is important, however, to highlight specific tooth-brushing problems, follow progress, and improve the weak points in their performance.

The objectives of this study were to:

1. compare, at the time of instruction and 1 month later, the ability of parents to follow tooth-brushing instructions for their children using a manual single-headed toothbrush and a triple-headed toothbrush;
2. test a simple and informative index for evaluating, by direct observation, tooth-brushing performance;
3. compare the results of tooth-brushing, using 2 types of toothbrushes, immediately after instruction and 1 month later, according to the plaque index (PI).

Methods

Population. Parents of children in 4 kindergarten schools in the same neighborhood (middle to upper socioeconomic status) were asked to participate in this study. The kindergartens were randomly assigned to the 2 research groups via a coin toss. In 2 of the kindergartens, parents were instructed in brushing

Drs. [1]Telishevesky and [3]Ashkenazi are in private practices, both in Tel-Aviv, Israel; and [2]Dr. Levin is a senior lecturer, Faculty of Medicine, Technion, Israel Institute of Technology, and Senior Physician Department of Periodontology, Rambam Health Care Campus, Haifa, Israel.

Correspond with Dr. Ashkenazi at malka.ashkenazi@gmail.com



Figure 1. The 2 types of toothbrushes used in the present study: single-headed toothbrush (Paro M27, Paro, Switzerland); and triple-headed toothbrush (Dr. Barman's Superbrush Medium [small size 10.8/6.3 mm], Dentaco, AS, Haukeland, Norway).

their children's teeth using a manual single-headed toothbrush (Paro M27, Paro, Switzerland; Figure 1); in the other 2 kindergartens, parents were taught to brush their children's teeth using a manual triple-headed toothbrush (Dr. Barman's Superbrush Medium [small size 10.8/6.3 mm], Dentaco, AS, Haukeland, Norway; Figure 1). The Ethics Committee of Tel Aviv University, Tel Aviv, Israel, and the Israel Ministry of Education approved the study, and written informed consent was obtained from the parents.

Study design. At the start of the study, the basic plaque index (**PI**) of each participating child was recorded by a single dentist immediately after dyeing the teeth with disclosing solution (Red-Cote, John D. Butler Company, Chicago, Ill, USA). All teeth were evaluated for PI according to the simplified oral hygiene index, developed by Greene and Vermilion.[11] The examination was carried out in a lighted room using a dental mirror. Immediately afterward, participating parents were personally instructed by the same dentist on how to brush their children's teeth. The tooth-brushing instruction included an explanation of the purpose of brushing and a demonstration of the technique on a plastic model and on their own children's teeth.

In the single-headed toothbrush group, parents were instructed to brush according to the horizontal scrub technique[19] (ie, to brush the buccal aspect in each arch in 5 segments [anterior, 2 canines, and 2 posterior segments] and the lingual/palatal aspect in 3 segments [anterior and 2 posterior segments]). They were taught to place the toothbrush partially on the gingiva and partially on the teeth and to perform 10 back-and-forth brushing strokes on each segment.

In the triple-headed toothbrush group, parents were instructed to brush each arch in 5 separate segments (anterior, 2 canines, and 2 posterior segments), place the toothbrush on the occlusal surfaces, and perform approximately 10 back-and-forth brushing strokes on each segment.

Children who were clinically diagnosed with caries were referred for dental treatment. Parents were asked to brush their children's teeth according to the given instructions. Their performance was evaluated and scored, as detailed below. Further instructions were provided when the technique was not optimal. At the end of the first session, any visible plaque was removed by tooth-brushing.

Parents received the toothbrush they used and toothpaste (Sensodyne Digimon [1,100 ppm F], donated by Glaxosmithkline Corp, Brentford, UK) free of charge, with instructions to brush their children's teeth twice daily (morning and evening) immediately after meals with a pea-sized amount of toothpaste. After 1 month, the children's PI and the parents' tooth-brushing performance were re-evaluated.

Tooth-brushing performance skill index (Ashkenazi Index[20]). Parents' tooth-brushing performance skill was evaluated according to 2 criteria: (1) correct placement of the toothbrush on each segment (even once; "reach"); and (2) the performance of a sufficient number of horizontal strokes (8-10) in each segment ("stay"). One point was assigned for each criteria performed, according to instruction. Therefore, the maximum score for the horizontal scrub technique was 32 points (16 points for reaching the 5 buccal and 3 lingual segments in the upper and lower arches, and 16 points for sufficient strokes in each segment). The maximum score using the triple-headed toothbrush was 20 points. An overall tooth-brushing performance skill index (**TB-PS-I**) was calculated as the percentage of points achieved of the maximal possible points for the relevant technique. The instructor also recorded whether brushing was performed systematically and whether additional instructions were required.

In a pilot study, 21 adult volunteers brushed their children's teeth twice in a 1-hour interval in the presence of the same instructor. The intraexaminer reliability for scoring TB-PS-I was approximately 85% (~84% for the "reaching" and ~86% for the "staying" components). Intraexaminer reliability for the PI, based on scores from 6 adult volunteers (192 teeth, 384 surfaces), calculated from 2 assessments in 15-minute intervals, was approximately 98%.

Statistical analysis. Differences in PI and TB-PS-I between the single- and triple-headed toothbrush groups were analyzed using the Student's *t* test. The correlation between TB-PS-I and PI was analyzed using the Pearson correlation test. The chi-square test was used to analyze differences between groups regarding parent gender, previous oral hygiene instruction, the hand used for brushing, and brushing at home by the child or parent before participating in the study. The level of significance was set at 5%.

Table 1. MEAN PLAQUE INDEX (PI) VALUES AT BASELINE AND AFTER 1 MONTH IN SINGLE-HEADED TOOTHBRUSH AND TRIPLE-HEADED TOOTHBRUSH GROUPS*

Segment	Single-headed tooth brush group				Triple-headed tooth brush group			
	Baseline PI	Follow-up PI	Percentage of change	*P*-value	Baseline PI	Follow-up PI	Percentage of change	*P*-value
Total	**0.91**	**0.97**	**6.6-**	**NS**	**0.91**	**0.72**	**20.9**	**<.01**
Maxillary teeth	0.90	0.93	3.3-	NS	0.99	0.67	32.3	<.001
Mandibular teeth	0.89	0.92	3.4-	NS	0.83	0.72	13.3	NS
P-value	NS	NS	NS		<.01	NS	<.01	
Lingual	0.53	0.65	22.6-	NS	0.54	0.36	33.3	<.01
Buccal	1.26	1.20	4.8	NS	1.28	1.03	19.5	<.01
P-value	<.01	<.01	NS		<.01	<.01	NS	

* NS=nonsignificant.

Results

Study population. The study consisted of 68 parents and their children. Of them, 28 and 40 parents, respectively, received instruction on the use of a single-headed toothbrush and triple-headed toothbrush. Overall, 12 parents and their children were not included in the analysis due to lack of follow-up (5 from the single- and 7 from the triple-headed group). The demographic characteristics of participants lost to follow-up were similar to those who remained in the study until the end. One child in the single-headed toothbrush group refused to stain his teeth with disclosing solution; thus, only 22 children in this group were evaluated for PI. His parent, however, agreed to participate in tooth-brushing evaluation. Overall, the range of children's ages was 3.5 to 7 years old (mean=5.1±0.75). The difference in ages between the single-headed toothbrush and triple-headed toothbrush groups was not statistically significant; age ranges and mean ages were 3.5 to 7 years old (mean=4.9±0.86) and 4 to 6.5 years old (mean=5.2±0.63), respectively.

Socioeconomic background. Statistically significant differences were not observed between the single-headed toothbrush and triple-headed toothbrush groups in the socioeconomic parameters assessed. Mean years of parents' education were 14.7 and 14.8, respectively. At baseline, PI was negatively correlated to the parents' years of education (R=-0.41, *P*=.001). At follow-up, however, no correlation was found between PI and parents' years of education.

PI. At baseline, PI values ranged from 0.18 to 1.85 (mean=0.93±0.37), with no significant difference between groups (Table 1). One month after receiving brushing instructions, PI decreased significantly in the triple-headed toothbrush group (21% reduction, from 0.91 to 0.72, *P*<.01) and increased slightly, with no statistical significance, in the single-headed toothbrush group (from 0.91 to. 0.97, *P*>.20; Table 1). At baseline and follow-up, the PI in the buccal aspect was double that of the lingual or palatal aspects in both groups (*P*<.01; Table 1).

At the 1-month assessment, PI in the single-headed toothbrush group was significantly higher (range=0.28-1.65, mean=0.97±0.38) than in the triple-headed toothbrush group (range=0.20-1.23, mean=0.72±0.29; *P*<.01; Table 2). Reduction in the PI of the triple-headed toothbrush group was due mainly to improvements in the maxillary teeth (Table 1).

After 1 month, statistically significant differences were found in the PI between the triple-headed and the single-headed toothbrush groups for the: total primary

Table 2. MEAN PLAQUE INDEX (PI) VALUES AT 1 MONTH FOLLOW-UP IN SINGLE-HEADED TOOTHBRUSH AND TRIPLE-HEADED TOOTHBRUSH GROUPS

Segment	Single-headed	Triple-headed	Difference in PI	Percentage of difference in PI	*P*-value
Total	**0.97**	**0.72**	**0.25**	**35**	**<.01**
Maxillary teeth	0.93	0.67	0.26	39	.01
Mandibular teeth	0.92	0.72	0.20	28	>.05
Lingual	0.65	0.36	0.29	81	<.01
Buccal	1.28	1.03	0.17	17	>.05

Table 3. COMPARISON OF MEAN TOOTH-BRUSHING PERFORMANCE SKILL INDEX AND ITS COMPONENTS ("REACH" AND "STAY") BETWEEN GROUPS AT BASELINE AND AFTER 1 MONTH*

Segment	Component	Single-headed toothbrush group				Triple-headed toothbrush group			
		Baseline	After 1 month	Percentage of change	*P*-value	Baseline	After 1 month	Percentage of change	*P*-value
Total	**Total**	**78.7**	**60.9**	**23-**	**<.02**	**84.5**	**85.7**	**1**	**NS**
Mouth	Reach	88.2	73.9	16-	<.02	92.2	93.1	1	NS
	Stay	70.0	50.4	28-	NS	84	77.2	8-	NS
P-value		.001	.001			01.>	01.>		
Maxillary teeth	**Total**	**77.8**	**59.3**	**24 -**	**.01**	**88.3**	**83.6**	**5 -**	**NS**
	Reach	87.5	73.5	16-	NS	92.7	93.6	1	NS
	Stay	75.5	41.3	45-	<0.03	83.7	74.2	11-	NS
P-value		.02	.01			01.>	01.>		
Mandibular teeth	**Total**	**80.3**	**60.8**	**24-**	**<.02**	**88.4**	**86.9**	**2-**	**NS**
	Reach	93.5	73.8	21-	NS	91.3	93.8	3	NS
	Stay	75.7	37.5	50-	.02	83.8	80.2	4-	NS
P-value		<.05	>.01			.001	.01		
Lingual	**Total**	**81.6**	**57.5**	**30-**	**.02**	**84.5**	**85.7**	**1**	**NS**
	Reach	83.3	68.5	18-	NS	92.2	93.8	2	NS
	Stay	71.5	35.2	51-	NS	83.1	77.5	7-	NS
P-value		NS	02.>			01.>	01.>		
Buccal	**Total**	**75.5**	**62.7**	**17 -**	**NS**	**84.5**	**85.7**	**1**	**NS**
	Reach	92	73	21-	.04	92.2	93.8	2	NS
	Stay	77	40	48-	<.02	83.1	77.5	7-	NS
P-value		>.05	.01			01.>	01.>		

* NS=nonsignificant.

Table 4. MEAN TOOTH-BRUSHING PERFORMANCE SKILL INDEX (TB-PS-I) AT BASELINE AND AFTER 1 MONTH FOLLOW-UP IN SINGLE-HEADED TOOTHBRUSH AND TRIPLE-HEADED TOOTHBRUSH GROUPS*

Segment	TB-PS-I component	Baseline			After 1 month		
		Single-headed toothbrush group	Triple-headed toothbrush group	*P*-value	Single-headed toothbrush group	Triple-headed toothbrush group	*P*-value
Total	**Total**	**78.7**	**84.5**	**NS**	**60.9**	**85.7**	**<.01**
	Reach	88.2	92.2	NS	73.9	93.1	<.01
	Stay	70.0	84.0	NS	50.4	77.2	<.01
Maxillary teeth	**Total**	**77.8**	**88.3**	**NS**	**59.3**	**83.6**	**<.01**
	Reach	87.5	92.7	NS	73.5	93.6	NS
	Stay	75.5	83.7	NS	41.3	74.2	<.02
Mandibular teeth	**Total**	**80.3**	**88.4**	**NS**	**60.8**	**86.9**	**<.01**
	Reach	93.5	91.3	NS	73.8	93.8	NS
	Stay	75.7	83.8	NS	37.5	80.2	<.01
Lingual	**Total**	**81.6**	**84.5**	**NS**	**57.5**	**85.7**	**<.01**
	Reach	83.3	92.2	NS	68.5	93.8	NS
	Stay	71.4	83.1	NS	35.2	77.5	<.01
Buccal	**Total**	**75.5**	**84.5**	**NS**	**62.7**	**85.7**	**<.01**
	Reach	92.0	92.2	NS	73.0	93.8	NS
	Stay	77.0	83.1	NS	40.0	77.5	<.01

* NS=nonsignificant.

maxillary teeth (0.67 vs 0.93, *P*<.001); lingual aspect of the primary maxillary teeth (0.16 vs 0.70, *P*<.01); lingual aspect of the primary mandibular incisors (0.63 vs 0.92, *P*=.04); and palatal aspect of the primary maxillary right canines (0.16 vs 0.45, *P*<.05). The magnitude of differences in PI between the groups for the different segments reached 438% (0.16 vs 0.70 for the lingual aspect of the primary maxillary teeth).

The participating parent's gender and the hand used to brush (right or left) had no influence on PI or on parents' ability to brush their children's teeth, as assessed by the TB-PS-I.

TB-PS-I. At baseline, total TB-PS-I scores and component scores ("reaching" and "staying") were slightly higher, without statistical significance, in the triple-headed toothbrush group than in the single-headed toothbrush group (Table 3). In both groups, the score for "reaching" was significantly higher than for "staying" (Table 3).

One month after instruction, the score for the "reaching" component was still significantly higher than for the "staying" component in both groups (Table 3). The TB-PS-I of parents in the triple-headed toothbrush group was significantly higher than that of parents in the single-headed toothbrush group (~86 and ~61%, respectively, *P*=.001; Table 4). Similarly, the scores for the "reaching" and "staying" components of the TB-PS-I were significantly higher in the triple-headed toothbrush group than in the single-headed tooth brush group (Table 4).

At baseline, following instructions, the percentage of parents who brushed their children's teeth properly was similar in both groups. The percentage of parents needing additional instruction after the first explanation was twice as high in the single-headed toothbrush group than in the triple-headed toothbrush group (30% and 15%, respectively; *P*=.20).

At the 1-month follow-up, the percentage of parents who did not systematically brush their children's teeth was significantly higher in the single-headed toothbrush group than in the triple-headed toothbrush group (~58% and ~28%, respectively, *P*=.04). The percentage of parents needing additional instruction was more than twice as high in the single-headed toothbrush group (58%) vs the triple-headed toothbrush group (25%; *P*<.04). Similarly, the percentage of parents who were considered to "perform proper tooth-brushing" (TB-PS-I= 100%) in the triple-headed toothbrush group was more than twice as high (69%) than that of the single-headed toothbrush group (32%; *P*<.04).

No correlation was found at baseline and the 1-month follow-up between TB-PS-I and the following factors: previous instruction for tooth-brushing; who brushed the children's teeth before the study (parent or child); the hand used for tooth-brushing; and parents' gender.

Correlation between TB-PS-I and PI. At the 1-month follow-up, TB-PS-I and PI correlated negatively (r=-0.39; *P*<.01). PI also correlated negatively with each of the 2 main components of the TB-PS-I: "reach" (r=-0.33; *P*<.02) and "stay" (r=-0.33; *P*<.02).

Discussion

This study evaluated parents' performance in brushing their children's teeth, using triple- or single-headed toothbrushes, immediately after receiving instructions and 1 month later. To the best of our knowledge, this is the first study in the English language to evaluate this subject. Furthermore, a novel index for assessing tooth-brushing performance was developed and tested.

Immediately after receiving instructions for brushing with a single- or a triple-headed toothbrush, parents brushed their children's teeth with comparable skill. Those instructed with the single-headed toothbrush, however, seemed to retain less knowledge during the month-long follow-up period. This finding is supported by the observation that parents who reported receiving previous instruction in tooth-brushing performed similarly

to those who were never instructed. While Cohen et al.,[21] reported decreased PI scores 1 week after instruction with a multi-tufted brush (single-headed), the score increased during the 2.5 months after instructions, although it did not reach the baseline score.

We found that, 1 month after instruction, parents in the triple-headed toothbrush group demonstrated significantly more effective tooth-brushing, as assessed by a: higher mean TB-PS-I, compared to those in the single-headed toothbrush group; and lower mean PI, as compared to baseline and the single-headed toothbrush group. While efficient tooth-brushing with the single-headed toothbrush requires brushing approximately 2 minutes, children and adults have been shown to spend only 52 to 90 seconds brushing their teeth.[16,22,23] This length is sufficient to brush all teeth using the triple-headed toothbrush. This advantage of the triple-headed toothbrush may induce better oral hygiene in the long-term. Nevertheless, longer-term follow-up is needed to confirm this.

Previous studies have shown greater efficacy of the triple-headed toothbrush in plaque removal from the lingual and palatal aspects, areas that are more prone to gingivitis and more difficult to reach during brushing.[24] Zimmer et al.,[6] and Agerholm[25] also found that a double-headed toothbrush, as well as a triple-headed one, achieved better lingual and palatal plaque control in adults and children. This may be attributed to easier handling and reduced gag reflex stimulation with the use of this brush.

Interestingly, though the PI was negatively correlated with the educational level of the parents at baseline, there was no such correlation 1 month after instruction. This suggests that effective tooth-brushing can be taught without any relation to a person's education.

Most studies evaluating the effectiveness of tooth-brushing have considered such outcome parameters as presence of plaque,[6-8,11,14] total duration of brushing,[3,16,17] and the presence of gingivitis.[10,26] These variables, however, do not indicate which specific problems must be solved to improve brushing performance (ie, hand-eye coordination, brushing regularly but neglecting several segments, or insufficient time spent brushing each segment). Obviously, the guidance required to improve brushing performance should be tailored to each child.[27] Even the duration of brushing does not indicate the effectiveness of the technique. Often, children spend sufficient time brushing their front teeth and the occlusal surfaces of their posterior teeth, but only a few seconds brushing the buccal and lingual aspects of their posterior teeth. Similarly, gingival indices are not adequate indications of effective plaque removal in children, since there is usually no correlation between the amount of dental plaque and clinical signs of gingivitis in children.[13-15]

In this study, parents' ability to brush their children's teeth was evaluated during direct observation, according to a novel index: the TB-PS-I, which is easy to implement, correlates negatively with PI, and has high reliability. Importantly, the index detects problems in brushing that are due to not "reaching" all tooth segments and to not "staying" long enough on each segment. The index is applicable for research, as well as clinical purposes.

A major shortcoming of the present study design is that the evaluator of PI at baseline and at the 1-month follow-up was not blinded to research group assignments. Clearly, the evaluation of tooth-brushing performance could not be blinded.

Conclusions

Based on this study's results, the following conclusions can be made:

1. Parental ability to immediately implement instructions for using single- or triple-headed toothbrushes was similar. Effective tooth-brushing skill was better retained with the use of a triple-headed toothbrush than with a single-headed one.
2. The main reason for deterioration in tooth-brushing performance after 1 month was insufficient number of strokes in the different segments.
3. The plaque index was statistically correlated with the tooth-brushing performance skill index.
4. This paper suggests a novel index for evaluation of the components of tooth-brushing.

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Abstracts of the Scientific Literature

Could developmental and behavioral disorders be influenced by early exposure to general anesthesia?

This study used data from a birth cohort to evaluate the hypothesis that children younger than age 3 years exposed to surgery and general anesthesia were at risk to exhibit behavioral and developmental disorders later in childhood. The data for the retrospective cohort came from the New York State Medicaid program and included children born between 1999 and 2005. There were 304 children receiving general anesthesia and 10,146 who did not, totaling 10,450 siblings. The analysis start date was the date of surgery for those exposed to general anesthesia and the age 10 months for those not exposed to anesthesia. The Columbia University IRB approved the study protocol with an exempt status. The study design for using siblings sought to control variables such as home environment, age, parenting style, and educational systems. Data files compiled by Centers for Medicaid and Medical Services (CMS) were categorized for demographics, admission and discharge, outpatient care, emergency care, and medication prescriptions. The predominant behavioral diagnosis for the children in this study was "developmental delay." A flow chart shows how the study groups of the exposed and unexposed children were chosen from the births in New York State for the time period between 1999-2005. Exposure was defined as a child younger than 3 years, with no prior diagnosis of behavioral or developmental disorders exposed to general anesthesia. The 10,146 unexposed children also had no previous anesthesia exposure or any diagnosis of developmental or behavioral disorders before age 10 months. Behavioral or neurodevelopmental disorders which might be associated with anesthesia exposure coincided with ICD-9 medical procedure codes for disorders such as unsocial or social conduct, reading, language or developmental delay, and attention deficit and emotional disorders. Appropriate statistical analysis was used to measure the collected data. Of the 304 children receiving anesthesia, 75 children were later diagnosed with behavioral or developmental diagnoses with an average age of 18 months. For the 10,146 unexposed children 896 were later diagnosed with behavioral or developmental disorders. Additional research is needed to determine more conclusive clinical evidence to answer this hypothesis.

Comments: *Until more concrete research information is known about the question of early exposure to general anesthesia causing developmental and behavioral disorders in children, we must continue using general anesthesia when it is indicated as the best recommendation for treating our pediatric patients.* ***JGJ***

Address correspondence to Charles DiMaggio, Department of Anesthesiology, Columbia University, 622 West 168 Street, New York, NY 10032; e-mail: cjd11@columbia.edu.

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