

# Evaluation of Tooth-brushing Time for Elementary School Students Related with Dental Caries and Oral Hygienic Condition

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## Abstract

The purpose of this study was to investigate the relation of dental caries, oral hygienic conditions, and tooth-brushing time on the oral health of the lower grades in elementary school. The subjects in this study were 208 students of 2 and 3 grade from elementary school in Seoul. Statistical analysis was performed using a computerized program in SPSS 18.0® (SPSS Inc., Version 18.0, Chicago, IL, USA). Tooth-brushing education is the most effective and easy to practice should be systematic to improve oral hygiene of the lower grades in elementary school.

**Keywords:** Children, Dental Caries, Elementary School Students, Oral Hygienic Condition, Tooth-Brushing Time

## 1. Introduction

Elementary school students will eventually want to be independent from their parents, so that they will have the freedom to decide for themselves. Moreover, they can analyze their own behavior due to the development of their cognitive structures. It is the time for students to learn skills related to personal hygiene management and to form health habits that they can benefit from their entire life. In establishing a foundation for lifelong oral health, it is very important for them to acquire the basic knowledge and skills for oral health care, such as the proper way to brush their teeth as part of their everyday life<sup>1</sup>. Proper tooth brushing method and time occupy the most important part of dental health in order to prevent

dental caries, which is one of the major oral diseases, and it keeps the oral cavity clean.

Dental caries is a persistent oral disease, and once it occurs, it continues to develop throughout a person's life. During the elementary school age, dental caries develop due to the children's lack of awareness on oral health, improper tooth brushing method, and snacking habit<sup>2</sup>. An oral health survey that was conducted as part of the national health promotion project revealed that six-year-old children have 1.35 dental caries on the average<sup>3</sup>.

Caries in milk teeth causes severe pain to children, affects their permanent dentition, leads to their emotional disturbances due to aesthetic problems, and affects their general development. Since considerable costs are spent for the treatment of an oral disease that is the subject of

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national management even in developed countries, various efforts have been made to reduce the incidence of the disease<sup>4</sup>.

In order to reduce dental caries, In<sup>5</sup> emphasized the reduction of snacking frequency, while and<sup>6</sup> suggested the use of fluoride toothpaste, and<sup>7</sup> recommended education on proper tooth brushing habits starting from infancy.

Schoolchildren are out of the main caregiver's reach; therefore, they will have many chances to eat processed food. At the same time, this period in growth is when mixed dentition occurs, wherein the first molar erupts in the mouth. Therefore, it is important to form good oral care habits, including a proper tooth brushing technique. In elementary school oral hygiene education, the teacher in charge must pay attention to the students<sup>8</sup>. Professional technical support and cooperation of dentists or dental hygienists should be given to these students in order to provide them with accurate oral health knowledge.

For the prevention of dental caries and ensure oral health maintenance, the school's oral health project is one of the most important projects. It must be recognized as a process of managing the students' oral health habits, changing their knowledge, attitudes, and behaviors toward oral health, and cultivating their ability to manage their own oral health throughout their life<sup>9</sup>. For this reason, education on proper tooth brushing is urgently required.

This study aims to analyze associations between tooth brushing time during the day, and oral hygiene and dental caries in elementary school students. It also seeks to provide basic data required for preventing dental caries and improving the oral health of elementary school student's in the future through effective tooth brushing frequency and time.

## 2. Materials and Methods

### 2.1 Study Subjects

This study was conducted by randomly selecting 215 students in the second or third grade of elementary schools located in the M area in Seoul. The study consisted of the current status of dental caries, oral examination for the

oral hygiene management ability test, and a survey. The students were asked to respond to the questions with their caregiver's help after the caregivers gave their consent. A total of 208 students' data were analyzed excluding 7 incomplete questionnaires.

### 2.2 Study Methods

In order to investigate the tooth-brushing time, a self-administered questionnaire was distributed and filled out by the students. An elementary school oral examination team consisting of dentists and dental hygienists examined the students' teeth for dental caries, treated the affected teeth, checked their oral hygiene status, and wrote the results in the oral examination record.

### 2.3 Statistical Analysis

For the statistical analysis, SPSS (ver. 18.0) was used. With regard to the general characteristics of the study subjects, the frequency and percentage were presented. In order to analyze the differences between the groups and the factors associated with development of dental caries and oral hygiene status, correlation analysis, multi-response analysis, and analysis of variance were performed.

## 3. Results and Discussion

### 3.1 General Characteristics of the Study Subjects

For the elementary school children, special care is required due to their lack of awareness on oral health and insufficient motivation<sup>10,11</sup>. It is during this time that their oral hygiene status is poor due to poor tooth brushing techniques and frequent intake of food with high sugar content. Dental caries also frequently occur at their age<sup>12</sup>. The general characteristics of the study subjects are shown in Table 1. In terms of gender, 49% were male and 51% were female. In terms of grade, 56.3% were in second grade while 43% were in the third grade. With regard to the oral hygiene status, the average was 63.9%, which was the highest, followed by poor 27.4%, and excellent 7.7%.

**Table 1.** General Characteristics of the Subject

Characteristics	Division	Frequency	Percentage (%)
Sex	Male	102	49.0
	Female	106	51.0
Grade	2	117	56.3
	3	91	43.7
Hygienic Conditions	Excellent	16	7.7
	Normal	135	63.9
	Poor	57	27.4
Total		208	100

### 3.2 Current Status of Dental Caries

The result on the development of caries in the oral cavity is shown in Table 2. As for the number of teeth that was treated for dental caries, there were none in the maxillary teeth in 73.6% and 75.5% in the mandibular teeth, which was the most common. As for the number of teeth treated for dental caries increased, the frequency of occurrence

gradually decreased. With regard to the number of teeth currently affected by dental caries, there was none in 92.3% in the maxillary teeth and 85.6% in the mandibular teeth, which was the most common. The incidence of dental caries is the highest in the lower grades. Thus, learning the proper toothbrushing techniques and tooth-brushing time at that age is very important, as it directly leads to a lifetime of healthy oral condition<sup>13,14</sup>.

**Table 2.** Present Condition of Caries

Number	Treated caries		Untreated caries	
	Upper	Lower	Upper	Lower
0	153(73.6)	157(75.5)	192(92.3)	178(85.6)
1	28(13.5)	29(13.9)	11(5.3)	22(10.6)
2	18(8.7)	13(6.3)	4(1.9)	4(1.9)
3	5(2.4)	5(2.4)	1(0.5)	2(1.0)
4	0(0)	3(1.4)	0(0)	2(1.0)
5	4(1.9)	1(0.5)	0(0)	0(0)
M±SD	0.48±0.98	0.42±0.89	0.11±0.40	0.21±0.62

### 3.3 Tooth-Brushing Time

The study results on tooth-brushing time during the day are shown in Table 3. After breakfast was the highest with 64.9%, followed by after dinner with 52.9%, and before bedtime with 51.0%. After snacking was the lowest with 14.9%. In the case of the elementary school students, correct toothbrushing, which is one of the most basic oral care habits, is very important in preventing the onset of dental caries<sup>15</sup>.

### 3.4 Tooth-Brushing Time Based on Grade and Gender

The study results on tooth-brushing time based on grade and gender of the students are shown in Table 4. Each time that tooth-brushing was done 1 point was given, otherwise 0 point was given. The value closer to 1 meant that the subjects brushed their teeth more frequently. In both the second and third graders, the points were high-

**Table 3.** Tooth-brushing Time

Characteristics	Division	N(%)
Tooth-brushing time	Before breakfast	60(28.8)
	After breakfast	135(64.9)
	After lunch	68(32.7)
	After dinner	110(52.9)
	Before sleeping	106(51.0)
	After eating snacks	31(14.9)

**Table 4.** Tooth-brushing Time according to Grade and Sex

Characteristics	Division	Grade(M±SD)		Sex(M±SD)	
		2	3	M	F
Tooth-brushing time	Before breakfast	0.26±0.44	0.32±0.47	0.27±0.49	0.30±0.46
	After breakfast	0.62±0.49	0.68±0.47	0.65±0.48	0.65±0.48
	After lunch	0.42±0.50	0.21±0.41	0.39±0.49	0.26±0.44
	After dinner	0.53±0.50	0.53±0.50	0.50±0.50	0.56±0.50
	Before sleeping	0.57±0.50	0.54±0.50	0.50±0.50	0.52±0.50
	After eating snacks	0.15±0.35	0.15±0.36	0.15±0.36	0.15±0.36

est after breakfast, and the same results were revealed in both the male and female students. The study results on tooth-brushing time based on grade and gender indicated that the students generally neglected toothbrushing after lunch. Since there is no supervisor available to provide and manage the students' oral health education on toothbrushing, particularly during lunch time, the students tend to miss toothbrushing after lunch. Therefore, classroom teachers should have accurate knowledge in order to supervise and provide the implementation of proper toothbrushing, along with the instructions.

### 3.5 Correlation between Grade and Gender, and Tooth-Brushing Time

The correlation between grade and gender, and toothbrushing time is shown in Table 5. The grade and gender showed a correlation of -0.222 and -0.136 with toothbrushing after lunch, respectively, which were significant at the 5% and 1% significance levels. With regard to toothbrushing after lunch, the frequency of toothbrushing was higher in the second grade than in the third grade, thereby showing a negative correlation. In terms of gender, the frequency of toothbrushing was higher in the male students than in the female students, thereby showing a negative correlation.

The elementary school lower graders have a strong collectivity. They also lack motivation and power of execution based on free will. This is a phenomenon wherein their behaviors depend on their peer group rather than as individuals. Results of analysis on toothbrushing time based on grade and gender showed significant differences in toothbrushing after lunch, which were -0.222 and -0.136 ( $p < 0.01$ ,  $p < 0.05$ ), respectively. With regard to toothbrushing after lunch, the frequency of toothbrushing was higher in the second grade than in the third grade, thereby showing a negative correlation. In terms of gender, the frequency of toothbrushing was higher in the male students than in the female students, thereby showing a negative correlation. The result indicates that the implementation rate of toothbrushing after lunch was higher in the second grade classes, thereby showing that the teachers are more active in supervising the lower grade level students. However, in the comparison between genders, the frequency of toothbrushing after lunch was lower in the female students than in the male students, thereby showing a contrast to the study result of<sup>6</sup> that the female students showed more interest in oral health and hygiene than the male students. Consequently, the toothbrushing implementation rate of the female students was higher than that of the male students.

**Table 5.** Correlation between Tooth-brushing Time, Grade and Sex

Variables	Grade	Sex
Before breakfast	0.059	0.030
After breakfast	0.060	0.004
After lunch	-0.222**	-0.136*
After dinner	-0.002	0.057
Before sleeping	-0.027	0.019
After eating snacks	0.012	0.005

### 3.6 Correlation between the Development of Dental Caries and Tooth-brushing Time

The correlation between the development of dental caries and tooth-brushing time is shown in Table 6. Maxillary dental caries showed a positive correlation of 0.212 with tooth brushing before breakfast ( $p<0.01$ ). On the other hand, maxillary dental caries showed a correlation of -0.158 with tooth brushing after breakfast and -0.212 with tooth brushing before bedtime. Mandibular dental caries showed a correlation of -0.265 with tooth brushing before bedtime at the 5% and 1% significance levels. Maxillary dental caries that currently developed had a statistically significant correlation of -0.148 with tooth brushing before bedtime ( $p<0.01$ ).

Theoretically, the ideal tooth-brushing times for preventing dental caries are before bedtime and after each meal. However, as shown in this study result, the implementation of tooth brushing before bedtime had a negative correlation with treated teeth. It also showed a negative correlation with maxillary dental caries. In this study, the frequency of the implementation of tooth brushing before bedtime appeared to be lower, which can

be a factor in causing maxillary and mandibular dental caries. A thorough tooth brushing instruction is required because elementary school lower graders do not brush their teeth regularly, especially before bedtime among the times of tooth brushing, and the possibility of developing dental caries increases due to their poor oral hygiene condition. Tooth brushing before bedtime is very important for children. For this reason, education for proper tooth brushing is required by increasing the awareness of the fact that as the amount of saliva production rapidly decreases at night, the environment for developing dental caries is formed.

In<sup>17</sup> emphasized that the provision of oral health education at school is very important because elementary school students do not have knowledge on oral disease prevention. They also do not know how to manage their oral health. As its importance increased in recent years, there is even a country where an oral health room is installed in elementary schools, and an oral health manager is assigned to promote the school's oral health project, oral disease prevention, first aid, and basic oral disease treatment programs<sup>18</sup>. However, in South Korea, tooth brushing preparation is not done properly because there is no facility to store the toothbrushes in the elemen-

**Table 6.** Correlation between Tooth-brushing Time, Grade and Sex

Variables	Treated caries		Untreated caries	
	Upper	Lower	Upper	Lower
Before breakfast	0.212**	0.059	0.044	0.005
After breakfast	-0.158*	-0.096	-0.132	-0.026
After lunch	-0.088	-0.109	-0.056	0.077
After dinner	-0.152	-0.131	-0.087	-0.004
Before sleeping	-0.212**	-0.265**	-0.148*	0.009
After eating snacks	-0.093	-0.076	-0.110	0.032

tary school. Moreover, oral health room facilities are not properly secured because discretionary power is given in terms of the installation of relevant facilities, although the current oral health law stipulates that the principal has to enforce collective toothbrushing among students. Therefore, problems need to be identified by analyzing the oral health awareness and behaviors in the elementary school lower graders based on the importance of tooth brushing education.

### 3.7 Oral Hygiene Status Based on the State of Dental Caries and Tooth Brushing Time

The study result on the development of dental caries and tooth brushing time based on the oral hygiene status is shown in Table 7. The oral hygiene status appeared to

differ according to the maxillary dental caries and the implementation of tooth brushing before breakfast. Even in post-hoc analysis to test the differences between the groups, significant differences were shown in maxillary dental caries and tooth brushing before breakfast. Based on this result, it was confirmed that the oral hygiene status differs depending on the maxillary dental caries and tooth brushing before breakfast.

With regard to associations between tooth brushing time and oral hygiene status, when the subjects brushed their teeth before breakfast, their oral hygiene status was poorer. It was because the oral hygiene status was examined in the morning, and after breakfast, the awareness of oral cleaning was higher at home. Moreover, it is not sufficient to determine oral health using only the oral hygiene status through a one-time examination because the students may eat snacks at school.

**Table 7.** Oral Hygienic Conditions according to the Dental Caries and Tooth-brushing Time

Division Excellent		Oral hygienic conditions			p-value
		Normal	Poor		
Treated caries	Upper	0.13±0.34 <sup>A</sup>	0.36±0.73 <sup>A</sup>	0.84±1.42 <sup>B</sup>	0.002*
	Lower	0.13±0.34 <sup>A</sup>	0.36±0.79 <sup>A,B</sup>	0.63±1.14 <sup>B</sup>	0.061
Untreated caries	Upper	0.00±0.00 <sup>A</sup>	0.12±0.44 <sup>A</sup>	0.11±0.36 <sup>A</sup>	0.541
	Lower	0.13±0.50 <sup>A</sup>	0.19±0.53 <sup>A</sup>	0.28±0.82 <sup>A</sup>	0.562
Tooth-brushing time	Before breakfast	0.19±0.40 <sup>A</sup>	0.24±0.43 <sup>A,B</sup>	0.44±0.50 <sup>B</sup>	0.012*
	After breakfast	0.81±0.40 <sup>A</sup>	0.65±0.48 <sup>A</sup>	0.60±0.49 <sup>A</sup>	0.279
	After lunch	0.50±0.51 <sup>A</sup>	0.32±0.47 <sup>A</sup>	0.30±0.46 <sup>A</sup>	0.299
	After dinner	0.63±0.50 <sup>A</sup>	0.53±0.50 <sup>A</sup>	0.51±0.50 <sup>A</sup>	0.711
	Before sleeping	0.38±0.50 <sup>A</sup>	0.54±0.50 <sup>A</sup>	0.47±0.50 <sup>A</sup>	0.376
	After eating snacks	0.19±0.40 <sup>A</sup>	0.13±0.33 <sup>A</sup>	0.19±0.39 <sup>A</sup>	0.448

\*p<0.05

A,B Results of Duncan's post analysis: there were not statistical differences between same letter.

In<sup>19</sup> argued that adults could not easily change their tooth brushing method, which was formed as an old habit, as compared to that of children. In<sup>20</sup> also emphasized that it is especially important to learn the proper tooth brushing techniques starting from childhood. In<sup>21</sup> particularly emphasized the importance of oral health care during school age, since oral health care in elementary school students will become the foundation of their life-long health. Therefore, a proper tooth brushing method should be habituated during childhood, and they should maintain and promote oral health when they become adults. Researchers have recommended tooth brushing as the most effective and basic oral health care method, and proper tooth brushing has already been reported to have a considerable inhibitory effect on the development of dental caries<sup>22-24</sup>. In<sup>25</sup> recommended brushing teeth properly right after each meal. According to<sup>26</sup>, more than 80% of children could not brush their teeth properly. Therefore, tooth brushing after each meal is very important and it must be emphasized in oral health education for elementary school lower graders.

Since lower graders in elementary school are at the stage of having mixed dentition, an oral health education program is desperately needed. Non-systematic and one-time tooth-brushing education can provide only basic knowledge, and it has a limitation in promoting effective tooth-brushing. In order to improve the oral health status and behavior of the students, implementation of knowledge acquired through oral health education is important<sup>27</sup>. Therefore, toothbrushing is the most efficient and easy to practice oral health care method. Based on this study, considering the association between tooth-brushing time and development of dental caries, systematic and effective methods for oral hygiene management in elementary school lower graders must be sought.

## 4. Conclusion

This study was performed in order to investigate the oral care status of lower grade students (second and third graders) in elementary school based on tooth brushing time and frequency. A questionnaire with subjects on grade, gender, hygiene status, tooth brushing time, and development of dental caries was used to prepare them

for oral health education. Based on the above results, systematic oral health education for elementary school students should be conducted with regard to proper tooth brushing time and method or preventing dental caries.

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## 6. References

1. Kang BH, Park SN, Shong KY, Moon JS. Effect of a tooth-brushing education program on oral health of preschool children. *Journal of Korean Academy Nursing*. 2008; 38(6):914-22.
2. Chang BJ. Study on relation between dental health beliefs and dental health behavior in the high grade students of elementary school. *Journal of DentalHygienic Science*. 2008; 8(3):163-8.
3. Ministry of health&welfare: National oral health survey in 2006. Seoul: 2007.p.62.
4. Jin BH, Lee BJ, Paik DI. Prevalence of incipient lesions in surveyed preschool children., Kuro-gu, Seoul: a pilot study. *Journal of Korean Academy Dental Health*. 2004; 28:548-58.
5. Lee SM. A study on the weight length index and dental caries of elementary students. Published doctor's thesis. Myongji University; Seoul.2003.
6. Petersen PE, Lennon MA. Effective use of fluorides for the prevention of dental caries in the 21st century: the WHO approach. *Community Dental Oral Epidemiology*. 2004; 32(5):319-21.
7. Lee ES, Shin SC. A study on the relations between the oral health care habits and caries in the deciduous teeth. *Journal of Korean Academy Dental Health*. 1996; 20:369-796.
8. Lee HK, Park CS, Kim MJ. Interrelation research of the knowledge regarding the oral health of the elementary school child and behavior. *Journal of Dental Hygienic Science*. 2008; 8(3):155-61.
9. Ahn YS, Lee YS, Ryu DY. Study of oral health-related quality of life index for primary school oral health program. *Journal of Dental Hygienic Science*. 2006; 6:79-84.
10. Grossman E, Proskin H. A comparison of the efficacy and safety of an electric and a manual children's toothbrush.

- Journal of American Dental Association. 1997; 128: 469–74.
11. Ju OJ, Park CS, Lee HS. A study on the status for oral health education of dental patients. *Journal of Dental Hygienic Science*. 2005; 5(2):77–82.
  12. Shin SC, Cho EH, Seo HS. School-based comprehensive oral health care program and expending proposal in Korea. *Journal of Korean Academy Dental Health*. 2000; 24:185–204.
  13. Lee JH, Kim JB, Cho GS. Effects of school incremental dental care program. *Journal of Korean Society Dental Hygienic*. 2010; 10(3): 465–71.
  14. An SY, Shim YS, Park SY. Aesthetic Rehabilitation in maxillary anterior tooth with early childhood caries using ZIRKIZ® crown: Long-Term follow-up. *Indian Journal of Science and Technology*. 2015; 8 (25):1–5.
  15. Chway GL, Kwak KH, Chung SC, Kim CY. A study on the oral health knowledge and attitude of elementary school nursing teacher in Seoul. *Journal of Korean Health Education*. 1990; 7(1):39–46.
  16. Jeong HJ, Kim HJ, Lee MK, Yoon HS, Oh SH, Lee JH. Oral health knowledge and practice of elementary school students in school dental clinics. *Journal of Korean Society Dental Hygienic*, 2013; 13(6):1047–56.
  17. Kim YH. A study on dental health knowledge and behavior of elementary school student. *Journal of Dental Hygienic Science*. 2006; 6(3):227–30.
  18. Chang SD. Analysis on dental caries according to oral health care in elementary school children., Published master's thesis., Cheongwon: Korea national university of education; 1997.
  19. Cho MS, Lee EK, Kang YJ. A study on toothbrushing habits depending in some of middle school students. *Journal of Korean Society Dental Hygienic*. 2011; 11(2):881–91.
  20. Kim EK, Moon HS, Jung JY et al. A study in the oral health awareness and behavior of lower grades in elementary school. *Journal of Korean Society Dental Hygienic*. 2001;1:39–51.
  21. Jang JH. The relationship of diet habits, obesity and level of oral health among elementary school children. *Journal of Korean Society Dental Hygienic*. 2008; 8(4):229–40.
  22. Ahn JK, Kim JB. An experimental study on the effects of the tooth brushing instructional methods., *Journal of Korean Academy Dental Health*. 1985; 9(1):127–31.
  23. Lee SS, Paik DI, Kim JB. A study on the effects of the tooth brushing instruction methods in dental health education. *Journal of Korean Academy Dental Health*. 1990; 14(1):233–42.
  24. Chang KW, Kim JB. An experimental study on the effects of the tooth brushing instructional methods. *Journal of Korean Academy Dental Health*. 1987; 11(1): 85–98.
  25. Fosdick LS. The reduction of the incidence of dental caries: immediate tooth brushing with a neutral dentifrice. *Journal of American Dental Association*. 1939; 40(2):133–43.
  26. Moon JS, Song BS, Park SN. Oral health behavior and dental health status of preschool children., *Journal of Korean Academy Community Health Nursing*. 2004; 15(4): 618–27.
  27. Jung JH, Woo HS. Analysis on Results of Oral Health Education among Educators and Learners. *Indian Journal of Science and Technology*. 2015; 8 (26):1–4.