

Assessment of Fine Motor Skills and Tooth Brushing Skills in 5-6 Year Olds in Tehran

Pejman Mahmoodi¹, Payman Salimi², Rozita Davari Ashtiyani², Naser Valaie³,
Marjan Azarshab⁴, Nasim Shafizadeh⁵

¹Periodontist

²Dentist

³ Faculty Member, Thalassemia Research Center, Mazandaran University of Medical Sciences

⁴Specialist in Pediatric Dentistry

⁵ Assistant Professor, Pediatric Dept, Islamic Azad University, Dental Branch Tehran, Iran

Received: March 2014

Accepted: Jul 2014

ABSTRACT

Background and Aim: Oral hygiene instructions appear to be ineffective in children who lack adequate motor skills for efficient tooth brushing. This will result in development of caries and periodontal disease. This study sought to assess the tooth brushing skills and the role of related factors in 5-6 year old children in Tehran, Iran.

Materials and Methods: This cross-sectional study was conducted on 680 five and six year-old children including 240 girls and 440 boys. The psychomotor skills of the hands and feet were tested in children and their tooth brushing skill was evaluated using 7 criteria. Other related factors were also assessed. Chi square test was applied to assess the correlation of tooth brushing skill with age of children and related factors.

Results: Of all children, 21.1% possessed the required tooth brushing skills while 78.9% did not; 41% of those who did not and 16% of those who did have the tooth brushing skills did not have psychomotor skills in hands and feet in their age group ($P < 0.001$). Significant correlations were found between tooth brushing skills of children ($P < 0.09$) and place of residence in the city ($P < 0.07$).

Conclusion: Lack of tooth brushing skills in children who otherwise have adequately acquired other psychomotor skills related to their age group indicates the complexity of tooth brushing technique for children. It is strongly recommended that tooth brushing be performed by parents in this age group.

Key words: Toothbrushing; Motor Skills, Child; Oral Hygiene

INTRODUCTION

Considering the destructive effect of microbial plaque on tooth structure and undeniable role of tooth brushing in mechanical plaque removal, brushing should be started at an early age. Tooth brushing is imperative to establish daily oral hygiene habits from an early stage of life^{1,2}. Efficient tooth brushing depends on learning

its correct technique.^{1,2,3}

Pinkham was among the first to study the relationship of age with oral hygiene and assessed the children's tooth brushing skills with the help of 9 dental assistants and 34 oral hygienists.¹ Until a child is fully capable of brushing his/her teeth efficiently, this important task should be carried out by parents^{1,2,4}. If a child is not physically capable of correct tooth brushing, oral hygiene instructions will not be effective which leads to incomplete removal of dental

Corresponding Author: Shafizadeh N, School of Dentistry, Tehran Azad University, Tehran, Iran
TEL: 22564571 Email: Nshafizad@yahoo.com

plaque and subsequent development of caries and periodontal disease^{5,6} To date, tooth decay has been known as the most costly human disease⁷

Based on the literature, efficient tooth brushing depends on the development of psychomotor skills, the child's hand function and coordination of visual and motor skills^{2,3}. Children show individual differences in terms of developing such skills and to the best of our knowledge, no national study has investigated the approximate age of Iranian children who are capable of correct tooth brushing. Moreover, this issue is a subject of controversy in foreign studies as some researchers believe that children are capable of tooth brushing on their own at the age of 5 (8); while some others believe that children acquire the tooth brushing skills at the age of 7 (9), 9 (2) or after 10 years of age. (10). Considering all the above, this study sought to assess fine motor skills and tooth brushing skills and related factors in this aspect in 5-6 year old children in Tehran.

Materials and Methods:

Based on the results of a pilot study and considering 95% confidence interval and 10% error rate, the required sample size for this study was calculated to be 680 cases (440 boys and 240 girls). Schools were chosen based on a stratified randomized sampling, from the list of pre-schools and schools in Tehran. In every school, children were chosen through simple random sampling. Data regarding the type of pre-school attended by children, order of the child in the family, number of children in the family, father's level of education, mother's level of education, father's occupation, mother's occupation, household size, place of residence in the city and medical history of the child were retrieved from the children's school records and a questionnaire was filled out accordingly. Examination was done in a well-lit room in the preschool that contained a table and 2 chairs. Children entered into the room one by one. The examiner tried to communicate with the child in

order to make him/her comfortable and eliminate any possible stress and then examined the child for the selected 4 motor skills. These psychomotor skills were selected following consultation with a Child and adolescent psychiatrist, specialist in growth and development process, taking into account the children's age.¹¹ The children were given a pencil and a piece of paper. A wooden square and a wooden triangle were shown to 5 and 6 year-olds and children were asked to draw it. If children were capable of drawing a square with the 4 sides connected or a triangle with the 3 sides connected, they were considered as having acquired this psychomotor skill. The next psychomotor skill was that the child had to stand on one foot (5 year old for 4 seconds and 6 year old for 6 seconds) without holding onto support. The third skill for the 5 year olds was to cut out a circle drawn on a piece of paper using scissors. The third skill for the 6 year olds was buttoning a jacket. The 4th skill for the 5 year-olds was hopping on one foot for at least 3 steps. The 4th skill for the 6 year olds was the heel to toe walk. The child had to be able to move forward while the feet were in contact with one another. If the child moved forward without the feet in contact or the feet were in contact but the child was unable to keep his/her balance, he/she was considered failed in this test. The final skill for the 6 year olds was to tie the shoelace of a given shoe (tying a simple knot was enough). When drawing a square or a triangle, the child's dominant hand was chosen. Finally, the tooth brushing skill was tested. The examiner asked children if they had ever brushed their teeth by themselves before and their answers were recorded in the questionnaire. Next, a new toothbrush was given to the child and the child was asked to brush his/her teeth in front of the examiner. The child's tooth brushing skill was assessed using the following 7 criteria:^{11, 12}

1. The children had to correctly hold the toothbrush in their hands. The handle should be held in the palm of the hand and gripped with fingers
2. The direction of bristles had to be towards the teeth

3. Back and forth motion on teeth surfaces
4. Back and forth motion on the occlusal surface of maxillary teeth
5. Back and forth motion on the occlusal surface of mandibular teeth
6. Back and forth motion on the buccal surface of maxillary teeth
7. Back and forth motion on the lingual surface of mandibular teeth

If the child did not brush a required area, the examiner asked him to do so. For example, the child was requested to brush the back of his/her lower teeth. If he/she did not comply, the examiner placed the head of toothbrush on the area and asked the child to continue brushing. If the child was able to perform the back and forth motion at the respective area, the child was considered as having acquired the skill and the "yes" choice was marked in the questionnaire. If the child performed all 7 motions correctly, he/she was given a score of 7 and considered as having possessed the tooth brushing skill. If the child scored 6 or lower, he/she was considered as not having the required tooth brushing skills. Chi square test was used to assess the relationship of tooth brushing skills with the child's age and other related factors.

Results:

This study was conducted on 240 girls and 440 boys. Overall, 21.1% of children possessed the required tooth brushing skills (55 girls and 89 boys) while 78.9% (185 girls and 351 boys) did not. Considering the mentioned values, the confidence interval for the lack of skill in 5-6 year olds was estimated to be in the range of 75.8% to 81.8%.

The results revealed that 62% of 5 year-olds did not and 37% did have the tooth brushing skills (Table 1).

Table 1- The frequency distribution of children based on their age and tooth brushing skills

Tooth brushing skill/Age	Yes	No	Total
6 year olds	82(57)	205(38)	287
5 year olds	62(43)	331(62)	393
Total	144(100)	536(100)	680

Based on Chi square test, this difference was statistically significant ($P < 0.001$). The number of 5 year-olds not having the tooth brushing skills was 1.4 times the rate in 6 year-olds.

Of children without the tooth brushing skills, 43% were 5 and 57% were 6 years of age (Table 2).

Table 2- The frequency distribution of children based on their age and psychomotor skills

Psychomotor skills/ Age	Yes	No	Total
5 year olds	290(66)	103(43)	393
6 year olds	150(34)	137(57)	287
Total	440(100)	240(100)	680

Also, 30% of children without and 7% of those with the tooth brushing skills did not have the required psychomotor skills for their age ($P < 0.01$).

In the 5 year-olds, type of preschool attended (public or private), order of child in the family, number of children in the family, father's level of education, mother's level of education, father's occupation, mother's occupation, household size, place of residence in the city and medical history of the child did not have a significant correlation with the tooth brushing skill. However, among the 5 year-olds who had the tooth brushing skill, 19% were living south of the Engelab street and 81% north of this street ($P < 0.01$). Of children who did not have the tooth brushing skill, 10% did not have any history of tooth brushing on their own. On the other hand, all children who possessed the tooth brushing skills mentioned a history of brushing

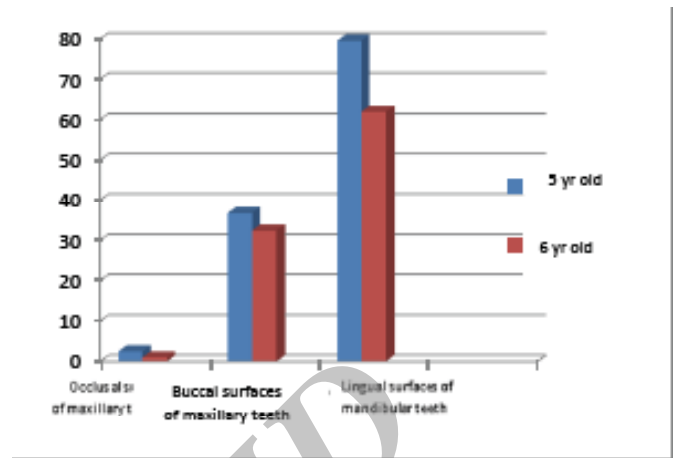
teeth on their own ($P < 0.05$).

In general, 58% of children who did not and 23% of those who did have the tooth brushing skills, indicated inadequate psychomotor skills for their age ($P < 0.005$).

In the 6 year-olds, type of preschool attended (public or private), order of child in the family, number of children in the family, father's level of education, mother's level of education, father's occupation, mother's occupation, household size, place of residence in the city and medical history of the child did not have a significant correlation with the tooth brushing skills. Of children who did not have the tooth brushing skills, 8% did not have any history of tooth brushing on their own. On the other hand, all children who possessed the tooth brushing skills mentioned a history of brushing their teeth on their own ($P < 0.05$).

The frequency of living in low socioeconomic areas was 1.9 times higher in 5-6 year-olds who did not have the tooth brushing skills compared to children who possessed the tooth brushing skills.

Most children did not have any problem in correctly holding the toothbrush in one hand, contacting the bristles with teeth, back and forth motion on teeth surfaces and back and forth motion on occlusal surfaces of mandibular teeth. However, they mostly had an issue with the back and forth movement of toothbrush on the occlusal surfaces of maxillary teeth, the buccal surfaces of maxillary teeth and the lingual surface of mandibular teeth. The frequency distribution of 5-6 year olds based on the percentage of lack of skills in the mentioned 3 criteria indicated that acquiring the skills improved in all the tested criteria with age. The prevalence of lack of skills for brushing the lingual surfaces of mandibular teeth was 79.6% in 5 year olds and 62% in 6 year-olds. Chi square test revealed that this difference was statistically significant ($P < 0.001$) (Diagram 1).



Discussions:

This study was conducted on 240 girls and 440 boys. Overall, 21.1% of children possessed the required tooth brushing skills (55 girls and 89 boys) while 78.9% (185 girls and 351 boys) did not. Buccal surfaces of maxillary teeth and lingual surfaces of mandibular teeth were the hardest areas to brush for 5-6 year olds. This finding is in agreement with the results of Livny et al. They evaluated the oral health promotion following a practical instruction for 196 first graders and concluded that the lingual surfaces of posterior teeth were the hardest areas to brush by children. At 4 months following the instruction, the percentage of brushing of these surfaces still remained low.¹³

Mentes et al. evaluated the tooth brushing skills of different quadrants in 75 children aged 3-11 years in a private dental clinic in Istanbul and concluded that tooth brushing was more efficient in children aged 9-11 years.⁶ However, they did not evaluate the correlation of hand motor skills with the technique of holding the toothbrush or the brushing of each quadrant.

Leal et al. evaluated 40 children aged 3-6 years in Brazil and reported that children over 6 years of age had greater capability for learning efficient tooth brushing. They emphasized on the importance of providing

instruction of tooth brushing for the children and supervising them in order to establish efficient oral hygiene habits. They reported a significant correlation between oral hygiene instructions and effective reduction in microbial plaque.¹⁴ However, they did not specify the surfaces that had to be brushed by children; whereas, these areas were precisely chosen in our study.

Das and Singhal evaluated tooth brushing skills of 3-11 year olds and found no significant association between age and tooth brushing method; but a significant difference existed in duration of tooth brushing between the two age groups of 3-5 and 9-11 years.³ In our study, holding the toothbrush was one of the assessed criteria. Furthermore, acquired task skill was measured by more precise criteria, which increased the accuracy of our study.

Pujar and Subbaredy in a similar study in 2013 concluded that method of tooth brushing and gender had no significant effect on the tooth brushing ability of 6-12 year-olds. Moreover, they reported that children under 10 years of age had low tooth brushing skills indicating the need for parental supervision at this specific age range.¹⁰ This finding is in agreement with our results.

In our study, efficient tooth brushing was considered to be the child's ability to reach the toothbrush to the respective area. This issue may be considered as a limitation of our study and it would have been better if we had evaluated the efficacy of plaque removal by brushing. However, the authors could not obtain the necessary approvals from the Ministry of Education and Training to use plaque disclosing agents for children and thus, microbial plaque removal was not assessed.

Our large sample size (680 children) is an advantage of the present study compared to previous ones. All children were examined by the same examiner; which is another strength point of this study. To the best of our knowledge, this study was the first to assess the correlation between hands and feet psychomotor skills and tooth brushing skills and confirmed the important role of psychomotor skills in efficient tooth

brushing.

The high prevalence of lack of tooth brushing skills in our study raises some concerns. Further studies are required to investigate the possible reasons and to propose preventive measures.

Our study showed that of all the factors evaluated, history of tooth brushing by children, hands and feet psychomotor skills and place of residence in the city were correlated with acquiring tooth brushing skills. These factors are somehow related. It is obvious that children with better-developed psychomotor skills are more capable of efficient tooth brushing. Moreover, families living in upscale areas with higher socioeconomic status pay more attention to encourage kids to brush their teeth. All these factors play a role in development of psychomotor skills; which per se, plays a critical role in acquiring tooth brushing skills.

Conclusion:

Lack of tooth brushing skills in 5-6 year olds is evident. Parental supervision is strongly recommended for tooth brushing in this age group.

References:

- 1- Casamassimo PS, Fields HW, Mctigue DJ, Nowak AJ. Pediatric Dentistry: Infancy through Adolescence. 5nd ed. Elsevier: Missouri; 2013 .P:58-60
- 2-Dean JA, Avery D.R, McDonald RE. Dentistry for the Child and Adolescent .9nd ed . Mosby:Missouri;2011.P:106-107
- 3- Das UM,Singhal P.Tooth brushing skills for the children aged 3-11 years. J Indian Soc Pedod Prev Dent 2009;27(2):104-7
- 4- Bozorgmehr E, Hajizamani A, Malek Mohammadi T.Oral health behavior of parents as a predictor of oral health status of their children. ISRN Dent 2013 8;2013:741783
- 5- Chachra S, Dhawan P, Kaur T, Sharma AK.The most effective and essential way of improving the oral health status education. J In-

- dian Soc Pedod Prev Dent. 2011;29(3):216-21
- 6- Menten A, Atukeren J. study of manual tooth brushing skills in children aged 3 to 11 years . J Clin Pediatr Dent 2002; 27(1) : 91_4
- 7- Murray J.J. Prevention of Oral Disease 4nd ed . Oxford university press ,:New york ; 2005. Chapter 2
- 8-Ogasawara T,Watanabe T,Kasahara H. Readiness for tooth brushing of young children . ASDC J Dent Child1992;59(5):353-9.
- 9-Grossman E,Proskin H.A comparison of the efficacy and safety of an electric and a manual children tooth brush. J Am Dent Assoc 1997 ; 128(4) :469-74.
- 10- Pujar P, Subbareddy VV..Evaluation of the tooth brushing skills in children aged 6-12 years.EU Arch Peadiatric Dent2013;14(4):213-219.
- 11-Wiener JM ,Dulcan MK.Textbook of child and adolescent psychiatry. 3nd ed.The American psychiatric publishing: Washington ;2004.P: 14_17
- 12- Sadock BJ ,Sadock VA . Synopsis of Psychiatry . 9 th ,Williams and Wilkins, Philadelphia , USA . 2003 , 22.
- 13- Livny A, Vered Y, Slouk L, Sgan-Cohen HD.Oral health promotion for schoolchildren evaluation of a pragmatic approach with emphasis on improving brushing skills.BMC oral health2008;8(4):21-27.
- 14-Leal SC ,Bezerra AC,deToledo OA.Effectiveness of teaching methods for tooth brushing in preschool children. Braz Dent J .2002 ;13(2) : 133-6