

MASTICATORY PERFORMANCE IN CHILDREN WITH HIGH AND LOW CARIES INDEX

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ABSTRACT

Masticatory performance is an individual ability to chew food and is affected by occlusal contact area. Caries is a kind of tooth decay occurred mostly in teeth and is able to reduce occlusal contact area. This study was conducted in order to compare masticatory performance in children with high and low caries index. This study was a descriptive observational study using multistage random sampling technique. As many as 100 children 4 to 6 years of age going to 22 kindergartens in Bandung City with high or low caries index were taken as samples. Masticatory performance was measured using artificial food that was previously chewed 20 times. The chewed artificial food was then sieved in order to measure food particle. Data was then analysed using T-test method. The result shows that the mean of Median Particle Size (MPS) of children with high caries index was 5,056 mm², while the mean of MPS of children with low caries index was 3,12mm². It can be concluded that masticatory performance in children with high caries index is lower than in children with low caries index.

Keywords: Masticatory performance- high caries index- low caries index

Introduction

Mastication is the most important process in stomatognathic system because not only it plays role on digestive system, it also contributes fully towards growth, development, and maintenance of osteodental arch. Mastication also plays role in dentocraniofacial growth by stimulating the growth of jaws in children, maintaining dental arch, occlusion stabilisation, and preserving craniofacial structure integrity.¹

Mastication is a learning process started in 4 to 5 months after birth when deciduous teeth started to erupt. This function coordinates well like it is in adults after all deciduous teeth erupted in 4-6 years of age.^{1,2} Masticatory ability has to be maintained and developed because it helps to complete nutrition and maintain children's eating habit pattern.³ Good mastication pattern stimulates the growth and function of maxillary and mandibular development.⁴ In contrast, mastication failure gives adverse effects such as nutrition deficiency and gastrointestinal disfunction.⁵

Success of masticatory learning can be measured by children's ability, efficiency, and masticatory performance.

Masticatory performance is the most common method used for measuring masticatory learning. The measurement is affected by some factors, such as malocclusion, occlusal contact area, number of teeth that function well, and bite strength.⁴

Occlusal contact area and number of teeth that function well affect masticatory performance. One of the most common problems in society that affect occlusal contact area and number of well-functioned teeth is caries.⁶ Dental caries is an infectious disease causing hard tissue demineralisation in teeth. Dental caries is progressive yet preventable.⁷ Caries becomes a serious problem among children 4-6 years of age due to its high prevalence.^{6,7} This number increases every year therefore it requires attention.⁶ A study showed that caries prevalence in preschool students in DKI Jakarta was 89,19% with mean def-t of 7,02 ± 5,25.⁷

High caries index in deciduous teeth may be caused by poor behavioral patterns of oral health and family. Although preventable, caries is proven to be a serious problem that attracts the attention of the World Health

Organization (WHO) for a long time to finally put out the world oral health mission of the WHO through the prevention of caries with restrictions mean of DMF-T index (decayed, missing, filled teeth) to be no more than three , and for the period of primary teeth is referred as def -index (decayed, extracted, filled teeth).⁸

Dental caries is a health problem that can lead to sub-optimal performance of mastication. With this background, the authors are interested in comparing the performance of mastication in children with high and low caries index. The purpose of the study was to compare the performance of mastication in children with high and low caries index.

Method

This type of research is an observational descriptive cross sectional method. The population were children 4-6 years old in the city of Bandung with high and low caries index. Children aged 4-6 years in Bandung were taken as sample using multistage random sampling technique, so that the selected 6 of the 30 districts in the city of Bandung as sample. As many as 166 kindergartens were located in the 6 districts and sample of kindergartens were obtained using multistage random sampling. There were 22 kindergartens obtained as the study sample. Study sample criteria of children in 22 kindergartens were: aged 4-6 years old, lives in Bandung, cooperative, well clinical condition, has signed informed consent from parents, has no bad habit, has low or high caries index, and has at least 8 posterior teeth. Masticatory performance is the ability to destroy the test food into particles with 20 chewing times of normal mastication, the result of chewing would then be tested using sieving test. Masticatory performance is expressed by the value of MPS (median particle size).

Test food was prepared using print materials with a ratio of elastomer base: catalyst = 1: 5; elastomer was then put into molds and allowed to harden. Test food obtained in the form of test food weighing 0.8 g ± 0.02 g; diameter of 18 mm and a thickness of 2 mm, as measured with a digital balance with a precision of 4 decimal. Test food was chewed much as 20 times the normal mastication, then chewed test food was collected in the filter paper, washed with water and dried. Chewed test food is then weighed, if there were more than 6% loss of initial weight, the procedure had to be repeated. Sieving test was then performed on the chewed test food to measure the performance of mastication.

Sieve test was carried out using seven levels of sieve that was composed of the largest diameter sieve to smallest: 5,6 mm², 4 mm², 2,8 mm², 2 mm², 0,85 mm², 0,425 mm² and 0,25

mm² (diameter accordance with the standards of USA). Chewed test food was placed on the top sieve and then vibrated using a Thermolyne Maxi Mix II 3000rpm. After that, the heavy particle in each sieve was measured using a digital scale (Toledo Mattler) with 4 decimal precision. Median particle size (X50) was the diameter of the gap that 50% of particles were able to pass through the sieve.

Result and Discussion

The results showed that of 433 children samples, there were 100 samples that met the criteria, 60 boys and 40 girls. Respondents with high caries index were mostly boys, as many as 28 children, and there were 31 people (62%) aged 5 years old. While at low caries index, the majority of respondents were boys, a total of 32 children (64%) and there were 28 children (56%) aged 5 years old. Table 1 showed that the average value of MPS in the high caries group is greater than in the low caries group

Table 1. Comparison of MPS value in High and Low Caries Index Group

V a l u e	M P S M P S	
	High Caries Index	Low Caries Index
M e a n	5 , 0 5	6 3 , 1 2
S t d . D e v i a t i o n	0 , 9 2	8 0 , 8 3 2
M i n i m u m	2 , 8	0 2
M a x i m u m	5 , 6	0 5 , 6 0

Differences of MPS average value on high and low caries groups were compared using *t independent sample test* with $\alpha = 5\%$, $t_{count} = 10.986$ and $t(\alpha; n1 + n2-2) = 1.99$, with criteria:

Ho was rejected if $t_{count} > t_{(\alpha/2;n1+n2-2)}$ or $t_{count} < -t_{(\alpha/2;n1+n2-2)}$

Ho was accepted if $t_{count} < t_{(\alpha/2;n1+n2-2)}$ or $t_{count} > -t_{(\alpha/2;n1+n2-2)}$

Table 2. Independent Sample T-Test of Median Particle Size

C a r i e s I n d e x G r o u p	t c o u n t	t t a b l e
Comparison of MPS in High and Low Caries Index	1 0 , 9 8 6	1 , 9 9

Table 2 shows that t_{count} is greater than t_{table} (10,986 > 1,99), therefore, Ho is rejected. It means that there was a difference in average of MPS in low and high caries index group.

Masticatory performance is a measure of the ability of individuals to destroy the food into smaller particles with a certain amount of mastication.⁹

Results shown in Table 1 indicate that the average value of MPS in children with high caries index (5,056mm²) is higher than the MPS children with low caries index (3,12mm²). Based on research conducted by Chai in 2013, the average value of MPS children who have normal teeth and do not have the bad habit is (1.98 mm²).¹⁰ This shows that there is a decrease in masticatory performance in children with high caries index compared to children with low caries index.

Masticatory performance can be affected by many factors such as the loss and restoration of posterior teeth, occlusal force, salivary flow, and motor function oral.¹¹ Occlusal strength and occlusal contact area on posterior teeth is a major factor affecting the performance of mastication.¹² The statement was supported by the results of research performed on 97 children aged 8-12 years in Sao Paulo, Brazil. Results showed that children with high DMF-T index performed worse mastication. Teeth distribution that are not functioning properly may affect its ability to destroy food.¹³ Another study conducted on 328 respondents in Osaka, Japan in 2000 and 2001 and 40 respondents in Ankara, Turkey showed that masticatory performance is influenced by the occlusal contact area.^{11, 12} This shows the similarities between the experimental results of the respondents in the three countries with respondents in Bandung. The decrease in the ability of mastication occurs when there is less than 20 teeth that function well.¹⁴ Teeth are designed specifically to perform mastication thus providing a significant impact on the quality mastication.¹⁵

Each type of tooth in the mouth has its own role in the process of mastication. Incisor has a role to cut food, the canine rip and tear the food, premolars plays role in crushing food into smaller particles, and molar teeth that have important roles to grind and smoothen the food so it is ready to be swallowed.¹⁶

Dental decay is most often caused by caries. Caries as an infectious microbiological disease can have a significant impact on masticatory performance because it may lead to the local destruction on calcified tissue of the tooth.¹⁷

Caries can reduce occlusal contact area and the number of teeth that can function well so that it affects the performance of mastication. Caries can cause pain or even destruction and loss of part of the tooth. Individuals who

have caries can still chew food and perform swallowing, but the destruction of the food will run less than optimal.¹⁸ The more caries a person has, the number of teeth that can function well will be reduced.

Based on theory and research that has been described, masticatory performance is affected by occlusal contact area, thus, caries on posterior teeth gives the biggest impact. This is because the posterior teeth have a variety of important elements that can have an effect on the smoothness of mastication, the element is a cusps, grooves, and sulcus.¹⁶

Part of the posterior teeth that plays an important role in the process of mastication is occlusal table. Occlusal table is the area between the buccal and lingual cusps on posterior teeth, covering 50-60% of bucolingual area.¹⁶ Damage to the area of the occlusal table can result in dysfunction of mastication.

Another factor that can affect the performance of mastication is saliva. Saliva has contributed to the destruction of food and lubricated food bolus so that it is easy to swallow.¹⁸ Children with high caries index tend to have less saliva than children with low caries index, so as to affect the performance of mastication.

Muscle strength and bad habits also have an important role in determining the performance of mastication. Muscles that are most responsible among others during mastication are masseter muscle, temporal, pterygoid media, and lateral pterygoid. Masseter muscle functions and helps to elevate lateral movement of the mandible during food destruction. Bad habits such as thumb sucking can cause weakening of the masseter muscle. Masseter muscle weakness leads to a decrease in masticatory performance.¹⁰ Research conducted on 100 children aged 4-6 years in Bandung shows that sucking, instead of chewing, food habits affects masticatory performance. Those children with the latter habit are not familiar with good chewing habits to maximize the performance of masticatory muscles that tend to have poorer masticatory performance.

The results showed that there is a relationship between the number of caries index with masticatory performance. The number of higher caries index can reduce the performance of mastication children

Conclusion

Based on the data analysis and discussion of research, it can be deduced that the number of indices of

caries in children aged 4-6 years can decrease the performance of mastication. Children with high caries index has lower masticatory performance compared to children with low caries index. Therefore, researchers suggest any improvement on children dental health maintenance, special attention from parents and health officials, particularly dentists, about dental health problems in children. Cooperation between parents and dentists should be nurtured in order to maintain the children oral health and to avoid more severe abnormalities of masticatory function. Further research on the impact of caries and other things that can affect the performance of mastication also should be conducted.

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