

Effects of temporomandibular joint disorder with clicking symptom towards mastication performance in children deuteromalay sub racial 12-15 years of age

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ABSTRACT

Temporomandibular Joint Disorder (TMD) could be caused by forward head posture. Articular sound/TMJ clicking is the most often sign and symptom for TMD that could happen in human being. The presence of TMD such as TMJ clicking would cause an imbalance masticatory system. The purpose of this research was to investigate TMJ clicking effects to masticatory performance. This research was cross-sectional study with epidemiology survey. Subject were children aged 12-15 years old Deuteromalay sub-races live in Bandung and was taken using multi-stage random sampling technique. Subject; consisted of 24 children as control group and 28 children as TMJ clicking group. Both group were then checked for masticatory performance using multiple sieve method and 20x chewing of artificial test food. Mastication performance value represented by median particle size (MPS) particle distribution (b) for each group. MPS from TMJ clicking group showed higher value than control group. Statistic analysis with t-test showed that there's a significant result in both of group ($p_{\text{value}}=0,0024$, $\alpha = 0,05$). Conclusion, temporomandibular joint clicking subject has lower masticatory performance.

Keywords: body posture, TMJ clicking, masticatory performance

ABSTRAK

Postur tubuh lebih condong ke depan dapat menyebabkan gangguan sendi temporomandibular. Gangguan yang sering terjadi berupa bunyi klik di sekitar sendi temporomandibular saat membuka dan menutup mulut. Gangguan pada sendi temporomandibular menyebabkan ketidakseimbangan sistem mastikasi. Tujuan penelitian adalah untuk mengetahui efek gangguan sendi temporomandibular dengan gejala klicking terhadap performa mastikasi. Metode penelitian menggunakan penelitian cross sectional tipe survei epidemiologi. Subjek penelitian anak usia 12-15 tahun Sub-ras Deutero Melayu di Kota Bandung. Teknik pengambilan sampel penelitian menggunakan teknik multistage random sampling, penentuan besarnya ukuran sampel berdasarkan sampel seadanya yang memenuhi kriteria penelitian, diperoleh 28 orang kelompok gangguan sendi temporomandibular dengan gejala klicking(kelompok uji) serta 24 orang sebagai kelompok kontrol. Performa mastikasi dinilai melalui kemampuan subjek penelitian dalam menghancurkan artificial test food dengan 20x pengunyahan, dan dilakukan pemeriksaan nilai median particle size(MPS) serta nilai distribusi sebaran partikel(b). Hasil penelitian menunjukkan nilai

rata-rata MPS kelompok uji=3.0571, dengan SD=0.9990 memiliki nilai lebih besar dibandingkan kelompok kontrol=2.28958, dengan SD=0.66838. Hasil uji nilai "t" memperlihatkan t -hitung=-3,20, lebih besar dibandingkan t -tabel=2,02, dan nilai $p=0,0024$ lebih kecil dari $\alpha=0,05$ sehingga terlihat perbedaan signifikan diantara kedua kelompok penelitian. Simpulan penelitian memperlihatkan bahwa gangguan STM dengan gejala klicking memberikan efek penurunan performa mastikasi.

Kata kunci: postur tubuh, sendi temporomandibular, klicking, performa mastikasi.

INTRODUCTION

Many indoor activities with forward head posture (FHP) can cause Temporo Mandible Joint disorder (TMJ). This position will result the TMJ muscles in an unbalanced state and often generate a force towards the top and back of the lower jaw leading to a reduction of chamber in TMJ structure, so in a long period it will make the activities of temporal and masseter muscles become overload.¹

The muscles which are not balanced around TMJ can lead to a click sound (clicking). It is caused by the existence of hyperactive muscles and creates hypermobility in TMJ area. Clicking is characterized by earlier or excessive translational movement that causes the capsule and ligament in TMJ area become weak. Damage in the structure causes derangement in one of or both sides of TMJ and may lead to pain, dysfunction, and arthritis.²

TMJ disorder with clicking symptom that lasts for a long time without treatment often associates with sensitivity to palpation in TMJ area, muscle spasm, jaw muscle tension, headache, tinnitus, pain, and jaw dislocation, as well as limitation in opening and closing mouth.^{3,4} The conditions will have an impact in masticatory system because TMJ is part of masticatory system.

The main objective of masticatory system is to destroy foods into fragments that are small enough to get swallowed and saliva provides lubrication for the fragments.⁵ Ability to destroy foods can be seen by measuring mastication performance along with certain treatment during masticating.⁶⁻¹⁶ Mastication performance can be affected by the signs and symptoms of temporomandible disorders as well as mandible closing and opening muscles.¹⁷⁻¹⁹

Studies on mastication performance often ignore TMJ disorders.^{11,20,21} While TMJ itself is a part of masticatory system function that cannot

be separated, so it shows the gap between studies. With the limitation of studies nowadays, the presence of TMJ, although not symptomatic (painful), has a relationship with masticatory function, especially in adults undergoing a decrease in occlusal support.²²

Twelve to fifteen years of age is a period of growth and development that plays a crucial role because it is the period of puberty in which there are physical and physiological changes.²³⁻²⁵ At the age of 12, most permanent teeth have erupted and are in complete occlusal arrangement that plays an important role in mastication function.²⁶ The author is interested in conducting a research on samples Deutero Malay subrace because this race inhabit most parts of Indonesia and are scattered in Java island and some provinces in Sumatera.²⁷

MATERIALS AND METHODS

The method of the study was cross-sectional study with epidemiology survey. Before conducting the study, the authors submit a letter to the Commission of Health Study Ethics and gives information to parents about the study and fill the informed consent. The population of the study is Junior High School students in Bandung aged 12-15 years, Deutero Malay subrace and are taken based on Bandung city division. The research sampling technique is multistage random sampling with sample size determination that meet the research criteria are 24 people in control group and 28 people in-group with TMJ disorder with clicking symptom.

The research subjects have the following inclusion criteria: Deutero Malay sub race children aged 12-15 years declared healthy by doctors with complete number of teeth proper with their age and do not have baby teeth. The children have also jaw joint disorder; TMJ clicking without pain, no extensive damage in teeth condition (profunda

carries). Meanwhile, children with orthodontic treatment having genetic disorder, losing permanent first molar teeth, having periodontal disorder (poor soft tissue condition), incorrect swallowing pattern, poor occlusion contact, and the presence of posterior crossbite are included to exclusion criteria of the research.

Selection of Deutero Malay sub race children aged 12-15 years, which is level two upward are Malay descent children through questionnaires. Examination is performed intra oral and extral oral. TMJ clicking examination using a stethoscope to the left and right sides of TMJ. The children are instructed to open and close their mouths repeatedly and slowly. Furthermore, they are also instructed to chew artificial test food 20 times normal mastication. The result of mastication is collected on filter paper and is dried. The result is re-measured and if there is more than 6% difference than the initial weight, the samples will be asked to do re-mastication.

The mastication result is then filtered in 7 filter levels as follow: 5.6mm², 4mm², 2.8mm², 2mm², 0.85mm², 0.425mm², and 0.25mm². The filter is stored in a vibrator for 20 minutes with 3000 RPM. The artificial test food in each filter is then weighed and measured using mastication performance size formula by Rosin-Rammler formula:

$$Q_w = 100 \left[1 - 2^{-\left(\frac{x}{x_{50}}\right)^b} \right]$$

Q_w is particle cumulative weight with the diameter smaller than x (maximum filter gap), MPS (median particle size) is the diameter of filter gap that can be passed by 50% of the artificial test food from weighing result and “ b ” is unit-less measure (constant) that shows distribution of particles. The measurement result is then compared to the control samples. Mastication performance is measured by the value of the MPS of each group. The smaller the MPS value, the better the mastication performance.

Materials and equipments (Figure 1) used in this research are diagnostic equipments such as, mouth mirror, sonde, tweezers, stethoscope, filters with diameter 5.6mm², 4mm², 2.8mm², 2mm², 0.85mm², 0.425mm², dan 0.25mm², vibrator (Thermolyne Maxi Mix II 3000rpm), digital balance (Mettler Toledo), filter paper and artificial test food (Panasil ratio base: catalyst = 1:5).

The research result data analysis uses t-test to see if TMJ clicking will give effects to mastication performance of children aged 12-15 years. The research was conducted in October to November 2012. The research was carried out by taking samples in 19 JHS, 13 JHS, 21 JHS, 31 JHS, 36 JHS, 37 JHS in Bandung and followed by examinations in Oral and Dental Hospital of Dentistry Faculty of Padjadjaran University.

RESULTS

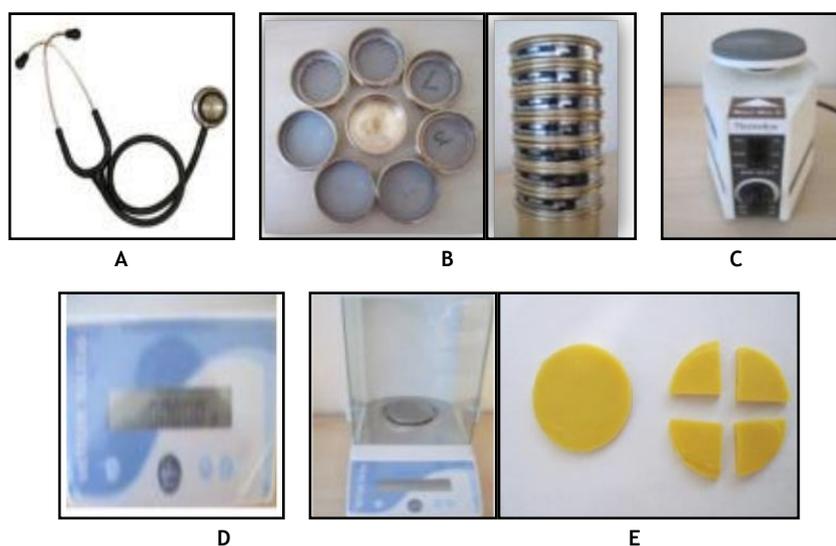


Figure 1. Research equipments. A. stethoscope, B. Filters, C. Vibrator, D. Digital balance, E. Artificial test food.

Median Particle Size Value, The result of mastication performance in test group and control group can be seen in table 1 by seeing the difference of Median Particle Size value of each group.

The results of MPS value in table 1 of both groups seem to be varied. The smallest MPS range of the test group is 2 mm² and the biggest is 5.6 mm². The MPS value of 2 samples (7,14%) is 5,6 mm², the MPS value of 6 samples (21,3%) is 4 mm², the MPS value of 13 samples (46,43%) is 2.8 mm²,

and the MPS value of 7 samples (25%) is 2 mm². It is noted that the test group mostly has the MPS value 2.8 mm² (46,43%). The smallest MPS value in control group is 0.85 mm² and the biggest is 2.8 mm². The MPS value of 3 samples (12,5%) is 0.85, the MPS value of 8 samples (33,33%) is 2 mm², and the MPS value of 13 samples (54,17%) is 2.8 mm². Even though most of the samples' MPS value is 2.8 mm², it is seen that the test group has bigger MPS value range than the control group.

Table 1. MPS value of each sample group.

	MPS Value (mm ²)							Σ
	5.6	4	2.8	2	0.85	0.45	0.25	
Test Group (n)	2	6	13	7	-	-	-	28
Control group (n)	-	-	13	8	3	-	-	24

Particle distribution value (b)

Particle distribution is the picture of particle distribution of mastication result from artificial test food in each group. The value can be illustrated in Diagram 1 and Diagram 2. The Diagrams show that in control group, the starting point of b value is lower than the test group that it shows a more descending curve (steep). This shows

that mastication performance of control group is better than the test group. Particle distribution of b value in control group is mostly in the MPS value for 2.8 mm², even though the test group has the same biggest value, in the test group the b value is bigger and the MPS value is 4 mm² more than the control group. The condition shows a slight decrease of mastication performance in the test group.

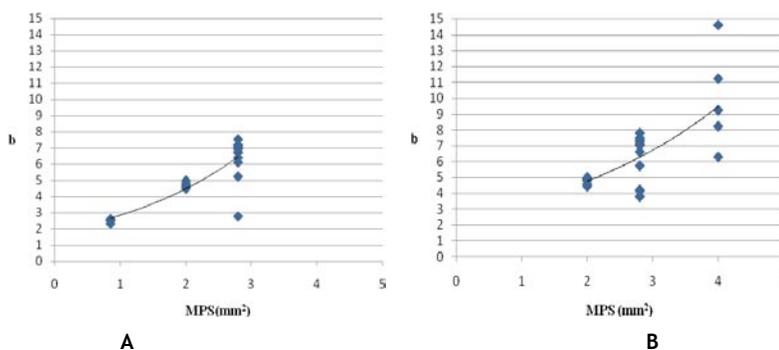


Diagram. Particle distribution (a) connected to the MPS value of 24 people in the control group; (b) connected to the MPS value of 28 people in the test group.

Statistical analysis

The statistical test used is the t-test based on the average value of MPS and particle distribution (b). The result of statistical analysis to the MPS value shows that based on t-value (-3,20) and p value =0,0024, then there is a difference in the

MPS value in the test group and the control group.

Similarly, the statistical analysis in particle distribution value shows that based on t-value (-2,32) and v-value =0,0244, then there is a difference in the particle distribution value in the test group and the control group. (Table 2).

Table 2. Statistical analysis of median particle size (MPS) and particle distribution of two study groups.

	MPS (Median Particle Size)			Particle distribution (b)		
	Mean	SD	n	Mean	SD	n
Control group	2.28958	0.66838	24	5.3926049	1.6526951	24
Test Group	3.0571	0.9990	28	6.9566191	2.8872773	28
t		-3,20			-2,32	
Value p=		0,0024			0,0244	

*significan bila $\alpha=0,05$

The statistical test result shows that the t-count (-3,20) is bigger than the T-Table (2,02) and the p-value (0,0024) is smaller than α (0,05), so that the difference is statistically significant that it shows that the disorders in temporo mandible joint with clicking symptoms decrease the mastication performance in children aged 12-15 years of Deutero Malay Sub race.

DISCUSSION

Descriptively, table 1 shows that the smallest MPS value of the test group is 2mm², while the smallest value in the control group is 0.85mm². Bigger MPS value in the test group indicates the decrease in mastication performance, in line with Toro¹² that mastication performance can be seen from the MPS value, the smallest the MPS value, the better the mastication performance.

Most of the research groups have the same MPS values, which is 2.8 mm², in the control group there are 13 samples (54,17%) and in the test group there are 13 samples (46,43%). The same MPS value is caused by the ability of every individual to adapt to the condition and environment can be well tolerated. As presented by Thorsten²⁸ that any changes, such as the speed of contraction and jaw muscle in controlling the position and the mandible movement can make individual adaptability vary. The adaptability of jaw muscle continues constantly and keep being affected by various local and systemic stimulus so it is able to adapt to any condition that occurs in its functional area. Nevertheless, despite the jaw muscles move together in a masticatory system, the ability of adaptation change is not necessarily always the same and varies according to the origin of the stimulus.

Different sensitivity of each individual has also an influence on the mastication performance,

that is the existence of psychological perception in terms of a sense of comfort and discomfort while masticating.²⁸ Some individuals have a greater tolerance effect to the size of food and vice versa. Mastication often ignores small objects (particles) and gives excessive perception on large objects. An individual with good mastication can easily crush foods into small particles because he has a greater tolerance effect and less sensitive to large objects. Different perception of each patient becomes an obstacle in this study.

Decrease in mastication performance in the test group can be caused by a change in mandible movement pattern when opening and closing the mouth because the condyle holder ligament is impaired. Disturbances in condyle area, especially in ligament may occur due to wrong posture, such as forward head posture or tendency of more forward head posture so there is an excessive pressure to the condyle area and muscle requires extra power to work.^{3,29} However, this study does not carry out further examination on the position and condition of articular disc that becomes the STM control center due to the limited cost and time.

The result also shows that according to the statement of Ikebe¹⁰ that the presence of temporo mandible joint disorders in form of clicking, although it is still asymptomatic (no pain) can reduce mastication performance, primarily in adults. Charts 1 and 2 show the particle distribution of both study groups. The result show that the test group has the starting point "b" which is greater than the control group, the condition indicates that the test group has lower mastication performance than the control group. Mastication performance decrease can be caused by more mastication needs to destroy food for people with STM clicking.³⁰

The result shows that there is a significant difference between the control group and the

test group. The control group has been selected rigorously through inclusion and exclusion criteria that shows a better mastication performance. This is due to all muscles and other structures such as teeth, bones and temporo mandible joints that play roles in mastication are in balanced condition that they do not have any problems in masticating artificial foods provided by the researchers.

The test group experiences an imbalance in the mastication system, so in line with the study conducted by Ikebe,²² the disorders can reduce mastication performance, although the study is conducted to adults, the researchers believe that the reduction of mastication performance can also occur in the age of childhood. This is caused by an imbalance in mastication system caused by poor posture.^{3,4,31,32}

The study is conducted to samples by age (12-15 years old) and the number of permanent teeth is complete and without extensive caries. Some researchers say that at those age, there is an increase in body size and muscles mass, so seems that mastication performance at the age of 12-15 years will be different from children aged 6-9 years.³³ The study conducted at this time does not indicate differences between the age group of 12-15 years and 6-9 years due to limited cost and time of the study. The result among the same age group indicates a significant difference between the control group and the test group shows that at the age of 12-15 years, the condition of temporo mandible joint in mastication system needs to be concerned, so there will be no decrease in mastication performance and bad impacts later on.

Some researchers show that pain in STM will reduce the mastication performance, therefore the samples having pain in the STM area are included into the exclusion criteria in order not to bias the study results.³⁵ The results study of Maria²⁰, Akeel¹¹, dan Lemos²¹ and other researchers ignore jaw joint disorder; the TMJ sound (STM clicking) in measuring the mastication performance. The researchers perceive it as something not quite right because the study result indicates the difference in the control group and the test group, so it will affect the result.

Mueller³⁴ conveys that articular sound cannot be used as an indicator of the level of STM damage. However, the result shows that a temporo mandible joint disorder with clicking symptom

will have an effect on mastication performance in children aged 12-15 years so that a precaution to avoid worse effect later on is needed.

Imbalance in one of masticatory system components will be visible in structure and functional disorders in one or more components.³² Nonetheless, many studies prove that masticatory system has the ability to adapt well both functionally and structurally. The adaptation of masticatory system can be temporary or permanent, other than that, the system is similar to other biological system in body, so it cannot be seen as something absolute.^{3,30,28} Therefore, chart 1 and 2 as well as table 1 shows good mastication (small MPS value) in the test group. This can be caused by good adaptation of the individual despite having STM disorder with clicking symptom, the mastication in the individual continues optimally.

CONCLUSION

Based on the results, it can be concluded that there is a decrease in mastication performance in children aged 12-15 years of Deutero Malay sub race that have temporo mandible joint clicking (STM). The results can be seen from the MPS (Median Particle Size) value of the test group which is smaller than the control group and statistically there is a significant difference between those two groups.

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