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DETERMINATION OF ORTHODONTIC TREATMENT TIME ON MALE CHILD WITH MIXED DENTITION PHASE BASED ON PALATAL MEASUREMENT

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ABSTRACT-*Some studies and research showed increasing in palatal dimension in children during the growth period. Orthodontist chooses to do an early orthodontic treatment at this period. The growth of palatal is different between early mixed dentition, late mixed dentition, and permanent dentition. Some orthodontist had argued that early orthodontic treatment gave the best result when the palatal growth occurred.* ***Objective****: This research target is to determine the right time to begin early orthodontic treatment in children by measuring palatal height, palatal width, and palatal depth.* ***Methods****: This study carried out at SDN Airlangga 2, Surabaya, in September 2011. The total sample is 90 male children, consist of 30 male children with early mixed dentition, 30 children with late mixed dentition, and 30 male children with early permanent dentition. The sample criteria are 8, 10, and 12 years old boys, never get any orthodontic treatment and Javanese people in Surabaya. Palatal height, palatal width, and palatal depth were measured by sample dental cast.* ***Result****: The results show there are an increase of palatal height, palatal width, and palatal depth as the growth of the age, but the differences are not significant.* ***Conclusion:*** *This research concludes that early orthodontic treatment can be held during the mixed dentition period.*

Keywords: palatal height, palatal width, palatal depth, mixed dentition, early treatment orthodontic

INTRODUCTION

The shape and size of the palate, both in the transverse and sagittal directions of an individual is different from other individuals. This is influenced by several factors, namely the environment, nutrition, genetics, race, and gender. Although environmental factors play a role, genetic factors are more important to determine the size and shape of the palate. Thus it can be said that variations in size and shape of the palate are influenced by genetic and environmental factors[1].

Much study has been done to measure the length, width, and depth of the palate. The study generally aims to measure the dimensions of the palate based on age, sex, ethnicity, or race. The results of the study of length, width, and height obtained an average length of the male palate is 19.67 mm and 18.89 mm for females. The average width of the male palate is 48.99 mm, and for a female is 46.89 mm. The average height of the male palate is 18.02 mm and for a female is 16.81 mm[2].

In a study comparing the length and width of the palate between the Javanese and the Batak people in Surabaya, the average length of the palate of the male Javanese is 41.91 mm and the male of Batak is 42.47 mm. The average palate length of female Javanese is 35.07 mm, and for the female of Batak is 41.74 mm. The

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average palate width of male Javanese is 57.32 mm, and for the male of Batak is 54.20 mm. The average palate width of Javanese female is 50.54 mm and in the female of Batak is 55.89 mm[3].

A study comparing jaw size differences based on the age period and the tooth phase shows that dentoalveolar development is quite significant in the erupting phase of the tooth until the permanent tooth phase[4]. After all permanent teeth erupted, no significant jaw size growth was seen. This development was seen from aspects of the size of the teeth[5], arch, length, and height of the palate. Permanent incisor eruption affects the size increase in the anterior segment, especially in the maxilla. Permanent canine eruption gives a slight increase in maxillary size. It can be said that the eruption of permanent teeth determines the increase in jaw size[6].

The study regarding Palatal measurement is often associated with defining a diagnosis and orthodontic treatment plan. In determining the diagnosis and orthodontic treatment plan, a practitioner must know the state of the tooth structure in the arch[7,8]. The height and shape of the palate is very influential on the growth and development of teeth that affect the composition of the teeth in the arch jaw. Palate height also affects the stability of orthodontic treatment results[9].

The deciduous and mixed dentition phase is a good time for orthodontic treatment. Orthodontic treatment is more effective in the mixed dentition phase compared to other phases[10,11]. This was agreed because the growth of the palatal dimensions showed considerable changes in the mixed dentition phase[12,13]. Orthodontic treatment at the age of these children is often referred to as first-phase orthodontic treatment or early orthodontic treatment[14,15].

At this time, it is still unknown the right age to start orthodontic treatment in order to obtain optimal treatment results. Orthodontic treatment patients performed by undergraduate students at the Dental and Oral Hospital (RSGM) of FKG Airlangga are children with mixed dentition phase who are treated using removable orthodontic appliances. Treatment using removable orthodontic appliances at RSGM Airlangga University is still far from the expected results. From 111 cases treated between 2008 and 2010, 76 cases showed treatment failure or worsened, 33 cases showed treatment progress by > 30%, and 2 cases showed treatment progress by 70%[16] .

Based on the description above, the authors would like to conduct a study to measure the length, width, and height of the palate in children with an initial mixed dentition phase (age 8 years), the final mixed dentition phase (age 10 years), and an initial permanent phase (age 12 years) to determine the effective time for orthodontic treatment. The age grouping of this study is based on the study by Thilander (2009)

MATERIAL AND METHOD

This study is an observational analytic that measures the length, width, and height of the palate. The total sample is 90 respondent, consists of 30 male children with mixed dentition phase aged from 7.5-8.5 years old and 30 male children aged from 9.5-10.5 years old, and 30 male children with permanent dentition phase aged from 11.5-12.5 years old, with the criteria that the first incisors and permanent first molars had erupted, with Angle's Class 1 molar relationship, never received orthodontic treatment, there is no caries in the permanent first molar, normal torus palatinus, and no extreme crowded teeth.

The tools and materials used in this study were sliding calipers, rulers, spatula casts, rubber bowls, upper jaw impression tray, alginates, and gypsum. The sliding caliper used in this study has an accuracy of 0.01 mm.

Palatal measurements were obtained from a sample's dental model. Each upper jaw of the sample impressed using alginate to obtain a dental impression. The dental impression is filled with gypsum to get a model that is ready to be measured using a sliding caliper. Each model is grouped according to age group.

The width of the palate is obtained from measuring the line between the points in the central fossa of the first permanent left molar to the point in the central fossa of the right permanent first molar (Figure 1). The length of the palate is obtained by measuring the contact points between the first two incisors perpendicular to the horizontal line formed by the width of the palate (Figure 2). The height of the palate is obtained by measuring the vertical line from the deepest point of the palate perpendicular to the occlusal surface of the teeth (Figure 3). To get an occlusal line, a ruler is used so that the measurement results obtained from the height of the palate are reduced by the thickness of the ruler. Each measurement is carried out three times to avoid measurement errors.

Data collected were tested for normality using the Kolmogorov Smirnov test followed by the One Way ANOVA parametric test to obtain the results of differences in the length, width, and height of the palate in each group, where the palate length of the group 1 compared to the group 2 and 3, the palate width of the group 1 compared to group 2 and 3, and the palate height of the group 1 compared to the height of the group 2 and 3.

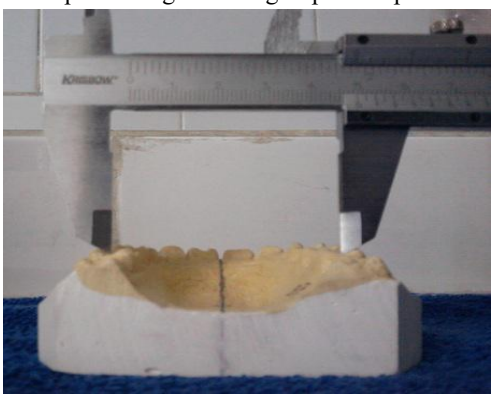

Figure 1. Palatal width measurement

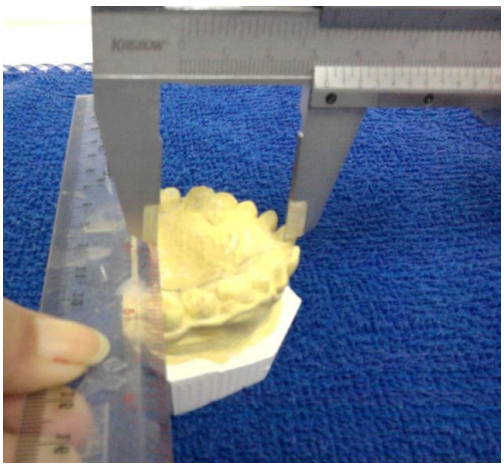

Figure 2. Palatal length measurement

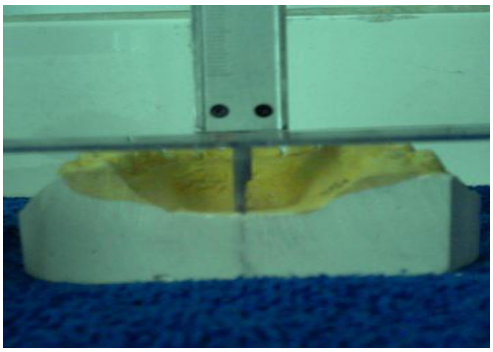

Figure 3. Palatal height measurement

RESULTS

From dental model, the length, width, and height of the palate were measured. The following are the results of the study in 3 sample groups, namely the initial mixed dentition phase (group 1), the final mixed dentition phase (group 2), and the initial permanent phase (group 3) which is measured in millimeters.

Table 1. Mean values and standard deviations of the length, width, and height of the palate

	Group	Mean (mm)	Standard deviations (mm)
I	Length	31,3073	2,99849
	Width	46,0777	3,33114

	Height	14,8617	2,16754
II	Length	31,0280	2,16782
	Width	47,2400	2,85658
	Height	15,9467	2,06230
III	Length	31,4897	2,12584
	Width	48,3883	2,56927
	Height	16,5367	2,75427

Table 1 shows an increase in the width and height of the palate according to the age difference in each sample group while there was no increase in the palate length in each age group.

Each group was tested using the Kolmogorov Smirnov test. The results of the three groups show that p-value > 0.05), which means the data in the study group is normally distributed so that data analysis can be continued using the One-way ANOVA parametric test. The results of one-way ANOVA test for the palatal length in each group shown in table 2

Table 2. The results of one-way ANOVA test for palatal length measurements between each group

		Sig.
Group I	Group II	0,899
	Group III	0,956
Group II	Group I	0,899
	Group III	0,749
Group III	Group I	0,956
	Group II	0,749

One-way ANOVA test results between the study groups show significant differences when the significance was less than 0.05 (p <0.05). From table 2 it can be seen that there is no significant difference in the palatal length between each group.

Table 3. The results of one-way ANOVA test for palatal width measurements between each group

		Sig.
Group I	Group II	0,276
	Group III	0,008*
Group II	Group I	0,276
	Group III	0,289
Group III	Group I	0,008*
	Group II	0,289

*= there is significant differences (p<0,05)

Table 4. The results of one-way ANOVA test for palatal height measurements between each group

		Sig.
Group I	Group II	0,179
	Group III	0,019*
Group II	Group I	0,179
	Group III	0,596
Group III	Group I	0,019*
	Group II	0,596

*= there is significant differences (p<0,05)

Tables 3 and 4 show a significant difference between the palatal width and height between group I and group III, where p <0.05. Between groups I and II, groups II and III there were no significant differences.

DISCUSSION

Results of the study show the mean palatal length in group I (7.5-8.5 years old) is 31.30mm, in group II (9.5-10.5 years old), is 31.02mm, and in group III (11.5-12.5 years old) is 31.48mm. The palatal length in the

group III is smaller than group I. This is because the study is not carried out longitudinally, but instead uses samples of different ages. It can be concluded that there is no increase in the palatal length according to age level. Literature and studies that have been done previously found an increase in the length of the palate in accordance with age, although growth is not significant. Various things can cause the absence of an increase in the palatal length, for example, the premature loss of deciduous teeth, which causes permanent teeth to not erupted in good dental arches, which does not increase the length of dental arches.

Local factors greatly influence the length of the dental arch, such as interproximal caries and premature loss of deciduous teeth, or both. Early loss of deciduous teeth can result in reduced space of 2-4 mm per quadrant per arch[17].

The results of this study found that the mean value of palatal width in the group I is 46.07 mm, in the group II is 47.24 mm, and the group III is 48.38 mm. Palatal width increases according to age. The difference in the width of the palate between the group I and group II, and between-group II and group III is not significant. In contrast, between the group I and group II there are significant differences.

A significant difference was also seen in the measurement of palatal height between group I and group III. While between group I and group II and between group II and group III, there was no significant difference in palatal height, although, between the age groups, there was an increase in size. The mean value of palatal height in the group I is 14.86 mm, the group II is 15.94 mm, and the group III is 16.53 mm.

An increase in palatal width and height is according to age. The results of this study are in accordance with previous studies, which showed greater changes in the dimensions of palatal width and height compared to the dimensions of palatal length. The vertical growth that forms the height of the palate occurs twice as large as the eruption of the first five permanent teeth when compared to the eruption of deciduous teeth. While the width of the palate increases to 1.8 times greater[18].

Changes in the width of the dental arch are strongly influenced by the mesiodistal width of the permanent teeth. The width of the mesiodistal permanent teeth is greater than the deciduous teeth. The mesiodistal width of the permanent teeth of male children is greater than female children[19,20]. The growth of the maxilla in the transverse direction is greater than the growth in the sagittal direction. Growth in the transverse direction results in the growth of the palatal width[21]. During permanent tooth eruption, bone apposition occurs on the endosteal surface of the labial cortex and periosteal labial cortex which increases the width and depth of the palate[22].

Palatal growth is inseparable from several conditions that accompany it during the fetus state to the growth period of the children. Nutritional intake during pregnancy and the growth period of the children will show optimal growth when compared to children who do not get balanced nutrition. Other conditions that affect the growth of the palate are polluted environmental conditions. Exposure to pollutants such as lead and mercury during pregnancy and the growth period of the children can also inhibit optimal growth and development[23,24].

Orthodontic treatment at the age of children or often referred to as early orthodontic treatment, is carried out at the mixed dentition phase. Treatment in this phase was chosen because it is expected that malocclusion has not occurred. During this time, there is a growth in the dimensions of the arch that is large enough to allow for more effective treatment and more optimal results[25].

CONCLUSION

The results of this study indicate changes in the dimensions of the length, width, and height of the palate. But the size difference is not significant between each age group. Significant differences were only obtained from the ratio of the width and height of the palate between group I and group III. Palatal growth in the replacement tooth phase shows an age-appropriate increase that occurs physiologically following the growth and development of the teeth and jawbone so that it can be concluded that early orthodontic treatment can be carried out during the mixed dentition phase. In early orthodontic treatment, a deeper history is needed about the condition experienced by the mother during childbirth and other conditions that accompany the growth and development of the child from birth to orthodontic treatment.

Further research needs to be done with a larger number of samples to obtain more accurate and significant data. Longitudinal study to monitor the growth of the palate so that the data obtained is more appropriate to determine the increase in palate growth from the age of the displacement to the permanent dentition.

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