Validity comparison between Moyers and Sitepu methods in the Javanese children of 11-14 years old

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ABSTRACT

Aim: This study aims to compare the validity between Moyers and Sitepu methods in the Javanese children of 11-14 years old.

Method: 50 children of 11-14 years old in SMP Al Islam 1 Surakarta that suitable to the study sampling criteria, upper and lower jaw were molded. The result of jaw molds as a study model was used as research samples for direct measurement using Moyers and Sitepu methods with a sliding caliper. The three results were recorded and analyzed using the statistic test of Kruskal-Wallis and post hoc Mann Whitney.

Study result: There is no difference in direct measurement result with Moyers method on the lower jaw (p>0.05) and there is a difference in direct measurement result with Moyers method on the upper jaw (p<0,05).

Conclusion: Sitepu method is valid for the upper and lower jaw and the Moyers method is valid for the lower jaw of Javanese children of 11-14 years old.

INTRODUCTION

Malocclusion is a problem found in dentofacial development and many malocclusion cases are found in mixed dentition periods. The mixed dentition period is transitional dentition or transition from the primary dentition to the permanent dentition. In this phase, there is a mixture of primary and permanent teeth in the oral cavity (Brahmanta (2015); Kurnia et al. (2021)).

The mixed dentition period is important in the growth and development of occlusion because most malocclusions are found in this period. Interceptive treatment is needed to prevent severity or remove malocclusion in the future. The dentist needs to determine the diagnosis and the treatment plan of the malocclusion case. Space analysis in mixed dentition is a method for predicting mesiodistal width in unerupted permanent teeth, namely canines, first premolars, and second premolars (C, P1, P2), whether using radiography or not. The analysis result is as a discrepancy model of the gap between available space with required space for teeth eruption of permanent teeth. Available space is a space in which the eruption of permanent teeth with a proper place from first mesial molar of right permanent to first mesial molar of left permanent. This discrepancy will determine the choice of the type of patient treatment as space maintenance, space regaining, serial extraction, or periodic observation (Amalia et al. (2012); Baktir et al. (2020); Djafar & Pudyani (2006); Giri et al. (2018)).

Moyers method is using a probability table to estimate the space needed to predict canine teeth, first premolar, and permanent second premolar (C-P1-P2) of the upper and lower jaw with a sum predictor of four permanent incisors on the lower jaw. Moyers is using a prediction table with a percentile of 75% because considered global and secure from malocclusion. Moyers table is the most extensively used table because it has some advantages such as; it has a minimum error, it can be used by both dentist and beginner, it does not take a long time to make, it does not need the radiographic image, and it can be used for both upper and lower jaw. This probability table is based on the data collected in the study on the North American Caucasoid race so that the accuracy of this method is questionable when applied to other races (Bhatnagar et al. (2017); Kurnia (2021); Maroli et al. (2015)).

2021 ISETH
International Summit on Science, Technology and Humanity

International Summit on Science Technology and Humanity (ISETH) 2021
Enhancement of Academic Capacity to Contribute Country Development

p-ISSN: 2477-3328
e-ISSN: 2615-1588

Another method used to compare other validity is the Sitepu method. The Sitepu method is also usually used to analyze the space needed by adding up the four mandibular incisors and then entering into the formula. The results of the measurement of the teeth showed the mesiodistal number of C-P1-P2 on one side. This formula has been studied in 215 children with the Deutro-Malay race in 1983 (Rahardjo, 2008). Although the Sitepu method is accurate, the accuracy value can be disturbed if the measurements are not appropriate (Wiyono et al., 2016).

Race is one of the factors that affect teeth malocclusion. Javanese race is the biggest race on Java Island. This race is a Deutro-Malay sub racial group that has certain physical characteristics, including a mesocephalic to brachycephalic head shape, a concave nose profile, slightly thick lips, dark brown eye color, black hair color, straight or curly hair shape, and brown skin color. In Javanese children, in general, the frontal direction is oval in shape for the highlands and round for the lowlands, while the sagittal direction is convex in both the lowlands and highlands. The Javanese have a flat dome of the palate with the palate tends to be wide and the mesiodistal width of males is larger than that of females. The presence of dietary factors and living habits, jaw structure which is influenced by tooth shape results in byzygomatic width and will affect the overall face size (Paramesthi (2011); Sukadana (1976); Sutardjo (2003)). Based on the description above, the researcher wanted to know the validity of the Moyers and Sitepu method on Javanese children aged 11-14 years.

RESEARCH METHOD

The research sample of the upper and lower jaw was molded using a mold that was adjusted to the size of the arch of the jaw. The subjects of this study were 50 children aged 11-14 years at SMP Al Islam 1 Surakarta. The criteria for the research subjects were to have complete mandibular incisors and clinically good morphology, were Javanese children of at least 2 generations above (Father, Mother, Grandfather, and Grandmother), permanent canines-first premolars-second premolars (C-P1-P2) has erupted and has no caries in the maxilla or mandible, is cooperative for the study model molding, and is not currently under orthodontic treatment. Research permits, ethical clearance, and informed consent were obtained before the research was conducted.

The upper and lower jaws of the study samples were impressed using a mold that was adjusted to the size of the arch of the jaw. Alginate impression material is mixed with water according to the specified ratio and stirred with a spatula in a rubber bowl. Alginate that has been stirred must be homogeneous. Homogeneous alginate is placed on a tray that has been prepared according to size and inserted into the oral cavity of the research subject in the upper and lower jaws to obtain negative impressions. The impressions were then filled with gypsum stone to get a positive impression, then planted in boxing using plaster casts and used as a study model for the research sample.

Three kinds of calculation were conducted in the study model namely direct measurement, calculation with Moyers method, and calculation with Sitepu method. Indirect measurement, the total mesiodistal width of the maxillary and mandibular permanent C-P1-P2 teeth was measured directly using a sliding caliper. Measurements were carried out three times for each side and the average value was obtained.

In the calculation with Moyers method, the total mesiodistal width of the four mandibular permanent incisors was measured and recorded. The sum of the four mandibular incisors was matched with the Moyers table with 75% probability by sex to predict the space required for the eruption of teeth C-P1-P2 on each side of the maxilla and mandible.

In the calculation using the Sitepu method, the four mandibular incisors were calculated using the Sitepu formula. The results of the sum of the mesiodistal widths of the mandibular incisors were included in the Sitepu prediction formula so that the Y and Z values were obtained. The Y value was the sum of the mesiodistal widths of the second premolars, first premolars, and canines on one side of the mandible. The Z value is the sum of the mesiodistal widths of the second premolars, first premolars, and canines on one side of the maxilla. From the results of the Y value, it can be

calculated the space needed in the lower jaw by adding the sum of the mesiodistal widths of the lower incisors by twice the Y value, maxilla by twice the Z value.

The result of direct measurement, Moyers method calculation, and Sitepu method calculation was recorded. The three measurement results and methods were compared and analyzed to determine their validity.

RESEARCH RESULT

The result of direct measurement, Moyers method calculation, and Sitepu method calculation on the upper and lower jaw is presented in Table 1. The data analysis in this study was using One Way ANOVA parametric data analysis with the significance of $p<0.05$ to know the difference between size prediction validity C-P1-P2 based on Moyers and Sitepu method. The test requirement is that the data must be normally distributed. To see the normality of the data, the Shapiro Wilk test was carried out because the sample was ≤ 50.

Table 1. Average Measurement of the Upper and Lower Jaw

Measurement and Method	Total Sample	Upper Jaw Average (mm)	Lower Jaw Average (mm)
Direct	50	22,39	21,61
Sitepu	50	22,58	21,25
Moyers	50	21,57	21,27

Kruskal Wallis's nonparametric test with an accuracy level of 95% ($p<0.05$) was conducted because the data was not normally distributed. Table 2 shows the result of the Kruskal Wallis test from the group of direct measurements, Sitepu and Moyers on the upper and lower jaw. The upper jaw test shows that $p=0.000$ ($p<0.05$) so that the data has a significant difference between the direct measurement, Sitepu method, and Moyers method. The test on the lower jaw shows the result of $p>0.05$, so there is no significant difference between the direct measurement, Sitepu method calculation, and Moyers method calculation.

Table 2. Kruskal Wallis Test of the Upper and Lower Jaw

Jaw	Measurement and Calculation	N	Mean Rank	Sig
Upper	Direct	50	82,13	
	Sitepu	50	94,43	0,000*
	Moyers	50	49,94	
Lower	Direct	50	85,20	
	Sitepu	50	71,42	0,152
	Moyers	50	69,88	

*Significantly different

A post hoc Mann Whitney test was conducted to see the difference between groups in the upper and lower jaw (Table 3). In the upper jaw, direct measurement and Sitepu method calculation have no significant difference ($p>0,05$) meanwhile in Moyers method is different from the two other measurements and calculation ($p<0.05$). In the lower jaw, there is no significant difference between groups of direct measurement, Sitepu method calculation, and Moyers method calculation. This result shows that measurement using the Sitepu method is valid for the upper and lower jaw; meanwhile, Moyers method is valid for the lower jaw.

ISETH 2021
International Summit on Science Technology and Humanity (ISETH) 2021
Enhancement of Academic Capacity to Contribute Country Development

p-ISSN: 2477-3328
e-ISSN: 2615-1588

Table 3. Mann Whitney Test of the Upper and Lower Jaw

Jaw	Measurement		Sig
Upper	Direct	Sitepu	0,199
		Moyers	0,000*
	Sitepu	Direct	0,199
		Moyers	0,000*
Lower	Direct	Sitepu	0,086
		Moyers	0,104
	Sitepu	Direct	0,086
		Moyers	0,756

*Significantly different

DISCUSSION

In space analysis of mixed dentition period, the available space for permanent teeth eruption obtained from direct measurement in the model, meanwhile the needed space not always can be calculated directly from the model if there is an unerupted tooth. The direct measurement method in the model to calculate the needed space is conducted to prevent bias if the measurement is done using a periapical photo, so the sample collected is permanent teeth phase. This will not affect the measurement result because human teeth size is relatively fixed and is not getting bigger with age. The prediction method is needed to calculate the needed space for permanent teeth to erupt. Appropriate analysis method determination should be conducted to carry out the right diagnosis and treatment plan for each malocclusion. Moyers method and Sitepu method are commonly used prediction methods in a measure the needed space (Baktir et al. (2020); Kurnia et al. (2021); Wiyono et al. (2016)).

Prediction tables that have been produced so far have limited clinical benefits because prediction tables for tooth size are only available for certain populations, whereas if used for other populations it will reduce the accuracy of these predictions. Moyers analysis method and Sitepu analysis method show different validity when were used for other populations it will reduce the accuracy of the prediction. Moyers analysis method and Sitepu analysis method show different validity when used for a different race. Both methods also use different races in the prediction result. The Moyers prediction data is carried out from the Kaukasoid race, meanwhile, the Sitepu prediction method is carried out from the Deutro-Malay race, so there are measurement differences in both prediction tables (Baktir et al. (2020); Kurnia et al. (2021)).

According to the research result, the Sitepu prediction method is valid for the upper and lower jaw. This is suitable with a study by Wiyono et al. (2016) that stated if Sitepu prediction method and direct measurement have no significant difference, which means the result of the Sitepu prediction method is quite accurate compared to the result of direct measurement as control. Kurnia et al. (2021) also stated that the Sitepu method was declared valid for the upper and lower jaw of the Minang race. This method and formula are created for the Deutro-Melayu subrace. Javanese is a race that includes to Mongoloid race and belongs to the Deutro-Melayu subrace (Paramesthi, 2011). The characteristics of Deutro-Malay subracial found in Javanese, which shows a pattern of tooth size that is almost the same between populations, and variations in tooth size are determined by genetic factors and environmental influences (Wiyono, 2016). In this research, only Javanese becomes a controlling factor, whereas the factors affecting the mesiodistal width of the teeth were not only race but also gender, genetics, nutrition, environmental factors, and socio-economics (Al-Bitar et al., 2008). The results of this study are not following the research of Baktir et al. (2020) stated that the Sitepu method is valid for predicting the eruption of mandibular C-P1-P2 teeth only.

Moyers prediction method is valid for the lower jaw but invalid for the upper jaw of Javanese. The difference between direct measurement and prediction values from Moyers analysis is 75% on the upper jaw, in this research significantly different as a statistic. Some research conducted to test the validity of Moyers analysis in various ethnic and racial groups shows the heterogeneous result. According to Thimmegowda et al. (2015), the use of Moyers table is accurate for males with the percentile of 50% and female 75%. Moyers table 85% for the upper jaw and 75% for the lower jaw, valid for the male population in China. In females, Moyers table 75% valid for the upper jaw but there is no precise percentile for the lower jaw. Literature shows that there is tooth size variation between men and women where men have bigger sizes than women. Other research declared that precise prediction for Arab Yaman race in Surabaya is Moyers method for the upper jaw. In the Arab population of Pekalongan, Moyers table 75% adequate for the upper jaw but not for the lower jaw. Other research on the Minang race stated that Moyers analysis method is invalid for the lower jaw. Mixed dentition Moyers analysis should be used selectively because its accuracy about probability level is still questionable (Baktir et al. (2020); Chong et al. (2021); Handayani & Hidayah (2019); Kurnia et al. (2021)).

Moyers table prediction analysis requires table renewal of validation once in each generation (30 years) because of the change of malocclusion and teeth size (Al-Kabab, 2014). It can be seen that there is a difference in the validity of the Moyers analysis method and the Sitepu analysis method from the results of previous studies. This is because there is no analytical method that will be completely valid for predicting the mesiodistal width of the canines and premolars (first and second) if used in different samples (Kurnia et al., 2021). Mixed dentition analysis methods require periodic modifications according to region, race, and sex. Modification of the current method is required to obtain accurate results. It is also recommended to have standardized values for the Asian population which will make it easier for dentists to determine an accurate treatment plan for children who need occlusion correction (Ravinthar & Gurunathan, 2020).

CONCLUSION

The Sitepu and Moyers methods can be used for mixed dentition space analysis in Javanese children. The Sitepu method is valid for the upper and lower jaw, meanwhile, the Moyers method is valid for the lower jaw in Javanese children of 11-14 years old.

ACKNOWLEDGEMENT

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