

# VALUE OF DENTAL ARCH INDEX IN CLASS I OCCLUSION OF 12 YEAR-OLD MUONG VIETNAMESE CHILDREN

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Currently, the dental index of the Muong ethnic group are not known in Vietnam. Therefore the study was conducted to determine the dental arch index of 12-year-old Muong Vietnamese children in the Class I occlusion, according to Angle (Author of classification of occlusion). A cross-sectional study of 118 children belong to class, coordinates were recorded at the contact point between two incisors, at the cusp tips of the canines, the buccal cusp tips of second-premolars, the mesiobuccal cusp tips of first molars and the distobuccal cusp tips of second-molars. Dimensions of dental arch widths, lengths and circumferences were analyzed using SPSS software version 16.0. Dental arch widths, lengths and circumferences (male: U33W =  $36.14 \pm 1.94$ , U55W =  $49.48 \pm 2.27$ ,... female: U33W =  $34.88 \pm 1.71$ , U55W =  $47.93 \pm 1.85$ ). The mean values of all variables were generally higher in males compared with the females and significant sex differences in means ( $P$ -value  $< 0.05$ ) were found in dental arch widths, lengths and circumferences of maxillary and mandibular arches, except for anterior lower length ( $p > 0.169$ ). Details of norms for dental arch widths, lengths, circumferences with age may allow for appropriate assessment of dental arch size and treatment plan.

**Keywords:** Dental arch dimension, Muong ethnic, plaster dental cast, 12-year-old.

## I. INTRODUCTION

Globally, there are many studies that have been conducted to investigate the dental arch dimensions; many authors have reported significant differences in maxillary and mandibular arches. Dental arch dimensions are of special interest for dentists and orthodontists in particular. Changes in the arch width, length and circumference result from orthodontic treatment; hence, an understanding of the dental arch dimensions is crucial. In 1988, Bishara SE studied the dental arches: changes in the molar relationship between the deciduous and permanent dentitions.<sup>1</sup> In 2009, Martins

and Lima studied the dental arches of Brazilian children age 10 to 12.<sup>2</sup> In 2014, Sudhanshu Sandhya and Manish Chadha studied the dental arches of children age 12-15.<sup>3</sup>

Methods of measuring dental arch.

- Measuring directly in the mouth: It does not require many steps but is difficult to measure the posterior width and length of dental arch.

- Photogrammetric method: It doesn't take impressions, modeling plaster casts but difficult determine landmark.<sup>4</sup>

- Using Digitization and Computed tomography to measure on dental cast. Both of these measurement are three-dimensional but actually two-dimensional so still not easy to determine the exact landmark on dental plaster cast.

- Using a digital sliding caliper to measure on dental cast: High precision (0.01mm) and easy

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to determine exact landmarks. This method is selected by many authors and also used in this study.

In Vietnam, the authors Hoang Tu Hung<sup>5</sup>, Le Duc Lanh<sup>6</sup>, Trinh Hong Huong<sup>7</sup> studied dental arch indexes but the subjects were from the Kinh ethnic group. Presently, the dental arch indexes of Muong ethnic children are not known and the population is one of the four most populous ethnic groups in Vietnam. Therefore the study was conducted to determine the dental arch indexes in Class I occlusion according to Angle with the objectives of:

- Determining dental arch width, length and circumference in male and female children of age 12 amongst Muong ethnic group with Class I occlusion, according to Angle.
- Comparing the mean value of male group and female group.

## II. SUBJECTS AND METHODS

A cross-sectional study of 118 dental plaster casts of 12 year-old Muong Vietnamese children, were used in the study (52 males, 66 females)

### 1. Subjects The children of age 12 were selected from high schools in Hoa Binh province

The criteria for selection included:

- Both parents of each subject were from the Muong ethnic group. There were not any inter racial marriages for at least two generations.
- Both male and female 12-year-old children are from the Muong ethnic groups in Vietnam.
- Class I occlusion, according to Angle
- Had complete permanent dentition with 28 teeth
- Showed well-aligned upper and lower dental arches
- Good facial symmetry clinically determined and no significant medical history
- No congenital defects or deformed teeth present.

- Absence of deleterious habit

Excluded criteria:

History of trauma and previous orthodontic or prosthodontic treatment or Milk teeth still exist on the dental arch or existence of supernumerary teeth or tooth out of dental arch

### 2. Research methods

A cross-sectional study of 118 subjects. The sample consisted of 118 individuals age 12 (male: 52, female: 66) and it is purposive sampling.

Location and time of collecting data: 7 secondary school, Kimboi district, in 2017.

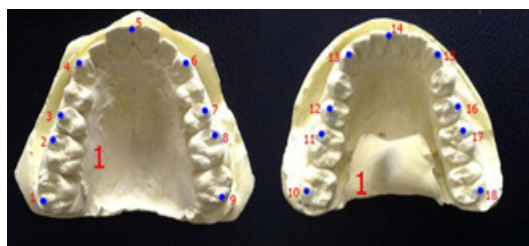
Tools and materials:

A digital sliding caliper, dental mirror, GC impression material, planet plaster, plaster cutting pliers, plaster grinding machine, Nikon 700D camera.

Steps of collecting data:

- Selecting locals
- Contacting local government official
- Preliminary examination and making the list of subjects
- Training for dentists and dental technicians
- Examine outside and in mouth to find out patients with Class I occlusion according to Angle
- Taking of photos, impressions, modeling plaster casts.
- Measuring dental casts
- Entering and analysing data
- + The dental casts were coded immediately after drying. The casts were each secured to a fixed plane and the marker was used to mark each measurement point. Coordinates were recorded at the cusp tips of the canines, the buccal cusp tips of the second-premolars, the mesiobuccal cusp tips of the first molars and the distobuccal of the second-molars (Fig.1). The contact point of the central incisors (upper, lower dental cast), the contact point of the lateral

incisor and canine(upper, lower dental cast), the contact point of the second premolar and first molar (upper, lower dental cast) (Figure.3).



**Figure.1: Measuring points**

The various measurements made are as follows:

+ Upper intercanine width (U33W) was measured from the cusp tip of the canine on one side to the cusp tip of the canine on the other side (upper dental cast).

+ Upper inter-second premolar width (U5-5W) was measured from the buccal cusp tip of the second premolar on one side to the cusp tip of the second premolar on the other side (upper dental cast).

+ Upper inter- first molar width (U66W) was measured from the Mesio-buccal cusp tip of the first molar on one side to the Mesio-buccal cusp tip of the first molar on the other side (upper dental cast).

+ Upper inter- second molar width (U77W) was measured from the distal buccal cusp tip of the second molar on one side to the distal buccal cusp tip of the second molar on the other side (upper dental cast)

+ Lower intercanine width (L33W) was measured from the cusp tip of the canine on one side to the cusp tip of the canine on the other side (lower dental cast).

+ Lower inter-second premolar width (L-55W), was measured from the buccal cusp tip of the second premolar on one side to the buccal cusp tip of the second premolar on the other side (lower dental cast).

+ Lower inter-first molar width (L66W) was measured from the Mesio-buccal cusp tip of the first molar on one side to the Mesio-buccal cusp tip of the first molar on the other side (lower dental cast).

+ Lower inter- second molar width (L77W) measured from the distal buccal cusp tip of the second molar on one side to the distal buccal cusp tip of the second molar on the other side (lower dental cast).

+ Anterior maxillary arch length (U13L): The vertical distance from the incisal point to the intercanine distance line

+ Middle maxillary arch length (U15L) : The vertical distance from the incisal point perpendicular to a line between the lower buccal cusp tips of the second premolars

+ Posterior maxillary arch length 1 (U16L): The vertical distance from the incisal point perpendicular to a line between the mesial buccal cusp tips of the first molars

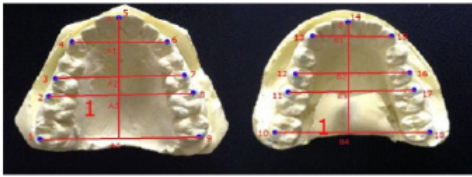
+ Posterior maxillary arch length 2 (U17L): The vertical distance from the incisal point perpendicular to a line between the distal buccal cusp tips of the second molars

+ Anterior mandibular length (L13L): The vertical distance from the incisal point to the intercanine distance line

+ Middle mandibular arch length (L15L): The vertical distance from the incisal point perpendicular to a line between the buccal cusp tips of the second premolars

+ Posterior mandibular length 1 (L16L): The vertical distance from the incisal point perpendicular to a line between the mesial buccal cusp tips of the first molars

+ Posterior mandibular arch length 2 (L17L): The vertical distance from the incisal point perpendicular to a line between the distal buccal cusp tips of the second molars



**Figure 2: Illustration of the maxillary, mandibular arches' widths and lengths**

AA1: Anterior Upper length (U13L) BB1: Anterio Lower length (L13L)  
 AA2: Middle Upper length (U15L) BB2: Middle Lower length (L15L)  
 AA3: Posterior Upper length 1 (U16L) BB3: Posterior Lower length (L16L)  
 AA4: Posterior Upper length 2 (U17L) BB4: Posterior Lower length (L17L)

**Dental arch circumferences**

- Distance 1 was measured from the contact point between the first molar and the second premolar to the contact point between the canine and the lateral incisor on the right side of the upper dental cast.

- Distance 2 was measured from the contact point between the canine and the lateral on the right side to the contact point between two central incisors of the upper dental cast.

- Distance 3 was measured from the contact point between two central incisors to the contact point between the lateral incisor and the canine on the left side of the upper dental cast.

- Distance 4 was measured from the contact point between the lateral incisor and the canine to the contact point between the second premolar and the first premolar on the left side of the upper dental cast.

- Distance 5 was measured from the contact point between the first premolar and the second premolar to the contact point between the canine and the lateral incisor on the left side of the lower dental cast.

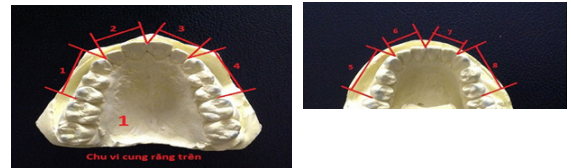
- Distance 6 was measured from the contact point between the canine and the lateral on the left side to the contact point between two central incisors of the lower dental cast.

- Distance 7 was measured from the contact point between two central incisors to the contact point between the lateral incisor and the canine on the right side of the lower dental cast.

- Distance 8 was measured from the contact point between the lateral incisor and the canine to the contact point between the second premolar and the first molar on the right side of the lower dental cast.

Upper dental arch circumference = distance (1+2+3+4) (Figure.3)

Lower dental arch circumference = distance (5+6+7+8) (Figure.3)



**Figurer 3: Dental arch circumference**

**3. Statistical Analysis**

Independent sample t-test was used to determine any statistically significant differences between males and females for each measurement. SPSS software was used for the statistical analysis (Version 16.0).

**4. Ethical issues**

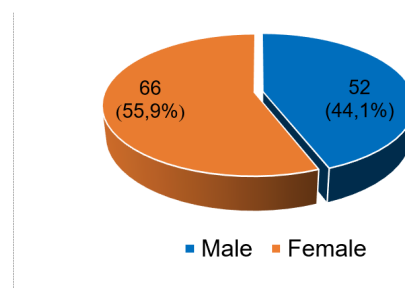
Since The moral council of Hanoi Medical University approved this study, it has started to be conducted on people.

**III. RESULTS**

**1. General characteristics of subjects**

The number of subjects (N =118)

There was no significant difference between genders



**Chart 1. Subjects were distributed by gender**

## 2. Dental arch measurement with age and gender among Muong children

All results are shown in Tables 1, all maxillary measurements showed statistically significant greater values for males compared to females (t-test;  $p < 0.05$  )

**Table 1. Comparison of different dental arch widths by age and gender in Class I occlusion according to Angle**

Measurement (mm)	Male Mean $\pm$ SD	Female Mean $\pm$ SD	Overall Mean $\pm$ SD	T test (P value)
U33W	36.14 $\pm$ 1.94	34.88 $\pm$ 1.71	35.43 $\pm$ 1.91	0.000*
U55W	49.48 $\pm$ 2.27	47.93 $\pm$ 1.85	48.61 $\pm$ 2.18	0.000*
U66W	54.34 $\pm$ 2.17	52.89 $\pm$ 1.75	53.53 $\pm$ 2.07	0.000*
U77W	58.69 $\pm$ 3.05	57.38 $\pm$ 2.22	57.96 $\pm$ 2.69	0.008*
L33W	27.34 $\pm$ 1.41	26.58 $\pm$ 1.55	26.92 $\pm$ 1.53	0.007*
L55W	40.75 $\pm$ 2.40	39.62 $\pm$ 2.87	40.12 $\pm$ 2.72	0.025*
L66W	46.65 $\pm$ 2.17	45.48 $\pm$ 2.02	46.00 $\pm$ 2.16	0.003*
L77W	53.52 $\pm$ 3.03	52.40 $\pm$ 2.55	52.89 $\pm$ 2.81	0.031*

All maxillary and mandibular measurements showed statistically significant greater values (\*) for males compared to females (t-test;  $p < 0.05$ ) except for D13L (t-test;  $p = 0.169$ ).

**Table 2. Comparison of maxillary, mandibular arch length of male and female.**

Measurement (mm)	Male Mean $\pm$ SD	Female Mean $\pm$ SD	Overall Mean $\pm$ SD	T test (P value)
U 13L	8.65 $\pm$ 1.07	8.06 $\pm$ 1.09	8.32 $\pm$ 1.12	0.005*
U 15L	22.91 $\pm$ 1.59	22.09 $\pm$ 1.54	22.45 $\pm$ 1.61	0.006*
U 16L	28.98 $\pm$ 1.71	28.12 $\pm$ 1.78	28.50 $\pm$ 1.79	0.009*
U17L	44.49 $\pm$ 2.41	43.13 $\pm$ 2.05	43.73 $\pm$ 2.31	0.001*
L13L	6.27 $\pm$ 8.44	4.82 $\pm$ 1.04	54.6 $\pm$ 5.67	0.169*
L15L	17.72 $\pm$ 1.53	17.07 $\pm$ 1.56	17.36 $\pm$ 1.57	0.026*
L16L	24.23 $\pm$ 1.76	23.43 $\pm$ 1.74	23.78 $\pm$ 1.79	0.015*
L17L	39.72 $\pm$ 2.05	38.61 $\pm$ 2.07	39.10 $\pm$ 2.13	0.005*

Circumference measurements showed statistically significant greater values for males compared to females (t-test;  $p < 0.05$  )

**Table 3. Comparison of upper and lower dental arch circumference by age and gender in Class I occlusion according to Angle**

Measurement (mm)	Male Mean $\pm$ SD	Female Mean $\pm$ SD	Overall Mean $\pm$ SD	T test (P value)
UC	77.46 $\pm$ 3.09	75.04 $\pm$ 2.76	76.11 $\pm$ 3.14	0.000*
LC	66.79 $\pm$ 2.96	64.75 $\pm$ 3.44	65.65 $\pm$ 3.38	0.001*

## IV. DISCUSSION

General characteristics of subjects: Study of 118 children, there are 52 males (46.5%) and 66 females (53.5%), the difference in these numbers was not statistically significant.

The size of the arch: Based on the results of the study, the upper and lower jaw width indexes (Table 1) are gradually increased in the posterior direction, the dental arch sizes of the males are generally larger than those of the females. This difference was statistically significant ( $p < 0.05$ ). Longitudinal arch: Indicators of maxillary length (Table 2) are gradually increased from front to back, we found that the length of arch sizes amongst males are larger than that of females except for Anterior Lower length (L3L)  $p = 0.169$ . Compared with the Vietnamese Kinh ethnic group, we found that our results are consistent with those of author Le Duc Lanh in 2002.<sup>6</sup> The length of the arch of the male is longer than the length of the female arch. That has statistical significance. There are no difference of the length of the front arch between male and female. We found that the size of the arch of the Muong ethnic group was smaller than that of the Kinh ethnic group; for example, the length of the upper arch to the second molar tooth of our study group is ( $43.73 \pm 2.31$ ), (Average for all 3 Angle's classes is:  $43.55 \pm 2.40$ ,  $N = 200$ ). As such it is smaller in comparison with similar data of the above author ( $46.64 \pm 2.8$ ).

Comparison with other countries: Hida Okori and colleagues (2015),<sup>8</sup> the upper length of 12-year-old Ugandans ( $13.36 \pm 2.07$ ) was longer than that of our study population ( $8.32 \pm 1.12$ ) (Average for all 3 Angle's classes is:  $8.07 \pm 1.41$ ). The lower frontal lengths of children in Uganda ( $9.08 \pm 1.93$ ) were greater than that of our study subjects ( $5.47 \pm 5.67$ ), (Average for all 3 Angle's classes is:  $5.28 \pm 4.40$ ). Nojima (2001), the length of the lower frontal teeth of

the Japanese was  $5.66 \pm 1.01^9$  whereas the results of our study subjects were:  $5.47 \pm 5.67$  (3 classes are divided by Angle is:  $5.28 \pm 4.40$ ). As the result, its figures were close to the size of Japanese arches, but smaller than the size of the Caucasian group ( $6.30 \pm 0.88$ ). The length of the lower back teeth through R6 (posterior lower length 1) of the Japanese ( $26.28 \pm 1.94$ ), of the Caucasian group ( $26.84 \pm 1.62$ ), while our study subjects were:  $23.78 \pm 1.79$  3 (Average for all 3 Angle's classes is:  $23.80 \pm 1.76$ ). Thus, they are smaller than the sizes of the Japanese and Caucasian groups. Louly and colleagues (2011).<sup>10</sup> The posterior maxillary arch length 1 (U16L) was  $40.2 \pm 2.3$  (mm). The number of our study is  $28.50 \pm 1.79$  (Average for all 3 Angle's classes is:  $28.32 \pm 1.96$ ). Thus it is smaller than the size of a 12-year-old Brazilian. John Y.K. Ling (2009).<sup>11</sup> The width of the Chinese arch (male:  $36.92 \pm 2.9$ , female:  $35.09 \pm 3.5$ ) looked closely familiar to our research, however, they were different from the Saudis' samples (male:  $33.88 \pm 2.47$ , female:  $33.71 \pm 2.74$ ) and also different from the Caucasian samples (male:  $34.05 \pm 2.1$ , female:  $32.77 \pm 2.2$ ).

This study has determined indexes of dental arch however it still has limitation on the number of subjects.

## V. CONCLUSION

The mean values were determined for dental arch widths, lengths, circumferences. The difference, similarity of that values between male and female.

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