

Proceeding



FDI - PDGI Continuing Education
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Bandung, 11 - 12 Nov 2016
Holiday Inn Pasteur



Description of Corpus Length and Ramus Height of Mandible in Patients with Panoramic Radiograph

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ABSTRACT

INTRODUCTION: Mandible consist soft woman parts which are the ramus and the corpus. Corpus length than ramus height grow differently according to age and gender. **Objective:** The purpose of this study is to determine the growth of corpus length and ramus height of mandible. **Materials and methods** The method of this research was a descriptive research with secondary data collected by cross-sectional technique from June until December 2014. There were 157 panoramic radiograph taken from Radiology Installation at RSGM UNPAD, 88 were females and 69 were males, measurements had been done using EzImplant software. Corpus length was measured from gonion to median line of mandible whereas ramus height was measured from highest point of condyle to gonion. **Result:** From the result, average of corpus length in males was 79.98mm (6-13 years), 90.89mm (14-16) and 93.22mm (17-30). Average of ramus height in males was 45.90mm (6-13), 56.69mm (14-16) and 59.62 (17-30). Average of corpus length in females was 75.49 mm (6-11 years), 85.85 mm (12-14) and 87.50 mm (15-30), while the average of ramus height in females was 42.92mm (6-11), 51.11mm (12-14) and 54.03 (15-30). **Conclusion:** As a conclusion, corpus length and ramus height increase along with age. The mean of corpus length and ramus height are higher in males than in females. The largest growth occurred during 14-16 years in males and 12-14 years in females, corpus length and ramus height showed the same growth pattern.

Keywords : corpus length, ramus height, mandible, panoramic radiograph

INTRODUCTION

Mandible is the bone of the lower jaw, which is known as one of the most important bones in the craniofacial complex. The pattern of mandibular growth coincides with body height growth during adolescence.¹ Thus, it can be represented the same as the growth in

height velocity curve. Although growth seems to cease after pubertal growth spurt, growth changes still occurred between late adolescence to mid-adulthood.² However, Behrents concluded that craniofacial skeletal changes continue to occur at least until the third decade.³ Mandible grows differently according to age and gender. The growth increases as the age increases. For example, in females, the mandibular length relatively increased from ages 6 to 14 per year, respectively.⁴ In adulthood, the corpus length are also increasing according to ages, from 6 to 18 years old.⁵ As stated before, gender also influenced the mandible's growth. Apparently, males have higher values of ramus height when compared to female and it is statistically significant.⁶ On the other hand, corpus length also is recorded higher in males.⁵

According to Enlow and Moyer's Classification, controlling factors that can influence craniofacial growth generally is divided into two categories which are the natural factors and disruptive factors.⁷ Examples of natural factors are genetic, function, general body growth and neutrophism while disruptive factors such as orthodontic forces, surgery, malnutrition, malfunction and gross craniofacial anomalies are the factors that can also influence the growth process.⁸

In this study, panoramic radiograph is used to describe the corpus length and ramus height that have been portrayed in the images. Panoramic radiography has contributed as the imaging procedure which is very useful for diagnostic problems as it gives broad coverage of maxilla and mandible.⁹ However, the main reason of using panoramic radiograph in this research is because it shows bilateral view of both jaws, therefore allow us to see any differences between two sides and also provide us with vertical measurements of the mandible adequately.⁶

This study is important in orthodontics for diagnosis, prevention, interception, and correction of malocclusions. This will help to will improve treatment planning as most orthodontic treatments take place during growth.¹⁰ Besides that, it also give contribution in dental implants as implant placement is recommended only after growth has ceased or clinically insignificant, the understanding of mandible growth and the changes that took place is.² However, the main contribution of this study is that it can be very useful for medico legal and anthropological work to identify human skeletal remains.¹¹ Mandible becomes the definite source for gender confirmation when there is absence of complete pelvis.¹²

Without the information of mandible's measurements which varies from different age and gender, treatment may be complicated and need further observation. Understanding the growth of craniofacial is one of the key points for successful orthodontic treatment. Orthodontic and dental implant treatment would not be successful without correlating treatment plan with craniofacial growth pattern in patient properly. Whereas in the scope of forensic, human identification process would take more time to be accomplished thus delay the data processing. The objective of this research is to know the average of corpus length and ramus height in patients with panoramic radiograph.

MATERIALS AND METHODS

This research is a simple descriptive research. The populations were the secondary data of panoramic radiograph in RSGM UNPAD. The samples are taken from June until December of 2014 from RSGM UNPAD based on the criteria below using purposive (non-random) sampling technique.

Samples taken must have the following criteria:

1. Age: From 6 to 30 years old
2. Presence of mandibular anterior teeth
3. Clear and sharp images of panoramic radiograph with good quality

Samples will be excluded according to these following criteria:

4. Presence of jaw fractures at growth center of mandible (condyle and angle)
5. Presence of wire and plates
6. Median line of the jaw portrayed on the panoramic radiograph images cannot be determined: when there are superimposed images and the position of roots are slanted.
7. Mandible is not rotated

The operational definition in measuring corpus length and ramus height are as followed:

1. Corpus length is a distance between gonion and the median line of mandible. Gonion is the bisecting point of intersection between posterior border of ramus and the body of mandible. Median line is the vertical line portrayed from a point in between of mandibular central incisors to the lowest point of chin.
2. Ramus height is a distance between condylion to gonion in which condylion is the highest point on the mandibular condyle whereas the definition of gonion is the same as stated before.

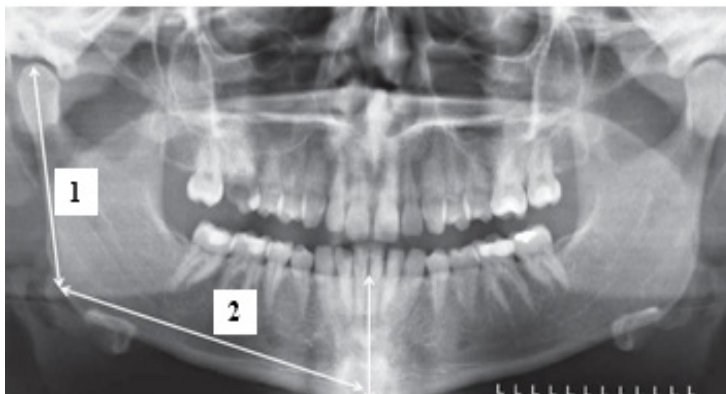


Figure 3.1 Diagram show on how to measure ramus height (1) and corpus length (2) of the mandible.¹³

RESULT

Each of the corpus length and ramus height is recorded and the result will be the mean of corpus length and ramus height based on gender and phase. Result is presented in the form of diagram as followed:

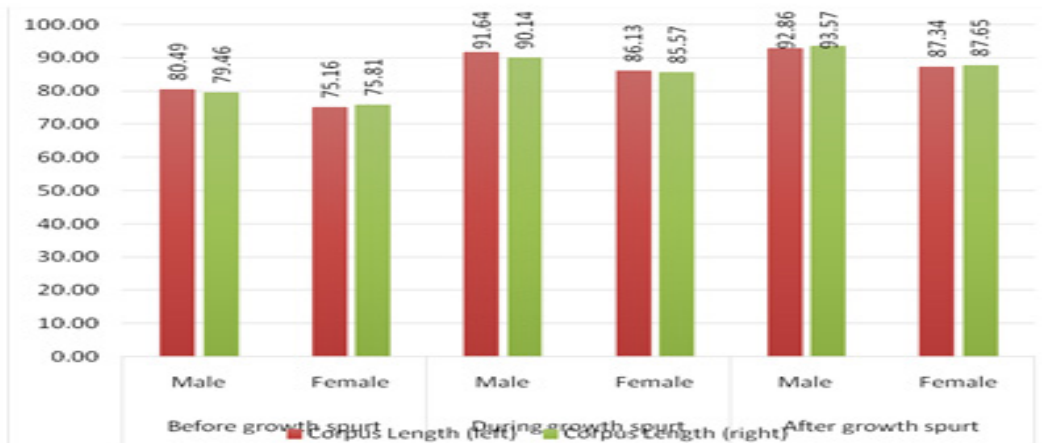


Diagram 4.1 Comparison of corpus length according to gender

Note: Before growth spurt (male) = 6-13 years old; Before growth spurt (female) = 6-11 years old; During growth spurt (male) = 14-16 years old; During growth spurt (female) = 12-14 years old; After growth spurt (male) = 17-30 years old; After growth spurt (female) = 15-30 years old

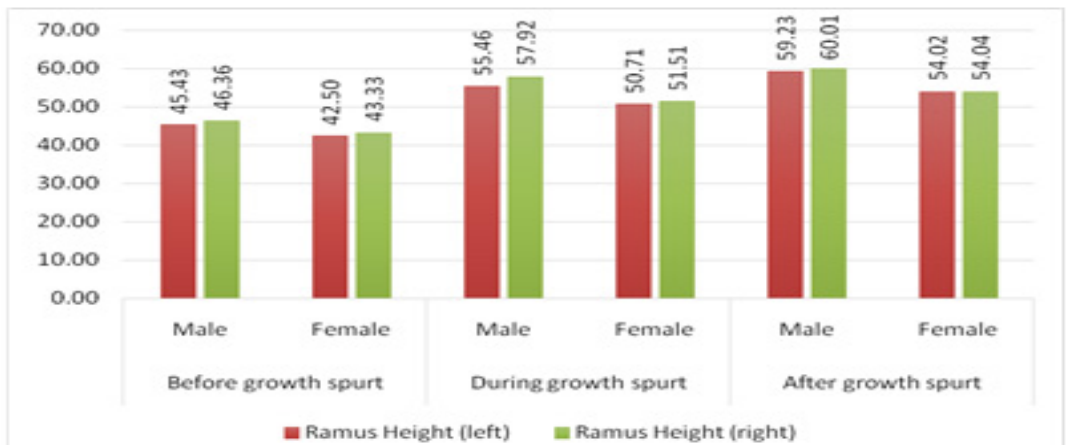


Diagram 4.2 Comparison of ramus height according to gender

Note: Before growth spurt (male) = 6-13 years old; Before growth spurt (female) = 6-11 years old; During growth spurt (male) = 14-16 years old; During growth spurt (female) = 12-14 years old; After growth spurt (male) = 17-30 years old; After growth spurt (female) = 15-30 years old

Based on the diagram above, there is a difference between male and female in which both sides of corpus length in male subjects are higher than female subjects from before growth spurt phase until after growth spurt phase. The graph also has shown that there is a slight difference between left and right side of corpus length in both genders although the value is very small. There is no determined result on which side of corpus length is longer.

Based on the diagram above, the difference of ramus height between male and female is quite obvious. Both sides of ramus height in male subjects are seen higher than female subjects in every phase. Similar to the comparison of corpus length, there is a slight difference between left and right side of ramus height seen in both genders.

To show the comparison of increment of corpus length and ramus height in each gender, the mean of measurements of left and right side are combined to find an average, as showed in table 4.1 above.

Based on the results from table 4.1, a diagram is illustrated as above to show the comparison of increment of corpus length and ramus height in male and female. According

Table 4.1 Average of corpus length and ramus height based on gender

Gender	Male			Female			
	Age (years)	6-13	14-16	17-30	6-11	12-14	15-30
Corpus length (mm)		79.98	90.89	93.22	75.49	85.85	87.50
Ramus height (mm)		45.90	56.69	59.62	42.92	51.11	54.03

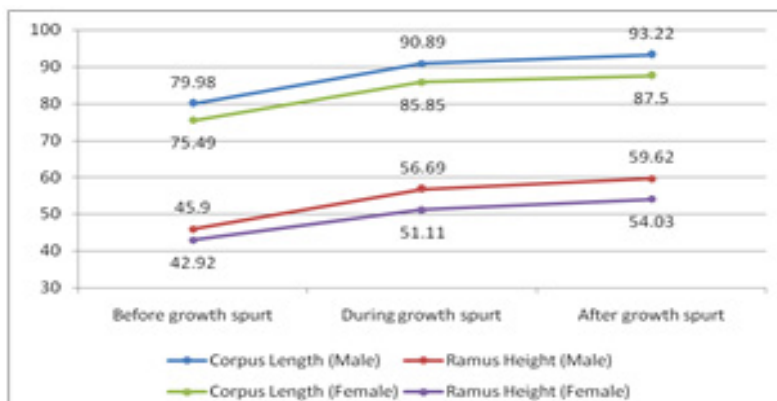


Diagram 4.3 Increment of corpus length and ramus height in both genders

to diagram 4.3, corpus length shows the same pattern and almost the same amount of increment as ramus height in male subjects. In female subjects, corpus length and ramus height display the same pattern of increment however, it can be seen in diagram 4.3 that corpus length shows a slightly higher increment than ramus height from before growth spurt until during growth spurt.

DISCUSSION

This research is carried out to study the growth and development of mandible. Hence, the subjects chosen in this research still undergo growth and development. Subjects beyond age of 30 years old are excluded since growth started to cease after that. In this research, it is found that corpus length and ramus height continuously increases with age. Corpus length increases from 79.98 mm to 90.89 mm until 93.22 mm recorded in the oldest age group in males. While in females, it increases from 75.49 mm to 85.85 mm and to 87.50 mm in the oldest age group. This confirms with the finding by Kostelac⁵ in 2004 that a gradual increase was noticed with age for both male and female subjects from age group of 6 to 12 years amounted to 74.73 mm, in the age group of 13 to 15 years it was 77.95 mm and in the oldest age group, from 16 to 18 years, 81.12 mm. A study about changes in the craniofacial complex from adolescence to mid-adulthood also reported that corpus length increases with age in both genders.²

Ramus height also showed the same pattern of growth when it increases from 45.90 mm to 56.69 mm until 59.62 mm in males. Whereas in females, it increases from 42.92 mm to 51.11 mm until 54.03 mm recorded in the oldest age group. The same result recorded by Kostelac⁵ in 2004 that ramus height increased gradually from 6 to 12, 13 to 15 and 16 to 18 years whereby the value measured was 43.38 mm, increasing to 46.81 mm and 49.66 mm respectively. This also confirms with the result found by Al-Habahbah⁶ in 2012 that the mean of ramus height in age group of 11 to 19 years was 46.116 increasing to 53.874 mm in age group of 20 to 29 in males while in females, it increased from 45.837 mm to 53.123 mm.

These results can be explained by the growth and development that occur in mandible in which remodeling and displacement take place. As a result, changes occur in growth of mandible with a basic concept known as the V principle.¹⁴ Bone deposition occurs on the inner side while resorption occurs on the outside surface. The "V" moves away from the tip and enlarges simultaneously. Thus, mandible increases in size and growth movement are in unified process.¹⁵ This explained the result of increasing corpus length and ramus height found in this research earlier.

Based on this study, the highest increments of both measurements are recorded from before growth spurt phase until during growth spurt phase. This is due to the pubertal growth spurt that took place during adolescence. According to a research conducted by Gomes¹⁰ in 2006, the highest mandibular growth rates of corpus length and ramus height were recorded during peak of growth velocity phase in which the pubertal growth spurt take place. This also confirms with the result in a research of growth of mandible during pubescence in which

the increments are recorded annually and the highest mean of increment of corpus length and ramus height were during pubertal spurts.¹⁶ According to Proffit¹⁷, greatest craniofacial change occurs during growth spurt takes place thus, supporting the result of this research.

This research's result also suggested that there is a slight difference between increment of corpus length and ramus height. This result contradicts with the theory and other previous studies. Theoretically, vertical aspects of craniofacial growth have greater growth potential than the anteroposterior aspects.¹⁸ According to Enlow and Hans⁷, the ramus normally becomes more vertically aligned during its development due to "remodeling" rotation of ramus alignment that causes condylar growth becomes directed in a more vertical course along with the rest of the ramus.

Thus, ramus height should display greater growth changes than corpus length as what has been proved in a study of maxillary and mandibular growth increments, showing a result of increment in ramus height by 30.6 % higher than in corpus length by 21.4 %. Hence, concluded that ramus exhibited the largest percentage increase.¹⁹ However, the increment of ramus height does not show much difference than corpus length in this result. This might be due to the differential rates and amounts of deposition and resorption throughout each field in every individual. Therefore, overall mandibular growth is not uniform and steady, because corpus length and ramus height grow in an irregular pattern.²⁰

In this research, it is concluded that male has longer corpus length and higher ramus height compared to female. This finding is in accordance with previous studies by Kostelac⁵ in 2004, Al-habab⁶ in 2012, Yassir²¹ in 2013 and West and Mcnamara² in 1999 suggesting that corpus length and ramus height were higher in males than in females. This could be due to the hormone factor. Gonadotrophic hormone of the pituitary gland stimulates the production of testosterone in males. This testosterone stimulate growth of muscle and bone in male in a way that it caused different changes in craniofacial skeleton between two sexes.²² Bite force also affected the growth of mandible where maximum bite force in male can increase the thickness of the masseter muscle thus, seem to develop a greater ramus height.²³ Another reason is because of the two extra years of childhood growth that males have since the pubertal growth spurt is delayed two years after females. Therefore, males tend to grow more and they become larger than females.¹⁸

The left and right side of corpus length and ramus height recorded in this research are approximately the same. Hence, this proves that there are no asymmetries in subjects studied in this research. Anatomically, the left and right side of mandible are equally the same except when there are conditions such as TMJ disorders, chewing habit and other factors that can affect the symmetry of jaw.

This research provides general information about growth and development of mandible that is easy to be comprehended. Grouping of ages in this study allows differentiating the rate of growth that takes place in every phase thus, concluding which phase display the highest growth. The mean and increment of corpus length and ramus height according to age could be determined and this information could be used mainly in the identification of individuals in forensic. However, the range of ages used in this study is quite large; therefore

it does not allow the author to elaborate more on the growth and development in every age of years hence, smaller range of ages would give a more accurate and detailed result.

CONCLUSION

Based on this research result, it can be concluded that the corpus length and ramus height increase along with age in subjects aged from 6 to 30 years old due to the growth and development process. Corpus length and ramus height are recorded higher in males than in females for both left and right side. The highest increments of both measurements are found before growth spurt phase until during growth spurt phase. Corpus length and ramus height showed the same growth pattern. The measurements of both left and right side are almost the same even though there is only a slight difference between both sides, thus it does not affect the result.

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