

PREVALENCE OF MANDIBULAR ASYMETRIES IN PATIENTS WITH MIXED DENTITION

¹GHULAM RASOOL

²FATIMA TU ZAHRA

³TAHIRA HUSSAIN

⁴FAIZANUL HASSAN

⁵SAIRA BILAL

ABSTRACT

Mild facial asymmetry can occur during growth and development but if it exceeds the normal limit it can affect the esthetics and developing occlusion of the growing individual complicating the orthodontic diagnosis and treatment. The aim of the present study was to determine the prevalence of mandibular asymmetries during the mixed dentition in growing children of local population.

A retrospective study was designed where various measurements were performed on the right and left sides of the mandible using panoramic radiographs of 50 children (males: 21; females: 29) in age range of 8–14 years. Two linear measurements, mandibular ramus height, ramus width and one angular measurement, mandibular gonial (Go) angle were analysed. All measurements were adjusted for the magnification factor. The final data were then processed for the asymmetry index (AI) to determine the severity of the asymmetries. Wilcoxon paired tests at the 95 per cent level of confidence was used for statistical analysis.

A moderate-to-severe mandibular asymmetry for the linear dimensions when both sides of the mandible were contrasted was found in more than a half of the sample. There was also a high prevalence of moderate and severe asymmetries when comparing Go angle on both sides of the mandible in studied population.

Key Words: Mandibular asymmetry, mixed dentition, ramus height, ramus width, gonial angle.

INTRODUCTION

Facial symmetry refers to state of balance and harmony where the form, size and arrangement of facial soft tissues and structures on both sides of the median sagittal plane correspond. Thus, the right and left sides of the craniofacial complex which are replica of each other must grow symmetrically.^{1,2} The lower part of the face deviates more frequently as compared to upper and middle parts, because the period of growth of the mandible is longer.³

Therefore, as an adaptive response of mandible

to changes during function, there may be modeling of condyle and glenoid fossa as well as remodeling and modeling of mandibular bone. This condition may lead to mandibular asymmetry.^{1,3} There are three main reasons for mandibular asymmetry; i) congenital. ii) developmental; arising during growth of the mandible and other craniofacial structures. iii) acquired; as a result of some disease or trauma.^{3,4}

Many studies have been done to associate mandibular asymmetries with crossbites. Santos Pinto et al (2001) radiographically found that on non-crossbite side the ramus of the mandible was significantly longer than on crossbite side.^{5,6} Although mandibular asymmetries have been reported to be a common feature in growing patients a dimensional difference of more than 2-3 mm between the sides of the mandible has been considered as asymmetry.⁷ Some clinicians consider it mandatory to carry out early treatment of crossbite in order to correct abnormal closing patterns of the mandible so as not to disturb normal growth.^{5,8,11}

Mandibular asymmetry can be diagnosed by various methods or combination of these methods. These

¹ Dr Ghulam Rasool, BDS, MCPS, FCPS (Orthodontics), Khyber College of Dentistry. **Address:** House No: 238, Street No: 4, Sector J-1, Phase-II, Hayatabad, Peshawar
Email: grasoolkcd@yahoo.com Cell: 0333-9126029

² Dr Fatima Tu Zahra, BDS, FCPS-II, Trainee Orthodontics, KCD
Email: fatimairfan215@gmail.com

³ Dr Tahira Hussain, BDS, FCPS-II, Trainee Orthodontic, KCD
Email: tahirahussain88@gmail.com

⁴ Dr Faizanul Hassan, BDS, FCPS-II, Trainee Orthodontics, KCD
Email: faizanulhassan88@gmail.com

⁵ Dr Saira Bilal, BDS, FCPS-II, Trainee Orthodontics, KCD
Email: saira.queshi1987@gmail.com

Received for Publication: November 3, 2015
Approved: November 14, 2015

include a thorough clinical examination, photographic analysis, routine radiographs like PA view cephalogram, Panoramic radiographs. Panoramic radiograph offers an acceptable cost-benefit ratio due to minimum radiation exposure.⁹ It also allows analysis of various structures of mandible (e.g. condyle, ramus and body) separately on right and left sides¹⁰ and even though one must be very careful while making absolute measurements or relative comparisons, the panoramic radiograph is reliable for determining mandibular asymmetries.¹²

Therefore, the aim of the present study was to determine the prevalence of mandibular asymmetries in growing children in mixed dentition in KPK population. For this linear and angular measurements of mandible were performed.

METHODOLOGY

A retrospective cross-sectional study was conducted from 1st June 2014 to 30th November 2014. Fifty subjects (21 boys and 29 girls) with age ranging from 8 to 14 years were included in the study. Panoramic radiographs were taken from the records of patients in department of Orthodontics, Khyber College of Dentistry, Peshawar. Sampling was performed according to the convenient sampling method.

The inclusion criteria were:

- Pakistani Nationality
- No systemic disease that could affect general development like hormonal diseases
- No history of orthodontic treatment
- Panoramic radiographs available with high clarity and good contrast
- No missing or anomalies (impaction, transposition) in dentition
- No history of trauma or surgery in the neck or dentofacial region.

Selection of the radiographs

Only those panoramic radiographs presenting no artefacts, the whole mandible fully captured on the radiograph, and contrast on the radiograph sufficient to perform all the intended measurements were chosen.

Panoramic radiograph of each individual was taken at Radiology Department of Khyber College of Dentistry, Peshawar with Kodac 900C. All Panoramic radiographs were placed on illuminator and measurements were done by two postgraduate trainees to determine mandibular asymmetry. Two different sets of measurements (mandibular dimensions and mandibular angle) were recorded.

Mandibular dimensions

The following longitudinal measurements were undertaken on both sides of each panoramic radiograph (Fig 1). Ramus height (RH): perpendicular distance between the deepest point of the mandibular ramus notch (R1) and the lower border of mandible (R2) as described by Ricketts (1961).

Ramus width (RW): perpendicular distance between the deepest point of the anterior border of the mandibular ramus (R3) and the posterior border of ramus (R4) as described by Ricketts (1961). Calculation of the distortion factor of the panoramic radiograph.

To determine the distortion the panoramic radiograph may have caused on the linear dimensions of the mandible on both sides, a distortion factor for each hemimandible was calculated. For this, 10 radiographs from the sample were randomly selected. Thus the distortion factor was applied to initial results which were then processed to obtain the asymmetry index (AI) and submitted to statistical analysis.

Distortion factor = $\frac{\text{Mesio-distal length on cast}}{\text{Mesio distal length on panoramic radiograph (for each four permanent molars)}}$

AI for the linear measurements

For each of the linear measurements, the severity of the asymmetry that could be present in the mandible of each subject was determined by means of the AI. The index was calculated following the formula proposed by Saglam (2003):

Asymmetry index (AI) =

$\frac{\text{Right measurement} - \text{Left measurement}}{\text{Right measurement} + \text{Left measurements}} \times 100$

Right measurement + Left measurements

Based on AI for each measurement on each radiograph, the results were classified into four categories of asymmetry: no significant (NS) asymmetry, when AI was between 0 and 2.99 percent; light (L), when AI was between 3 and 5 percent; moderate (M), when the index was greater than 5 percent; and severe (S), when AI was more than 10 percent.

Although the results for the severity of dimensional mandibular asymmetries are reported as a percentage, they may be measured in millimeters as follows: NS, a difference of 0-2 mm between both sides of the mandible; L, a difference of 2-3 mm; M, a difference of 4-5 mm; and S, a difference greater than 5 mm between both sides of the mandible for the correspondent measurement.

Mandibular angle

Gonial (Go) angle was measured at the intersection of the planes formed by the posterior border of the

mandibular ramus (Ar-Go on the mandibular ramus) and the lower border of the mandibular corpus (Go on the mandibular corpus – Pg). The results are presented as angular degrees. Mandibular angle measured for this study is shown in Fig 1.

Determination of assymetry between mandibular angles

The difference between the right and left angle was used to determine the amount of assymetry between the angles. The value of the left angle was subtracted from that of the right angle. Thus, the severity of the assymetry was determined as follows: NS, when the difference between the right and left angle was between 0 and 2.99 degrees; L, when the difference between both sides between 3 and 5 degrees; M, when the difference was greater than 5 degrees but less than and equal to 10 degrees; and S, when the difference was more than 10 degrees.

Since the radiographs were selected from existing data, there was no risk of additional radiation exposure to patients. All radiographs were analyzed by two postgraduate trainees of orthodontics who examined the panoramic radiographs. Cases with disagreement between the observers were excluded.

Statistical analysis

The data was statistically compared using Wilcoxon paired analysis, a non- parametric test, at the 95 percent level of confidence. The data also was contrasted by age and gender. P<0.05 were considered statistically significant. SPSS 16.0 was used for statistical analysis.

RESULTS

Mandibular dimensions

Wilcoxon paired tests showed a statistically significant difference (P < 0.05) in both sides of the mandible for the two longitudinal measurements on the panoramic radiographs (RH and RW). The means and standard deviation for each measurement are shown in Fig 2. The means for the right and left sides, respectively, were RH 32.81 ± 3 mm and 36.72 ± 3 mm; RW 21.45 ± 2.5 mm and 23.81 ± 1 mm respectively. For both measurements, the means were higher on the left side compared with the right side. Regarding age and gender, no significant differences were observed (data not shown).

Regarding the severity of the mandibular asymmetry calculated with the AI, a high percentage of the subjects presented moderate or severe asymmetry when both sides were compared. Thus, 26 of the 50 subjects were classified as M and 2 as S when considering RH. On the other hand, 22 subjects were classified as M and

6 as S when considering RW. The results showed that more than a half of the sample had either moderate or severe asymmetry when comparing both sides of the mandible on the panoramic radiograph. The corresponding percentages for the severity of the asymmetry for each measurement are shown in Table 1.

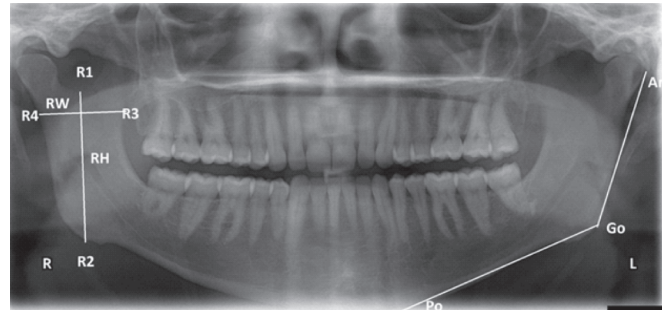


Fig 1:

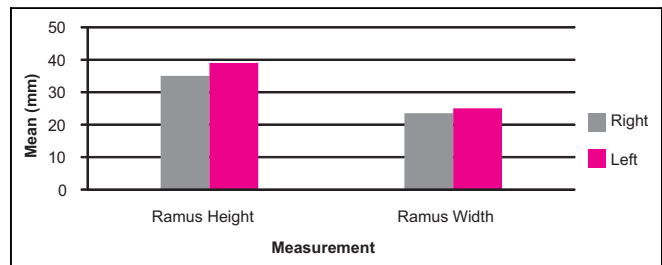


Fig 2: Graph showing the means and standard deviation of the dimensional measurements performed on the panoramic radiographs to determine asymmetries between two hemimandibles.*p<0.05.

TABLE 1:

Severity/Measure-ment	NS(%)	L(%)	M(%)	S(%)
Linear measurements				
Ramus Height	14.3	32	49	4
Ramus Width	24	18	44.5	13
Angular measurement				
Gonial Angle	52.9	22	24.5	1

TABLE 2: THE FREQUENCY AND PERCENTAGE OF PATIENTS ACCORDING TO THEIR AGE

Age	Frequency	Percentage
8	5	10
9	7	14
10	7	14
11	5	10
12	9	18
13	8	16
14	9	18
Total	50	100

Moderate asymmetry was present in a high percentage of subjects at all ages for the mandibular dimensions evaluated. The percentage of subjects for each type of asymmetry (NS, L, M, and S) was similar between females and males.

Mandibular angle

For gonial angle, there was a statistically significant difference ($P < 0.05$) between the right and left sides. The means showed that the right gonial angle was more open (right 126.81 ± 2 degrees; left 126.09 ± 4 degrees). No significant differences were computed when the data were contrasted for age and gender. When the severity of the asymmetry was calculated through subtraction of the left and right angles, 26 subjects were classified as NS for the gonial angle, 11 as L, 12 as M, and 1 as S. The percentages for the severity of asymmetry for each angle are shown in Table 1.

DISCUSSION

Craniofacial symmetry and balance is referred to as the 'state of equilibrium', where there is a uniformity in size, shape and form of the various structures on both sides of the median sagittal plane.¹³ The present study evaluated the prevalence of dimensional and angular asymmetries in the mandible of growing children in the mixed dentition. Some of the authors consider mandibular dimensional asymmetries to be associated with growth periods and thus should not be considered relevant for treatment purposes.¹² However, the present results show that high percentage of the studied population, had significant dimensional asymmetry in the mandibular ramus, which appear to be associated with angular asymmetries, supporting the studies reporting that dimensional mandibular asymmetries are independent of gender and age. On the other hand, a controversy still exists as to whether dimensional mandibular asymmetries are considered normal at certain ages⁷ and how a malocclusion may be associated with the presence of mandibular asymmetries.¹⁴ Asymmetries have been associated with periods of significant growth, mandibular displacements due to malocclusion, condylar resorption or fracture and developmental anomalies.¹⁵ Mandibular dimensional asymmetries greater than 2-3 mm might affect facial appearance⁷, whereas some studies considered 4-5 mm as a range for normal asymmetry of facial dimensions.¹⁶ In the current study, moderate asymmetry was classified as a difference between both sides of the mandible from 3 to 5 mm whereas, more than 5 mm difference was considered as severe asymmetry. More than half of the subjects had moderate- to-severe asymmetry for both the height and width of the mandibular ramus. Thus, these results showed that more than a half of the population studied had a significant difference in

dimensions between the two sides of the mandible. Asymmetry may be an adaptive response to functional demands^{13,17} as mandible adapts to mandibular deviations by modelling glenoid fossa and CO fossa.^{18,19} In occlusions with a crossbite, functional shift can produce asymmetric mandibular growth.^{20,21} Therefore, the prevalence of mandibular asymmetries in young growing patients must be further studied, as well as the effect that those asymmetries may have on facial growth. Another finding of this investigation was the side predominance of mandibular asymmetries. Other studies have reported that right side predominates over left side when the size of both sides of mandible is considered.^{7,15} In contrast, in this study opposite was proved. The means of the two dimensional measurements, RH, RW, were considerably larger for the left side of the mandible. Based on the present findings, it cannot be said that right side always predominates when mandibular asymmetry is present in young subjects. The reason for this mismatch might be racial difference. The previous studies were done in white population in contrast to the present study. This shows that there might be difference in side predominance in different populations or races and so genetic influence is involved.

Only a few studies have investigated angular asymmetries in the craniofacial complex. Some reported no statistically significant difference in gonial angle measurements between sides^{22,23} but the results of this study showed that more than 25% of the population studied had either moderate or severe asymmetry when comparing left and right gonial angles. Studies in rabbits have demonstrated that the dimensions of the mandible, are affected when masticatory function is altered.²⁴ In that context, the current results support the hypothesis that the mandible responds with different amounts of growth at different sites and adjusts the angles between the various component parts (corpus, ramus, and condyles), so adapting to functional demands.²⁵ Nevertheless, further studies are required to fully understand the effect of oral function on growth and development of the mandible in humans.

The limitations in this study are small sample, single set and radiograph with less diagnostic value. Asymmetry can be completely diagnosed with CBCT and PA ceph.

CONCLUSION

There is a high prevalence of dimensional and angular mandibular asymmetries in the KPK population. Further studies are required to better understand the association between mandibular asymmetries and oral function.

REFERENCES

- 1 Ercan I, Ozdemir ST, Etoz A, Sigirli D, Tubbs RS, Loukas M, Guney I. Facial asymmetry in young healthy subjects evaluated by statistical shape analysis. *J Anat* 2008 Dec; 213(6): 663-69.
- 2 Nadia AK, Kau CH. Measuring mandibular asymmetry in Class I normal subjects using 3D novel coordinate system. *Annals of Maxillofacial Surgery*; offic public Ind acad maxillofac surg 2014 May; 4(1): 34-38.
- 3 Cheong YW, Lo LJ. Facial Asymmetry: Etiology, Evaluation, and Management. *Review article* 2013; 144(1): 55-59.
- 4 Kawamoto HK, Kim SS, Jarrahy R, Bradley JP. Differential diagnosis of the idiopathic laterally deviated mandible. *Plast Reconstr Surg* 2009 Nov; 124(5): 1599-609.
- 5 Keulen CV, Martens G, Dermaut L. Unilateral posterior crossbite and chin deviation: is there a correlation? *Eur J Orthod* 2004; 26: 283-88.
- 6 Brian L, O'Byrn, Sadowsky C, BeGole EA. An evaluation of mandibular asymmetry in adults with unilateral posterior crossbite. *Am J Orthod Dentofacial Orthop* 1995 April; 107(4): 394-400.
- 7 Kula KA, Esmailnejad A, Hass A. Dental arch asymmetry in children with large overjets. *Angle Orthod* 1998; 68: 45-52.
- 8 David A. Correcting True Unilateral Posterior Crossbites. *Am J Orthod Dentofacial Orthop* 2012 July; 45: 89-93.
- 9 Van Elslande DC, Russett SJ, Major PW, Flores-Mir C. Mandibular asymmetry diagnosis with panoramic imaging. *Am J Orthod Dentofacial Orthop* 2008 Aug; 134(2): 183-92.
- 10 Gupta S, Jain S. Orthopantomographic analysis for Assessment of Mandibular Assymetry. *J Ind Orthod Soc* 2012; 46(1): 33-37.
- 11 Pamela R, Hanson, Michael B, Melugin M. Surgical/Orthodontic Treatment of Mandibular Assymetries. 2009 Dec; 15(4): 268-78.
- 12 Liukkonen ML, Sillanmaki L, Peltomäki T. Mandibular asymmetry in health children. *Acta Odontol Scandi* 2005; 63: 168-72.
- 13 Duthie J, Bharwani D, Tallents R H, Bellohusen R, Fishman L. A longitudinal study of normal asymmetric mandibular growth and its relationship to skeletal maturation. *Am J Orthod and Dentofacial Orthop* 2007; 132: 179-84.
- 14 Ferrario VF, Sforza C, Ciusa V, Dellavia C, Tartaglia GM. The effect of sex and age on facial asymmetry in healthy subjects: a cross-sectional study from adolescence to mid-adulthood. *J Oral Maxillofac Surg* 2001; 59: 382-88.
- 15 Langberg BJ, Arai K, Miner RM. Transverse skeletal and dental symmetry in adults with unilateral lingual posterior crossbite. *Am J Orthod Dentofac Orthop* 2005; 127: 6-15.
- 16 Skvarilová B. Facial asymmetry: type, extend and range of normal values. *Acta Chirurgia Plastica* 1993; 35: 173-80.
- 17 Shah SM, Joshi MR. An assessment of asymmetry in the normal craniofacial complex. *Angle Orthod* 1978; 48: 141-48.
- 18 Pirttiniemi P, Kantomaa T. Relation of glenoid fossa morphology to mandibulofacial asymmetry, studied in dry human skulls. *Acta Odontol Scandi* 1992; 50: 235-43.
- 19 Liu C, Kaneko S, Soma K. Glenoid fossa responses to mandibular lateral shift in growing rats. *Angle Orthod* 2007; 77: 660-67.
- 20 Thilander B, Lennartsson B. A study of children with unilateral posterior crossbite treated and untreated, in the deciduous dentition — occlusal and skeletal characteristics of significance in predicting the long-term outcome. *J Orofac Orthop* 2002; 63: 371-83.
- 21 Kilic N, Kiki A, Oktay H. Condylar asymmetry in unilateral posterior crossbite patients. *Am J Orthod Dentofac Orthop* 2008; 133: 382-87.
- 22 Kurt G, Uysal T, Sisman Y, Ramoglu SI. Mandibular asymmetry in Class II subdivision malocclusion. *Angle Orthod* 2008; 78: 32-37.
- 23 Kwon TG, Park HS, Ryoo HM, Lee SH. A comparison of craniofacial morphology in patients with and without facial asymmetry — a three-dimensional analysis with computed tomography. *Int'l J Oral Maxillofac Surg* 2006; 35: 43-48.
- 24 Poikela A, Kantomaa T, Pirttiniemi P. Craniofacial growth after a period of unilateral masticatory function in young rabbits. *Eur J Oral Sci* 1997; 105: 331-37.
- 25 Frost HM. A 2003 Update of bone physiology and Wolff's law for clinicians. *Angle Orthod* 2004; 74: 3-15.

CONTRIBUTION BY AUTHORS

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|----------------------------|--|
| 1 Ghulam Rasool: | Paper writing, supervisor. |
| 2 Fatima Tu Zahra: | Data collection, statistical analysis and literature review. |
| 3 Tahira Hussain: | Data collection. |
| 4 Faizan Ul Hassan: | Data collection. |
| 5 Saira Bilal: | Proof reading. |