


Proportion of Skeletal and Dental Components in Patients with Facial Asymmetry: A Cephalometry Study

Ellen Teora¹, Sariesendy Sumardi², Retno Widayati³

¹Faculty of Dentistry, Universitas Indonesia, Jakarta, Indonesia.  0000-0002-9311-6189

²Department of Orthodontics, Faculty of Dentistry, Universitas Indonesia, Jakarta, Indonesia.  0000-0002-3284-6428

³Department of Orthodontics, Faculty of Dentistry, Universitas Indonesia, Jakarta, Indonesia.  0000-0002-2535-3983

Author to whom correspondence should be addressed: Retno Widayati, Department of Orthodontics, Faculty of Dentistry, Universitas Indonesia, Jalan Salemba Raya No.4, Jakarta 10430, Indonesia. Phone: +62 811965364. E-mail: rwidayati1965@gmail.com.

Academic Editors: Alessandro Leite Cavalcanti and Wilton Wilney Nascimento Padilha

Received: 21 January 2019 / Accepted: 15 May 2019 / Published: 29 May 2019

Abstract

Objective: To determine the skeletal and dental components in patients with facial asymmetry treated at the orthodontic specialist clinic of the Faculty of Dentistry, Universitas Indonesia. **Material and Methods:** This was a descriptive study using secondary data from the tracing of postero-anterior cephalograms of patients aged >14 years 4.2 months for males and >11 years 6.2 months for females using the Grummons analysis. A total of 46 patients were selected through purposive sampling. Data were analyzed using descriptive statistics. **Results:** The proportions of asymmetric direction based on the deviation of the mandibular menton, maxillary midline, and mandibular midline tending to the left and the right sides of the face were 58.7% and 41.3%, respectively. The skeletal component found in the vertical direction showed a greater mean value difference than that observed in the transverse direction. The mean value difference was greater in the midline of the mandibular teeth than in the maxillary teeth. **Conclusion:** Facial asymmetry tended more towards the left side of the face than the right side. Moreover, the skeletal component was greater in the vertical direction than the transverse direction. In the transverse direction, it was shown that the left side of the face was larger than the right side. In addition, dental asymmetry was more commonly observed in the midline of the mandibular teeth than the maxillary teeth.

Keywords: Orthodontics; Facial Asymmetry; Cephalometry.

Introduction

A human face with a proportional and symmetrical profile and shape is considered aesthetically pleasing [1]. However, most human faces are not symmetrical. The face of a patient was deemed to be asymmetric following the detection of a deviation in any of the four landmarks, namely the anterior nasal spine (ANS), incisal edge midpoint of the maxillary central incisor (A1), incisal edge midpoint of the mandibular central incisor (B1), or mandibular menton >2 mm from the midsagittal line [2].

Numerous epidemiological studies investigating human facial asymmetry have been conducted. Previous authors assessed in sixty healthy Chinese adult that more asymmetric front was observed in the lower part of the face [3]. The prevalence of facial asymmetry in orthodontic patients ranged from 12% to 37% in United States, 21% in Hong Kong and 23% in Belgium [4].

Facial asymmetry may be classified into skeletal, dental, muscular, and functional. Congenital deformities such as hemifacial macrosomia, condyle fractures, unilateral condyle resorption, hemimandibular hyperplasia, condyle hypoplasia, hemifacial atrophy, arthritis, ankylosis, neoplasia, or fibrous dysplasia may cause skeletal asymmetry. The causes of dental asymmetry include ankylosis teeth, ectopic eruption of the permanent maxillary first molar, congenitally missing teeth, interproximal caries, and supernumerary teeth [5]. Muscular asymmetry may be caused by abnormal muscle structure or activity on one side of the face. Functional asymmetry may be the result of functional deviation of the mandible in response to occlusal interference [6].

Components involved in skeletal asymmetry include the condylar height, coronoid height, ramal height, corpus length, maxillary length, bilateral facial widths of the zygomatic frontal sutures, jugal processes, antegonial notch, gonion, condyle, and mandibular menton to the midsagittal line [7,8].

An asymmetrical face may be found in any case of malocclusion. In contrast, there have not been many studies at orthodontic specialist clinic of the Faculty of Dentistry, Universitas Indonesia that reviewed the skeletal and dental components in patients with facial asymmetry [9]. The objective of this study was to determine the skeletal and dental components in patients with facial asymmetry.

Material and Methods

Study Design

This descriptive study was conducted between 2014 and 2017. The study analyzed secondary data of postero-anterior cephalometric tracing performed in the Department of Radiology, Faculty of Dentistry, Universitas Indonesia.

Patients included in the study were diagnosed with facial asymmetry, as indicated by deviation in any of the four landmarks namely the anterior nasal spine, B1, and mandibular menton >2 mm from the midsagittal line. The patients had not undergone previous orthodontic or surgical treatment for any syndromic disease or cleft lip/palate. A total of 46 patients aged >14 years 4.2 months for males and >11 years 6.2 months for females were selected through purposive sampling.

Prior to the analysis, an assessment of inter-observer reliability was performed between the two raters of this study. The assessment of facial asymmetry was performed using the Grummons analysis.

Data Analysis

Data were analyzed using IBM SPSS Statistics for Windows Software, version 22 (IBM Corp., Armonk, NY, USA). Descriptive statistics was used to determine the minimum, maximum, mean, and standard deviation values of the skeletal and dental components.

Ethical Aspects

The study was approved by the Ethical Committee of the Faculty of Dentistry, Universitas Indonesia.

Results

The proportions of asymmetric direction based on the deviation of the mandibular menton, maxillary midline, and mandibular midline tending to the left and the right sides of the face were 58.7% (n=27) and 41.3% (n=19), respectively.

As shown in Table 1, the facial asymmetry direction is denoted by (+) in the right direction and by (-) in the left. The skeletal component found in the vertical direction showed a greater mean value difference than that observed in the transverse direction. The mean value difference was greater in the midline of the mandibular teeth than the maxillary teeth. Table 2 shows that B1 had a greater mean value difference than A1 in the dental component.

Table 1. Facial asymmetry mean values and standard deviation based on skeletal components.

Variables	Skeletal Components	Right		Left		Delta	
		Mean	SD	Mean	SD	Mean	SD
Transverse	Zygomatic	67.74	5.34	67.71	4.58	0.03	2.84
	Nasal	17.39	1.20	17.17	2.14	0.22	2.29
	Jugulare	35.64	3.57	35.73	3.35	-0.09	1.92
	Condyle	57.04	4.94	57.39	4.94	-0.35	3.59
	Antegonial	46.79	3.95	47.59	4.5	-0.79	6.06
	Facial Volume	4186.96	526.05	4313.76	600.14	-126.8	426.6
Vertical	Zygomatic	95.99	9.62	97.98	10.08	-1.99	4.06
	Nasal	77.03	9.80	77.54	9.95	-0.51	2.01
	Jugulare	65.75	8.70	67.10	9.14	-1.34	3.10
	Condyle	95.71	10.47	97.60	9.90	-1.89	3.81
	Antegonial	27.85	7.46	29.80	7.71	-1.96	4.16
Mandibular Morphology	Corpus Length	56.13	6.10	56.40	5.63	-0.27	4.81
	Ramal Height	69.74	7.78	68.82	8.09	1.03	3.24
	Co-Me	113.43	8.16	113.85	8.67	-0.41	5.42
	Ag Angle	130.26	6.35	132.72	7.33	-2.46	5.98
Menton Deviation	Menton	4.63	2.72	-4.37	2.77	-0.65	5.24

Table 2. Facial asymmetry mean values and standard deviation based on dental components.

Variables	Dental Components	Right		Left		Delta	
		Mean	SD	Mean	SD	Mean	SD
A1, B1 Deviation	A1	2.09	1.2	-1.13	1.08	-0.01	1.91
	B1	3.31	1.68	-2.45	2.03	-0.45	3.36
Molar-J	M-J	19.14	5.89	19.42	6.47	-0.28	2.52

Discussion

This study was conducted to determine the proportion of skeletal and dental components in patients with facial asymmetry. The results showed that facial asymmetry tended more to the left of the face than to the right. However, the mandibular menton tended to the right than to the left [7,10,11,12]. Moreover, it was demonstrated that the increasing size of the right hemisphere of the brain affected functional activity and facial structure [13]. However, the results of the present study indicate that the left side of the face is more dominant than the right side. This is consistent with findings from previous studies [14,15]. However, the findings of the present study contrast with those reported previously [16-18]. These differences in the results may be attributed to the use of different methodologies and differences in the age range of patients [14].

Table 1 shows that the width of the left side of the face is greater than that of the right side in the transverse direction. In the vertical direction, the analysis showed that the left side of the face is greater than the right side. The component with the most considerable mean value difference was the zygomatic. This finding shows that the mean value difference in the vertical direction was greater than that reported in the transverse direction.

Analysis of the mandibular morphology in this study showed that the mean value of corpus length, condyle-menton, and antegonial notch angle were greater in the deviated side, left side than in the right side. Therefore, facial asymmetry tended to the left, as shown by the greater left side components compared with those of the right side to the mandibular menton plane and the greater right ramal height compared with that of the left ramal height resulting in mandibular menton deviation.

The mandibular menton is commonly used as a parameter to determine facial asymmetry [11,19-22]. An asymmetrical face has a mandibular menton deviation of >2 mm from the midsagittal line [23]. The present data showed that the mandibular menton deviations tended to the left side of the face than to the right side according to the negative difference mean value. Dental asymmetry parameters include A1 for maxillary teeth and B1 for mandibular teeth. The greater mean value of B1 versus that of A1 reported in the present study indicates that dental asymmetry is more commonly observed in the mandibular teeth than the maxillary teeth.

Conclusion

Facial asymmetry tended more towards the left side of the face than the right side. Moreover, the skeletal component was greater in the vertical direction than the transverse direction. In the transverse direction, it was shown that the left side of the face was larger than the right side.

In addition, dental asymmetry was more commonly observed in the midline of the mandibular teeth than the maxillary teeth.

Authors' Contributions: ET, SS and RW contributed to the study design, data analysis and interpretation, article writing, critical review of the intellectual content and approval of the final version to be published.

Financial Support: This study was supported by a grant from the Directorate of Research, Universitas Indonesia (Hibah PITTA 2017).

Conflict of Interest: The authors declare no conflicts of interest.

References

- [1] Lee JK, Jung PK, Moon CH. Three-dimensional cone beam computed tomographic image reorientation using soft tissues as reference for facial asymmetry diagnosis. *Angle Orthod* 2014; 84(1):38-47. <https://doi.org/10.2319/112112-890.1>
- [2] Nur RB, Çakan DG, Arun T. Evaluation of facial hard and soft tissue asymmetry using cone-beam computed tomography. *Am J Orthod Dentofac Orthop* 2016; 149(2):225-37. <https://doi.org/10.1016/j.ajodo.2015.07.038>
- [3] Huang CS, Liu XQ, Chen YR. Facial asymmetry index in normal young adults. *Orthod Craniofac Res* 2013; 16(2):97-104. <https://doi.org/10.1111/ocr.12010>
- [4] Severt TR, Proffit W. The prevalence of facial asymmetry in the dentofacial deformities in the population at the University of North Carolina. *Am J Adult Orthod Orthognath Surg* 1997; 12(3):171-6.
- [5] Srivastava D, Singh H, Mishra S, Sharma P, Kapoor P, Chandra L. Facial asymmetry revisited: Part I - Diagnosis and treatment planning. *J Oral Biol Craniofac Res* 2017; 8(1):7-14. <https://doi.org/10.1016/j.jobcr.2017.04.010>
- [6] Maheshwari S, Verma SK, Gaur A, Dhiman S. Diagnosis and management of facial asymmetries. *J Orthod Res* 2015; 3(2):81-7. <https://doi.org/10.4103/2321-3825.149054>
- [7] Fong JH, Wu HT, Huang MC, Chou YW, Chi LY, Fong Y, et al. Analysis of facial skeletal characteristics in patients with chin deviation. *J Chin Med Assoc* 2010; 73(1):29-34. [https://doi.org/10.1016/S1726-4901\(10\)70018-6](https://doi.org/10.1016/S1726-4901(10)70018-6)
- [8] Hirpara N, Jain S, Hirpara VS, Punyani PR. Comparative assessment of vertical facial asymmetry using posteroanterior cephalogram and orthopantomogram. *J Biomed Sci* 2017; 6(1):1-7. <https://doi.org/10.21767/2254-609X.100052>
- [9] Purbiati M, Purwanegara MK, Kusdhany L, Himawan LS. Prediction of mandibulofacial asymmetry using risk factor index and model of the dentocraniofacial morphological pattern. *J Int Dent Med Res* 2016; 9(3):195-201.
- [10] Reddy MR, Bogavilli SR, Raghavendra V, Polina VS, Basha SZ, Preetham R. Prevalence of facial asymmetry in Tirupati population: A posteroanterior cephalometric and photographic study. *J Int Soc Prev Community Dent* 2016; 6(Suppl 3):S205-S212. <https://doi.org/10.4103/2231-0762.197194>
- [11] Sumant G, Anand A, Milind D, Sourabh S. An assessment of facial asymmetry Karnataka population. *J Indian Orthod Soc* 2003; 37(1):30-8.
- [12] Rajpara Y, Shyagali TR, Trivedi K, Kambalyal P, Sha T. Evaluation of facial asymmetry in esthetically pleasing faces. *J Orthod Res* 2014; 2(6):79-84. <https://doi.org/10.4103/2321-3825.131118>
- [13] Woo TL. On the asymmetry of the human skull. *Biometrika* 1931; 22:324-2.
- [14] Ercan I, Ozdemir ST, Etoz A, Sigirli D, Tubbs RS, Loukas M, et al. Facial asymmetry in young healthy subjects evaluated by statistical shape analysis. *J Anat* 2008; 213(6):663-9. <https://doi.org/10.1111/j.1469-7580.2008.01002.x>
- [15] Hewitt AB. A radiographic study of facial asymmetry. *Br J Orthod* 1975; 2(1):37-40. <https://doi.org/10.1179/bjo.2.1.37>
- [16] Farkas LG, Cheung G. Facial asymmetry in healthy North American caucasians. *Angle Orthod* 1981; 51(1):70-7.
- [17] 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(4):382-8.
- [18] Shaner DJ, Peterson AE, Beattie OB, Bamforth JS. Assessment of soft tissue facial asymmetry in medically normal and syndrome-affected individuals by analysis of landmarks and measurements. *Am J Med Genet* 2000; 93(2):143-54.
- [19] Lee HJ, Lee S, Lee EJ, Song IJ, Kang BC, Lee JS, et al. A comparative study of the deviation of the menton on posteroanterior cephalograms and three-dimensional computed tomography. *Imaging Sci Dent* 2016; 46(1):33-8. <https://doi.org/10.5624/isd.2016.46.1.33>
- [20] Choi KY. Analysis of facial asymmetry. *Arch Craniofac Surg* 2015; 16(1):1-10. <https://doi.org/10.7181/acfs.2015.16.1.1>

- [21] Trpkova B, Prasad NG, Lam EWN, Raboud D, Glover KE, Major PW. Assessment of facial asymmetries from posteroanterior cephalograms: Validity of reference lines. *Am J Orthod Dentofac Orthop* 2003; 123(5):512-20. <https://doi.org/10.1067/mod.2003.S0889540602570347>
- [22] Kim J, Jung H, Jung Y, Hwang C, Park H. A simple classification of facial asymmetry by TML system. *J Craniomaxillofac Surg* 2014; 42(4):313-20. <https://doi.org/10.1016/j.jcms.2013.05.019>
- [23] Haraguchi S, Iguchi Y, Takada K. Asymmetry of the face in orthodontic patients. *Angle Orthod* 2008; 78(3):421-6. <https://doi.org/10.2319/022107-85.1>