The Relationship Between Skeletal and Dental Characteristics in Patients with Class II Malocclusion

I Gusti Aju Wahju Ardani[1]*, Diamanta Anandamaya[1], Alida[1]

1. Department of Orthodontic, Faculty of Dental Medicine, Universitas Airlangga, Surabaya, Indonesia.

Abstract

The aim of this study was to determine the relationship between dental and skeletal characteristic of Javanese ethnic patient with Class II skeletal malocclusion. This was a descriptive analytic research using lateral cephalograms and dental casts of 65 Javanese ethnic patients with skeletal class II malocclusion. Lateral cephalograms for each patient was traced with digital cephalometric to measure skeletal parameters (SNA, SNB, ANB, and Y Axis) and dental parameters (overbite, overjet, dental arch shape, width and length of dental arch, interpremolar and intermolar height, interpremolar and intermolar width) were measured also using vernier calliper. The data obtained were analyzed using Pearson correlation test with $p < 0.05$. The highest frequency of maxillary and mandibular denture arch shape were v-shape. There was a correlation between patterns of skeletal class II and dental characteristics, SNA was positively correlated with maxillary interpremolar width and SNB was negatively correlated with mandibular interpremolar height. There are various skeletal and dental characteristics that are correlated with DeutroMalayu races (Javanese ethnic) which makes dentocraniofacial complexity in class II skeletal malocclusion.

Clinical article (J Int Dent Med Res 2019; 12(4): 1421-1425)

Keywords: Class II malocclusion, Dental characteristics, Skeletal characteristics.

Received date: 21 October 2018 **Accept date:** 22 May 2019

Introduction

In today's modern era, a need and demand for orthodontic treatment are increasing. People are becoming more and more aware of irregularities of the teeth, especially with facial deformities due to inharmonious jaw relationship that will greatly affect appearance. In additionally, irregular teeth and inharmonious jaw relationship will extremely affect the mastication, digestion and articulation systems.[1, 2]

Occlusion is maximum contact from the relationship between the maxillary teeth and the mandibular teeth during the mandibular resting position. While all kinds of deviation from ideal occlusion is called malocclusion.[1]

The prevalence of malocclusion in various countries is still fairly high. In Indonesia, the prevalence of malocclusion reached 80% of the population. This is worsened with lack of orthodontic treatment awareness and bad habits such as thumb sucking or other objects sucking. At the same time, a research in Seoul in 2012, showed that the prevalence of malocclusion was quite high about 50.2% of the total population with age over 19 years old, with 33.6% of class II malocclusion and 23.6% of class III malocclusion. While patients who required tooth extraction were 60.4% and required orthognathic surgery were 6.9%. Furthermore, the results of Baral's research showed that 61.3% of Aryan races and 64% of Mongoloid races had class I malocclusions.[3] Class II malocclusion of division 1 was 25.2% of Aryan races and 17.9% of Mongoloid races. While class II malocclusion of division 2 had lower prevalence about 5.3% of Aryan race and 2.5% of Mongoloid race, and class III malocclusion was 8.2% of Aryan race and 15.6% of Mongoloid race.[3-6]

Malocclusion may be caused by a dental or skeletal misalignment. Dental malocclusion is classified according to the first permanent molars relation. Classsification of malocclusion according to Angle's classification method is still used at present-day considering its convenient to use. Besides that, skeletal malocclusion can be determined by various cephalometric analyzes. Pattern of skeletal class II malocclusion can

Corresponding author:
I Gusti Aju Wahju Ardani
Orthodontic Department,
Faculty of Dental Medicine, Universitas Airlangga,
Surabaya, Indonesia.
E-mail: wahju_ardani@fkg.unair.ac.id

determine the facial profile and dental characteristics. Patients with skeletal class II malocclusions, can be assured to have pattern of dental class II malocclusion. However, patients with dental class II malocclusion can not be assured to have pattern of skeletal class II malocclusions. Clinically, skeletal class II malocclusion can not determine whether the mandibular is too far backward to the maxilla or maxilla too far forward to the mandibular. The results of the study still can not reveal the dentofacial characteristics of class II division 1. The opinions of the preceeding orthodontist are also ambiguous and even contradictory. McNamara concluded that the retrusion mandibular is the main characteristic of class II malocclusion and is rarely found in the protrusion maxilla.[7] On the contrary, Rothstein said the mandibular is most often found in the range of normal position characteristics, size, and shape.[8] While Rosenblum found that 56.6% of subjects with class II malocclusions had a protrusion maxilla and only 26.7% had a retrusion mandibular.[9]

Knowledge about the variation of dental relation towards the skeletal patterns in individuals with good occlusion, will support to determine inharmonious of malocclusions. Thus it is necessary to understand the variation of skeletal pattern relation towards the dental pattern to reveal the complexity of a malocclusion, where the dental condition can affect skeletal condition that getting worse. Based on this reasoning, it is expected to understand the relation between dental and skeletal pattern of patients with skeletal class II malocclusion.

Materials and Methods

The type of this research is descriptive analytic research of all patients with skeletal class II malocclusion (ANB ≥ 4^{o}) and undergoing orthodontic treatment at Dental Hospital Universitas Airlangga. The inclusion criteria of the reseach subjects refer to patients with various ages, Javanese ethnic, all permanent teeth had erupted, no missing teeth, agenesis or other dental anomalies, and had never been undergone orthodontic treatment before.

Lateral cephalograms and dental casts of 65 patients with skeletal class II malocclusion were collected. Lateral cephalograms for each patient was traced with OrthoVision (Vatech, Gyeonggi-do, Korea) digital cephalometric to measure skeletal parameters (SNA, SNB, ANB, and Y Axis) and dental parameters (overbite, overjet, dental arch shape, width and length of dental arch, interpremolar and intermolar height, and interpremolar and intermolar width) were measured also using vernier calliper (Mitutoyo, Kawasaki, Japan).

The data obtained were analyzed using SPSS v.25 (IBM Company, New York, USA) through Pearson correlation test to determine the correlation between pattern of skeletal class II and dental characteristics with $p < 0.05$.

Results

In this research, pattern of skeletal class II malocclusion and dental characteristics were measured (Table 1). The pattern of dental characteristics measured includes: dental arch shape; overjet; overbite; shape, width, and length of the dental arch; and also inter-premolar and molar arch height. The highest frequency of maxillary denture arch shape was v-shape with 52.3%, followed by omega shape with 30.8%, square shape with 12.3%, and parabolic shape with 4.6%. The same result was found in the lower jaw, the highest fequency of denture arch shape was v-shape with 55.4%. While the square shape with 23.1%, omega shape with 20% and parabolic shape with 1.5%. Normal parabolic arch shaped is quite rarely found in skeletal class II malocclusion, because narrowing of the anterior dental arch can be found more in the maxilla and mandibular by the researchers.

Other skeletal and dental parameters were correlated using the Pearson correlation test and the result showed that there was a correlation between patterns of skeletal class II and dental characteristics, SNA was positively correlated with maxillary interpremolar width and SNB was negatively correlated with mandibular interpremolar height.

Variable	Mean±SD	Min Value	Max Value

SNA	82,28±3,46	73.57	91.32
SNB	75,85±3,47	64.80	84.75
ANB	6,49±1,71	4	13.58
Y Axis	71,44±4,91	57.93	84.48
Overbite	3,81±1,21	1,00	8,00
Overjet	4,04±1,84	0	10
Mandibular arch lenght	80,83±5,10	69	90
Maxillary interpremolar width	38,15±2,66	32	44
Mandibular interpremolar width	31,89±2,76	26	40
Maxillary intermolar width	46,20±2,71	39	51
Mandibular intermolar width	40,73±2,42	35	47
Maxillary interpremolar height	13,08±3,25	6	24
Mandibular interpremolar height	7,65±1,87	4	13
Maxillary intermolar height	31,18±2,97	25	39
Mandibular intermolar height	25,03±2,46	18	32

Table 1. Descriptive Analysis of Skeletal Patterns and Dental Characteristics in Individuals with Skeletal Class II Malocclusions.

Discussion

This research was conducted to determine the correlation between dental and skeletal characteristic of patients with class II malocclusion. The sample used in this study were Javanese ethnic patients with skeletal class II malocclusion, no dental anomalies, missing teeth, microdonti, macrodonti, agenisi, persistence etc. which could affect the perimeter length of the dental arch. The collected sample was 65 samples included inclusion criteria which derived from 93 total samples studied.

The measurement parameters of the skeletal are SNA, SNB, ANB, and Y Axis. Whereas the dental variables measured were overbite, overjet, maxillary and mandibular dental arch length, maxillary and mandibular interpremolar width, maxillary and mandibular intermolar width, maxillary and mandibular interpremolar height, maxillary and mandibular intermolar height.

The dental arch shape is crucial for determining the diagnosis, planning and stability of long-term care.[10] One of the way to measure the dental arch shape is to determine the interpremolar and intermolar width. Literature studies provide an overview about intercanine and intermolar width in the mandibular arches of Caucasian is smaller when compared to Japanese. This showed that the characteristics of different dental arches are influenced by ethnic background. According to Sulandjari[1], the Javanese population has specific characteristics that are different from other populations, so that evaluation of soft tissue and hard tissue profiles is required for considering successful orthodontic treatment.

The results of this study showed that the Deutro Melayu population (Javanese ethnic) with class II malocclusion, had mean of maxillary and mandibular interpremolar widht 38.15 mm and 31.89 mm, while the maxillary intermolar was 46.20 mm and mandibular was 40.73mm. The value obtained is much smaller when compared to the value of class I malocclusion found from population in the literature. According to Sayin and Turkkahraman[11], the interpremolar and intermolar width of maxillary in patients with class I malocclusion is greater when compared to patients with class II malocclusion.

According to the research conducted by Suri et al.[12], the delayed of permanent tooth eruption can affect the dental arch shape. Premature loss of primary molar teeth may result in narrowing of the leeway space so that the first permanent molar moved mesially, and then class II molar relation is obtained. According to Graber[13], Caucasian race the maxillary arch is smaller compared to the mandibular, this is consistent with the results of this study where many anterior arch narrowing were found and formed V-shape.

The mean value of SNA was 82.28 and the mean value of SNB was 75.85. From the

measurement results can be seen that the population Deutro Melayu (Javanese ethnic) has a pattern of skeletal class II malocclusion with SNB value was much smaller compared to the average standard value. A high ANB value in class II malocclusion was generally caused by the mandibular retrusion. This caused the state of skeletal class II malocclusion getting worse. McNamara[7] concluded that the mandibular retrusion was the single most common characteristic of class II samples, whereas an far forward upper jaw was not generally found. The mandibular is suspected to be an important factor of class II malocclusion occurrence, because the mandibular is a craniofacial complex structure that capable of growing continuously until adulthood and is strongly influenced by epigenetic and environmental factors.[14] According to a study by Munandar and Snow[15], it showed that mandibular ramus growth of Indonesian Deutero-Malay race is more vertical compared to some races other than Chinese-Malays, who are anthropologically similar in dentofacial anatomy aspects to Indonesian Deutero-Malays.[15]

The mean Y-axis in this study was 71.44, with minimum value 57.93 and maximum value 84.48, this indicating a variation in facial growth patterns of skeletal class II malocclusion. According to Jacobson and Jacobson[16], the normal Y-axis standard value was 59.4. Munandar and Snow[14] stated that the normal mean Y-axis in DeutroMelayu population was 63.1. Y-axis value in class II malocclusion is much greater compared to class I, which caused the appearance of facial profile of class II malocclusion more convex and retrusion mandibular.

According to research by Sidlauskas et al.[17], the mean standard of over bite was 2.83mm and the overjet was 3.74mm, while in this study the mean of overbite was 3.80mm and the overjet was 4.03mm. Generally, cases of skeletal class II malocclusion have high values of overbite and overjet. Correction of overbite and overjet are very important to achieve optimal results and maintain the stability of orthodontic treatment.

The results of this study indicated a significant correlation between skeletal and dental characteristics in class II malocclusion. The larger SNA angle causes increased maxillary interpremolar width. The larger SNB angle caused the lower interpremolar diameter smaller. The large number of dental variations in the case of skeletal class II malocclusion, according to previous studies are actually influenced by the dominant genetic factors and the great influences from environment during dental development, starting from the deciduous teeth phase, turnover, and permanent teeth.[18, 19]

Through this study, it can be concluded that there are various skeletal and dental characteristics that are correlated with DeutroMalayu races (Javanese ethnic) which makes dentocraniofacial complexity in class II skeletal malocclusion.

References

1. Sulandjari H. Buku ajar ortodonsia I KGO I. 1st ed. Yogyakarta: UGM Yogyakarta 2008;32–6.
2. Figueroa FR, Bancalari C, Cartez-Velásquez R, Sanhueza M, Palma C. Prevalence of maloclussion and its psychosocial impact in a sample of chilean adolescent aged 14 to 18 years old. J Int Dent Med Res 2017;10(1):14-8.
3. Baral P. Prevalence of malocclusion in permanent dentition in Aryan and Mongoloid races of Nepal-A Comparative study. Pakistan Orthod J 2013;5(2):57–9.
4. Budiyanti EA. Pengaruh perilaku ibu dan pola keluarga pada kebiasaan mengisap jari pada anak, dikaitkan dengan status oklusi geligi sulung: studi epidemiologis pada anak TK di DKI Jakarta. Jakarta: FKG-UI 1996;10.
5. Jung M-H. Age, extraction rate and jaw surgery rate in Korean orthodontic clinics and small dental hospitals. Korean J Orthod 2012;42(2):80–6.
6. Lew KK, Foong WC, Loh E. Malocclusion prevalence in an ethnic Chinese population. Aust Dent J 1993;38(6):442–9.
7. McNamara Jr JA. Influence of respiratory pattern on craniofacial growth. Angle Orthod 1981;51(4):269–300.
8. Rothstein T, Yoon-Tarlie C. Dental and facial skeletal characteristics and growth of males and females with Class II, Division 1 malocclusion between the ages of 10 and 14 (revisited)—Part I: Characteristics of size, form, and position. Am J Orthod Dentofac Orthop 2000;117(3):320–32.
9. Rosenblum RE. Class II malocclusion: mandibular retrusion or maxillary protrusion? Angle Orthod 1995;65(1):49–62.
10. Ogodescu AE, Tudor A, Szabo K, Daescu C, Bratu E, Ogodescu A. Longitudinal changes of dental arches in growing children. Jurnalul Pediatrului 2011;14(55-56):12-7.
11. Sayin MO, Turkkahraman H. Comparison of dental arch and alveolar widths of patients with Class II, division 1 malocclusion and subjects with Class I ideal occlusion. Angle Orthod 2004;74(3):356–60.
12. Suri L, Gagari E, Vastardis H. Delayed tooth eruption: pathogenesis, diagnosis, and treatment. A literature review. Am J Orthod Dentofac Orthop 2004;126(4):432–45.
13. Graber LW, Vanarsdall RL, Vig KWL, Huang GJ. Orthodontics-e-book: current principles and techniques. 6th ed. St. Louis: El Health Sci 2016;200-1.
14. Jacob HB, Buschang PH. Mandibular growth comparisons of Class I and Class II division 1 skeletofacial patterns. Angle Orthod 2014;84(5):755–61.
15. Munandar S, Snow MD. Cephalometric analysis of Deutero‐Malay Indonesians. Aust Dent J 1995;40(6):381–8.
16. Jacobson A, Jacobson RL. Radiographic Cephalometry: From Basics to 3-D Videoimaging. 2nd ed. USA: Quintessence Books 2006;197.
17. Sidlauskas A, Svalkauskiene V, Sidlauskas M. Assessment of skeletal and dental pattern of Class II division 1 malocclusion with relevance to clinical practice. Stomatologija2006;8(1):3-8.

18. Weaver CA, Miller SF, da Fontoura CSG, Wehby GL, Amendt BA, Holton NE, et al. Candidate gene analyses of 3-dimensional dentoalveolar phenotypes in subjects with malocclusion. Am J Orthod Dentofac Orthop 2017;151(3):539–58.
19. Jazaldi F, Handayani ED, Damayanti YNU, Sarwono AT, Soegiharto B, Nurtami, Ibrahim E. The LEPR Q223R polymorphism as a potential bioindicator of class II malocclusion. J Int Dent Med Res 2016;9(Special Issue, UI 1st International Workshop on Dental Research):351-5.