ORIGINAL ARTICLE

Assessment of the Mandibular Asymmetryin Class II Subdivision cases from a Sample Pakistani Population

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ABSTRACT

Objectives: To determine the asymmetry of mandibular condyle and ramus in a group of patients with Class II subdivision malocclusion. Furthermore, to evaluate the difference in the prevalence of Class II subdivision malocclusion on either side of the mandible.

Methodology: This was a cross-sectional (comparative) study carried out for six months from 20th September 2015 to 20th March 2016 at the Department of Orthodontics, Sindh Institute of Oral Health Sciences, Jinnah Sindh Medical University. History, clinical examination, intraoral photographs, and plaster models were used to classify the patients according to their malocclusion. Orthopantomogram (OPG) that are routinely taken for orthodontic patients' records were used for this study and condyle, ascending ramus, and both sides of the corpus were traced. The condylar height, ramal height, and gonial angles were measured and the asymmetry index computed.

Results: A total of 80 patients (34 males and 46 females) were taken in the age range of 12-26 years. There were no age related statistically significant differences found for male and female subjects compared. Class I and Class II subdivision groups were computed for the heights of condylar process. Ramus and gonial angles were measured followed by asymmetry index calculation in both groups. Among the values statistically significant differences were found for condylar height ($p=0.021$), ramal height ($p<0.001$), condylar height index ($p<0.001$) and ramal height index ($p=0.014$) whereas, values including gonial angle, condylar height plus ramal height and condylar height plus ramal height index values were statistically insignificant. The results showed for Class I group longer values of gonial angle, ramal height and condylar-plus-ramal height measurements.

Conclusion: Class II subdivision patients have significant differences for the ramal height, condylar height, condylar height index and ramal height index, when compared to normal occlusion sample.

Key words: Asymmetry, Class II Subdivision, Malocclusion

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عنوان: پاکستانی آبادی کے ایک نمونہ میں درجہ دوئم کی ذیلی تقسیم میں مینڈیبلر کے غیر متناسب ہونے کی تشخیص۔

مقصد: اس مطالعہ کا مقصد درجہ دوئم کی ذیلی تقسیم کے مریضوں میں مینڈیبل، کونڈائیل اور رامس کے ناساز گار اور غیر متناسب ہونے کی تشخیص کرنا اور مزید یہ کہ کلاس II کے مریضوں میں مینڈیبل کے کسی بھی جانب پھیلاؤ کے فرق کو جانچنا ہے۔

طریقہ: یہ کروسیکشنل مطالعہ جناح سندھ میڈیکل یونیورسٹی کے سندھ انسٹیٹیوٹ آف اورل ہیلتھ سائنسز کے شعبہ آرتھوڈونٹکس میں چھ ماہ (۲۰ ستمبر ۲۰۱۵ سے ۲۰ مارچ ۲۰۱۶) کے دورانیے میں مکمل کی گئی۔ مریضوں کی انکے کلینیکل معائنہ، منہ کے ایکسرے اور پلاسٹر ماڈل کے لحاظ سے درجہ بندی کی گئی۔ آرتھوڈونٹک مریضوں کی باقائدگی سے کی گئی Orthopantomogram (OPG) کے ریکارڈز کو اس مطالعہ میں استعمال کیا گیا۔ اینڈ کونڈیل، بڑھتے ہوئے رامس اور کارپس کے دونوں اطراف کی جانچ کی گئی۔ کنڈیلر کی اونچائی، رامس کی اونچائی، اور گونئیل کے زاویہ کی پیمائش کی گئی اور غیر متناسب حالت کا اندازہ کیا گیا۔

نتائج: 12 سے 26 سال کی عمر کے مجموعی طور پر 80 مریض (34 مرد اور 46 خواتین) اس تحقیق میں شامل کیے گئے۔ موازنہ کرنے پر معلوم ہوا کہ عمر اور جنس کے لحاظ سے کسی قسم کا کوئی اہم فرق معلوم نہیں ہوا۔ کلاس I اور کلاس II کے گروپس میں کنڈیلر کی اونچائی، رامس اور گونئیل کا زاویہ کی پیمائش کی گئی۔ کنڈیلر کی اونچائی (p-value = 0.021)، رامس کی اونچائی (p-value <0.001)، اور کنڈیلر کی اونچائی کی انڈیکس ($p<0.001$) رامس کی اونچائی انڈیکس ($p=0.014$) جبکہ کنڈیلر کی اونچائی، رامس اور گونئیل کا زاویہ اور کنڈیلر کی اونچائی اور رامس کی اونچائی انڈیکس کی قیمتیں غیر اہم معلوم ہوئیں۔ جبکہ حاصل ہونے والے نتائج میں کلاس I میں قیمتیں بڑی ریکارڈ ہوئیں۔

حاصلِ مطالعہ: عام حالت کے مقابلے میں کلاس II کے مریضوں میں کنڈیلر کی اونچائی، رامس کی اونچائی اور کنڈیلر کی اونچائی اور رامس کی اونچائی انڈیکس میں خاصا فرق پایا گیا۔

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INTRODUCTION

Symmetry, in consideration to the face, refers to the harmony in size, shape, and location of facial structures on the opposite sides of the median sagittal plane[1]. Mild asymmetry in the right-left side of the dentition and face is a natural phenomenon found irrespective of gender and race[2]. According to the classification by Angle; Malocclusions with unilateral Class II molar relationships are called Subdivision cases[3]. Asymmetry could be of many possible origins i.e. skeletal, dental or combination of both. Alavi et al[4], in his study proved that the eruption of mandibular first molar into a distal position on the affected side is the main contributing factor to an anteroposterior discrepancy[5].

Another contributing factor is the medial positioning of the maxillary first molar on the subdivision side. Consequently, two types of Class II subdivision malocclusions observed are: type I with distal position of the mandibular first molar on the subdivision side and type II with mesial position of the maxillary molar on the affected side[6]. Class II, type II subdivision does not present skeletal asymmetries in relation to normal occlusion. However, it is not uncommon to notice mild facial asymmetries in Class II, type I subdivision malocclusion cases[7]. It has been shown by evidence that subdivision malocclusion is most commonly seen in mandibular asymmetry cases. The mandibular asymmetry directly affects facial appearance; it may affect aesthetics but could also cause functional problems in the stomatognathic system. The mandibular condyles are the regions with the highest growth potential due to the presence of condylar cartilages. Injury to this area during the growth period can disturb the mandibular down-and-forward growth potential, causing asymmetric displacement of the mandible toward the affected side. Thus, condylar asymmetries are thought to be one of the most important causes of mandibulo-facial asymmetries[1]. Williamson and Simmons in their study used Submentovertex view (SMV) films that highlighted a predisposition of Class II posterior segment relationship on the shorter side of the mandible[8].

Sanders et al, concluded in his study that a deficiency in the size of the mandible on the Class II side was a primary contributing factor in the development of a Class II subdivision, which accounted for 61% of the total discrepancy between the groups. Equally important is the finding that there were no significant asymmetries among condylar pole measurements in the subdivision group, however significant dentoalveolar asymmetries were present[9].

Investigations used to identify the location and extent of asymmetry include the postero-anterior radiographs (PA view) and Orthopantomographs (OPG). Traditionally the Submentovertex (SMV) radiographs are suggested for analysis of asymmetry. This investigation helps in viewing the jaw in both transverse and anteroposterior relationships.

Various radiological modalities have been evaluated for imaging of the TMJ and skeletal structures. Orthopantomographs routinely suggested for viewing dental pathologies associated with the teeth, alveolar process of the upper and lower jaws, neurovascular bundle as well as for pathologies of the salivary glands. It is a useful tool for measurement of "side-to-side" height differences. If joints are differentially affected, an asymmetry may develop. A few studies have used measurements of condylar height and total height to define side-to-side variation[10].

Habets et al described a method for evaluating condylar and ramal asymmetry. This method has been used to calculate and compare the heights of the right and left sides of the mandible for asymmetries in temporomandibular disorder (TMD) patients and different malocclusion groups including Class I, II, III types, bilateral posterior cross-bites, and different skeletal patterns[11].

The primary objective of this research was to determine the asymmetry of mandibular condyle and ramal process in a group of patients from a Pakistani population with Class II subdivision malocclusion and compare the data with similar measurements from a normal occlusion sample.

The second objective was to evaluate the difference in the prevalence of Class II subdivision on either side of the mandible.

This information could be employed in educating patients and clinicians as literature search has shown availability of limited data for recent studies over local population from South East-Asia particularly for Pakistani population. Moreover, the results will help the clinicians to identify the possible etiology and better understand the treatment planning of the condition in our part of the population.

The result of this research can be used as a ground work source for planning and gathering data for conducting future studies.

METHODOLOGY

Two groups of patients selected from the Faculty of Dentistry at the Department of Orthodontics of Sindh

Institute of Oral Health Sciences and Dr Ishrat-Ul-Ebad Khan Institute of Oral Health Science. The present study was performed on Orthopantomograms (OPG) of 40 Normal occlusion and 40 Class II subdivision malocclusion subjects.

The OPGs of the 40 adolescent control subjects (16 males and 24 females) with normal occlusion were selected from patient records with informed consent and met the following criteria:—Patients with Class I buccal occlusion relationship with mild or no crowding; normal growth and development; well aligned upper and lower dental arches; completely dentate; bilateral symmetrical face; absence of any systemic disease; absence of previous trauma, orthodontic, prosthodontic and maxillofacial & plastic surgery treatment

The OPGs of 40 subjects (18 male and 22 female) with Class II subdivision malocclusion were chosen with the following criteria:

One side of the dental arch with complete Class I molar relationship: Class II molar relationship ranging from one half to full cusp on the other side; Never treated Orthodontically; Absence of mandibular lateral shift on closure observed clinically;—Absence of medical conditions or head and neck trauma that might alter the growth of the skeletal structures;—The absence of any severely mal-aligned or blocked out teeth.

Intraoral photographs and plaster models were used to classify the patients according to their malocclusion. These subjects were also evaluated by taking history and clinical examination and were selected in clinical evaluation by three examiners. Since OPG is routinely used as a screening procedure, all subjects had films available for review. These radiographs were taken using standardized protocol by the same operator. The subjects were positioned with the lips in rest position and the head oriented to the natural head position (Frankfort horizontal plane).

All the films were traced and measured by the same author (EB). Acetate paper was used to trace bilateral corpus, ascending ramus and the condyle. On the tracing sheet, the most lateral points of the condyle (O1) and the ascending ramus (O 2) were used to draw A- Line (the ramus tangent) (See Figure 1). B-line was defined by extending a line from the most superior point of the condylar image towards the ramus tangent (A- Line). The vertical distance from B-line on the ‘‘ramus tangent’’ to the O1 projected on the ramus tangent was measured. This distance was called the condylar height (CH). Ramus height (RH) was taken as the distance between O1 and O2. A line was drawn as a tangent on corpus (body) of the mandible bilaterally and was named C-Line. The gonial angle was measured between A and C-lines.

All statistical analyses were performed using the SPSS software package (Statistical Package for Social Sciences for Windows, version 17.0, SPSS Inc.). The Independent t-test was used to determine the possible statistically significant differences between the groups for condylar, ramal and condylar-plus-ramal height, and gonial angle measurements. Mann Whitney-U test was used to determine statistically significant differences between the groups for condylar height, ramal height, and condylar-plus-ramal height index measurements at 95% confidence interval and $p < 0.05$ was considered as significant.

RESULTS

There were no statistically significant differences found in male and female subjects compared. Class I and Class II groups (with subdivision) were compared for the values of asymmetry index and gonial angle measurements for right and left sides in both groups (Table 1 and 2). There were statistically significant differences for condylar height ($p=0.021$), ramal height ($p<0.001$), condylar height index ($p<0.001$), and ramal height index ($p=0.014$) measurements. The gonial angle, condylar height plus ramal height, and condylar height plus ramal height index values were not statistically significant (Table 2).

The results also showed that except for condylar height measurements, Class I group has longer values for gonial angle, ramal, and condylar-plus-ramal height measurements (Table 1).

DISCUSSION

In this study, male and female subjects were in different proportions and no gender related statistically significant differences were found between compared sides. Studies of the etiology of condylar asymmetries in which gender related differences were investigated revealed results that were statistically insignificant[10,12]. Also these findings were supported by Kiki et al[13] and Sezgin et al[14] who used the same method described in the present study. Arnold et al[15], Melnik,[16] in their studies concluded that there were no statistically significant gender differences regarding asymmetries after the age of 14 and with growth there is an equal probability for the asymmetry to improve or worsen. Another study on asymmetry did not specify gender[17]. Thus; the age difference between the groups should not interfere with this type of evaluation.

In this study, OPG has been used for the assessment of condylar, ramal, and condylar plus ramal heights to define side-to-side asymmetries[10,13]. Bilateral views of the mandible can be obtained with OPG, and vertical

Table 1: Statistical Side Comparisons of Normal Occlusion and Class II Malocclusion Sample

Class I Group				Subdivision Group		
Variable	Right Side	Left Side	p-value	Class I Side	Class II Side	p-value
CH	8.28±2.27	7.06±1.86	0.101	9.01±2.37	9.08±2.08	0.881
RH	46.61±6.47	46.10±5.99	0.714	44.46±4.36	42.78±4.94	0.113
Gonial angle	124.75±6.75	124.3±6.91	0.769	122.6±11.13	120.82±10.66	0.469
CH + RH	54.8±6.52	53.13±5.94	0.237	53.45±5.33	51.52±5.17	0.105

p-value is calculated by Student's t-test and variables are presented as Mean ± SD.
CH = Condylar Height
RH = Ramal Height
CH+RH = Condylar Height + Ramal Height

Table 2: Statistical Comparisons of All Asymmetry Measurements Between Class II Subdivision Patients and Normal Occlusion Sample

Variable	Class I Group	Class II Subdivision Group	p-value
CH	15.35±3.71	18.1±4.01	0.021*
RH	92.71±12.21	18.11±4.11	< 0.001*
Gonial angle	249.05±13.22	243.42±21.22	0.159*
CH + RH	107.93±12.19	104.97±9.81	0.233*
CH Index	8.71(15.11)	4.23(12.27)	< 0.001¥
RH Index	1.03(3.39)	2.22(4.71)	0.014¥
CH + RH Index	1.74(3.94)	2.07(4.10)	0.374¥

*p-value is calculated by Student's t test and variables are presented as Mean±SD

¥p-value is calculated by Mann Whitney-U test and variables are presented as Median (IQR)

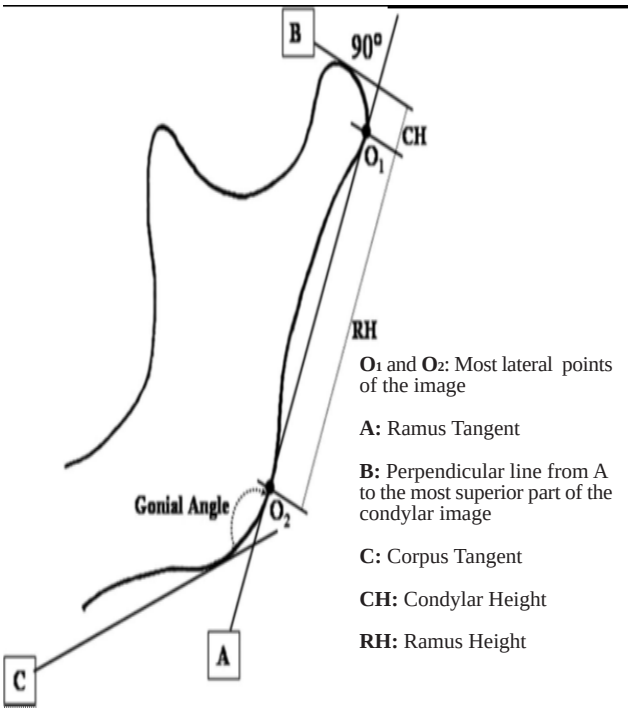

Figure1. Measuring Method According to Habets et al.[10]

Non-significant Mean Difference on Either Side of Mandible in Class II Subdivision (p>0.05)

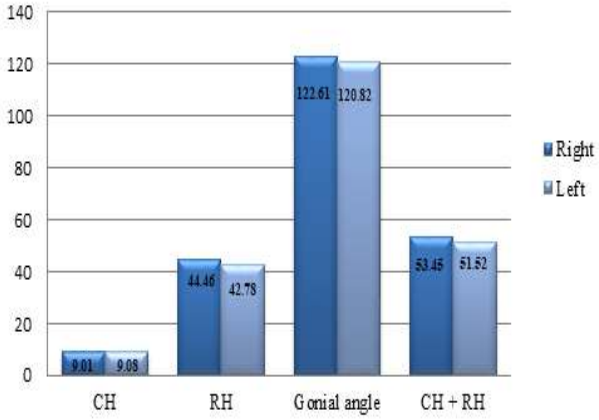

Chart 1: Mean Difference on Either Side of Mandible in Class II Subdivision Group (p-value > 0.05)

measurements can be achieved. Although the use of panoramic radiographs to evaluate side-to-side differences is questionable, it is possible to image joints, teeth, and other parts of the jaws in one exposure. For different mandibular measurements such as tooth length or bone height, OPG is used as a diagnostic tool and in more complicated situations, such as to evaluate TMDs, denture wearers or orthodontic anomalies[18,19].

A number of different studies have suggested that acceptable results can be achieved with this technique which are noninvasive, expose subjects to relatively low doses of radiation, and have a favourable cost-benefit relationship[10,20].

Therefore, in order to standardize the procedure, all the films were taken in ideal conditions and inadequate or poor quality films were excluded.

In the literature, the dentofacial asymmetries assessments have been performed by using different techniques including submentovertex[21] or postero anterior cephalometric radiographs[22], computed tomography[23], and magnetic resonance imaging[24]. Studies have shown that the cephalometric (PA) films

have some limitations of methodology and reliability and the submentovertex (SMV) view has been suggested to be a better choice of radiograph[25]. However, it is capable of significant distortion since the mandible is situated farthest from the film plane. Both of these radiographs are of limited value in orthodontic diagnosis and treatment planning for the individual.

In the present study, statistically significant differences ($p < 0.05$) were found for condylar height, ramal height, condylar height index, and ramal height index measurements. The gonial angle, condylar height plus ramal height, and condylar height plus ramal height index values were not statistically significant (Table 2). The results also showed that except for condylar height measurements, Class I group has longer values for gonial angle, ramal, and condylar-plus-ramal height measurements.

In consistence with the results of the previous studies, the present study revealed that the prevalence of class II subdivision was more towards the right side although the values detected a non-significant difference (Chart 1).

The results of current study are coincident with the findings of Williamson and Simmons which revealed that the shorter side of the mandible might have a propensity to show class II molar relationship.[26] According to authors there will always be Class II molar relationship on the shorter side, if the value of asymmetry is up to or more than 3 mm. However, it cannot be concluded that Class II relation is always associated with shorter side of the mandible on the respected side. It can be hypothesized that unilateral condylar hypoplasia causing shorter mandibular length can lead to class II subdivision malocclusion. However, the results of Rose et al[22], and present study are almost matched statistically between the groups regarding skeletal mandibular asymmetry.

CONCLUSION

According to Angle's classification, majority of Class II malocclusion cases seem to be more related to condylar asymmetries and had significantly higher values for condylar asymmetry than normal occlusion control groups[1,7].

The results of the present study are, in some aspects consistent with the results of previous studies in that Class II subdivision patients have statistically significant differences for condylar height, ramal height, condylar height index, and ramal height index measurements when compared to class I sample according to Habet's Mandibular Asymmetry Indices.

Malocclusions affect the condylar and ramal height measurements but ramal height was markedly affected in comparison with condylar height of the mandible. In consistence with the results of the previous studies, the present study revealed that the prevalence of class II subdivision was more towards the right side although the values detected a non-significant difference (Chart 1).

Authors' contributions: Dr Erum Behroz conceived the study, searched for literature, contributed in data collection, analysis, review, and worked on introduction and discussion. Prof Syed Muhammad Tariq Rafi contributed in data collection, analysis and write up. Dr Sanam Tauheed and Dr Ali Raza worked on literature search, results and discussion. Dr Erum Behroz and Dr Nisar Ali reviewed the literature, contributed to the discussion and edited the manuscript. Dr Sanam Tauheed reviewed the literature, results and conclusion. All authors contributed to the final manuscript.

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