



A lateral cephalometric and arch width Study between class II division 1 malocclusion and Class II division 2 malocclusion (A comparative study)

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Abstract

Background: the purpose of this retrospective study was to compare some craniofacial cephalometric measurements and arch width dimensions between subjects with class II division 1 and class II division 2 malocclusion in Iraqi population.

Materials and methods: 60 digital true lateral cephalometric radiographs 30 for class II division 1 and 30 for class II division 2 subjects (15 males, 15 females for each group) were selected from the files of the patients attending the orthodontic clinic in the college of dentistry, university of Baghdad with an over jet more than 6 mm and class II molar and canine relation. Also for each group a study model were take to measure the arch width for both upper and lower arches. The inter molar, inter premolar and inter canine measurements were carried out on study models. The radio graphs were digitized by using the Auto CAD program in the personal computer all the data compared by independent t- test.

Results and conclusions: For the dental arch width measurements the statistically significant difference was found between the mandibular inter canine width and maxillary inter molar width. The cephalometric results that class II division 1 showed a retrognathic mandible, and this due to the difference in SNB angle between the two groups, the class II division 2 subjects had anterior position of the mandible relative to the cranial base, more concave profile, great posterior face height, horizontal growth, the mandibular inclination is interiorly, more deep bite, and reduction in the mandibular inter canine width and maxillary inter molar width .

Key words: Orthodontic, cephalometric, Class II division 1 malocclusion, class II division 2 malocclusion, Arch width.

Introduction

Class II malocclusion by definition by angle lower molar distal to upper molar ⁽¹⁾ . class II division 1 means there is proclination of maxillary anterior teeth with over jet more than normal over jet (normal over jet 2-4mm), while class II division 2 means retroclination of the maxillary anterior

teeth (at least of the two central incisors) ⁽²⁾ . Many researchers have studied the growth of arch widths in persons with normal occlusion. Little studies were done in Iraqi population, Suhad. H⁽³⁾ studied the difference between arch width of normal occlusion and class II division 1

malocclusion Wisam Issa Lasso and Nidhal. H. Ghaib ⁽⁴⁾. studied the maxillary arch dimensions between class I and class II division one occlusion. The few studies for class II division 2 may be due to less frequently of it's occurrence in the population ⁽²⁾. Moorrees etal⁽⁵⁾ used dental casts to compare arch dimensions of untreated class II division 1 and division 2 groups and concluded that in class II division 2 subjects the maxillary and mandibular intercanine distance were greater than the control reference population , where as inter molar distance were normal. On the other hand, in the class II division 1 group the inter canine and inter molar distance were found to be smaller than average. Walkow and pek ⁽⁶⁾ indicated in their studies that division 2 subjects show a reduced intercanine width. In across sectional study of 386 white women, Buschang etal⁽⁷⁾ found that class II division 2 patients had greater maxillary inter canine and inter molar distances than did class II division 1 patients, however, the class II division 2 patient show mandibular inter canine and inter molar width less than the class I and class II division 1 patients. In this study in addition to arch width comparison between class II division 1 and division 2 the cephalometric analysis for both groups were done, A study comparing study casts and cephalometric measurements of adults with normal occlusions and adults with class II division 1 malocclusions revealed that the class II division 1 group had a tendency y to a posterior cross bite⁽⁸⁾. A comparison of dento skeletal morphology in 347 class II division 1 and 156 class II division 2 malocclusion per formed by Pancherz etal ⁽⁹⁾,using lateral cephalometric radiographs, the results revealed broad variations in the variables analyzed. Pancherz etal ⁽⁹⁾ stated that mandibular

retusion was a common characteristic not only of class II division 1 subjects, but also of division 2 subjects. In a more recent investigation, the craniofacial morphology in class II division 1 children with and with out deep bite was evaluated, and the results that the anterior mandibular growth rotation occurred especially in subjects with alack of incisor support ⁽¹⁰⁾ Demisch etal ⁽¹¹⁾ found no dent alveolar discrepancy, when class II division 2 malocclusions were considered. In this study the arch width was compared between class II division 1 malocclusion and class II division 2, Also some cephalometric points analyzed to reveal any differences between the two groups ,so any dental or skeletal differences between subject with class II division 1 and class II division 2 malocclusion was determine.

Material and Methods

The sample consist of 60 patients 30 with class II division 1 and 30 with class II division 2 malocclusion, the sample selected from the files of the patients attending the orthodontic clinic in the college of dentistry, university of Baghdad. For each patient for both groups lateral cephalometric radiographs and dental casts were taken, using alginate impression and dental stone. The age of the patients between 18 and 25 years old, and the criteria for inclusion :-

1. No history of previous orthodontic treatment.
2. Presence of permanent dentition (excluding the third molar).
3. Class II Angle classification molar relation as well as class II canine relation
4. With no open bite.
5. Over jet more than 6 mm for class II division 1 patients.

6. For class II division 2 patients there was retraction of the maxillary anterior teeth (at least of the two central incisors).
7. No gender specification.

Data collection:-

For dental casts measurements a caliper was used to measure the transverse widths of the upper and lower dental casts , the following distances were measured :-

- 1.the distance between mesio buccal cusps of tips of the molars (first molars)
- 2.the distance between the buccal cusp tips of the first and second premolars .
- 3.the distance between the tips of the canines .

For the cephalometric measurements:-

Equipments

Analyzing software (Auto CAD. Program, 2006) and personal computer. Cephalometric analysis :-

Every lateral cephalometric radiograph was analyzed using Auto CAD program to calculate the angular and linear measurements. After importing the picture to the Auto CAD program the points were localized, the planes were determined, and the angles and distances were measured. The angles were measured directly as they were not affected by magnification, while the linear measurements were divided by scale for each pictures to over come the magnification.

Cephalometric points:-

1. point S (sella): the midpoint of the hypophysial fossa ⁽¹²⁾
2. point N(Nasion): the most anterior point of the naso frontal suture in the median plane ⁽¹²⁾.
3. point Ar (Articulare):- the point of intersection of the external dorsal contour of the mandiblar condyle and the temporal bone ⁽¹³⁾
4. point A (subspinale). The deepest midline point on the

premaxilla between the Anterior Nasal spin and prosthion ⁽¹⁴⁾

5. point B (supramental):The deepest midline point on the mandible between intradentale and pogonion. ⁽¹⁴⁾
6. ANS (Anterior Nasal spine) : it is the tip of the bony anterior nasal spine in the median plane ⁽¹²⁾.
7. Point Me (Menton) : the lowest point on the symphyseal shadow of the mandible seen on alateral cephalograms. ⁽¹⁵⁾
8. Point (Gn) (Gnathion): the most anterior and inferior point of the bony chin ⁽¹²⁾.
9. Point (Gonion): A constructed point, the intersection of the lines tangent to the posterior margin of the ascending ramus and the mandibular base ⁽¹²⁾.
10. Point pog (pogonion): it is the most anterior point on the mandible in the mid line ⁽¹⁴⁾.

Cephalometric Angles:

1. SNA: - the angle between lines S-N and N-A. It represents the angular anterior- posterior position of the maxilla to cranial base ^(15,16)
2. ANB:- the angle between lines A-N and N-B. it represents the angular anterior posterior position of the mandible to the cranial base. ^(15,16)
3. ANB angle:- the angle between lines N-A and N-B it is the most commonly used measurement for appraising anteroposterior disharmony of the jaw . ^(15,16)
4. Y axis (N-S-Gn):- this angle determines the position of the mandible relative to the cranial base, it has a mean value of 66° ; if it is greater than that, the mandible is in a posterior position, with growth predominantly vertical. If the angle is less than 66° , the mandible is in an anterior

position relative to the cranial base, and growth is predominantly anterior⁽¹²⁾

5. convexity angle (N-A- pog):- with mean value of 175° , this convexity decrease with age⁽¹²⁾
6. H- angle :- this a quantitative angle. Holdaway determines the angle between a tangent to the upper lip and the NB line⁽¹²⁾
7. SN –MP angle:- this angle gives the inclination of the mandible to the anterior cranial base. Taking the mean value to be 32° , if the angle is greater than 32° , inclination is posterior, if less than 32° , anterior, this angle registers vertical dysplasras⁽¹²⁾
8. SN-Ar (saddle angle):- the angle between the anterior and the posterior cranial base. This angle formed at the point of intersection of the S-N plane and the S-Ar plane .⁽¹²⁾

Other cephalometric measurements

9. Jara bak ration:-

Posterior face height (SGO) x 100 :
anterior face height (N Me)⁽¹²⁾

Statistical analyses:-

For both dental arch width measurements and cephalometric measurements all the data of the sample were subjected to computerized statistical analysis using SPSS version 15 (2006) computer program. The statistical analysis included.

- 1.Descriptive statistics:- mean, standard deviation (SD), and the statistical table.
- 2.Inferential statistics:- independent samples t-test for the comparison between both groups. In the statistical evaluation, the following levels of significance are used:-
 - P < 0.05 signiticant.
 - P > 0.05 NO n significant

Results and Discussion (table1,table2).

Results

For dental cast measurement there was statistically significant difference between the groups for dental cast measurement for mandibular inter canine width and maxillary inter molar width. The cephalometric results revealed that the SNB angle was responsible for the skeletal sagittal differences, between the two groups. Jarabak ratio, SN-MP angle and y axis all showed that the division 1 group had higher vertical proportion. Convexity angle, H angle indicated that the class II division 2 group present amore concave profile.

Discussion

Arch width:-The sample consist of subjects in the permanent dentition to ensure minimal changes in arch widths due to growth.⁽¹⁷⁾ the patients selection criteria were based only on the visual evaluation of the dental casts, the overjet was more than 6mm, open bite were excluded. The only statistically significant difference among the groups for the dental cast measurements found in mandibular inter canine, and maxillary inter molar width. Buschang etal⁽¹⁸⁾ have a similar finding, regarding the constriction of mandibular inter canine width in division 2 subjects. Where as Moorrees. etal⁽⁵⁾, found a similar finding as this study. Walkow and Peck⁽⁶⁾ suggested that class II division 2 malocclusion is characterized by normal transverse dimensions in the maxillary and mandibular posterior segments, but reduce inter canine arch dimension in the mandible, decrease in mandibular anterior arch width is a result of severe bite that inhibits forward mandibular dentoalveolar growth but not the strong basal and symphyseal growth in the class II

division 2 mandible⁽¹⁹⁾. Investigators who studied growth changes in the transvers, arch width found that molar and canine arch widths did not change after 13 in female subjects and age 16 in male subjects. The minimum ages of the subjects measured in this study were chosen on the basis of these previous studies. In a cross-sectional study, Buschange etal⁽⁷⁾ found that class II division 2 patients showed smaller mandibular intercanine and inter molar width than the class I and class II division 1 patients.

Cephalometric analysis :-

The SNA angle showed no any statistical difference between class II division 1 and division 2, so that means that the maxilla was normally positioned in both sample groups, this finding was in agreement with Isik. F etal.⁽²⁾ Schwarze⁽²¹⁾ in 1956 concluded in his studies that division 2 malocclusions revealed only dentoalveolar, not skeletal discrepaccies in similar studies, Harries etal⁽²²⁾ and Pancherz etal⁽²³⁾ found asmall SNA angle (maxillary retrusion) in class II division 2 groups, whereas Rothstein⁽²⁴⁾ and rosenblum⁽²⁵⁾ noted a protrusive maxilla. In this study there was a significant difference in the value of SNB between class II division 1 and division 2, for the clas II division 1 it's mean value 73.15 wherase for the class II division 2 it's mean value was 76.26 As suggested by Rakosi⁽¹²⁾ the value of this angle of class I is 79° , and this angle reflect the antero posterior position of the mandible, so both the division 1 and 2 group was found to be smaller than normal suggested aretrognathic mandible for both groups, this finding in agreement with Pancherz eta.⁽²³⁾ The retrognathism of the mandible showed in this study for the clas II division 1 more than class II division 2 this finding is agree with Demisch etal

⁽¹¹⁾ and Peck etal⁽¹⁹⁾, who statede that in class II division 2 cases, the mandible is not posteriorly displaced. Areason for the dissimilar results for mandibular position may be explained by the difference between the samples. Pancherz etal⁽²³⁾, who found that the division 2 group presented smaller SNB angle than division 1 group , this may resulted from the constriction of the retroclined anterior maxillary dentition on the mandibular structures.

The angle determine the position of the mandible relative to the cranial base is the N-S-Gn (y Axis) angle its normal value according to Racosi⁽¹²⁾ is 66° , in this study both class II division 1 and 2 showed less than normal value (61.83, 59.36) respectively, so the mandible is in an anterior position relative to the cranial base and growth predominantly anterior. The value of y axis for class II division 2 is less than class II division 1, so the class II division 2 patients show more anterior position of the mandible relative to the cranial base. The skeletal convexity decrease with age, in this study there was high significant difference in the angle of convexity between class II division 1and class II division 2,class II division 2 group have more concave profile this find in agreement with Karlson⁽¹⁰⁾. On the other hand not agreed with Houston⁽²⁶⁾ and kerretal⁽²⁷⁾. According to the Jaraback ratio in this study there was a significant difference in the value of this ratio between class II division 1 group and division 2 group. The mean value of this ratio for class II division 2 group is 67.4% means relatively greater posterior face height and horizontal growth, this agreed with Bjok and Skillar⁽²⁸⁾ and with Karlson⁽¹⁰⁾. The inclination of the mandible to the anterior cranial base is determined by the SN-Mp angle, in our study there was high significant difference in the

amount of this angle between class II division 1 group and division 2 the value of this angle for class II division 1 is more than class II division 2 in this study, so the inclination of the mandible for the class II division 1 group is posterior. While, for the class II division 2 patient the inclination of the mandible is anterior. So the class II division 2 subjects have a more hypo divergent skeleton facial pattern than division 1 cases. Similar findings of a definite hypo divergent facial pattern with a flat mandibular plan angle have also been found, Houston⁽²⁶⁾, Pancherz et al⁽²³⁾ and Peck et al⁽¹⁹⁾. There was no significant difference in the amount of saddle angle between the two groups, both demonstrate a large saddle angle indicate a posterior position of the fossa. There was a high significant difference between class II division 1 and 2 malocclusion in the mean value of the H-angle this difference may be due to the difference in the amount of ANB angle, this finding indicated a more concave profile for class II division 2 subjects. According to Lapatki et al⁽²⁹⁾ this the result of the lower lip exerting an excessive pressure on the anterior teeth, which made division 2 treatment more prone to relapse^(2,29,30). In this study the mean value of the overjet for the class II division 1 was 7.700, whereas its mean value for the class II division 2 was 3.133, this is due to the retroclination of the anterior teeth in class II division 2 cases, this agrees with other studies⁽³⁰⁾. The bite indicates a deep bite condition for the class II division 2 cases more than class II division 1 this is in agreement with Isik et al⁽²⁾.

Conclusions

- 1- The class II division 1 subject show more retrognathic mandible than do class II division 2 subjects.

- 2- The mandible is in an anterior position relative to the cranial base for the class II division 2 subjects.
- 3- Class II division 2 subjects have more concave profile.
- 4- The class II division 2 subjects have a greater posterior face height and horizontal growth.
- 5- the inclination of the mandible for the class II division 2 subject is inferiorly, and for the class II division 1 is superiorly.
- 6- The class II division 2 subjects showed more deep bite.
- 7- There was a reduction of mandibular intercanine width in the division 2 subjects, this may be due to the deep bite, retrusive maxillary incisors and excessive lip pressure which are the main keys to the frequently encountered problem of relapse in these patients.

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Table (1):-comparisons of cephalometric measurement s

Cephalometric measurements	Class II division 1		class II division 2		t-test	p-value
	Mean	SD	Mean	SD		
SNA	80.67	0.805	81.18	0.914	1.61	0.12 NS
SNB	73.15	1.143	76.26	1.714	5.84	0.009 S
Garabak ratio	64.6	0.752	67.4	0.736	10.25	0.003 S
Y axis	61.83	1.302	59.36	0.722	6.42	0.008 S
Convexity angle	168.16	1.29	172.77	0.90	11.36	0.000 HS
H angle	22.3	0.335	17.67	0.389	35.11	0.000 HS
Over jet	7.700	1.099	3.133	0.694	13.61	0.000 HS
Over bite	3.82	1.048	4.987	1.06	3.03	0.005 S
SN-Mp	35.74	0.811	30.32	0.785	18.59	0.000 HS

Table (2):-comparison of dental cast measurements.

U3	34.008	0.339	34.057	0.849	0.32	0.75 NS
U4	40.334	0.489	40.328	0.217	0.08	0.94 NS
U5	45.529	0.088	45.571	0.069	0.56	0.58 NS
U6	50.609	0.066	51.301	0.264	9.86	0.008 S
L3	27.634	0.213	26.165	0.292	1574	0.006
L4	35.125	0.412	35.209	0.356	0.58	0.57 NS
L5	40.96	0.274	40.879	0.417	0.68	0.50 NS
L6	45.553	0.663	45.973	0.777	1.59	0.12 NS

***P<0.05 Significant**

****P>0.05 Non sin significant**