Evaluation of asymmetries between subjects with Class II subdivision and apparent facial asymmetry and those with normal occlusion

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Introduction: The objective of this study was to compare the degree of skeletal asymmetry between subjects with Class II subdivision malocclusion and apparent facial asymmetry and subjects with normal occlusion. **Methods:** The sample consisted of 23 subjects with Angle Class II subdivision malocclusions and apparent facial asymmetry (mean age, 15.78 years) and 30 subjects with normal occlusions (mean age, 22.42 years). Each had all permanent teeth, including first molars. Radiographic asymmetry was assessed by measuring the relative difference in spatial position of dental and skeletal landmarks between right and left sides in both anteroposterior and transverse dimensions in the submentovertex and in the transverse and vertical dimensions in the posteroanterior radiographs. Independent *t* tests were used to compare radiographic asymmetries between groups. **Results:** Despite the predominantly dentoalveolar nature of the asymmetries found in Class II subdivision malocclusions with apparent facial asymmetry, the radiographic mandibular asymmetry was small in relation to Class II subdivision malocclusions in general. The components that contributed to the asymmetric anteroposterior relationship in the Class II subdivision malocclusion with apparent facial asymmetry were mainly dentoalveolar. The primary contributor to the differences between the 2 groups was the distal positioning of the mandibular first molars on the Class II side. A secondary contributor was the mesial positioning of the maxillary first molars on the Class II side. As a consequence of the more frequent asymmetry in the lower third of face, the mandibular dental midline and the antegonial angle were deviated on the Class II side, as evaluated on the posteroanterior radiograph. **Conclusions:** The main component of Class II subdivision is dentoalveolar, primarily distal positioning of the first mandibular molar on the Class II side and secondarily mesial positioning of the first maxillary molar on the same side. (Am J Orthod Dentofacial Orthop 2006;129:376-83)

Class II subdivision malocclusions present difficulties in orthodontic treatment because of the asymmetric occlusal relationship—Class II on 1 side of the dental arch and Class I on the other side. It is difficult to diagnose the factors responsible for the malocclusion. A question frequently addressed in the literature is the source of the asymmetry: is it predominantly dentoalveolar, skeletal, or a combination of both? The subdivision attempt approach 50% of Class II malocclusions, while in the general distribution of the malocclusions the Class II have an incidence of 42%. Class II subdivision does not present skeletal asymmetries in relation to normal occlusion.[1,2] Alavi et al[2] observed that Class II subdivisions result mainly from asymmetry of the mandibular first molars. However, they did not determine whether this was due to dentoalveolar or skeletal asymmetry. Rose et al[3] confirmed that the Class II subdivision occurred, in general, by distal positioning of the mandibular first molars on the Class II side. Janson et al[1] concluded that the components that contributed to the asymmetric anteroposterior relationship in the Class II subdivision malocclusion were mainly dentoalveolar, and the primary contributor to the differences between the Class II subdivision malocclusion and the normal occlusion was the distal positioning of the mandibular first molars on the Class II side in mandibles without unusual skeletal or positional asymmetries. A secondary contributor was mesial positioning of the maxillary first molars on the Class II side. However, in many Class II subdivision patients, it is possible to discern mild facial asymme-

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tries.[1] Therefore, the objective of this study was to compare through submentovertex and posteroanterior radiographs the degree of dentoskeletal asymmetry between subjects with Angle Class II subdivision malocclusions and apparent facial asymmetry and subjects with normal occlusions.

MATERIAL AND METHODS

The sample consisted of an experimental group of 23 subjects (12 male, 11 female; average age, 15.78 years) with Class II subdivision malocclusions and apparent facial asymmetry, selected from those who sought orthodontic treatment at the Orthodontic Department of the Bauru Dental School, University of São Paulo. The control group consisted of 30 subjects chosen over 4 weeks (10 male, 20 female; average age, 22.42 years) with normal occlusions selected from students and employees of the same dental school who asked to participate in the study.

The selection criterion for each subject in both groups was all maxillary and mandibular permanent teeth, including the first molars. The additional criteria for the malocclusion group were as follows: (1) a complete Class I molar relationship on 1 side of the dental arch with a full Class II relationship on the other side, (2) no previous orthodontic treatment, (3) no lateral mandibular shift during closure, as determined by clinical examination, (4) no history of facial trauma or medical conditions that could have altered the growth of the apical bases,[4] and (5) no crowding or, at most, symmetrical crowding of up to 3 mm in the 2 dental arches. These subjects were evaluated with clinical histories and examinations.

Two radiographs—submentovertex and posteroanterior—were obtained from each subject. The cephalometric tracings were made on acetate paper by a single investigator (A.R.P.A.) and then digitized (Houston Instrument DT-11, Houston Instruments, Houston, Tex). These data were stored on a computer and analyzed with Dentofacial Planner 7.0 (Dentofacial Planner Software, Toronto, Ontario, Canada).

The experimental group was selected in clinical evaluations by 3 examiners. Each subject had apparent facial asymmetry that was evaluated by a facial clinical examination in the frontal view (Fig 1). The subjects were positioned with the lips in repose and the head oriented to the Frankfort horizontal plane.[5-7]

The submentovertex radiograph was obtained by using the following technique[8-11]: each subject was positioned in a cephalostat and seated on a stool without support. The head was rotated back until that the Frankfort plane was parallel to the film. The machine was the TUR D800 (Hermann Matern, Dresden, Germany), with Kodak X-Omat K film (Kodak, Rochester, NY) with an exposure time of 0.125 seconds at 70 kV and 32 mA. The distance from the focal point to the metallic ear rods was set at 152 cm, and the distance from the metallic ear rods to the film was set at 16 cm; this yielded a magnification factor of 9.55%. During exposure, the subjects kept their teeth in centric occlusion under light pressure.

Fig 1. Subject with Class II subdivision malocclusion and apparent facial asymmetry.

The tracings of the submentovertex radiograph included foramen magnum, foramen spinosum, metallic ear rods, mandible (including condyles, gonial angles, and coronoid processes), posterior cranial vault, zygomatic arches, anterior cranial vault, pterygomaxillary fissures, vomer, maxillary and mandibular first molars, and maxillary and mandibular central incisors. The landmarks are defined and illustrated in Figure 2A.

The Ritucci and Burstone method[12] evaluates the asymmetry of the craniodental structures in relation to different systems of coordinates. We used this method with some modifications.[1] The coordinate systems used were the mandibular, the cranial floor, and the zygomaxillary complex. The angular measurements between the abscissa of the coordinate systems were also obtained.

The coordinate system consisted of 2 axes perpendicular to each other. The lateral and the anteroposterior positions of all pertinent structures were evaluated in relation to these axes. The transcondylar axis was established in the mandibular coordinate system, passing through the condylar midpoints. This axis was used

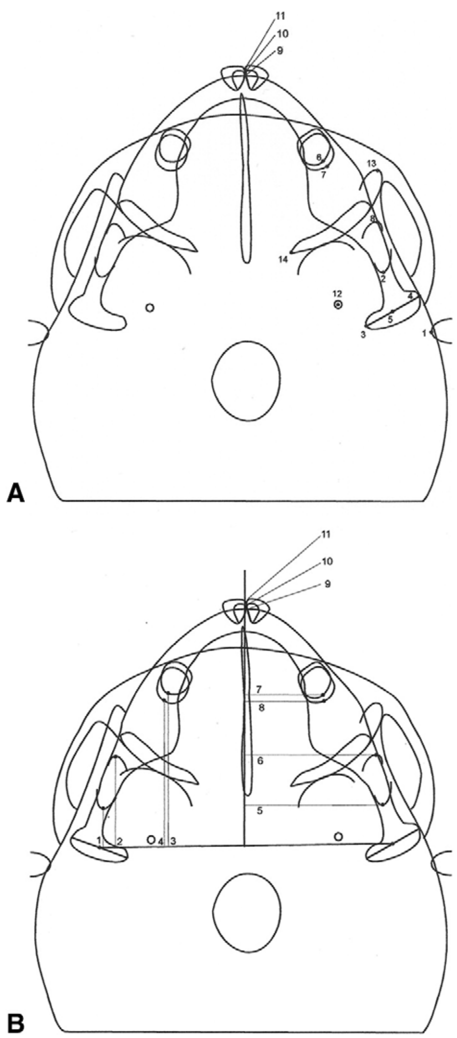

Fig 2. A, Structures and landmarks in submentovertex radiograph: *1,* metallic ear rod point, medial center of each metallic ear rod; *2,* gonion point, midpoint mediolaterally on posterior border of each gonial angle; *3,* medial condylar point, tangent to each medial condylar border of line drawn parallel to each mandibular body line; *4,* lateral condylar point, tangent to each lateral condylar border of line drawn parallel to each mandibular body line; *5,* condylar midpoint, midpoint between lateral and medial condylar points on each condyle; *6,* distal mandibular first molar point, most distal point in line with central groove on each mandibular first molar; *7,* distal maxillary first molar point, most distal point in line with central groove on each maxillary first molar; *8,* coronoid process point, most anterior point relative to transcondylar axis on each coronoid process; *9,* mandibular midline, most anterior point of mandibular body (skeletal point); *10,* mandibular dental midline, point of contact between mesial surfaces of crowns of mandibular central incisors; *11,* maxillary dental midline, point of contact between mesial surfaces of crowns of maxillary central incisors; *12,* foraminaspinosa points, geometric center of each foramen spinosa; *13,* angulare, most anterior point relative to transpterygomaxillary axis of triangular opacities at external orbital angle where maxillary and mandibular orbital rims meet and zygomatic arch inserts; *14,* pterygomaxillary fissure, most medial and posterior point of each pterygomaxillary fissure. **B,** Measurements from the submentovertex radiograph, mandibular coordinate system. Anteroposterior: *1,* gonion to transcondylar axis; *2,* coronoid process point to transcondylar axis; *3,* distal mandibular first molar point to transcondylar axis; *4,* distal maxillary first molar point to transcondylar axis. Transverse: *5,* gonion to intercondylar axis; *6,* coronoid process point to intercondylar axis; *7,* distal mandibular first molar point to intercondylar axis; *8,* distal maxillary first molar point to intercondylar axis; *9,* mandibular midline to intercondylar axis; *10,* mandibular dental midline to intercondylar axis; *11,* maxillary dental midline to intercondylar axis (Reprinted with permission from Janson et al[1].)

to evaluate the symmetry of the anteroposterior positioning of the mandibular structures. In addition, the symmetry of the transverse positioning of these structures was evaluated by using the intercondylar axis drawn perpendicular to the transcondylar axis from its midpoint. Similarly, the transspinosum and interspinosum axes were constructed for the coordinate system of the cranial floor, and the transpterygomaxillary and interpterygomaxillary axes were constructed for the zygomaxillary coordinate system. For paired structures, the distance to the reference axis was determined for both landmarks, and the difference in the horizontal distance was calculated. For unpaired points, the horizontal distance to the midline was determined. There were 42 variables of the submentovertex radiograph. Figure 2, *B,* illustrates the mandibular coordinate system variables.

The posteroanterior radiographs were obtained according to Harvold's method.[13] The machine was the Roentax 10090 (Eletro Medicina Indústria e Comércio LTDA, São Paulo, Brazil), with Kodak X-Omat K film and an esposure time of 1 second at 90 kV(p) and 25 mA. The distance from the focal point to the metallic ear rods was standardized at 152 cm, and the distance from the metallic ear rods to the film was fixed at 16 cm; this yielded a magnification factor of 8.91%. During exposure, the subjects kept their teeth in centric occlusion.

The tracings of the posteroanterior radiograph included the following structures: orbits, contours of the nasal cavity, crista galli, zygomatic arches, mandibular contour from 1 condyle to the other, left and right maxillary contours, lateral aspects of the frontal bone, lateral aspects of the zygomatic bones, maxillary and mandibular central incisors, and maxillary and mandibular first molars. The landmarks are defined and illustrated in Figure 3, *A*. The cephalometric measurements were obtained according to the method described by Grummons and Van de Coppello[14] (Fig 3, *B*). For paired structures, the distance to the reference midline was determined for both landmarks, and the difference between the distances was calculated. For unpaired points, the horizontal distance to the midline was determined.

Statistical analyses

Twenty randomly selected radiographs from 10 subjects were retraced, redigitized, and remeasured by the same examiner (A.R.P.A.). The casual error was calculated according to Dahlberg's formula ($S2 = \Sigma d^2/2n$) and the systematic error with a dependent *t* test, for $P < .05$.

These analyses were performed with Statistica (Sta-

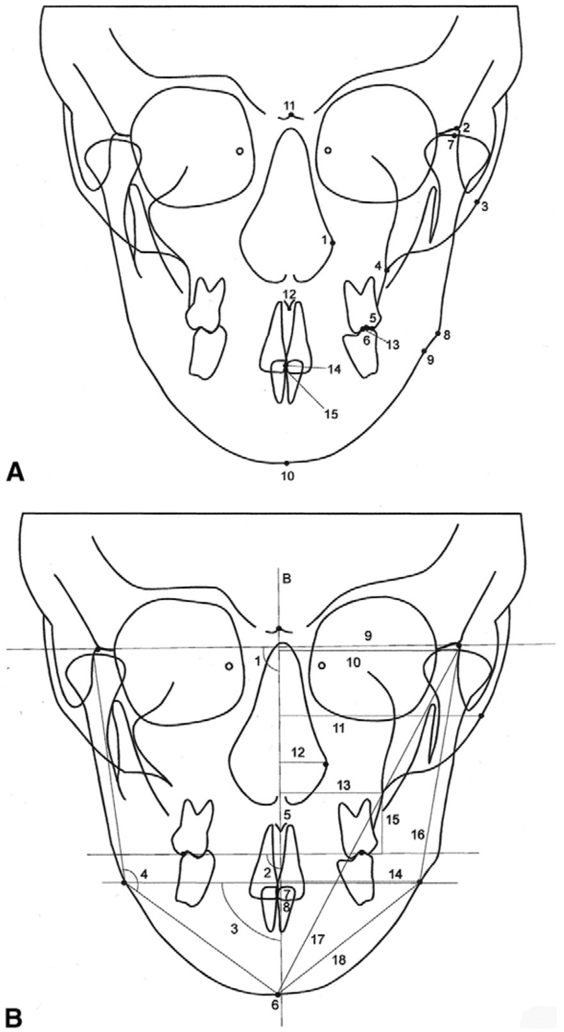

Fig 3. A, Structures and landmarks in posteroanterior radiograph: *1,* most lateral point on outline of nasal orifice near each piriform aperture; *2,* superolateral reference point, point at lateral aspect of each frontozygomatic suture; *3,* lateral aspect of each zygomatic arch centered vertically; *4,* point at depth of concavity of each lateral maxillary contour at junction of maxilla and zygomatic buttress; *5,* buccal cusp tip of each maxillary first molar; *6,* buccal cusp tip of each mandibular first molar; *7,* point on superior surface of head of each condyle centered mediolaterally; *8,* point at each gonial angle of mandible; *9,* point at each antegonial notch; *10,* menton, most inferior point on anterior border of mandible at symphysis; *11,* most superior point of crista galli located ideally in skeletal midline; *12,* tip of anterior nasal spine; *13,* mean contact point between each maxillary and mandibular first molar; *14,* midpoint between maxillary central incisors; *15,* midpoint between mandibular central incisors. **B,** Angular and linear measurements from posteroanterior radiograph: *1,* Z plane angle, angle between Z plane and Cg-ANS line; *2,* occlusal plane angle, angle between occlusal plane and Cg-ANS line; *3,* antegonial plane angle, angle between antegonial plane and Cg-ANS line; *4,* antegonial angle, angle between mandibular ramus and mandibular body; *5,* anterior nasal spine deviation, horizontal distance between anterior nasal spine and X-line (vertical line representing medial plane drawn at right angle to Z plane through root of crista galli)[22]; *6,* mandibular deviation, horizontal distance between menton and X-line; *7,* maxillary dental midline deviation, horizontal distance between dental maxillary midline and X-line; *8,* mandibular dental midline deviation, horizontal distance between dental mandibular midline and X-line; *9,* frontozygomatic suture to X-line distance, horizontal distance between frontozygomatic suture and X-line; *10,* condylion to X-line distance, horizontal distance between condylion and X-line; *11,* zygoma distance, distance between zygomaxillary arch and X-line; *12,* piriform aperture to X-line distance, horizontal distance between lateral wall of piriform aperture and X-line; *13,* maxillary buttress to X-line distance, horizontal distance between maxillary buttress and X-line; *14,* antegonial notch to X-line distance, horizontal distance between antegonial notch and X-line; *15,* maxillary first molar height, vertical distance between maxillary buttress and buccal cusp tip of maxillary first molar; *16,* condylion to antegonial notch distance, size of mandibular ramus from condylion to antegonial notch; *17,* condylion to menton distance, mandibular length from condylion to menton; *18,* menton to antegonial notch distance, mandibular body size from menton to antegonial notch (Reprinted with permission from Janson et al[1].)

Table I. Means and standard deviations of asymmetry measurements (differences between measurements of right and left sides and distances of unpaired structures to reference midplanes) from submentovertex radiographs

	Normal occlusion		Class II subdivision with facial asymmetry	
	Mean	SD	Mean	SD
Mandibular coordinate system				
Anteroposterior (mm)				
Gonion to transcondylar axis	1.21	1.22	1.54	0.99
Coronoid process point to transcondylar axis	1.32	0.85	1.30	1.06
Distal mandibular first molar point to transcondylar axis	0.96	0.64	2.79	1.34
Distal maxillary first molar point to transcondylar axis	0.96	0.72	1.39	1.02
Transverse (mm)				
Gonion to intercondylar axis	1.95	1.25	2.63	2.62
Coronoid process point to intercondylar axis	2.58	1.82	2.21	1.76
Distal mandibular first molar point to intercondylar axis	2.94	2.04	3.69	3.17
Distal maxillary first molar point to intercondylar axis	2.69	1.84	3.26	2.81
Mandibular midline to intercondylar axis	1.88	1.50	3.09	2.87
Mandibular dental midline to intercondylar axis	1.72	1.24	2.59	2.00
Maxillary dental midline to intercondylar axis	1.55	1.12	1.88	1.85
Cranial floor coordinate system				
Anteroposterior (mm)				
Condylar midpoint to transspinosum axis	1.59	1.27	1.37	0.76
Gonion to transspinosum axis	1.63	1.42	2.03	1.11
Coronoid process point to transspinosum axis	1.68	1.28	2.01	1.24
Distal mandibular first molar point to transspinosum axis	1.04	0.84	2.95	1.27
Distal maxillary first molar point to transspinosum axis	1.02	0.90	1.34	1.03
Transverse (mm)				
Condylar midpoint to interspinosum axis	0.95	0.68	1.33	1.21
Gonion to interspinosum axis	1.78	1.31	2.81	2.57
Coronoid process point to interspinosum axis	2.74	1.92	2.60	1.64
Distal mandibular first molar point to interspinosum axis	3.26	2.41	3.91	2.98
Distal maxillary first molar point to interspinosum axis	2.86	2.15	3.48	2.70
Mandibular midline to interspinosum axis	2.13	1.87	3.33	2.84
Mandibular dental midline to interspinosum axis	1.90	1.67	2.61	2.31
Maxillary dental midline to interspinosum axis	1.94	1.32	2.18	1.69

tistica for Windows 5.0A, StatSoft, Tulsa, Okla), on a personal computer.

RESULTS

Means and standard deviations for the differences between the right and left sides for all variables in both groups are listed in Tables I through III. Of the 66 variables, only 14 had casual errors slightly above 1 mm. All others were below 1 mm or 1°. The paired *t* test on differences between the replications showed significant differences for only 2 variables.

DISCUSSION

The submentovertex radiographs were taken in centric occlusion. Ideally, they should be taken in centric relation to detect any functional mandibular deviation that might interfere with the evaluation of mandibular asymmetry in relation to the maxilla and the cranial base.[8,12,15-17] However, in this study, a prerequisite for the subjects of both groups was no lateral functional mandibular deviations. The elimination of postural asymmetries ensured accuracy in the evaluation of mandibular asymmetry in relation to the maxilla and the cranial base. The posteroanterior radiographs were obtained in centric occlusion for the same reasons.

The *t* test showed a statistical significant difference for these variables: distal mandibular first molar point to transcondylar axis (Table I), distal mandibular first molar point to transspinosum axis (Table I), and distal mandibular first molar point to transpterygomaxillary axis (Table II) for anteroposterior position of the mandibular first molar in relation to the positions of the transcondylar, transspinosum, and transpterygomaxillary axes, respectively. This result shows that the primary contributor to the subdivision is the distal positioning of the mandibular first molars on the Class II side, confirming that the primary component of the Class II subdivision is dentoalveolar. Alavi et al[2] and Janson et al[1] found, in addition to the distal positioning of the mandibular first molars, a secondary contributor

Table II. Means and standard deviations of asymmetry measurements (differences between measurements of right and left sides and distances of unpaired structures to reference midplanes) from submentovertex radiographs

	Normal occlusion		*Class II subdivision with facial asymmetry*	
	Mean	*SD*	*Mean*	*SD*
Zygomaxillary coordinate system				
Anteroposterior (mm)				
Distal mandibular first molar point to transpterygomaxillary axis	1.27	0.95	3.16	1.93
Distal maxillary first molar point to transpterygomaxillary axis	1.23	0.90	1.13	0.94
Transverse (mm)				
Distal mandibular first molar point to interpterygomaxillary axis	2.52	2.66	3.21	2.44
Distal maxillary first molar point to interpterygomaxillary axis	2.26	2.61	2.58	2.03
Mandibular midline to interpterygomaxillary axis	1.76	1.91	2.64	2.23
Mandibular dental midline to interpterygomaxillary axis	1.72	1.24	2.59	2.00
Maxillary dental midline to interpterygomaxillary axis	1.82	1.85	1.93	1.52
Dental coordinate system				
Transverse (mm)				
Mandibular midline to intermandibularmolar axis	0.88	0.68	1.84	1.38
Mandibular dental midline to intermandibularmolar axis	0.63	0.52	1.07	0.96
Maxillary dental midline to intermandibularmolar axis	0.73	0.49	3.60	1.38
Mandibular midline to intermaxillarymolar axis	0.89	0.74	2.47	1.88
Mandibular dental midline to intermaxillarymolar axis	0.62	0.52	2.42	1.35
Maxillary dental midline to intermaxillarymolar axis	0.55	0.47	0.99	0.53
Angular measurements between abcissa of coordinate system (°)				
Interspinosum axis to intercondylar axis	0.81	0.64	0.72	0.42
Transspinosum axis to transcondylar axis	0.84	0.65	0.73	0.40
Transpterygomaxillary axis to transcondylar axis	1.23	0.84	1.28	1.21
Transpterygomaxillary axis to transspinosum axis	1.46	1.02	1.27	1.14
Transmandibularmolar axis to transspinosum axis	1.09	0.87	3.13	1.32
Transmandibularmolar axis to transcondylar axis	1.02	0.67	2.94	1.35
Transmandibularmolar axis to transpterygomaxillary axis	1.38	1.04	3.30	1.97
Transmaxillarymolar axis to transspinosum axis	1.04	0.92	1.41	1.11
Transmaxillarymolar axis to transcondylar axis	1.00	0.76	1.45	1.07
Transmaxillarymolar axis to transpterygomaxillary axis	1.27	0.97	1.18	0.99
Additional variables (mm)				
Condylar midpoint to mandibular midline	1.77	1.53	3.48	3.43

to the subdivision: the mesial positioning of the maxillary first molars on the Class II side; this was not observed in our study.

In the dental coordinate system, a statistically significant difference was observed for all variables (Table II) to intermaxillary molar axis and intermandibular molar axis, confirming that the primary component of the subdivision is dentoalveolar.[1] The dental midline deviations, maxillary or mandibular, in relation to the intermolar axis of the opposite arch (maxillary dental midline to intermandibular molar axis, mandibular dental midline to intermaxillary molar axis), were expected results in these subjects with minimal symmetrical crowding. However, dental midline deviations in relation to intermolar axis in the same dental arch (mandibular dental midline to intermandibularmolar axis, maxillary dental midline to intermaxillary molar axis) were observed also. The statistically significant deviations for both midlines suggest asymmetry on the maxillary and mandibular arch forms in the Class II subdivision, demonstrating that subjects with apparent facial asymmetry also have asymmetric dental arches. These results were similar to those reported by Janson et al.[1] The mandibular midline deviation in relation to the intermandibular molar axis suggests an asymmetric position of the mandibular teeth in their bony bases. The mandibular midline also showed a greater deviation in relation to the intermaxillary molars in the subdivision group than in the normal occlusion group. These results suggest displacement of the maxillary teeth to 1 side, a dentoalveolar or mandibular skeletal deviation to the opposite side, or even a combination of both in the Class II subdivision patients.[1]

Angles between condylar axis of spinosum and transpterygomaxillary foramens did not have statistically significant differences between the groups, showing that subjects with apparent facial asymmetry do not have positional mandibular asymmetry and conse-

Table III. Means and standard deviations of asymmetry measurements (differences between measurements of right and left sides and distances of unpaired structures to reference midplanes) from posteroanterior radiographs

	Normal occlusion		Class II subdivision with facial asymmetry	
	Mean	*SD*	*Mean*	*SD*
Angular measurements (°)				
Z plane angle	89.90	1.27	89.59	1.70
Occlusal plane angle	89.34	1.74	89.59	2.00
Antegonial plane angle	88.63	1.51	88.19	2.88
Antegonial angle	2.40	1.51	4.13	2.66
Linear measurements (mm)				
Anterior nasal spine deviation	1.33	0.84	1.52	1.59
Mandibular deviation	2.71	1.63	2.88	1.80
Maxillary dental midline deviation	1.40	0.90	1.71	1.58
Mandibular dental midline deviation	1.58	0.97	2.27	1.25
Frontozygomatic suture to X-line distance	1.77	1.24	1.71	1.63
Condylion to X-line distance	3.20	2.42	3.14	2.63
Zygoma to X-line distance	2.86	1.96	3.30	2.81
Pyriform aperture to X-line distance	2.51	1.57	2.33	2.48
Maxillary buttress to X-line distance	2.47	1.65	2.68	2.56
Antegonial notch to X-line distance	4.25	3.19	3.67	3.01
Maxillary first molar height	1.37	1.05	1.57	1.33
Condylion to antegonial notch distance	2.70	2.10	3.35	3.06
Condylion to menton distance	2.26	2.21	2.45	2.26
Menton to antegonial notch distance	2.28	1.92	3.45	2.59

quently skull asymmetry (Table II). A statistically significant difference was observed for all variables of the transmandibular molar axis (Table II), demonstrating the effect of asymmetric positioning of the mandibular teeth in relation to the skull, its apical base, and the maxilla, to produce the subdivision, as shown by previous studies.[1-3] Rose et al[3] also found similar results between the transmandibular molar axis and the transcondylar and transspinosum axes.

Additionally, a statistically significant difference for the additional skeletal variable, condylar midpoint to mandibular midline, was observed (Table II), demonstrating a small skeletal asymmetry in size of the sides of the mandible, more evident in Class II subdivision subjects, that perhaps justifies their mandibular asymmetrical appearance.

In posteroanterior radiograph (Table III), only 2 variables with a statistically significant difference were found between the Class II subdivision group and the normal occlusion group (mandibular dental midline deviation and antegonial angle). The antegonial angle demonstrates, as well as the condylar midpoint to mandibular midline variable (Table II), a small skeletal asymmetry, that perhaps justifies the mandibular asymmetrical appearance in the subjects with subdivision, since the difference in this angle demonstrates that, in 1 side of the mandible, a point of this angle is higher than the other, evidencing asymmetry between the sides of the mandible. With this result, it can be observed what has been cited in other studies—that the asymmetry is mainly in the lower third of the face[18,19] and that, although we notice asymmetry in the subjects with Class II subdivision, this asymmetry is only slightly different compared with a normal-occlusion group, because these subjects also have some facial asymmetry.[20,21] The significance of the mandibular dental midline deviation variable supports clinical evidence in subjects with Class II subdivision—ie, the presence in many patients of mainly mandibular dental midline deviations, or maxillary dental midline deviations, in relation to the medium sagittal plane. Janson et al[1] also found a significant difference for the mandibular dental-midline-deviation variable, but they also found a significant result for the maxillary dental-midline-deviation variable; this was not found in our study.

General considerations

The comparison between subjects with Class II subdivision malocclusion who also had apparent facial asymmetry and those with normal occlusions demonstrated a small statistically significant difference. Perhaps this was because subjects with normal occlusions have some skeletal and facial asymmetry[20,21] (Tables I and II). The skeletal contribution found in the subjects with Class II subdivision was very small when there was apparent asymmetry, compared with subjects with normal occlusion. This study demonstrated that the main component of Class II subdivision is dentoalveolar, primarily as distal positioning of the mandibular first molar on the Class II side and secondarily as mesial positioning of the maxillary first molar on the same side.

CONCLUSIONS

According to our results with the methodology used, we conclude the following:

1. Despite the predominantly dentoalveolar nature of asymmetries in Class II subdivision malocclusions with apparent facial asymmetry, there was a small amount of radiographic mandibular asymmetry in relation to Class II subdivision malocclusions in general.
2. The components that contributed to the asymmetric anteroposterior relationship in the Class II subdivision malocclusion with apparent facial asymmetry were mainly dentoalveolar.
3. The primary contributor to the differences between the 2 groups was the distal positioning of the mandibular first molars on the Class II side. The secondary contributor was the mesial positioning of the maxillary first molars on the Class II side.
4. As a consequence of the more frequent asymmetry in the lower third of face, the mandibular dental midline and the antegonial angle were deviated on the Class II side, as evaluated on the posteroanterior radiograph.

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