Original Article

Comparison of Dental Arch and Alveolar Widths of Patients with Class II, Division 1 Malocclusion and Subjects with Class I Ideal Occlusion

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Abstract: This study evaluates dental arch and alveolar widths of patients with Class II, division 1 malocclusion. Thirty female patients with Class II, division 1 malocclusion were compared with 30 female subjects with Class I ideal occlusion. Patients with posterior crossbites even in a single tooth were excluded from the study. According to our results, arch widths measured between maxillary second premolars and maxillary first molars were found narrower in the Class II, division 1 group, and mandibular intercanine widths were narrower in the Class I group. Interalveolar widths showed no difference between the groups. These results suggested that transverse discrepancy in Class II, division 1 patients originated from upper posterior teeth and not from the maxillary alveolar base. Therefore, slow maxillary expansion rather than rapid maxillary expansion may be considered before or during the treatment of Class II, division 1 patients. (*Angle Orthod* 2004;74:356–360.)

Key Words: Alveolar width; Class II malocclusion; Transverse discrepancy

INTRODUCTION

Class II malocclusion is reported as the most frequently seen skeletal disharmony in orthodontic population.[1–7] Transverse component in Class II patients is of great importance as sagittal or vertical components. Some of the authors evaluating transverse dimensions had reported that maxillary arch was narrower in patients with Class II, division 1 malocclusion, and an expansion was needed during or before treatment.[8–12] Besides, Varella[13] had reported that the deficient transversal growth of the maxilla and the sagittal growth of the mandible appeared to cause the typical Class II occlusion. However, in one of the earlier studies, Fröhlich[14] found no difference in transverse dimension between Class I and Class II subjects.

Staley et al[15] stated that patients with Class II, division 1 malocclusion had narrower maxillary intercanine, intermolar, and alveolar widths. Buschang et al[16] had evaluated the differences in dental arch morphology among untreated adult females with Class I, Class II, division 1, and Class II, division 2 malocclusions and reported that Class II, division 1 females had the longest and narrowest arches.

Tollaro et al[9] found that patients with Class II malocclusions had a significantly narrower maxillary area during the mixed dentition phase. Bishara et al[8] reported that transverse discrepancy in Class II, division 1 subjects did not appear to be self-corrected from the deciduous to the permanent dentitions. Similarly, Baccetti et al[10] reported that transverse interarch discrepancy was evident in the deciduous dentition and persisted into the mixed dentition.

Review of the literature indicated that few studies evaluated transverse dimension in Class II, division 1 patients in the permanent dentition. This study compares arch and alveolar widths of patients with Class II, division 1 malocclusion and subjects with Class I ideal occlusion in the permanent dentition.

MATERIALS AND METHODS

Maxillary and mandibular dental casts of 60 girls, referred to the Department of Orthodontics, University of Suleyman Demirel, with a minimum age of 13 years were evaluated in this study. The means and standard deviations of the ages of the Class II and Class I patients were 16.07 ± 2.76 years and 19.17 ± 3.19 years, respectively. None of the subjects had undergone orthodontic treatment. Permanent incisors, canines, premolars, and first premolars were fully erupted in all subjects. None of the teeth were rotated or out of the arches. Two groups were formed according to the following criteria.

Class II, division 1 group (30 girls):

- Bilateral Class II molar relationship in centric occlusion.

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Accepted: July 2003. Submitted: June 2003.

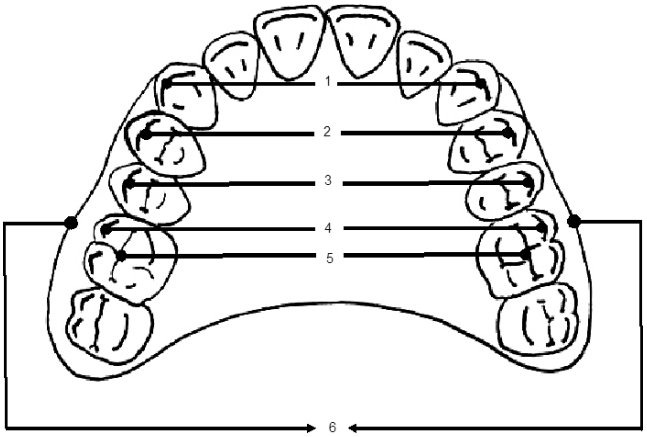

FIGURE 1. Maxillary dental cast measurements.

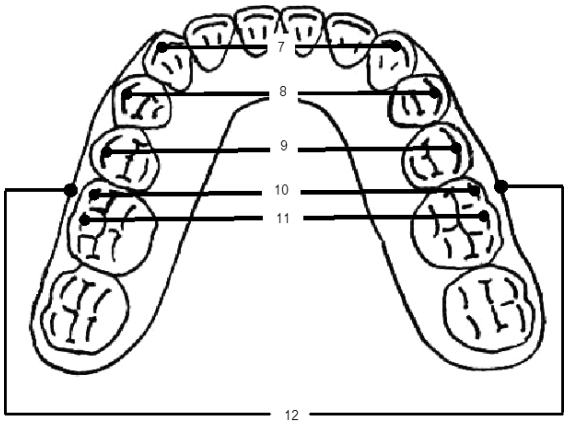

FIGURE 2. Mandibular dental cast measurements.

- Protrusive maxillary incisors.
- Convex soft tissue profile.
- Excessive overjet (more than five mm).
- No missing teeth (except wisdom teeth).
- Absence of posterior crossbite (even limited to a single tooth).

Class I group (30 girls):

- Bilateral Class I molar relationship in centric occlusion.
- Well-aligned maxillary or mandibular arches with less than two mm spacing or crowding.
- Class I soft tissue profile.
- Normal overbite and overjet relationships.
- No missing teeth (except wisdom teeth).
- Absence of posterior crossbite (even limited to a single tooth).

Measurements used in this study are as follows.
Maxillary measurements (Figure 1):

- Maxillary intercanine width—Distance between the cusp tips of right and left maxillary permanent canines.
- Maxillary interpremolar width I—Distance between buccal cusp tips of right and left maxillary permanent first premolars.
- Maxillary interpremolar width II—Distance between buccal cusp tips of right and left maxillary permanent second premolars.
- Maxillary intermolar width I—Distance between the mesiobuccal cusp tips of right and left maxillary permanent first molars.
- Maxillary intermolar width II—Distance between the central fossae of right and left maxillary permanent first molars.
- Maxillary interalveolar width—Distance between the mucogingival junctions above the mesiobuccal cusp tips of the maxillary right and left permanent first molars.

Mandibular measurements (Figure 2):

- Mandibular intercanine width—Distance between the cusp tips of right and left mandibular permanent canines.
- Mandibular interpremolar width I—Distance between buccal cusp tips of right and left mandibular permanent first premolars.
- Mandibular interpremolar width II—Distance between buccal cusp tips of right and left mandibular permanent second premolars.
- Mandibular intermolar width I—Distance between the mesiobuccal cusp tips of right and left mandibular permanent first molars.
- Mandibular intermolar width II—Distance between the distobuccal cusp tips of right and left mandibular permanent first molars.
- Mandibular interalveolar width—Distance between mucogingival junctions below the buccal grooves of the right and left mandibular permanent first molars.

Maxillary and mandibular measurement differences:

- Intercanine widths difference—The mandibular intercanine width was subtracted from the maxillary intercanine width.
- Intermolar widths difference—The mandibular intermolar width I was subtracted from the maxillary intermolar width I.
- Interalveolar widths difference—The mandibular interalveolar width was subtracted from the maxillary interalveolar width.

Dental cast measurements were performed by a dial caliper to the nearest 0.01 mm. All measurements of all subjects were carried out again two weeks later to evaluate the measurement error. The repeatability of the measurements was given at Table 1. Statistical comparison of two groups was performed with independent samples' *t*-test. Our null hypothesis was that dental and alveolar width measurements were similar in Class II, division 1 and Class I subjects.

TABLE 1. Reliability Coefficients of the Measurements

	Reliability Coefficient
Maxillary intercanine width	.9908
Maxillary interpremolar width I	.9930
Maxillary interpremolar width II	.9757
Maxillary intermolar width I	.9844
Maxillary intermolar width II	.9795
Maxillary interalveolar width	.9749
Mandibular intercanine width	.9850
Mandibular interpremolar width I	.9917
Mandibular intermolar width I	.9862
Mandibular intermolar width II	.9872
Mandibular interalveolar width	.9781

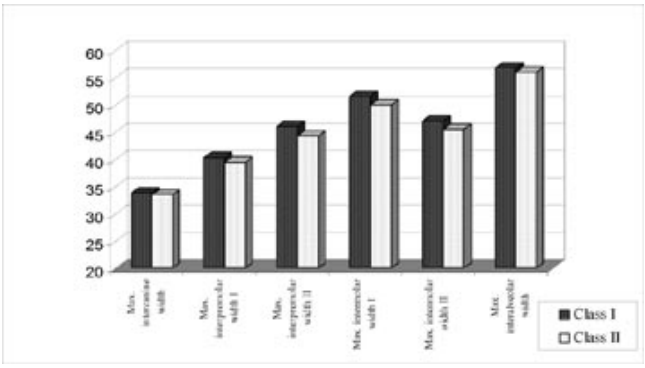

FIGURE 3. Bar graphs of maxillary measurements.

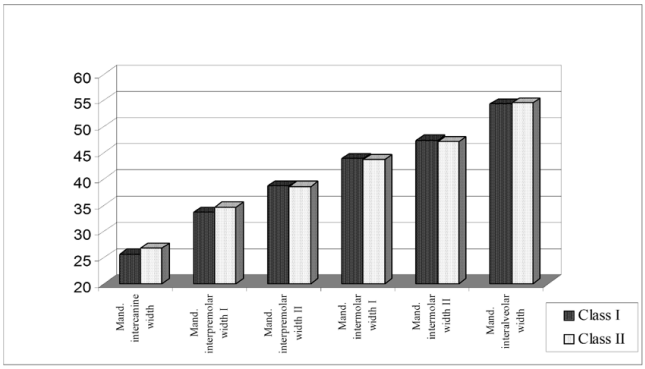

FIGURE 4. Bar graphs of mandibular measurements.

RESULTS

The results of descriptive statistics and *t*-test are shown in Table 2. Bar graphs of the measurements are shown in Figures 3 through 5.

Intercanine widths

Mandibular intercanine widths were significantly larger in Class II, division 1 group than Class I group ($P < .05$), whereas no significant differences were found between maxillary intercanine width measurements of the two groups.

Interpremolar widths

No differences were observed between groups in maxillary and mandibular interpremolar width I and mandibular interpremolar width II. Maxillary interpremolar width II indicated a significantly larger value in Class I group than Class II, division 1 group ($P < .01$).

Intermolar widths

Maxillary intermolar widths I and II were significantly larger in Class I group than Class II, division 1 group ($P < .01$); however, mandibular intermolar widths I and II did not differ significantly between groups.

TABLE 2. Descriptive Statistics and the Results of *t*-Test

	Class I (n = 30)					Class II, Division 1 (n = 30)					
	Mean	SD	SE	Minimum	Maximum	Mean	SD	SE	Minimum	Maximum	P[a]
Maxillary intercanine width	33.87	1.87	0.34	29.65	37.70	33.56	2.73	0.50	27.51	39.05	.612
Maxillary interpremolar width I	40.34	2.11	0.38	36.13	44.79	39.46	2.51	0.46	35.20	45.02	.147
Maxillary interpremolar width II	46.05	1.95	0.36	40.15	50.10	44.32	2.28	0.42	40.02	48.46	.002**
Maxillary intermolar width I	51.60	1.96	0.36	47.62	56.26	50.00	2.20	0.40	45.87	54.67	.004**
Maxillary intermolar width II	47.10	1.97	0.36	43.18	51.82	45.50	2.27	0.41	41.00	49.71	.005**
Maxillary interalveolar width	56.81	2.19	0.40	52.51	61.00	56.09	1.95	0.36	52.66	60.23	.183
Mandibular intercanine width	25.64	1.89	0.35	22.05	29.74	26.80	2.25	0.41	20.12	30.79	.035*
Mandibular interpremolar width I	33.60	1.87	0.34	29.57	37.15	34.58	2.62	0.48	29.01	39.64	.101
Mandibular interpremolar width II	38.68	2.32	0.42	32.63	44.00	38.53	2.84	0.52	31.47	42.82	.824
Mandibular intermolar width I	43.87	2.11	0.39	39.25	49.94	43.70	2.58	0.47	39.28	49.40	.773
Mandibular intermolar width II	47.39	1.98	0.36	42.93	52.22	47.12	2.40	0.44	43.46	52.37	.642
Mandibular interalveolar width	54.30	2.45	0.45	48.74	61.00	54.49	2.31	0.42	50.32	59.32	.757
Intercanine widths difference	8.23	1.34	0.24	5.54	11.10	6.76	2.13	0.39	2.17	11.06	.002**
Intermolar widths difference	7.73	1.27	0.23	5.56	10.24	6.31	2.17	0.40	−0.12	11.74	.003**
Interalveolar widths difference	2.51	2.08	0.38	−2.76	7.00	1.60	2.57	0.47	−2.12	7.79	.136

[a] * $P < .05$, ** $P < .01$, *** $P < .001$. Not significant, $P > .05$.

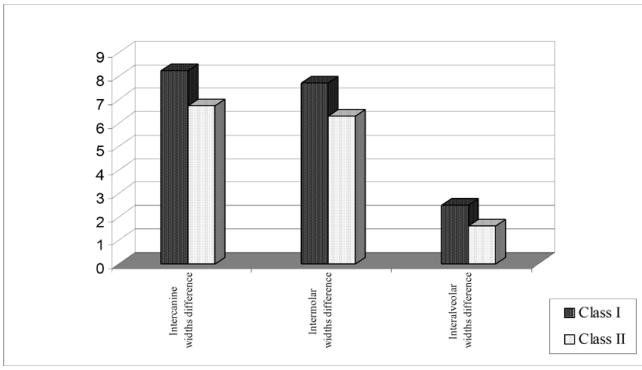

FIGURE 5. Bar graphs of widths differences.

Interalveolar widths

Maxillary and mandibular interalveolar widths showed no significant difference between groups.

Intercanine widths difference

This difference was significantly greater in Class I group than Class II, division 1 group ($P < .01$).

Intermolar widths difference

Intermolar widths difference was significantly greater in Class I group than Class II, division 1 group ($P < .01$).

Interalveolar widths difference

No significant differences were found between the groups in this measurement.

DISCUSSION

Authors investigating dental arch widths in different populations reported that in girls, little or no change occurred in molar and canine regions in these dimensions after 13 years of age.[17–22] For this reason, minimum age of the subjects participating in this study was 13 years. Because our study compares dental and alveolar arch widths, subjects without posterior crossbites, even in a single tooth, were selected not to affect the results. In addition to measurements in canine and molar regions, arch widths between premolar teeth were also calculated.

Intercanine widths were investigated in a few of the previous studies, and conflicting results were found. These differences may be due to the age or severity of malocclusion of the subjects examined.

Fröhlich[14] compared intercanine widths of both arches from 51 children with Class II malocclusion with data collected by Moorrees[21] from children with normal occlusion and found that absolute arch widths of the Class II children did not differ appreciably from those of children with normal occlusion.

Staley et al[15] compared arch widths of 36 normal occlusion subjects (19 males and 17 females) with 39 Class II, division 1 subjects (20 males and 19 females), and they reported that subjects with normal occlusion had larger maxillary canine widths than the malocclusion subjects, but no differences were found in mandibular canine widths. Intercanine widths difference was found to be significantly greater in Class I group than Class II, division 1 group.

Bishara et al[8] compared dental arch width differences of 37 Class II, division 1 malocclusion subjects (15 males and 22 females) with 55 Class I subjects (28 males and 27 females) at three dentition stages (deciduous, mixed, and permanent dentition), and cross-sectionally, in permanent dentition stage they reported no differences in maxillary and mandibular canine width measurements between the groups.

According to our findings, in contrast with previous findings, mandibular intercanine widths were significantly larger in Class II, division 1 group than Class I group ($P < .05$), whereas no significant differences were found between maxillary intercanine width measurements of two groups. This finding may be the cause or result of the excessive overjet in Class II, division 1 patients. As an expected result, intercanine widths difference was significantly greater in Class I group than Class II, division 1 group ($P < .01$).

Intermolar widths were the most commonly evaluated measurement in previous studies.

Fröhlich[14] found no difference in molar widths between normal and Class II subjects. Bishara et al[8] found no significant differences in the female comparisons of the intermolar width measurements.

Staley et al[15] reported that subjects with normal occlusion had larger maxillary molar widths and intermolar width differences than subjects with malocclusion. While evaluating alveolar widths, they reported that maxillary alveolar widths and mandibular alveolar widths of the males were larger in the Class I group. Again, alveolar width differences were found to be greater in the Class I group. They suggested that palatal movement of maxillary posterior teeth in Class II patients was needed to compensate for the increased overjet and to have good posterior interdigitation.

Tollaro et al[9] compared arch widths of 60 Class II, division 1 patients (26 males and 34 females) with 70 Class I subjects (25 males and 35 females) in the mixed dentition. Class II, division 1 subjects were grouped according to the presence of the posterior transverse interarch discrepancy (PTID). They reported that Class II, division 1 patients with PTID had narrower maxillary intermolar widths than Class II, division 1 patients without PTID and Class I subjects. Mandibular intermolar widths did not differ between the three groups. They also suggested that Class II patients with PTID needed a preliminary expansion of the maxillary arch.

Baccetti et al[10] evaluated transverse discrepancy in 25 subjects with Class II malocclusion (13 males and 12 females) and compared it with a control group of 22 subjects with ideal occlusion from deciduous to mixed dentition stage. They reported that transverse interarch discrepancy

determined in Class II malocclusion in deciduous dentition persisted into the mixed dentition, and treatment to correct Class II problem could be initiated in all three planes of space, such as rapid maxillary expansion (RME), extraoral traction, and functional jaw orthopedics.

According to our results, maxillary intermolar widths I and II were significantly larger in Class I group than Class II, division 1 group ($P < .01$); however, mandibular intermolar widths I and II did not differ significantly between groups. As an expected result, intermolar widths difference was significantly greater in Class I group than Class II, division 1 group ($P < .01$). No differences were observed between groups in maxillary and mandibular interpremolar width I and mandibular interpremolar width II. Maxillary interpremolar width II indicated a significantly larger value in Class I group than Class II, division 1 group ($P < .01$). These results showed that rather than maxillary canines and first premolars, maxillary second premolars and first molars played a major role in transverse discrepancy. Maxillary and mandibular interalveolar widths and interalveolar width differences showed no significant difference between groups.

In contrast to Staley et al,[15] who suggested that the narrow widths of the dental arch in Class II patients appeared to be caused by palatally tipped teeth and also by narrow bony bases of the dental arch, our results showed that transverse discrepancy in Class II, division 1 patients originated from upper posterior teeth and not from the maxillary alveolar base. Staley et al[15] had not mentioned about posterior crossbites in the Class II group. In selecting the subjects, we took into consideration that no posterior crossbites (even in a single tooth) were present. This may be an important factor that can affect the results if Class I patients had no crossbites and some of the Class II patients had crossbites. Class I patients who have well-aligned arches may have posterior crossbites too. If posterior crossbites would not have been taken into consideration in both Class I and Class II, division 1 subjects, then a large number of subjects should be evaluated in further studies.

CONCLUSIONS

Mandibular intercanine widths were significantly larger in Class II, division 1 group than Class I group, whereas no significant differences were found between maxillary canine width measurements of the two groups.

Although maxillary intermolar widths were larger in Class I group, maxillary interalveolar widths did not differ between the groups. This result suggests that transverse discrepancy in Class II, division 1 patients originated from upper posterior teeth and not from the maxillary bony base.

Slow maxillary expansion rather than RME may be considered before or during the treatment of Class II, division 1 patients.

ACKNOWLEDGEMENT

We thank Dr Mehmet Sarioglu for the measurements he contributed.

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