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ORIGINAL ARTICLE

Evaluation of Arch Width in Class-II div1 Patients with Excessive Vertical Growth.

A. Sodagar
Associate Professor, Department of Orthodontics, Faculty of Dentistry, Tehran University of Medical Sciences, Tehran, Iran.
E. Sanaeie
Orthodontist, Private Practice, Tehran, Iran.
T. HosseinZadehNik
Professor, Department of Orthodontics, Faculty of Dentistry, Tehran University of Medical Sciences, Tehran, Iran.
S. SheikhZadeh*
Postgraduate student of Orthodontics, Faculty of Dentistry, Tehran University of Medical Sciences, Tehran, Iran.

Background and aim: With the hypothesis that there is an interrelation between the cephalometric characteristics and difference in the arch widths, the aim of this study was to evaluate the relationship between the dental and skeletal features.

Materials and methods: Lateral cephalograms and dental casts of 42 untreated cl II div 1 patients with excessive vertical growth were evaluated for arch widths and cephalometric parameters. Student *t* -test was used to evaluate the difference of variables with normal distributions and Mann-Whitney as the nonparametric equivalent of t-test.

Results: Maxillary arch width in class II div1 subjects is narrower than normal groups in both genders and mandibular arch width is the same as normal group in females and smaller in males. In females, a moderate to high relationship was seen between cephalometric parameters and arch widths.

Conclusion: The existence of relationship between craniofacial dimensions and arch widths should be mentioned in treatment planning to prevent unwanted side effects and relapse.

Keywords: Class II div1,Arch widths, Craniofacial dimensions, Cephalometric parameters.

***Correspondence:** S. SheikhZadeh
Orthodontic department, Faculty of dentistry, Tehran university of medical sciences, North kargar street, Tehran, Iran.

Introduction

A comprehensive examination of dental and skeletal characteristics is prerequisite for ideal treatment planning. Cl 2 malocclusions are one of the most prevalent malocclusions denoted in populations.[1,2,3] Such abnormalitiesreveal different sagittal and vertical discrepancies that clinicians have to take into account during treatment planning.

Stanley claims that transverse maxillary deficiency and posterior crossbite tendency is more prevailing in clII div1 malocclusions.[4] so expansion would be a choice in such cases while other studies defined no certain differences in the intercanine and intermolar widths.[5,6]

The study of Pancherz*etal*. *Showed* that both mandibular retrusion and maxillary protrusion were common characteristics of Class II division 1 subjects.[7] Rosenblum claimed that the maxilla in Class II div1 patients was in normal position despite the presence of a retrusive mandible.[8] Several studies have shown that maxillary normal position, mandibular retrusion and excessive vertical growth of face are thefeatures of Class II div1.[9]

It should be kept in mind that cl2 malocclusion like the other craniofacial abnormalities is a combination of skeletal and dental components. Few studies have discovered no difference in vertical facial morphology between Cl II div1 and Cl II div2 except for the position of the maxillary incisors.[7] Phelan T et al. reported mandibular dental protrusion[10] while McNamara found mandibular dentition in neutral position[9] in ClII div1 cases.

With the hypothesis that there was an interrelation between the cephalometric characteristics and difference in the arch width, this study was done to evaluate the relationship between the dental and skeletal features.

Material &Methods

The data was made up of lateral cephalograms and dental casts of untreated ClII div 1 patients with long face which were randomly selected from the Orthodontics department, Tehran University of Medical Sciences, Iran. (20 males and 22 females aged between 13-22)

The Cl II div1 subjects were selected according to the following inclusion criteria:

Bilateral cl2 relationship in centric occlusion.

Steep mandibular plan and long faces.(SN-MP> 34 , FMA> 26 , Jaraback index<%62)

Presence of all permanent teeth except second and third molars.

Aligned dental arches with less than 2mm crowding or spacing.

Absence of cross bite or open bite.

No previous prosthodontic treatments, no history of trauma on canines and first molars.

Absence of a deep curve of spee (less than 5mm on each side).

Dental casts of 67 adult subjects (22 females and 45 males) with normal occlusion served as control group, the inclusion criteria were:

(1) Class I canine and molar relationship with minor or no crowding.

(2) Normal skeletal proportions.

(3) Aligned maxillary and mandibular dentition.

(4) Presence of all permanent teeth except second and third molar.

(5) No previous prosthodontic treatments, no history of trauma on canines and first molars.

Analysis on dental casts was performed by a digital dial caliper, and measured as followings:

Maxillary intercanine width: the distance between the cusp tips of the right and left canines.

Maxillary intermolar width: the distance between the mesiobuccal cusp tips of the right and left first molars.

Mandibular intercaninewidth : the distance between the cusp tips of the right and left mandibular canines.

Mandibular intermolar width: distance between the tips of the distobuccal cusps of the right and left first mandibular molars.

Maxillary canine alveolar width: the distance between the points between mucogingival junctions above the cusp tips of the maxillary right and left canines.

Maxillary molar alveolar width: the distance between the points the at mucogingival junctions above the mesiobuccal cusp tips of the maxillary first molars.

Mandibular canine alveolar width: the distance between the points at mucogingival junctions below the cusp tips of the mandibular right and left canines.

Mandibular molar alveolar width: the distance between the points at the mucogingival junctions below the distobuccal cusp tips of the mandibular first molars.

Lateral cephalograms were traced to investigate 12 variables:

SNA : Maxillary apical base relationship to anterior cranial base

SNB : Mandibular apical base relationship to anterior cranial base

ANB: Difference between SNA and SNB.

SN-MP: Inclination of mandibular plane to anterior cranial base

Wit's appraisal: Wit's.

U1–FH: Inclination of maxillary incisors to FH

FMA: Inclination of Frankfurt to mandibular plan.

Jaraback index: Sella- gonion distance divided to nasion-menton.

IMPA: Inclination of lower incisior axis to mandibular plan.

Facial angle: angle between Frankfurt plane to N-pog.

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS, Version 18).Unpaired student *t* -test was used to evaluate the difference of variables with normal distributions and Mann-Whitney as the nonparametric equivalent of t-test.

Results

Normality test was carried out to identify the parameters which were not normally distributed. ANB, SNMP, FMA, Facial angle and Jaraback index did not have normal distribution.

Compared to the subjects in the control group, maxillary intercanine width, maxillary intermolar width and maxillary posterior alveolar width in both genders were significantly narrower in the ClII div1 group. These variables had statistically significant differences between males and females in control group while the results showed that only differences between intercanine width and anterior alveolar measurements were significant between the sexes in ClII div1.

In males, mandibular intermolar width and posterior alveolar width in ClII div1 were significantly smaller than normal groups. In control group, except for mandibular intercanine width, all measurements were equal in the males and females in comparison with the Class II/1 group. Tables 1-3 show comparison data of dental casts between the study and control groups.

Table 1. Comparisons of dental cast measurements of the females participated in the studysignificance: *P* _value< .05

	Cl 2 div 1		cl1		T-test
	Mean	**SD**	**Mean**	**SD**	**P-value**
M_1x	42.93	1.84	49.77	2.4	**<0.001**
M_2x	56.3	1.75	61.6	2.4	**<0.001**
C_1x	32.98	2.08	36.28	0.9	**<0.001**
M_1x	46.75	2.39	48.7	1.9	**<0.01**
M_2x	56.71	2.41	58.7	1.7	**<0.02**
C_1n	26.26	1.53	25.3	1.8	>0.8

Table 2. Comparisons of dental cast measurements of the males participated in the study
Significance: *P* _value< .05

	Cl 2 div 1		cl1			
	Mean	SD	Mean	SD		T-test P-value
M1x	41.99	2.01	47.14	2.4		<0.001
M2x	55.5	2.27	56.7	2.4		<0.05
C1x	31.28	1.9	33.32	0.9		<0.001
M1x	46.14	2.22	46.4	1.9		>0.06
M2x	55.17	2.07	54	1.6		>0.05
C1n	25.09	1.57	25.3	1.5		>0.6

Table3. Comparison between mean of arch widths in males and females.
Significance: *P* _value< .05

Arch variables	M_1x	M_2x	C_1x	M_1n	M_2n	C_1n	M_1x-M_1n
P-value	0.13	0.21	**0.009**	0.395	**0.032**	0.018	0.655

In cephalometric evaluation, all measurements had significant differences in gender groups except for variables including FMA, IMPA. In experimental groups, more severe vertical and sagittal discrepancies were reported in females. The mean and standard deviation for cephalometric variables of Class II div1 and significant differences between the sex groups are presented in table 4.

Table4. Cephalometric measurements of the study groups. Significance: *P* _value< .05
Ns: not significant *****: significant difference

	Female(N=22)		Male(N=20)		Total		T-test	Mann-whitney
	Mean	SD	Mean	SD	Mean	SD		
SNA	78.2	2.4	80.6	2.5	79.3	2.8	*	
SNB	72.5	4.4	76.6	3.3	74.5	4.4	*	
ANB	5.7	2.4	3.9	1.3	4.8	2.2		ns
Wits	3.1	1.8	2.2	1.8	2.7	1.8	ns	
Facial angle	85.4	1.8	84.1	1.8	84.8	1.9	*	
Upper 1 to FH	119.6	4.1	116.1	4.1	118	4.4	*	
IMPA	101.1	5.1	98.8	5.1	100	5.2	ns	
SNMP	41.3	5	38.8	2.4	40.1	4.1		*
FMA	31.3	3.3	29.2	1.6	30.3	2.8		ns
Jaraback index	57.4	3.1	60.1	1.8	58.7	2.9		*

No statistically significant correlation was seen between cephalometric variables and maxillary width in males although significant correlation was found between maxillary posterior alveolar width, anterior alveolar width and intercanine width with ANB and Wits appraisal.

In male subjects, only maxillary posterior alveolar width has significant correlation with mandibular plan rotation while both anterior and posterior alveolar width correlates with mandibular plan rotation in females.

Table 5 shows the correlation between cephalometric variables with dental arch dimensions.

Table 5.Correlation between cephalometric variables and dental arch width.
Ns: not significant *****: significant difference
significance: *P* _ .05

	Female(N=22)				Male(N=20)				Total			
	M_1x	M_2x	C_1x	C_2x	M_1x	M_2x	C_1x	C_2x	M_1x	M_2x	C_1x	C_2x
ANB	ns	*	*	ns	ns	nsnsns			ns	*	*	*
Wits	ns	*	*	*	ns	nsnsns			*	*	*	*
SNMP	ns	*	ns	*	ns	*	ns	ns	ns	*	*	*
Upper 1 to FH	*	*	*	*	ns	ns	*	*	*	*	*	*

Discussion

This study was designed to explore the relation between skeletal features and maxillary and mandibular arch widths of both sexes in class II/1. The age of the examination group was varied from 13-22. Bishara [11] showed that intercanine and intermolar distances would increase in dimension during mixed dentition. After permanent teeth eruption was completed; limited diminution would take place so it can be assumed that in this study group, little change willoccurr in the intercanine and the intermolar widths after this period.

We found that maxillary arch widths in class II/1 subjects were narrower than normal groups in both genders and mandibular arch distance was the same as normal group. These findings have been approved by Staley and Asiry.[4,12] Staley found that only male subjects with normal occlusion had larger mandibular molar widths and mandibular alveolar widths than the class II malocclusion subjects. Compared to the subjects in the control group, maxillary intercanine width and maxillary intermolar width were significantly narrower in the ClII div1 group. A recent study by Shu R showed the palatal tilt of the maxillary posterior teeth plays the most important role in ClII div1 malocclusion compensation [13] and this maybe a probable reason for the finding ofdecreased interdental widths in our study.

In contrast with normal group, mean difference between maxillary and mandibular width were significant which showed a transverse base discrepancy in upper and lower arch in class II/1 patients. This finding was in agreement with Staley and Tollaro.[4,14]

SNA and SNB with mean degree of 79.3 and 74.5 can be interpreted as mild maxillary and moderate mandibular retrusion. Mean Upper 1 to FH of 118 and IMPA of 100 showed proclination of upper and lower incisors in class II/1 subjects. Several studies reported maxillary incisors protrusion in ClII div1 samples.[8,15, 16] Phelan reported the protrusion of teeth in both jaws as a feature of cl2 div 1 in mexican patients.[10] In contrast with our study, Bishara introduce the lower incisors retrusion as a feature of ClII div1. He claimed that variation in dentofacial characteristics of this malocclusion is understandable because of dental, skeletal and soft tissue interactions.[17]

In this study, a high relationship between incisors protrusion and anterior maxillary width was found in both sexes (r=-0.78). Decrease in arch width diminishes the space for erupting teeth so as a result, the expected phenomena would be crowding or protrusion of anterior teeth. As the crowding was an exclusion criterion in this study, so most probably protrusion would be the expected result of decreased available space.

In female subjects, posterior and anterior alveolar widths and intercanine width had moderate to high relation with ANB and witts. Tollaro claimed that decreased maxillary width plays an important role in sagittal jaw relation. [14] In present study, maxillary intermolar width was significantly narrower when compared to class1 but decrease in mandibular intermolar width was not statistically significant, As

the absence of crowding and crossbite were the inclusion criterion in the Class II groups it can be supposed that the mandible had shifted to a posterior position to compensate the constricted maxilla. This may be supported by the study of Rosenblum who found that the maxilla in Class II div1 patients was in normal position despite the presence of a retrusive mandible.[8]

In male group, decreased maxillary posterior alveolar width was in relation with mandibular backward rotation, while in females, anterior and posterior alveolar width had positive correlation with forward mandibular rotation. Some studies accepted the relation between maxillary constriction and backward rotation of lower jaw.[18,19,20] Proffit noted the presence of backward mandibular rotation and maxillary constriction in long face patients with mouth breathing.[21]

SNMP and SNB had significant correlation in females(r=-67) while this relation was not statistically significant in male group. Shuddy and sassouni noted that vertical discrepancies are important etiologic factors in skeletal class 2 malocclusions.[22,23] Isaacson also found that the vertical and sagittal growth are related by means of mandibular rotations.[24] Nigel claims that this rotation is more prominent in females.[25] These findings are in agreement with the results of present study.

Conclusion

The present study suggested following findings:

The arch widths were smaller in Cl II div1 malocclusion in comparison with Class I occlusion.

The relationship between craniofacial dimensions and arch widths should be mentioned in treatment planning to prevent unwanted side effects and relapse.

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