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Relationship of Lateral Dentoskeletal Morphology to Dental Crowding in Patients With Class II Malocclusions.

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الخلاصة

الأهداف: تهدف الدراسة إلى تقيم العلاقة بين القياسات الهيكلية السنية الجانبية مع كمية تزاحم الأسنان في المرضى ذوي سوء الإطباق من الصنف الثاني. **المواد وطرائق العمل**: تم تقييم قوالب الأسنان والصور الإشعاعية الجانبية للرأس ل ٦٢ مريض عراقي (٣٠ ذكرا و٣٢ أنثى) يعيشون في مركز مدينة الموصل من الصنف الثاني من سوء الإطباق، قسمت العينة إلى مجموعتين اعتمادا على شدة تزاحم الأسنان الأمامية السفلية قبل العلاج.تكونت المجموعة الأولى من ٣٠ مريض لديهم تزاحم الأسنان اكبر أو مساوٍ ل ٣ملم. المجموعة الثانية مكونة من ٣٢ مريض لد يهم تزاحم أسنان اقل من ٣ملم .أخذت القياسات على قوالب الأسنان والصور الجانبية الإشعاعية للرأس.تم استخدام القياسات الهيكلية (الخطية والزاويَة) لتحديد تأثير هذه القياسات على تزاحم الأسنان.**النتائج**: الاختلافات المعنوية بين مجموعتي تزاحم الأسنان كانت في S-Go، S-N-Ocp،S-N-L1 للذكور، أما في الإناث الاختلافات المعنوية كانت بين زاوية S-N-L1 ، SN-GoMe. بينما لم تظهر القياسات الأخرى اختلافات معنوية. تم دراسة معامل الارتباط بين كمية تزاحم الأسنان وبقية القياسات ،كان البعض منها ارتباطه موجب بينما الأخر كان سالبا. **الاستنتاجات**: المرضى ذوي سوء الإطباق من الصنف الثاني والذين كان لديهم كميات مختلفة من تزاحم الأسنان لم يظهروا علاقات معنوية مع القياسات الهيكلية السنية.اقترحت النتائج على انه تزاحم الأسنان غير معتمد على القياسات الهيكلية.

ABSTRACT

Aims: The aims of this study was to evaluate the relationship of lateral dentoskeletal morphology to the amount of dental crowding in patients with Class II malocclusion. **Materials and Methods**: Study models and lateral cephalometric radiographs of a Class II malocclusion of 62 Iraqi patients(18-25 years) lived in the center of Mosul City (30males and 32 females), were evaluated. The sample was divided into two groups according to severity of pretreatment mandibular crowding. Group 1 consisted of 30 patients and have crowding ≥ 3 mm. Group 2 have 32 patients and crowding <3 mm. Measurements were performed on pretreatment dental casts and lateral headfilms. Dental and skeletal (linear and angular) cephalometric measurements were used to determine the effect of these measurements on crowding. **Results**: Significant differences between crowding less than 3mm and crowding groups more than 3mm were seen in posterior facial height (S-Go) , the angle between sella, nasion and occlusal plane line (S-N-Ocp) and the angle between sella, nasion and the long axis of lower central incisor (S-N-L1) in males, while in females, the significant differences were seen in the angle between sella, nasion and the long axis of lower central incisor (S-N-L1) and the angle between Sella–nasion line and mandibular plane(NS-GoMe). The other parameters showed no significant differences. The correlation coefficients of the amount of crowding with all the measurements were studied. Some of them showed a positive correlation, while others showed a negative one. **Conclusions**: Subjects with Class II malocclusion and different amount of dental crowding have no significantly relation with skeletal parameters. Results suggest that dental crowding is independent of the skeletal measurements.

Key words: Dental crowding; ClassII malocclusion; Dentoskeletal morphology.

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INTRODUCTION

The determination of the factors contributing to mandibular anterior crowding, especially in the early mixed dentition stage, is of great importance for treatment planning.[1] Several factors can be assumed to affect the development and severity of crowding, such as direction of mandibular growth, early loss of deciduous molars, mesiodistal tooth and arch dimensions, the oral and perioral musculature, and incisor and molar inclination[2-5] and a genetic origin.[6,7] An understanding of the relationship between skeletal and dental components that contribute to malocclusion is important in orthodontic treatment planning, Class II malocclusion is reported as the most frequently seen skeletal disharmony in orthodontic population.[8,10] Numerous studies have been conducted to determine the anteroposterior and vertical components of patients with Class II malocclusion.[11] Staley *et al*.,[12] Tollaro *et al*.,[13] and Sayin and Turkkahraman[14] proposed that Class II malocclusion had a narrower maxillary arch width than Class I or normal occlusion, but the arch is narrow at different posterior teeth positions in these studies. Shu *et al*., found that the buccolingual inclination rather than arch width and alveolar width plays an important role in transverse discrepancy of Class II division 1 malocclusion.[15] Also in Class II an association was found between the overjet value and the tendency toward a hyperdivergent pattern. As the overjet increased, the angle between anterior cranial base and mandibular plane (S-N:Go-Me),basal plane angle(SPP:Go-Me), Sum [Bjork], Y-axis angle, and Lower gonial angle (N Go Me) tended to increase and Posterior/anterior facial height ratio (S-Go/N-Me), Ramal plane (Ar-Go), andAnterior facial height (N-Me) tended to decrease.[16] In general, patients with Class II malocclusion have a smaller mandibular length than subjects with normal occlusion and Class I malocclusion.[17,18] Therefore, the objective of this study was to evaluate the relationship of dentoskeletal parameters to the amount of dental crowding in patients with complete Class II malocclusion.

MATERIALS AND METHODS

The sample of this study was selected from College of Dentistry in Mosul University, Department of Orthodontics and consisted of maxillary and mandibular dental casts and lateral cephalometric radiographs of 62 patients(18-25 years) , 30 males and 32 females. These subjects were selected according to the following criteria : presence of a complete (full cusp) bilateral Class II malocclusion (molar relationship) with no openbite or crossbite;[16] presence of all permanent teeth excluding second and

third molars; absence of proximal decay or restoration; and absence of dental anomalies of number, size, form, and position.

The sample was divided into two groups according to severity of pretreatment mandibular crowding. Group 1 consisted of 30 patients (15 male, 15 female) with crowding ≥ 3 mm. Group 2 had 32 patients (15 male, 17female) with crowding <3 mm. For each individual, the following measurements were obtained from the maxillary and mandibular casts and measured with a digital caliper to the nearest 0.01mm: [19]

1-Space required = the sum of tooth mesiodistal widths from the second premolar to the second premolar on the other side, in millimeters.

2-Space available= was measured from the mesial aspect of the permanent first molar to its antimere with a brass wire. Space required was subtracted from available space to calculate the amount of crowding. The lateral cephalometric radiographs from the selected individuals were taken using conventional cephalometric x-ray machine, type STRATO-M .505 model-2000,Italy and traced manually, and reference points and planes were then recorded Figure (1):

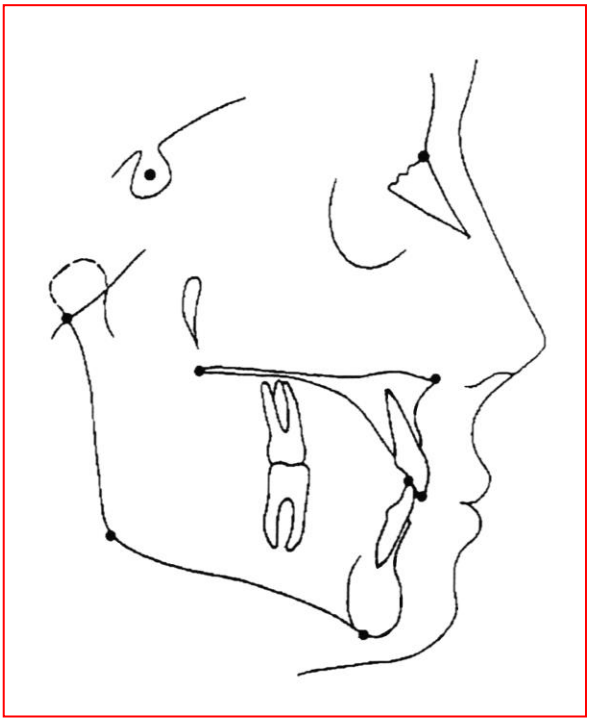

Figure (1): Cephalometeric Variables(Linear And Angular Measurements).

The linear measurements:

1. N-Me: Anterior facial height. [20]
2. S-Go: Posterior facial height.[20]
3. Go-Me: Mandibular plane. [20]
4. L1-SN:Distance from the center of sella to the projection on the S-N line of the most labially placed lower incisor tip.[22]
5. Cd-A: Maxillary length.[21]
6. Cd-Gn: Mandibular length.[21]

***The angular measurements:**

1. S-N-Me: Sella–nasion line/ menton angle.[22]
2. S-N-Ocp: Sella–nasion line/occlusal plane angle.[22]
3. NS- GoMe: Sella–nasion line/ mandibular plane angle. [20]
4. U1-SN: Axis angle of upper incisor, angle between long axis of upper incisor and anterior cranial base. [20]
5. L1-GoMe: Axis-angle of lower incisor, angle between long axis of the lower incisor and mandibular plane. [20]
6. L1-SN: angle between long axis of the lower incisor and Sella–nasion line.[22]

Analysis of data using SPSS software was done including descriptive statistics (means and standard deviations) of all measurements for males and females. Comparison between the two groups were done using *t*-test at $P \leq 0.05$ or $P \leq 0.01$ level of significance. Pearson correlation was used to examine inter relationships between crowding and cephalometric measurements ,correlation is significant at 0.01 or 0.05 levels.

RESULTS

Table (1) shows descriptive statistics (means and standard deviation) for all variables in males and females.

Table(1):Descriptive Statistics For all Measurements for Males and Female Groups.

Variables	crowding	Males			Females		
		No.	Mean	SD	No.	Mean	SD
UC*	less 3	15	3.33	3.95	17	2.67	2.76
	more 3	15	6.96	4.01	15	6.44	3.35
LC*	less 3	15	1.50	1.00	17	1.35	1.16
	more 3	15	4.43	1.19	15	4.63	0.76
Cd-A*	less 3	15	88.20	7.74	17	85.52	5.64
	more 3	15	88.20	9.43	15	82.33	3.55
Cd-Gn*	less 3	15	115.13	8.11	17	109.3	5.86
	more 3	15	116.20	10.2	15	108.8	5.95
N-Me*	less 3	15	121.73	7.41	17	121.1	7.43
	more 3	15	128.13	9.88	15	120.0	8.40
S-Go*	less 3	15	81.60	6.70	17	76.35	10.00
	more 3	15	88.13	6.20	15	76.26	5.92
Go- Me*	less 3	15	72.40	6.11	17	71.58	6.78
	more 3	15	73.20	10.5	15	67.06	5.75
SN-L1*	less 3	15	65.60	5.15	17	59.29	6.46
	more 3	15	65.66	6.93	15	53.93	3.03
SN- Me**	less 3	15	77.60	4.79	17	72.41	3.39
	more 3	15	76.86	7.30	15	72.73	5.07
SN-GoMe**	less 3	15	34.20	3.28	17	37.58	6.77
	more 3	15	33.13	5.28	15	38.00	9.05
SN-Ocp**	less 3	15	14.66	7.65	17	19.58	2.69
	more 3	15	18.06	6.28	15	20.53	3.88
S-N-L1**	less 3	15	42.66	7.65	17	42.52	9.64
	more 3	15	48.53	6.28	15	46.60	9.93
GoMe-L1**	less 3	15	101.46	8.26	17	98.41	8.54
	more 3	15	99.26	6.95	15	92.93	5.47
SN- U1**	less 3 more 3	15	107.46	7.56	17	101.9	16.46
		15	103.00	6.64	15	103.0	3.40

*:Measurements in millimeters. **:Measurements in degrees. No.: numbers

Results of *t*-test between two crowding groups are presented in Table (2). In males significant differences were found in S-Go, SN-Ocp and S-N-L1. while in females significant differences were noticed in S-N-L1and GoMe-L1.

Table(2): Comparison of Variables Between Crowding Groups for Males And Females.

Variables	crowding	Males Mean	SD	*t*-value	*P*-value	Females Mean	SD	*t*-value	*P*-value
Cd-A*	less 3	88.20	7.74	0.00	1.00	85.52	5.64	1.88	.069
	more 3	88.20	9.43			82.33	3.55		
Cd-Gn*	less 3	115.13	8.11	-.347	.731	109.3	5.86	.236	.815
	more 3	116.20	10.2			108.8	5.95		
N-Me*	less 3	121.73	7.41	-1.891	.069	121.1	7.43	.399	.692
	more 3	128.13	9.88			120.0	8.40		
S-Go*	less 3	81.60	6.70	-2.048	.050#	76.35	10.00	.029	.977
	more 3	88.13	6.20			76.26	5.92		
Go- Me*	less 3	72.40	6.11	-.339	.737	71.58	6.78	2.014	.053
	more 3	73.20	10.5			67.06	5.75		
SN-L1*	less 3	65.60	5.15	-.021	.983	59.29	6.46	2.933	.006##
	more 3	65.66	6.93			53.93	3.03		
SN- Me**	less 3	77.60	4.79	.329	.745	72.41	3.39	-0213	.833
	more 3	76.86	7.30			72.73	5.07		
SN-GoMe**	less 3	34.20	3.28	.473	.640	37.58	6.77	-.147	.884
	more 3	33.13	5.28			38.00	9.05		
SN-Ocp**	less 3	14.66	7.65	-2.116	.043#	19.58	2.69	-.807	.426
	more 3	18.06	6.28			20.53	3.88		
S-N-L1**	less 3	42.66	7.65	-2.293	.030#	42.52	9.64	-1.175	.249
	more 3	48.53	6.28			46.60	9.93		
GoMe-L1**	less 3	101.46	8.26	.789	.437	98.41	8.54	2.126	.042#
	more 3	99.26	6.95			92.93	5.47		
SN- U1**	less 3	107.46	7.56	-.564	.577	101.9	16.46	-.258	. 798
	more 3	103.00	6.64			103.0	3.40		

Significance at $p \leq 0.01$, #Significance at $p \leq 0.05$ level. *:Measurements in millimeters.
**:Measurements in degrees.

The correlation coefficients between the amount of crowding and all measurements for males and females are described in Table (3).

Table (3): Pearson Correlations of the Lower Crowding and All the Measurements for Males and Females.

Variables	Crowding	Males	Females
Cd-A	less 3	-.184	-.309
	more 3	-.124	-.384
Cd-Gn	less 3	-.157	-.012
	more 3	-.338	-.025
N-Me	less 3	-.387	-.221
	more 3	.039	.499
S-Go	less 3	-.039	-.145
	more 3	-.232	-.118
Go- Me	less 3	-.628	-.402
	more 3	-.399	.370
SN-L1	less 3	-.093	-.076
	more 3	-.158	-.548*
SN- Me	less 3	.582*	-.221
	more 3	-.174	-.430
SN-GoMe	less 3	.045	-.320
	more 3	.452	.123
SN-Ocp	less 3	-.087	.148
	more 3	.227	.022
S-N-L1	less 3	.224	.498*
	more 3	.052	-.405
GoMe-L1	less 3	-.795**	-.156
	more 3	-.342	-.049
SN- U1	less 3	.028	-.056
	more 3	-.199	-.082

*Correlation is significant at $P \leq 0.05$ level.
**Correlation is significant at $P \leq 0.01$ level.

In males group for less than 3 mm crowding positive correlations were seen in SN-Me and negative correlation with GoMe-L1. In female group for less than 3 mm crowding a positive correlations was noticed only for S-N-L1 .

In 3 mm crowding group negative correlation was noticed only for in females with SN-L1.

DISCUSSION

Cephalometric measurements:

Berg[23] compared cephalometric variables of patients with and without crowding and found that variables related to lower jaw dimensions (Ar-Po, SNB) had significantly smaller values in the crowded group while the result of the present study show no significant differences between the most of the cephalometric variables and crowding and this result agree with Montasser and Taha[24] who suggest that dental crowding is independent of the skeletal measurements.

The result of the present study show no significant differences between the maxillary basal length(Cd-A) and mandibular basal length(Cd- Gn) between two groups and this disagree with Turkkahraman and Sayin[21] which found that the maxillary skeletal lengths (Co-A) of the crowded group in mixed dentition were significantly smaller. The SNA angle was also smaller in the crowded group, but the difference was statistically nonsignificant and the result of the present study also disagree with Janson *et al.*,[25] who concluded that patient with class II malocclusion and moderate to severe mandibular crowding have significantly smaller effective apical base lengths(Co-A, Co-Gn) than subjects with the same malocclusion and slight mandibular crowding. Our study show that no significant differences between crowding and non crowding groups in mandibular plane length(Go-Me) and mandibular plane(Go-Me) to SN plane angle and this result not agreement with Leighton and Hunter[22] and Sakuda *et al.*,[26] who found shorter mandibular body lengths and larger mandibular plane and occlusal plane angles to SN in cases with crowding.

The result of the present study showed significant difference in the lower incisors position and inclination between crowded and non crowded groups and this result is in disagree with Miethke and Behm-Menthel[27] who accepted as fact that lower incisor crowding manifests itself in differing skeletal morphologies , independent of lower incisor position. The present study showed significant difference in the posterior facial height in male group between crowding and non-crowding groups and this agree with the result obtained by Leighton and Hunter.[22] However our results did not confirm Turkkahraman and Sayin[21] findings who used posterior/anterior face height ratio and found no significant difference between the groups in early mixed dentition.

Correlations:

Conflicting results existed in the literature evaluating the correlation between crowding and dentoskeletal dimensions. Miethke and Behm-Menthel[27] reported that no correlation existed between crowding and vertical skeletal dimensions and lower incisor position. Janson *et al.*,[25] found a significant inverse correlation between maxillary and mandibular effective lengths and the severity of dental crowding. Miethke[28] reported there is no correlation between mandibular anterior crowding and vertical craniofacial configuration or sagittal lower incisor inclination. Tu rkkahraman and Sayin[21] found significant inverse correlations between crowding and SNB, lower incisor to NB angle, anterior cranial length, mandibular length, maxillary length, mandibular dental measurements and direct

correlations between crowding and interincisal angle, overjet, overbite, and FMIA. Our study showed no significant correlation was found between the crowding and dental and skeletal measurements except a positive correlation with S-N-L1, SN-Me, and a negative correlation with GoMe-L1, SN-L1. So results suggest that dental crowding is a local, independent, genetically determined discrepancy between tooth width and size of supporting bone.

CONCLUSIONS

Subjects with complete Class II malocclusion and different amount of dental crowding have no significant relation with skeletal parameters. Results showed the absence of correlation between the skeletal dimensions and severity of dental crowding .Results suggest that dental crowding is independent of the skeletal measurements.

REFERENCES

1. Sayin M O, Turkkahraman H. Factors contributing to mandibular anterior crowding in the early mixed dentition. *Angle Orthod.* 2004;74(6):754–758.
2. Sanin C, Savara BS. Factors that affect the alignment of the mandibular incisors: A longitudinal study. *Am J Orthod.* 1973;64:248–257.
3. Shab A, Elcock C, Brook A. Incisor crown shape and crowding. *Am J Orthod Dento Facial Orthop*. 2003;123(5):562-567.
4. Bernabe E, Flores-Mir C. Dental morphology and crowding. *Angle Orthod*.2006;76(1):20-25.
5. Bernabe E, Biostat C, Villanueva K, Flores-Mir C. Tooth width ratio in crowded and noncrowded dentitiion. *Angle Orthod*.2004;74(6):765-768. (www.ivsl.org)
6. Mockers O, Aubry M, Mafart B. Dental crowding in aprehistoric population. *Eur J Orthod.*2004;26(2):151-156.
7. Normando D, Almeida A, Quinta˜o C . Dental crowding,The role of genetics and tooth wear. *Angle Orthod*. 2013;83(1):10–15.
8. Youssef M. The prevalence of dentofacial deformities in Syria. *Damascus Univ J*. 1996;12:151–186.
9. Silva RG, Kang DS. Prevalence of malocclusion among Latino adolescents. *Am J Orthod Dentofacial Orthop.* 2001;119:313–315.
10. Lauc T. Orofacial analysis on the Adriatic islands: an epidemiological study of malocclusions on Hvar Island. *Eur J Orthod.*2003;25:273–278.
11. Hassan AH. Cephalometric characteristics of Class II division 1 malocclusion in a Saudi population living in the western region. *Saudi Dent J*. 2011;23:23–27.

12. Sayin MO, Turkkahraman H. Comparison of dental arch and alveolar widths of patients with Class II, division 1 malocclusion and subjects with Class I ideal occlusion. *Angle Orthod*. 2004;74(3):356–360.
13. Staley RN, Stuntz WR, Peterson LC. A comparison of arch widths in adults with normal occlusion and adults with Class II, division 1 malocclusion. *Am J Orthod*. 1985;88:163–169.
14. Tollaro I, Baccetti T, Franchi L, Tanasescu CD. Role of posterior transverse interarch discrepancy in Class II, division 1 malocclusion during the mixed dentition phase. *Am J Orthod Dentofacial Orthop.* 1996;110:417–422.
15. Shu R, Han X, Wang Y, Xu X, Ai D, Wang W, Wu Y, Bai D. Comparison of arch width, alveolar width and buccolingual inclination of teeth between Class II division 1 malocclusion and Class I occlusion. *Angle Orthod*. 2013;83(2):246–252.
16. Saltaji H, Flores-mir C, Major P, Youssef M. The relationship between vertical facial morphology and overjet in untreated Class II subjects. *Angle Orthod*.2012;82(3):432–440. (www.ivsl.org)
17. Karlsen AT. Craniofacial morphology in children with Angle Class II-1 malocclusion with and without deepbite. *Angle Orthod*. 1994;64:437–446.
18. Baccetti T, Franchi L, McNamara JA Jr, Tollaro I. Early dentofacial features of Class II malocclusion: a longitudinal study from the deciduous through the mixed dentition. *Am J Orthod Dentofacial Orthop*. 1997;111:502–509.
19. Efisio D,Ginlia B,Andlea M.Dental arch dimensions in the mixed dentition.A study of Italian children born in the 1950s and the 1990s. *Angle Orthod*.2006;76(3):446-451.
20. Rakosi T.An atlas and manual of cephalometric radiography.2nd ed.Wolf medical publications LTD.1982;Pp: 42,66-67.
21. Turkkahraman H, Sayin MO. Relationship between mandibular anterior crowding and lateral dentofacial morphology in the early mixed dentition. *Angle Orthod* 2004;74(6):759–764.
22. Leighton BC, Hunter WS. Relationship between lower arch spacing/crowding and facial height and depth. *Am J Orthod.*1982;82(5):418-25.
23. Berg R. Crowding of the dental arches: a longitudinal study of the age period between 6 and 12 years. *Eur J Orthod.* 1986;8: 43–49.
24. Montasser M A, Taha M. Relationship between dental crowding, skeletal base lengths, and dentofacial measurements. *prog orthod*.2012;13(3):281-287.

25. Janson J G, Goizueta O E, Garib D G, Janson J M. Relationship between maxillary and mandibular base lengths and dental crowding in patients with complete Class II malocclusions. *Angle Orthod*. 2011;81(2):217–221.
26. Sakuda M, Kuroda Y, Wada K, Matsumoto M. Changes in crowding of teeth during adolescence and their relation to the growth of the facial skeleton. *Trans Eur Orthod Soc.* 1976:93–104.
27. Miethke RR, Behm-Menthel A. Correlations between lower incisor crowding and lower incisor position and lateral craniofacial morphology. *Am J Orthod Dentofacial Orthop.* 1988;94:231–239.
28. Miethke RR. No correlation between primary mandibular anterior crowding and vertical craniofacial configuration or lower incisor inclination. *J Orofac Orthop*.2000;61(5):297-304.