VOLUME-6 | ISSUE-3 | MARCH - 2017 • ISSN No 2277 - 8179 | IF : 4.176 | IC Value : 78.46

DENTOALVEOLAR AND MORPHOLOGICAL CHANGES IN MAXILLA & MANDIBLE OF WESTERN UTTAR PRADESH POPULATION WITH DIFFERENT OVERJETS: A CEPHALOMETRIC STUDY

Dental Science

KEYWORDS: Benign lymphoepithelial lesions, lymphoid tissue, Mikulicz's disease, sjogren's syndrome

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ABSTRACT

Introduction : Studying the relationship during the growth process of maxillo-facial and dentoalveolar structures would be useful in enhancing the accuracy of prediction of maturational changes. There are few studies examining relationship between overjet and dentoalveolar and skeletal morphology of jaws and effect of gender on this relationship. Therefore the purpose of the present study was to evaluate dentoalveolar and morphological changes in maxilla and mandible with different overjets.

Materials & Method: 120 subjects(60males&60females) were selected for the study. Subjects were divided into three groups of 40 each based on overjet. On lateral cephalograms various cephalometric points, planes, linear and area measurements were used in this study to evaluate the morphology of mandible and maxilla in different overjet groups.

Result and Conclusion: MxAABH (Maxillary dentoalveolar height) between the overjets showed significantly different and higher MxAABH at extreme overjet as compared to both normal and increased overjects in both the genders. MxPABH between the overjets showed lowered value significantly at both increased and extreme overjets in females. Cd-Gn (Mandibular length) and Cd-Go (ramal length) were lowered at extreme overjet in both males and females. Correlation were found significant for both males and females , MxAABH showed positive correlation and Cd-Gn and SD(only for females) showed negative correlation.

Introduction

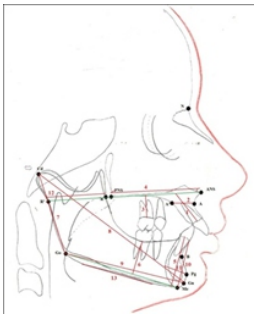
Facial balance is a cardinal concern to health specialties not only because vital organs are concentrated in a circumscribed area but also because of the social value of the face. Artists, dentists, physician and anthropologist have studied the face from diverse angles[1]. Studying the relationship during the growth process of maxillo-facial and dentoalveolar structures would be useful in enhancing the accuracy of prediction of maturational changes[2]. Significant facial characteristics of the face are influenced by the direction and magnitude of mandibular growth. Vertical development of facial skeleton has been related to many skeletal units. The nasomaxillary complex alveolar process and the mandible have been associated with normal and abnormal vertical development[3]. The difference in the interarch relationship of subjects with class I,II and III malocclusion are probably not directly due to differences in skeletal morphology, but rather to the fact that in class I group ,in contrast to class II and III subjects the variation in jaw relationship has been compensated for by the dentoalveolar compensatory mechanism (Solow 1980).Therefore the purpose of the present study was to evaluate dentoalveolar and morphological changes in maxilla and mandible with different overjets[4].

Materials & Method:

The study was conducted in the Department Of Orthodontics and Dentofacial Orthopedics, Kothiwal Dental & Research Centre, Moradabad.The chronological ages of the 120 subjects(60 males,60 females) ranged from 18 to 25 years. Overjet was measured as a distance between the incisal tip of the maxillary central incisor and buccal surface of the mandibular central incisor parallel to the occlusal plane[4]. Subjects were classified into three groups[5]:

Group I Normal : Overjet less than or equal to 3mm
Group II Increased : Overjet more than 3 mm but less than or equal to 6mm
Group III Extreme : Overjet more than 6mm

Patients who had already undergone orthodontic treatment, any congenital abnormality and any facial or orthognathic surgery were excluded. Before shooting the lateral radiograph it was ensured that the subjects were standing in erect position with Frankfort Horizontal plane parallel to the floor and teeth in occlusion. The subjects were fixed on the cephaloststst with ear rods and nasion pointer. The distance between the x-ray source and mid sagittal plane was 5 feet or 60 inches. The exposure parameters were 70 to 80 Kvp, 10 mPA and exposure time was 1.6 second. On matte acetate tracing sheets, Placom digital planimeter was used for area measurement(KP-90N-series)[11].



(Fig. 1 Illustration of linear cephalometric measurements from the tracing). They are (1) MxAABH, (2) MxAD, (3) MxPABH, (4) ANS-PNS, (5) MdAABH, (6) MdPABH, (7) Cd-Go, (8) Cd-Gn, (9) Go-Gn, (10) SH, (11) SD, (12) RW

Fig. 2 Area measurements. 1 (MxA), 2 (TMdA), 3 (SA)

Linear measurements[3] (Fig 1):

Maxillary anterior alveolar and basal height(MxAABH): It is the distance between the mid points of alveolar meatus of maxillary central incisor and long axis of the maxillary central incisor. **Maxillary anterior depth(MxAD):** It is the distance between point A and A'. **Maxillary posterior alveolar and basal height(MxPABH):** It is the perpendicular distance between the mid point of alveolar meatus of the maxillary first molar and the palatal line. Anterior nasal spine-posterior nasal spine(ANS-PNS): It is the distance between the maxillary ANS and PNS point or palatal length or maxillary corpus length. **Mandibular anterior alveolar and basal height(MdAABH):** It is the perpendicular distance between the mid point of alveolar meatus of the mandibular central incisor and the mandibular plane. **Mandibular posterior alveolar and basal height(MdPABH):** It is the perpendicular distance between the mid point of alveolar meatus of the mandibular first molar and **mandibular plane. Condylion- gonion(Cd-Go):** The distance between condylion and gonion points. Condylion - gnathion(Cd-Gn): It is the distance between condylion and gnathion points. Gonion-gnathion(Go-Gn): **It is the distance between gonion and gnathion points. Symphysis height(SH): It is the distance between infradental and menton points. Symphysis depth(SD):** It is the distance between the pogonion and most posterior wall of the symphysis. **Ramus width(RW):** It is the distance between R and R' points.

Area measurement[1](Fig 2): Symphyseal area (SA), Total mandibular area(TMdA), Area of maxilla(MxA)

Linear and area measurements were compared by two factor (sex and overjet) analysis of variance (ANOVA) and the significance of mean difference within (intra) and between (inter) the groups was done by Tukey's post hoc test after ascertaining normality by Shapiro-Wilk's test and homogeneity of variance between groups by Levene's test. Pearson correlation analysis was done to assess association between the variables. Pearson correlation analysis was done to assess association between the variables. Analyses were performed on SPSS software.

Results

Table 1 Linear measurements (Mean ± SD) of males and females at different overjets

Linear measurements (mm)	Overjet	Male (n=20)	Female (n=20)	p value
MxAABH	Normal	23.85 ± 2.03	23.35 ± 3.50	0.988
	Increased	25.90 ± 1.62	21.85 ± 1.93	<0.001
	Extreme	31.30 ± 3.13	26.90 ± 1.97	<0.001
MxAD	Normal	16.50 ± 1.96	14.65 ± 2.48	0.061
	Increased	16.05 ± 1.99	15.75 ± 2.77	0.997
	Extreme	16.65 ± 1.35	14.70 ± 1.53	0.041
MxPABH	Normal	19.20 ± 3.87	18.90 ± 2.20	0.999
	Increased	19.10 ± 1.77	16.30 ± 2.85	0.013
	Extreme	19.20 ± 2.65	15.80 ± 1.82	0.001
ANS-PNS	Normal	55.50 ± 2.33	51.70 ± 6.40	0.018
	Increased	57.90 ± 3.28	53.80 ± 2.26	0.008
	Extreme	54.35 ± 2.80	52.45 ± 3.43	0.582
MdAABH	Normal	37.05 ± 3.72	35.50 ± 1.91	0.502
	Increased	36.00 ± 2.15	33.45 ± 3.05	0.053
	Extreme	39.45 ± 2.78	35.10 ± 2.81	<0.001
MdPABH	Normal	28.80 ± 3.02	26.90 ± 3.64	0.212
	Increased	29.25 ± 1.77	24.95 ± 1.90	<0.001
	Extreme	29.05 ± 1.96	25.00 ± 2.96	<0.001
Cd-Go	Normal	64.25 ± 3.49	57.70 ± 4.04	<0.001
	Increased	64.30 ± 1.87	59.50 ± 3.46	<0.001
	Extreme	61.90 ± 2.86	56.05 ± 3.76	<0.001
Cd-Gn	Normal	128.85 ± 2.54	118.60 ± 2.91	<0.001
	Increased	128.95 ± 2.24	116.20 ± 4.77	<0.001
	Extreme	124.25 ± 3.67	114.25 ± 6.62	<0.001
Go-Gn	Normal	83.60 ± 5.60	75.65 ± 4.91	<0.001
	Increased	81.85 ± 3.18	74.90 ± 4.83	<0.001
	Extreme	80.35 ± 2.37	74.50 ± 5.39	0.001
SH	Normal	35.90 ± 5.07	32.80 ± 2.17	0.026
	Increased	36.40 ± 2.41	32.00 ± 2.49	<0.001
	Extreme	36.40 ± 2.26	32.70 ± 3.36	0.004
SD	Normal	17.80 ± 2.91	22.45 ± 2.74	<0.001
	Increased	18.00 ± 3.66	14.85 ± 1.57	0.002
	Extreme	18.05 ± 1.99	13.55 ± 1.61	<0.001
RW	Normal	34.20 ± 2.67	32.65 ± 2.81	0.422
	Increased	33.90 ± 2.00	31.55 ± 3.33	0.058
	Extreme	33.40 ± 2.09	31.05 ± 2.54	0.058

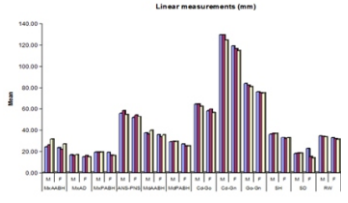
Table 2 For each gender, comparison (p value) of mean linear measurements between overjets by Tukey test

Comparisons	MxAABH		MxAD		MxPABH	
	Male	Female	Male	Female	Male	Female
Normal vs. Increased	0.098	0.392	0.983	0.548	1.000	0.027
Normal vs. Extreme	<0.001	<0.001	1.000	1.000	1.000	0.004
Increased vs. Extreme	<0.001	<0.001	0.942	0.598	1.000	0.991

Comparisons	ANS-PNS		MdAABH		MdPABH	
	Male	Female	Male	Female	Male	Female
Normal vs. Increased	0.318	0.471	0.843	0.197	0.994	0.188
Normal vs. Extreme	0.922	0.988	0.081	0.998	1.000	0.212
Increased vs. Extreme	0.034	0.856	0.002	0.430	1.000	1.000

Comparisons	Cd-Go		Cd-Gn		Go-Gn	
	Male	Female	Male	Female	Male	Female
Normal vs. Increased	1.000	0.527	1.000	0.432	0.827	0.995
Normal vs. Extreme	0.230	0.620	0.007	0.013	0.217	0.967
Increased vs. Extreme	0.210	0.017	0.005	0.658	0.901	1.000

Comparisons	SH		SD		RW	
	Male	Female	Male	Female	Male	Female
Normal vs. Increased	0.996	0.966	1.000	<0.001	0.999	0.767
Normal vs. Extreme	0.996	1.000	1.000	<0.001	0.927	0.386
Increased vs. Extreme	1.000	0.981	1.000	0.583	0.991	0.991



VOLUME-6 | ISSUE-3 | MARCH - 2017 • ISSN No 2277 - 8179 | IF : 4.176 | IC Value : 78.46

Fig: 3 Mean linear measurements of three groups and two genders

Area measurements (mm^2)	Overjet	Male (n=20)	Female (n=20)	p value
SA	Normal	413.00 ± 58.41	322.00 ± 58.90	<0.001
	Increased	360.55 ± 46.87	371.00 ± 50.88	0.994
	Extreme	397.50 ± 76.70	351.55 ± 64.76	0.160
TMdA	Normal	3292.00 ± 318.16	2991.00 ± 400.94	0.039
	Increased	3151.00 ± 288.81	3103.00 ± 183.16	0.997
	Extreme	3349.00 ± 395.85	3146.50 ± 265.22	0.340
MxA	Normal	445.00 ± 57.81	377.50 ± 78.06	0.030
	Increased	416.50 ± 70.06	419.00 ± 50.88	1.000
	Extreme	444.50 ± 84.20	386.00 ± 69.16	0.090

Table 4 For each gender, comparison (p value) of mean area measurements between overjets by Tukey test

Comparisons	SA		TMdA		MxA	
	Male	Female	Male	Female	Male	Female
Normal vs. Increased	0.073	0.112	0.725	0.875	0.784	0.411
Normal vs. Extreme	0.964	0.631	0.993	0.635	1.000	0.999
Increased vs. Extreme	0.383	0.910	0.366	0.998	0.796	0.661

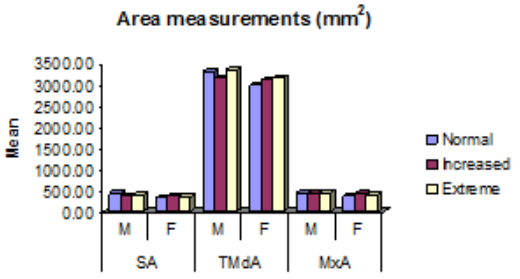


Fig 4 Mean area measurements of three groups and two genders.

Table 7 Correlation of linear, angular and area measurements with overjet of males, females and total males and females

Parameters	Variables	Correlation (r value) Overjet vs.		
		Males (n=60)	Females (n=60)	Total (n=120)
Linear measurements (mm)	MxAABH	0.79***	0.48***	0.62***
	MxAD	0.02	-0.08	-0.02
	MxPABH	-0.02	-0.36**	-0.15
	ANS-PNS	-0.24	0.06	-0.06
	MdAABH	0.26	-0.02	0.14
	MdPABH	0.05	-0.26	-0.08
	Cd-Go	-0.29*	-0.18	-0.15
	Cd-Gn	-0.59***	-0.32*	-0.24*
	Go-Gn	-0.30*	-0.13	-0.15
	SH	0.00	-0.07	-0.01
	SD	0.07	-0.69***	-0.35***
	RW	-0.13	-0.20	-0.14
Area measurements (mm2)	SA	0.00	0.19	0.09
	TMdA	0.12	0.16	0.14
	MxA	0.11	-0.04	0.05

Discussion

Many studies have insvestigated dentoalveolar compensation and variations in vertical dentoalveolar compensation and variations in vertical jaw relationships. Also many studies have insvestigated dentoalveolar compensation and variation in sagittal jaw relationships.[4,6,7]. However, there is surprisingly little data concerning relationship between overjet and the dentoalveolar and skeletal patterns of the jaw. MxAABH: On comparing the mean MxAABH between the overjets in both males and females highly significant difference of MxAABH at extreme overjet was found as compared to both normal and increased overjet in both genders. However in the present study there was no statistically different MxAABH value obtained when in both the genders normal and increased overjets were compared (Table no 2). But the study conducted by Baydas B et al[8] and Buschang PH et al[9] showed that the value for MxAABH was more in males as compared to females. For each overjet comparing the mean MxAABH between the genders a significantly different MxAABH in both increased and extreme overjets was found and its value was higher in males. But there was no significant difference between the two genders on comparison at normal overjet. This finding was consistent with the result obtained by Baydas B et al[8]., they reported that there are gender difference in MxAABH (Table 1). This measurements shows that there was a significant and positive correlation in both the genders which shows as the overjet increases the MxAABH values also increases. But in the study of Gupta K et al[3] the correlation was weak for males but in females it shows statistically insignificant (Table 5). In accordance with our study a study was done by Ceylan I et al[4], which reported that maxillary dentoalveolar height was more effective than mandibular dentoalveolar height at providing dentoalveolar compensation in different overjet groups, while Janson et al.10 reported that maxillary and mandibular dentoalveolar heights were similar between Class I and Class II dental and skeletal malocclusions. MxAD: On comparing mean MxAD of males and females at different overjet. MxAD showed no significant change with overjet, but at extreme overjet MxAD showed significantly lowered value in females (Table no 1) and the measurements shows weak correlation with overjet groups (Table no 5), this was in accordance with the study conducted by Gupta K et al[3]. But in their study there was no significant gender-overjet interaction for MxAD. On comparing the mean MxAD between overjet for both males and females there was no significant difference (Table no 2). MxPABH: On comparing the mean MxPABH between the overjet groups. In males Turkey test showed MxPABH was similar between the overjet groups but at extreme and increased overjet MxPABH showed significantly lowered in females as compared to normal overjet (Table no 1). And on comparing MxPABH for each genders between overjet increased and extreme overjet showed lowered value significantly in females as compared to males and the difference was statistically significant (Table no 2). The measurements showed week correlation with overjet groups in males and negative correlation in females (Table no 5). This present study was in accordance with the study conducted by Baydas B et al[8]. Which reported that there are statistically significant differences in the MxPABH between overjet groups. Gupta K et al[3] showed that there are statistically singnificant gender difference but no overjet differences and no significant gender-overjet interaction for MxPABH.

ANS-PNS: On comparing ANS-PNS between the overjet groups in both males and females significant difference was at normal and increased overjet but at extreme overjet the difference was not statistically significant (Table no 1). For each gender on comparing the mean ANS-PNS between overjet a significantly different ANS-PNS at increased and extreme overjet and value for males is higher than females (Table no 2). Measurements showed weak correlation with overjet groups (Table no 5). This present study was similar to the study done by Gupta K et al[3]. They showed that palatal length increases in normal overjet as compared to negative overjet group in males. They also showed that there were no gender differences for ANS-PNS. MdAABH: On comparing MdAABH at different overjets in both males and females there was no significant difference for this MdAABH in different overjet groups for females. (Table no 1). There was no significant gender-overjet correlation for MdAABH (Table no 5). On comparing MdAABH for each gender between overjets there was no significant difference for this measurement in females but in males at extreme overjet this measurement was significantly higher as compared to increased overjet (Table no 2) A similar study done by Ceylan I et al[4] showed that whilst there were significant differences in

maxillary dentoalveolar heights between the overjet groups, mandibular dentoalveolar heights were similar and Gupta K et al[3] also demonstrated no interaction effect between gender and overjet groups.MdPABH: On comparing the mean MdPABH between overjets there was no significant difference was found for both genders (Table no 2). But on comparing mean of males and females at different overjet at increased and extreme overjet the mean MdPABH was found lowered in females and difference was statistically highly significant (Table no 1). And this parameter showed weak correlation with overjet (Table no 5). Gupta K et al[3] and Ceylan I et al[4] showed that MdPABH does not change with overjet groups in both males and females. They also showed that there are statistically significant gender differences, but no overjet differences and no significant gender-overjet interaction for MdPABH. Cd-Go: On comparing the mean Cd-Go between the overjet groups there was no significant difference for males. But in females at extreme overjet as compared to increased overjet Cd-Go (ramal length) was found lowered and which was statistically significant (Table no 2). Between genders at all overjets the difference for ramal length was highly significant and value for this measurement was lowered in females as compared to males (Table no 1). This parameters showed negative correlation with overjet in males (Table no 5). Because ramal length is short at extreme overjet in females for this change the mandibular rotation might be the reason. This study was in accordance with the study conducted by Gupta K et al[3]. Cd-Gn: On comparing the mean Cd-Gn (mandibular length) between the overjet groups the difference between normal overjet and extreme overjet was significant in both males and females and in males the difference between increased and extreme groups was also statistically significant (Table no 2). And on comparing between genders at different overjets the difference for mandibular length was highly significant and value for this measurement was lowered in females as compared to males (Table no 1). So in this present study the short mandibular length might be the reason for extreme overjet. This measurements showed a negative correlation with overjet in both genders means as overjet increases mandibular length decreases (Table no 5). This present study was in accordance with the study done Gupta K et al[3] and Beydas B et al[8]. They showed that if overjet increases the length of the mandible decreases. Go-Gn: On comparing between overjets the mean Go-Gn was found similar in both males and females (Table no 2). But between genders at different overjets values for Go-Gn were lowered in females as compared to males (Table no 1). This present study was similar to the study done by Gupta K et al[3]. They showed that Go-Gn does not change with overjet. They also showed that there were significant gender differences but no significant gender-overjet interaction for Go-Gn. Go-Gn showed a negative correlation with the overjet and a weak gender-overjet correlation (Table no 5). This result was in accordance with the study conducted by Baydas B et al[8] where they found negative correlation of Go-Gn with overjet in females. SH: no statistically significant difference was found in both genders when the overjets were compared (Table no. 2). This parameters showed a weak overjet correlation in both genders (Table no 5). Gupta K et al[3] showed that SH does not change with overjet and there were statistically significant gender differences, but no overjet differences and no significant gender-overjet interaction. SD: On comparing between overjet groups this parameter was found similar in males but in females it was significantly increased in normal as compared to increased and extreme overjet (Table no 2). And on comparing between genders Turkey test showed that at normal overjet it was significantly different and higher in females as compared to males but at extreme and increased overjet symphysis depth was significantly higher in males as compared to females (Table no 1). And for this parameter there was a significant negative correlation with overjet in females (Table no 5). But in the study conducted by Gupta K et al[3] showed that SD (symphysis depth) was significantly increased in edge-edge group when compared to positive and normal overjet groups. They also showed that there were no statistically significant gender difference.

RW: On comparing the mean between the overjets in both genders ramus width was found similar (Table no 2). It also not differed between the genders at all overjets(Table no 1) and it showed a weak correlation with overjet(Table no 5). A study conducted by Gupta K et al[3] showed that as overjet increases RW decreases in females. They also showed a positive gender-overjet correlation. On comparing the mean among overjets SA, TMdA and MxA were found statistically same in both genders (Table no 4). However between genders at normal overjets they were significantly lowered in females as compared to males but there was no statistically significant difference (except symphyseal area for this measurement the difference was statistically significant at normal overjet) between males and females at extreme and increased overjets (Table no 3). There was a weak gender-overjet interaction for this measurement (Table no 5).

CONCLUSION

Overjet patterns have an effect on the maxillary and mandibular morphology. It also shows that there are gender differences in maxillary and mandibular morphology in different overjet groups. For males MxAABH, ANS-PNS, MdAABH and Cd-Gn were found statistically significant different among overjet groups. In females MxAABH, MxAD, MxPABH, Cd-Go, Cd-Gn, SD and GA were found significant different among overjet groups.

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