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Dento-alveolar heights in egyptian children – a retrospective study

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Abstract:

Objective: This study was done to evaluate dento-alveolar heights in Egyptian children with class III malocclusion. Material and Methods: A sample of 85 pretreatment cephalometric films for Egyptian children (39 boys and 46 girls) were collected over several years. The age range for the study was 7-12 years. The sample was divided into two groups according to skeletal and dental relations. Group 1: Class I (Control group: n=40, mean age: 9.18±1.48). Group 2: Class III (Study group: n=45, mean age: 9.36±1.39). Results: For dento-alveolar heights: U1-PP (mm), L1-MP (mm) & U6-PP (mm) Showed significant lower values in class III group. PP-GoMe (angle) was statistically significant with lower value in class III group compared with the control group. Conclusion: U1-PP, L1-MP and U6-PP, all these dento-alveolar heights were shorter in class III comparing to those of class I. The accurate treatment planning for growing class III patients is the key for a successful orthodontic outcome.

Introduction

Malocclusion was first classified by Angle in 1899 into, class I, II and III according to first molars relationship.(1) Eruption of the teeth and surrounding alveolar bone result in formation of dento-alveolar segment. Vertical dimension of the jaws should be carefully monitored for successful orthodontic treatment .Changes in the dento-alveolar height may be due to manifestation of the underlying skeletal malocclusion. Cephalometric analysis is useful to determine any dentofacial discrepancy and to assess its severity. Dento-alveolar heights increase from 10 to 15 years of age with male adolescence having larger heights than female adolescents as reported by Buschange et al.(2) To know how much dento-alveolar modification is needed will be useful in orthodontic treatment. Fouda found that all percentages of dentoalveolar heights were larger in males than females except for posterior dento-alveolar height.(3) The severity of any dentofacial discrepancies can be determined by cephalometric norms helping in evaluation of any changes accompanying orthodontic treatment.(3, 4) Clinically class III malocclusion is formed early in life, so it is recommended for early intervention in deciduous dentition because it is not self-corrected disharmony.(5) Class III malocclusion may exhibit skeletal and dental components within facial skeletons.(6, 7) Some studies indicated severe increase in overbite which occurred during the transition from deciduous to permanent dentition i.e. the mixed dentition.(8) The facial pattern is developed early long before the adolescent growth spurt, even before the eruption of the first permanent first molars.

The purpose of the present study was to evaluate dento-alveolar heights in Egyptian children with class III malocclusion.

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Material and methods

The study compromised 85 retrospective pretreatment cephalometric films of Egyptian children with age ranged from 7 to 12 years (39 boys and 46 girls) and with class III malocclusion of teeth were obtained from orthodontic department at the University of Mansoura. Radiographs were digitally traced** by the authors and 10 radiographs as a sample were picked randomly and retraced for accuracy. The definition of the cephalometric points and variables described in this study are shown in figures 1 and 2 and table 1 and 2. The sample was divided into two groups according to their skeletal relationship. Group 1; the control group (n=40, mean age, 9.18±1.48 years). The included subjects followed these criteria: 1-Angle class I bilaterally. 2-Overjet not more than 3mm. 3-Overbite not more than 1/3 of lower anterior teeth. 4-Subjects with acceptable occlusion. 5-No previous orthodontic treatment. Group 2; Class III group (n=45, mean age, 9.36±1.39 years) included subjects that followed these criteria: 1-Angle class III bilaterally. 2-Fully erupted first molars. 3-No craniofacial anomalies. 4-No previous orthodontic treatment. 5-Edge to edge and/ or crossbite of the incisor teeth. 6-Wits = zero or less.

**Onyx Ceph™, version 2.7.7.0, Chemnitz, Germany.

Statistical Analysis

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp). The Kolmogorov-Smirnov test was used to verify the normality of distribution Quantitative data were described using mean and standard deviation. Significance of the obtained results was judged at the 5% level.

The used tests were: F-test (ANOVA) for normally distributed quantitative variables, to compare between more than two groups, and Post Hoc test (LSD) for pairwise comparisons. Student t-test for normally distributed quantitative variables, to compare between two studied groups.

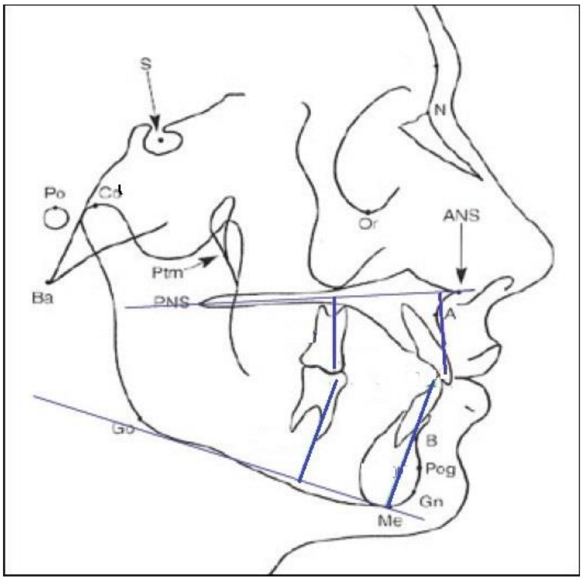

Fig 1. Landmarks and planes

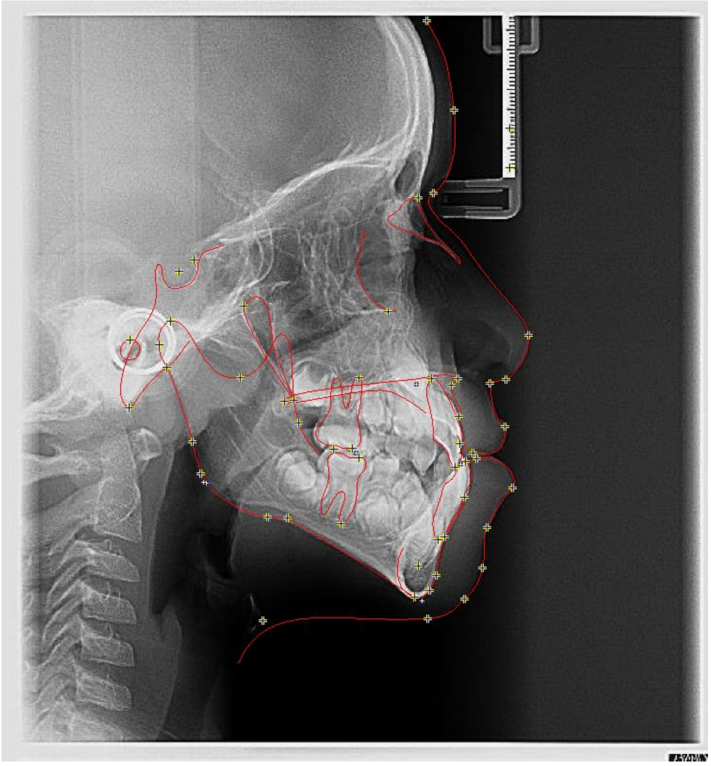

Fig 2. Cephalometric tracing by software

Table (1): points used in the study [3]

A) Points	
Anterior nasal spine (ANS)	Process of the maxilla forming the most anterior projection of the floor of the nasal cavity.
Pogonion (Pog)	Most prominent point on the anterior aspect of symphysis of the mandible.
Menton (Me)	The most inferior point on the symphysis of the mandible.
Gonion (Go)	Most posterior inferior point on ramus of the mandible.
Porion (Po)	Superior aspect of external auditory meatus.
Orbital (Or)	Lowest point on the inferior bony margin of the orbit.
Pterygomaxillary Fissure (PTM)	Posterior superior aspect of Pterygomaxillary Fissure.
Gnathion (Gn)	Intersection of Facial Plane and Mandibular Plane.
Condylion (Co)	The highest point of superior curvature of the condyle of the mandible
Point A	The deepest point on the curved bony outline between the anterior nasal spine (ANS) and prosthion (Pr).
Pont B	The point of the deepest concavity anteriorly on the mandibular symphysis

Table (2): variables used in the study [3]

variables	RELATION
SNA	The angle between SN line and NA line
SNB	The angle between SN line and NA line
ANB	The difference between SNA and SNA
SN.PP	Determines the inclination of the palatal plane to the anterior cranial base.
Mand 1.MP	Determines the position of the axes of the mandibular incisors in relationship to the mandibular plane.
Max 1. PP	Determines the position of the axes of the maxillary incisors in relationship to the palatal plane.
SN.PP	Determines the inclination of the palatal plane to the anterior cranial base.
SN.OCP	Determines the inclination of the occlusal plane to the anterior cranial base.
SN.GOMn	Determines the inclination of the mandibular plane to the anterior cranial base.
PP.GoMn	Angle between the palatal plane and the mandibular plane.
U1-PP (Upper anterior dento-alveolar height)	Distance from incisal edge of the most protruded upper incisor tooth to palatal plane; measured perpendicular to the maxillary plane.
U6-pp (Upper posterior dento-alveolar height)	Distance between mesial cusp tip of upper first molar to palatal plane; measured perpendicular to the maxillary plane
L1-MP (lower anterior dento-alveolar height)	Distance from the incisal edge of the most protruded lower incisors to the mandibular plane; measured perpendicular to mandibular plane.
L6-MP (lower posterior dento-alveolar height)	Distance from the mesial cusp tip of the lower first molar to mandibular plane; measured perpendicular to mandibular plane.

Results

Table (3): Comparison between the classes according to different parameters

Deg.		Class I		Class III		F	p
		Mean	±SD.	Mean	±SD.		
SNA	Boys	80.17	3.95	79.24	3.22	1.359	0.265
	Girls	81.39	2.71	80.17	3.77	0.598	0.553
SNB	Boys	76.62	4.96	79.85#	2.83	9.167*	<0.001*
	Girls	77.71	2.69	80.53#	4.31	20.536*	<0.001*
ANB	Boys	4.02	2.14	-0.60#	2.70	47.587*	<0.001*
	Girls	3.67	2.36	-0.36#	2.32	74.652*	<0.001*
SN.PP	Boys	10.87	3.72	15.12#	5.53	3.865*	0.026*
	Girls	12.96	3.82	13.36	5.29	0.955	0.389
U1-PP (mm)	Boys	25.67	2.27	23.30#	3.88	11.061*	<0.001*
	Girls	24.96	2.06	22.05#	3.29	14.350*	<0.001*
L1-MP (mm)	Boys	37.01	3.29	34.69#	4.46	3.676*	0.031*
	Girls	35.23	3.18	34.38	2.26	1.149	0.322
U6-PP (mm)	Boys	18.86	1.82	17.22#	3.29	4.467*	0.016*
	Girls	17.85	2.12	17.32	2.15	1.730	0.184
L6-MP (mm)	Boys	27.76	3.46	26.20	4.50	1.372	0.261
	Girls	25.94	2.41	25.61	1.90	0.134	0.875
Max1-PP	Boys	110.86	8.65	113.66	7.98	2.163	0.124
	Girls	114.44	6.79	113.25	11.39	0.115	0.892
Mand1-MP	Boys	94.16	9.18	90.40	6.38	10.199*	<0.001*
	Girls	94.72	8.07	89.18#	7.21	10.657*	<0.001*
SN-OcP	Boys	19.84	4.06	19.50	4.05	0.203	0.817
	Girls	20.9	2.68	18.04	5.95	3.001	0.055
SN-GoGn	Boys	33.81	4.82	33.60	4.96	0.499	0.609
	Girls	36.76	3.63	32.80	5.61	3.054	0.053
PP-GoMe	Boys	27.79	4.48	26.15	4.66	2.066	0.136
	Girls	29.19	4.35	25.28#	6.07	4.009*	0.022*

F,p: F and p values for **ANOVA test**, Sig. bet. groups was done using Post Hoc Test **(LSD)**

#: Significant with class I

*: Statistically significant at $p \leq 0.05$

Table (4): Relation between gender and different parameters in class I and class III

Deg.	Class I (n = 40)						Class III (n = 45)					
	Boys (n = 19)		Girls (n = 21)		t	p	Boys (n = 20)		Girls (n = 25)		t	p
	Mean	±SD.	Mean	±SD.			Mean	±SD.	Mean	±SD.		
SNA	80.17	3.95	81.39	2.71	1.142	0.260	79.24	3.22	80.17	3.77	0.874	0.387
SNB	76.62	4.96	77.71	2.69	0.882	0.383	79.85	2.83	80.53	4.31	0.615	0.542
ANB	4.02	2.14	3.67	2.36	0.489	0.628	-0.60	2.70	-0.36	2.32	0.326	0.746
SN.PP	10.87	3.72	12.96	3.82	1.744	0.089	15.12	5.53	13.36	5.29	1.081	0.286
U1-PP(mm)	25.67	2.27	24.96	2.06	1.031	0.309	23.30	3.88	22.05	3.29	1.170	0.248
L1-MP(mm)	37.01	3.29	35.23	3.18	1.738	0.090	34.69	4.46	34.38	2.26	0.279	0.783
U6-PP(mm)	18.86	1.82	17.85	2.12	1.599	0.118	17.22	3.29	17.32	2.15	0.124	0.902
L6-MP (mm)	27.76	3.46	25.94	2.41	1.941	0.060	26.20	4.50	25.61	1.90	0.586	0.561
Max1-PP	110.86	8.65	114.44	6.79	1.463	0.152	113.66	7.98	113.25	11.39	0.136	0.893
Mand1-MP	94.16	9.18	94.72	8.07	0.206	0.838	90.40	6.38	89.18	7.21	0.590	0.558
SN-OcP	19.84	4.06	20.90	2.68	0.986	0.330	19.50	4.05	18.04	5.95	0.937	0.354
SN-GoGn	33.84	4.82	36.76	3.63	2.176*	0.036*	33.60	4.96	32.80	5.61	0.500	0.620
PP-GoMe	27.79	4.48	29.19	4.35	1.002	0.322	26.15	4.66	25.28	6.07	0.528	0.600

t, p: t and p values for **Student t-test** for comparing between boys and girls

*: Statistically significant at $p \leq 0.05$

Descriptive statistics for cephalometric variables are shown in table (3) & (4). SNB showed greater significance in class III group, while ANB showed statistical significance with lower value in class III group. SN-PP angle was statistically significant in class III group. For dento-alveolar heights: U1-PP (mm), L1-MP (mm) & U6-PP (mm) Showed significant lower values in class III group. L6-MP (mm) had no statistically significant difference. Mand1-MP showed statistical significance in girls with class III group also showed significance with control group recording small value than control group. SN-OCP (angle) had no statistical significance with smaller value in class III patient than control group. SN-GoGn (angle) had no statistical significance with smaller value in class III patient than control group. PP-GoMe (angle) was statistically significant in class III girls that also was significant with control group recording lower value.

Discussion

The purpose of this study was to evaluate dento-alveolar heights in Egyptian children with class III malocclusion. The results revealed gender difference between boys and girls in 10 variables. Matching control groups for sex and age was advisable and preferable for more valid comparison.[9] ANB angle showed significance in both girls and boys in class III group that was also significant with control group. This suggested less forward movement of A-point as the mandible tended to move more horizontally. This agrees with McDonald et al work.[10] PP- GoMe (basal plane angle) showed significance in girls with class III group recording lower value. This angle showed significance with class I control group, suggested decreased lower anterior face height that can be attributed to palatal plane and agrees with Enoki et al and disagrees with Guyer et al findings.[6, 11] Roy et al found that basal plane angle in low angle cases reduced significantly as compared to high angle cases.[12] SNB angle was significant in boys and girls in class III group, with girls the angle was higher than boys and showed significance with the control group. This disagrees with McNamara et al.[13] The present study showed that SN-PP was significantly increased in class III group with higher value in boys than girls, but not significant with the control group. Significant decrease found in Mand1-pp in class III group with girls showed slightly higher value. This indicated more uprighting of the lower anterior teeth. SN-PP, in boys with class III (15.12^{o}) showed statistical significance with the control group and higher value than girls (13.36^{o}) by 1.76 degrees. This indicated more inclination of the maxilla with the anterior base of the skull and contradicts the result obtained by Alzain and Ferguson and disagrees with Guyer et al.[6, 14, 15] Treatment of any vertical skeletal discrepancies will be done by either stimulation or inhibition or both of the dento-alveolar structures vertically.[16] The value of U1-PP (upper anterior dento-alveolar height) was significant showing lower value in class III patients and significant also with the control group with boys having higher value than girls. U6-PP (upper posterior dento-alveolar height) showed significance recording higher value in boys and significant in the control group and this agrees with scheidman et al and Tandon et al work.[17, 18]

The latter finding indicated also that the molar height decreased in class III patients. L1-MP (lower anterior dento-alveolar height) showed statistical significance in class III boys with lower value and significance with the control group. This linear measurements were similar to the results obtained by Kucera et al and Janson et al study.[19, 20] L6-MP (lower posterior dento-alveolar height) did not show any significant difference between groups. SN-Ocp showed significance in girls with class III group and significance with the control group recording lower values than class I control group. Bacetti stated that all linear measurements suggested for female subjects with class III malocclusion presented with smaller values in maxilla and mandible when compared to male subjects.[12] This agrees with the present study except for upper posterior dento-alveolar height. SN-GoGn showed significance in girls in class III group with lower values than boys, indicating lower degree of the mandibular inclination to the anterior cranial base in girls compared to that in boys. SN-GoGn was the only significant value in comparison between genders in class I group, where girls showed higher values than boys.

Conclusion

1- This study was useful in providing data for cephalometric diagnosis for class III in mixed dentition in Egyptian children.

2- U1-PP, L1-MP and U6-PP, all these dento-alveolar heights were shorter in class III comparing to those of class I.

3- Understanding different malocclusion patterns and their effects on the dento-alveolar structures help orthodontists to choose the best treatment protocol.

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