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THE RELATION BETWEEN CONGENITAL HYPODONTIA AND SKELETAL VERTICAL MEASUREMENTS IN SYRIAN COAST POPULATION

Hazem Hassan[1], MohammadKhadija[2]

1.Professor at Orthodontics and Orthopedics Department - Faculty of Dentistry - Tishreen University - Lattakia – Syria

2.Master's degree student at Orthodontics and Orthopedics Department - Faculty of Dentistry - Tishreen University - Lattakia – Syria

ABSTRACT:

Congenitally missing teeth (CMT) is one of the most common abnormalities in permanent dentition. Many studies studied CMT effect on craniofacial skeleton according to location of CMT or sex or type of missing teeth, but their results were controversial. The aim of this study was to evaluate the effects of sex and location of missing on vertical relationship of facial skeleton. In this study, 96 cephalograms were taken for patients of Syrian coastal origin.The angles ArGoMe, B, FH-GoMe and NS-GoMe were the parameters studied. The sample was divided according to sex and to the location of the missing teeth (anterior, posterior, anterior + posterior). The results showed that there is no significant effects for sex and location on the vertical measurements we studied. Results also showed that female are more likely to be affected with CMT by double. This study is an evidence that CMT affects craniofacial skeleton.

Key Words: CMT, hypodontia, cephalometric, craniofacial skeleton, Syrian coast.

INTRODUCTION

Congenitally missing teeth (CMT) had been defined as those teeth that fail to erupt into the oral cavity and remain invisible in radiographs [1]. This could be in form of hypodontia (agenesis of one to six teeth), oligodontia (absence of six or more teeth, excluding the third molar) or anodontia (complete failure of one or both dentitions to develop [2-6]. It could be an isolated trait, or could be syndromic with an underlying recognizable clinical syndrome [7].

The prevalence of congenitally missing teeth among different population had been reported with a wide range from 0.3% to 17.1% [4,7,8-17]. This wide variation in the prevalence and distribution reported worldwide could be attributed to variations in age distribution of the study population, sampling techniques, methods of examination, as well as sex and racial origin of the different sample populations [10, 12, 18].

Third molars are the most commonly absent tooth in the dentition [19]. Many authors reported that the most frequently CMT after the third molar was mandibular second premolars, followed by maxillary second premolars or maxillary lateral incisors [15, 20]. There were however, contrary reports which showed maxillary lateral incisors [7, 10, 14, 21,22], mandibular incisors [9], and

*Corresponding Author Address: Dr. Mohammad Khadija. E-mail: dr.mhdkhadija@gmail.com

mandibular lateral incisors [23] as the most frequent congenitally missing teeth in their respective studies.

According to some studies, dental aplasia is not correlated with the vertical relationship of the jaws.[24,25] However some investigators have found significant associations between the CMT ocurrence with reduced anterior lower facial height [26,27,28,29] and increased overbite, [30] which intensifies by increasing the severity of CMT, [31,32] or less severe deep bite in CMT patients [33] and decreased maxillary-to-mandibular-planes angle, which was clinically relevant only in severe CMT.[32] Furthermore anterior CMT might have a significant effect on the vertical skeletal relationships with increasing severity of CMT.[32] It also might contribute to a more acute mandibular angle and flatter chin.[26]

MATERIALS AND METHODS

Subjects:

A total of 94 Syrian population (32 male, 64 female) with hypodontia (the total group), excluding third molars, were selected as the subjects from the files of orthodontic patients who had been treated at our clinics in Tishreen University (Lattakia, Syria). The subjects were selected on the basis of the following criteria: a dentition showing the eruption of second molars or within approximately 6 months after full eruption of all four second molars, no premature loss of deciduous teeth, no previous orthodontic or prosthodontic treatment, and no craniofacial anomalies. The mean age of the subjects was 19 years (SD 1 year 4 months).

Hypodontia was diagnosed by using orthodontic records, which included orthopantomograms, cephalograms, and anamnestic data. A tooth was identified as a congenitally missing tooth when there was no evidence that it had been extracted and when no mineralization of the tooth crown could be recognized on orthopantomograms.[34,35] The anamnestic data were used as reference material to avoid wrong diagnoses. Longitudinal orthopantomograms were examined to exclude the registration of late mineralized teeth as congenitally missing teeth. The criteria for the finals were based on the finding by Aasheim and Ogaard,[11] who reported that apart from third molars no tooth had been found mineralized after the age of 12 years. Third molars were excluded from the present study. The same investigator reexamined each orthopantomogram, and a reproducibility of 100% was obtained in the identification of hypodontia.

Our hypodontia subjects (the total group) were categorized into three groups according to the distribution of congenitally missing teeth in the dental arches. The anterior group consisted of 36 patients with hypodontia in the anterior region only (incisors and canines). The posterior group consisted of 58 patients with hypodontia in the posterior region only (premolars and molars). The anterior-posterior group consisted of 2 patients with hypodontia in both anterior and posterior regions.

Cephalometric Analysis:

A single investigator prepared and assessed lateral cephalograms, which were taken with the same cephalostat and with the standardized settings. Nine reference points were marked, and 4 reference lines were manually drawn on each tracing paper [35] (Table 1, Figure 1). For each tracing, 4 angular measurements were made with a protractor (Table 2). The angular measurements were estimated to the nearest 0.5º.

Statistical Analysis:

Statistical analyses were performed by SPSS (version 17.0). Differences in mean values among the hypodontia groups were assessed for each measurement by using "one-way ANOVA test" after testing the homogeneity of the variances.

Measurement Error:

Twenty lateral cephalograms were used for measurement once again after 3 weeks, and the means of each measurement were used in the statistical calculations. Student's t-test with a 95% confidence interval did not reveal any systematic measurement errors. Measurement errors, which were assessed with the Dahlberg [36] formula, were found to be <0.5º for angular measurements.

RESULTS:

The sample consisted of 96 patients (32 males and 64 females – male to female ratios is 1:2). 36 patients (37.5%) have CMT in the anterior region (central incisors, lateral incisors and canines) and 58 patients (62.5%) have CMT in the posterior region (1st premolars, 2nd premolars, 1st molars and 2nd molars) and two patients have CMT in both the anterior and posterior regions. The number of CMTs in every patients was between 1 and 4 (The sum of CMTs is 174 in all the sample) with a ratio of 1.81 CMT in every patient. 48 patients (50%) have CMT in the maxilla, 26 (27.08%) patients have CMT in the mandible and 22 patients (22.92%) have CMT in the both jaws. 16 patients (16.67%) have CMT in the left side, 28 patients (29.17%) have CMT in the right side and 52 patients (54.17%) have CMT in the both sides.

First: Studying the effect of sex on angles ArGoMe, B, GoMe-SN and GoMe-FH.

- Descriptives:

(Table 3) shows mean and standard deviation and standard error and lower bound and higher bound of the mean at confidence interval 95% for angles ArGoMe and B and FH-GoMe and SN-GoMe after dividing the sample to subgroups according to sex.

- Results of one-way ANOVA test:

(Table 4) shows that the significance level is higher than 0.05 when studying the differences in means between males and females in the angles ArGoMe, B, FH-GoMe and NS-GoMe. i.e. at confidence level of 95% there is no statistical differences between the means of these angles if the patient is either male or female.

Second: Studying the effect of region of missin on angles ArGoMe, B, FH-GoMe and NS-GoMe.

- Descriptives:

(Table 5) shows mean and standard deviation and standard error and lower bound and higher bound of the mean at confidence interval 95% for angles ArGoMe and B and FH-GoMe and NS-GoMe after dividing the sample to subgroups according to the region of missing.

- Results of one-way ANOVA test:

(Table 6) shows that the significance level is higher than 0.05 when studying the differences in means between the subgroups divided according to the region of missing in the all studied angles. i.e. at confidence level of 95% there is no statistical differences between the means of these angles if CMT is located in the anterior, posterior or anterior + posterior regions of the jaws.

DISCUSSION :

The studied sample represents patients willing to undergo orthodontic treatment, so it may not represent all CMT patients in the society because we didn't make a survey to gather all CMT patients in our sample, but only patients who attend Orthodontic Clinic in Tishreen University.

Regarding region of missing (anterior, posterior, anterior + posterior – missing in our study was more common in posterior region), we disagreed with Haddad [37] and Celikoglu et al. [25], while Amini [38] didn't find any differences in CMT prevalence according to region of missing (anterior or posterior)

About the higher incidence rate of CMT in females in comparison with males we agreed with many other studies [39,40,41] where they found a male-to-female ratio of 1:1.8 and we found it to be 1:2. But we disagreed with Medina [42] who found that male-to-female ratio is 3:2. In a big study conducted on six regions in Turkey it's been found that in five of these regions the incidence rate of CMT in females was larger than males, but in the sixth region it was higher in males.[43] The higher incidence rate in females could be attributed to biological differences such as smaller jaws which may provoke some environmental factors, and this can be confirmed by the suggestion that says teeth may get missed if the buds development is delayed so the space necessary for these teeth can be occupied by nearby tissues [44]. Also there is another factor may play a role in raising the incidence rate in females which is the higher need from affected females to undergo orthodontic treatment as they are more concerned about their appearance [38] and the big interest the society pays to women esthetics.[44] However, this last reason may not reflects reality because many studies made on school pupils found a higher incidence rate in females, and moreover Chung didn't find a difference between male and female orthodontic patients in CMT incidence rates.[45] Race is considered one of the factors responsible for these conflicts between studies results.

As for the differences in vertical plane between males and females, we didn't find any statistically significant difference between males and females in all the angles studied in our study. The values we found for our angles coincide what Shaghaf Bahro [47] found in her study on healthy Syrian coast population who have Class I occlusion and don't have CMT, and she also didn't find any significant differences between males and females in all our studied angles in her study. Moreover, some studies didn't relate CMT with vertical relationships.[25] However, our results disagree with many studies which found reduction in angles ArGoMe [47], B [34], FH-GoMe [48] and NS-GoMe [40] in CMT patients. This agreement with Bahro results (which represent normal values of these angles in healthy people in Syrian coast) and disagreement with the last four studies to the low congenitally missing teeth number in our sample patients (a mean of 1.81 CMT\patient).

Regarding differences in vertical plane according to region of missing (anterior, posterior or anterior + posterior) we also didn't find any statistically significant differences between all our studied angles values according to region of missing. Our results agree with Ben-Bassat results [48], who didn't find any significant differences in angle FH-GoMe value according to region of missing. This agreement can be attributed to the fact that our study and Ben-Bassat et al.'s study have been conducted in the same geographical region (The Mediterranean basin). However, we disagreed with Acharya et al [32] who found that the value of angle B decreases in cases of anterior CMT and increases in cases of posterior CMT, but he didn't find any statistically significant differences in this value in cases of anterior + posterior CMT. This disagreement with Acharya et al could be attributed to the fact that his study sample involved patients with higher number of CMTs than ours.

We can conclude from our results that congenitally missing teeth when it's between 1 and 4 teeth may not affect vertical relationships in CMT patients, and we may need a sample with a higher rate of CMT to define whether region of missing could affect our studied angles' values or not.

CONCLUSIONS:

1. The incidence rate of CMT in females is larger than males (the ratio is 2:1) in Syrian coast population.

2. According to sex, we didn't find any statistical significant difference between

males and females in skeletal vertical measurements we studied in our study.

3. According to region of missing we didn't find any statistical significant difference between cases that have CMT in the anterior, posterior and anterior + posterior regions of dental arches in skeletal vertical measurements we studied in our study.

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TABLES:

Table 1: POINTS AND REFERENCE LINES USED IN THE CEPHALOMETRIC ANALYSIS

POINT/REFERENCE LINE	DEFINITION
Sella (S)	The midpoint of the sella turcica (pituitary fossa)
Nasion (N)	The most anterior point on the frontonasal suture in the midline
Porion (Po)	The upper- and outer-most point on the external auditory meatus
Orbitale (Or)	The most inferior and anterior point on the orbital margin
Articulare (Ar)	The point of intersection of the posterior margin of the ascending mandibular ramus and the outer margin of the posterior cranial base
Menton (Me)	The most inferior point of the mandibular symphysis in the midline
Gonion (Go)	The most posterior and inferior point on the angle of the mandible
Anterior nasal spine (ANS)	The tip of the bony anterior nasal spine in the midline
Posterior nasal spine (PNS)	The tip of the posterior nasal spine in the midline
Frankfort horizontal plane	a horizontal reference constructed as a line through porion to orbitale
Sella-nasion plane	a line extending from sella to nasion
Maxillary plane	A line connecting the anterior and posterior nasal spines
Mandibular plane	A line constructed from gonion to menton

Table 2: ANGULAR MEASUREMENTS USED IN THE CEPHALOMETRIC ANALYSIS

ANGULAR MEASUREMENT	DEFINITION
ArGoMe	The angle of the mandible
B	The angle between mandibular plane and maxillary plane
GoMe-SN	The angle between mandibular plane and Sella-nasion plane
GoMe-FH	The angle between mandibular plane and Frankfort horizontal plane

Table 3: STUDYING THE EFFECT OF SEX ON ANGLES ArGoMe, B, GoMe-SN AND GoMe-FH (DESCRIPTIVES)

ANGLE		NUMBER	MEAN (°)	STD. DEVIATION	STD. ERROR	95% CONFIDENCE INTERVAL FOR MEANS (°)		MANIMUM (°)	MAXIMUM (°)
						LOWER BOUND	UPPER BOUND		
ArGoMe	Male	32	123.750	4.9727	.8791	121.957	125.543	116.7	134.0
	Female	64	122.706	5.6588	.7074	121.293	124.120	112.0	136.3
	Total	96	123.054	5.4359	.5548	121.953	124.156	112.0	136.3
angle-B	Male	32	25.444	4.0385	.7139	23.988	26.900	19.3	32.7
	Female	64	24.072	5.3528	.6691	22.735	25.409	14.0	38.9
	Total	96	24.529	4.9745	.5077	23.521	25.537	14.0	38.9
FH-GoMe	Male	32	22.250	3.4102	.6028	21.020	23.480	16.5	27.3
	Female	64	21.747	4.5684	.5710	20.606	22.888	14.9	33.2
	Total	96	21.915	4.2062	.4293	21.062	22.767	14.9	33.2
NS-GoMe	Male	32	34.738	5.2467	.9275	32.846	36.629	24.0	44.0
	Female	64	35.681	5.8378	.7297	34.223	37.139	26.1	48.8
	Total	96	35.367	5.6376	.5754	34.224	36.509	24.0	48.8

Table 4: STUDYING THE EFFECT OF SEX ON ANGLES ArGoMe, B, GoMe-SN AND GoMe-FH (RESULTS OF ONE-WAY ANOVA TEST)

ANGLE		SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIFICANCE
ArGoMe	Between Groups	23.241	1	23.241	.785	.378
	Within Groups	2783.958	94	29.617		
	Total	2807.198	95			
angle-B	Between Groups	40.150	1	40.150	1.633	.204
	Within Groups	2310.728	94	24.582		
	Total	2350.878	95			
FH-GoMe	Between Groups	5.400	1	5.400	.303	.583
	Within Groups	1675.319	94	17.823		
	Total	1680.720	95			
NS-GoMe	Between Groups	19.001	1	19.001	.595	.442
	Within Groups	3000.373	94	31.919		
	Total	3019.373	95			

Table 5: STUDYING THE EFFECT OF REGION OF MISSING ON ANGLES ArGoMe, B, FH-GoMe AND NS-GoMe (DESCRIPTIVES)

ANGLE		NUMBER	MEAN (°)	STD. DEVIATION	STD. ERROR	95% CONFIDENCE INTERVAL FOR MEANS (°)		MANIMUM (°)	MAXIMUM (°)
						LOWER BOUND	UPPER BOUND		
ArGoMe	Ant.	36	122.778	5.4747	9124.	120.925	124.630	112.5	136.3
	Post.	58	123.445	5.4060	7098.	122.023	124.866	112.0	134.0
	Ant. + Psot.	2	116.700	0.0000	0.0000	116.700	116.700	116.7	116.7
	Total	96	123.054	5.4359	.5548	121.953	124.156	112.0	136.3
angle-B	Ant.	36	24.211	4.8854	8142.	22.558	25.864	15.9	32.0
	Post.	58	24.728	5.1463	6757.	23.374	26.081	14.0	38.9
	Ant. + Psot.	2	24.500	0.0000	0.0000	24.500	24.500	24.5	24.5
	Total	96	24.529	4.9745	.5077	23.521	25.537	14.0	38.9
FH-GoMe	Ant.	36	21.550	4.2658	7110.	20.107	22.993	15.6	33.2
	Post.	58	22.248	4.2161	5536.	21.140	23.357	14.9	30.1
	Ant. + Psot.	2	18.800	0.0000	0.0000	18.800	18.800	18.8	18.8
	Total	96	21.915	4.2062	.4293	21.062	22.767	14.9	33.2
NS-GoMe	Ant.	36	35.067	6.2759	1.0460	32.943	37.190	26.1	45.3
	Post.	58	35.621	5.3412	7013.	34.216	37.025	24.0	48.8
	Ant. + Psot.	2	33.400	0.0000	0.0000	33.400	33.400	33.4	33.4
	Total	96	35.367	5.6376	.5754	34.224	36.509	24.0	48.8

Table 6: STUDYING THE EFFECT OF REGION OF MISSING ON ANGLES ArGoMe, B, FH-GoMe AND NS-GoMe (RESULTS OF ONE-WAY ANOVA TEST)

ANGLE		SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIFICANCE
ArGoMe	Between Groups	92.353	2	46.176	1.582	.211
	Within Groups	2714.846	93	29.192		
	Total	2807.198	95			
angle-B	Between Groups	5.927	2	2.963	.118	.889
	Within Groups	2344.951	93	25.215		
	Total	2350.878	95			
FH-GoMe	Between Groups	30.645	2	15.322	.864	.425
	Within Groups	1650.075	93	17.743		
	Total	1680.720	95			
NS-GoMe	Between Groups	14.718	2	7.359	.228	.797
	Within Groups	3004.655	93	32.308		
	Total	3019.373	95			

FIGURES:

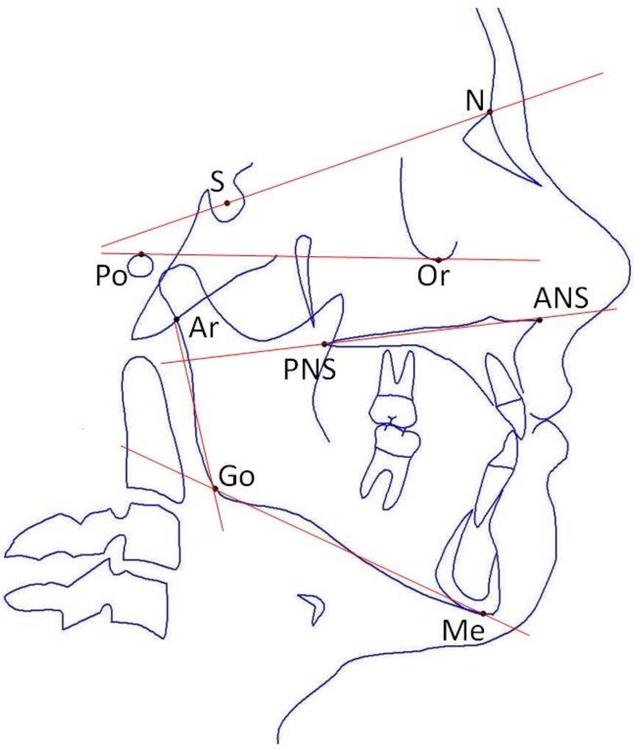

Figure 1: Points and reference lines used in the cephalometric analysis.