Assessment of dental arches symmetry in a sample of Iraqi children at the mixed dentition stage

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ABSTRACT

Background: Little is known about asymmetry of children's dental arches, the purpose of this study was to verify the presence of asymmetry of dental arches among Iraqi children in the mixed dentition stage.

Materials and methods: The sample included 52 pairs of dental casts, 27 pairs belong to males and 25 pairs for females. Three linear distances were utilized on each side on the dental arch: Incisal-canine distance, canine-molar distance and incisal-molar distance, which represent the dental arch segmental measurements using the digital sliding calipers, which is accurate up to 0.02 mm.

Results: No significant sides' differences with high correlation coefficient were found between the right and left incisal-canine, canine-molar and incisal-molar distances in both dental arches for both genders with males exhibited higher mean values than females in all segmental measurements of the dental arches.

Conclusion: The findings of the present study revealed the symmetrical pattern of dental arches, since statistically the right and left sides showed no significant difference with high correlation coefficient in all measuring segments.

Key words: Dental arch, asymmetry, mixed dentition. (J Bagh Coll Dentistry 2014; 26(2): 138-143).

INTRODUCTION

Although each person shares with the rest of the population a great many characteristics, there are enough differences to make each human being a unique individual. Variations in the size, shape and relationship of the dental, skeletal and soft tissue facial structures are important in providing each individual with his or her own identity [1].

Stedman's medical dictionary defined symmetry as "equality or correspondence in form of parts distributed around a center or an axis, at the two extremes or poles, or on the two opposite sides of the body" [2]. Dental arch asymmetry can be caused by a combination of genetic [1,3] and environmental [3] factors, with skeletal, dental or functional repercussions [1]. In individuals with symmetric development, the slight differences between the right and left sides may be due to external environmental factors such as: thumb sucking, unilateral chewing, loss of contact due to cavities, extraction or trauma [3]. Children can also feature asymmetric dental arches [4] and older individuals tend to have greater arch asymmetry, resulting from lifelong external environmental factors [5].

It is rare to find a totally symmetric individual; therefore, small asymmetries are regarded as normal [6]. Most individuals with normal occlusion may show almost coinciding midlines (deviation smaller than 1 mm), and many can have molar asymmetry greater than 1 mm in transversal and anteroposterior directions [7]. Dental midline deviations greater than 2 mm are easily detected by lay persons, and should therefore be considered when planning orthodontic treatments [8].

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Dental arch asymmetry is a common finding in normal (orthodontically untreated) children [1], but during the mixed dentition, environmental factors may account better for asymmetry because growth and developmental changes are accelerated after the relatively stable period of the deciduous dentition [4,9]. However little is known about dental arch asymmetries in children at the mixed dentition stage, so early diagnosis and treatment of dental arch asymmetry could minimize the need for complex treatment mechanics or asymmetric extractions [10].

Most studies of dento-alveolar asymmetry have used dental models and most often only the maxillary arch using the median raphe as an axis of symmetry. Some of these studies reported some degree of dental arch symmetry even in persons with normal occlusion [3,11]. Hechter [12] analyzed asymmetry of the dental arches in normal and malocclusion subjects and reported greater asymmetry in the mandibular arch for both groups. In addition he found an increase in asymmetry in both arches when malocclusion was present. Adults with missing teeth tend to be more asymmetric than adults with intact dentitions [5]. The purpose of this study was to assess the dental arches asymmetry in a sample of Iraqi children at the mixed dentition stage.

MATERIELS AND METHODS

Sample

The sample consisted of (52) Iraqi children aged 8-9 years at the mixed dentition stage (27 males and 25 females) selected from different primary schools from Baghdad city.

The inclusion criteria of the sample selection were the presence of all the permanent first molars, permanent central and lateral incisors,

deciduous canine, first and second deciduous molars. While the exclusion criteria were chosen to minimize variables influencing asymmetry such as; history of orthodontic treatment or space maintenance, visually apparent inter-proximal caries, history of primary molar or canine extractions, history of dental trauma, restorations or fractures that included the incisal edges of the permanent central incisors, digit habits past the age of 3 years, ectopically erupting first molars, evidence of a syndrome or craniofacial malformation or obvious facial asymmetry .

Methods

Each child was seated on dental chair in upright position asked information about name, age, origin, history of previous orthodontic treatment, maxillofacial surgery and extensive restorative dental treatment. Then they were clinically examined to check their fulfillment for the selection criteria and data recording case sheet was filled for every child. Upper and lower impressions were taken with a perforated metal orthodontic trays using alginate hydrocolloid impression material [13]. Alginate impressions were poured with stone within 1 hour and a base was constructed for each cast using plaster of Paris. Casts were trimmed and numbered for each child.

Certain selected tooth-related points visible in an occlusal view were marked bilaterally with a sharp pencil in the maxillary and mandibular study casts. Great care was taken to ensure that the landmarks were accurately located on the study casts. Three segments on the maxillary and mandibular dental arch were measured using the digital sliding calipers with 0.02 mm. accuracy. The measurements included (Figure 1):

A. Incisal-canine distance (INCD): right and left linear distance from the incisal point to the canine cusp tip.
B. Canine-molar distance (CMD): right and left linear distance from the canine cusp tip to the disto-buccal cusp tip of the first permanent molar.
C. Incisal-molar distance (INMD): right and left linear distance from the incisal point to the disto-buccal cusp tip of the first permanent molar.

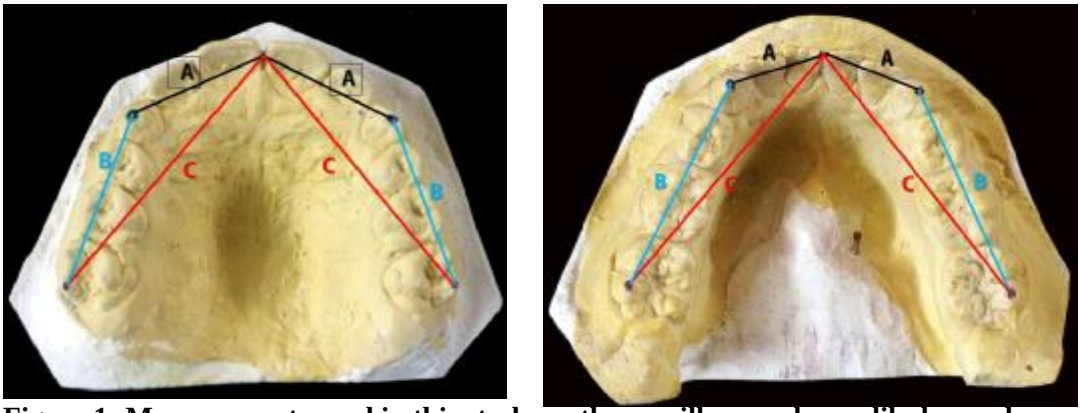

Figure 1: Measurements used in this study on the maxillary and mandibular arches

Statistical analysis

The statistical analyses included the descriptive statistics (means, standard deviations, minimum, maximum, range) and the inferential statistics (paired sample t-test to compare between the right and left sides, Pearson's correlation coefficient to test the relation between both sides and independent sample t-test for comparison between the males and females).

RESULTS

The results in table 1 showed the descriptive statistics of the maxillary dental arch segmental measurements. Generally, male group displayed higher mean values than female group in all measurements. On the other hand, table (2) showed the descriptive statistics of the mandibular dental arch segmental measurements for both genders and also the males recorded higher mean values than females in all measuring distances.

Side difference

As shown in tables 3 and 4, there were no significant differences between the right and left incisor-canine distance (INCD), canine-molar distance (CMD) and incisor-molar distance (INMD) for both genders and dental arches.

Correlation between the right and left sides

The findings in tables 3 and 4 revealed the presence of high significant correlation between right and left sides of maxillary and mandibular segmental measurements (INCD, CMD and INMD) for both genders.

Table 1: Descriptive statistics of maxillary segmental measurements (in mm.) in both genders

Genders	Statistics	INCD		CMD		INMD	
		Right	Left	Right	Left	Right	Left
Males	Mean	20.04	19.81	27.46	27.38	44.59	44.91
	Max.	23.10	22.45	30.82	31.09	48.38	50.23
	Min.	17.06	17.65	23.90	24.44	34.85	41.00
	SD	1.26	1.07	1.39	1.42	2.86	2.10
Females	Mean	18.87	18.69	26.97	26.91	43.27	43.24
	Max.	20.60	20.20	28.88	28.51	45.40	45.45
	Min.	17.40	17.46	24.75	24.40	39.93	40.47
	SD	0.83	0.69	1.03	1.00	1.37	1.25

Table 2: Descriptive statistics of mandibular segmental measurements (in mm.) in both genders

Gender	Statistics	INCD		CMD		INMD	
		Right	Left	Right	Left	Right	Left
Males	Mean	14.45	14.57	28.08	28.08	39.65	39.72
	Max.	15.88	16.05	30.48	30.24	41.94	41.92
	Min.	13.11	13.16	25.10	25.14	36.20	37.20
	SD	0.84	0.78	1.14	1.12	1.56	1.47
Females	Mean	13.81	13.89	27.71	27.67	38.50	38.53
	Max.	16.42	16.07	29.13	28.80	40.50	40.39
	Min.	12.70	12.84	25.50	25.70	36.15	36.08
	SD	0.79	0.78	0.96	0.75	1.23	1.12

Table 3: Paired sample t-test and correlation between right and left sides of maxillary dental arch segmental measurements for both genders

Genders	Dimensions	Right	Left	P- value	Significance	P- value of Correlation coefficient	Significance
Males	INCD	20.04	19.81	0.49	NS	0.00	HS
	CMD	27.46	27.38	0.84	NS	0.00	HS
	INMD	44.59	44.91	0.64	NS	0.00	HS
Females	INCD	18.87	18.69	0.41	NS	0.00	HS
	CMD	26.97	26.91	0.84	NS	0.00	HS
	INMD	43.27	43.24	0.95	NS	0.00	HS

NS: Non-significant (P > 0.05), HS: Highly significant (P < 0.01)

Table 4: Paired sample t-test and correlation between right and left sides of mandibular dental arch segmental measurements for both genders

Genders	Dimensions	Right	Left	P- value	Significance	P- value of Correlation coefficient	Significance
Males	INCD	14.45	14.57	0.58	NS	0.00	HS
	CMD	28.08	28.08	0.99	NS	0.00	HS
	INMD	39.65	39.72	0.86	NS	0.00	HS
Females	INCD	13.81	13.89	0.72	NS	0.00	HS
	CMD	27.71	27.67	0.85	NS	0.00	HS
	INMD	38.50	38.53	0.95	NS	0.00	HS

NS: Non-significant (P > 0.05), HS: Highly significant (P < 0.01)

Genders differences

As there were non-significant differences between right and left sides, the data were collected together and represented as maxillary and mandibular segmental dimensions for male and female groups which were represented in tables 5 and 6.

Independent sample t –test showed significant difference in all maxillary and mandibular segmental measurements with higher mean values in males than females (tables 5 and 6).

Table 5: Descriptive statistics and genders difference of the maxillary segmental measurements

Dimensions	Gender	Mean	SD	Max.	Min.	Range	p-value
INCD	Males	19.92	1.166	23.10	17.06	6.04	0.000
	Females	18.78	0.764	20.60	17.40	3.20	HS
CMD	Males	27.42	1.398	31.09	23.90	7.19	0.05
	Females	26.94	1.011	28.88	24.40	4.48	S
INMD	Males	44.75	2.496	50.23	34.85	15.38	0.000
	Females	43.25	1.300	45.45	39.93	5.52	HS

S: Significant (P < 0.05), HS: Highly significant (P < 0.01)

Table 6: Descriptive statistics and genders difference of the mandibular segmental measurements

Dimensions	Genders	Mean	SD	Max.	Min.	Range	p-value
INCD	Males	14.51	0.809	16.05	13.11	2.94	0.00
	Females	13.85	0.783	16.42	12.48	3.94	HS
CMD	Males	28.08	1.127	30.48	25.10	5.38	0.05
	Females	27.69	0.859	29.13	25.50	3.63	S
INMD	Males	39.69	1.505	41.94	36.20	5.74	0.00
	Females	38.52	1.169	40.50	36.08	4.42	HS

S: Significant (P < 0.05), HS: Highly significant (P < 0.01)

DISCUSSION

Few studies have quantified dental arch asymmetry in children, although asymmetry is reported frequently in adults [4], so the proper diagnosis of asymmetries whether skeletal, dental, or a combination of both is extremely important in order to address the origin of the problem during treatment.

In the present study, an investigation of model analysis attempted to identify and analyze asymmetry in the dental arch segmental measurements at the mixed dentition stage among sample of Iraqi children aged 8-9 years from different primary schools in Baghdad city.

Although each ethnic group has certain characteristics that should not be taken as standards for other areas with the different developmental and ecological foundation [14] , the study and determination of criterion for different ethnic groups is essential to promote accurate diagnosis and planning for orthodontic treatment.

In this study, fixed reproducible control points were selected, which were called the "print" of the arch form as any finger has its unique print, also each arch form has its unique print, the print of the arch form will be presented by the buccal cusp tips and the incisal edges of anterior teeth; in addition, using tooth-related points are less subjected to error when measured more than the alveolar points, which may be affected by the distortion of the gingiva owing to the fit or position of the impression trays. Besides, measurements that taken from a definite cusp tips to a corresponding definite cusp tip are very reliable [15,16].

It is obvious from tables 1 and 2 that the mean values of all maxillary measurements taken for the dental arch segments are larger than that in the mandibular counterpart [15,17-20]; this is consistent with the principle that the maxillary dental arch overlaps the mandibular dental arch.

Dental arch asymmetry (right and left comparison)

In the present study, when the mean values of the right and left incisal-canine, canine-molar and incisal-molar distances were compared using paired sample t-test which showed non-significant differences in both arches and for both genders indicating the symmetrical pattern of maxillary and mandibular dental arches [14,20]. Sawiris [21] measured the buccal segment from canine cusp tip to the disto-buccal cusp tip of second molar of 50 British subjects with class I occlusion and reported that the right side was larger by (0.24 mm.).

Correlation between right and left sides of dental arches

It can be noted that there are high values of correlation coefficient of the relationship between all right and left segmental measurements in both maxillary and mandibular dental arches for both genders (tables 3 and 4). These results give an impression that the dental arches, despite their forms are proportioned in this plane. These proportioned measurements might be attributed to the fact that the teeth are positioned within the alveolar bone which is affected by the dental base, which it rests on [22], this result coincides with

previous studies [23,25] and contradicts with others [26].

Genders difference

In this study, the mean values of dental arch segments are larger in males than that of females (tables 5 and 6) with a high significant difference in the incisor-canine and incisor-molar distances and significant difference in the canine-molar distance in both arches. In most studies, the arch dimensions depended on the gender of the subjects, with smaller values in females [14,20,27]. Generally, the dental arches in males grow larger and for longer time than in females during both the preadolescent and adolescent periods [23,24]. However, differences between females and males were shown not to be systematic across all studies [15,28,29].

Another finding observed from table 5, that the widest range of reading was in the longest distance measured which is the incisor-molar distance in the maxillary arch in the male group about (15.38 mm.) with high standard deviation about (2.496 mm.); this may be attributed to the midline diastema (ugly duckling stage) in the maxillary arch along with the overlapping of permanent lateral incisors which appear at the age 8-9 years and persist 3-4 years [30], and recorded only in male group may be because the eruption time in female an average approximately 5 months earlier than males [31].

As conclusions;

1. There were no significant sides' differences with high correlation coefficient both in maxillary and mandibular segmental measurements which indicate the symmetrical pattern of the dental arches for both male and female sample.
2. Male sample possesses higher mean values in all segmental measurements than the female sample.
3. Maxillary segmental dimensions show higher values than the mandibular.

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