



## Prevalence of Median Diastema in a Sample of Iraqi Population Concerning on the Mesiodistal Width of Anterior Teeth and Frenal Attachment as Etiological Factors

Zainab M Kadhom<sup>1\*</sup> and Mays M. Sadoon<sup>2</sup>

<sup>1</sup>Assistant Lecturer, Department of Orthodontics, College of Dentistry, University of Baghdad, Baghdad, Iraq

<sup>2</sup>Dentist, Ministry of Health, Iraq

\*Corresponding e-mail: [schati1981@yahoo.com](mailto:schati1981@yahoo.com)

### ABSTRACT

**Aim:** The purpose of this study was to evaluate the prevalence of mid line diastema between the group of Iraqi students of Dentistry College in Baghdad University, and to determine the etiological factors of this diastema whether it is due to height frenal attachment or due to the discrepancy in the width of the anterior teeth as etiological factors or/and another cause and to determine the gender difference. **Materials and methods:** Out of 600 students aged between 18-23 years were clinically examined; only 41 students (30 females and 11 males) fulfilled the inclusion criteria and were having diastema. Maxillary median diastema and mesiodistal width of the sex upper anterior teeth was measured directly (intra orally) with stainless steel vernier calipers. **Results:** Results showed that about 30 females and 11 males were only having maxillary midline diastema from the total sample. There was no significant difference between males and females concerning the width of maxillary midline diastema. In both sexes, the mesiodistal width of all anterior teeth was nearly equal except the maxillary left lateral incisors which were significantly wider in females than in males. **Conclusion:** In dentally aware societies the presence of diastema was un-aesthetic so many students improved such appearance by orthodontic treatment or restorative veneer, therefore Iraqi students had less prevalence of maxillary diastema than other studies. Females express more prevalence of maxillary midline diastema than male. Mesiodistal width of upper anterior teeth is nearly within the normal range of Iraqi norms. Another etiological factor such as hereditary, genetic or oral habit can be considered as a cause of diastema in our sample who have diastema without high frenal attachment or tooth width discrepancy.

**Keywords:** Median diastema, Frenal attachment, Mesiodistal width, Etiological factors

### INTRODUCTION

Diastemas are spaces between two or more consecutive teeth which can occur anywhere in the upper or lower arches, caused by many etiologic factors [1]. Maxillary midline diastema is a common esthetic problem in mixed and early permanent dentitions [2]. Median diastema is caused by many etiological factors like the disproportion between teeth sizes and dental arches length and abnormal labial frenum attachment between central incisors [3,4]. Moreover, congenitally missing or extracted incisors or canine impaction, peg-shaped lateral incisors are observed [5-7]. Ethnic background: black people are more than twice at a risk to have a median diastema than white people which were regarded as other etiological factors [6,8].

Richardson, et al., found that the incidence of median diastema varies greatly with age and race, he saw that the maxillary median diastema is higher in black than in white people and higher in males than in females of the same age and race [9]. At the site of the median diastema, there was an abnormal maxillary labial frenum attached to soft and bony tissues between incisors which can be related with this diastema [4].

Median diastema was closed either to improve the esthetic situation or to provide enough space for permanent canines to erupt. A median diastema greater than 2 mm was unlikely to close spontaneously while in many children small maxillary median diastema was required for orthodontic treatment as it tends to close spontaneously when the canines erupt. The anterior space closure occurs by mesio-distal movement either by removable or fixed appliance [10].

When the tooth size discrepancy occurs the ideal occlusion is impossible [11,12]. Also, malocclusion can be caused

by the differences in the tooth sizes [13]. Tooth size discrepancy has been defined as disproportion in the sizes of teeth between the maxillary and mandibular arches. The teeth must be proportional in size for good occlusion. An ideal occlusion cannot be attained if teeth are mismatched and unusually large teeth in one arch compared to the other [3]. The present study was made to evaluate the prevalence of mid line diastema between the group of Iraqi students of Dentistry College in Baghdad University and relate it with high frenal attachment or/and the discrepancy in the width of the anterior teeth as etiological factors.

#### **PATIENTS AND METHOD**

Total of 600 students was clinically examined; only 41 students (30 females and 11 males) fulfilled the inclusion criteria and were having diastema. The sample included undergraduate students in the College of Dentistry, University of Baghdad. The research project was confirmed by the Research Ethics Committee. All of them were Iraqis Arabs with an age ranged between 18-23 years. The following criteria were used in the selection of the total sample:

- All subjects were Iraqi Arabs in origin, ethnicity verified by patient histories, they should have no loss of anterior teeth materials due to caries, fracture, no gross or any restorations, build ups, crowns or congenital (peg shaped lateral incisors) or developmental defects
- Full set of permanent teeth [14]
- The patients should have no systemic disease, no midline pathology, and obvious dental or dent facial abnormalities and sever periodontal disease were excluded
- A sample includes different skeletal classes determined clinically by two fingers method and different dental classes determined clinically by examination of molar classification, canine classification, and incisors classification according to British Standards incisor classification [15-18]
- No history of extraction, impacted teeth, of orthodontic treatment and no interproximal stripping was performed or obvious loss of anterior teeth materials

Each individual was seated on a dental chair and asked information about name, age, origin, history of orthodontic treatment and previous extraction. The anteroposterior skeletal relationship and dental relationship (molar, canine and incisors relationships) were assessed [15-18]. Maxillary median diastema was measured with stainless steel vernier calipers directly (intra orally) at the narrowest portion because it gives the real size of median diastema, the narrowest portion will resemble the real size of median diastema [19,20]. Moreover, we measured the mesiodistal width of the upper anterior teeth directly (intra orally) and separately (each tooth was measured alone) [21-25]. Usually, the level of vernier is parallel to the incisal edge level of the tooth that is being measured and it is important to measure every tooth from its highest contour [10]. The presence of high labial frenum attachment was checked by stretching of the upper lip and frenum where the upper lip was distending outward and upward, so the tissue between central incisors moves and blanched [26].

#### **Statistical Analysis**

All the data of the sample were collected and subjected to computerized statistical analysis using SPSS version 15 (2006) computer programs. The statistical analysis included:

#### **Descriptive statistics:**

- Mean
- Standard deviation (SD)
- Frequency and percentage
- Minimum and maximum values

#### **Inferential statistics:**

- Person correlation coefficient test
- Independent samples t-test for the comparison between both genders

In the statistical evaluation the following levels of significance were used:

- $p > 0.05$  Non-significant (NS)
- $0.05 \geq p > 0.01$  \*Significant (S)
- $\geq p > 0.001$  \*\*Highly significant (HS)
- $p \leq 0.001$  \*\*\*Very highly significant (VHS)
- $0.4 \geq r$  weak relation
- $0.4 \leq 0.7$  moderate relation
- $0.7 \leq r$  strong relation

## RESULTS

In this study, 600 subjects were selected randomly and examined clinically, all of them were in different skeletal and dental classes. In this study from 413 females only 30 females (5%) and from 187 males only 11 males (1.833%) were having maxillary midline diastema (Table 1).

**Table 1 Frequency distribution and percentage of the cases with and without midline diastema in both genders**

Genders		With Diastema	Without Diastema	Total
Males	N	11	176	187
	%	1.833%	29.333%	31.167%
Females	N	30	383	413
	%	5.000%	63.833%	68.833%
Total	N	41	559	600
	%	6.833%	93.167%	100.000%

As seen in Table 2 it is clear that there was no significant correlation (weak relation) between the midline diastema and width of upper anterior teeth in both sexes. The correlation coefficient in males was ( $r=0.175$ ), while in females was ( $r=0.008$ ).

**Table 2 The relation between median diastema and upper anterior teeth width in both genders**

Variables	Males	Females
R	0.175	0.008
p-value	0.606	0.965

From 30 females there were only 4 females having a high frenal attachment as seen in Table 3, while the males having no high frenal attachment.

**Table 3 The percentage of the presence of high frenal attachment in females**

Frenal attachment	With	Without	Total
N	4	26	30
%	13.33%	86.67%	100.00%

The mean value of the maxillary midline diastema width in both males and females was nearly equal, there was no significant difference regarding this variable. On the other hand, the mean values of the mesio-distal width of all anterior teeth were nearly equal in both sexes except the maxillary left lateral incisors width which was higher in females than in males with a significant difference regarding this variable. While there was no significant difference for the remaining upper anterior teeth width in both sexes (Table 4).

**Table 4 Descriptive statistic and gender differences for the width of maxillary midline diastema and upper anterior teeth**

Variables	Males (N=11)		Females (N=30)		Gender difference	
	Mean	S.D.	Mean	S.D.	t-test	p-value
Width of diastema	1.264	0.383	1.200	0.551	0.352	0.727
MDR3	7.718	0.596	7.970	0.573	-1.234	0.225

MDR2	6.645	0.890	6.707	0.603	-0.252	0.802
MDR1	8.564	0.686	8.630	0.489	-0.345	0.732
MDL1	8.418	0.688	8.543	0.442	-0.688	0.496
MDL2	6.264	0.512	6.830	0.745	-2.320	0.026*
MDL3	7.727	0.510	7.723	0.565	0.020	0.984
Sum of width of anterior	45.336	2.720	46.403	2.109	-1.327	0.192

MDR3: Mesiodistal width of upper right canine; MDR2: Mesiodistal width of upper right lateral incisor; MDR1: Mesiodistal width of upper right central incisor; MDL1: Mesiodistal width of upper left central incisor; MDL2: Mesiodistal width of upper left lateral incisor; MDL3: Mesiodistal width of upper left canine

## DISCUSSION

This was not the first Iraqi study conducted to evaluate the contributing factors for median diastema but the first one concern the mesio-distal width of the anterior teeth as an etiological factor [20]. It is clear that the achievement of acceptable orthodontic results depends firstly on correct diagnosis and accurate case evaluation. Moreover, the stability of the treatment results depends on good assessment [27]. An enlarged labial frenum has been held responsible for most persistent diastemas, but its etiological part represents only a small case [28].

The sample selected in this study was composed of young adults 18-25 years because most of the growth of facial area could be considered to be complete after the age of 18 years, with a full set of permanent teeth [14,29]. From the results in Table 1, it has been shown that only 30 females from 413 and only 11 males from 187 males were having maxillary midline diastema, this means that the diastema in female was more prevalent than in males and agrees with Richardson, et al., and other many studies, while Steigman and Weissberg, Nainar and Gnanasundaram and Al-Huwaizi, et al., referred that the prevalence of maxillary midline diastema is more in males [6,9,30-35]. These differences in our study may be due to race, age, and sample size differences. Generally, maxillary midline diastema occurs in approximately 50% of children between 6-8 years of age and it decreases in its size and prevalence with age [28].

Although the tooth-size discrepancies is one of the main causes for maxillary midline diastema but there was no significant correlation between the presence of maxillary midline diastema and width of upper anterior teeth, so the width of upper anterior teeth in the present study did not act as etiological factor of maxillary midline diastema because there was no tooth size discrepancy and the width of upper anterior teeth in our study were nearly equal or within the normal range of the width of upper anterior teeth for Iraqi norms in both sex [36,37] (Table 2).

In this study, 30 females were having diastema out of which there were only 4 females with high frenal attachment while there were no males having high frenal attachment this may be because of a sample size of the males which is smaller than the female's size (Table 3). The high frenal attachment had been considered in many studies as an etiological factor of median diastema as in our study (in 4 females with high frenal attachment) and this comes in agreement with Sękowska and Chałas and Angle, but Teit showed that the median diastema is an affect but not a cause for the incidence of diastema [4,30,38,39]. More over there was no strong correlation between abnormal frenum and the presence of median diastema [6,28,33]. According to this study, the low frenal attachment was not the major etiological factor causing midline spacing.

In both sexes there was no significant difference regarding the mean value of both width of midline diastema this disagrees with Sękowska and Chałas and the width of upper anterior teeth and this disagrees with Mehdi who refers to the presence of sexual difference and the teeth in males which possess a higher mean values in width than that of females, except in the mean value of mesio-distal width of upper left lateral incisor which is wider in females this comes in contrast with Mehdi who found this tooth displayed a non-significant difference in both gender [28,37,40].

The morphological variability of the maxillary lateral incisor. This tooth frequently shows a reduction in size, and various shape alterations, for example, peg-shaped, barrel shaped, cone-shaped, and canine shaped [41]. These gender differences in our present study may be due to the small sample size of males (Table 4). The prevalence of a genetic factor contributes to midline diastema expression, so heredity may play an important role than environment in the development of such malocclusions [6].

## CONCLUSION

- In dentally aware societies the presence of diastema was an aesthetic so many students improved such appearance by orthodontic treatment or restorative veneer, therefore Iraqi students had less prevalence of

maxillary diastema than other studies, add to that the small sample size and racial with age differences were used in this study

- Females express more prevalence of maxillary midline diastema than a male who has no high frenal attachment
- The width of maxillary midline diastema and the width of upper anterior teeth are nearly equal in both sexes
- The mesiodistal width of upper anterior teeth is nearly within the normal range of Iraqi norms, therefore it can't be regarded as etiological factors in the present study
- Other etiological factors such as hereditary, genetic or oral habit are considered as a causes of diastema in our sample who have diastema without high frenal attachment or tooth width discrepancy

#### DECLARATIONS

##### Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

#### REFERENCES

- [1] Bishara, Samir E. "Management of diastemas in orthodontics." *American Journal of Orthodontics and Dentofacial Orthopedics*, Vol. 61, No. 1, 1972, pp. 55-63.
- [2] Koorra, Kiran, M. S. Muthu, and Prabhu V. Rathna. "Spontaneous closure of midline diastema following frenectomy." *Journal of Indian Society of Pedodontics and Preventive Dentistry*, Vol. 25, 2007, pp. 23-26.
- [3] Bolton, Wayne A. "Disharmony in tooth size and its relation to the analysis and treatment of malocclusion." *The Angle Orthodontist*, Vol. 28, 1958, pp. 113-30.
- [4] Edwards, John G. "The diastema, the frenum, the frenectomy: a clinical study." *American Journal of Orthodontics and Dentofacial Orthopedics*, Vol. 71, 1977, pp. 489-508.
- [5] Keene, Harris J. "Distribution of diastemas in the dentition of man." *American Journal of Physical Anthropology*, Vol. 21, 1963, pp. 437-41.
- [6] Nainar, SM Hashim, and N. Gnanasundaram. "Incidence and etiology of midline diastema in a population in south India (Madras)." *The Angle Orthodontist*, Vol. 59, No. 4, 1988, pp. 277-282.
- [7] Walther, DP. "Orthodontic notes: malocclusion due to local cases." 1967, p. 73.
- [8] Lavelle, C. L. B. "The distribution of diastemas in different human population samples." *European Journal of Oral Sciences*, Vol. 78, 1970, pp. 530-34.
- [9] Richardson, Elisha R., et al. "Biracial study of the maxillary midline diastema." *The Angle Orthodontist*, Vol. 43, No. 4, 1973, pp. 438-43.
- [10] Proffit, WR. "Contemporary orthodontics. 3rd Ed. Mosby year book." 2000, p. 10-12.
- [11] Fattahi, Hamid Reza, Hamid Reza Pakshir, and Zohreh Hedayati. "Comparison of tooth size discrepancies among different malocclusion groups." *The European Journal of Orthodontics*, Vol. 28, 2006, pp. 491-95.
- [12] Othman, Siti, and Nigel Harradine. "Tooth size discrepancies in an orthodontic population." *The Angle Orthodontist*, Vol. 77, No. 4, 2007, pp. 668-74.
- [13] Akyalçın, Sercan, et al. "Bolton tooth size discrepancies in skeletal Class I individuals presenting with different dental angle classifications." *The Angle Orthodontist*, Vol. 76, No. 4, 2006, pp. 637-43.
- [14] Björk, A., A. A. Krebs, and B. Solow. "A Method for Epidemiological Registration of Malocclusion." *Acta Odontologica Scandinavica*, Vol. 22, 1964, pp. 27-41.
- [15] Foster, TD. "A textbook of Orthodontic. 2nd Ed. Blackwell Scientific Publications 1985.
- [16] Angle, EH. *Dental Cosmo*, Vol. 41, No. 3, 2018, pp. 48-264.
- [17] Jones, M.L., and Oliver, R.G. "Walther and houston's orthodontic notes." John Wright, 2000, p.19.

- [18] British Standards Institution. *British standard glossary of dental terms*. British Standards Institution, 1983.
- [19] Hamad, Nail Hasan. "Incidence of Maxillary Midline Diastema in Iraqi Students in Baghdad City." *Almustansiriyah Journal of Pharmaceutical Sciences*, Vol. 15, No. 1, 2015.
- [20] Sullivan, Terence C., David L. Turpin, and Jon Årtun. "A postretention study of patients presenting with a maxillary median diastema." *The Angle Orthodontist*, Vol. 66, No. 2, 1996, pp. 131-38.
- [21] Mills, Loren F. "Arch width, arch length, and tooth size in young adult males." *The Angle Orthodontist*, Vol. 34, No. 2, 1964, pp. 124-29.
- [22] Smith, Stephanie S., Peter H. Buschang, and Etsuko Watanabe. "Interarch tooth size relationships of 3 populations: "Does Bolton's analysis apply?"" *American Journal of Orthodontics and Dentofacial Orthopedics*, Vol. 117, 2000, pp. 169-74.
- [23] Kinaan, BK. "Simple combined dental lathe and model trimming machine." *Iraqi Dental Journal*, Vol. 15, 1990, pp. 4-9.
- [24] Al-Hassany ZR. "Relation and alignment of anterior teeth with class I occlusion." Master thesis, 1995.
- [25] Vadavadagi, Suneel V., et al. "Variation in size and form between left and right maxillary central incisor teeth." *Journal of International Oral Health*, Vol. 7, No. 2, 2015, pp. 33-36.
- [26] Dewel, B. F. "The normal and the abnormal labial frenum: clinical differentiation." *The Journal of the American Dental Association*, Vol. 33, No. 5, 1946, pp. 318-29.
- [27] Graber, Lee W., et al. *Orthodontics: current principles and techniques*. Elsevier Health Sciences, 2016.
- [28] Huang, Wen-Jeng, and Curtis J. Creath. "The midline diastema: a review of its etiology and treatment." *Pediatric Dentistry*, Vol. 17, No. 3, 1995, pp.171-79.
- [29] Graber, Touro M. *Orthodontics-principles and practice. 3rd*. WB Saunders, 1988, pp. 55-60.
- [30] Sękowska, A., and R. Chałas. "Diastema size and type of upper lip midline frenulum attachment." *Folia Morphologica*, Vol. 76, 2016, pp. 501-05.
- [31] Oji, C, Obiechina, AE. "Diastema in Nigerian society." *Odonto-Stomatologie Tropicale*, Vol. 17, No. 68, 1994, pp. 4-6.
- [32] Athumani, A. P., and E. A. Mugonzibwa. "Perception on diastema medialis (mwanya) among dental patients attending Muhimbili National Hospital." *Tanzania Dental Journal*, Vol. 12, No. 2, 2006, pp. 50-57.
- [33] Al-Hashimi, Hadeel Ali Hussein. "Significance of various etiological factors as an indicator for the persistence of median diastema." *Al-Rafidain University College for Sciences*, Vol. 30, 2012, pp. 139-56.
- [34] Steigman, S., and Y. Weissberg. "Spaced dentition: an epidemiologic study." *The Angle Orthodontist*, Vol. 55, No. 2, 1985, pp. 167-76.
- [35] Al-Huwaizi, Akram Faisal, Wael S. Al-Alousi, and Ausama A. Al-Mulla. "The dental midline at 13 year of age." *Journal of the College of Dentistry*, Vol. 15, 2003, pp. 1-7.
- [36] Oesterle, Larry J., and William Craig Shellhart. "Maxillary midline diastemas: a look at the causes." *The Journal of the American Dental Association*, Vol. 130, 1999, pp. 85-94.
- [37] Mehdi, BS. "Determination of normal overall ratio and the effects of premolar extractions on the overall tooth-size discrepancies in Iraqi sample." 2011.
- [38] Sicher, Harry. *Oral anatomy*. CV Mosby Company, 1965.
- [39] Angle, Edward Hartley. *Treatment of Malocclusion of the Teeth: Angle's System. Greatly Enl. and Entirely Rewritten, with Six Hundred and Forty-one Illustrations*. SS White dental manufacturing Company, 1907, pp. 103-04.
- [40] Tait, Cecil H. "The median frenum of the upper lip and its influence on the spacing of the upper central incisor teeth." *Dent Cosmos*, Vol. 76, 1934, pp. 991-92.
- [41] Kondo, Shintaro, Grant Townsend, and Masanobu Matsuno. "Morphological variation of the maxillary lateral incisor." *Japanese Dental Science Review*, Vol. 50, No. 4, 2014, pp. 100-07.