Medline diastema of orthodontic patients - Prevalence and Etiology in Erbil Population - A cross-sectional study

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ABSTRACT

To investigate the prevalence and etiological factors that contribute in midline diastema in Erbil population among different age groups and genders. A sample of (ex: 1021 orthodontic patients (537 males and 484 females) were randomly selected from Erbil population attending to orthodontic department of khanzad polyclinic teaching center (General directorate of hawler / Ministry of health/ Kurdistan region- Iraq) during 2018-2019 period. Aged (13-35 years) with mean age ± SD was 19.6 ± 4.8 years, with a median of 19 years. The examination included patient history taking, intraoral examination, photograph, intraoral periapical radiography of incisors area and panoramic radiographic. Diastema consider positive when the space between central incisors is 0.5mm and more, width was measured clinically used digital Vernier calipers at one millimeter above the incisors edge. In this study the prevalence of midline diastema was 23.2%, location was in the maxilla (97%), in mandible (1.3%) and in both was (1.7%). The prevalence of midline diastema differs significantly between the age groups (p < 0.001). The highest prevalence (55.8%) was among patients aged ≥ 30 years, and it was also high (37.7%) among those aged < 15 years. The prevalence among females (26.4%) was significantly higher than the prevalence (20.3%) among males (P= 0.020). The main causes of midline diastema in females was thumb sucking and missing lateral incisors (14.1% and 12.5% respectively) and in males was high labial frenum and supernumerally teeth (39.4% and 30.3% respectively). The prevalence of diastema in Erbil City (Kurdistan regional- Iraq) area was 23.2%, the location mostly in maxilla (97%). The prevalence of diastema in females more than males.

INTRODUCTION

Diastema in Greek means interval, gap or space between two or more adjacent teeth. Spacing of upper or lower central incisors is commonly known as midline diastema. It has been defined as a natural spacing between the central incisors occurring more frequently on the upper teeth (Jacob, 1998).

(Keene, 1963) found the prevalence of midline diastema in the full permanent dentition amounting to (14.8%) in maxilla, and (1.6%) in case of mandible diastema. According to (Lavelle, 1970) maxillary midline diastema incidence in
adult’s amounts from 1.6% to 25.0%, and according to (Proffit, 2009) it is 6.0% in adolescents and adults. The median diastema occurs more frequently in the maxillary than mandibular arch (Phulari, 2011), and it may be accompanied by general diastemata (Proffit, 2009). The epidemiological studies show that the highest percentage is observed in Africans race in comparison to Caucasians race (Lavelle, 1970; Shashua and Artun, 1999).

Recently, we have been a lack of information in the literature on the prevalence and etiology of midline diastema in Erbil population -Kurdistan Region-Iraq. The main purpose of this research was to investigate the prevalence and etiological factors of midline diastema in Erbil population among different age groups and genders.

MATERIALS AND METHODS

A sample of (ex: 1021 orthodontic patients (537 males and 484 females) were randomly selected from Erbil population attending to orthodontic department of khanzad polyclinic teaching center (General directorate of hawler / Ministry of health/ Kurdistan region- Iraq) during the period extended from 2018-2019 year. Orthodontic patient age was (13-35 years) with mean age ± SD was 19.6 ± 4.8 years, with a median of 19 years, this is the preferred age range for orthodontic treatment.

Table 2: Location of the midline diastema.

<table>
<thead>
<tr>
<th>Location</th>
<th>No.</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maxilla</td>
<td>230</td>
<td>(97.0)</td>
</tr>
<tr>
<td>Mandible</td>
<td>3</td>
<td>(1.3)</td>
</tr>
<tr>
<td>Both</td>
<td>4</td>
<td>(1.7)</td>
</tr>
<tr>
<td>Total</td>
<td>237</td>
<td>(100.0)</td>
</tr>
</tbody>
</table>

The examination included patient’s history taking (including family, trauma, medical and dental history), intraoral examination using direct vision (sometime using dental mirror) under dental unit light, intraoral periapical radiography of incisors area, panoramic radiography (especially with that related to ectopic eruption of canine or missing lateral incisors), photography in cases related to identification of midline pathology. The examination all was done by same authors. Patients with visible space between maxillary or mandibular central incisors were clinically examined by measuring the width with digital Vernier calipers at 1 mm above the incisors edge. The present of a 0.5mm or more space between the maxillary or mandibular central incisors was considered as positive diastema patient.

To treat the midline diastema properly, very well diagnosis of the etiology of midline diastema and a relevant to the specific etiological factor is necessary. Timing of the treatment is important to achieve satisfactory results (Abu-Hussein et al., 2014; Azzaldeen and Muhamad, 2015; Abu-Hussein et al., 2015).

Figure 1: Pie chart showing Prevalence of diastema among Erbil population.
Table 3: Prevalence of diastema by age and gender.

<table>
<thead>
<tr>
<th>Age</th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;15</td>
<td>57</td>
<td>94</td>
<td>151</td>
</tr>
<tr>
<td>15-19</td>
<td>75</td>
<td>330</td>
<td>405</td>
</tr>
<tr>
<td>20-24</td>
<td>67</td>
<td>275</td>
<td>342</td>
</tr>
<tr>
<td>25-29</td>
<td>14</td>
<td>66</td>
<td>80</td>
</tr>
<tr>
<td>≥ 30</td>
<td>24</td>
<td>19</td>
<td>43</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gender</th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>109</td>
<td>428</td>
<td>537</td>
</tr>
<tr>
<td>Female</td>
<td>128</td>
<td>356</td>
<td>484</td>
</tr>
</tbody>
</table>

The prevalence of diastema was 23.2% as presented in Figure 1. It is evident in Table 2, that in almost all the patients the location of the diastema was in the maxilla, either alone (97%) or in both the maxilla and mandible (1.7%). It is evident in Table 3 that the prevalence of diastema differs significantly between the age groups (p < 0.001). The highest prevalence in this study (55.8%) was among patients aged ≥ 30 years, and it was also high (37.7%) among those aged < 15 years, while relatively low rates (< 20%) were observed among patients aged 15-29 years. So there is no consistent pattern. The prevalence of midline diastema in this study among females (26.4%) was significantly higher than the prevalence (20.3%) among males (p = 0.020).

The main causes of diastema are presented in Table 4 as follows: high labial frenum (34.2%), supernumerally teeth (23.6%), thumb sucking (10.5%), missing lateral incisors (10.1%), peg shape lateral incisors (6.3%) and Dento-alveolar disproportion (4.6%). The other rare causes are presented in Table 4.

Nearly significant association was detected between the causes of diastema and gender (P= 0.056). It is worth to mention that the proportions of males with high labial frenum (39.4%) and super numerally teeth (30.3%) were higher than those of females (29.7% and 18.0% respectively), while the proportions of thumb sucking and missing lateral incisors among females (14.1% and 12.5% respectively) were higher than those among males (6.4% and 7.3% respectively).
Table 4: Etiological factors of diastema among the gender.

<table>
<thead>
<tr>
<th>Etiological Factor</th>
<th>Male No.</th>
<th>Male (%)</th>
<th>Female No.</th>
<th>Female (%)</th>
<th>Total No.</th>
<th>Total (%)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>High labial frenum</td>
<td>43</td>
<td>(39.4)</td>
<td>38</td>
<td>(29.7)</td>
<td>81</td>
<td>(34.2)</td>
<td></td>
</tr>
<tr>
<td>Super numerally teeth (MD)*</td>
<td>33</td>
<td>(30.3)</td>
<td>23</td>
<td>(18.0)</td>
<td>56</td>
<td>(23.6)</td>
<td></td>
</tr>
<tr>
<td>Thumb sucking</td>
<td>7</td>
<td>(6.4)</td>
<td>18</td>
<td>(14.1)</td>
<td>25</td>
<td>(10.5)</td>
<td></td>
</tr>
<tr>
<td>Missing lateral incisors</td>
<td>8</td>
<td>(7.3)</td>
<td>16</td>
<td>(12.5)</td>
<td>24</td>
<td>(10.1)</td>
<td></td>
</tr>
<tr>
<td>Peg shape lateral incisors</td>
<td>2</td>
<td>(1.8)</td>
<td>13</td>
<td>(10.2)</td>
<td>15</td>
<td>(6.3)</td>
<td></td>
</tr>
<tr>
<td>Dento-alveolar Disproportion lip biting</td>
<td>5</td>
<td>(4.6)</td>
<td>6</td>
<td>(4.7)</td>
<td>11</td>
<td>(4.6)</td>
<td>0.056*</td>
</tr>
<tr>
<td>Mouth breathing</td>
<td>2</td>
<td>(1.8)</td>
<td>4</td>
<td>(3.1)</td>
<td>6</td>
<td>(2.5)</td>
<td></td>
</tr>
<tr>
<td>Family history</td>
<td>2</td>
<td>(1.8)</td>
<td>2</td>
<td>(1.6)</td>
<td>4</td>
<td>(1.7)</td>
<td></td>
</tr>
<tr>
<td>Tongue thrust</td>
<td>1</td>
<td>(0.9)</td>
<td>2</td>
<td>(1.6)</td>
<td>3</td>
<td>(1.3)</td>
<td></td>
</tr>
<tr>
<td>Micro-dontia</td>
<td>1</td>
<td>(0.9)</td>
<td>2</td>
<td>(1.6)</td>
<td>3</td>
<td>(1.3)</td>
<td></td>
</tr>
<tr>
<td>Macro-glossia</td>
<td>2</td>
<td>(1.8)</td>
<td>1</td>
<td>(0.8)</td>
<td>3</td>
<td>(1.3)</td>
<td></td>
</tr>
<tr>
<td>Ectopic migration of canine</td>
<td>1</td>
<td>(0.9)</td>
<td>1</td>
<td>(0.8)</td>
<td>2</td>
<td>(0.8)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>109</td>
<td>(100.0)</td>
<td>128</td>
<td>(100.0)</td>
<td>237</td>
<td>(100.0)</td>
<td></td>
</tr>
</tbody>
</table>


The main purpose in this study was to determine the prevalence and etiological factors contributed to midline diastema (High labial frenum, Super numerally teeth, Missing lateral incisors, Peg shape lateral incisors, Dento-alveolar Disproportion, Habits (Mouth breathing; Thumb sucking; Tongue thrust and Lip biting), Family history, Micro-dontia, Macro-glossia, Ectopic migration of canine, ankylose central incisor), in different age groups and genders. Ages ranged from (13 - 35 years) is the preferred age range for orthodontic treatment of midline diastema, patients under 13 years were excluded to avoid cases of midline diastema due to the normal stages of development (Ugly daggie stage), patients above 35 years were excluded to avoid cases of midline diastema due to migration of teeth and progressive periodontal diseases (Hashim et al., 1989).

The prevalence of diastema in this study was 23.2%. The prevalence among females (26.4%) was significantly higher than that among male (20.3%) (P= 0.020), the prevalence was considerably same as found in Saudi nationalities (23%) (Luqman et al., 2011), and less than found in Kuwait (26.8%) (Enezl et al., 2002), Baghdad City (28%) (Al-Rabii and Hadi, 2013), adolescent Nigerian (37%) (Oesterle and Shellhart, 1999). More than found in Turkish population (4.5%) (Mevluteclikoglu and Yavuz, 2017), United Kingdom of Caucasian (3.4%) (Lavelle, 1970), Pakistan (12.59%) (Hamedullahjan and Naureen, 2010), and south India (1.6%) (Nainar and Gnanasundaram, 1989), this differences in findings may be attributed to the increased number of factors contributing to midline diastema or to genders, race differences and hereditary factors.

Midline diastema prevalence in this study was 23.2% (maxillary 97%, mandibular 1.3%, and in both the maxilla and mandible 1.7%). This can be comparable with result found in Baghdad City (maxillary 22.5%, mandibular 2.3% and both arches 3.2%) (Al-Rabii and Hadi, 2013), in Tanzanians population, they found the incidence to be (26%, 11% and 8% for maxillary, mandibular, and both respectively) (Mugonzibwa and Athumani, 2006). This difference in the midline diastema location may be attributed to the difference in inclusion criteria, population races, sampling technique or genetic predisposition factors.

The prevalence of diastema in this study was differs significantly between the age groups (P < 0.001). The highest prevalence was (55.8%) among patients aged ≥ 30 years, and it was also high (37.7%) among those aged < 15 years. Comparable with that found in Saudi Arabia (20-25 years) (Luqman et al., 2011). This may be attributed to diastema spacing could be reduced through the mesial drifting of permanent teeth following the eruption of third molars. This could explain the reduction in the frequency of...
midline diastema in ages (25 year) (Luqman et al., 2011).

The prevalence among female’s patients (26.4%) was significantly higher than the male patients (20.3%) (P= 0.020) in this study, similar to that found in Pakistan population (Hamedullahjan and Naureen, 2010) and to that in Baghdad City Hamad and Nail (2015). But differ than (the incidence of male was more than female) found in Saudi Arabia (Luqman et al., 2011). This may be attributed to the high level of cosmetic concern in that female’s gender predisposing them to visit the orthodontist more frequently or could be attributed to genetic, family factors or hereditary (Hamedullahjan and Naureen, 2010; Hamad and Nail, 2015).

There was allot of etiological contributing factors responsible in the development of midline diastema have been reported and discussed widely in the literature. Till now There is no agreement that single factors could be the precise etiological factor (Abu-Hussein et al., 2014).

In this study the most common etiology effecting (39.4%) of subjects was high labial frenum attachment, this came similar to that found by Ferguson and Rix (1983) and (Ross et al., 1990). The worth mansion frequency of high frenum attachment earlier theory that it might be the cause of diastema but now a day this fact is not free of controversies that high frenum isn't the main cause but could be contributed to maxillary midline diastema (Tait, 1934; Furuse et al., 2007), (30.3%) was Mesiodens supernumerily tooth among males, thumb sucking and missing lateral incisors among females (14.1% and 12.5% respectively), this might comparable with that found by (Luqman et al., 2011; Al-Zahrani, 1992; Hamedullahjan and Naureen, 2010).

As we mansion previously, there is many factors that contributed in midline diastema such as hypodontia, macro-glossia, anchylose central incisors, dentoalveolar discrepancy and ectopic canine eruption. Midline alveolar bone clefts also could be considered as contributing factors of midline diastema (Jr and Williams, 1968; Kotysheva et al., 2018). The difficulties for orthodontist is whether trying to close, open or redistribute the space. Closing space by orthodontist may eliminates the need for prosthetic rehabilitation but may there is an aesthetics or/and function problems especially in case of missing lateral incisors. This was depending on many factors such as amount of over-jet, lip support status, crown color, shape and root position. If all these factors are unfavorable, so opening space and prosthetic replacement will be the best choice (Chay and Ho, 2000).

This study may not detect the exacting etiology of Midline diastema. Future studies need to detect the exacting single etiological factors correlation of midline diastema with a more purified sampling technique (Individual frequency of some observed etiological factor could be the reasons for this. Furthermore, Bolton’s discrepancy, extractions, variable size of pre-maxilla and periodontal problems must be taken into consideration (Hamedullahjan and Naureen, 2010).

CONCLUSIONS

In this study the prevalence of diastema in Erbil population (Kurdistan Region-Iraq) area was 23.2%. The location of the diastema was in the maxilla (97%), in mandible (1.3%) and in both was (1.7%). The highest prevalence of diastema (55.8%) was among patients aged ≥ 30 years, and it was also high (37.7%) among those aged < 15 years. The prevalence among females was (26.4%) significantly higher than that in males (20.3%). Main causes of diastema in females was thumb sucking and missing lateral incisors. The main causes of diastema in males was high labial frenum and super numerally teeth.

Ethical Permission

The following permissions were taken before starting regarding international and center standard:

- Permission from khanzad polyclinic teaching center administration.
- Permission from the orthodontic patient or their parents involved in this study a data.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Article funding

Any funding will be belonging article authors.

Declaration of patient consent

Patient’s consent not required as patient’s identity is not disclosed or compromised. but following usual protocol consent was taken signed by patient herself and her parents.

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**Conflicts of interest**

The authors declare that they have no conflict of interest for this study.

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