

PREVALENCE OF DEVELOPMENTAL MAXILLARY MIDLINE DIASTEMA IN CHILDREN- A RETROSPECTIVE STUDY

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ABSTRACT

The midline diastema is a space (or gap) between the maxillary central incisors. Midline diastema in mixed dentition is the so-called “ugly duckling” stage for children. The space can be characteristic of normal growth in primary and mixed dentition. The aim of the study was to investigate the prevalence of developmental maxillary midline diastema in different age groups of children. A retrospective cross sectional study was conducted by collecting the patient records and dental radiographs from June 2019 to march 2020. The maxillary radiographs of children of age group 6-12 years were collected, measured the midline width and statistically analyzed. The results proved that maximum midline diastema width was seen in the age group 6-8years. Within the limitation of the current study, prevalence of maxillary midline diastema decreases with age. Midline diastema is usually a part of normal dental development and hence its presence during the mixed dentition period is not a matter of concern. However, if the diastema is present even after the eruption of lateral incisors and canine, an orthodontic intervention will be necessary.

Keywords:

Age, Developmental Diastema, Gender; Midline Spacing, Ugly Duckling Phenomenon

INTRODUCTION:

A diastema is defined as a space greater than 0.5 mm between the proximal surfaces of two adjacent central incisors. ((Keene, 1963; McVay and Latta, 1984; Jeevanandan, 2017) The midline diastema is a space (or gap) between the maxillary central incisors. Midline diastema in mixed dentition is the so-called “ugly duckling” stage for children. The space can be characteristic of normal growth in primary and mixed dentition and generally is closed by the time the maxillary canines erupt. (Baum, 1966; Lavelle, 1970; Lindsey, 1977; Becker, 1978; Govindaraju, Jeevanandan and E. M. G. Subramanian, 2017a) In most children, the medial erupting path of the maxillary lateral incisors and maxillary canines, as described by Broadbent, results in normal closure of this space. ((Foster and Grundy, 1986; Somasundaram *et al.*, 2015; Govindaraju, Jeevanandan and E. M. G. Subramanian, 2017b) However in some individuals the space does not close spontaneously. Midline diastema can be physiological, dentoalveolar, due to a missing tooth, due to peg shaped lateral, midline supernumerary teeth, proclination of the upper labial segment, prominent frenum and due to a self-inflicted pathology by tongue piercing. ((Edwards, 1977; Ketaki Kamath and Arun, 2016; Govindaraju, Jeevanandan and E. Subramanian, 2017; Jeevanandan and

Govindaraju, 2018) Other etiologies associated with diastema include oral habits, muscular imbalances, physical impediments, abnormal maxillary arch structure, and various dental anomalies. ((Rahilly and Crocker, 2003; Ravikumar, Jeevanandan and Subramanian, 2017; Panchal *et al.*, 2019) Differences in race were also found to affect the percentage of children who have midline diastema. ((Isiekwe, 1983; Huang and Creath, 1995; Christabel and Gurunathan, 2015; Packiri, Gurunathan and Selvarasu, 2017)

The presence of a diastema between the teeth is a common feature of the anterior dentition that remains until the completion of the permanent dentition. The needs for treatment are primarily attributed to aesthetic and psychological rather than functional reasons. Carefully developed diagnoses and advanced planning enable the identification of the most appropriate treatment to address the needs of each individual patient. (Oquendo, Brea and David, 2011; Gurunathan and Shanmugaavel, 2016; Govindaraju and Gurunathan, 2017; Subramanyam *et al.*, 2018)

The esthetic importance of maxillary anterior spacing varies both culturally and racially as well as with the incidence of diastemas within a given population. The incidence of diastemas varies greatly with age and race. In 5-year-olds, the incidence has been reported to be as high as 97 percent, with the incidence decreasing with age. Racial and gender differences also exist for diastemas. Lavelle and associates reported the prevalence of the maxillary median diastema was greater in Africans (West Africa) than in Caucasians (British) or Mongoloids (Chinese from Hong Kong and Malaya). Horowitz reported that black children, 10 to 12 years old, exhibit a higher prevalence (19%) of midline diastema than do white children (8%), Becker confirmed racial differences and stated that blacks and Mediterranean whites. (Horowitz, 1970; Becker, 1978; 'Fluoride, Fluoridated Toothpaste Efficacy And Its Safety In Children - Review', 2018; Nair *et al.*, 2018) It is clear that the incidence of midline diastemas varies greatly with the races and age group studied, hence the aim of this study is to investigate the prevalence of developmental maxillary midline diastema in children of South-Indian population.

MATERIALS & METHODS:

Study design and setting

This retrospective study examined the records of patients from June 2019 - April 2020 undergoing treatment at Saveetha Dental College and Hospitals, Chennai. Ethical approval was obtained from the Institutional Ethical Committee. (Ethical Approval Number SDC/SIHEC/2020/DIASDATA/0619-0320).

Inclusion Criteria:

The age group 6-12 years were included in this study. Both the central incisors to be present in the maxillary cast.

Exclusion Criteria:

Children below the age of 6 years and above 12 years were excluded from this study, to avoid bias of ugly duckling stage. Children with dento-facial defects, who are undergoing orthodontic treatment or with crowns in the anterior teeth were excluded from this study. Patients with high frenal attachment were excluded from this study. These exclusion criteria were verified using patient records, depending on the patients maxillary casts that were chosen.

Data Collection:

Data was collected by viewing 3500 patient records in the age group of 6-12 years visiting Saveetha Dental College. About 700 records were selected for which patient age, gender, inclusion and exclusion criteria were checked, radiographs (RVG) were evaluated and data was gathered. Patients records containing relevant data were included and incomplete records were excluded, cross verification was done by means of photograph and the obtained data was verified by 3 external reviewers. The maxillary midline diastema widths were measured using radiograph.

Statistical Analysis:

Data gathered were entered in Microsoft Excel spreadsheet 2016 and later exported to IBM SPSS (version 20.0 Chicago . USA) and subjected to statistical analysis. Chi-square test was applied with a level of significance set at $p < 0.05$.

RESULTS & DISCUSSION:

Distribution of children based on age groups:

The total patient cast obtained was 700, the age group of the patients were divided into age groups, 6-8years, 8-10years & 10-12years respectively on basis of convenient sampling. The number of children in the age group 6-8years 57.1% (n=199), followed by age group 8-10years 36.7% (n=128) and in the age group 10-12 years 6% (n=21)

Distribution of children based on gender :

The male patients were 53.3% (n=373) followed by females 46.7% (n=327)

Prevalence of Width of the midline diastema:

The measurements of the diastema were grouped as 0-1mm, 1-2mm & 2-3mm respectively. The highest prevalence of midline diastema width in the range 0-1mm 66.3% (n=464), followed by 1-2 mm 31.1% (n=218) and 2-3mm width 2.6% was seen as shown in figure 1

Prevalence of midline diastema based on age groups :

Children of age 6-8years showed the maximum prevalence of presence of midline diastema 57.1% (n=199), followed by the age group 8-10years 36.7% (n=128), the least number of maxillary midline diastema was seen in the age group 10-12 years 6% (n=21) as shown in fig 2. Which illustrates a drop in the prevalence of diastema as age progresses. (Table 1)

Prevalence of midline diastema based on Gender:

In males, the prevalence of midline diastema was 54.3% and in females 45.69% of midline diastema were noticed (fig 3.)

Comparison between age and width of the diastema:

The width of the diastema was divided as 0-1mm, 1-2mm & 2-3mm. Majority of the children of age 6-8years had diastema in the range 0-1mm width was 62.8%, followed by 1-2mm 32.7% & the least was seen in the range 2-3mm 4.4%. In the age group 8-10 years, 0-1mm width of midline diastema was seen in 65.3%, children who had diastema in the range of 1-2mm were 34.2% & the least were seen in the range of 2-3mm .45% as shown in fig 4. In 10-12 years of age, the children with 0-1mm width of midline diastema measured was 82.7%, followed by 1-2mm 17.2% & in 2-3 mm width no casts were observed. There was statistical significance between age and width of the diastema ($p < 0.05$). (Table 3)

Comparison between Gender & Width of the Diastema :

The width of the diastema was divided as 0-1mm, 1-2mm & 2-3mm. Majority of the males had diastema of 0-1mm 65.9%, followed by 1-2mm 30.8% and the least was seen in the width of 2-3mm 3.2%. The females who had diastema of 0-1mm was 66.6% followed by 1-2mm 31.4%, the least width was seen in 2-3mm 1.8% as shown in fig 5. There is no statistical significant difference obtained among gender and width of diastema ($p > 0.05$)

The midline diastema, which results from this flaring is normal and often is called the "ugly duckling stage" of the developing dentition. The permanent maxillary central incisors are flared laterally at this time because the unerupted lateral incisors constrain the roots of the centrals. As the permanent maxillary lateral incisors and canines erupt, pressure is exerted medially, causing the space to close. (Dewel, 1966) In the present study results showed an increase in the prevalence of maxillary midline diastema in the age group 6-8 years which gradually decreased as the age progressed. In the other study it was proved that midline diastema occurs approximately 98% of 6 year olds, 49% of 11 year olds and 7% of 12-18 year olds, which was in accordance with our study. (Marques *et al.*, 2006) A study conducted by Gardiner also showed an increase in the prevalence of maxillary midline diastema in children of the age 6-7years. (Gardiner, 1967) Similar studies conducted by Weyman J *et al*, Liu *et al* & Taylor *et al* also showed an increase in the incidence of maxillary diastema in the age of 6-7 years. Thus the above literature results

were in accordance with our study. (Taylor, 1939; Weyman, 1967; Liu, Hsu and Chen, 2013) Study conducted by Jyotsna Sanjeevi showed that 93% of the children had no presence of maxillary midline diastema at the age of 15 to 18 years. (Sanjeevi, Arun and Rathna Subhashini 3, 2019) The decrease of maxillary midline diastema follows age progression as the eruption of lateral incisor and canine. After complete maxillary canine eruption, the percentage of boy and girl with midline diastema was 11%. This finding indicated that some midline diastema did not automatically close with age and tooth eruption, these may require further orthodontic care.

In our study prevalence of maxillary midline diastema was seen to be higher in males (53%) than in females. Umanah et al proved in his study that it was an increase in number in females who had maxillary midline diastema. (Ciuffolo *et al.*, 2005; Umanah, Omogbai and Osagbemi, 2015) The possible reason being, early dental development in females when compared to males. The closure of diastema in girls is earlier than boys, therefore sex difference should be also taken into consideration when doing orthodontic treatment. Also another study conducted by Liu et al, showed an increase in the prevalence of maxillary midline diastema in females when compared to males. Fabio Ciuffolo et al study revealed an increase in the prevalence of maxillary midline diastema in males when compared to females which is in accordance with our study. Hence depending on different races and geographic location it may change.

The size of the midline diastema in the current study varied from 0-3mm, majority of the midline diastema ranged from 0-1mm. The prevalence of diastema and the size decreased with age. Least number of midline diastema was seen in the age group 10-12 years. Similar study conducted by Liu et al suggested the decrease in the prevalence of maxillary midline diastema as age progresses. The study conducted by PT Jonathan also stated the increase in the prevalence of maxillary midline diastema of 1-1.5mm in the age group 6-8 years. (Jonathan *et al.*, 2018) Longitudinal studies of Bergström et al, Popovich et al, Taylor, and Weyman confirm the hypothesis that the midline diastema is decreasing with increasing age of the individual and higher prevalence was mostly seen before the eruption of the lateral incisors. (Taylor, 1939; Weyman, 1967; Bergström, Jensen and Mårtensson, 1973; Popovich, Thompson and Main, 1977). The above mentioned literature correlates with our present study.

LIMITATION OF THIS STUDY:

The limitation of this study is that it included a relatively smaller population. Patients of other geographic locations were not able to be added in this study.

CONCLUSION:

Within the limitation of the current study, prevalence of maxillary midline diastema decreases with age. Patients of age group 6-8 years had the highest prevalence of maxillary midline diastema. Midline diastema is usually a part of normal dental development and hence its presence during the mixed dentition period is not a matter of concern. However, if the diastema is present even after the eruption of lateral incisors and canine, an orthodontic intervention will be necessary.

AUTHOR CONTRIBUTION:

Westeous Dominic Pereira, contributed in concept, acquisition of data analysis, interpretation of data and also drafting the article and revising it critically for important intellectual content. Jessy P, contributed in study design, correction, alignment and supervision. Surendar S, contributed to alignment and formatting and final approval of the submitted version of the manuscript

CONFLICT OF INTEREST:

Author has no known conflict of interest associated with this study.

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Age	Measurement in mm				Chi-Square Test
	0-1mm	1-2mm	2-3mm	Total	
6-8 years	242	126	17	385	Pearson Chi-square: 25.109* p-value: 0.000*
8-10 years	145	76	1	222	
10-12 years	77	16	0	93	
Total	464	218	18	700	

Table 1: Prevalence of width of midline diastema based on age groups. There was a significant association between age group and width of the midline diastema. $p < 0.00$ (< 0.05). The maximum width of maxillary

midline diastema was seen in the age group of 6-8years, and it is seen that as the age progressed the midline diastema reduced.

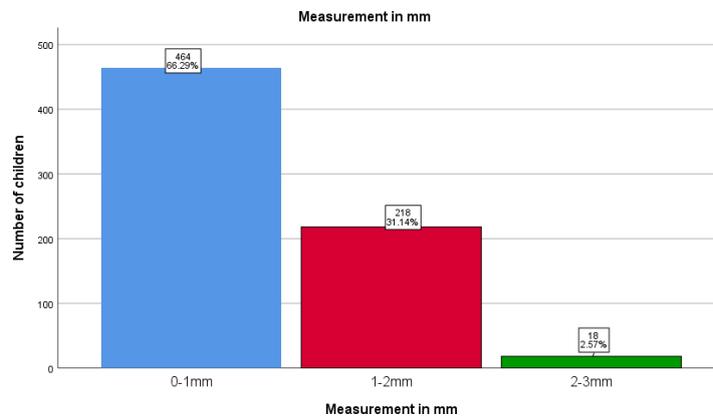


Figure 1: Bar graph representing distribution of children with different ranges of maxillary midline diastema width. X-axis represents the width of the midline diastema (mm) and Y-axis represents the number of children, with midline diastema width of 0-1 mm width (blue), 1-2 mm (red) and 2-3 mm (green). Majority of the children (66.27%) have midline diastema width of 0-1 mm.

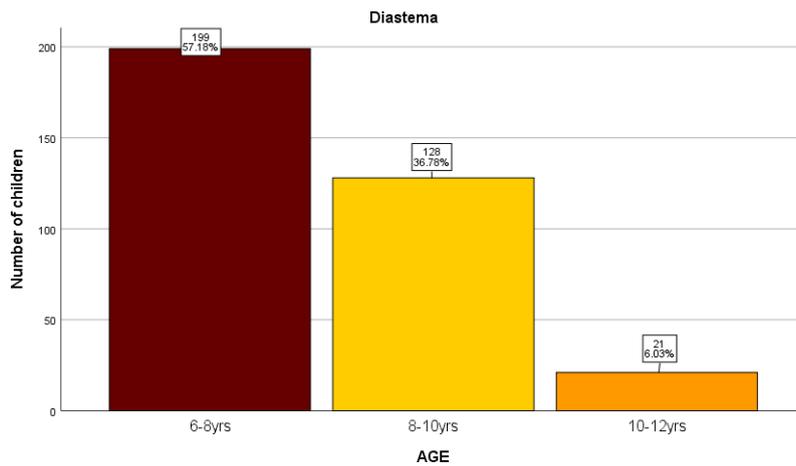


Figure 2: Bar graph representing the distribution of children with maxillary midline diastema based on age groups X-axis denotes the distribution of age while Y-axis denotes the number of patients. 57.1% of children with maxillary midline diastema are in the age group of 6- 8 years (brown) followed by 36.78 % of children in the age group of 8-10 years (yellow) and 6.03 % of children in the age group of 10-12 years (orange)

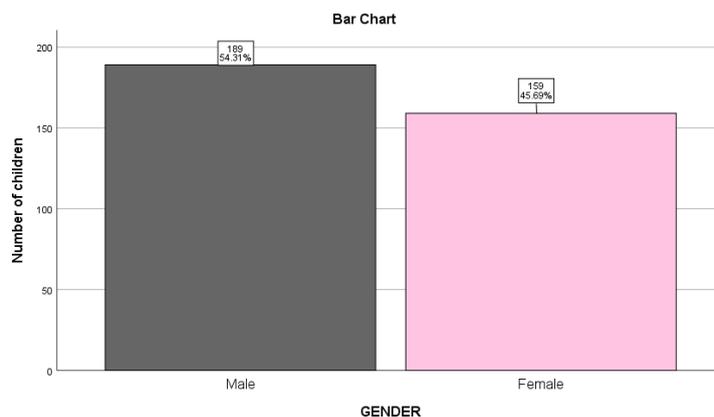


Figure 3: Bar graph representing the gender distribution of children with maxillary midline diastema, X-axis denotes the distribution of gender and Y-axis denotes the number of children. 54.31 % of children with maxillary midline diastema are males (grey) and 45.69 % are females (pink).

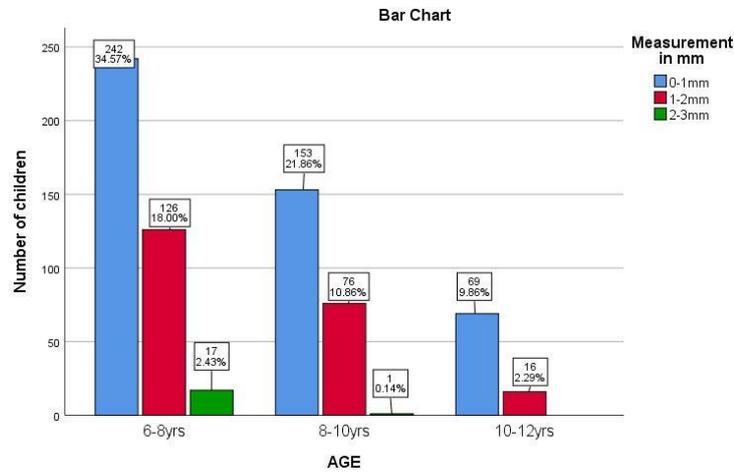


Figure 4: Bar graph showing the association between age and width of maxillary midline diastema. X axis represents the age group and Y axis represents the number of children, with midline diastema width of 0-1 mm (blue), 1-2 mm (red) and 2-3 mm (green). 0-1 mm width of maxillary midline diastema is more commonly seen in all the age groups and the maximum width of maxillary midline diastema is seen in the age group of 6-8years and the midline diastema width is seen to reduce with increase in age. (Chi square test, Pearson Chi-square value: 25.109, p-0.00 (<0.05 which is statistically significant)).

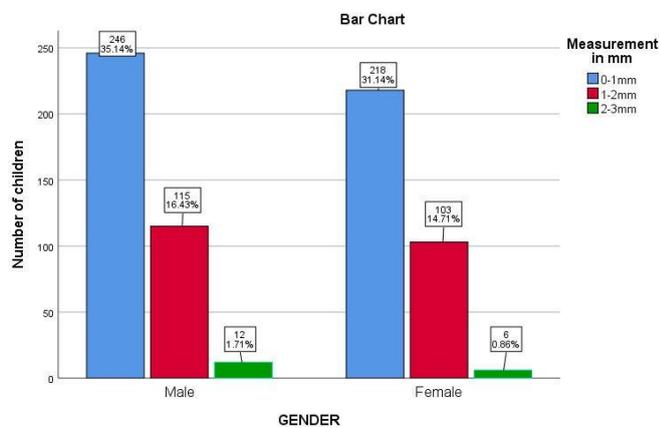


Figure 5: Bar graph representing association of gender and width of midline diastema. X axis represents the gender and Y axis represents the number of children, with midline diastema width of 0-1 mm (blue), 1-2 mm (red) and 2-3 mm (green). Males exhibited more width of midline diastema when compared