

Prevalence of Midline Diastema and Willingness for Treatment in Adults of Chennai: A Cross-sectional Study

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ABSTRACT

Introduction: Dental midline diastema is a major aesthetic concern. The prevalence of midline diastema varies in different population groups and with age, gender and race.

Aim: To determine the prevalence of midline diastema among 500 adult patients (18 to 35 years) in Chennai and their willingness to undergo treatment.

Materials and Methods: A cross-sectional study was conducted from January 2018 to June 2018 at Meenakshi Ammal Dental College and Hospital, Chennai, Tamil Nadu, India. A total of 500 patients were clinically examined. Midline diastema, if present was measured intraorally using a divider and ruler by measuring the distance between the mesioincisal angles of the central incisors. The presence of potential factors leading to diastema and willingness to undergo treatment were assessed and recorded. The collected data was statistically analysed and Chi-square test was done to elucidate the association between proportionate variables. The p-value ≤ 0.001 was considered significant.

Results: A total of 500 patients (339 females and 161 males) in the age group of 18-35 years (mean age 23.61 ± 6.59 years) were included in this study. Out of 500 patients, 128 had midline diastema. Prevalence of midline diastema was higher in the maxilla (21.80%) than in mandible (9%). The most common aetiological factor was generalised spacing with deleterious habits for midline diastema in the maxilla (30.30%) and periodontitis for the mandible (44.44%). The 35 people were willing to undergo treatment (62.86% for the maxillary arch and 42.86% for the mandibular arch) of which 5 people chose cosmetic treatment over orthodontic treatment.

Conclusion: The prevalence of maxillary midline diastema was high. The willingness to undergo treatment for maxillary diastema was greater due to aesthetic concern. The lack of knowledge and awareness among the patients regarding midline diastema and the availability of treatment often results in delayed diagnosis and necessary treatment.

Keywords: Aesthetics, Malocclusion, Orthodontic space closure, Permanent dentition

INTRODUCTION

Diastema or spacing between two or more consecutive teeth is a major aesthetic concern for teenagers and young adults, especially when it occurs in the anterior region of the maxillary and/or mandibular arches. Dental midline diastema as described by Angle (1970) is a rather common form of incomplete occlusion characterised by a space between the maxillary and less frequently mandibular central incisors [Table/Fig-1] [1]. Though maxillary midline diastema may occur during the mixed dentition phase, there is spontaneous closure with the eruption of permanent lateral incisors and canines [2].

However, it is not seen to occur in some individuals and the diastema persists even through their adult life. This is due to multiple underlying independent or interdependent aetiological factors including genetic predisposition. Tooth and dental arch size discrepancy, abnormal labial frenal attachment, pernicious habits, tooth anomalies, supernumerary teeth (mesiodens) and pathological lesions in the midline are some of the causes for maxillary midline diastema and tongue thrust at low rest position for mandibular midline diastema

[3,4]. Hence, the management of diastema depends on the specific aetiological factor.

Apart from aesthetic concerns, wide midline diastema may lead to phonetic problems. However, the mere presence of diastema does not associate with the need to get treated. Sometimes it is excluded to be mentioned as a complaint during a dental visit due to lack of awareness about the availability of treatment for the same. The prevalence of median diastema varies in different population groups and varies greatly with age, gender and race [5]. The self-perception of midline diastema by the adult patients and how they are perceived by the society affects their social interaction and psychological well-being. Studies have shown that lay persons may not be able to detect midline diastema upto 1.5 to 2 mm. Negligence may result in the aetiological factor being undetermined as aesthetic perception is one of the reasons for the patients to seek treatment [6,7].

Though similar studies have been conducted in the past, it mainly included children and teenagers with mixed dentition and very few considered the permanent dentition [8,9]. However, the present study was done in a southern state of India and the adult population was exclusively chosen as subjects which gives scope for comparison among various regions within the country and away. The need for thorough examination for identifying the underlying reason for the presence of midline diastema was established. Thus, the present study was conducted to determine the prevalence of midline diastema among adult patients and their willingness to undergo orthodontic treatment.

MATERIALS AND METHODS

A cross-sectional study was conducted from January 2018 to June 2018 at Meenakshi Ammal Dental College and Hospital, Chennai,



[Table/Fig-1]: a) Subject with maxillary diastema; b) Subject with both maxillary and mandibular diastema along with high frenal attachment.

Tamil Nadu, India, on patients visiting the Institute. Ethical clearance to conduct the study was obtained from the Institutional Review Board of Meenakshi Ammal Dental College, Chennai (Protocol number MADC/IRB-XII/2017/266).

Sample size calculation: By allowing 5% type 1 error and prevalence of midline diastema as 28% as obtained from previous literature, the sample size for the present study was calculated as 457 which was rounded to 500 [10]. The formula used for sample size estimation was: $4pq/L^2$ where, L was taken as 15% of the prevalence. The study population was selected based on the following inclusion and exclusion criteria.

Inclusion criteria: The study included 500 adult patients in the age group of 18-35 years with full set of permanent dentition were included in the study.

Exclusion criteria: Subjects with any loss of anterior tooth material due to fracture or dental caries, congenital malformations like cleft lip and/or cleft palate and those with previous history of corrective orthodontic treatment were excluded from the study.

Procedure

Each individual was seated on a dental chair and the patient's complete history was recorded. Clinical examination was done under natural day light and/or artificial light with the use of sterile disposable gloves, mouth mirror and probe to thoroughly inspect the oral cavity. Presence of space in the anterior teeth region of the dental arches was recorded. Midline diastema, if present was measured intraorally using a divider and ruler by measuring the distance between the mesioincisal angles of the central incisors. The technique used in the study was a simple and quick chair side procedure which has been used in similar studies that were done earlier [11,12]. It also enabled repeatability and reproducibility of the readings that were taken.

Examination done and recorded by the principal observer was repeated by the second observer to avoid errors. The most common reasons for midline diastema are presence of deleterious habits, high frenal attachment, periodontal disease were assessed and recorded. The patients were then made aware of the treatment options available for correction of midline diastema. Corrective orthodontic treatment procedures for diastema closure were explained and additional surgical or periodontal procedures were also mentioned if necessary. For the aesthetic approach, composite resin restorations and veneers were suggested for those with a mild diastema (upto 2 mm). The patients were then asked for their willingness to undergo treatment for diastema closure and the reason behind it if any. Their responses were noted accordingly.

STATISTICAL ANALYSIS

The data collected from the samples were compiled and statistically analysed using the computer software Statistical Package for the Social Sciences (SPSS) version 17.0. Descriptive analysis of the recorded data was expressed in the form of frequency table and cross tabulation. Chi-square test was done to elucidate the association between proportionate variables and the p-value ≤ 0.001 was considered significant.

RESULTS

A total of 500 patients (339 females and 161 males) in the age group of 18-35 years (mean age 23.61 ± 6.59 years) were included in this study. A total of 109 patients presented with midline diastema in the maxilla and 45 patients in the mandible. It was observed that 83 patients had midline diastema only in the maxillary arch, 19 patients had it only in the mandible and 26 patients had it in both the arches. Prevalence of midline diastema was higher in the maxilla (21.80%) than in mandible (9%) and the difference was statistically significant (p-value < 0.001). The frequency distribution and percentage of cases with and without midline diastema in both genders in the maxilla and mandibular arches are represented in [Table/Fig-2,3], respectively.

Sex and midline diastema (Maxilla)			
Sex	Present (%)	Absent (%)	Total (%)
Females	69 (20.40%)	270 (79.60%)	339 (100%)
Males	40 (24.80%)	121 (75.20%)	161 (100%)
Total	109 (21.80%)	391 (78.20%)	500 (100%)

[Table/Fig-2]: Prevalence of cases with and without midline diastema in both genders in Maxilla.
 $\chi^2=1.291$; p-value=0.25

Sex and midline diastema (Mandible)			
Sex	Present (%)	Absent (%)	Total (%)
Females	35 (10.30%)	304 (89.70%)	339 (100%)
Males	10 (6.20%)	151 (93.80%)	161 (100%)
Total	45 (9.0%)	455 (91.0%)	500 (100%)

[Table/Fig-3]: Prevalence of cases with and without midline diastema in both genders in Mandible.
 $\chi^2=2.255$; p-value=0.13

The association between prevalence of midline diastema and gender was not statistically significant in both the maxillary and mandibular arches as the p-value > 0.001.

The most common aetiological factor for maxillary midline diastema was found to be generalised spacing due to jaw and tooth size discrepancy in combination with deleterious habits such as thumb sucking and nail biting (30.30%). The other potential factors were periodontitis, generalised spacing, trauma, hereditary and also a combination of various factors which are represented in [Table/Fig-4].

For mandibular midline diastema, periodontitis (44.44%) was the most common reason. The distribution of other aetiological factors for mandibular midline diastema is represented in [Table/Fig-5].

Aetiology and midline diastema (Maxilla)			
Aetiology	Present (%)	Absent (%)	Total (%)
None/Unknown	16 (14.70%)	368 (94.1%)	384 (76.80%)
Hereditary	1 (0.91%)	0 (0%)	1 (0.20%)
Periodontitis	23 (21.10%)	9 (2.30%)	32 (6.40%)
Generalised spacing	12 (11.0%)	1 (0.26%)	13 (2.60%)
Trauma	2 (1.83%)	0 (0%)	2 (0.40%)
Deleterious habit*	0 (0%)	1 (0.26%)	1 (0.20%)
High frenal attachment	20 (18.34%)	2 (0.51%)	22 (4.40%)
Periodontitis and deleterious habits*	1 (0.91%)	0 (0%)	1 (0.20%)
Generalised spacing and deleterious habits*†	33 (30.30%)	9 (2.30%)	42 (8.40%)
Trauma and high frenal attachment	1 (0.91%)	0 (0%)	1 (0.20%)
Trauma and deleterious habit*	0 (0%)	1 (0.26%)	1 (0.20%)
Total	109 (100%)	391 (100%)	500 (100%)

[Table/Fig-4]: Distribution of aetiological factors of midline diastema in the maxillary arch.
 $\chi^2=314.550$; p-value < 0.001; *Nail biting, †Lower lip biting

Aetiology and midline diastema (Mandible)			
Aetiology	Present (%)	Absent (%)	Total (%)
None/Unknown	9 (20.00%)	444 (97.60%)	453 (90.60%)
Hereditary	2 (4.44%)	0 (0%)	2 (0.40%)
Periodontitis	20 (44.44%)	4 (0.90%)	24 (4.80%)
Generalised spacing	5 (11.11%)	2 (0.40%)	7 (1.40%)
Generalised spacing and Macroglossia	3 (6.70%)	0 (0%)	3 (0.60%)
Generalised spacing and deleterious habits*	6 (13.33%)	4 (0.90%)	10 (2.00%)
Trauma	0 (0%)	1 (0.20%)	1 (0.20%)
Total	45 (100%)	455 (100%)	500 (100%)

[Table/Fig-5]: Distribution of aetiological factors of midline diastema in the mandibular arch.
 $\chi^2=304.846$; p-value < 0.001; *Nail biting, †tongue thrusting

The exact aetiology for the presence of midline diastema was not elucidated for 16 (14.70%) individuals in the maxilla and 9 (20%) individuals in the mandible since it was unable to assess clinically. With the assistance of other accessory diagnostic methods such as radiographs, any underlying pathologies of jaw and tooth size discrepancies can be assessed and shall aid in identifying the exact aetiologies in such cases. The association between the aetiological factors and the presence of midline diastema was found to be statistically significant (p -value <0.001).

Out of the 500 subjects who were examined, 128 people presented with midline diastema. Amongst them, 35 people were willing to undergo treatment. The willingness to get treated for the maxillary midline diastema ($n=22$; 62.86%), was higher when compared to that of mandibular midline diastema ($n=15$; 42.86%); 2 subjects had midline diastema in both and the difference was statistically significant (p -value <0.001). Out of the 35, five subjects with mild maxillary diastema (<2 mm) chose cosmetic correction over orthodontic treatment.

The patients who were willing to get the diastema treated seemed very concerned about their appearance and the popular reason behind their willingness was their want for a good smile. The subjects who were unwilling for the diastema treatment had varied reasons such as affordability, fear of undergoing treatment, multiple visits to the hospital and long duration of specific treatments. Also, they often disregarded the need for correction and were very much satisfied with their appearance and smile [Table/Fig-6].

a) Reasons given by patients willing to undergo treatment for midline diastema	
Reasons	N (%)
Improved dentofacial/smile aesthetics	18 (51.43%)
Feel more comfortable during social interaction	10 (28.57%)
Suggested by a family member or partner	5 (14.29%)
Referred by a general dentist	2 (5.71%)
b) Reasons given by patients not willing to undergo treatment for midline diastema	
Reasons	N (%)
Satisfied with the appearance/smile	210 (45.16%)
Prefer original look over altered aesthetics	41 (8.82%)

Sl. No.	Author's name and year of study	Place of study	Number of subjects	Age group of subjects	Prevalence of midline diastema	Most common aetiology
1.	Present study	Chennai, India	500	18-35 (23.61 \pm 6.59) years	21.80% (maxillary), 9% (mandibular)	Generalised spacing along with deleterious habits (30.30%-maxilla), Periodontitis (44.44%-mandible)
2.	Shivanni SS et al., 2020 [8]	Chennai, India	305	23 \pm 5.25 years	22.3% (maxillary)	High frenal attachment 52%, Generalised spacing 36%
3.	Gupta R et al., 2017 [9]	Jammu, India	200 (129 males, 71 females)	13-40 years	23% (maxillary)	Generalised spacing (39%)
4.	Temisanren OT and Opeodu OI 2019 [10]	Ibadan, Nigeria	164	Age not mentioned (College students)	28% (69.6% maxillary, 23.9% mandibular and 6.5% both)	High frenal attachment (30.4%)
5.	Hasan HS et al., 2020 [13]	Kurdistan-region	1021 orthodontic patients (537 males and 484 females)	13-35 years	23.2% (97% maxillary, 1.3% mandibular, and both -1.7%)	Females- Thumb sucking (14.1%), Males- High labial frenum (39.4%)
6.	Elfadel II and Abuaffan AH 2016 [14]	Sudan	2200 (1706 females, 494 males)	18-23 years	7.3% (7% maxillary, 0.2% mandibular, both- 0.1%)	Family history (70%), high frenal attachment (59%)
7.	Jan CHU et al., 2010 [15]	Rawalpindi, Pakistan	1747	19.4 \pm 8.51	12.59% (maxillary)	Excessive overjet 56.56%
8.	Erfan O et al., 2020 [16]	Kabul, Afghanistan	999	15-30 years	5.8 % (maxillary)	Not evaluated
9.	Kadhom ZM and Sadoon MM 2019 [17]	Baghdad, Iraq	600 (413 females, 187 males)	18-23 years	6.83% (5% females, 1.83% males)	No major aetiological factor established
10.	Luqman M et al., 2011 [18]	Saudi Arabia	200 (158 males, 42 females)	13-40 years	23%	Generalised spacing (39%)
11.	Rekhi A et al., 2016 [19]	Dehradun, India	660 (352 males, 308 females)	16-24 years	26.9%	Not evaluated
12.	Narayanan RK et al., 2016 [20]	Kozhikode, India	2366 (1281 males, 1085 females)	10-12 years	0.76%	Not evaluated
13.	Shivakumar KM et al., 2009 [21]	Davangere, India	1000	12-15 years	18.83%	Not evaluated
14.	Kaur H et al., 2013 [22]	Karnataka, India	2400	13-17 years	15.43%	Not evaluated

[Table/Fig-7]: Details from studies on midline diastema done in various regions.

Treatment cost affordability	38 (8.17%)
Multiple visits to the dental hospital	45 (9.68%)
Time spent at the clinic affects regular work	37 (7.96%)
Fear of undergoing dental treatment	34 (7.31%)
Embarrassed to wear braces to school/work	31 (6.66%)
Not specified	29 (6.24%)

[Table/Fig-6]: Reasons given by patients willing and not willing to undergo treatment for midline diastema.

DISCUSSION

There are plenty of studies regarding the prevalence of midline diastema in children and teenage population with mixed dentition. However, the number of studies regarding the same is comparatively less in adult population with permanent dentition. A list of similar studies that were done in different parts of the world is represented in for comparison [Table/Fig-7] [8-10,13-22]. In the present study, 21.80% presented with midline diastema in the maxilla and 9% in the mandible. This was in accordance with another institutional study from the same city where the prevalence rate of midline diastema was 22.3% [8]. The similarity could be attributed to the similarity in the age group and ethnic background of study population. However it was in contrast with other studies done in Sudanese population (7.0% in maxilla and 0.2% in mandible), Pakistani population (12.59% in maxilla), Afghanistan population (5.8% maxilla) and Iraqi population (6.83% in maxilla) as a result of variation in the race and ethnic background though the age group of the population was similar [14-17]. The most common underlying reason for maxillary midline diastema was the presence of generalised spacing along with deleterious habits (30.30%). Altered equilibrium of forces from the cheek, tongue and lips often result in unwanted dentofacial changes. The mild continuous outward force with incompetent lip seal results in flaring and spacing of anterior teeth [5].

Studies done on South Indian population (52%) and Sudanese population (51.9%) have determined that high frenal attachment is the major aetiological factor for midline diastema [8,14]. However, the results of our present study (18.30%) was in contrast to these studies and inclined towards the controversial statement done by Tait CH that high frenal attachment is the effect and not the cause for midline diastema [23]. Generalised spacing and excessive

overjet were also found to have high prevalence rates in association with midline diastema in other studies done around the world [9,15,18,24]. More than one contributing factor may lead to the development of midline diastema and are often co-related [24]. This was found to be relevant for our study as well.

Periodontitis (44.44%) was the most common reason for mandibular midline diastema. According to Nainar SM and Gnanasundaram N, true midline diastema are exclusive of periodontal disease and periapical pathology [25]. However, in the present study this factor was included as periodontal disease is more common in adults. In an earlier study by Attia Y, tongue thrust at a low rest position was considered as the primary contributing factor for mandibular diastema [4].

A 62.86% expressed their willingness to undergo treatment for maxillary midline diastema and 42.86% for the mandible. The rate was comparatively high for the maxilla for cosmetic reasons as it is starkly visible during smile and speech. The mandibular diastema, though more dramatic often remains hidden as it is covered by the lower lips. The mere presence of diastema does not always drive the patients to the dentist to get it treated. In our study, most of the people who were willing to undergo treatment were concerned about their appearance and wanted to have a good smile. It was also noted that those who were not willing for treatment felt satisfied with their appearance and felt no need for correction. Few individuals believed in the myth that the presence of diastema is lucky (dents du bonheur) [4].

The need to analyse and arrive at the accurate diagnosis for the aetiology of midline diastema is essential for its effective treatment. Both clinical and radiological examinations are necessary for the correct diagnosis of causative factors leading to midline diastema in the patients [26]. Dental casts and photographs of the patient may also aid in the diagnosis [27,28]. Only clinical examination was done in this study and radiological examination shall be included while expanding this study for further research. Dental practitioners should be cautious when a patient presents with midline diastema and the aetiological factor remains unknown as in the case of our study. Radiographs are necessary to rule out any midline pathology that may be undiagnosed clinically and remain asymptomatic which gives rise to midline diastema such as odontomas or cysts. Odontomas being the most commonly occurring odontogenic tumour, found to occur most commonly in the maxillary arch (67%), with the compound odontoma showing a predilection for the anterior segment (61%) [29]. Contact between the crowns of erupted maxillary central incisors may be prevented when odontomas lie between their roots, resulting in the formation of large diastema [3].

In African countries such as Nigeria and Ghana, the presence of midline diastema is considered attractive especially in women. A study has also shown that some Africans chose to get artificially created midline diastema [30]. Lewis KC et al., showed that fashion magazines with Caucasian models displaying midline diastema are becoming popular. Recently, youngsters chose to sport their midline diastema or get it done artificially because its presence makes them more characteristic like few famous personalities and there is an increase in sexuality [31,32]. Hence, the need to get midline diastema treated may become less of a worry for adolescents and young adults who are cautious about their appearance. However, help of the dental practitioner is required for thorough examination and diagnosis of aetiology for the midline diastema and to rule out the presence of any hidden midline pathologies.

Limitation(s)

The limitation in this study was that radiographs were not a part of investigation and they could have been helpful to arrive at the exact aetiology by ruling out others. Radiographs of the subjects shall be included while expanding this study for further research.

CONCLUSION(S)

In this study, the prevalence of midline diastema was higher in the maxilla than in the mandible. The most common aetiological factor was diagnosed as generalised spacing with deleterious habits for midline diastema in the maxilla and periodontitis for the mandible. The willingness among the patients to get the maxillary midline diastema was higher due to aesthetic concerns. The diagnosis of aetiological factors was only done based on clinical examination for this short study.

The study shall be expanded for further research and the patient radiographs are also to be incorporated to establish the exact aetiological factor and to rule out underlying midline pathology. The lack of knowledge and awareness about the possibility of any hidden pathology among the patients often inhibits them from receiving appropriate treatment at the right time due to delayed diagnosis. It is crucial for the dental practitioners and the patients to pay more attention to the seemingly harmless midline diastemas.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]

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- Manual Googling: Sep 20, 2021
- iThenticate Software: Oct 14, 2021 (7%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:

- Financial or Other Competing Interests: None
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- Was informed consent obtained from the subjects involved in the study? Yes
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