ORIGINAL RESEARCH

Prevalence and Etiology of Maxillary Midline Diastema among University Students, Hodeidah Governorate, Yemen: A Cross-sectional Study

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Abstract

Aim: This study assessed the prevalence and etiological factors of maxillary midline diastema (MMD) in students attending different colleges and universities in Al-Hodeidah governorate, Yemen.

Participants and methods: A total of 1,661 participants from different universities in Al-Hodeidah governorate were assessed, analyzed, and screened for the presence or absence of MMD. Only 246 had positive MMD and were divided five age-groups. Maxillary midline diastema width was assessed, and three groups were established: groups I (0.5–1 mm), II (1.1–2 mm), and III (over 2 mm). Associations of MMD with gender, family history, and etiology of MMD were documented. The data were recorded and statistically analyzed.

Results: Out of the total students from different colleges, 1,107 were males (66.6%). The 19–20-year age-group was the largest (712; 42.9%), and 264 participants had positive MMD (15.9%). A significant difference in MMD was found between genders ($p = 0.002$), but no significant differences were found among different age-groups ($p = 0.511$). Highly attached labial frenum attachment was the most frequent cause of MMD. Males were larger in number and had higher percentages for all different causes, and a significant difference was observed between genders in terms of highly attached labial frenum and generalized spacing parameters ($p = 0.004, 0.009$). The Chi-squared test showed significant differences in family history and presence of MMD between genders ($p = 0.016$). Large MMD widths were recorded in groups I, II, and III (1.00, 1.5, and 2.1 mm, respectively), which were together 108 (83.1%), 60 (87.0%), and 16 (53.3%), respectively.

Conclusion: The prevalence of MMD can be considered high in the participants and slightly higher in males. Among the causative factors of MMD, a highly attached labial frenum was the most common cause. Group II recorded the highest number of participants with large MMD widths, followed by group I.

Clinical significance: Addressing the prevalence and causes of MMD can result in proper planning to minimize further esthetic appearances and functional complications.

Keywords: Age, Etiology of diastema, Gender, Maxillary midline diastema, Prevalence, Width of diastema.

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Background

Dental anomalies include a wide range of deviations from normal dental anatomy, alignment, and occlusion.[1] Maxillary midline diastema (MMD) is one of the known dental anomalies that can considerably affect an individual's oral health, esthetics, and psychosocial well-being.[2] According to Profit, a space between adjacent teeth is called a diastema. MMD is spacing greater than 0.5 mm between erupted maxillary central incisors and measured from the mesial surfaces.[1]

The size of the gap can vary and may be a cosmetic concern for some people. Maxillary midline diastema is a common dental condition that can occur in primary and permanent dentition.[3] It occurs naturally and is common in children under 8 years old, less common in children aged 9–11, and even less common in individuals aged 15.[4] The gap is a normal growth in deciduous and mixed dentition and closes physiologically when the upper canines erupt, however, in some children, it is not closed.[5] The time duration between 9 and 14 years of the midline diastema is physiologic and usually gets resolved as permanent teeth erupt. However, if it persists even after the permanent teeth erupt, it is considered MMD and a malocclusion.[6]

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The frequency of MMD differs by gender, age, and ethnicity.[6] Hussain et al.,[7] it is highly prevalent in young children, that is, approximately 98% of 6–8-year-old children. In 11-year-old children, the prevalence is approximately 49%, decreasing to 7% in individuals aged 12–18. MMD is a type of malocclusion and can be considered a multifactorial factor that contributes to the MMD. These factors can include genetic influences, environmental factors, physiological factors, presence of supernumerary teeth, abnormal attachment of the frenum, discrepancies in tooth size and habits, and midline pathologies or iatrogenic causes.[8] A study conducted in Kuwait reported that the incidence of median diastema was 26.8%.[9] AlHudaithi et al.[10] stated that rotated teeth result in a space between maxillary teeth in 1.4% of Saudi patients in Riyadh City.

In the Turkish population, MMD was observed in 4.5% of patients and was almost equally distributed between genders: 35% for females and 33% for males.[11] A study on Tanzanians found that the incidence rates were the highest on maxillary, followed by mandibular, and both arches, respectively.[12] The prevalence of MMD among the South Indian population is lesser.[13]

In 1988, Moyers stated that the causes of MMD are incomplete fusion at the midline of the premaxilla, enlarged or misaligned upper labial frenum, normal growth, congenitally absent lateral incisors, presence of supernumerary teeth at the midline, unusually small teeth, and a combination of imperfect fusion and congenitally missing lateral incisors, respectively.[14]

Among Saudis, Luqman et al.[15] stated that the prevalence of DDM was observed in 23% with widths ranging from 0.5 to 4 mm; the most prevalent cause was generalized spacing, and gender differences were noted with higher occurrence observed in males. Notably, a significant proportion of patients (78%) reported that at least one family member, typically a sibling, had diastema. Al-Zubair and Almulla[16] observed spacing in 25.8% of Yemeni children they examined. In the age-group of 9–12 years, the presence of diastema was considered a normal occurrence as it is physiologic during dentition development, which usually is resolved with time.

Abdulateef et al.[17] stated that the prevalence of MMD among participants from Sulaimani City, Iraq was 21.7% and found similar percentages in males and females; highest in the youngest age-group and lowest in the oldest. The most frequent etiological factor associated with MMD was oral unhealthy habits, which were observed in 8.7% of the overall study population. In an Iraqi population, the incidence of MMD was 3.8% in students aged 18–22, and the prevalence was slightly higher in females (4.1%) vs males (3.4%); MMD was found to be more common in female students among the Iraqi population.[18]

Among Egyptians, 17.3% of patients had MMD, with no significant difference between genders. The common etiological factors identified were congenitally missing laterals, highly attached frenum, generalized spaces, and flared incisors.[19] In Sudan, the prevalence of MMD ranged between 0.1 and 7.0% for arches, more frequent in females; among the examined students, 70% had midline diastema and had a family history of the condition, 56% did not consider midline diastema an esthetic problem, and 10.6% had a speech problem.[20]

Due to the lack of evidence and investigation in this issue and the importance of diagnosis of the MMD and its relation with esthetics and function among populations in Hodeidah Governorate, Yemen. Thus, the current study aimed to evaluate the prevalence and etiological factors of MMD in Yemeni students at different colleges and universities in Hodeidah Governorate, Yemen. Also, MMD width was measured. The null hypothesis was that differences in prevalence, width sizes, and family histories of MMD would be nonsignificant between males and females and among age-groups.

Participants and Methods

Study Design and Ethical Consideration

This descriptive cross-sectional study was conducted on students at governmental and private universities in Al-Hodeidah Governorate from June to September 2024. Approval was obtained from the medical ethics committee of the Faculty of Dentistry, Sana'a University (Ref No.: 457; Date: 3/06/2024). Participants received a summary of the study's objectives and questionnaires, and each provided consent. The study was conducted in compliance with the Declaration of Helsinki guidelines.[21]

Study Setting and Sample Size Calculation

Students from the aforementioned medical institutes, namely, Al-Hodeidah, AL-Shifa'a Technical and Medical Science, Science and Technology, and the Yemen of Gulf University for Science and Technology, were selected. The sample size was determined based on the number of students in the selected colleges, and the effect sample was calculated at 85% power and significance level (α) of 0.05. The calculated sample size was 1,450 participants, with an additional 10% to account for potential dropouts, leading to a final required sample size of 1,600 participants took part in this study.[22]

Participants Inclusive and Exclusive Criteria

The inclusion criteria were as follows: age of 19–26 years, presence of permanent maxillary central incisors (MCIs), permanent dentition, presence of full sound set teeth, absence of attrition of teeth, and absence of history of extracted teeth. Students with dentofacial deformity and previous restoration of MCIs and those who underwent orthodontic treatment were excluded.

Participant Screening

After the signing informed consent forms, the participants received information about the purpose of the study and the voluntary nature of their participation and were informed that they could withdraw at any time. Data were collected through a combination of structured interviews, clinical examinations, and periapical radiographs at different stages and steps. A total of 5,280 participants from different colleges and universities were interviewed and asked to be included in this study. Only 2,539 students agreed to participate, of which 1,661 participants satisfied the selection criteria and underwent screening and clinical examination.

Examination and Data Collection

The first part of the examination was related to participants' characteristics and conducted through a direct interview at the students' college or university. The collected demographic details were gender (male or female) and age (grouped into five age-groups; 19–20, 21–22, 23–24, 25–26, and >26 years old) were recorded.

The second part of the examination was carried out at portable clinics and consisted of the following steps:

A direct visual inspection of the oral cavity (soft and hard tissues) was performed using a disposable examination kit (Guangzhou Jaan Medical CO., Ltd, China). Examination was conducted under natural daylight conditions and with the use of portable artificial lighting to ensure proper visualization.

The space or gap between the MCIs was measured. The spaces were recorded as MMDs and measured in millimeters. The measurements were performed by placing the two tips of the vernier caliper 1 mm above the incisal tips of MCIs, and the reading was recorded in mm as seen in Figure 1. The spaces between the MCIs or the MMDs were measured using digital vernier calipers (Mitutoyo, Japan**)**. The MMDs were inspected, assessed, and recorded as presence (positive MMD) or absence (negative MMD). All measured MMD were considered and counted as permanent MMD and pathologic malocclusion.

Participants with spaces between MCIs of less than <0.5 mm (negative MMD) did not undergo further assessments. Participants with more than ≥0.5 mm (positive MMD) space between the MCIs underwent further analysis and assessment. The recorded spaces were categorized into three groups with a previously described scheme with some modifications.[4,15] Group I comprised participants with MMD between 0.5 and 1 mm and subdivided into 0.50, 60, 65, 70, 80, 90, and 1.00 mm groups, whereas group II (1.1–2 mm) was divided into 1.10, 1.20, 1.30, 1.40, 1.50, 1.75, and 1.80 mm groups. Group III (above 2 mm) was divided into 2.10, 2.50, 3.00, 3.50, and 4.00 mm groups. Physiologic and gets resolved as permanent teeth erupt and if it persists even after the permanent teeth erupt it is considered as MMD and a malocclusion. Kindly emphasize the former at the beginning of the methodology and provide a clear demarcation between physiologic and pathologic malocclusion.

Fig. 1: Points of maxillary midline diastema measurements

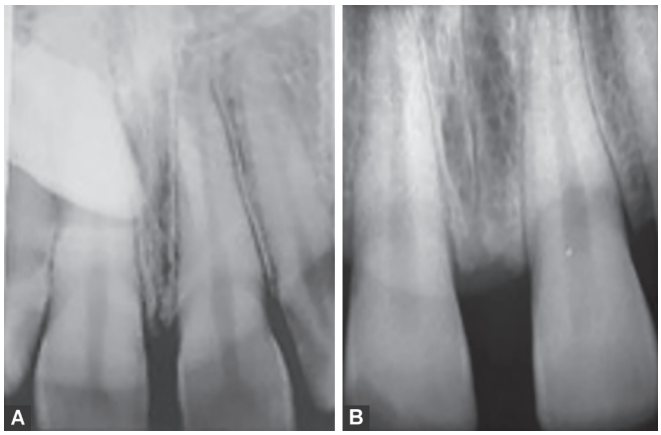
The existing association between the MMDs and family history was further explored. Specifically, the participants were asked if any of their immediate family members, such as parents, siblings, or grandparents, had been diagnosed with or exhibited visible signs of MMD. The findings were categorized as ''yes "or "no."

Finally, participants who were identified as having positive MMDs during the screening and visual examination were further examined and grouped about the existing causes of MMD. The etiological factors considered were: the clinical presence of a highly attached frenum (Fig. 2A), generalized spacing between teeth and congenitally missing lateral incisor (Fig. 2B), flared or rotated central incisors (Fig. 2C), and malposed canine tooth (Fig. 2D). Some participants were further examined for X-ray examination, and the periapical radiographs of participants identified with MMD were recorded as impacted canine teeth (Fig. 3A), and highly attached frenum (Fig. 3B). Table 1 shows the causes parameter of MMD and their definition as recorded and mentioned in previous similar studies.[1,23–27]

Figs 2A to D: Clinical cases present with different etiologies of maxillary midline diastema. (A) Presence of a highly attached frenum; (B) Generalized spacing between teeth and congenitally missing lateral incisor; (C) Flared or rotated central incisors; (D) Malposed canine teeth

Calibration and Reliability

Before the study, intra-examiner calibration was performed at two weeks. This process involved jointly examining 25 students at two different time points and recording the findings based on established diagnostic criteria for MMD and its etiological factors. This calibration process continued until a satisfactory level of reliability was achieved. The reliability of the examinations was assessed using Statistical Package for Social Since and recorded.



Figs 3A and B: Radiographic cases show causes of maxillary midline diastema. (A) Impacted canine teeth; (B) Highly attached frenum

Reliability was 1.000 for prevalence of MMD, generalized spaces, flared incisors, peg-shaped later incisors, rotated central incisors, midline pathology, congenital missing laterals, and impacted canine and was 0.998, 0.975, and 0.986 for MMD diameters, highly attached frenum, and existing family history of MMD, respectively. The overall agreement between the first and second examinations conducted by the examiners was 0.985%, indicating high consistency.

Statistical Analysis

Data were inputted in an Excel sheet, arranged, categorized, and transferred to Statistical Package for Social Since for data analysis. The frequency and percentage were calculated for each variable about the participants and their categories. Chi-squared was used in estimating statistically significant differences among parameters and variables. A p-value of < 0.05 indicated statistical significance.

Results

Participants Characteristics

The total sample size of the participants was 1,661, and the mean age was 21.3 ± 1.73 years (the youngest age was 19, and the oldest was 26). Males constituted 1,107 (66.6%) of the participants. Among the different age-groups, the 19–20 group was the largest (712; 42.9%), followed by the 21–22 age-group (590; 35.5%). Only 10 individuals were older than 26 years (0.6%). The highest number of participants with negative MMD was 1,397 (84.1%), and only 264 (15.9%) had positive MMD (Fig. 4).

Table 1: Causes of maxillary midline diastema parameters and their definition

Parameter	*Definition*	*References*
Presence of a highly attached frenum	The frenum is a small fold of tissue that connects the lips or cheeks to the gums. If this frenum is abnormally high or tight, it can contribute to the development of an MMD	Divater et al.[23] Priyanka et al.[24]
Generalized spacing between teeth	Widespread spacing or gaps between multiple teeth, beyond just the central incisors, can be another factor leading to MMD	Proffit et al.[1]
Flared or rotated central incisors	Improper positioning or angulation of the MCI teeth can create a gap or space between them	Sobral[25]
Peg-shaped lateral incisors	Teeth that are abnormally small or conical in shape, such as peg-shaped lateral incisors, may also contribute to the occurrence of MMD	Hua et al.[26]
Malposed or impacted canine teeth	If the canine teeth are not properly positioned or are impacted within the jawbone, this can disrupt the normal alignment of the front teeth and lead to a midline gap	Manne et al.[27]

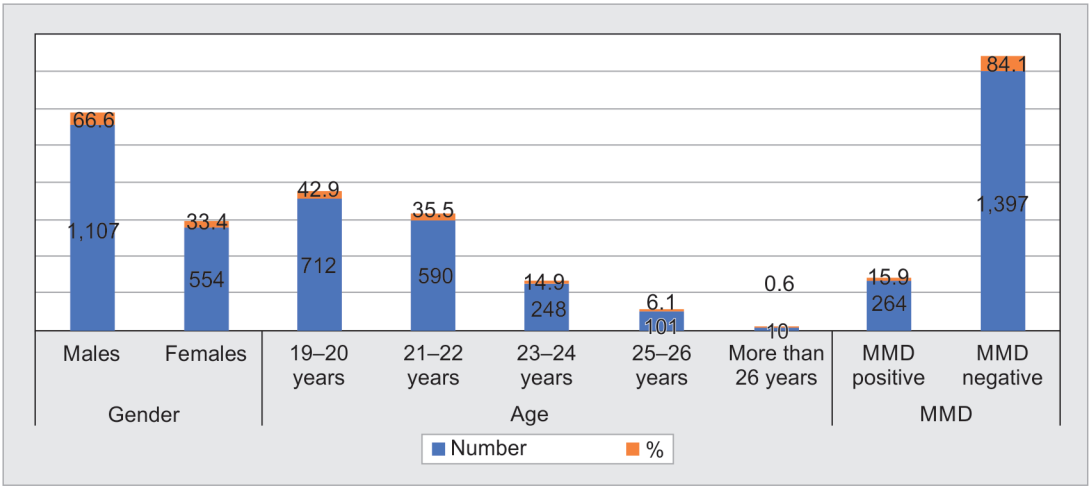


Fig. 4: Participant characteristics

Maxillary Midline Diastema Correlation with Gender and Age-groups

The ratio of positive MMD was higher in males (198; 17.9%) than in females (66; 11.9%), and a significant difference was found between genders ($p = 0.002$; Table 2). A direct proportion between age-groups and the number of positive MMD was observed (Table 2) as age and the number and percentage of positive MMD cases increased, but these increases were not significant ($p = 0.511$).

Distribution of Participants According to MMD Cause

The most common cause of MMD was highly attached frenum (209; 54.3%), followed by generalized spaces (104; 27.0%) and flared incisors (20; 5.2%). The lowest percentages were determined for impacted canines (12; 3.1%), followed by those for rotated central incisors (6; 1.6%; Fig. 5).

Correlation between Etiological Factors of MMD and Gender

Regarding the MMD etiological factors and gender, males were higher in number, and significant differences in highly attached frenum and generalized spacing parameters were found, only with *p*-values of 0.004 and 0.009. No significant differences were found in the other causes ($p \leq 0.050$; Table 3).

Table 2: Association between MMD with gender and age-groups (Chi-squared test)

Variables	*MMD positive N (%)*	*MMD negative N (%)*	*Chi-squared*	*p-value*
Gender				
Male	198 (17.9)	909 (82.1)	9.853	0.002*
Female	66 (11.9)	488 (88.1)		
Age-groups				
19–20 years	111 (15.6)	601 (84.4)	3.285	0.511
21–22 years	102 (17.3)	488 (82.7)		
23–24 years	37 (14.9)	211 (85.1)		
25–26 years	14 (13.9)	87 (86.1)		
More than 26 years	0 (0.0)	10 (100)		

*Significant differences when $p \geq 0.050$

Association between MMD and Family History ($N = 264$)

Table 4 shows the associations between the presence of a familiar history of MMD and gender, numbering at 89 (44.9%) and 41 (62.1%) for males and females, respectively. The Chi-squared test showed significant differences in family history and presence of MMD between males and females ($p = 0.016$).

Contributions of MMD Width among Different Groups

Moreover, 130 (56.8%), 69 (30.1%), and 30 (13.1%) MMDs were recorded for groups I, II, and III, respectively. The MMDs 1.00 mm

Table 3: Association between etiology of MMD with gender (Chi-squared test)

Etiology	*Male N (%)*	*Female N (%)*	*Total N (%)*	*p-value*
Highly frenum				
Yes	165 (83.3)	44 (66.7)	209 (79.2)	0.004*
No	33 (16.7)	22 (33.3)	55 (20.8)	
Generalized spaces				
Yes	87 (43.9)	17 (25.8)	104 (39.4)	0.009*
No	111 (56.1)	49 (74.2)	160 (60.6)	
Flared incisors				
Yes	14 (7.1)	6 (9.1)	20 (7.6)	0.591
No	184 (92.9)	60 (90.9)	244 (92.4)	
Peg shape lateral incisors				
Yes	14 (7.1)	3 (4.5)	17 (6.4)	0.469
No	184 (92.9)	63 (95.5)	247 (93.6)	
Rotated central incisor				
Yes	4 (2.0)	2 (3.0)	6 (1.5)	0.921
No	194 (98.0)	64 (97.0)	260 (98.5)	
Congenital missing of lateral				
Yes	12 (6.1)	5 (7.6)	17 (6.4)	0.664
No	186 (93.9)	61 (92.4)	247 (93.60	
Impacted canine				
Yes	10 (5.1)	2 (3.0)	12 (4.5)	0.495
No	188 (94.9)	64 (97.0)	252 (95.5)	

*Significant differences when $p \geq 0.050$

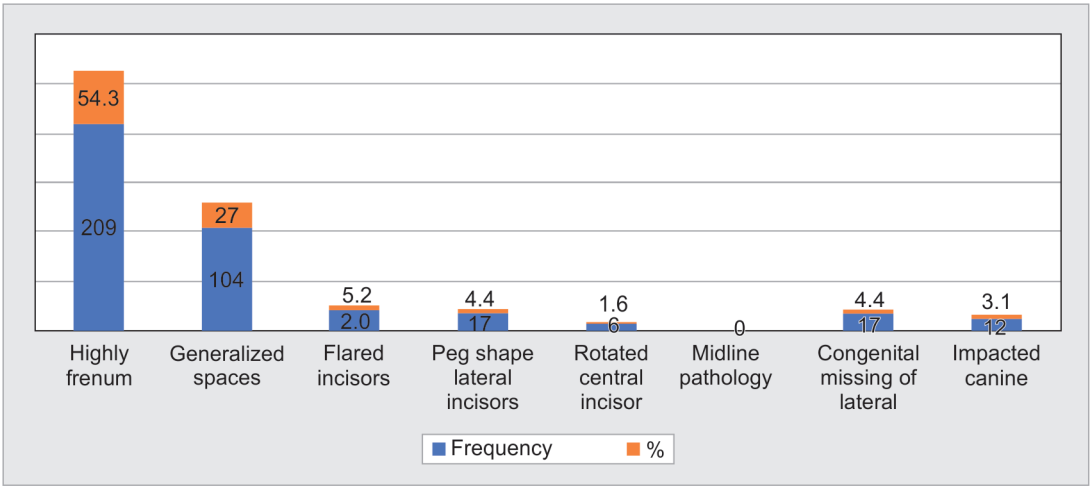


Fig. 5: Participants according to different causes of midline maxillary diastema

in diameter numbered 108 in group I (83.1%), 60 in group II (87.0%), and 16 in group III (53.3%; Fig. 6).

The overall prevalence of the MMD is high, slightly higher among males. The highly attached labial frenum was the most common etiological factor documented, while the rotated central incisors were the least frequent cause. The MMD width with 0.5–1 mm was the most observed and recorded group.

Discussion

Maxillary midline diastema is a common dental anomaly that considerably affects an individual's appearance and self-esteem, especially during the critical developmental years of young adulthood.[2,28] For patients, attractivity is a characteristic required and considered in smile design for any individual and population.[29] Maxillary midline diastema is a frequently observed cosmetic concern of patients seeking dental treatment across different dental specialties. Thus, this cross-sectional study aims to examine the prevalence and etiology of MMD in Yemeni university students in Hodeidah Governorate.

The overall prevalence of MMD in the participants in this study was 15.9%, and a significant difference in MMD prevalence was found between males and females. Thus, the null hypothesis was rejected in this variable. This finding was consistent with the prevalence reported by studies conducted worldwide (1.6%–25%).[4,7,12,15,19,20,30]

The prevalence reported by the participants of the current study was consistent with that reported in Egypt (17.3%)[19] but was much higher than that recorded in a US population (6.0%).[20]

Sudanese students (7.0%),[31] and a South Indian population (1.9%).[13,32] By contrast, the prevalence of MMD in this study was lower than that reported in Tanzanian (26%) and Iraqi patients (28%).[12,30] Differences in MMD prevalence among various studies may be attributed to differences in factors, such as genetics, environment, race, age, gender, and sample size, among the studied populations.

The present study found a higher prevalence of MMD in males compared with females. However, the prevalence in males was lower than that documented among Saudi (25.0%),[15] Indian (51.9%),[4] Pakistani (34.4%),[17] and Iraqi populations (31.5%).[33] However, it was much higher than that found in Bagdad City (3.4%).[18] Meanwhile, the prevalence in females was marginally higher than that reported by studies in Saudi Arabia (14.0%).[15] and India 19.7%[4] and much lower than that reported by studies in Iraq (68.5% and 65.6%).[17,18] Variation in the prevalence of MMD concerning gender can be attributed to the increased level of cosmetic concern of females, who visit dental clinics more frequently than males. This variation may also be related to genetics, familial factors, sampling techniques, and sample distribution (ratio between males and females).

A hypertrophic labial frenum can be considered a major contributing factor to the development of an MMD and patient satisfaction.[33] When the labial frenum is thick and fleshy, the fibroelastic band crosses the alveolar ridge and inserts itself into the incisive papilla, which prevents MCIs from approximating properly.[23] Consistent with the findings of the present study, an abnormal attached labial frenum was identified as the most common etiological factor of MMD. This result is marginally close to that obtained from university students (51.9%)[20] but slightly higher than that recorded for Indians (45.6%)[3] and in the Kurdistan Region, Iraq (39.4%).[4]

However, the results of the present study disagreed with previously reported results, which indicated that the most common etiological factor of MMD is imperfect fusion at the midline of the premaxilla; the second most common factor is the highly attached labial frenum, which was the cause of 24.4% of examined cases.[14] Furthermore, the most common factor for MMD in the Saudi population was generalized spacing (39%).[15] However, in Egypt, the most common etiological factor of MMD was congenitally missing laterals.[19] Dental anomalies (tooth/arch size discrepancies, microdontia of lateral incisors, congenitally missing teeth, impacted canines, and abnormal occlusal patterns) are the causes of approximately 68.6% of MMD.[34] Whoever, generalized

Table 4: Association between family history of MMD and gender (Chi-squared test)

Family history	*Male N (%)*	*Female N (%)*	*Total N (%)*	*p-value*
Yes	89 (44.9)	41 (62.1)	130 (49.2)	0.016*
No	109 (55.1)	25 (37.9)	134 (50.8)	
Total	198 (100)	66 (100)	264 (100)	

*Significant differences when $p \geq 0.050$

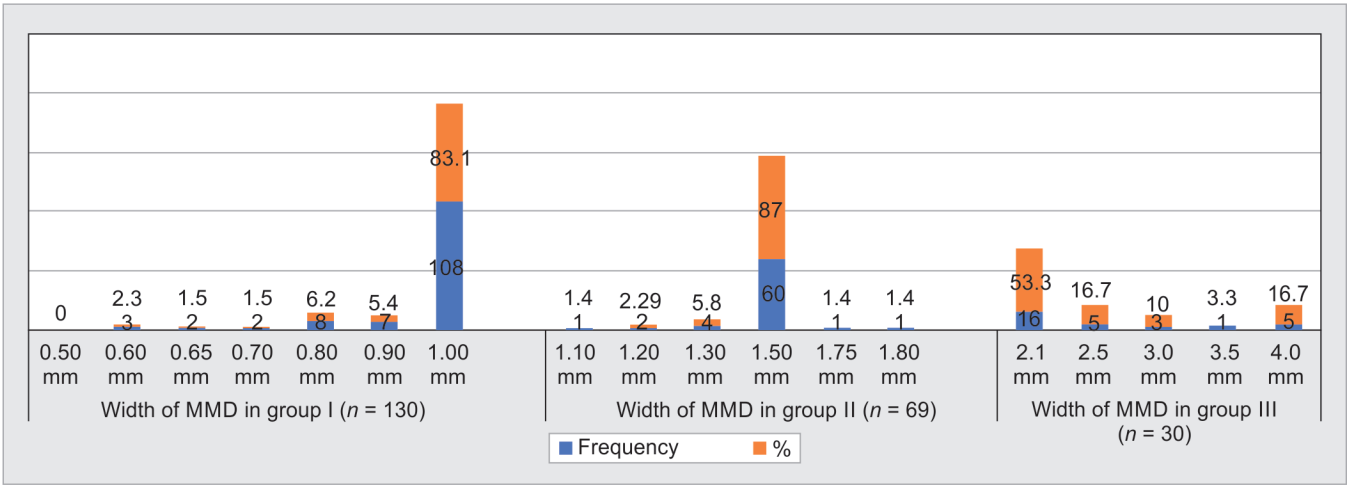


Fig. 6: Width of midline maxillary diastema in the three groups

spacing was the second common etiological factor of the MMD in the current study. This rate was lower than previously reported rates (48.8 and 39.0%).[4,20]

Peg-shaped lateral incisors are considered dental developmental anomalies and can occur as isolated anomalies or can be associated with other dental or craniofacial abnormalities.[26] The present study found that peg-shaped lateral incisors were the cause of 4.4% of MMD cases. This rate was similar to that reported in Saudi (4%)[15] and Iraqi populations (5.3%)[3] and in the Kurdistan Region, Iraq (6%).[17] However, the present study's findings disagree with the results reported in an Egyptian population, which showed a higher percentage.[19] Other studies showed that 8.1% and 7% of MMD cases were caused by peg-shaped lateral incisors.[4,17]

Congenital missing lateral incisors are considered the most common forms of congenitally missing permanent teeth in the maxillary anterior region, representing approximately 20% of all dental anomalies.[2,35,36] However, the prevalence of this condition varies considerably by geographical region and study population. Approximately 4.4% of the subjects with MMD were due to congenital lateral missing incisors, which is higher than the proportion of subjects reported by Moyers (2.4%)[14] among his studied population, and the 2.2% among Iraqi samples.[17] By contrast, a much higher percentage of MMD due to the absence of congenital lateral incisors was obtained in an Egyptian population (38.5%)[19] while only 11.0% was recorded in a Sudanese sample.[20]

In addition, flared incisors were identified as etiological factors contributing to MMD, accounting for 5.1% of cases in this study. However, this result differed significantly from the findings obtained in Egypt (26.0%)[18] and Sudan (17.5%).[19]

The eruption of canines is a well-known physiological cause of spontaneous diastema closure. As the permanent canines erupt and move into their proper position, they can help close any existing diastemas between anterior teeth.[37] An improperly erupting or positioned canine can contribute to the development or persistence of a midline diastema rather than facilitating its closure.[5] The present study found a ratio (3.1%) of impacted or malposed canines as an etiological factor of MMD.

The etiological factor with the lowest ratio was rotated incisors, which accounted for 1.6% of the cases. This finding contradicted that reported by Hasan et al. in that the ectopic migration of the canine was the least common cause (0.8% of cases) in Kurdistan Region, Iraq.[3] Peg-shaped laterals were the least common causes in India (8.6%)[4] and Saudi Arabia (4%).[15] Additionally, supernumerary teeth were the least common etiological factor for missing maxillary lateral incisors.[20]

The causes of MMD are multifactorial and can occur alone or in combination. The genetic, hereditary, and racial characteristics of a study population may affect dental anomaly and incisor positioning and cause flared incisors, peg-shaped lateral incisors, and impacted canines. Other factors, such as local, demographic, and environmental factors, oral health education, esthetic awareness, modern lifestyle, sampling methods, and number of participants or sample size contribute to divergent findings.

In this study, approximately 49.2% of participants with MMD had a family history of MMD; thus, the null hypothesis was rejected for this parameter. The rate was much lower than that reported in similar studies carried out on Saudi (78.0%)[15] and Sudanese university students (70.0%).[20] These consistently high rates of familial clustering for MMD in studies in Yemen, Saudi Arabia, and Sudan suggest a strong genetic or hereditary influence on the development of this dental trait in Arabian populations.

In the present study, MMD was categorized into three groups by width: groups I (0.5–1 mm), II (1.1–2 mm), and III (over 2 mm). The findings revealed that group I was the most common, with 56.8% of the cases. This percentage was higher than the MMD width recorded by Gupta et al.[4] (40.7%; 1.1–1.5 mm) and Luqman et al.[15] (43.5%; 1–1.4 mm). In group III, cases with an MMD width of up to 4 mm had the smallest number (5; 16.7%). The same maximum width was observed in Indian and Saudi populations.[4,15] But, disagree with the finding among Bulgaria population that recorded that over 35% of participants had an MMD width between 7.88 mm and 1.05 mm.[38]

Variations in the results can be attributed to the age range of the participants (19–26 years), which were older than those examined in previous studies (13–40 years old).[4,15] Moreover, the inclusion of participants with canines that were still in the process of physiological eruption at 13 years old may have influenced the findings because the complete closure of an MMD may not have been achieved in these cases. Genetic and hereditary factors could also play a role in the observed differences.

Overall, this study offers a unique opportunity to examine the interplay between MMD and related factors. The causes are multifactorial, and genetic and environmental influences play a role. Potential contributing factors include tooth size and jaw size discrepancies, habits, missing teeth, frenum attachments, malposed canine, and flared or rotated incisors.[19] This is in agreement with the findings among Nigerian samples about the cause of frenum attachment.[39] Identifying the relative importance of these etiological factors in university students may provide valuable insights into the development and persistence of this condition during young adulthood. The occurrence and frequency of MMD vary among different populations. The findings from this study could inform targeted prevention and intervention strategies to address this common dental anomaly.

One of the limitations of the present study is the sample size. Mandibular midline diastema was not assessed which can be counted as another limitation. A larger sample size, including many Yemeni Governorates, is recommended. Further studies using advanced digital technology for measuring MMD digitally and intraoral scanning devices are recommended.

Conclusion

From this cross-sectional study, the following conclusions were formulated:

The prevalence of MMD is high and can be considered a common problem among the examined participants from the colleges and universities in Hodeidah governorate, Yemen. It is slightly higher in prevalence in males.

Maxillary midline diastema commonly has a multifactorial etiology, and the highly attached labial frenum was the most common etiological factor observed. Meanwhile, rotated central incisors were the least frequent cause. Group I had the largest MMD width.

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