



ASSOCIATION BETWEEN HIGH FRENAL ATTACHMENT AND MIDLINE DIASTEMA IN AL-LATRUN MILITARY HOSPITAL

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ABSTRACT

Objective: The aims of this study were to assess the link between high frenal attachment and midline diastema in a cohort of Jordanian patients. **Methods:** We conducted a retrospective study at Al-Latrun Military Hospital-King Hussein Medical City, between March 2025 and March 2026. Demographics (age, gender) and clinical-related characteristics (habits, diastema, and frenal type) were collected and analyzed using R studio 4.2.2. **Results:** This study included 200 patients, 68 (34%) showing midline diastema with a median age of 21 vs 22, $p > 0.2$. Papillary (38%) and gingival (33%) were the most prevalent forms in the non-diastema group. Frenal type between groups was significant ($p < 0.001$). Diastema patients had thicker frenal attachments than those without ($p = 0.075$). Oral hygiene status, thumb sucking and mouth breathing did not significantly differ across the groups ($p > 0.05$). Papilla-penetrating frenal attachment was substantially linked to lower risks of diastema than gingival type, according to multivariable logistic regression (OR=0.26, 95% CI: 0.10–0.64, $p = 0.004$). Compared to patients with other frenal types, those with papillary and papilla-penetrating attachments had noticeably larger diastema gaps. **Conclusion:** The incidence of midline diastema was found to be significantly correlated with specific frenal attachment types. The most common attachments in people with diastema were papillary and papilla-penetrating. After controlling certain variables, papilla-penetrating attachments were linked to decreased probabilities of diastema. Another significant contributing factor was periodontal health, with gingivitis being more common in the diastema group.

KEYWORDS: Midline Diastema, High Frenal Attachment, Jordan, Dental Aesthetics, Retrospective.

INTRODUCTION

Midline diastema is defined as the space in the upper incisors, which can rise due to several etiologies such as, heredity, extra teeth, oral piercing, or high frenal placement.^[1,2] In patients under twelve, nasal airflow condensation, and the differences in labial anatomy are considered the common reasons for this condition.^[3] One study suggested that the midline gap can vary in different age groups and ethnicities. Some cultures consider 2-4 mm separation a beauty standard, specifically in West Africa.^[4] While other cultures consider middle teeth gaping to be aesthetically unacceptable according to the population and experts in the field.^[5] Midline diastema is considered a normal occurrence among developing children, especially during the mixed dentition phase.^[6]

Anatomic examination plays a crucial role in assessment and treatment when incorporated, many new studies have showed that high frenal attachment was significantly linked to more prevalence of diastema.^[7] A variety of treatment approaches can be utilized depending on the underlying etiology, orthodontic gap closure, frenectomy surgery, or restorative techniques have all shown their capacity to be helpful in improving aesthetics and functionality.^[8] However, retention procedures are a must following such techniques to ensure prevention of post-treatment relapse.^[9] While not all patients present with the same opinion and attitude towards midline diastema, understanding how age, gender, and cultural differences play a role in psychological repercussions highlights the importance of individualized treatment plans.^[10]

In the current study, we will aim to assess the link between high frenal attachment and midline diastema among patients with different ages in Jordan, and to evaluate independent predictors contributing to presence of diastema.

METHODS AND MATERIALS

Study Design

This retrospective, single-center, exploratory study was carried out at Al-Latrun Military Hospital - King Hussein Medical City, between March 2025 and March 2026.

Data Collection

200 patients were assessed for eligibility to be enrolled in our study, 68 (34%) had midline diastema. Demographic data along with clinical characteristics (midline diastema, frenal attachment, some habits such as thumb sucking and mouth breathing, and gingival and periodontal health) were collected in an excel sheet.

Ethical Consideration

The need for informed consent was waived by the institutional review board (IRB) at our hospital due to the retrospective nature of the study, all data was anonymized prior to analyzing.

Statistical Methods

After assessing data normality, continuous data was displayed as medians (Interquartile Ranges) and counts (%) for categorical data. Median comparisons was conducted using Wilcoxon rank-sum test, while chi-squared or fisher's exact test were utilized to compare proportions.

Independent predictors of midline diastema were examined using multivariable logistic regression while adjusting for certain variables. Odds ratio (OR) was computed, along with 95% confidence intervals (95% CIs), with p-value preset at 0.05. All statistical analyses were conducted using R studio 4.2.2 (Austria, Vienna).

RESULTS

200 patients were enrolled; 68 (34%) had midline diastema. In the diastema group, the median age was 21 years (IQR: 13–27) compared to that in the parallel arm 22 years (IQR: 15–29) ($p = 0.2$). Males made up 56% of

individuals with diastema and 57% of those without ($p = 0.9$), indicating a comparable gender distribution across groups. Additionally, oral hygiene level was similar, with 43% of patients with diastema reporting acceptable oral hygiene, 44% reporting good oral hygiene compared to 52%, and 13% reporting poor oral hygiene compared to 7.6% ($p = 0.4$). While healthy periodontal status was more common in the non-diastema group (69% vs. 18%) ($p < 0.001$), gingivitis was much more common in those with diastema (79%) than in those without (31%). Periodontitis was observed exclusively in the diastema group, affecting 2.9% of patients (Table 1).

Thumb sucking was reported in 7.4% of the diastema group and 4.5% of the non-diastema group ($p = 0.5$). Mouth breathing was present in 10% of those with diastema and 7.6% without ($p = 0.5$). Gingival recession was similarly distributed between groups (15% vs. 14%, $p = 0.8$). The distribution of oral hygiene categories remained consistent across groups in this subset (Table 2). With respect to frenal characteristics, papillary attachment was the most common type among those with diastema (44%), followed by papilla-penetrating (35%), gingival (19%), and mucosal (1.5%). Among those without diastema, papillary and gingival attachments were most common (38% and 33%, respectively), followed by papilla-penetrating (17%) and mucosal (13%) ($p < 0.001$). Thick frenal attachments were more prevalent in the diastema group (66%) than in the non-diastema group (53%) ($p = 0.075$) (Table 3).

Papilla-penetrating frenal attachment was substantially linked to a decreased risk of developing diastema than gingival attachment type, according to multivariable logistic regression analysis (OR = 0.26, 95% CI: 0.10–0.64, $p = 0.004$). Age (OR = 1.03, $p = 0.2$), gender (OR = 0.82 for males, $p = 0.5$), frenal thickness (OR = 1.10 for thin vs. thick, $p = 0.8$), thumb sucking (OR = 0.60, $p = 0.5$), mouth breathing (OR = 0.87, $p = 0.8$), or oral hygiene status ($p > 0.2$ for all categories) did not show any significant correlations (Table 4). Among patients with diastema, diastema width was greater in those with papilla-penetrating and papillary frenal types compared to gingival and mucosal types (Figure 1).

Table 1: Demographic and clinical characteristics by diastema status.

Variable	Diastema N = 68 ¹	No Diastema N = 132 ¹	Overall N = 200 ¹	p-value ²
Age (years)	21 (13, 27)	22 (15, 29)	21 (14, 28)	0.2
Gender				0.9
Female	30 (44%)	57 (43%)	87 (44%)	
Male	38 (56%)	75 (57%)	113 (57%)	
Oral Hygiene Status				0.4
Fair	29 (43%)	54 (41%)	83 (42%)	
Good	30 (44%)	68 (52%)	98 (49%)	
Poor	9 (13%)	10 (7.6%)	19 (9.5%)	
Periodontal Health				<0.001
Gingivitis	54 (79%)	41 (31%)	95 (48%)	

Healthy	12 (18%)	91 (69%)	103 (52%)	
Periodontitis	2 (2.9%)	0 (0%)	2 (1.0%)	
¹ Median (Q1, Q3); n (%)				
² Wilcoxon rank sum test; Pearson's Chi-squared test; Fisher's exact test				

Table 2: Association between habits/oral hygiene and diastema.

Variable	Diastema N = 68 ¹	No Diastema N = 132 ¹	Overall N = 200 ¹	p-value ²
Thumb Sucking	5 (7.4%)	6 (4.5%)	11 (5.5%)	0.5
Mouth Breathing	7 (10%)	10 (7.6%)	17 (8.5%)	0.5
Gingival Recession	10 (15%)	18 (14%)	28 (14%)	0.8
Oral Hygiene Status				0.4
Fair	29 (43%)	54 (41%)	83 (42%)	
Good	30 (44%)	68 (52%)	98 (49%)	
Poor	9 (13%)	10 (7.6%)	19 (9.5%)	
¹ n (%)				
² Fisher's exact test; Pearson's Chi-squared test				

Table 3: Frenal type and frenal thickness vs diastema.

Variable	Diastema N = 68 ¹	No Diastema N = 132 ¹	Overall N = 200 ¹	p-value ²
Frenal Attachment Type				<0.001
Gingival	13 (19%)	43 (33%)	56 (28%)	
Mucosal	1 (1.5%)	17 (13%)	18 (9.0%)	
Papilla-penetrating	24 (35%)	22 (17%)	46 (23%)	
Papillary	30 (44%)	50 (38%)	80 (40%)	
Frenal Thickness				0.075
Thick	45 (66%)	70 (53%)	115 (58%)	
Thin	23 (34%)	62 (47%)	85 (43%)	
¹ n (%)				
² Pearson's Chi-squared test				

Table 4: Multivariable logistic regression predicting diastema presence.

Characteristic	OR	95% CI Lower	95% CI Upper	p-value
Age (years)	1.03	0.99, 1.07	1.07	0.2
Gender				
Female	—	—		
Male	0.82	0.42, 1.55	1.55	0.5
Frenal Attachment Type				
Gingival	—	—		
Mucosal	6.04	1.00, 117	117	0.10
Papilla-penetrating	0.26	0.10, 0.64	0.64	0.004
Papillary	0.50	0.22, 1.12	1.12	0.10
Frenal Thickness				
Thick	—	—		
Thin	1.10	0.55, 2.19	2.19	0.8
Thumb Sucking				
No	—	—		
Yes	0.60	0.14, 2.57	2.57	0.5
Mouth Breathing				
No	—	—		
Yes	0.87	0.29, 2.72	2.72	0.8
Oral Hygiene Status				
Fair	—	—		
Good	1.65	0.82, 3.35	3.35	0.2
Poor	1.18	0.39, 3.63	3.63	0.8
Abbreviations: CI = Confidence Interval, OR = Odds Ratio				

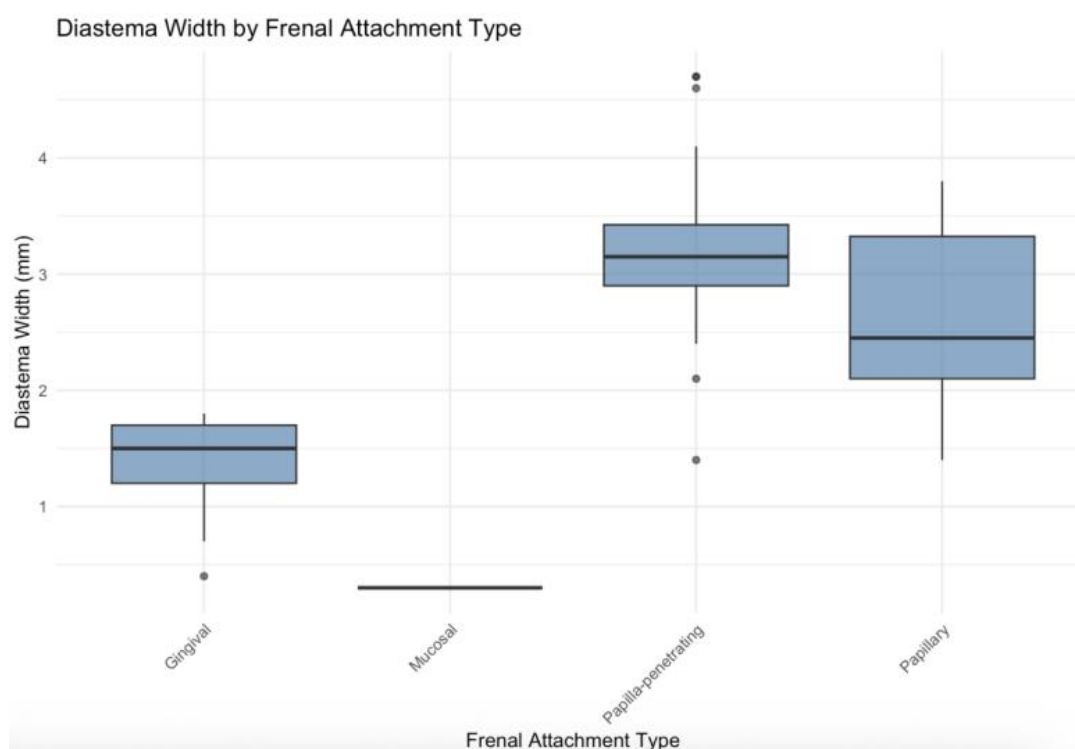


Figure 1: Boxplot of diastema width by frenal type (for those with diastema).

DISCUSSION

An interdental gap larger than 0.5 mm between the maxillary central incisors is known as midline diastema.^[11] A mix of environmental and genetic factors may cause it. About 98% of 6-year-olds, 49% of 11-year-olds, and roughly 7% of people between the ages of 12 and 18 have the disorder. Its incidence among adults varies from 1.6% to 25.5%. Additionally, Black populations are more likely to experience it than White, Asian, and Hispanic populations.^[12] High frenal attachment is known to be a significant contributing cause to midline diastema, one of the most common aesthetic dental issues. A complete clinical history, gap width measurement, and specialized tests like the blanch test to check frenal attachment are all part of the diagnosis process. In addition to radiographic imaging to identify supernumerary teeth, bone notching, or other underlying pathologies.^[13]

High frenal attachment is significantly seen with midline diastema especially in males in the younger children.^[14] It is associated positively with the severity of midline diastema, with the most prevalent attachment type being papillary type and the length of space being 2-3mm.^[15] However, timely diagnosis and management of midline diastema and supernumerary teeth can reduce the future need for complex surgery and orthodontic treatment.^[16] In this study we aim to evaluate the association between high frenal attachment and midline diastema among patients in Jordan, providing insight into the burden of this condition and its associated factors.

Our cohort consisted of 200 individuals, 68 of whom had midline diastema and 132 of whom did not. The

diastema group's median age was 21, whereas the non-diastema group's was 22. Males made up 56% of the diastema group and 57% of the non-diastema group, indicating a similar gender distribution between the two groups. The median age of participants in a study of orthodontic patients in the Kurdistan area was 19. Nonetheless, 52.6% of the patients in their group were male, indicating a rather balanced gender distribution.^[17] According to our findings, 43% of patients with diastema and 41% without reported having fair oral cleanliness, 44% reported having high oral hygiene compared to 52%, and 13% had poor oral hygiene compared to 7.6%. About 40% of patients in a similar orthodontic study between the ages of 15 and 30 were classed as having good oral hygiene, whereas 60% had poor hygiene.^[18] While healthy periodontal status was more common in the non-diastema group (69% vs. 18%), gingivitis was more common in our patients with diastema (79%) than in those without (31%). In our sample, only 2.9% of the diastema group had periodontitis.

The authors of a recent case study reported that a 20-year-old lady with persistent gingivitis had a high frenal attachment and a substantial midline diastema.^[19] This corroborated our discovery that gingival inflammation is typically present in diastema patients. Thumb sucking was reported by 4.5% of the non-diastema group and 7.4% of the diastema group in our cohort. 10% of people with diastema and 7.6% of people without had mouth breathing. Thumb sucking and the congenital lack of lateral incisors were shown to be the most frequent contributing factors in a study of patients with midline diastema in the Kurdistan region.^[17] The most prevalent kind among individuals with diastema in our population

was papillary attachment, which was followed by papilla-penetrating, gingival, and mucosal. In comparison to the non-diastema group, thick frenal attachments were more common in the diastema group (Table 3). According to a different study, patients with diastema were more likely to have an enlarged upper lip frenulum attachment. Furthermore, they discovered that papillary and papilla piercing frenulum were the most frequently seen types in diastema patients.^[20]

One limitation of this study is that its retrospective, single center data, which may limit the generalizability of the findings across bigger populations. However, a key strength of our study is the large sample size and detailed clinical evaluation of frenal attachment, types and thickness. We recommend researchers to develop future prospective multicenter studies that can explore the long-term outcomes of different frenal attachment types on diastema relapse following orthodontic or surgical interventions.

CONCLUSION

This study shows that the presence of midline diastema is significantly correlated with certain forms of frenal attachment. Patients with diastema most frequently had papillary and papilla-penetrating frenal attachments, which were similarly linked to greater diastema width. Frenal thickness by itself was not a statistically significant predictor, despite the fact that thick frenal attachments were more common in the diastema group. Furthermore, when other factors were taken into account, papilla-penetrating attachments were associated with lower risks of diastema despite their prevalence, and gingivitis showing more prevalence in the diastema arm. Age, gender, dental hygiene, thumb sucking, and mouth breathing were not significantly correlated. Our findings call attention to the importance of proper clinical examination with more caution towards analyzing of frenal morphology in the clinical management of midline diastema. Capturing high-risk attachment styles early on the journey may probably assist in reducing the probability of relapse post-therapy.

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