

## An Assessment of a Possible Relationship between Level of Frenal Attachment and the Severity of Midline Diastema among Selected Group of Nigerians

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### ABSTRACT

**Background:** There are divergent opinions concerning the coexistence of midline diastema with high frenal attachment. While some have reported high frenal attachment in association with wide midline diastema, others have reported otherwise.

**Objective :** To assess the relationship between the level of frenal attachment and the severity of midline diastema

**Materials and Methods:** Midline diastema was measured to the nearest millimeters in a cross sectional study among one hundred and sixty-four selected group of Nigerians. The level of attachment of the median labial frenum was assessed and classified into the mucosal, gingival and the papillary attachment types. The mean width of the midline diastema was compared with the height of the frenal attachment using t-test and level of statistical significance was set at  $p < 0.05$ .

**Results:** One hundred and sixty-four participants consisting of 16 (9.8%) males and 148 (90.2%) females were assessed. A larger percentage (12/18) of papillary type of frenal attachment had diastema greater than 1 millimeter, while one of those with mucosal attachment had midline diastema. There was a statistically significant relationship between the presence of midline diastema and the level of frenal attachment ( $p < 0.000$ ). Similar findings were observed when mean width of midline diastema was compared with the frenal height ( $p < 0.000$ ) and when mean differences of midline diastema of the various frenal heights were compared.

**Conclusion:** Within the limitation of this study, frenal height was found to be associated with the presence and severity of midline diastema. This may be essential in the management of midline diastema, especially in its orthodontic closure as it is considered as a malocclusion trait, which may necessitate surgical excision of the frenum.

**Keywords:** Frenum, Level of attachment, Midline Diastema, Maxilla, Prevalence

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### INTRODUCTION

Midline diastema, also called “gapped teeth” or “open teeth” describes a space greater than 0.5mm, occasionally found between the central incisors. It may occur in the maxillary or the mandibular or both dental arches of an individual<sup>1,2</sup>. The affected dentition may be the primary, mixed or permanent teeth. It is considered part of normal development in a developing dentition as the required extra space must accommodate the permanent teeth, which are larger than their deciduous counterparts<sup>3,4,5</sup>.

When midline diastema is seen in permanent dentition, its acceptability varies widely based on the sociocultural differences of those involved. Many cultures in Africa considered midline diastema as adding to their beauty, while the Europeans view it as being not aesthetically pleasing<sup>4,6,7,8,9</sup>. However, a study has suggested a possible change in the trend among Caucasians with the possibility of increasing acceptance of midline diastema and impact on the orthodontic treatment planning in the presence of diastema<sup>10</sup>. So, while some are seeking for ways of eliminating it when present, others are looking for a way to create the midline diastema where none previously existed.

Possible aetiologic factors which have been associated with midline diastema can be grouped into developmental, iatrogenic factors and pathological. The ugly duckling phenomenon is one of the developmental factors and is associated with the developing maxillary canines<sup>11,12</sup>. Some of the iatrogenic causes include cases in which an individual artificially creates diastema, especially in cultures where diastema is associated with beauty<sup>6,7</sup>. Pathological causes include oral habits like finger sucking, which cause proclination of incisors and interdental spacing, microdontia, supernumeraries (mesiodens), tooth size-arch length discrepancy, dental anomalies such as peg shaped lateral incisors and high frenal attachment<sup>11,12</sup>.

In a desperate crave for midline diastema, some individuals have artificially created midline diastema through teeth filings and they may have to cope with the possible complications resulting from its creation through dentinal and pulpal injury leading to pulpal necrosis, which may necessitate endodontic therapy or even extraction in hopeless situations<sup>6,7</sup>. Some complications emanating from midline diastema may include speech disturbance such as lisping, poor aesthetics, tongue thrusting habit through diastema and periodontal effects and incisal proclination secondary to traumatic occlusion to maxillary

incisors<sup>11-13</sup>. Possible methods that had been utilized in eliminating midline diastema for those who considered it as unaesthetically pleasing include restorative procedures such as crowning the affected teeth, composite restoration and possibly orthodontic management<sup>5,8,9</sup>.

The frenal attachment in various individuals has shown a wide range of variations and anomalies and it has been classified into mucosal, gingival, papillary and papillary penetrating types by Mirko et al<sup>13</sup>. Frenal attachment level and types have been reported severally in many scholarly journals as having a significant role to play in various dental conditions and anomalies especially its effect in the aetiology of midline diastema<sup>14,15</sup>. Frenal attachments are located in the labial, lingual and the buccal areas of the oral cavity. The maxillary labial frenum attachment has particularly caught the attention of research due to the perceived part it plays in the aetiology of midline diastema. However, high frenal attachment had been reported in a study as an effect rather than a cause of midline diastema while other researchers have reported high frenal attachment as a cause of midline diastema<sup>15,16</sup>. Jonathan et al. in a study reported that high frenal attachment was commonly observed in the younger age group and this is due to the apical migration of the frenum over time hence diastema is commoner in the younger age group and decreases with advancing age<sup>17</sup>.

The reported prevalence of midline diastema has been found to vary with racial background, culture, ethnicity, age group and gender. Previous studies have reported a prevalence of 31.5% among adolescents in Nigeria<sup>16</sup> and 23.2% among Iraqis<sup>18</sup>. Therefore, this study aims at assessing the relationship between the level of frenal attachment and the severity of midline diastema among respondents, which may have some implications in the management of midline diastema and frenum.

### MATERIALS AND METHODS

One hundred and sixty-four subjects, consisting of sixteen males and one hundred and forty-eight females were recruited for this study using convenient sampling based on the availability of participants at the dental clinic. The participants were assessed for the presence and severity of maxillary midline diastema and frenal attachment. Those with artificially created maxillary midline diastema, missing or periodontally compromised maxillary anterior teeth and any pathology such as swelling or tumours involving the anterior maxilla

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were excluded. A structured questionnaire with section A on biodata and B for the recording of clinical findings of respondents following clinical examination was used in the assessment. The presence of midline diastema was recorded when a space greater than 0.5mm was measured between the central incisors. A meter rule was used to measure the diastema to the nearest millimeter, from the mid-point of the mesial surface of one central incisor to the other (the contact points). Respondents were grouped into three age groups,  $\leq 20$ , 21-29,  $> 29$  years, in order to facilitate statistical analysis.

An initial calibration of the questionnaire was done using ten cases which were excluded from the study. A single researcher made all the measurements. The level of attachment of the median labial frenum was also assessed and classified based on Mirko et al<sup>23</sup> classifications into:

Mucosal type, where the frenum is attached to the mucogingival junction with no evidence of crossing into the attached gingiva

Gingival type, where the frenum is inserted into the attached gingiva but not extending coronal to the line demarcating the base of the midline papilla. The line demarcating the base of the midline papilla was defined as the line connecting the gingival zeniths of the two central incisors.

Papillary type – frenum inserting coronal to the line demarcating the base of the midline papilla without any visible evidence of frenum extension to the palatal aspect or of blanching anywhere on the palatal aspect of the midline papilla or on the incisive papilla, even when further tension was applied to the frenum.

Papillary penetrating type – frenum inserting coronal to the line demarcating the base of the midline papilla combined with visible evidence of frenum extension to the palatal aspect or of blanching anywhere on the palatal aspect of the midline papilla or on the incisive papilla when further tension was applied to the frenum<sup>23</sup>.

The collated data was entered into a personal computer using the SPSS application, version 23. The results were presented as means and standard deviations for quantitative variables. Qualitative data were expressed as percentages and compared using Pearson's Chi-square and t-test. The level of statistical significance was set at  $p < 0.05$ . One-way ANOVA was used in the comparison of the presence and width of maxillary midline diastema with the frenal height amongst participants. All data collected conformed with the Helsinki Declaration for human research participants.



Mucosal Attachment



Gingival Attachment



Papillary

## RESULTS

One hundred and sixty-four subjects, consisting of sixteen males (9.8%), and one hundred and forty-eight females (90.2%), participated in the study. The age of respondents ranged from 18 to 47 years with a mean of  $24.4 \pm 4.02$  years with majority of them being in the age range 21 – 29 years (Table 1).

**Table 1: Sociodemographic distribution of respondents according to their age and gender**

		Number (%)
Age Groups	$\leq 20$ years	16 (9.8)
	21 – 29 years	133 (81.1)
	$> 29$ years	15 (9.1)

Gender	Male	16 (9.8)
	Female	148 (90.2)
Total (%)		164 (100)

The majority of the respondents had no midline diastema, which was found in 44/164 (26.8%) of the respondents. More female respondents had maxillary midline diastema than their male counterparts. Based on their age groups, most of the respondents with the papillary type of frenal attachment were in the age group 21 – 29 years and those older than that age group had the least of the papillary type of frenal attachment. The majority of those with the gingival type of frenal attachment 112/141 (79.4%) had no diastema while the majority

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of those with the papillary type of frenal attachment 14/18 (77.8%) had diastema (Table 2). The width of the midline diastema was greater than 1 mm in the majority of respondents who had the condition (32/44). The majority of the respondents had the gingival type of frenal attachment accounting for 141/164 (86.0%) with a majority of them not having midline diastema (Table 2). When the height of the

frenal attachment was compared with the presence and width of the midline diastema using one-way ANOVA, the majority of respondents with the gingival type of frenal attachment had no diastema, while a majority of those with the papillary type of frenal attachment had wide midline diastema. This was found to be statistically significant at  $p < .000$  (Table 2).

**Table 2: Comparison of the height of frenal attachment with the presence and width of maxillary midline diastema in participants**

		Severity of midline diastema			Total N(%)
		No diastema N (%)	<1mm N(%)	> 1mm N(%)	
Frenal Attachment Level	Papillary type	4 (2.4)	2 (1.2)	12 (7.3)	18 (11.0)
	Gingival type	112 (68.3)	10 (6.1)	19 (11.6)	141 (86.0)
	Mucosal type	4 (2.4)	0 (0)	1 (0.6)	5 (3.0)
<b>Total</b>		120 (73.2)	12 (7.3)	32(19.5)	164 (100)

$P < .000$

Using one way ANOVA, the mean width of the midline diastema was compared with the frenal height and the papillary attachment type of frenal attachment was found to be associated with the widest midline diastema and the mucosal attachment type associated with the narrowest midline diastema. This was also statistically significant at  $p < .000$  (Table 3). When the mean differences of the midline diastema (MDMD) associated with the different levels of frenal attachment were compared using the independent t-test, the greatest difference was between the papillary and the mucosal frenal attachment levels. The comparison of the mean differences between the gingival and mucosal frenal attachment was not statistically significant ( $p = 0.928$ ), while that between the papillary and mucosal and papillary and gingival attachment were statistically significant at  $p < .004$  and  $p < .000$  respectively (Table 4).

**Table 3: Comparing the mean width of the midline diastema in the different levels of frenal attachment**

	LEVELS OF FRENAL ATTACHMENT			F	P-Value
	Papillary	Gingival	Mucosal		
MWMD (SD)	1.944 (1.349)	0.443 (1.016)	0.400 (0.894)	16.096	0.000

**MWMD – Mean Width of Midline Diastema**

**Table 4: Multiple comparisons of the level of frenal attachment with midline diastema**

		MDMD	SE	CI	P
Frenal Attachment level	Papillary vs Mucosal	1.544	0.533	0.493 – 2.596	0.004
	Papillary vs Gingival	1.501	0.264	0.980 – 2.022	0.000
	Gingival vs Mucosal	.043	0.479	- 0.904 – 0.990	0.928

**MDMD – Mean difference of midline diastema**

## DISCUSSION

This study was conducted among a group of selected Nigerians to determine the relationship between the level of frenal attachment and midline diastema and a quarter of the participants had maxillary midline diastema with a majority of them having the gingival type of frenal attachment. This prevalence of maxillary midline diastema was lower than the 31.5% reported by Adigun et al.<sup>16</sup>, which could have been because their study was conducted among adolescents aged 10 – 19 years compared with the present study that was conducted among adults. Previous studies have reported the presence of papillary frenal attachment with wider midline diastema among children<sup>19,20</sup>. The studies reported that frenal attachment was migrating apically and the midline diastema narrowing with increasing age<sup>17,21</sup>. If this inference of decreasing width of diastema with age is true, it stands to reason that the prevalence of diastema among adult population will be lower than that among children even within the same geographical locations. The prevalence of 26.8% for midline diastema among adults in this study is lower than the 31.5% reported by Adigun et

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al<sup>16</sup> among adolescents, which might be a confirmation of the conclusion that midline diastema tends to decrease with age.

Our findings in this current study show that the level of frenal attachment is related to the presence of maxillary midline diastema with those having papillary type of frenal attachment being more associated with the presence of diastema compared with those having mucosal and gingival type. This could have been because the more coronally positioned papillary type of frenal attachment may hinder the full closure of the space between the central incisors leading to maxillary midline diastema. This agrees with the study by Adigun et al.<sup>16</sup> who reported that papillary type of frenal attachment is more associated with midline diastema than other forms of frenal attachment. Some other studies have also reported similar findings of wider midline diastema being associated with the papillary and the papillary penetrating types of frenal attachment<sup>13,21,22</sup>. The reason for this wider diastema has been attributed to the insertion of the frenum into the alveolar bone with a heavy band of fibrous tissue at the midline of the jaws creating a cleft separating the central incisors<sup>12,16</sup>. There is no case of papillary penetrating type of frenal attachment among our respondents, which would have shed greater light on the effect of high frenal attachment on the presence and severity of midline diastema.

The mean width of the midline diastema when compared with the level of frenal attachment in this study showed that the papillary type of frenal attachment is associated with the widest diastema compared with those having mucosal and gingival attachment, which was in agreement with the report by Adigun et al.<sup>16</sup>. However, this finding is contrary to some other studies that reported no relationship between the level of frenal attachment and the width of midline diastema<sup>13,22</sup>. The authors presumed that the difference between these studies<sup>13,22</sup> and ours could have been as a result of cultural and socio-economic differences and further studies may be required to shed more light in this area. The fact that the papillary penetrating type of frenal attachment was not seen in this study may also be a limitation, which if included among our participants would have been associated with the widest diastema if indeed level of frenal attachment significantly affects width of diastema.

The three different types of frenal attachment level combined (72.7%) were found to present midline

diastema greater than 1mm. Though, the papillary type of frenal attachment level was noted to have the greatest mean width of midline diastema among the trio and this was followed by the gingival type and the mucosal type respectively (Table 3). This observation was in agreement with previous findings by Adigun et al.<sup>16</sup> in a similar Nigerian study and other researchers<sup>13,16,21,22</sup> where they observed larger midline diastema to be associated with the papillary and the papillary penetrating types of frenal attachment. The reason for this wider diastema has been attributed to the insertion of the frenal into the alveolar bone with a heavy band of fibrous tissue at the midline of the jaws creating a cleft separating the central incisors<sup>16</sup>. However, the mere fact that a respondent with mucosal type of frenal attachment presented with wide midline diastema is a pointer to the possibility of other factor(s) that may contribute to the presence and severity of midline diastema. Therefore, the authors are suggesting that further studies be carried out to elucidate the role(s) of other contributing factors in the aetiology of midline diastema.

### CONCLUSION

Within the limitation of this study frenal height was found to be associated with the presence and severity of midline diastema. This may be essential in the management of midline diastema, especially in orthodontic closure of this space considered as a malocclusion trait and which may necessitate surgical excision of the frenum.

### Sources of support

Nil

### Conflict of interest

None Declared

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