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Evaluation of Association Between High Frenal Attachment and Severity of Midline Diastema

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Abstract

Introduction: *A "midline diastema" arises when there is a space of more than 0.5 millimeters between the proximal surfaces of two consecutive teeth. There is usually open space between the two central incisors. Depending on its width, a midline diastema can make speaking difficult and look unsightly. Genetic factors, large tongues, improper tongue positioning during rest or function, microdontia or hypodontia of upper lateral incisors, extra teeth between upper central incisors, particularly mesiodens, aberrant frenal attachment, periodontal disease, and extra teeth are some of the multifactorial causes of midline diastema. The aim of this study is to assess the association between high frenal attachment and the severity of midline diastema.* ***Materials and method:*** *The study involved 126 patients. We assessed the frequency of high frenal attachment and midline diastema in these patients. The Chi square test was used to examine the data in the SPSS Software.* ***Results and discussion:*** *The current study has arrived at a positive correlation between the frenal attachment type and the severity of the midline diastema space. Midline diastema might be transitory or result from pathogenic, developmental, or iatrogenic reasons. Treatment options for diastema vary, and each one calls for an accurate etiology diagnosis and prompt action appropriate to that etiology. A correct diagnosis needs radiographic and clinical examination, medical and dental history, and perhaps tooth size assessment.* ***Conclusion:*** *Within the limitations of the study, it can be concluded that there is a positive correlation between the frenal attachment type and the severity of midline diastema space. It was also observed that the most common frenal attachment type was papillary type and the space more commonly was 2-3 mm in length.*

Keywords: *Etiology; High Frenal Attachment; Midline Diastema; Orthodontic Treatment.*

INTRODUCTION:

When the proximal surfaces of two successive teeth are separated by more than 0.5 millimeters, this is referred to as a "midline diastema." (1) According to Angle (1907), the dental midline diastema is a rather common type of malocclusion distinguished by a space between the maxillary and, less commonly, the mandibular central incisors. The space between the two central incisors is frequently present. A midline diastema appears unaesthetic and makes speaking difficult depending on its width(2). The alveolar mucosa, gingiva, and underlying periosteum are joined to the upper lip through the maxillary labial frenum, a fold of mucous membrane. Because it is only slightly deeper than the muscle attachments, it is one of the mouth cavity's anatomical features that is most prone to change. In babies, the palatal papilla is reached by a raphe created by the frenum that passes through the alveolar process (3). As the alveolar process matures and teeth emerge, the frenum's attachment frequently changes, taking on the adult form at the alveolar mucosa.

The most typical diastema is at the maxillary midline, between the upper central incisors. There are several causes for diastema(4). In general, Attia identifies four categories of diastema causes:1. Tooth defects, such as microdontia or hypodontia, which are most common in the upper lateral incisors, or additional teeth between

the upper central incisors, especially mesiodens.2. Neuromuscular issue, which results in the tongue not resting in the proper position during speaking or swallowing. 3. An improper frenulum attachment or periodontal disease are examples of periodontal defects. 4. A malformed muscle, like a large tongue. An aberrant attachment of the is one of the most often cited causes for the top lips midline frenulum(5).

The maxillary midline diastema is undoubtedly one of the dentoalveolar issues that parents and patients are most concerned about. A characteristic of the development of the stomatognathic system in the mixed dentition era is the existence of a maxillary midline diastema during the early phases of the eruption of permanent maxillary central incisors, sometimes known as the "ugly duckling" stage.(6).

The limitation of the maxillary frenum can happen on its own or in conjunction with tongue knots, and it is simple to change. Epithelium and loose connective tissue make up the anterior frenum(3). The orbicularis oris muscle of the top lip may occasionally provide muscular fibers to the frenum. The soft tissue structure known as the maxillary frenum has the widest range of forms. The anterior papillae entering into the palate and the associated gingiva are two places where the frenum may connect(7). The labial frenum is classified in a variety of ways. The labial frenum is a dynamic and malleable structure that can vary in size, shape, and location as an organism grows and develops(8).In Placek's method, the labial frenum attachment type is categorized both morphologically and functionally with the aim of aiding medical professionals in recognising functional problems that need therapy(9). The four types of frenum attachment are categorized as mucosal, gingival, papillary, and papillary penetrating depending on whether the attachment is located at the mucogingival junction, the connected gingiva, the interdental papilla, or through the interdental papilla all the way to the palate. Rarely, the frenum could not even exist(10).Numerous factors contribute to midline diastema, such as genetics, large tongues, incorrect tongue positioning during function or rest, extra teeth between upper central incisors, particularly mesiodens, aberrant frenal attachment, periodontal disease, and supernumerary teeth. (11).

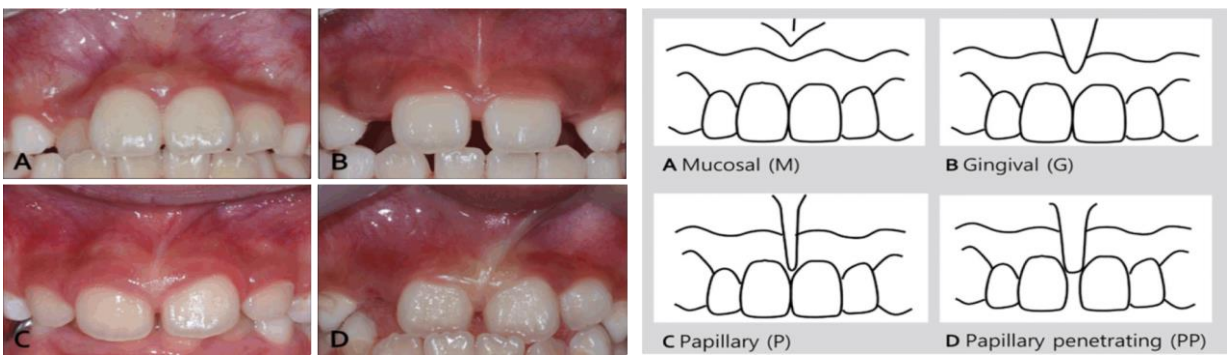
Researchers have looked at the connection between the maxillary midline diastema and labial frenal attachment. Some of these investigations came to the conclusion that an aberrant frenum can explain why midline diastema persists(12). The gingival insertion level of the frenum and the midline diastema were shown to be significantly inversely correlated. Other research, on the other hand, claimed that aberrant frenum is a consequence of midline diastema rather than the cause of it(13).

The aim of this study is to assess the association between high frenal attachment and the severity of midline diastema.

MATERIALS AND METHODS:

This study was carried out in Saveetha Dental College and Hospitals in a prospective university setting. The population was chosen at random. From the institutional study committee, approval was received. The study featured two examiners. To reduce sampling bias, simple random sampling was used. The population of south India was generalized for this study. With midline diastema, 126 patients made up the final sample size. The patients were clinically evaluated. The participants of the study were clinically assessed on two terms: classification of their frenal attachment and severity of midline diastema. The study did not include any data that was censored or incomplete.

The frenal attachments of the patients were classified using Placek's method as mucosal, gingival, papillary, and papillary penetrating.



The diastema space of the patient was also assessed using a marked probe (William's probe). The probe was placed on the incisal edge of the right maxillary central incisor with the tip extending to the left maxillary central incisor. The resulting space was measured and categorized into 4 categories: 0.5-1 mm, 1-2 mm, 2-3

mm and more than 3 mm. The data was entered in Microsoft Excel manually and imported to IBM SPSS software for analysis.
The resulting data was analyzed and expressed using Bar graphs.

Results and Discussion

Out of 126 patients, 66 (52.4%) were males and 60 (47.6%) were females. 72 (57.1%) belonged to the age group 10-35 years, 48 (38.1%) belonged to 36-50 years and 6 patients (4.8%) were above 50 years of age. Out of 126 patients, 9 (7.1%) had a mucosal type of frenal attachment, 32 (25.4%) had a gingival type of frenal attachment, 48 (38.1%) had a papillary type of attachment and 37 (29.4%) had a papillary penetrating attachment. 12 (9.5%) patients exhibited a midline diastema space of 0.5-1 mm, 39 (31%) had a space of 1-2 mm, 47 (37.3%) had a space of 2-3 mm and 28 (22.2%) had a space of more than 3 mm. Papillary type of attachment was found to be the most common type of frenal attachment and the diastema space most commonly observed was 2-3mm. There is a positive correlation between the type of attachment and the extent of midline diastema.

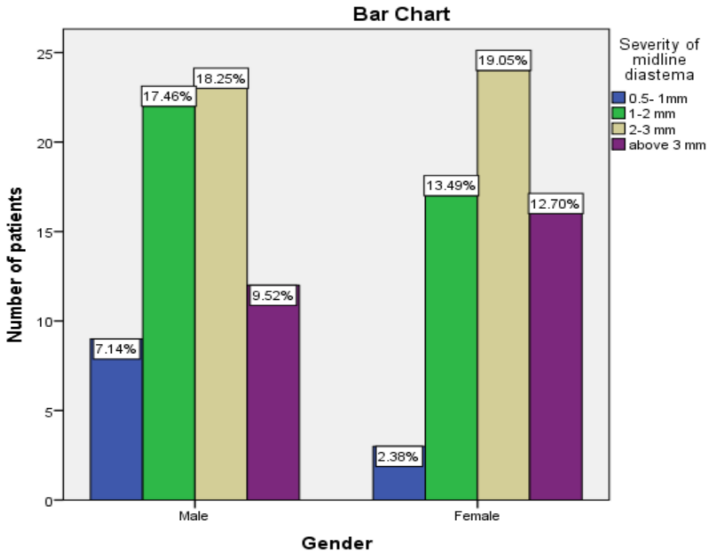


Fig. 1. Bar graph representing the correlation between the gender of the patient and the severity of the midline diastema. Gender is represented in the X axis and the number of patients is seen in Y axis. Chi square test was performed and the association was not statistically significant. Pearson's Chi value: 4.682, df: 4, p-value= 0.147 (p>0.05).

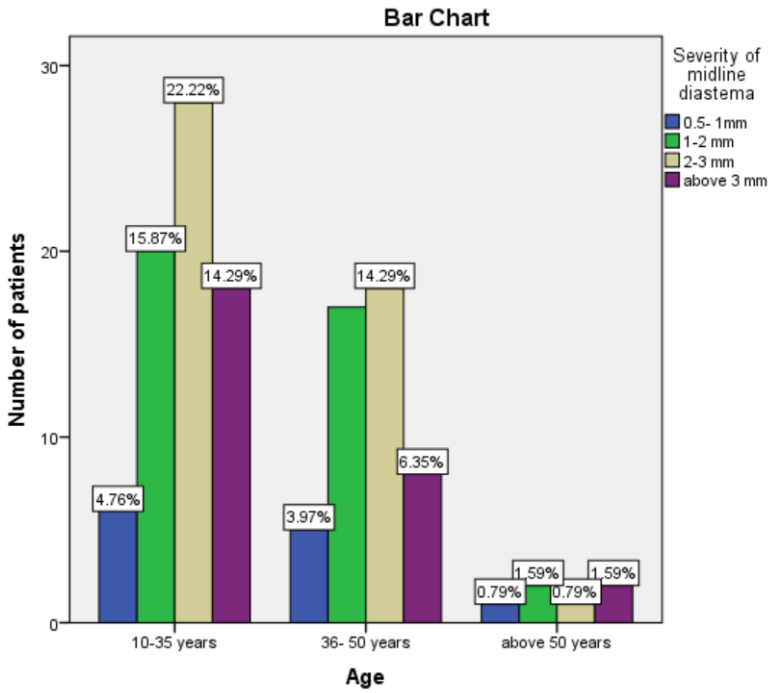


Fig. 2: Bar graph representing the correlation between Age and the severity of midline diastema. Age is represented in X axis and the number of patients is represented in Y axis. Chi square test was done and it was not found to be statistically significant (Pearson Chi square= 6.707, df= 2, p value= 0.035 <0.05).

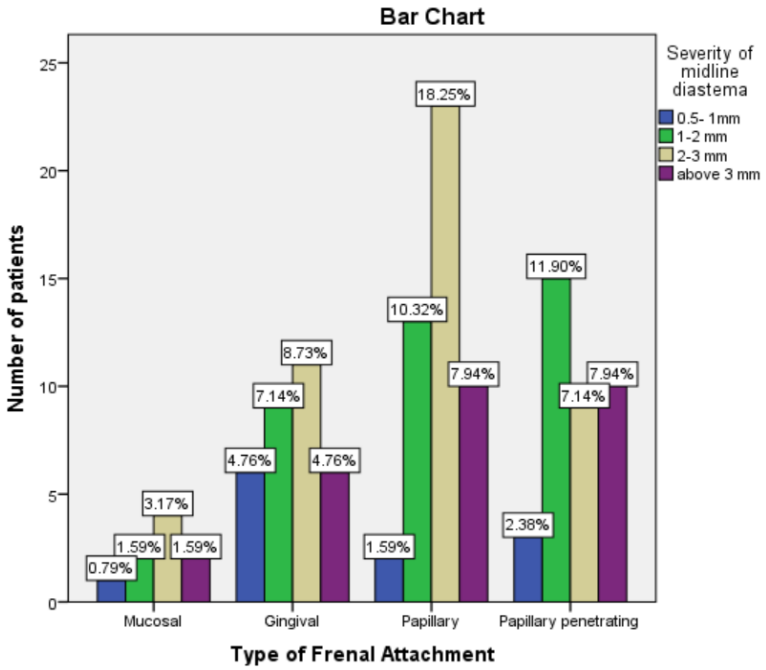


Figure 3: Bar graph representing the association between type of frenal attachment and severity of midline diastema. X axis represents type of frenal attachment and Y axis represents the number of patients. Blue represents 0.5-1 mm space, green represents 1-2 mm space, beige represents 2-3 mm and purple represents more than 3 mm of diastema space. Chi square test was done and the association was found to be statistically significant. Pearson's chi square value: 26.694, df: 6, p value: 0.00 ($p < 0.05$); hence it is statistically significant and it shows that papillary type of attachment is more commonly with a diastema space of 2-3 mm and papillary penetrating type of attachment is more commonly associated with a diastema space of more than 3 mm.

DISCUSSION:

The current study has arrived at a positive correlation between the frenal attachment type and the severity of the midline diastema space. According to Campbell et al., midline diastema might be transitory or result from pathogenic, developmental, or iatrogenic reasons. Treatment options for diastema vary, and each one calls for an accurate etiology diagnosis and prompt action appropriate to that etiology. A correct diagnosis needs radiographic and clinical examination, medical and dental history, and perhaps tooth size assessment(14).

A prior study conducted in 2020 by Arvind Kumar et al. discovered a statistically significant correlation between midline diastema and high frenal attachment. This aligns with the results of our investigation. (1).

Jonathan P. T. et al. found high frenal attachment in the younger age group in a study similar to the current one, which they explained by the frenum's gradual apical migration. In his research, Taylor found that the percentage of diastema sharply declined with age. (16). According to Spilka and Mathews, recurrence is a key problem in the repair of midline diastema(15,17). Thus, accurate identification and eradication of the etiology are critical to achieving a consistent result in the treatment of midline diastema.

The study by Kaimenyi and Adams indicates that hypertrophic labial frenum is thought to be a major etiological factor for midline diastema (18). On the other hand, some research, including Popovich et al.'s, assert an inverse relationship between high frenal attachment and the midline diastema. They contend that the labial frenum persists primarily to the preexisting diastema and that there is little to no frenum atrophy since the dentition places little pressure on the tissues(19). According to Kamath M. K. et al., a tiny percentage of cases of persistent diastema are thought to be caused by a hypertrophic labial frenum(20).

Bennett et al. claim that a high labial frenum is the root cause of the maxillary midline diastema, yet frenectomy has little effect on the stability of gap closure(21). Gardiner concurred with this viewpoint(22). Haynes disputed this, claiming that an aberrant frenum is an outcome rather than a cause of the incidence of diastema.(23) For stability after the closure of the midline diastema, most researchers agree that the removal of the high bulbous labial frenum.

Reji Abraham claims that there is no one accepted aetiological factor for the formation of a midline diastema because different aetiological factors are discussed and addressed in the literature. (24). This investigation may pave the way for greater research into the pathophysiology of midline diastema space, which may aid in definitive diagnosis and successful treatment choices. The study's shortcomings are limited to certain demographics and small study samples.

CONCLUSION:

Within the limitations of the study, it can be concluded that there is a positive correlation between the frenal attachment type and the severity of midline diastema space. It was also observed that the most common frenal attachment type was papillary type and the space more commonly was 2-3 mm in length.

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All authors have equal contribution in conducting the study and drafting the manuscript.

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CONFLICT OF INTEREST:

The author has none to declare.

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