

Review Article

Diastema and Frenum – An InsightNazam lakhani¹, K. L. Vandana²¹Department of Periodontics, College of Dental Sciences, Davangere, Karnataka, India²Department of Periodontics, College of Dental Sciences, Davangere, Karnataka, India***Corresponding Author:**

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Abstract: The midline diastema is a space (or gap) between the maxillary central incisors . The space can be a normal growth characteristic during the primary and mixed dentition and generally is closed by the time the maxillary canines erupt. Researchers and clinicians now believe that multiple factors may contribute to a midline space including abnormal frenum, midline bony clefts ,oral habits, soft tissue imbalances, physical impediments, dental anomalies and/or dental/skeletal disharmonies, as well as normal dentoalveolar development. Most often, during the oral examination of the patient the dentist gives very little importance to the frenum. The frena may jeopardize the gingival health when they are attached too closely to the gingival margin, either due to an interference in the plaque control or due to a muscle pull. Orthodontic and anatomic approaches have led many authors to classify the type of the frenum exclusively according to the morphological means. The importance of various types of normal to abnormal frenii associated with diastema has not been distinguished in Indian population which is of concern to periodontist, orthodontist and restorative dentist. As of now there is no comprehensive review on diastema and frenum, a tiny fold that plays an important role silently , if found abnormal in location and morphogenetically, to and gains an interdisciplinary attention in dentistry Hence a first attempt is made to present a comprehensive review on diastema and frenum in this paper.

Keywords: diastema, frenum, etiology, orthodontics, periodontics

INTRODUCTION

The midline diastema is a space (or gap) between the maxillary central incisors . The space can be a normal growth characteristic during the primary and mixed dentition and generally is closed by the time the maxillary canines erupt [1]. For most children, the medial erupting path of the maxillary lateral incisors and maxillary canines, as described by Broadbent, results in normal closure of this space. For some individuals, however, the diastema does not close spontaneously.

Researchers and clinicians now believe that multiple factors may contribute to a midline space including abnormal frenum , midline bony clefts ,oral habits, soft tissue imbalances, physical impediments, dental anomalies and/or dental/skeletal disharmonies, as well as normal dentoalveolar development as proposed by Becker, Edwards, Steigman, Clark, Bishara, and Campbell [2].

The role of frenum in causing midline diastema is of significant interest. Frenum is a fold of mucous membrane ,usually with enclosed muscle fibers, that attaches the lips and cheeks to the alveolar mucosa and /or gingiva and underlying periosteum [3].

There are several frena that are normally present in the oral cavity, most commonly seen are maxillary labial frenum, the mandibular labial frenum, and the lingual frenum [4].

The relocation of the attachment in an apical direction is usually accomplished by the normal vertical growth of the alveolar process. The failure of the attached frenal fibers to migrate apically results in a residual band of tissue between the maxillary central incisors, which has been implicated as an important causative factor in persistent midline diastema. The residual frenal fibers which persist between the maxillary central incisors may also attach to the periosteum and internal connective tissue of the V shaped intermaxillary suture In addition preventing the closure of space between the maxillary central incisors, and thus creating an area for food impaction, the frenal tissues have been implicated with poor oral hygiene, due to difficulty in tooth brushing and the resulting in inflammatory periodontal destruction [5].

A simple fold of mucous membrane if found abnormal in size and location, interferes with oral hygiene and interferes with interdisciplinary treatment approaches and more importantly becomes unesthetic.

Besides the maxillary diastema, the mandibular labial frenii to cause spacing between lower incisors has not been paid attention so far . The mandibular diastema is not a normal growth characteristic. The spacing, though seen less frequently than maxillary diastema, often is more dramatic. No epidemiologic data have been published on its prevalence. The primary etiologic factor in mandibular diastemas is tongue thrust in a low rest position [6]. Even the buccal frenii are responsible for spacing in the premolar area.

DEVELOPMENT OF FRENUM

The maxillary labial frenum is a fold of tissue, usually triangular in shape, extending from the maxillary midline area of the gingiva into the vestibule and mid portion of the upper lip [5].

The superior labial frenum appears to be developed from the frontonasal process [7].



Within the first few months of fetal life, it emerges as a part of the oral cavity, along with the lips and the cheeks [8].



As growth and development progress, a prominence begins to appear in the middle part of the inner zone of the upper lip, and this becomes the tuberculum.



About this time, another prominence forms on the anterior part of the palate and develops into the palatine papilla



A continuous fold of tissue, the tectolabial frenum, connects the tuberculum with the palatine papilla (tectolabial frenum of the fetus simulates the abnormal frenum of postnatal life, in that it extends as a continuous band of tissue from the inner aspect of the upper lip, over and across the alveolar ridge, to be inserted in the palatine papilla)



Normally, the growing alveolar process causes a severance of the continuous fold of tissue, dividing it into a palatal and labial portion. The palatal part corresponds to the palatine papilla, and the labial tissue

becomes the superior labial frenum, extending from the lip to the crest of the alveolar ridge [9].

FRENUM AS ETIOLOGIC FACTOR

The anatomical presence of labial and buccal frenum are extremely important in maintaining the lips and cheeks in place by its tiny fold of mucosa containing muscle fibres or elastic fibers, collagen fibers is controversial.

- The abnormality of frenum is recognized in its attachment to gingiva and size .The different attachments beyond its normal mucosal attachment can be affecting the health of mucogingival junction by its pull effect during muscular movements resulting in plaque accumulation indirectly that can lead to gingivitis to localized periodontitis or if the gingiva thickness is less than 1mm would result in gingival recession. The effects of pull syndrome is only realized on clinical presentation of above changes.
- On the other hand , the unesthetic thick abnormal size of frenum in anterior segment usually maxillary arch leads to diastema and is often subjected to mechanical trauma during brushing . Some authors have reported that maxillary labial frenum is the main etiological factor as well as intervening factor for the closure of the midline diastema. However, there are no studies that establish a relationship between the different types of frenum and the development of midline diastema in children with primary dentition, mixed dentition, or permanent dentition [25].
- The frequently alleged etiologic agent in relapse of approximated teeth in previous area of diastema is the maxillary labial frenum and / or its associated interdental soft tissue.
- The frenum as an anatomical entity plays an important role in expression of various signs gingival recession and diastema along with functional and esthetic compromise

CLASSIFICATION OF FRENUM

Literature review reflects that maxillary labial frenum has diverse morphology and clinical implications.

Table 1: Sewerin Classification Based On Morphotypes [10]

1	Simple
2	persistent tectolabial
3	simple with appendix
4	simple with nodule
5	double frenum
6	frenum with nichum
7	bifid frenum
8	frenum with two or more variations at the same time

Table 2: Placek Classification Based On Attachment Location [11]

Mucosal attachment	when the frenal fibers are attached up to mucogingival junction
gingival attachment	when fibres are inserted within attached gingiva
papillary attachment	when fibres are extending into inter dental papilla
papilla penetrating attachment	when the frenal fibres cross the alveolar process and extend up to palatine papilla

Midline spacing has a racial and familial background [12]. Although no specific genes have been investigated for its genetic etiogenesis but there are many syndromes and congenital anomalies which contained midline diastema one of their component e.g. Ellis-van Creveld syndrome, [13] Pai Syndrome, [14] lateral incisor agenesis [15] and cleft palate, [16] median cyst [17]. Lavelle and associates reported the prevalence of the maxillary median diastema was greater in Africans than in Caucasians or Mongoloids [18]. Horowitz [19] reported that black children, exhibit a higher prevalence (19%) of midline diastema than do white children (8%). Becker confirmed racial differences and stated that blacks and Mediterranean whites exhibit the midline diastema as an ethnic norm [20]. Richardson and coworkers found females in both races showed a higher prevalence than males at age 6; however, at age 14, males had a higher prevalence in both races [21]. Enlarged and low frena do exist in the absence of a median diastema. Also, diastemas can exist without an abnormal frenum. Frena may exert passive resisting mesial pressure, but are not an important etiologic factor in midline diastemas. Ceremello also demonstrated no relationship between diastema and the frena configuration [22].

Midline diastema may be considered normal for many children during the eruption of permanent maxillary central incisors. It has been concluded that the presence of papilla penetrating frenum is cause for

midline diastema and this view was supported by other researchers [23].

Dewel [24] stated that the frenum is an effect and not a cause for the incidence of diastema. It is also stated that if the midline diastema persists even after the orthodontic treatment, the surgical correction of the frenum attachment has to be corrected. Therefore an accurate diagnosis is necessary before any treatment can be initiated.

Presence of abnormal labial frenum may also interfere with retention of denture fit, [25] can cause gingival recession, [26] can interfere with effective tooth brushing leading to incomplete plaque removal [27]. It has been observed that abnormal frenum can indicate the presence of a syndrome [28]. However, it was also noted that hyperplastic, hypoplastic, or agenesis of the labial frenum may be observed in the absence of syndromic disease. Biber [29] in his review paper has presented various complications resulting from oral piercings and maxillary labial frenum piercing is one among the different piercing sites in the mouth and it is popular in teenagers and can result in complications [30]. A torn labial frenum has been reported as an indicator of child abuse [31]. All these clinical significances show that every specialist of dentistry must give more importance for frenum assessment during oral examination of children.

Table 3: Interdisciplinary Importance

Angle [32]	Angle was probably the first to describe the abnormal condition, and with his typical thoroughness and clinical acuity he noted that the teeth were separated not only by its passive presence, but also by its action mechanically
Dewey[33]	early noted that the abnormal frenum was of congenital origin, and that, the tissue in the abnormal frenum would grow down with the alveolar process instead of the process growing away from the frenum. To express this another way, we could say that the frenum retained its primitive form while the alveolar process proceeded on its normal path of growth and development
Strang [34]	described the abnormal frenum as elongated at its alveolar end into a sheet like process that extended lingually between the central incisors, cutting through the interproximal fibers of the periodontal membrane, and ending in the central papilla of the rugae. He added that by its presence it prevented the permanent incisors from approximating each other.
Tait [35]	stated that the frenum has no function and that its action, if any, in relation to the maxillary incisors is surely passive
Ceremello [36]	compared the frena of two groups, one with diastemas and the other without. He found no correlation between frenum attachment and diastema width, between frenum width and diastema, or between frenum height and frenum width.
Dewel [37]	Enlarged and low frena do exist in the absence of a median diastema. Also, diastemas can exist without an abnormal frenum

ABNORMAL FRENUM IN MIXED DENTITION FROM ORTHODONTIC AND PEDODONTIC PERSPECTIVE: DIASTEMA AND TIMING OF FRENUM EXCISION

Although most tests state that an abnormally large and marginally positioned labial frenum may result in a persistent maxillary midline diastema. There is also apparent agreement in both the orthodontic and pedodontic literature that rarely should any portion of even an “abnormal” labial frenum be removed prior to eruption of the maxillary lateral incisors and canines, since it has been observed that most diastemas close autonomously with the final eruption of the remaining anterior teeth [38].

- Taylor [39] describes the existence of a maxillary midline diastema as normal in 98 per cent of 6- to 7-year-old children, whereas only 7 per cent of a 12 to 18 year old population sample retain these diastemas.
- Dewel has stated that early (“preventive”) frenectomies without prior orthodontic closure in diastema situations may result in scar formation, which itself might tend to prevent normal mesial movement of the incisors.
- Archer [40] depicts the classic frenectomy technique in which the frenum, interdental tissues, and palatine papilla are completely excised, leaving bone and/or periosteum exposed.
- In contradiction to many oral surgeons, orthodontists have for years advocated that the frenectomy procedure be initiated only after the diastema has been closed since, although there is some evidence that frenectomy prior to orthodontic closure increases the speed of tooth movement, the tissue configuration after closure of the diastema would be less predictable and the speed with which a frenum can be closed is relatively rapid, even without early frenectomy.
- Nevertheless, in the performance of a frenotomy for the alleviation of relapse of orthodontically closed diastemas, the removal of the periosteum under the excised portion of the frenum is advocated in an attempt to remove the elastic fibers of the frenum which have been shown to penetrate the periosteum. Such elastic fibers have not been demonstrated to adversely affect the increase in attached gingiva following a frenotomy; nor have they been shown to adversely affect the alleviation of relapse in diastema cases.
- However, if the purpose of the surgical procedure is to eliminate the undesirable frenal tissue and to establish a normal interdental soft-tissue anatomy, it is seemingly important to remove the elastic fibers impregnating the periosteum underlying the frenum, since nowhere in the normal human periodontium is there an elastic tissue involvement with attached gingiva.
- The pretreatment relationship between a clinically “abnormal”-appearing maxillary midline frenum

and a midline diastema showed a strong, but not absolute, correlation. A certain percentage of patients demonstrated a diastema but not an “abnormal” frenum or no diastema but an “abnormal” frenum.

- A midline diastema usually is part of normal dental development during the mixed dentition. However, several factors can cause a diastema that may require intervention. Effective diastema treatment requires correct diagnosis of its etiology and intervention relevant to the specific etiology. Correct diagnosis includes medical and dental histories, radiographic and clinical examinations, and possibly tooth-size evaluations [6].

SUMMARY [36]

1. The superior labial frenum has been described embryonically, histologically, and anatomically as a normal structure of the oral cavity, which vary in size and bulk within a normal range as do other structures of the human body.
2. The abnormal frenum may occur only at very infrequent intervals; thus care should be exercised by the diagnostician, so as not to classify the normal as abnormal, or to assume that the frenum is abnormal simply because it may be enlarged or hypertrophied, or because of the incidental presence of a midline diastema of the teeth.
3. The superior labial frenum and the midline diastema should be considered as more or less separate entities.
4. The midline diastema of the teeth is often a normal or developmental occurrence, due to the position of the teeth in their bony crypts, to the eruption path of the cuspids, and to the increase in size of the premaxilla at the time of eruption of the maxillary permanent central incisors.
5. Since frenum is considered a problem only if the teeth are separated, the effect of the natural forces is not only to close the midline dental space, but also automatically to eliminate the problem of the frenum.

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