

# The Maxillary Labial Fraenum - A Controversy of Oral Surgeons vs. Orthodontists

## SUMMARY

*The maxillary labial fraenum is a normal anatomic structure in the oral cavity, formed by mucous membrane and connective tissue. Although it is a normal structure, its presence has been associated with some unpleasant and even pathological situations. Specifically, a thick, hypertrophic or broad fibrous fraenum has been accused of causing a maxillary midline diastema, interfering with plaque removal, causing tension and gingival recession. A surgical removal of the fraenum is indicated in order to prevent these situations or facilitate orthodontic closure of the diastema. Frenectomy is the complete removal of the fraenum, including its attachment to the underlying bone. As shown in the literature there has been a controversy among researchers regarding the need of frenectomy and the time of the surgery.*

*The purpose of this study was to demonstrate the controversy of researchers regarding the removal of the maxillary labial fraenum, as a result of the study of the literature. Additionally, there has been an attempt to suggest the appropriate therapeutic strategy and indications for frenectomy, counting the medical experience and the patient's needs. At the beginning of the study, it was important to cite the characteristics of normal and abnormal fraenum and consequences that presence of a pathological fraenum causes. Finally, there is a brief description of the most important surgical techniques for removal of the maxillary labial fraenum.*

**Keywords:** Maxillary Labial Fraenum; Frenectomy, controversy

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## Introduction

The maxillary labial fraenum is a normal anatomic structure in the oral cavity, usually triangular in shape, extending from the maxillary midline area of the gingiva into the vestibule and mid-portion of the upper lip<sup>16</sup>. It consists of epithelium, collagen fibres, blood vessels, nerves and sometimes few elements of minor salivary glands and isolated stratified muscle fibers<sup>19,42</sup>.

The fraenum is a dynamic and changeable structure, which tends to have variations in size, shape, and position of attachment during the different stages of growth and development<sup>12</sup>. It is found to be smaller in length, thicker and more inferiorly attached in children<sup>12,34</sup>. The eruption of primary incisors, the development of the maxillary sinus and vertical growth of the alveolar process make that insertion of the fraenum moves apically<sup>28</sup>. In

some of the cases a variation may lead to an “abnormal fraenum”; a fraenum which appears inordinately large or is attached especially close to the gingival margin<sup>16</sup>. Henry et al<sup>25</sup>, in their histological study, concluded that there are also elastic fibres which extend sometimes to the whole length of the fraenum, even perforating the periosteum. Those authors considered that the harmful effect of the fraenum is due to the presence of the elastic and collagen fibres, while no evidence of substantial differences in composition of normal and abnormal fraena were identified. Miller characterized as “pathological” a fraenum which is uncommonly wide, when there is insufficient attached gingival zone in the midline, and when the interdental papilla moves by stretch of the fraenum<sup>35</sup>.

An abnormal labial fraenum has been implicated in functional and aesthetic problems, such as a maxillary

midline diastema. Regarding the maxillary midline diastema, two ways were suggested in which the fraenum may cause it. In the first way, the bulk of the fraenum fibres, retaining their embryological connection with the incisive papilla, will physically prevent approximation of central incisors<sup>2,15,22</sup>. Alternatively, these fibres will interrupt the fibres of the periodontal ligament between the central incisors and produce a weak link in the chain of fibres that join the teeth from one end of the arch to the other<sup>1,5,13</sup>.

High fraenum insertion can lead to gingival recession due to the tension which is applied on the tissues during normal functions, such as speaking, chewing, and laughing<sup>4,21,24,37,44</sup>. Moreover, a fraenum that encroaches on the gingival margin and prevents the closure of space between the maxillary central incisors creates an area for food impaction and difficulty in plaque removal<sup>24,37</sup>. The poor oral hygiene, due to difficulty in tooth brushing results in inflammatory periodontal destruction<sup>33</sup>. Aesthetics could be affected as well in cases of a high smile line<sup>4,44</sup>. Finally, a big and high attached fraenum could eliminate lip movement<sup>4</sup>.

Over the years, the relationship between the maxillary midline diastema and the labial fraenum has been the subject of much controversy and confusion. In the 1939, Hirschfield advocated frenectomy as a mucogingival procedure to eliminate the aforementioned pathologic situations caused by an abnormal fraenum attachment<sup>44</sup>. There is still a controversy among researchers concerning the need for it at all, as well as the right time for frenectomy.

Many orthodontists support the idea that even in cases of an abnormal fraenum we should wait the eruption of all 6 permanent anterior teeth first. If the eruption of all 6 permanent teeth has failed to close the diastema, frenectomy has a clinical validity only in conjunction with orthodontic treatment<sup>16,27</sup>. They also state that the relapse of orthodontically treated diastema caused by an abnormal fraenum, which had not been excised, is a rare phenomenon<sup>3,5,16</sup>. On the other hand, surgeons accuse a hyperplastic type of fraenum, usually with a fanlike attachment, of causing a diastema and enhancing the possibilities of a relapse. A frenectomy could also prevent the other unpleasant situations cited previously, such as gingival recession<sup>4,9,23,24,28,33,37</sup>.

There are some clinical situations in which a maxillary labial frenectomy is indicated<sup>4,24,37,49</sup>:

1. To avoid a relapse of an orthodontically treated maxillary diastema;
2. In cases with a too short labial fraenum, which creates problems in upper lip movement, speech etc;
3. To avoid gingival recession due to tension created during the normal oral function;
4. To facilitate lip lengthening procedure;
5. To allow effective tooth brushing in the area of the fraenum;
6. When a maxillary labial fraenum prevents the installation of a removable denture;
7. In rare occasions, for aesthetic reasons.

## The Fraenum by Orthodontic Approach

The presence of the maxillary labial fraenum has a great significance for the orthodontic community, since it is considered to be the commonest causative factor for a maxillary midline diastema. An abnormal fraenum has also been accused of being a great danger for relapse after orthodontically treated diastema. Consequently, maxillary labial frenectomy was considered for many years as the indicated treatment for maxillary midline diastema<sup>9,14,34,37</sup>.

There has been a controversy even among orthodontists concerning the need at all, and the timing for a frenectomy. Some orthodontists support a viewpoint that there is a need for an early removal of the fraenum, so as to prevent any obstacles to complete diastema closure. Other orthodontists propose to close the diastema first, and then carry out frenectomy in the hope that the resultant scar tissue will hold together the teeth in close apposition. A third body of clinicians rarely, if ever, considers surgical removal of the fraenum. They prefer to combat the undeniably increased relapse potential when a diastema is closed, by using bonded retainers on the two central incisors<sup>6,31,37</sup>.

Literature offers a great variety of opinions during years and it is obvious that they differ a lot concerning the etiology of a persisting diastema, such as to the possibility of promoting closure of a diastema by means of frenectomy<sup>9</sup>.

At the beginning it was thought that the labial fraenum interfered with the closure of the midline diastema. This belief resulted in misdiagnosis and unnecessary surgical intervention of the fraenum<sup>13,14</sup>. Adams<sup>1</sup> suggested that there is a specific type of fraenum which interrupts the continuity of interdental fibre, forms the factor that induces the reaction for the development of the diastema. Although, he stated that there is a need of presence of other causative factors. Campbell et al<sup>11</sup> stated the same. Shashua and Artun<sup>43</sup> found that there is a relationship between abnormal fraenum and the width of the maxillary midline diastema. Edwards<sup>16</sup> supported the presence of a strong but not absolute correlation between the fraenum and the upper midline diastema. Gardiner<sup>18</sup> made a survey of 1000 children 5-15 years old. 80% of the cases with midline diastema were associated with a prominent fraenum. He took this finding as an evidence to support the opinion that the fraenum is often a contributory cause of midline diastema. Angle<sup>2</sup> concluded that the presence of an abnormal fraenum is a cause for

midline diastema. James<sup>29</sup> used a sample of 10 girls 12-22 years old with medial diastema. A year after frenectomy, a reduction was noted in 8 cases. He assumed that frenectomy leads to a reduction of the diastema. By the time researchers rejected this statement and proved that there is no evidence to establish a relationship between the different types of fraenum and diastema.

Tait<sup>46</sup> stated that the fraenum has no effect to the maxillary central incisors. Ceremelo<sup>12</sup> concluded that the fraenum is not related to the presence or the width of the diastema. Bergstorm et al<sup>9</sup> stated that the long term potential for spontaneous diastema closure, in patients with abnormal fraenum, has no difference even if there has been a frenectomy, or not. Popovich et al<sup>40,41</sup> suggested that the presence of the diastema leads to the abnormal fraenum, and not the adverse.

Since there is no quite evidence concerning the fact that the maxillary labial fraenum is the main causative factor for a midline diastema, some orthodontists propose the following therapeutic methodology<sup>37,45</sup>: Initially, it is necessary for the dentist to make a diagnostic trial, in order to find out whether the fraenum is implicated in the pathogenicity of the diastema.

1. Positive "blanch test" of the incisal papilla, when pulling the lips forward. By pulling the upper lip and exerting pressure on the fraenum, if there is a blanching, (ischemia in the papilla) it is safe to predict that the fraenum will unfavourably influence the development of the anterior occlusion;

2. With the use of a periapical radiograph, in the area of central incisors we can discover: a presence of a mesiodens, an odontoma in the middle line; a presence of residual suture of alveolar bone. If we find out that the diastema in our case is related to the fraenum, a maxillary labial frenectomy is indicated.

It is important to emphasize on the fact that frenectomy has clinical validity only after the eruption of all 6 permanent teeth if it failed to close the diastema, and then only in conjunction with orthodontic treatment. So after the eruption of all 6 permanent teeth, orthodontic appliances are used to close the diastema. A frenectomy is carried out, so as the scar tissue will hold the teeth together<sup>16,20,27,33,37,39,48</sup>.

During the primary dentition phase, surgical intervention of the labial fraenum is not recommended<sup>7</sup>.

## The Fraenum by Oral Surgery Approach

Oral surgeons accused an abnormal fraenum of causing unpleasant situations, such as maxillary midline diastema and consequently suggested the operation of maxillary labial frenectomy<sup>20,36</sup>.

In case of a diastema, a hyperplastic type of fraenum, with a fanlike attachment, can inhibit the closure of the diastema or even lead to a relapse of an orthodontically corrected diastema. Studies reveal that a midline diastema has closed earlier in operated cases. Thus, the result implies that frenectomy is indicated, if early closure of the diastema is considered desirable, especially if patient finds it very unsightly<sup>9</sup>.

The advantage of an early excision prior to orthodontic treatment is the ease of surgical access<sup>33,37</sup>. Access to the surgical procedure is more limited after orthodontic closure and it will not be possible to remove all the residual fibrous tissue thoroughly from the interdental suture area<sup>37</sup>.

In guides of paediatric, oral surgery treatment is suggested when attachment exerts a traumatic force on the gingiva, causing the papilla to blanch when the upper lip is pulled, or if it causes a diastema to remain after eruption of permanent canines<sup>23</sup>.

Interference with oral hygiene measures, aesthetics and psychological reasons are contributing factors that relate the treatment of the maxillary fraenum<sup>23</sup>.

Also, elimination of the maxillary labial fraenum is often indicated in edentulous or partial edentulous patients to allow denture flange extension in this area<sup>49</sup>.

## The Fraenum by Periodontal Approach

The labial frenectomy must be examined by the aspect of periodontists as well. In 1950, Friedman was the first to introduce the term "mucogingival surgery", in order to describe techniques that aim to preserve the attached gingiva, remove aberrant fraenum or muscle attachment and increase the depth of the vestibule<sup>36</sup>. For years, clinicians targeted in removing the fraenum or deepening the vestibule<sup>17</sup>; today, it is approved that the presence of an adequate zone of attached gingiva is the basic factor. When there is an adequate zone of attached gingiva, even a high fraenum attachment does not constitute dangerous factor for the beginning and the process of periodontal disease. On the other hand, in the case of inadequate zone of the attached gingiva, the draw of the fraenum and muscle attachment cannot be balanced, there is inability of good and atraumatic oral hygiene, and this is a fact that usually leads to gingival recession<sup>32,36</sup>. Consequently, there exist anatomic (not adequate zone of attached gingiva), biologic (inflammation, inability for good oral hygiene) and functional (inability for protection during chewing procedure) factors that lead to the decision of frenectomy<sup>32</sup>. The maxillary labial fraenum may present the aesthetic problem as well, compromise an orthodontic result or create traumatic problems in tissues

during oral hygiene actions. These situations also need surgical intervention<sup>32</sup>.

The initial approach was to remove the fraenum with simultaneous deepening of the vestibule. Later, this technique was replaced by plastic surgery, which aimed to cover the root of the tooth. Another technique was a frenectomy with a gingival augmentation procedure, using a pedicle graft<sup>36</sup>.

Edwards<sup>16</sup> used a sample of 308 patients, who prior to orthodontic treatment demonstrated either diastema an abnormal fraenum or a combination of both. In his technique he noticed the aesthetic maintenance of the interdental papilla between the central incisors. Miller chose a surgical technique in which he avoided removal of the entire fraenum, but emphasized in orthodontic stability without aesthetic sacrifice. His technique seemed to be similar, but Edwards thought that the transeptal fibres of the fraenum should be destroyed, whereas Miller made no effort to destroy transeptal fibres<sup>35,36</sup>. Regarding the interdental papilla, it proved that it should be maintained, even though clinically it may appear to be a part of the labial fraenum<sup>36</sup>.

Periodontists do not tend to use the classical frenectomy, in which interdental tissue and palatine papilla are completely excised. Today, we use frenectomy in which we have a partial removal of the fraenum and relocate it to a more apically position. This technique leads to an acceptable solution of the problem and to the movement of the fraenum more apically<sup>16,44</sup>.

In case of a diastema, the ideal time for this technique is after the beginning of orthodontic treatment and about 6 weeks before the appliances are removed. That allows healing, tissue maturation and does not prolong orthodontic treatment<sup>36</sup>.

## Surgical Techniques

Various surgical techniques have been described for the management of the abnormal upper labial fraenum<sup>8,20,30</sup>. It is important to refer that there is a distraction between the terms “frenectomy” and “frenotomy”. Frenectomy is the complete removal of the fraenum including its attachment to underlying bone; frenotomy is the partial removal of the fraenum and is used extensively for periodontal purposes to relocate the fraenum attachment, so as to create an increased zone of the attached gingiva between the gingival margin and the fraenum<sup>16,24,37</sup>.

2 main ways for the removal of the fraenum are the conventional technique with scalpels or periodontal knives and the technique with the use of soft tissue laser<sup>24,47</sup>. Archer described the classic frenectomy technique in which the fraenum, interdental tissues and palatine papilla are completely excised, leaving bone

and periosteum exposed<sup>3</sup>. After that, some modifications include the addition of horizontal relaxing incisions and the mucogingival junction, and the lateral underlying of the labial attached gingiva adjacent to the excision area. Disagreements have been expressed because of the increased possibility for creating hematoma and concerning the need for a dressing over the wound<sup>16</sup>.

Another procedure that was described called “the z-plasty technique”. In this technique, the fraenum is not removed but it is intended to relax the pull of the fraenum on the interdental soft tissue<sup>16,20</sup>. By the aspect of periodontists, there has been described a frenotomy with no excision of the marginal papilla, and “the curtain type” of gingivotomy of the palatal tissue behind 4 incisors (Frisch, Jones, Bhaskar)<sup>16</sup>. Other clinicians combined the classic frenectomy with a lateral pedicle graft, free papilla graft and free gingival graft taken from the papilla<sup>4,20</sup>. A lateral pedicle graft does not offer a complete coverage of the wound and has aesthetic problems creating an unsatisfactory colour match<sup>4</sup>. A technique known as “Archer incision” is a simple frenectomy that is made with a V-shaped incision<sup>3</sup>. The disadvantage of this technique is that it leaves a longitudinal surgical incision and scarring, which may lead to periodontal problems and an non-aesthetic appearance<sup>4</sup>.

Recently a new frenectomy technique has been proposed by Bagga et al<sup>4</sup>, which provides a good aesthetic result. In this technique, a V-shaped full-thickness incision was placed at the gingival base of the fraenum attachment. After the excision of a fraenum, a V-shaped defect on the gingiva side has remained. An oblique partial thickness incision is placed on adjacent attached gingiva extending beyond the mucogingival junction. A partial-thickness dissection of the attached gingiva is formed in an apico-coronal direction. Then we have a triangular pedicle of the attached gingiva with free apex and the base continuous with the alveolar mucosa. Finally, a bilateral triangular pedicle is sutured at the centre, covering the underlying defect<sup>4</sup>.

## Discussion

The study of the literature reveals that the presence of the maxillary labial fraenum has been associated with many pathological situations in the oral cavity; the most common of them is the maxillary midline diastema. Consequently, for decades there has been a tendency from every part of the dental community, to remove the fraenum at an early age in order to achieve the diastema closure.<sup>13</sup> Many researchers dealt with this issue and many research papers have been published. The therapeutic approach gradually changed into a more conservative management and a controversy among researchers started, existing until nowadays.

In the orthodontic community there is unanimity on this issue<sup>37</sup>. Orthodontists support that the fraenum should be maintained until the age of the eruption of all 6 permanent anterior teeth. After that, and only if the diastema remains the same, a frenectomy is indicated, with subsequent orthodontic closure of the diastema<sup>9,16</sup>.

Periodontists concentrate on the issue of the adequate zone of the attached gingiva. In case of inadequate zone of the attached gingiva, the increased tension causes gingival recession and a frenectomy is recommended<sup>24,32,36</sup>.

Oral surgeons suggest that in case of a maxillary midline diastema, a small intervention of the fraenum is useful. In this way, the closure of the diastema is facilitated and the orthodontic treatment is not affected<sup>9,20</sup>. In cases that the fraenum causes problems in periodontal tissues, such as gingival recession, the removal of the fraenum should be direct<sup>24,44</sup>.

Moreover, it is quite clear that when the presence of the maxillary labial fraenum interrupts the installation of a removable denture, the removal of the fraenum is imperative<sup>49</sup>.

Today, the belief that the presence of a maxillary midline diastema does not prompt an early frenectomy predominates. We must wait for a short period, specifically until the eruption of all 6 permanent anterior teeth<sup>9,14,16,20,34,36,37</sup>. Yet, this is acceptable if the fraenum is not responsible for other pathological situations in the oral cavity.

On the other hand, it is important to remember that the final decision is taken by patients. The duration and the cost of the treatment are 2 basic factors. Patients rarely compromise with expensive and long-term procedures, especially if these include orthodontic treatment which affects aesthetics<sup>8,9</sup>.

## References

8. Adams CP. The relation of spacing of the upper central incisors to abnormal labial fraenum and other features of the dento-facial complex. *Dent Prac Dent Rec*, 1954; 74:72-86.
9. Angle EH. Malocclusion of the teeth. 7<sup>th</sup> ed. Philadelphia: White dental manufacturing, 1907.
10. Archer WH. Oral surgery for dental prosthesis. In: Archer WH (Ed). Oral and maxillofacial surgery. Philadelphia: Saunders, 1975; pp 135-210.
11. Bagga S, Bhat KM, Bhat GS, Thomas BS. Esthetic management of the upper labial fraenum: a novel frenectomy technique. *Quintessence*, 2006; 37:819-823.
12. Baum AT. The midline diastema. *J Oral Med*, 1966; 21:30-39.
13. Beasley WK, Maskeroni AJ, Moon MG, Keating GV, Maxwell AW. The orthodontic and restorative treatment of a large diastema: a case report. *Gen Dent*, 2004; 52:37-41.
14. Bedell WR. Nonsurgical reduction of the labial fraenum with and without orthodontic treatment. *J Am Dent Assoc*, 1951; 42:510-515.
15. Bell WH. Surgical-orthodontic treatment of interincisal diastemas. *Am J Orthod*, 1970; 57:158-163.
16. Bergstrom K, Jensen R, Martensson B. The effect of superior labial frenectomy in cases with midline diastema. *Am J Orthod*, 1973; 63:633-638.
17. Campbell A, Kindelan J. Maxillary midline diastema: a case report involving a combined orthodontic/maxillofacial approach. *J Orthod*, 2006; 33; 22-27.
18. Campbell PM, Moore JW, Matthews JL. Orthodontically corrected midline diastemas. A histologic study and surgical procedure. *Am J Orthod*, 1975; 67:139-158.
19. Ceremello PJ. The superior labial fraenum and the midline diastema and their relation to growth and development of the oral structures. *Am J Orthod*, 1953; 39:120-139.
20. Dewel BF. The labial fraenum, midline diastema, and palatine papilla: a clinical analysis. *Dent Clin North Am*, 1966; pp 175-184.
21. Diaz-Pizan ME, Lagravere MO, Villena R. Midline diastema and fraenum morphology in the primary dentition. *Journal of dentistry for children*, 2006; 73:11-14.
22. Dickson GC. Orthodontics in general dental practice. London: Pitman, 1964.
23. Edwards JG. The diastema, the fraenum, the frenectomy: A clinical study. *Am J Orthod*, 1977; 71:489-508.
24. Friedman N. Mucogingival surgery. *Texas Dent J*, 1957; 75.
25. Gardiner JH. Midline spaces. *Dent Prac Dent Rec*, 1967; 17:287-298.
26. Gartner LP, Schein D. The superior labial fraenum: a histologic observation. *Quintessence Int*, 1991; 22:443-445.
27. Gkantidis N, Topouzelis N, Zouloumis L. Differential diagnosis and combined treatment of maxillary midline diastema caused by the fraenum and/or intermaxillary suture. *Balk J Stom*, 2008; 12:81-88.
28. Gottsegen R. Fraenum position and vestibule depth in relation to gingival health. *Oral Surg Oral Med Oral Pathol*, 1954; 7:1069-1078.
29. Graber TM. Orthodontics: Principles and Practice. Philadelphia: Saunders, 1972.
30. Guideline on Pediatric Oral Surgery, American Academy of Pediatric Surgery (AAPD). 2010; p 8.
31. Haytac MC, Ozelik O. Evaluation of patient perceptions after frenectomy operations: a comparison of carbon dioxide laser and scalpel techniques. *J Periodontol*, 2006; 77:1815-1819.
32. Henry SW, Levin MP, Tsaknis PJ. Histologic features of the superior labial fraenum. *J Periodontol*, 1976; 47:25-28.
33. Herremans EL. Anterior diastema: frenectomy. *Dent Surv*, 1971; 47:33-37.
34. Huang SW, Creath CJ. The midline diastema: a review of its etiology and treatment. *Pediatr Dent*, 1995; 17:171-179.
35. Jacobs MH. The abnormal fraenum labii. *Dent Cosmos*, 1932; 74:436-439.
36. James GA. Clinical implication of a follow-up study after frenectomy. *Dent Pract*, 1967; 17:299-305.
37. Kahnberg KE. Fraenum surgery. A comparison of three surgical methods. *Int J Oral Surg*, 1977; 6:328-333.
38. Kinderknecht KE, Kupp LI. Aesthetic solution for large maxillary anterior diastemas and fraenum attachment. *Prac Periodontics Aesthet Dent*, 1996; 8:95-102.
39. Konstantinidis A. Periodontology. Vol 1. Thessaloniki: Konstantinidis A, 2003; p 77.

40. Koora K, Muthu MS, Rathna PV. Spontaneous closure of midline diastema following frenectomy. *J Indian Soc Pedo Prev Dent*, 2007; 25:23-26.
41. Lindsey D. The upper mid-line space and its relation to the labial fraenum in children and in adults. A statistical evaluation. *Br Dent J*, 1977; 143:327-332.
42. Miller PD Jr. The frenectomy combined with a laterally positioned pedicle graft. Functional and esthetic considerations. *J Periodontol*, 1985; 56:102-106.
43. Miller PD Jr. Regenerative and reconstructive periodontal plastic surgery. *Dent Clin North Am*, 1988; 32:287-305.
44. Mittal M. Maxillary labial fraenectomy: indications and technique. *Dent Update*, 2011; 38:159-162.
45. Munshi A, Munshi AK. Midline space closure in the mixed dentition: A case report. *J Indian Soc Pedo Prev Dent*, 2001; 19:57-60.
46. Oesterele LJ, Shellhart WC. Maxillary midline diastema: a look at the causes. *J Am Dent Assoc*, 1999; 130:85-94.
47. Popovich F, Thompson GW, Main PA. The maxillary interincisal diastema and its relationship to the superior labial fraenum and intermaxillary suture. *Angle Orthod*, 1977; 47:265-271.
48. Popovich F, Thompson GW, Main PA. Persisting maxillary diastema: differential diagnosis and treatment. *Dent J*, 1977; 43:330-333.
49. Ross RO, Brown FH, Houston GD. Histologic survey of the frena of the oral cavity. *Quintessence Int*, 1990; 21:233-237.
50. Shashua D, Artun J. Relapse after orthodontic correction of maxillary median diastema: a follow-up evaluation of consecutive cases. *Angle Orthod*, 1999; 69:257-263.
51. Sorrentino JM, Tarnow DP. The semilunar coronally repositioned flap combined with a frenectomy to obtain root coverage over the maxillary central incisors. *J Periodontol*, 2009; 80:1013-1017.
52. Spiropoulou MN. Basic Principles of Orthodontic. Vol 2. 2006; pp 250-251.
53. Tait CW. The median fraenum of the upper lip and its influence on the spacing of the upper central incisor teeth. *Dent Cosmos*, 1924; 76:991-992.
54. Takei HH, Azzi RA. Periodontal plastic and esthetic surgery. In: Newman MG, Takei HH, Carranza FA (Eds). Carranza's clinical periodontology. London: WB Saunders, 2002; pp 870-871.
55. Taylor JE. Clinical observations relating to the normal and abnormal fraenum labii superiors. *Am J Orthod*, 1939; 25:646-660.
56. Terry BC, Hillenbrand DG. Minor preprosthetic surgical procedures. *Dent Clin North Am*, 1994; 38(2):193-216.

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