Management of midline diastema using a new surgical technique

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SUMMARY. Aim: The aim of this study was to evaluate spontaneous closure of the interincisive diastema in a group of patients, using a new surgical technique for the treatment of upper lip frenulum hypertrophy.

Study design: A triangular flap was lifted, rotated and sutured across the midline. A primary intention healing and positioning of the flap allowed minimal tissue contractures.

Materials and methods: 65 patients aged between 8-11 years, presenting with a wide upper labial frenum inserted in the palatine papilla and with a diastema of 4.5 mm or more, were divided into three groups: A) 33 patients underwent an upper labial frenoplasty using the new triangular flap technique, with no other treatment. B) 22 patients received orthodontic treatment for the closure of their diastema; C) 10 patients, whose parents refused both surgery and orthodontic treatment, were used as a control group.

Results: None of the patients in group A presented with complications after surgery. In 32 patients spontaneous closure of the midline incisor diastema was obtained without any orthodontic treatment. In all patients in group B, closure of the diastema was obtained, but retention had to be applied to avoid relapse. Eruption of lateral incisors was observed in only two patients in the control group C within one year, and both were in ectopic position (buccally), while in the other groups lateral incisors erupted correctly.

Discussion: There are many advantages in using the triangular flap technique. It avoids orthodontic treatment of the diastema, which can be closed within 2-4 months, but oral hygiene is difficult because of the large frenum and the presence of brackets. Therefore, this new surgical approach allows a reduced healing time while preventing tissue contractions.

Conclusions: The triangular flap is a safe, easy, reliable and well accepted procedure that provides positive aesthetic results and allows spontaneous closure of the diastema.

KEY WORDS. Upper labial frenum, Frenoplasty, Diastema.

Introduction

A midline diastema is a space between the maxillary central incisors, which may be a normal growth characteristic of primary and mixed dentition and is generally classified according to the time when the maxillary canines erupt [Huang and Creath, 1995]. Multiple factors may contribute to a midline space [Edwards, 1977, 1993]: upper frenum, oral habits, incorrect positioning, physical impediments, dental anomalies [Bishara, 1972; Campbell et al., 1975; Clark and Williams, 1978; Steigman et al., 1985] and abnormal occlusal patterns, such as rotated incisors and Class II Division 1 malocclusion. However, many authors have become aware of the possible influence of an abnormal superior labial frenum on midline diastema [Edwards, 1977; Spilka and Mathews, 1979; Huang and Creath, 1995].

The upper labial frenum of the oral cavity is a natural anatomical structure consisting of a triangular plica of mucosa that connects the attached gingiva to the upper lip. The frenum is made up of collagen fibers with small perivessel neural structures. In cadaver based research, Henry [1976] showed the absence of muscular fibers in the structure. At birth, it is constituted by a cord of fibrous tissue inserted into the palatine papilla and crossing the alveolar arch, dividing it into two symmetrical parts. At birth, due to the junction of the alveolar arch at the midline, the frenum starts its involution from the papilla maxillary attachment. With the eruption of the maxillary lateral incisors, the frenum starts to retract and atrophies. In an examination of children aged 6 years or older, it was observed that...
98% had a midline diastema which tended to decrease between the ages of 11 and 12 years [Powell and McEniery, 1982; Miller, 1985]. In the absence of superior migration and atrophy of the frenum, a cord of fibrous tissue may persist between the upper central incisors. There has been a great deal of discussion regarding the issue of whether abnormal insertion of the frenum can provoke a diastema [Bergstrom et al., 1973; Huang and Creath, 1995]. In 1976 Stubley stated that when normal eruption of the upper incisors occurs, an aperture remains in the bone and the transeptal fibers change their horizontal course orthogonally without touching the contralateral side [Stubley, 1976]. He also reported that when the fibers run in continuity, orthodontic treatment is sufficient to eliminate the diastema. In contrast, when the transpalatal fibers run vertically, frenoplasty becomes necessary, as in the case when the frenum is inserted into the maxillary papilla.

The relationship between a hypertrophic frenum and the presence of a diastema of the upper central incisors [Bergstrom et al., 1973; Jacobson et al., 1974; Huang and Creath, 1995] and periodontal damage has been the subject of much controversy [Bell, 1970; Edwards, 1977]. In this context, the majority of authors agree that it is worthwhile, from both an orthodontic and periodontal point of view, to perform frenoplasty [Edwards, 1993; Vanarsdall, 1994].

A diastema of over 2 mm generally requires active intervention. In the presence of a diastema of 3 mm or more, treatment with removable or fixed appliances prior to canine eruption may be indicated for orthodontic closure [Proffit, 1986]. When the diastema is larger (5-8 mm), a frenoplasty is recommended in the mixed dentition to prevent ectopic eruption of the lateral incisors and canines [Vanarsdall, 1994].

The aim of this study was to evaluate spontaneous closure of an interincisive diastema in a group of patients aged 8-10 years who underwent frenoplasty using a technique previously reported by the authors [Morselli et al., 1999], without orthodontic treatment and compared with an orthodontically treated group and a control group.

Materials and methods

From 1995 to 1998, 65 patients (42 male and 23 female) aged 8-10 years (mean age 9.2 years) were chosen for closure of the upper midline diastema to allow the lateral incisors to erupt. There was insufficient space for the eruption of the lateral incisors or the canines.

To be selected for inclusion in this study a child had to present with the maxillary medial frenum inserted into the palatine papilla and the diastema was wider than 4.5 mm (mean ±0.1 mm). In our study, we did not include thumb suckers or patients with agenesis or tooth eruption anomalies. Patients did not need treatment for skeletal problems. Each patient underwent radiographic and clinical examination. The blanching test was used to evaluate the frenal attachments. This test was proposed by Graber (1994) to demonstrate a continuity of the tissue fibers of the labial frenum through the diastema to the palatine papilla. The examiner (IM) lifted the upper lip upward until the frenum was tightly stretched. If the procedure produced a blanching or change in contour in this area the frenum was considered abnormal [Huang and Creath, 1995] (Fig. 1). Consent was obtained from parents, who were fully informed about the surgical technique, expected results and possible negative events, such as lack of closure of the diastema, and the probabilities of success.

The 65 patients were divided into three groups according to the following criteria: for groups A and B we used a double blind method; group C was used as a control group and was constituted by patients whose parents did not give consent to any treatment.

In group A, 33 patients (23 males and 10 females, mean age 9.2 years) were surgically treated using the new surgical technique described in this work. All operations were performed under local anaesthesia using an epinephrine 1:100,000 solution. An anaesthetic spray was used before the insertion of the needle in order to obtain a local pre-anaesthetised area. The technique aims to release the maxillary labial frenum from the inferior insertion and producing a loss of tissue which will be closed by using a triangular flap from the mucosal tissue with a horizontal pedicle [Morselli et al., 1999].

The surgical technique is schematically reproduced in the illustrations (Fig. 2, 3, 4). Figure 2 is a diagram showing the position of the incisions to raise the flap for access. The point of the initial incision is shown in Figure 3a. The incision continues in an upward cranial direction until it reaches the junction between the attached and mobile gingiva. Triangular flap horizontal base is rotated from vertical to horizontal crossing the middle line so that a triangular hole gapes (Fig.
The horizontal incision is made 1 mm above the junction of the mobile and attached gingiva. The incision should be 4-5 mm in length on one side and 2-3 mm in length on the opposite side; on the same side the triangular flap can be dissected. After rotation, the side of the triangular flap will be horizontal above the attached gingiva and will exceed the midline. The triangular shaped gap is shielded by advancing the mucosal tissue of the opposite side of the pedicle of the triangular flap [Morselli et al., 1999]. The flap is closed with sutures as appropriate (Fig. 3c). Postoperatively healing is successful with no evidence of scar tissue (Fig. 4).

**Fig. 1** - The blanching test to evaluate the frenal attachments.

**Fig. 2** - Diagram showing triangular flap.

**Fig. 3a** - Initial vertical incision begins from the most inferior point of the insertion of the frenum.

**Fig. 3b** - A triangular shaped gap has now been created.

**Fig. 3c** - The complete closure of the open incision is obtained by advancing the apex to the middle of the base of the triangle and suturing.

**Fig. 4** - Assessment at 9 months post-operatively. No scar contraction is evident and the diastema has closed.
In group B, 22 patients (15 males and 7 females) were treated orthodontically with a fixed appliance, because the diastema required closure by moving the crowns and roots of the central incisors. Brackets were applied on central incisors and an M-shaped diastema closing device tied onto the edgewise brackets. The M-shaped spring is narrower than the distance between these two brackets and is stretched for attachment onto the brackets. The compressive force from the active spring will close the diastema. When the diastema was closed, a Hawley-type removable appliance with clasps and labial bow as retainer was applied until the adjacent permanent anterior teeth erupted.

In group C, 10 subjects (6 males and 4 females), whose parents refused both surgery and orthodontic treatment, were used as a control group and no therapy was performed.

All patients were studied for one year.

Results

In 32 of the 33 patients in group A, a spontaneous closure of the diastema of the central incisors was obtained after the frenoplasty within a period of about seven months and the closure of the diastema led to spontaneous eruption and positioning of lateral incisors (Fig. 4). Only one patient did not show spontaneous closure of the central incisors. None of the 33 patients in our study showed postsurgical complications, such as excessive pain, swelling or problems related to food intake.

No complications, such as infections, dehiscence of the suture site, scar contracture or hypertrophic scarring were reported.

In group B patients, closure of the diastema was obtained in 2-4 months (mean 1.6 month), but all subjects showed gingival hypertrophy in the frontal area because oral hygiene was difficult due to the large frenal and the presence of brackets.

Eruption of the lateral incisors was observed in only two patients in the control group, but in a buccal position, and the closure of their diastema was only 0.6 mm. In another two patients from this group the diastema opened further, up to 9.9 mm (Fig. 5).

Discussion

Another surgical technique group was not used because it was thought that the new technique would be better for the children. Instead an orthodontic treatment group was used as a positive control because some authors advise the management of midline diastema with orthodontics to close the diastema and a surgical technique should only be used once the permanent canines have erupted.

We consider our technique better than others as the triangular flap breaks down the lines of cicatrisation thus causing only a minimal contraction. In fact, the classic frenulectomy leaves a vertical scar on the midline with periodontal damage and unaesthetic healing.

Results similar to those obtained with our approach can be achieved using Z plastic technique, but this technique appears more difficult as it needs a double flap. Our technique is simpler and faster, and we consider this aspect to be of great importance when treating paediatric patients.

All cases of surgery led to closure of the diastema within seven months and in these cases there was still no eruption of the permanent canines, in agreement with the statistics of Vanarsdall [1994]. However, the very hyperplastic types of frenal, with a fan-like attachment, may obstruct diastema closure and should be removed or relocated [Zachrisson, 1997].

In the presence of a very large frenulum (over 4-5 mm and with fan like attachment) some authors suggest the closure of the diastema via an orthodontic treatment and to postpone the surgical treatment to after the eruption of canines. Such a large diastema needs orthodontic treatment [Proffit, 1986; Vanarsdall, 1994] because the incisors or the canines could erupt in ectopic position and not be aligned. We have shown that in

**Fig. 5** - Photograph of one patient in the control group after one year showing diastema remaining.
the control group the diastema became much larger or closure of the diastema was not obtained, in spite of lateral incisors erupting. Furthermore, little space was left for canines.

The current consensus among clinicians is that a diastema needs to be corrected initially with orthodontic treatment [Bishara, 1972; Edwards, 1977; Edwards, 1993; Vanarsdall, 1994]. With orthodontic treatment, closure of the diastema is obtained quickly (2-4 months), but oral hygiene is difficult due to the large frenum and the presence of brackets.

Besides, patients must wear a retainer for a long time. Treatment is costly for patients and time-wasting for dentists.

Moreover, these types of orthodontic treatment will require retention. The desire to close diastemas at an early age is tempered by experience of how difficult it can be to keep the space closed. A Hawley-type retainer or multistranded archwire bent to the linguocervical portion of the incisors will provide retention. With this technique it is more difficult to maintain correct oral hygiene because of the fixed retainer and especially because the patients are younger.

According to some authors, it is an error to remove the frenum surgically and then delay orthodontic treatment in the hope that the diastema will close spontaneously, because if the frenum is removed while there is still a gap between the central incisors, scar tissue forms as healing progresses and it becomes more difficult to close the space. The triangular flap, however, is positioned horizontally across the midline above the attached gingiva. This position provides a good barrier and avoids scar contraction, preventing deformity of the periodontal attachment of the anterior teeth.

Where the diastema persists after eruption of the maxillary canines, or where excessive bunching of tissue continues because the diastema has been closed orthodontically, or if the space re-opens upon removal of retention, then surgery becomes necessary [Huang and Creath, 1995].

An abnormal frenum may cause inflammatory periodontal destruction, because efficient toothbrushing is often inhibited by the close proximity of the frenal tissue to the margin of the gingiva or to the interdental papilla [Friedman and Levine, 1964]. In these cases surgical intervention is indicated.

Furthermore, in the case of a large diastema (>5 mm), surgery may be initiated prior to permanent canine eruption [Vanarsdall, 1994].

Our data show that in patients without skeletal malocclusion or incorrect positioning of the tongue, the diastema is closed by means of surgery. A s the technique is painless, fast, inexpensive and aesthetically worthwhile, it offers the patient an alternative to orthodontic treatment and subsequent continuous retention. The latter is more expensive and involves prolonged paediatric dentistry control.

Conclusion

Treatment of a maxillary median diastema requires a correct diagnosis of its specific aetiology and, hence, relevant intervention. For accurate diagnosis, details of medical and dental history are needed, as well as a clinical and radiographic examination and possibly tooth-size evaluation. A period of at least six months after surgery is important to achieve satisfactory results. In many cases it is important to defer the treatment until eruption of the permanent canines, but with a very large diastema it can begin earlier.

Our technique can thus be a good solution as there are many advantages in using the triangular flap technique: the incisions made in this procedure are sutured across the midline and therefore healing occurs by primary intention, allowing both a reduction in the amount of healing time required, and also preventing tissue contractures [Morselli et al., 1999].

References


