Management of central diastema with high-frenulum labialis

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Abstract
Objective: To explain the management of the central diastema case in a patient with high-frenulum labialis.
Methods: Using a conventional Orthodontic appliance MBT system. This method is selected to orthodontically corrected central diastema while eliminating deep bites and other existing malposition in this case.
Results: Central diastema and deep bite corrected, as well as other malposition. However, the frenulum labialis which was planned to undergone frenectomy was postponed to avoid an open gingival embrasure (black triangle).
Conclusion: Correction of central diastema done by using a conventional orthodontic appliance MBT system. However, the disposal of frenulum labialis should not always be done, because it should consider the possibility of the emergence of gingival embrasure (black triangle) after the Labialis frenulum was discarded.
Keywords: Black triangle, Central diastema, Frenulum labialis, Gingival embrasure, MBT system

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Introduction
Central diastema is the space or distance between the central tooth incisive in upper jaw. This condition can usually be corrected when the canine tooth begins to grow. However in some individual, gaps between these teeth cannot be enclosed spontaneously. Central diastema as a relation in the first-class Malocclusion, appeared in 98% of children aged 6 years, 49% age 11 years, and 7% at the age of 12-18 years, but the size of the gap and the prevalence will diminish with age. The cause of the central diastema is the period of normal tooth growth, disharmony between the size of the teeth and the jaw arch, missing teeth (missing teeth), supernumerary teeth, proclination of the anterior maxillary tooth, and the superior labial frenulum that High. One of the causes of central diastema is the superior labial frenulum which is formed at the time of the fetus 10 weeks. The third month in the uterus tectolabial frenulum continues to extend from the inside of the lips until it passes through the alveolar ridge and ends in the palatine papilla. Frenulum located in alveolar ridge will cause the central incisive tooth to grow more to the lateral thus eventually forming a gap between the teeth. However, once the lateral and canine teeth begin to erupt, the eruption of the tooth's leads to the median. The growth of the median is what leads to a gap between the teeth, and the frenulum undergoes atrophy. In some cases, spontaneous closure do not occur, so the central incisive tooth grows to form a gap. A blanching test can be used to prove whether a frenulum labialis causes a gap between
the central and upper jaw teeth. As for how to perform this blanch test is by pulling the upper lip until the place of the frenulum attachment turns colour to pale white. If the pale white colour is between the central incisive tooth, then it is certain that frenulum labialis is high. The case report is a central diastema case treatment in the first-class malocclusion, where several treatment options, in this case, are based on clinical and aesthetic considerations.

**Management Central diastema**

The central diastema treatment approach can be distinguished into action before the eruption of the canine teeth, or after the eruption of the canine teeth. If the gap is greater than 3mm and there is a lack of space between the lateral incisive before the eruption of the canine tooth, it is needed to close the diastema on the central incisive tooth. The gap closure of this central incisive tooth is needed to provide space for lateral incisive to erupt and prevent the canine tooth to resorb lateral incisive tooth roots. In the case of central diastema, long-term use of retention is needed to prevent relapse. Relapse in the case of central diastema is often the case if there is a history of hereditary patients who have a central diastema whose magnitude is more than 2 mm.³

Cases of high frenulum labialis are one of the causal factors of central diastema, so it can be suggested the action of Frenectomy. Regarding the action of a frenectomy, there are still differences of opinion about the time is done before treatment, or waiting for the completion of treatment.³⁵ Wheeler et al said that one indication of doing a frenectomy before orthodontic treatment is if the frenulum is so large that it prevents the closing of the gap between the teeth.⁵ The action of frenectomy itself can be performed in several ways, such as using laser, electrosurgery, or cutting using standard surgical knives.⁵ In principle, there is the four-method treatment of central diastema, the first is movement tipping of incisive tooth into the mesial, bodily movement of the incisive tooth, third central diastema treatments with overjet reduction, and all fourth Comprehensive orthodontics treatments.¹ The first method, tipping of incisive tooth into mesial can be performed in the central diastema case-patients which accompanied by normal posterior occlusion. This treatment can be done using removable orthodontic appliances, for example, a Hawley removable device in combination with finger spring to close the diastema. In addition to the removable appliances, we can also use a simple tool with a U-shaped wire or V, or a closing loop that is attached to the palatal surface of the incisive tooth.

The second method, an incisive bodily tooth movement can use a fix orthodontic apparatus with a sectional wire. Usually using wire 0.018 mm placed on the bracket that is attached to the four anterior teeth as well as the two permanent molar teeth. Elastomeric chain or Power chain is used as a source of force to close the gap of central diastema. The elastomeric chain is attached to the mesial wing of the central incisive bracket to the incisive lateral. This treatment is known as "2x4 appliances".¹ This treatment will produce a good result if done after the eruption of Canine tooth.

If a central diastema treatment is needed to be accompanied by an overjet reduction, it will be very difficult to use a removable appliance. The use of a removable appliance in such a case can cause new problems such as an increased overbite. An overjet reduction in such cases requires a fixed orthodontic appliance mounted on the bottom and upper teeth. The fourth method, comprehensive orthodontic treatment corrects central diastema, with the bodily movement of a tooth, where the crown and roots are simultaneously moving either controlled or uncontrolled tipping. After that proceed with the root enforcement, to avoid the occurrence of relapse after the central diastema treatment is complete. In the use of a fixed orthodontic appliance in addition to the central diastema problem, the problem of increasing overbite at the time of reducing the magnitude of overjet can also be done by the intrusion of incisive teeth concurrently during anterior retraction, so that in a single stage treatment we can get diastema correction through the bodily movement of the incisive teeth, reducing the overjet, and as well as reducing the risk of increased overbite. In general, treatment with the fixed orthodontic
appliance is a better treatment option because it has better control in overjet, overbite as well as roots torque.

Case Report
Female patients 26 years 8 months came to the specialist clinic RSGM-P FKG UI, with central diastema in the upper jaw and mild anterior crowding in the lower jaw. Patients have a symmetrical, balanced, and mesofacial face, with straight chin and convex facial profile. Oral hygiene and gingiva health are quite good, deep-palate and medium size of the tongue. Frenulum labialis is high, which is ensured by using the Blanch test. The patient has a 3 mm central diastema between the central incisive tooth, and a gap of 1 mm between the right lateral incisive and the right canine tooth. While in the upper jaw have a mild 3 mm anterior crowding. Incisive class 2 relation (overjet 4mm), deep bite (4 mm), right permanent molar relation class 3 (2 mm), left permanent molar relation remained class 1, the right and left canine relation class 1, the deep curve of spee, the middle line of the upper and lower teeth are aligned, as well as the oval curved shape of the upper and lower tooth arch.

Panoramic radiograph shows that the level of alveolar bone is within normal limits. The upper and lower anterior tooth roots are not parallel. Ramus mandibular left and right are symmetrical. Position of the condylus bone symmetrical. Teeth 37 and 47 caries dentine. As well as teeth 18, 28, 38 and 48 have a full eruption. The radiographic of lateral cephalometry indicates a mandibular relationship to maxilla is orthognathic. Skeletal pattern class 1. Skeletal and soft tissue profiles are normal. Normal horizontal skeletal growth pattern. The interincisal angle, upper incisor to the maxillary plane, and profile are protrusive. The upper lip is right on the E-line and the lower lip in front of e-line 4mm.

![Intraoral Photos before treatment](image)

Based on the analysis of the study model obtained an excess space of 9 mm in the upper tooth arch. And on the lower arch have a lack of space of 8 mm. These findings are supported by the method of Lundstrum which finds a total excess space of 9 mm. This is a confirmation of central and multiple diastemata. The space analysis according to Bolton showed that there is an excess of space in the upper anterior of 2.6 mm. Kesling analysis results showed the lack of space in the upper right area of 2 mm, left 3mm, bottom right (2 mm), and left 3 mm. Those analyses obtained once planned to close the central diastema on the upper anterior tooth, retraction of the upper anterior teeth of 4mm and 2 mm on the lower anterior teeth, as well as eliminating the mild crowding on the lower jaw. These calculations provide an indication of treatment with non-extraction approaches. As for the non-extraction approach chosen is the interproximal slicing of teeth 41, 42, 31, 32, and closes the gap between the teeth 13, 12, 11, 21, 22, and 23.

Diagnosis and treatment plan
Female patients 26 years and 8 months come with central diastema and mild crowding. It has first-class malocclusion and mesofacial, symmetrical and balanced facial types. Skeletal pattern Class 1, normal skeletal profile, soft tissue profile is somewhat convex. Diastema on Teeth 13,11, 21, 12, 22, and 23. The protrusive upper incisive, right permanent molar relation class 3, and left class 1. Overjet 4 mm, and overbite 4 mm. Space requirements upper right Regio 2mm, left 3mm, bottom right 2mm, and left 3mm. High-frenulum Labialis. This case does not have a skeletal problem, because of the first-class skeletal pattern, with an orthognatic maxilla and mandible relationship, in addition to that normal vertical growth pattern. But there is a disharmony between the size of the jaw with the size of teeth thus give a trait of central and multiple diastemata, also high frenulum-labialis as the cause of central diastema. The goal treatment is to level and align irregular malposition teeth and closing the gaps between the teeth. The protrusive upper anterior teeth (overjet 4 mm), which will be retracted for 4 mm. And as for lower arch will be retracted for 2 mm, while eliminating the deep bite. Central diastema between the central incisive tooth is corrected by closing the gap between the central tooth incisive. The class 3 right molar relation is expected to be corrected into class 1.

**Treatment phase**

Based on a list of problems and treatment goals, in this case, is to close the gap between the teeth by closing the gap between the upper anterior teeth, in addition, the existing space is also used to correct the upper anterior dental inclination. It then corrected mild crowding on the lower anterior teeth, by interproximal slicing of the lower anterior teeth.

Orthodontic treatment begins with the bonding of the MBT slot 0.022 x 0.025, the molar band’s installation in teeth 16, 26, 36, and 46 and starts the aligning and levelling stages. The correction of the mild crowding of the lower anterior teeth performed by an interproximal slicing of the distal side of the teeth 33-43. In the third month, the upper jaw teeth are already aligned and level on the wire NiTi 0.016x0.022. The fourth-month treatment is resumed on the SS wire 0.016x0.016 and closes the gap between the central incisive teeth using power chain.

After a seventh month, the aligning and levelling phases are completed, followed by the retraction stage. Using an SS 0.016x0 wire 0.22 performed anterior segment retraction by using the power chain from a crimp able hook between the lateral incisive teeth to the right and left Canine. The retraction at this stage is accompanied by stepping down the stainless steel wire of the right and left lateral incisive teeth to prevent the deepening of the bite to the anterior teeth when it is retracted. The retraction is aimed at fixing the protrusive anterior segment.

The gap between the central incisive tooth has been corrected, but the gingival embrasure (black triangle) is now visible in the Interdental area. In addition to the lower jaw, there is still a mild crowding on teeth 31 and 32. So it was decided to perform an interproximal slicing of distal tooth 42 thus slightly fix the midline arch of lower teeth as well as to provide space for the correction of a mild crowding on the teeth 31 and 32. The retraction of the anterior segment runs up to the ninth month. At that time the black triangle still appeared so that it was decided to do the interproximal slicing on the mesial teeth 11 and 21 to reduce the trait of the gingival embrasure (black triangle) on the area of interdental papillae. The midline correction of the lower teeth is then undergone, while also giving room for the correction of crowding in teeth 31 and 32. In the twelve months, the anterior retraction is still going on which in the right and left Regio interdigitation already looks good. The right molar relationship which at the beginning of treatment was class 3, is now already a class 1. At the end of the treatment, all treatment goals have been achieved such as central diastema correction, mild crowding on the lower arch, reduced overjet and correction of deep bite. The patient looks more confident with her smile.
**Figure 2.** A. Picture of the black triangle in the interdental area of 11 and 21, B. After the correction of the black triangle the trait is gone.

**Treatment results**

After 12 months of treatment, it is completed and a cephalometric analysis is performed to see the changes occurring after treatment is completed. The results of a cephalometric analysis are shown in the table below.

**Table 1.** Analyses of cephalometry before and after treatment

<table>
<thead>
<tr>
<th>Dental Parameters</th>
<th>Average</th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interincisal Angle</td>
<td>135°±10</td>
<td>122°</td>
<td>120°</td>
</tr>
<tr>
<td>UI-SN</td>
<td>104°±6</td>
<td>112°</td>
<td>110°</td>
</tr>
<tr>
<td>UI-MxP</td>
<td>109±6</td>
<td>120°</td>
<td>115°</td>
</tr>
<tr>
<td>UI-NA</td>
<td>4 mm±2</td>
<td>9 mm</td>
<td>8 mm</td>
</tr>
<tr>
<td>UI-Apg</td>
<td>4 mm±2</td>
<td>9 mm</td>
<td>8 mm</td>
</tr>
<tr>
<td>LI-Apg</td>
<td>2 mm±2</td>
<td>4 mm</td>
<td>5 mm</td>
</tr>
<tr>
<td>LI-MP</td>
<td>90°±4</td>
<td>91°</td>
<td>94°</td>
</tr>
<tr>
<td>LI-NB</td>
<td>4 mm±2</td>
<td>6 mm</td>
<td>7 mm</td>
</tr>
</tbody>
</table>

**Skeletal Parameters (Horizontal)**

<table>
<thead>
<tr>
<th>Average</th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNA</td>
<td>82°</td>
<td>82°</td>
</tr>
<tr>
<td>SNB</td>
<td>80°</td>
<td>81°</td>
</tr>
<tr>
<td>ANB</td>
<td>2°</td>
<td>1°</td>
</tr>
<tr>
<td>The Wits</td>
<td>F: 0(±2)</td>
<td>1 mm</td>
</tr>
<tr>
<td>Facial Angle</td>
<td>87°±3</td>
<td>84°</td>
</tr>
<tr>
<td>Angle of Convexity</td>
<td>0°±10</td>
<td>1°</td>
</tr>
</tbody>
</table>

**Skeletal Parameters (Vertical)**

<table>
<thead>
<tr>
<th>Average</th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y-axis</td>
<td>60°±6</td>
<td>66°</td>
</tr>
<tr>
<td>Go angle</td>
<td>123°±7</td>
<td>122°</td>
</tr>
<tr>
<td>SN-MP</td>
<td>32°±3</td>
<td>34°</td>
</tr>
<tr>
<td>MMPA</td>
<td>27±4</td>
<td>25°</td>
</tr>
</tbody>
</table>

Table 1 can be added that this treatment does not alter the skeletal parameters either horizontally or vertically. However, this treatment changes the dental parameters as seen in the table above. From the table above, it appears that the upper inclination of both profile and skeletal changes are more retrusive. While the lower incisive of both profile and skeletal undergo more protrusive changes, the effect of changes in the dental parameters interincisal angle is more taper (before 122° to 120°). The lower incisive inclination change is more protrusive due to the lower anterior region flaring forward, in order to break down the anterior crowding as well as minimize the overjet with the upper tooth arch. Upper incisive inclination changes occur due to the upper anterior retraction process, to correct the overjet. Superimposition changes can be seen in the superimposition image below.
Superimposition of Cephalograms before and after 12 months of treatment, indicating an incisive upper inclination becomes more upright. The lower incisive inclination becomes more protrusive. As for the clinical patients experience a change in the appearance of a smile that becomes better without central diastema and gingival embrasure. As for the changes we can see on the photo extra oral comparison before and after the treatment below.

**Figure 3.** A. superimposition of a lateral cephalometric radiograph on the SN field, B. superimposition of the lateral cephalometric radiograph of the palatal field, C. mandibular field. The black colour indicates a cephalometric before treatment and the red colour indicates a cephalometric after treatment.

**Figure 4.** A. An extraoral photograph before treatment, B. An extra-oral picture of the patient after treatment is completed, a better smile look without a central diastema and black triangle.
Figure 5. A. Panoramic radiograph and cephalometric radiograph before treatment, B. Panoramic radiograph and cephalometric radiograph after treatment, C. Before treatment of the right molar relationship class 3, D. After treatment of right molar relationship class 1, E. Intra oral result after debonding.

Intra-oral changes at the right molar relation that was previously class 3 corrected to class 1. Central diastema, In this case, is also corrected without leaving a trait of the gingival embrasure (black triangle) between the central incisive teeth, resulting in a better picture of the smile for the patient. These intra-oral changes can be seen in the picture below.

Discussion
The patient has a first-class malocclusion accompanied by diastema on 11, 12, 13, 21, 22 and 23 teeth. As for the central diastema on this case is allegedly caused due to high-frenulum labialis, which is confirmed through the Blanch test. The treatment plan, in this case, is by closing the gap between the tooth (central diastema), correcting the mild crowding on the lower arch of the tooth, correcting the overjet with the anterior retraction while fixing the deep bite, as well as planning frenectomy. But towards the end of treatment, in this case, it is not in correction with a frenectomy. This is due to the fear of frenectomy, which will cause the black triangle in the interdental region between the central incisive teeth. This is in line with Hwang's opinion stating that this action can leave a poor and less aesthetically pleasing outcome, which is the formation of a dark room between a central incisive tooth (black triangle). This triangular-shaped dark space is called the gingival embrasure(black triangle). Gingival embrasure is caused by the absence of interdental papillae that fills the area.9

Relapse can occur even after the orthodontic treatment is complete.10 especially in the case of central diastema. Morais states that 60% of the central diastema cases are relapsed and require a fixed retainer for long periods.10,11 Morais also said one of the causes of relapse in
the case of central diastema is the imperfect alignment of roots after treatment is completed. Therefore permanent retention is required in the central diastema case, as well as the alignment of the roots after the completion of treatment is important. The Lingually bonded retainer is planned to be glued to the upper incisive central, to prevent relapse from occurring. A lingually bonded retainer is glued to the central incisive cingulum to prevent poor contact with the lower arch. The Lingually bonded retainer can also be extended to incisive lateral and canine.

**Conclusion**

In the case management of central diastema caused by high-frenulum labialis, not always accompanied by frenectomy. It is important to note that especially in adult patients is the possibility of forming gingival embrasure (black triangle). In general, adult patients experience alveolar bone loss in the interdental papillae area so that when central diastema is corrected, it leaves the trait of gingival embrasure (black triangle). This will be heavier if previously the interdental papillae area is filled by high-frenulum labialis. Almost certainly the orthodontic treatment that closes central diastema will be accompanied by "void" between central incisive teeth, it will be even more noticeable if it is disposed of frenulum labialis. Therefore, if in theory it is said to require consideration in the disposal of the frenulum labialis either before or after treatment, it should also be considered not to dispose of the frenulum labialis.

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**Conflict of Interest**

The authors report no conflict of interest.

**References**