Clinical Study of Laser Treatment for Frenectomy of Pediatric Patients

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ABSTRACT

Aim: To suggest regarding the timing of oral surgery and laser treatment for frenulum abnormalities in the pediatric population.

Materials and methods: We investigated the sex, age, frenulum site, reason for consultation, treatment method, and prognosis of 35 patients aged 15 years or younger and who were examined at our hospital for the chief complaint of frenulum abnormality.

Results: A total of 21 (mean age, 6.0 years) of the 35 patients underwent frenectomy using a carbon dioxide (CO₂) laser. Of these, 7 patients (mean age, 2.8 years) underwent the procedure with general anesthesia and 14 patients (mean age, 7.6 years) underwent the procedure with local anesthesia. The surgical site was the lingual frenulum in 15 patients and the maxillary labial frenulum in 6 patients. No adverse events were intraoperatively reported in any of the patients, and the procedure was quickly and safely performed. The mean postoperative follow-up period was 4.6 months, and readhesion was noted in one patient (4.8%). The most common reason cited for not undergoing frenectomy in the 14 patients (mean age, 3.4 years) was the young age of the child.

Conclusion: Retrospective study of pediatric patients with frenulum abnormalities demonstrated the usefulness of the CO₂ laser in performing frenectomy and offered suggestions regarding the timing of this procedure.

Clinical significance: Frenectomy performed using a CO₂ laser for pediatric patients is a useful, simple, and safe treatment method.

Keywords: CO₂ laser, Lingual frenectomy, Maxillary labial frenectomy.

INTRODUCTION

Most frenulum abnormalities occur in the lingual or maxillary labial frenulum. In the lingual frenulum, adhesion to the proglossis impairs tongue movement, causing problems, such as suckling, articulation, and speech disorders. In the maxillary labial frenulum, high adhesion to the alveolar portion causes diastema of the dentition and eruption site abnormalities in the central incisors. Although treatment might be required if these symptoms are observed, this is often difficult due to problems in gaining the understanding and cooperation of the patient because these are mostly infants or early school year-aged children. In addition, the pediatric patients could even be subjected to psychological trauma by the distress experience of the stressful treatment from dentist; hence, a simple method of treatment that offers reliable effects is needed.

As the CO₂ laser has a wavelength of 10.6 μm, it shows excellent hemostatic ability with minimal heat damage to the surrounding tissues, and it is used for the resection and vaporization of oral soft tissue because it can do so without coming into contact with the affected site. At our hospital, the CO₂ laser is used for many procedures, including soft tissue tumor resection, mucositis vaporization, and mucous cyst extirpation, as well as commonly for frenectomy. Frenulum abnormalities are generally difficult to judge and treat in pediatric patients. This clinical retrospective study investigated pediatric patients with frenulum abnormalities in our hospital and demonstrated the disease state and the usefulness of CO₂ laser treatment.

MATERIALS AND METHODS

We assessed the sex, age, frenulum site, reason for consultation, classification, prognosis, and complications of 35 patients aged 15 years or younger who were examined at our hospital for undergoing frenectomy in the 5-year period from March 2010 to March 2015. Ito’s classifications and Rui’s classifications were used as references of the classifications for lingual and maxillary labial frenulum respectively (Table 1). The procedure involved infiltrating about 1 mL of anesthesia into the frenulum before applying a continuous wave of the CO₂ laser at 2 to 5 W for approximately 60 seconds. For the lingual frenulum, a suture thread was occasionally placed around...
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Table 1: Representative classifications of frenulum

| Types                        | Classifications                                      |
|------------------------------|------------------------------------------------------|
| Ito’s lingual frenulum       |                                                      |
| I                            | Despite sufficiently opening the mouth and elevating  |
|                              | the lingual apex, the lingual apex does not reach    |
|                              | the palate. The lingual apex is constricted and      |
|                              | appears to be two apexes.                           |
| II                           | Despite elevating the lingual apex, it only lifts    |
|                              | slightly higher than the occlusal plane              |
| III                          | The lingual apex can hardly be elevated at all      |
| Rui’s maxillary labial frenulum |                                                   |
| I                            | Alveolar mucosa                                      |
| II                           | Gingival insertion                                   |
| III                          | Interdental papilla                                 |
| IV                           | Transpapillar                                        |

RESULTS

The study sample comprised 20 boys and 15 girls aged between 1 month and 14 years. The frenulum site was the lingual frenulum in 27 patients and the maxillary labial frenulum in 8 patients. The patients’ reasons for consultation were as follows: being advised to get a regular checkup at a dental clinic or school (13/35 patients; 37.1%), speech disorders (7 patients; 20.0%), cosmetic problems needing orthodontic treatment (5 patients; 14.3%), being advised by parents or people around them (4 patients; 11.4%), eating/suckling disorder (3 patients; 8.6%), postresection recurrence (1 patient; 2.9%), and other reasons [(2 patients; 5.7%); (Table 2)].
Frenectomy was performed using a CO₂ laser in 21 patients (60%) with a mean age of 6 years (Table 3). Based on the site, 15 of 27 patients had lingual frenulum (55.6%; mean age, 5.2 years) and 6 of 8 patients had maxillary labial frenulum (75%; mean age, 8.2 years). Of the patients with lingual frenulum that underwent resection, 9 were type I, 6 were type II, and none were type III by Ito’s classifications. Of the patients with maxillary labial frenulum, 2 were type II, 4 were type III, none type I or VI by Rui’s classifications (Table 4). For 7 patients (mean age, 2.8 years), the procedure was performed under general anesthesia, whereas for 14 patients, the procedure was performed under local anesthesia (mean age, 7.6 years; Table 3). Suturing was performed in 7 of the 15 patients with lingual frenulum and in one of the 8 patients with maxillary labial frenulum. No problems intraoperatively occurred in any of the patients, and surgery was quickly and safely performed. No patients exhibited any adverse symptoms, such as hemorrhage or spontaneous pain after returning home. Readhesion occurred in one of the 15 patients with lingual frenulum (6.7% of resection patients) and in none of the patients with maxillary labial frenulum.

The follow-up observation period for the 21 patients who underwent resection ranged from 1 week to 3 years, and the mean follow-up period was 4.6 months (patients with lingual frenulum, 5 months; patients with maxillary labial frenulum, 1.6 months). The mean age of the 14 patients (39%) who did not undergo surgical treatment was 3.4 years (patients with lingual frenulum, 3.8 years; patients with maxillary labial frenulum, 1 year). Reasons for not undergoing resection were young age (6 patients; mean age, 1.2 year), no abnormal findings/disability (5 patients; mean age, 5.5 years), and refusal of treatment under general anesthesia (3 patients; mean age, 4.3 years; Table 5).

DISCUSSION

Patients with Frenulum Abnormalities Who were Examined at our Hospital

In this study, a clear difference in the number of patients with maxillary labial frenulum (n = 8) or lingual frenulum (n = 27) was observed. A common chief complaint for patients with maxillary labial frenulum was cosmetic problems.8 Because a tendency for reduction of maxillary labial frenulum is noted, with alveolar bone growth and tooth eruption, many general practitioners (GPs) choose to take a conservative approach for such cases. Meanwhile, lingual frenulum abnormalities tend to be considered more problematic because they can lead to functional disorders, such as speech or eating disorders.9-11 We believe that the reason for many such cases being referred to the Department of Oral and Maxillofacial Surgery (our hospital) as compared with those of labial frenulum is that many GPs are reluctant to treat sublingual soft tissue due to the technical difficulty.

Timing and Reason for Consultation

Ankyloglossia caused by lingual frenulum abnormalities is mainly characterized by the fibrous adhesion of the tongue to the floor of the oral cavity. It is classified as complete or partial ankyloglossia depending on the extent of adhesion.12,13 Cases of complete ankyloglossia

| Table 2: Patient’s reasons for consultation |
|--------------------------------------------|
| **Lingual frenulum** | **Maxillary frenulum** | **Total** |
| **Regular checkup** | 12 | 1 | 13 |
| **Speech disorders** | 7 | 0 | 7 |
| **Cosmetic problems** | 1 | 4 | 5 |
| **Advised by parents or people around them** | 4 | 0 | 4 |
| **Eating/suckling disorder** | 3 | 0 | 3 |
| **Postresection recurrence** | 0 | 1 | 1 |
| **Other reasons** | 0 | 2 | 2 |
| **Total** | 27 | 8 | 35 |

| Table 3: Age distributions of lingual and maxillary frenulum patients |
|---------------------------------------------------------------|
| **Age** | **Lingual frenulum** | **Excision (under general anesthesia)** | **Maxillary frenulum** |
| **Total** | **Observation** | **Excision (under general anesthesia)** | **Total** | **Observation** | **Excision (under general anesthesia)** |
| 0 | 3 | 2 | 1 (1) | 0 |
| 1 | 1 | 1 | 0 | 2 | 2 | 0 |
| 2 | 4 | 3 | 1 (1) | 0 |
| 3 | 5 | 1 | 4 (4) | 0 |
| 4 | 1 | 0 | 1 (0) | 1 | 0 | 1 (0) |
| 5 | 3 | 2 | 1 (1) | 0 |
| 6 | 2 | 1 | 1 (0) | 0 |
| 7 | 2 | 1 | 1 (0) | 1 | 0 | 1 (0) |
| 8 | 4 | 0 | 4 (0) | 3 | 0 | 3 (0) |
| 9+ | 2 | 1 | 1 (0) | 1 | 0 | 1 (0) |
| **Total** | 27 | 12 | 15 (7) | 8 | 2 | 6 (0) |
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Discussion of the usefulness of Laser Treatment

The energy emitted by a CO2 laser at the wavelength of 10.6 μm is efficiently absorbed into tissues with high moisture content, and this laser is commonly used for surgical procedures, such as frenectomy with surface anesthesia.

Discussion of Treatment Standards

When the frenulum abnormality is causing difficulty in suckling, some reports recommend early resection of the lingual frenulum. However, numerous reports
suggest avoiding performing resection on patients of a very young age due to the possibility of improvement with growth and the fact that the procedure can cause scarring.\textsuperscript{24,25} Furthermore, Tachimura et al\textsuperscript{26} suggested that it is important to first conduct an articulation training before determining resection timing based on the degree of development in articulation function. Thus, no fixed consensus has been reached regarding the optimal timing for resection at the present time. In this study, 15 patients that underwent lingual frenectomy (mean age, 5.2 years) and 12 patients that underwent conservative treatment (mean age, 3.8 years) were retrospectively investigated. Excluding the patients whose speech had not fully developed and the patients in whom postoperative tongue motion functional training was difficult, a trend toward performing lingual frenectomy from the age of 3 years and onward was noted. All resection cases in this study were classified as I to II (moderate or lower level of impairment of tongue range of motion or deformity) according to Ito’s classifications (Table 4), and surgery was selected for young patients aged 2 years or younger with sucking disorders in infancy or functional disorders in the growth process, such as marked speech disorders. Therefore, rather than relying upon systematic classifications, we determined whether or not to perform surgery at our hospital based on functional disorders as described by parents, who observed these problems on a daily basis. General anesthesia was selected for most procedures performed on patients aged 3 years or younger. This allowed the treatment to be smoothly performed and reduced the psychological stress and trauma of the patient. The disorders caused by maxillary labial frenulum abnormalities include diastema and abnormal central incisor position, onset of dental caries and periodontal disease due to the retention of food residue, and movement and cosmetic impairment of the upper lip. However, if no functional disorders, such as the above mentioned are clearly noted, it is best to take a conservative approach with regular follow-up observation. In the present study, the mean age of the six maxillary labial frenulum cases that underwent resection was 8 years, and 50\% of these cases underwent the procedure as a preliminary treatment for subsequent orthodontic treatment. Unlike the lingual frenulum cases, none of the maxillary labial frenulum cases underwent resection with general anesthesia.

CONCLUSION

Clinical data from 36 patients with frenulum abnormalities that were examined at the Department of Oral and Maxillofacial Surgery demonstrated the usefulness of the CO\textsubscript{2} laser in performing frenectomy and offered suggestions regarding the timing of this surgical procedure. CLINICAL SIGNIFICANCE

Frenectomy performed using the CO\textsubscript{2} laser in pediatric patients is a useful, simple, and safe treatment method that leads to good postoperative outcomes.

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