

## Evaluation of Children's Perceptions after Frenectomy: Diode Laser vs. Conventional Scalpel Technique

Raif Alan<sup>1\*</sup>, Onur Gezgin<sup>2</sup>, Emre Korkut<sup>3</sup>, Hazal Özer<sup>3</sup>

1 Çanakkale Onsekiz Mart University, Faculty of Dentistry, Department of Periodontology, Çanakkale, TR

2 Başkent University, Faculty of Dentistry, Department of Pediatric Dentistry, Konya, TR

3 Necmettin Erbakan University, Faculty of Dentistry, Department of Pediatric Dentistry, Konya, TR

\* Corresponding Author: Raif Alan E-mail: [draifalan17@gmail.com](mailto:draifalan17@gmail.com)

### ABSTRACT

**Objective:** The presence of abnormal frenum may cause aesthetic or functional problems, which can be prevented by frenectomy operation. Therefore, the aim of this study is to compare children's perceptions of pain, speech and chewing difficulties after conventional scalpel technique and diode laser-assisted frenectomy operations.

**Material and Methods:** Twenty-one patients, aged 10 to 16 years, who were indicated for Frenectomy were assigned to be treated with conventional scalpel technique or diode laser. In the comparison between both techniques, the Wong-Baker FACES Pain Rating Scale was used to evaluate pain immediately after surgery and pain, speech and chewing difficulties at days 1, 3, 7, and 10 following the procedure. Factors such as duration of surgery, use of anaesthetic, and need for analgesics were also recorded. Moreover, Corah's Dental Anxiety Scale was used to evaluate the dental anxiety levels of parents about their children.

**Results:** When compared to the conventional scalpel technique, it was found that the surgery took shorter, and no postoperative analgesic was needed in the group that underwent Diode laser surgery. In addition, as the age of the children increased, the anxiety levels of the parents decreased. When the postoperative perceptions of pain and functional discomforts were evaluated, there was no significant difference between the groups.

**Conclusion:** According to the results of this study, Diode laser provided benefits such as significantly shortening the operation time and not requiring surgical sutures and analgesics in children. It may also allow the use of less infiltrative anaesthetic during the operation.

**Keywords:** Conventional surgery, Diode laser, Frenectomy, Pain

### INTRODUCTION

The labial frenum is a mucous membrane fold that combines the lip with the periosteum and alveolar mucosa and is composed of connective tissue, collagen and elastic fibrils, vascular structure and epithelial layer (1). High attachment of the frenulum of the upper lip to the alveolar bone fragment can cause diastema and abnormalities in the central incisors, as well as biofilm accumulation, gingivitis, and a reduction in keratinized gingival tissue (2,3). All these problems can be treated or prevented by surgical excision of the frenum. Frenectomy is a surgical operation in which the connection between the frenum and the adjacent bone is removed by separating it (4). Once the indication for Frenectomy has been established, there are several surgical techniques the clinician can use to perform this. Conventional scalpel technique and laser surgery are the most commonly used techniques (3 6).

In addition to the conventional scalpel technique, which has been used for a long time, laser surgery has become a preferred technique in recent years (7). Depending on tissue interactions and properties such as wavelength and frequency, various types of lasers can be used for soft tissue surgeries, including CO<sub>2</sub>, Nd:YAG, Er:YAG, and Diode lasers (8). The Diode laser, which has an affinity for wet tissues, has become popular in recent years for its effectiveness and ease of use in intraoral soft tissue surgery.

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In addition, other advantages of Diode lasers include smaller size, portability, minimal setup time and low cost (9,10).

Studies using various types of lasers to manage soft tissue procedures have demonstrated successful clinical results (10-12). Although advantages such as shorter operation time, hemostasis, and reduced postoperative pain have been reported with the use of laser techniques in frenectomy operations, there is no consensus on the benefits of this application (13). In particular, the results obtained from various studies regarding the usage of Diode laser in Frenectomy are variable (14). In a systematic review, Protásio et al. (15) noted that there is still not enough argument to conclude that laser use is better than conventional scalpel use in frenectomies. In line with this information, this study aims to compare children's perceptions of pain, speech and chewing difficulties after frenectomy operations using conventional scalpel and diode laser-assisted techniques.

## MATERIAL and METHODS

This study was approved by the Ethics Committee at the Faculty of Dentistry, Necmettin Erbakan University (app. no: 2017.01) in accordance with the Helsinki declaration. A written informed consent was obtained from all participant parents. They participated in the study voluntarily and had the right to withdraw their participation at any time.

Twenty-one subjects aged 10 to 16 years, who were referred to Necmettin Erbakan, Faculty of Dentistry, Department of Pediatric Dentistry and required Frenectomy due to high labial frenum attachment (Figure 1A,C) participated in this study. The inclusion criteria for the participants were as follows: (1) 10 to 18 years old, (2) systemically healthy, (3) non-smoker, (4) not use any medication, (5) no oral disease/condition that could affect chewing and speech and (6) had good oral hygiene. The participants with indications for maxillary labial frenectomy were assigned to two groups: Group A, consisting of 11 subjects treated with Diode laser-assisted surgery, and Group B, consisting of 10 subjects treated with conventional scalpel surgery. All surgeries were performed by the same experienced operator.

**Conventional Scalpel Surgery:** Adjacent to the frenum attachment, infiltration was performed using 1:200.000 adrenaline local anesthetic (Ultraver D-S Forte, Haver Farma İlaç, İstanbul, Turkey). A flat hemostat was inserted deeply into the vestibule to grasp the frenum, and the soft tissue was incised with a 15c scalpel along the surface of the hemostat. The resected part of the soft tissue was removed, and then a gentle horizontal incision was made to separate the fibrils. At the end of the surgery, 4.0 silk sutures were used to close the wound site. Sutures were gently removed 1 week after surgery.

**Diode Laser-assisted Surgery:** Diode laser (Wiser, Doctor Smile, Italy) was used with the settings in accordance with the manufacturer's recommendations for use in Frenectomy and goggles covering the wavelength have been used by both clinician and the patient. The laser equipment used in the study was described by the manufacturer and is detailed in Table I. Prior to the laser-assisted excision procedure, a lidocaine-based anesthetic spray (Vemcaine, VEM İlaç, İstanbul, Turkey) was applied to the frenum. For patients who still experienced pain during the procedure, a local anesthetic

(Ultraver D-S Forte, Haver Farma İlaç, İstanbul, Turkey) solution was infiltrated around the frenum. The laser fiber tip was applied in contact mode and with a brush stroke in the apical direction, starting from the base of the frenum, thereby cutting it out. After irradiation with the laser tip, residual fibers on the periosteum were removed while the laser tip was at reduced power. The ablated residual tissue was cleaned with saline-soaked gauze. No sutures were used in any patient.

Both groups were informed about postoperative care and prescribed analgesics when needed.

**Surgical time:** Operation times were recorded from the moment the operator initiated the procedure with a laser or scalpel until the completion of the operation, including suture and hemostasis.

**Scoring:** Immediately after treatment, each child was asked to point out the degree of pain on the scale. For this purpose, Wong-Baker FACES Pain Rating Scale (WBS), a self-report tool containing six symbols ranging from 'No Hurt' to 'Hurts Worst' combined with a series of numbers (0-2-4-6-8-10) was used (16). The scale presents 6 different faces representing different levels of feelings and scoring is done as follows: Face 1 = No Hurt (0), Face 2= Hurts Little Bit (2), Face 3 = Hurts Little More (4), Face 4 = Hurts Even More (6), Face 5 = Hurts Whole Lot (8), and Face 6 = Hurts Worst (10). Children pointed to the face or selected the number most describing their pain during treatment. In addition, evaluation was made to determine pain and discomfort during chewing and speech on the 1st, 3rd, 7th and 10th postoperative days.

**Questionnaire:** When parents came to the department, they were asked to answer questions on the questionnaire to evaluate parental dental anxiety levels regarding their children according to Corah's Dental Anxiety Scale (C'DAS) (17). The C'DAS consists of four questions, each with five potential options regarding various states of dental anxiety, and scoring is done as follows: score  $\geq 4$  = No anxiety (0), score 5-9 = Low anxiety (1), score 10-14= Moderate anxiety (2) and score 15-20= High anxiety (3).

The data were analyzed using IBM SPSS Statistics for Windows (Version 20.0. Armonk, NY: IBM Corp.). First, all data were checked whether all the data showed a normal distribution, analyzed descriptively, and presented as mean $\pm$ SD values. Mann-Whitney U and Wilcoxon tests were used to compare the mean values. The Pearson correlation coefficient was used to present the correlation. The significance level was set at  $p < 0.05$ .

## RESULTS

Twenty-one patients completed the study, and no complications were observed after the surgical techniques were applied (Figure 1B,D). As a result of the comparison of gender distribution and mean age, there was no significant difference between the groups. When the duration of surgery was compared, excluding the duration of local anaesthesia, it was found that laser-assisted surgery was performed in a statistically significantly shorter time than conventional scalpel surgery ( $p = 0,018$ ) In addition, it was observed that there was no need for postoperative analgesic use in children who underwent laser-assisted surgery ( $p = 0.001$ ).

Moreover, although less infiltrative anesthesia use was detected during laser-assisted surgery, there was no significant difference when compared with the conventional scalpel technique (Table 2).

Immediate postoperative pain perception was evaluated, and there was no significant difference between the groups, with both groups experiencing low levels of pain on average (Table 2). Similarly, when comparing pain, chewing, and speech discomfort on the first, third, seventh, and tenth postoperative days, lower values were observed in the laser-assisted surgery group, although not statistically significant.

However, by the tenth day, patients in both groups reported no discomfort in all evaluated parameters (Figure 2).

In correlation assessment, a negative correlation was found between patients age and the anxiety level specified by their parents ( $r = -0.507$ ;  $p = 0.019$ ) (Figure 3). Accordingly, it was found that as the age of the patient decreased, the level of parental anxiety increased significantly.

**Table 1:** Diode laser device specifications.

<b>Model name</b>	Doctor Smile WISER
<b>Laser source</b>	Diode
<b>Wavelength</b>	980 nm
<b>Frequency</b>	Up to 25 kHz
<b>Max power</b>	7 W (0,10 W to 7 W in 100mW steps)
<b>Mode</b>	Continuous (CW) or Pulsed Modes (MP, SP, SSP); customizable modes
<b>Fibre/Tips</b>	Integrated fibre with variable autoclavable tips for specific application

**Table 2:** Comparison of the data of the groups in which the conventional scalpel technique and the diode laser technique were applied.

	Gender distribution <i>n</i>	Age mean±SD	Surgery duration (sec) mean±SD	WBS Scores <sup>¶</sup> mean±SD	Need for anesthesia Frequency	Need for analgesics Frequency
<b>Group A (n=11)</b>	9 (F), 2 (M)	13.46±1.92	261.82±97.76	2.36±1.50	72.7%	0
<b>Group B (n=10)</b>	8 (F), 2 (M)	13.50±1.96	372.00±101.19	2.60±1.89	100%	70%
<b>p-value</b>	NS	NS	*	NS	NS	**

\* $p < 0.05$ ; \*\* $p = 0.001$ , F: female, M: male, WBS: Wong-Baker FACES Pain Rating Scale, NS: non-significant, ¶Immediately after surgery



**Figure 1:** A: Pre-op and B: post-op 10th day view of the case who underwent conventional scalpel technique. C: Pre-op and D: post-op 10th day view of the case who underwent diode laser technique.

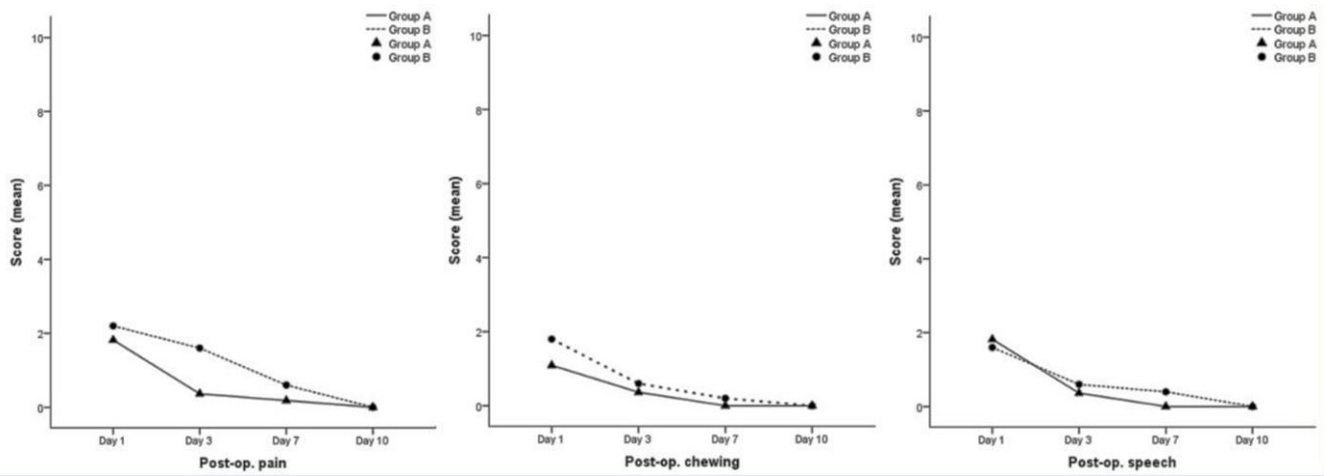


Figure 2: Comparison of postoperative pain and functional discomforts between groups.

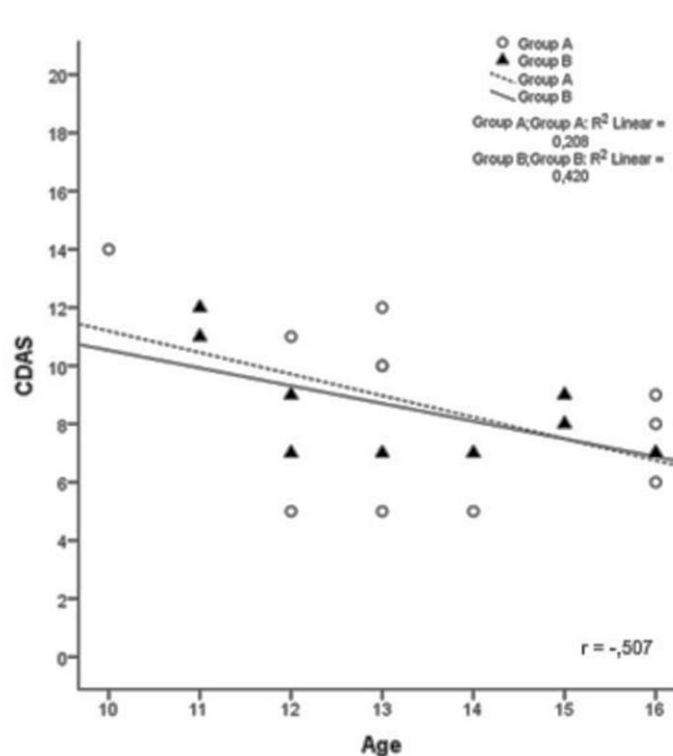


Figure 3: Correlation of parental dental anxiety levels with their children's age.

## DISCUSSION

Although the conventional surgical technique is widely used for the maxillary labial frenum commonly observed as a problem in children with primary/mixed dentition, laser technique is considered as the best alternative procedure (14,18). In addition, the inclusion of less invasive methods is evolving in dentistry to minimize patient pain and discomfort during and after operations (19). Therefore, the use of laser in dental surgery has been admitted as an efficient and reliable option (20). Diode lasers, which offer great energy efficiency, are suitable for intraoral soft tissue implementations due to their positive effects, such as adequate hemostasis, exact incision lines, no swelling and pain (5, 21). Therefore, in the current study, Diode laser was preferred in laser surgery to compare with the conventional scalpel technique.

Pain control during routine dental treatment is important not only for the patient's physical and psychological comfort, but also for the efficacy of the treatment. In addition, a painless, uncomplicated and comfortable postoperative period allows clinicians to predict the success of treatment (22). Since pain is a subjective experience, it is not possible to evaluate it objectively. In addition, there are many methods for assessing pain (23). In children, self-report scales are often used to obtain information about pain (24). Facial expression drawings are within the various tools that can be utilized to evaluate pain severity in children. Similarly, WBS specifies the severity of pain and is preferred by children and their parents (25). Therefore, in this study, pain perceptions of children after the operation were evaluated using WBS.

In addition, children younger than 10 years of age were not included in this study owing to the reliability of the evaluation results, since it is estimated that children younger than 10 years of age have difficulty in distinguishing their feelings (26).

Postoperative pain is the most researched criterion for comparing laser and conventional surgery (15). In addition to studies showing that patients undergoing laser-assisted frenectomy experience less postoperative pain and discomfort than patients undergoing conventional Frenectomy (27-29), there are also studies reporting no significant difference (3,8,30). Similarly, in the current study, although less pain scores were observed after the application of the laser-assisted technique compared to the conventional scalpel technique, there was no statistically significant difference between the two groups. Pain and incisive objects are among the reasons of sensitivity observed in children. In addition, past dental experiences can influence children's behavior during any treatment procedure. When a frenectomy is performed with a diode laser, the operator typically does not need to use a scalpel or sutures, which can help minimize or prevent mental trauma or pain during the procedure (16). In this study, the fact that the children were older than 10 years made cooperation easier. Moreover, due to the improvement of ego strength and cognitive abilities, most developmental fears decrease or disappear with age in children. This, in turn, results in children overcoming many fears (31). This may explain the ease of cooperation and the absence of intergroup differences in pain after techniques for Frenectomy.

In this study, all frenectomies using the conventional scalpel technique were performed with infiltration anaesthesia compared to 72.7% of procedures using the laser-assisted surgical technique. Moreover, it was observed that patients treated with the laser-assisted technique did not need postoperative analgesics. Similarly, studies that performed laser procedure without infiltration anesthesia and suture reported less postoperative pain and discomfort (32,33). As specified by Olivi et al. (6), in this study, the postoperative period, the laser-assisted technique was used in the group that was comfortable and well tolerated by the children, thus no use of analgesics was observed, leading to complete acceptance of the procedure. Based on these, the important effects of Diode laser application in children with frenectomy indication, such as significantly shortening the operation time, avoiding surgical sutures, and increasing patient compliance, should not be overlooked.

Assessing anxiety levels can be beneficial for ensuring quality dental procedures and enabling better management of patients' behavior. In an ideal measurement method for this purpose, validity, ease of application, and ease of scoring in the clinical setting are desirable features, even for individuals with limited skills (34, 35). Therefore, in this study, C'DAS was used to evaluate the dental anxiety levels of parents regarding their children. Since this scale has reliable and acceptable validity, it has been utilized in previous years to assess behaviour management procedures in children and predict the prevalence of dental anxiety (34,35). Parental anxiety, which was the most focused on in the literature, was stated as an important external agent that can affect the child's anxiety and behavior in dentistry clinic (36-38). Dikshit et al. (39) found that 37.6% of parents accompanying their children

during treatment had moderate to severe anxiety levels. A study by Uzel et al. (40) found that parents' dental anxiety levels significantly influenced the anxiety levels of their children in the 7-8 age groups, but there was no significant difference in the 11-12 age group. In the current study, parents' anxiety levels varied from no anxiety to moderate anxiety, and no high anxiety was detected. In addition, as the age of the children increased, parental anxiety levels decreased and there was no significant difference between the dental anxiety levels of the parents and the perception levels of our patient population between the ages of 10-16.

## CONCLUSION

Although there was no significant difference in patients' perceptions of pain, speech, and chewing disorders between the conventional scalpel technique and the laser-assisted technique when a frenectomy operation was indicated, the laser-assisted technique had several advantages. Specifically, the operation took a shorter time, no infiltrative anesthesia was needed in some cases, sutures were not used, and there was no need for the use of analgesics in the laser-assisted group. We believe that these advantages should be taken into account for frenectomy operation, which is indicated especially in pediatric and uncooperative patients, and will facilitate the patient's compliance to the operation. However, to obtain more precise evidence on the impacts of the techniques, future studies should be conducted using larger sample sizes, longer follow-up periods, different wavelengths, and even different surgical techniques.

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**Author Contributions: RA, OG, EK, HÖ:** Study design, collecting data, statistical analysis **RA:** Manuscript preparation, Literature search and revisions

**Ethical approval:** All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and/or with the Helsinki Declaration of 1964 and later versions. Informed consent or substitute for it was obtained from all patients for being included in the study. This study was approved by the Ethics Committee at the Faculty of Dentistry, Necmettin Erbakan University (app. no: 2017.01)

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