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Original Article

# Patient perceptions and clinical efficacy of labial frenectomies using diode laser versus conventional techniques

A. Uraz [a,*], F.D. Çetiner [a], S. Cula [b], B. Guler [c], S. Oztoprak [a]

[a] Gazi University, Faculty of Dentistry, Department of Periodontology, 8. cadde, 82. Sok 06510 Emek, Ankara, Turkey
[b] Başkent University, Faculty of Commercial Sciences, Department of Insurance and Risk, Ankara, Turkey
[c] Dumlupınar University, Faculty of Dentistry, Department of Periodontology, Kütahya, Turkey

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ABSTRACT

*Introduction:* The aim of present study was to compare the keratinized gingival tissue measurements, degree of subjective complaints and functional complications of using an 980 nm diode laser versus a scalpel for labial frenectomies.
*Material and methods:* Thirty-six patients requiring labial frenectomies, between 14 and 51 years old, were randomly assigned to either scalpel or diode laser treatments. The soft tissue measurements, including the keratinized gingiva width (KGW), attached gingiva width (AGW) and attached gingiva thickness (AGT), were recorded before surgery, immediately after, one week later and one, three and six months after surgery. In addition, the functional complications and the morbidity (level of pain, swelling and redness) were evaluated during the first postoperative week using a visual analog scale (VAS).
*Results:* We determined statistically significant gains in the KGW, AGW and AGT after surgery in both groups; however, there was no significant difference between the study groups. The VAS scores indicated that the patients treated with a diode laser had less discomfort and functional complications compare with scalpel surgery.
*Discussion:* The results described above show that diode laser surgery offers a safe, impressive alternative for labial frenectomies that are comfortable for the patients.
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## 1. Introduction

The labial frenulum is composed of fibrous, muscular, or fibromuscular tissue, and is covered with a mucosal membrane, extending from the interdental surface of the upper mucosa to the alveolar or gingival mucosa and the underlying periosteum between the central incisors. It acts as a flexible checkrein, limiting the movement of the cheeks and lips. In many abnormal cases, there are restrictive problems associated with lip movement, aesthetics, interincisal diastema and stability of the denture. Direct tension exerted on the marginal gingiva leads to the accumulation of biofilm, inflammation and pocket formation, as well as a decrease in the keratinized gingival tissue. The treatment of such mucogingival problems includes conventional and laser surgery [1–3].

A labial frenectomy aims to completely remove the excessive interdental tissue, including its attachment to the underlying bone and reduce the tension of the marginal gingival tissues to overcome these limitations. It also prevents diastema relapse and reconstruction of the normal anatomy in the area and improves the aesthetics, while helping to prevent periodontal conditions [1,2,4]. The conventional technique, using scalpels and periodontal knives, has been used for many years; however, modern technology, like laser surgery, now offers an alternative mode of treatment. Carbon dioxide, neodymium-doped yttrium aluminum garnet (Nd:YAG), argon, erbium YAG (Er:YAG) and diode lasers are commonly used in frenectomies and other soft tissue procedures for periodontal surgery [5,6].

The use of diode lasers in soft tissue surgery has gained popularity over the past few years. The diode wavelength absorption depth in water, especially in 810–980 nm wavelength diodes, is several times greater than that of the Nd:YAG (1004 nm) laser, but not quite as rapid as with the argon laser [7,8]. The oral tissue is composed of > 90% water; therefore, a diode laser is easy and effective for use in intraoral soft tissue surgery, including

* Corresponding author.
*E-mail address:* ahuuraz@gazi.edu.tr (A. Uraz).

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frenectomy, because of its affinity for wet tissues. The main advantages of the diode laser are its smaller size, portability, minimum setup time and lowest price of all surgical lasers currently available [8,9]. These lasers have become popular for aesthetic soft tissue procedures and mucogingival problems (such as in a frenectomy, gingivectomy, or recontouring), as both a definitive treatment and with restorative dentistry, because of the notable surgical cutting efficiency in well-vascularized tissues [7,10,11].

The main objective of the present study was to compare labial frenula reinsertion and keratinized tissue differences following a frenectomy performed with a diode laser or conventional surgery. The study also aimed to determine and compare the soft tissue alteration and the degree of patient perception, during and after these two different frenectomy techniques.

## 2. Materials and methods

### 2.1. Subjects and study design

The study, designed as a randomized prospective controlled clinical trial, was conducted to compare the clinical outcomes of labial frenectomies performed using conventional surgery or a diode laser. Thirty-six patients (28 females and 8 males) between 14 and 51 years old were selected from those patients referred to the Faculty of Dentistry at Gazi University and Faculty of Dentistry, Dumlupınar University between February 2015 and May 2017. All of the patients requiring labial frenectomies were randomly assigned into two groups: G1 ($n = 20$) was treated with a diode laser[1] (2.8 W continuous wave mode, wavelength 980 nm), and G2 ($n = 16$) received conventional scalpel surgery.

Those subjects with maxillary anterior frenula extending to the interdental papilla of the central incisors, those undergoing labial frenectomies for orthodontic, prosthodontic, or periodontal treatment, and those with no surgical contraindications were included in this study. The patients were excluded if they exhibited poor oral hygiene, received periodontal therapy, were being treated with antibiotics, anti-inflammatories, or analgesics during the previous three months, or if they had any systemic conditions that could affect oral surgery.

Ethical approval was obtained from the Institutional Review Board of Dumlupınar University (2015-KAEK-86/05-39) and written informed consent was obtained from all of the patients. The trial is registered at ClinicalTrials.gov, number NCT03156387.

### 2.2. Surgical technique

All of the surgeries were performed by the same surgeon, following the principles of antisepsis, with local anesthesia, incision, hemostasis and excision of the frenulum. The conventional surgical technique was as follows:

- topical anesthesia (20% benzocaine);
- local anesthesia using the bilateral vestibular infiltration technique, with 0.6 mL (one third of the carpule contents) of 4% articaine and 1:200,000 epinephrine;
- hemostatic clamping of the frenulum;
- excision of the whole band of tissue, together with its alveolar attachment, with a 15 C scalpel blade;
- relaxation and unbending of any fibrous adhesions to the underlying periosteum;
- simple suturing with 5-0 silk thread.

A 2.8 W, 980 nm diode laser in continuous wave mode with an air-cooling handpiece was used in the alternative labial frenectomy technique. The frenulum was held with a hemostat and a repeated continuous wave mode was applied for the excision. It was also used to remove the periosteal adhesion. The remnants of the ablated tissue were removed with saline and no sutures were placed after the diode laser treatment.

Both groups received the following postoperative instructions:

- abstain from mechanical trauma;
- brushing;
- chewing;
- flossing around surgical area for one week.

They were told to use analgesics as necessary and were called for follow-ups one week, one month and 3 months after the surgery.

### 2.3. Clinical parameters and scoring method

The whole mouth records of each participant served as a basis for the clinical periodontal diagnoses. Prior to the frenectomy, the same investigator recorded the following parameters: plaque index (PLI), gingival index (GI), pocket probing depth (PD), clinical attachment level (CAL) and bleeding on probing (BOP). All of the clinical parameters were measured at six sites per tooth (mesio, mid, and distobuccal and mesio, mid and distopalatal) using a Williams periodontal probe[2] calibrated in millimeters.

The patients were instructed to record the postoperative degrees of pain, redness, swelling and functional complications, including chewing and speech, on a 10 cm horizontal visual analog scale (VAS), by placing a vertical mark between the two endpoints, from the first through seventh days. The scale was graded from left to right with values ranging from "0" (no pain, functional complications, discomfort, swelling or redness) to "10" (worst pain, extreme functional complications, extreme discomfort, extreme swelling and extreme redness). The keratinized gingiva width (KGW), attached gingiva width (AGW) and attached gingiva thickness (AGT) were also recorded before the surgery. Postoperative analyses were performed at four separate times:

- immediately;
- at the first week;
- at the first and third months after surgery.

The patients in each group were also asked if they required anesthesia during the operation and analgesics after the operation.

### 2.4. Statistical method

The statistical analysis of the results was done using the Statistical Package for Social Sciences[3]. Non-parametric tests were chosen for the continuous variables because the data were not distributed normally, and the comparisons between the groups were analyzed using the Mann–Whitney $U$ test. The time-dependent intragroup data were analyzed using the Wilcoxon rank sum test and the categorical variables between the groups were analyzed using the $\chi^2$ or Fisher's exact test. Repeated measurements were performed and the results were shown as the mean ± SD. A $P$ value $< 0.05$ was considered to be statistically significant. To achieve a power of 80%, the minimum required sample size was determined to be 15 in the paired study groups.

[1] SIROLaser Advance, Sirona, Germany.

[2] Nordent Manufacturing Inc., Elk Grove Village, IL, USA.

[3] SPSS v.17.0; SPSS Inc., Chicago, USA.

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