



The influence of diode laser (810–980) nm in treatment of the labial frenum in jaws: clinical study

Mays Y. Kadhim¹ , Soudad S. Ahmed² , Hamid H. Enezei³

¹ Department of Oral and Maxillofacial Surgery, College of Dentistry, University of Baghdad, Baghdad, Iraq

² Department of Laser and Optoelectronics, College of Science, University of Baghdad, Baghdad, Iraq

³ Department of Oral and Maxillofacial Surgery, College of Dentistry, University of Anbar, Al Anbar, Iraq

✉ mays.yahia2201m@ilps.uobaghdad.edu.iq

Abstract

INTRODUCTION. Midline diastema, gingival recession, and functional and aesthetic issues are possible outcomes of a high labial frenum. Although the traditional scalpel frenotomy is still effective, it is often characterized by intraoperative bleeding, the necessity to sew a wound, and a long postoperative period. Diode lasers with wavelengths of 810–980 nm have been reported to provide better hemostasis and reduced tissue trauma. The current study compared the clinical results of the diode laser and scalpel frenotomy.

MATERIALS AND METHODS. A randomized controlled trial was done on 50 patients (age 12 to 55 years) with high labial frenum who were referred to the Al Falah Special Dental Centre in Baghdad in 2024–2025. The subjects were randomly grouped either in the diode laser group ($n = 25$) or the scalpel group ($n = 25$). The outcomes of the postoperative period were measured with pain intensity using a visual analogue scale (VAS), bleeding, edema, oral functional status, and patient satisfaction on postoperative day 1, week 1, week 2, and week 4. The data were analyzed by means of the Mann-Whitney U test, and the statistical significance threshold of the test was p below 0.05.

RESULTS. Patients who had laser frenotomy had better outcomes. The laser group did not require any intraoperative bleeding or suturing, compared with the scalpel group. At the conclusion of week 2, the pain and edema scores were significantly lower in the laser group ($p < 0.001$). Oral functional recovery was faster, and patient satisfaction scores were mostly above all the measurements of the same ($p < 0.001$).

CONCLUSIONS. Diode laser frenotomy is a safe, less invasive, and patient-friendly procedure compared to the conventional use of a scalpel. It provides superior hemostasis, reduced postoperative pain and edema, faster functional recovery, and increased patient satisfaction, making it the modality of choice in periodontal practice.

Keywords: diode laser, frenotomy, labial frenum, periodontics, randomized controlled trial

Article info: received – 17.11.2025; revised – 24.12.2025; accepted – 05.01.2026

Conflict of interest: The authors report no conflict of interest.

Acknowledgements: The authors thanks the Department of Periodontics, AL Falah Specialized Dental Center, for their kind help and cooperation.

For citation: Kadhim M.Y., Ahmed S.S., Enezei H.H. The influence of diode laser (810–980) nm in treatment of the labial frenum in jaws: clinical study. *Endodontics Today*. 2026;24(1):49–57. <https://doi.org/10.36377/ET-0158>

Влияние диодного лазера (810–980 нм) на лечение губной уздечки челюстей: клиническое исследование

М.Ю. Кадхим¹ , С.С. Ахмед² , Х.Х. Энези³

¹ Колледж стоматологии, Университет Багдада, г. Багдад, Ирак

² Колледж науки, Университет Багдада, г. Багдад, Ирак

³ Колледж стоматологии, Университет Анбара, г. Аль-Анбар, Ирак

✉ mays.yahia2201m@ilps.uobaghdad.edu.iq

Резюме

ВВЕДЕНИЕ. Высокая губная уздечка может приводить к медианной диастеме, рецессии десны, а также к функциональным и эстетическим проблемам. Хотя традиционная френотомия скальпелем остается эффективной, она часто сопровождается интраоперационным кровотечением, необходимостью наложения швов и длительным послеоперационным периодом. Сообщается, что диодные лазеры с длиной волны 810–980 нм обеспечивают лучшую гемостазу и меньшую травматизацию тканей.

Настоящее исследование сравнивало клинические результаты френотомии с использованием диодного лазера и скальпеля.

МАТЕРИАЛЫ И МЕТОДЫ. Рандомизированное контролируемое исследование проведено на 50 пациентах (возраст 12–55 лет) с высокой губной уздечкой, направленных в Специальный стоматологический центр «Аль-Фалах» в Багдаде в 2024–2025 гг. Пациенты случайным образом были распределены на две группы: группа лазера ($n = 25$) и группа скальпеля ($n = 25$). Послеоперационные результаты оценивались по интенсивности боли с использованием визуальной аналоговой шкалы (VAS), кровотечению, отеку, функциональному состоянию полости рта и удовлетворенности пациентов на 1-й день, через 1 неделю, 2 недели и 4 недели после операции. Данные анализировались с помощью критерия Манна–Уитни, статистическая значимость считалась при $p < 0,05$.

РЕЗУЛЬТАТЫ. Пациенты, у которых выполнялась френотомия лазером, показали лучшие результаты. В группе лазера не наблюдалось интраоперационного кровотечения и необходимости в наложении швов по сравнению с группой скальпеля. На 2-й неделе после операции показатели боли и отека были значительно ниже в лазерной группе ($p < 0,001$). Восстановление функциональных возможностей рта происходило быстрее, а показатели удовлетворенности пациентов в основном превышали соответствующие показатели группы скальпеля ($p < 0,001$).

ВЫВОДЫ. Френотомия с использованием диодного лазера является безопасной, менее инвазивной и более комфортной для пациента процедурой по сравнению с традиционной френотомией скальпелем. Она обеспечивает лучший гемостаз, снижает послеоперационную боль и отек, ускоряет функциональное восстановление и повышает удовлетворенность пациентов, что делает ее предпочтительным методом в пародонтологической практике.

Ключевые слова: диодный лазер, френотомия, губная уздечка, пародонтология, рандомизированное контролируемое исследование.

Информация о статье: поступила – 17.11.2025; исправлена – 24.12.2025; принята – 05.01.2026

Конфликт интересов: Авторы сообщают об отсутствии конфликта интересов.

Благодарности: Авторы выражают благодарность кафедре пародонтологии специального стоматологического центра «Аль-Фалах» за их любезную помощь и сотрудничество.

Для цитирования: Кадхим М.Ю., Ахмед С.С., Энези Х.Х. Влияние диодного лазера (810–980 нм) на лечение губной уздечки челюстей: клиническое исследование. *Эндодонтия Today*. 2026;24(1):49–57. <https://doi.org/10.36377/ET-0158>

INTRODUCTION

The frenum is a delicate mucosal fold composed of muscle fibers and connective tissue that anchors the lip and buccal mucosa to the underlying periosteum. During normal growth, the attachment of the frenulum typically migrates apically as the alveolar bone develops vertically, often becoming less prominent [1–11]. Frenums in the oral cavity are categorized based on anatomical location as labial, lingual, or buccal. The labial frenum is further classified into superior and inferior types depending on its position. From a clinical perspective, frenal attachments are divided based on their insertion level into four types:

- 1) **mucosal** – fibers attach at the mucogingival junction;
- 2) **gingival** – fibers attach to the attached gingiva;
- 3) **papillary** – fibers extend into the interdental papilla;
- 4) **papillary Penetrating** – fibers extend beyond the alveolar process to the palatine papilla [2; 9].

Excessively high frenal attachments may cause a continuum of clinical problems, including midline diastema, recessive gingiva, poor oral health, and shallow vestibular depth. It can also be aesthetically inappropriate and hinder the preservation of periodontal health due to such pathology. It was suggested that surgical correction, usually consisting of a frenotomy or frenectomy, is indicated by:

- 1) high frenular attachment in a patient with midline diastema;

- 2) flat interdental papillae in co-existence with a closely related frenulum that contributes to the position of the gingival margin, resulting in recession and plaque accumulation;

- 3) an aberrant frenulum in relation to poorly attached gingiva and a shallow vestibule [3; 9].

Frenotomy is a minor surgery wherein the frenal attachment is removed or redone in order to relieve muscular tension and fix normal oral functionality. Aesthetic considerations and the quest for improved tooth appearance also support the need to intervene in a few cases. Gingival recession may be aggravated when there is excessive tension on the soft tissues due to the proximity to the gingival margin.

Dental lasers have become practical alternatives to traditional scalpel-based methods in contemporary periodontal practice [5]. In the (810–980 nm) wavelength range, diode lasers have become commonly used in soft-tissue surgery since water-containing tissues highly absorb them. The minimal contact with the hard tissues, such as the enamel, makes these devices intraoral. Since oral soft tissues contain more than 90% water, diode lasers offer safety, reduced invasiveness, and therapeutic functionality. In addition, diode lasers are small, affordable, and less technique-sensitive, thus increasing their clinical utility [4].

The research involves a comparative study of frenum management under laboratory conditions, comparing two modalities: a diode laser dual wavelength (810–980 nm) and conventional scalpel dissection.

These goals are to evaluate and compare clinical outcomes, including healing time, pain management, hemorrhage, and postoperative morbidity, to explain the comparative benefits and drawbacks of each method. The study also compares postoperative analgesia, hemorrhage, edema, functional oral recovery, and patient satisfaction using the two interventions.

MATERIALS AND METHODS

Setting and design

This investigation was performed at the Department of Periodontics, AL Falah Specialized Dental Center, Baghdad, Iraq, over eight months between 2024 and 2025. It was designed as a parallel, randomized, controlled clinical trial comparing diode-laser and conventional scalpel frenotomies. The trial was reported in accordance with the Consolidated Standards of Reporting Trials (CONSORT) guidelines [9]. The overall process of patient enrollment, allocation, follow-up, and analysis is summarized in the CONSORT flow diagram (Fig. 1).

Study population

Inclusion criteria

Patients were eligible if they:

1. We're undergoing fixed orthodontic treatment of the maxilla or both jaws.
2. Presented with a midline diastema between the maxillary central incisors due to a high labial frenum attachment.
3. Were systemically healthy.
4. Maintained good oral hygiene.
5. Had a clinical need for frenectomy.

Exclusion criteria

Patients were excluded if they:

1. We're undergoing active periodontal treatment of the anterior maxilla.
2. Had a dental diastema unrelated to high frenum attachment.
3. Were uncooperative with dental treatment.

Patients were selected by convenience sampling from those referred to periodontal and orthodontic clinics.

Sample size and randomization

a total of 50 patients, aged 12–55 years, were enrolled in the study. Participants were randomly assigned to two groups using simple randomization:

Group I (Laser group): Diode laser frenotomy ($n = 25$).

Group II (Scalpel group): Conventional scalpel frenotomy ($n = 25$).

All procedures were performed by a single experienced operator.

Interventions

Anesthesia

Local infiltration anesthesia (2% lidocaine with 1:80,000 epinephrine) was administered when required. All patients in both the scalpel and laser groups required anesthesia.

Scalpel Technique (Control group): Following local infiltration anesthesia, the lip was retracted to put the frenum in tension. The frenum was stabilized with a hemostat. To release the fibrous attachment,

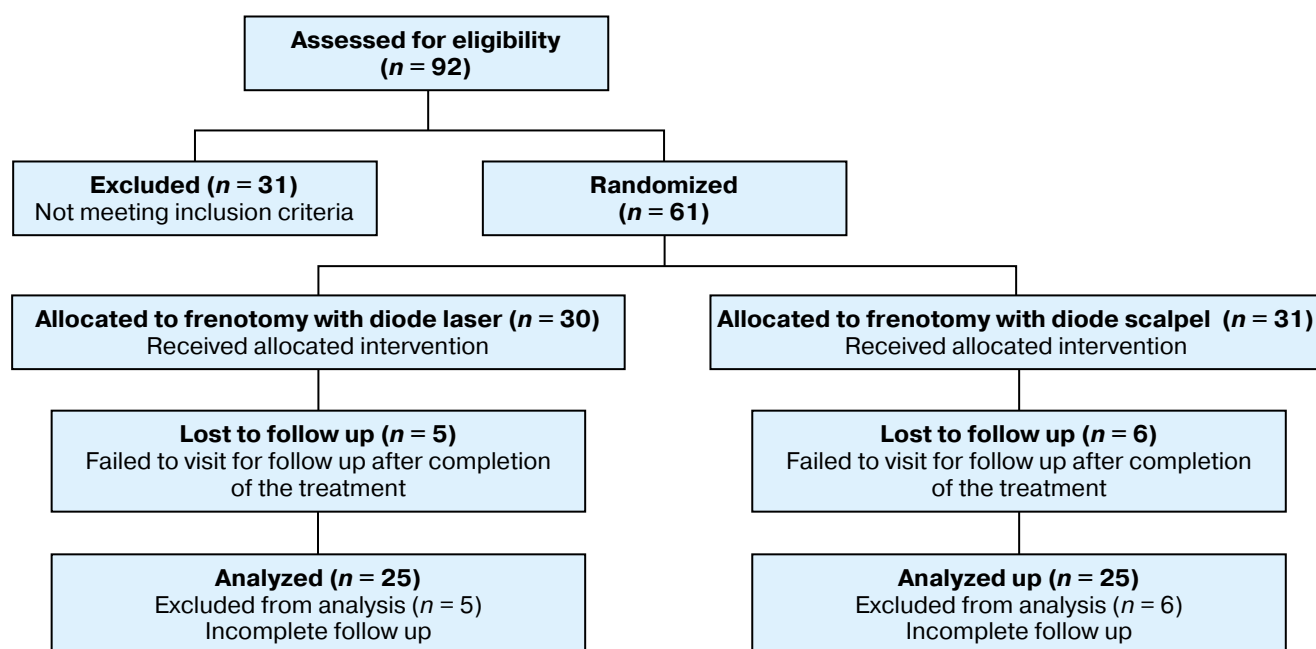


Fig. 1. Consort flow diagram depicting patient enrollment, randomization, allocation, and analysis in a clinical trial comparing diode laser and scalpel frenotomy

Рис. 1. Диаграмма потока CONSORT, демонстрирующая набор пациентов, рандомизацию, распределение по группам и анализ в клиническом исследовании, сравнивающем френотомию с использованием диодного лазера и скальпеля

a controlled scalpel incision was made, and muscle fibers extending toward the papilla or periosteum were detached as needed. Fibrous tissue was excised as needed, and after proper release was confirmed, the wound was sutured (Fig. 2).

Diode Laser Technique (Experimental group):

In the experimental group, labial frenotomy was performed using a QuickLase DentaLase diode laser dual wavelength (810–980 nm, 1.2 W, continuous wave mode) with a 400 µm initiated fiber tip applied in a light, contact brushing motion under aseptic conditions. Both operator and patient wore wavelength-specific protective eyewear. The frenum was ablated in a controlled,

layer-by-layer manner until adequate release was achieved. Immediate hemostasis was obtained without the need for sutures, and the wound was left to heal by secondary intention (Fig. 3).

Postoperative care

All patients received standardized instructions:

1. Soft, cold diet for the first 12 hours.
2. 0.12% chlorhexidine gluconate rinse once daily for 5 days.
3. Ibuprofen 200 mg if needed for pain relief, with additional analgesics permitted at patient discretion [9].



A



B



C



D

Fig. 2. Surgical blade technique for labial frenotomy in a 43-year-old female patient: (A) Preoperative view showing a thick and high-attached labial frenum; (B) Frenotomy performed using a scalpel with precise incision and release of the fibrous attachment, followed by suturing; (C) One week postoperatively, satisfactory healing is observed with mild scarring; (D) One month after surgery, the mucosa appears healthy, and the surgical site shows stable healing with minimal visible scarring

Рис. 2. Методика лабиальной френотомии с использованием скальпеля у 43-летней пациентки:

(A) предоперационный вид: толстая и высоко прикрепленная губная уздечка; (B) выполнение френотомии с помощью скальпеля с точным разрезом и освобождением фиброзного прикрепления, последующее наложение швов; (C) через неделю после операции отмечается удовлетворительное заживление с незначительными рубцами; (D) через месяц после операции слизистая оболочка выглядит здоровой, хирургический участок зажил стабильно, видимые рубцы минимальны

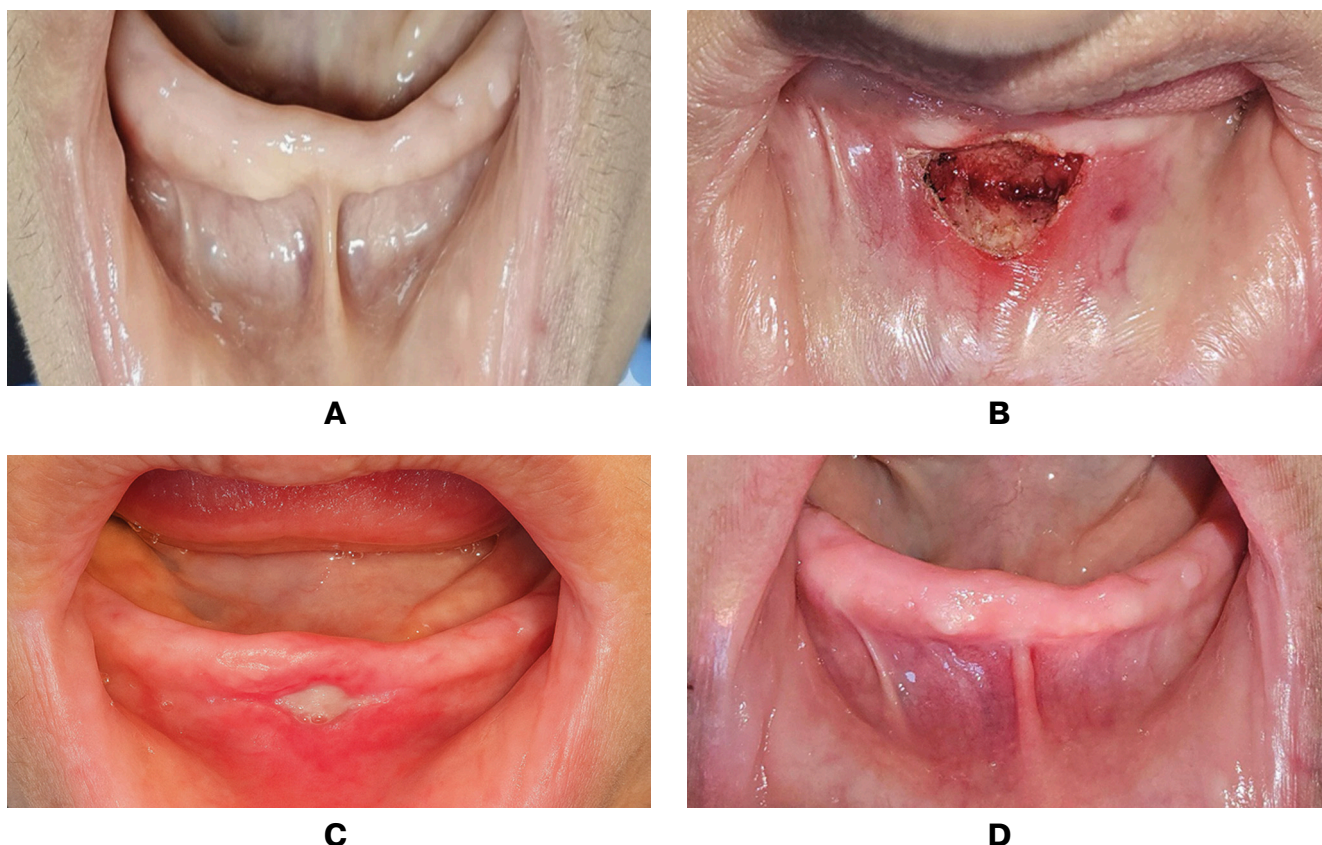


Fig. 3. D iode laser (810–980 nm) technique for labial frenotomy in a 53-year-old female patient: (A) Preoperative view showing a thick and high-attached labial frenum; (B) Frenotomy performed using a diode laser (810–980 nm) under local anesthesia, allowing for precise incision and minimal bleeding; (C) One week postoperatively, the surgical site shows satisfactory healing with minimal edema and no signs of infection; (D) One month after the procedure, the mucosa appears healthy with smooth tissue continuity and no visible scar formation

Рис. 3. Методика лабиальной френотомии с использованием диодного лазера (810–980 нм) у 53-летней пациентки: (А) предоперационный вид: толстая и высоко прикрепленная губная уздечка; (В) френотомия выполнена с использованием диодного лазера (810–980 нм) под местной анестезией, обеспечивая точный разрез и минимальное кровотечение; (С) через неделю после операции хирургический участок зажил удовлетворительно, с минимальным отеком и без признаков инфекции; (D) через месяц после процедуры слизистая оболочка выглядит здоровой, ткань ровная и непрерывная, видимых рубцов не обнаружено

Outcome measures

Clinical parameters

Postoperative outcomes were assessed on day 1 and at weeks 1, 2, and 4. The following parameters were recorded:

1. **Pain:** Pain was rated on a verbal rating scale (VRS) to assess severity during the first 7 days after the operation. The other levels of pain were rated as 0 (no pain), 1 (substantial discomfort), 2 (moderate pain), and 3 (severe pain). Participants were advised to record their pain experience in a specific form at any time they deemed appropriate [10].

2. **Bleeding:** To determine intraoperative bleeding, clinical assessments were conducted and categorized as follows: no bleeding = 1, self-limiting = 2, requires pressure = 3, requires coagulation = 4, and requires ligation = 5 [11].

3. **Edema:** Clinical assessment of postoperative swelling was scored as no swelling = 1, very slight = 2,

moderate (noticeable but not interfering) = 3, severe (prevents eating) = 4, and very severe (prevents eating and limits mouth opening) = 5 [12].

4. **Oral function:** assessed at follow-up appointments based on the ability to consume food, speak, and uphold oral hygiene; “No Interference” = 0, “Mild Interference” = 1, “Moderate Interference” = 2, and “Severe Interference” = 3 [13].

5. **Patient satisfaction:** After the follow-up period had ended, the overall level of satisfaction with the outcome was assessed. The following categories were used to classify the results: excellent (76–100%), good (51–75%), fair (26–50%), and poor (0–25%) [13].

Assessment schedule

1. **Pain, bleeding, and edema:** measured on day 1 and at weeks 1, 2, and 4.

2. **Oral function and satisfaction:** assessed at the same intervals.

Statistical analysis

SPSS version 26 was employed to analyze the data. Categorical data were presented as frequencies and percentages, and continuous data were expressed as the mean $\pm$ standard deviation (SD). Normality was tested using the Kolmogorov–Smirnov test. Inter-group comparisons of continuous variables (pain, bleeding, edema, oral function, satisfaction) were performed with the Mann–Whitney U test. A p -value < 0.05 was considered statistically significant.

RESULTS

A total of 50 patients diagnosed with high labial frenum were enrolled and completed the study. The study population included 38 females and 12 males, with an age range of 12–55 years. Participants were equally distributed, with 25 patients undergoing frenotomy using a diode laser (Group I) and 25 patients treated with the conventional scalpel technique (Group II). Baseline demographic and clinical characteristics were comparable between the two groups, as shown in Fig. 4.

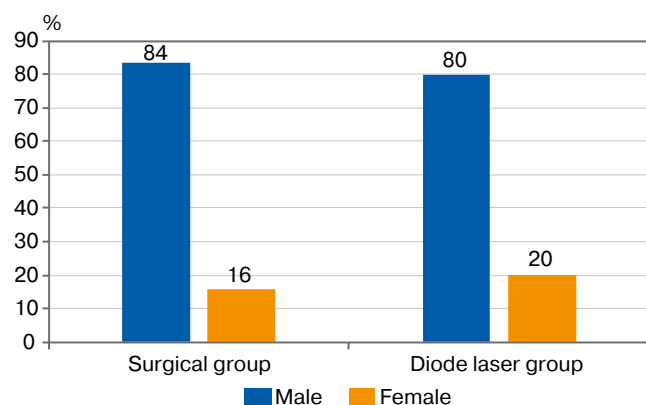


Fig. 4. Distribution of sex group in both diode laser and surgical groups in patients with labial frenum

Рис. 4. Распределение по полу в группах диодного лазера и скальпеля у пациентов с губной уздечкой

During the procedures, all patients in the scalpel group and diode laser group required local anesthesia. Intraoperatively, all laser-treated sites demonstrated adequate coagulation with no bleeding, while all scalpel-treated sites exhibited bleeding that required suturing. None of the diode laser cases required sutures.

Postoperative pain scores were significantly lower in the diode laser group at all time points through week 2. On day 1, the mean pain score was 1.6 ± 0.5 in the diode laser group compared with 2.52 ± 0.51 in the scalpel group ($p < 0.001$). At week 1, pain decreased to 0.84 ± 0.69 in the diode laser group and 1.84 ± 0.80 in the scalpel group ($p < 0.001$). At week 2, no pain was reported in the diode laser group, while mild pain persisted in the scalpel group (1.44 ± 1.04 ; $p < 0.001$). By week 4, both groups were pain-free (Table 1).

Bleeding was minimal in the diode laser group throughout the study. On day 1, mean bleeding scores were 0.36 ± 0.49 in the diode laser group versus 2.08 ± 1.04 in the scalpel group ($p < 0.001$). At week 1,

bleeding was absent in the diode laser group but persisted in the scalpel group with a mean score of 1.24 ± 1.13 ($p < 0.001$). From week 2 onwards, no bleeding was reported in either group (Table 2).

The diode laser treatment significantly reduced edema in the group. The mean edema score was 1.28 ± 0.46 for the diode laser group on day one, which was significantly lower than the score of 2.24 ± 0.66 for the scalpel group ($p < 0.001$). The edema reduced to 0.56 ± 0.51 in the diode laser group and 1.80 ± 0.82 in the scalpel group at week 1 ($p < 0.001$). According to Table 3, there was no observable edema in either group between weeks two and four.

Oral function recovery was faster in the diode laser group. On day 1, the mean oral function score was 0.40 ± 0.50 in the diode laser group compared with 0.00 ± 0.00 in the scalpel group ($p = 0.001$). At week 1, scores were 1.08 ± 0.57 and 0.32 ± 0.48 , respectively ($p < 0.001$). By week 4, both groups showed substantial improvement, with significantly better outcomes in the diode laser group (2.36 ± 0.81 vs. 1.76 ± 0.66 ; $p = 0.006$) (Table 4).

Table 1. Mean pain score in patients with labial frenum operations

Таблица 1. Средний показатель боли у пациентов после операций на губной уздечке

Pain Index (1 to 5)				
Duration	Groups	Mann-Whitney Utest	Zvalue	Sig (Pvalue)
Day1	A vs. B	90	-4.775	< 0.001
Week1		123	-3.920	< 0.001
Week2		62.5	-5.507	< 0.001
Week4		312.5	0	1

Note. A – Diode laser group; B – Surgical group. Statistical significance was set at $p < 0.05$.

Примечание. А – группа с диодным лазером; В – хирургическая группа. Статистическая значимость установлена на уровне $p < 0,05$.

Table 2. Mean bleeding score in patients with labial frenum

Таблица 2. Средний показатель кровотечения у пациентов с губной уздечкой

Bleeding index (1 to 5)				
Duration	Groups	Mann-Whitney Utest	Zvalue	Sig (Pvalue)
Day1	A vs. B	64.5	-5.025	< 0.001
Week1		100.0	-4.903	< 0.001
Week2		312.5	0	1
Week4		312.5	0	1

Note. A – Diode laser group; B – Surgical group. Statistical significance was set at $p < 0.05$.

Примечание. А – группа с диодным лазером; В – хирургическая группа. Статистическая значимость установлена на уровне $p < 0,05$.

Table 3. Average of characteristic oral edema in patients with labial frenum operations

Таблица 3. Средний показатель отека полости рта у пациентов после операций на губной уздечке

Edema index (1 to 5)				
Duration	Groups	Mann-Whitney Utest	Zvalue	Sig (Pvalue)
Day1	A vs. B	93.5	-4.592	<0.001
Week1		77	-4.931	<0.001
Week2		312.5	0	1
Week4		312.5	0	1

Note. A – Diode laser group; B – Surgical group. Statistical significance was set at $p < 0.05$.

Примечание. А – группа с диодным лазером; В – хирургическая группа. Статистическая значимость установлена на уровне $p < 0,05$.

Table 4. Average of characteristic oral function criteria in patients with labial frenum operations

Таблица 4. Средние показатели функциональных критериев полости рта у пациентов после операций на губной уздечке

Function index (1 to 5)				
Duration	Groups	Mann-Whitney Utest	Zvalue	Sig (Pvalue)
Day1	A vs. B	187.5	-3.500	0.001
Week1		117.5	-4.203	<0.001
Week2		57.5	-5.673	<0.001
Week4		180.5	-2.724	0.006

Note. A – Diode laser group; B – Surgical group. Statistical significance was set at $p < 0.05$.

Примечание. А – группа с диодным лазером; В – хирургическая группа. Статистическая значимость установлена на уровне $p < 0,05$.

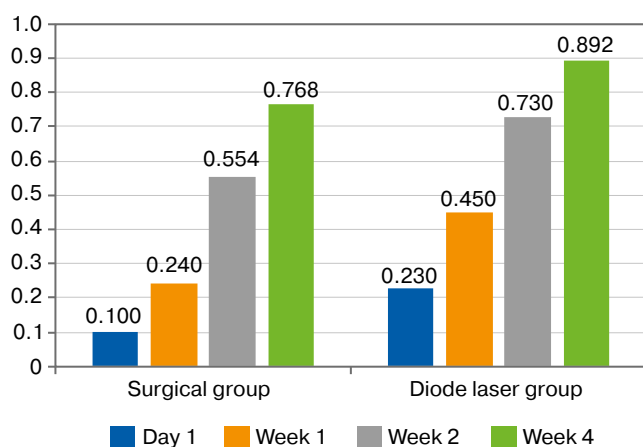


Fig. 5. Postoperative Satisfaction score in the diode laser and surgical groups in patients with labial frenum

Рис. 5. Показатель послеоперационной удовлетворенности в группах диодного лазера и скальпеля у пациентов с губной уздечкой

Patient satisfaction was consistently higher in the diode laser group throughout the study period. On day 1, mean satisfaction scores were 0.23 ± 0.13 in the diode laser group and 0.10 ± 0.00 in the scalpel group ($p < 0.001$). At week 1, scores increased to 0.45 ± 0.15 and 0.24 ± 0.12 , respectively ($p < 0.001$). By week 4, satisfaction reached 0.89 ± 0.03 in the diode laser group and 0.77 ± 0.12 in the scalpel group ($p < 0.001$), as shown in Fig. 5.

Diode laser frenotomy demonstrated superior clinical performance compared with the conventional scalpel technique. The laser method reduced the need for anesthesia and sutures, and improved postoperative outcomes in pain, bleeding, edema, oral function, and patient satisfaction.

DISCUSSION

It is a randomized controlled clinical trial that assessed the clinical effectiveness of diode laser frenotomy compared with the standard scalpel approach for the treatment of labial frenum attachments and reported on intraoperative and postoperative outcomes. The study found that diode laser frenotomy showed better clinical outcomes across several parameters, including intraoperative hemostasis, postoperative pain severity, edema resolution, functional recovery, and patient satisfaction.

One key benefit of the intraoperative setting noted with the diode laser method was its high hemostatic effect. None of the patients who were treated using laser needed to be sutured, but all the patients who participated in the scalpel group had to be sutured due to the intraoperative bleeding. The results are consistent with the conclusions of earlier studies by Sobouti et al. and Paleriya et al., which placed significant emphasis on the powerful coagulative capabilities of diode lasers for the treatment of soft tissue. Maintaining a clean field with no blood improves visualization during the operation, reduces its duration, and increases precision [7; 9]. All of these benefits make the recovery process more predictable and quicker, and they add to patient comfort. In line with this, the diode laser is an effective, patient-friendly apparatus in oral soft-tissue dental surgery [14–16].

The diode laser group reported a significantly lower rate of postoperative pain, as indicated by steadily low Visual Analogue Scale (VAS) scores during the first and second postoperative weeks. By the fourth week, both groups reported no pain. These findings are consistent with previous studies showing that laser-based operations are associated with reduced postoperative discomfort compared with scalpel-based operations [4; 5; 13]. The analgesic effects of laser irradiation could be explained by its ability to close sensory nerve endings and alter the production of inflammatory mediators in the surgical area [10].

On the same note, postoperative edema was significantly reduced in patients in the diode laser group, especially in the initial phase of healing. This finding is consistent with the results of Agha and Polenik and Menziletoglu et al., who stated that laser-assisted cuts

lead to reduced collateral tissue damage, thereby reducing inflammatory oedema, and that wounds heal more properly. The decreased mechanical manipulation and photobiomodulatory activity of the diode lasers are likely to be accountable factors in catalyzing these desirable healing dynamics [11; 12].

Functional recovery, as measured by mastication, speech, and oral hygiene maintenance, was previously observed in patients who received diode laser treatment. Resuming normal oral operations is paramount to the patient's quality of life. These findings agree with Vincent et al. [10], who described functional recovery as one of the key determinants of patients' preference for laser-based surgical procedures. Therefore, overall patient satisfaction was significantly greater in the diode laser group, reflecting the combined effects of less postoperative pain, less edema, no sutures, and rapid restoration of oral function. Patient-reported satisfaction has become a critical outcome measure in modern oral surgery research [17–19].

However, some limitations should be mentioned. Although the sample size was large enough to detect statistically significant clinical differences, it might not

have been large enough to detect rare complications or to assess long-term recurrence rates. In addition, the relatively high price of diode laser systems, the level of operator expertise, and the specialised training might limit their use in clinical practice, especially in situations with limited resources. To validate these findings and shed light on the long-term stability and periodontal consequences of laser-assisted frenotomy, multicentre randomized trials with larger sample sizes and more extended follow-up periods are required in the future.

CONCLUSIONS

Among the constraints of this trial, the results of diode laser frenotomy were better than those of the traditional scalpel method. The diode laser significantly reduced intraoperative bleeding, decreased postoperative pain and edema, accelerated functional recovery, improved patient satisfaction, and eliminated the need for sutures. These results favor the adoption of diode lasers as a minimally invasive, effective, and patient-friendly alternative for frenotomy in the periodontal and orthodontic practice.

REFERENCES / СПИСОК ЛИТЕРАТУРЫ

- Rudhra K., Mari R., Balaji A., Valiathan M. Mari's novel T shaped incision in frenotomy technique with bilateral pedicle flap- an aesthetic approach. *J Oral Biol Craniofac Res.* 2024;14(6):782–784. <https://doi.org/10.1016/j.jobcr.2024.09.008>
- Hendro O.V., Laksono V., Prahasanti C. Combination of frenotomy and gingivectomy treatment with laser diodes as aesthetic corrections: A case report. *Dentino: Jurnal Kedokteran Gigi.* 2020;5(2):194–200. <https://doi.org/10.20527/dentino.v5i2.8974>
- Negoro V.P., Darjanki C.M., Krismariono A. Management of high frenulum attachment in upper anterior teeth: A case report. *International Journal of Health & Medical Research.* 2024;3(7):531–534. <https://doi.org/10.58806/ijhmr.2024.v3i07n20>
- Shrestha S., Aryal S., Pradhan A., Shrestha S.M. Comparison of pain perception between scalpel and laser technique during and after frenotomy. *J Nepal Soc Perio Oral Implantol.* 2024;8(1):1–6. Available at: <https://j.nspoi.com.np/index.php/JNSPOI/article/view/260> (accessed: 14.06.2025).
- Shirbhate U., Agrawal K., Bajaj P., Shinde S., Meshram M., Kayarkar V.S., Patil P.S. Diode laser intended frenotomy procedure for high frenal attachment causing gingival recession: A case presentation. *Cureus.* 2024;16(9): e70212. <https://doi.org/10.7759/cureus.70212>
- Curran M. Superior labial frenotomy. *J Am Dent Assoc.* 1950;41(4):419–422. <https://doi.org/10.14219/jada.archive.1950.0198>
- Paleriya K., Patil R., Dhadse P., Saliyan S., Punse S., Rai A. Maxillary labial double frenum frenectomy using a diode laser: A case report. *Cureus.* 2024;16(6):e63400. <https://doi.org/10.7759/cureus.63400>
- Singh K., Nautiyal A., Bali S., Aggarwal P., Garg A. Frenectomy: A literature review. *J Surv Fish Sci.* 2023;10(1):871–875. Available at: <https://sifisheriestsciences.com/index.php/journal/article/view/690> (accessed: 14.06.2025).
- Sobouti F., Moallem Savasari A., Aryana M., Hakimiha N., Dadgar S. Maxillary labial frenectomy: a randomized, controlled comparative study of two blue (445 nm) and infrared (980 nm) diode lasers versus surgical scalpel. *BMC Oral Health.* 2024;24(1):843. <https://doi.org/10.1186/s12903-024-04364-w>
- Vincent K., Aslam S., Abida R., Thomas T., Cherian M.P., Soman S. Evaluating the clinical efficacy of maxillary labial frenectomy procedure using diode laser (980 nm) and conventional scalpel: an observational study. *J Pharm Bioallied Sci.* 2023;15(Suppl 1):S688–S692. https://doi.org/10.4103/jpbs.jpbs_85_23
- Taher Agha M., Polenik P. Laser treatment for melanin gingival pigmentations: A comparison study for 3 Laser Wavelengths 2780, 940, and 445 nm. *Int J Dent.* 2020;2020:3896386. <https://doi.org/10.1155/2020/3896386>
- Menziletoğlu D., Güler A.Y., Baştürk F., Yakut K. Assessment of the relationship between edema measurement methods after impacted mandibular third molar surgery. *Aurum Journal of Health Sciences.* 2024;6(3):175–180. Available at: <https://dergipark.org.tr/tr/pub/ajhs/article/1299444> (accessed: 14.06.2025).
- Marhab E.I., Mahdi Z.F. A comparison between diode laser 976 nm and conventional technique in treatment of gingival fibromatosis. *Iraqi Journal of Laser.* 2024;23(1):71–79. <https://doi.org/10.31900/ijl.v23i1.412>
- Al Ghazali S.R., Ahmed S.S., Abdulhameed B.S. The clinical evaluation of oral fibroma lesion removal utilizing two types of diode lasers 980 nm and 450 nm. *Iraqi Journal of Laser.* 2024;23(1):80–89. <https://doi.org/10.31900/ijl.v23i1.431>
- Mawlood Qassab A.H., Hamad S.A. Comparison between diode laser and scalpel for lip lengthening in patients

- with gummy smile. *J Bagh Coll Dent*. 2019;31(1):60–64. <https://doi.org/10.26477/jbcd.v31i1.2580>
16. Alashbal A.F.A., Hameed B.S.A., Ahmed S.S. Clinical efficiency of diode lasers (810 + 980 nm) in exposure of maxillary impacted canines. *Dent 3000*. 2024;12(2):703. <https://doi.org/10.5195/d3000.2024.703>
 17. Alghazali M.W., Althabit R.A., Alwan A.H., Jameel M.F., Hussain A.A. Comparative study of oral soft tissue operations using a laser vs. a scalpel. *NeuroQuanto-logy*. 2022;20(5):488–491. <https://doi.org/10.14704/nq.2022.20.5.NQ22199>
 18. Tawi S.R., Ahmed S.S., Algarak B.S. Histopathological evaluation of two diode lasers 450 and 980 nm in excision biopsies of oral benign lesion. *Lasers Dent Sci*. 2023;7(4):251–258. <https://doi.org/10.1007/s41547-023-00205-1>
 19. Aldelaimi A.A., Ahmed R.F., Enezei H.H., Aldelaimi T.N. Gummy smile esthetic correction with 940 nm diode laser. *International Medical Journal: IMJ*. 2019;26(6):513–515.

INFORMATION ABOUT THE AUTHORS

Mays Y. Kadhim – MSc, Lecturer, Department of Oral and Maxillofacial Surgery, College of Dentistry, University of Anbar, Al Anbar, Iraq; <https://orcid.org/0009-0005-7362-293X>

Soudad Salman Ahmed – PhD, Professor, Faculty member, Department of Laser and Optoelectronics, College of Science, University of Baghdad, Baghdad, Iraq; <https://orcid.org/0000-0001-7658-8160>

Hamid H. Enezei – PhD, Professor, Chair, Department of Oral and Maxillofacial Surgery, College of Dentistry, University of Anbar, Al Anbar, Iraq; <https://orcid.org/0000-0002-6507-6482>

ИНФОРМАЦИЯ ОБ АВТОРАХ

Мейс Ю. Кадхим – магистр наук, преподаватель, кафедра челюстно-лицевой хирургии, Колледж стоматологии, Университет Анбар, Аль-Анбар, Ирак; <https://orcid.org/0009-0005-7362-293X>

Саудад С. Ахмед – доктор философии, профессор, член факультета, кафедра лазеров и оптоэлектроники, Колледж науки, Университет Багдада, Багдад, Ирак; <https://orcid.org/0000-0001-7658-8160>

Хамид Х. Энези – доктор философии, профессор, заведующий кафедрой, кафедра челюстно-лицевой хирургии, Колледж стоматологии, Университет Анбар, Аль-Анбар, Ирак; <https://orcid.org/0000-0002-6507-6482>

AUTHOR'S CONTRIBUTION

Mays Y. Kadhim – a substantial contribution to the concept or design of the article; the acquisition, analysis, or interpretation of data for the article.

Soudad S. Ahmed – a substantial contribution to the concept or design of the article; a substantial contribution to the concept or design of the article.

Hamid H. Enezei – a substantial contribution to the concept or design of the article; approved the version to be published.

ВКЛАД АВТОРОВ

М.Ю. Кадхим – значительный вклад в концепцию или дизайн статьи; сбор, анализ и интерпретация данных для статьи.

С.С. Ахмед – значительный вклад в концепцию или дизайн статьи; значительный вклад в концепцию или дизайн статьи.

Х.Х. Энези – значительный вклад в концепцию или дизайн статьи; одобрение окончательной версии к публикации.