DENTAL LASERS IN PREPROSTHETIC SURGERY: A NARRATIVE REVIEW

Cristian Orghidan[1], Decebal Vasincu[2], Raluca Dragomir[3], Alina-Elena Jehac[3]*, Ovidiu Stefănescu[3], Claudiu Topoliceanu[4], Agop-Forna Doriana[3]

[1] PhD student, Faculty of Dental Medicine, "Grigore T. Popa" University of Medicine and Pharmacy, Iași, Romania
[2] Discipline of Fundamentals of Physics and Biophysics in Dentistry, Faculty of Dental Medicine, "Grigore T. Popa" University of Medicine and Pharmacy, Iași, Romania
[3] Department of Dento-Alveolar and OMF Surgery, Faculty of Dental Medicine, "Grigore T. Popa" University of Medicine and Pharmacy, Iași, Romania
[4] Department of Odontology-Periodontology, Fixed Restorations, Faculty of Dental Medicine, U.M.F. "Grigore T.Popa" Iasi

Correspondent author: Univ.Assist. Alina-Elena Jehac; e-mail : alina.jehac@umfiasi.ro

Abstract

This narrative literature review aimed to evaluate the existing evidence regarding the use of surgical lasers in preprosthetic interventions, analyzing clinical efficacy, tissue interaction mechanisms, laser parameter protocols, and postoperative outcomes across the main preprosthetic procedures: gingivectomy, frenectomy, vestibuloplasty, and post-extraction socket biostimulation. The literature search was conducted in PubMed, Scopus, and Web of Science, covering original clinical studies, in vitro and in vivo experimental studies, systematic reviews, and reference textbooks published over the last 20 years. Four major laser categories were evaluated: diode lasers (810–1064 nm), Nd:YAG (1064 nm), erbium lasers (Er:YAG 2940 nm; Er,Cr:YSGG 2780 nm), and CO_2 (10,600 nm). Laser energy interacts with oral tissues through absorption, reflection, diffusion, and transmission, generating graded photothermal effects alongside a biostimulatory response. Diode lasers, selectively absorbed by hemoglobin and melanin, are the most widely used in soft tissue preprosthetic procedures, offering excellent hemostasis and reduced postoperative morbidity. Erbium lasers are the only category effective on both soft and hard tissues, being preferred for frenectomies, vestibuloplasties, and osseous remodeling. Nd:YAG lasers provide deep hemostasis and are indicated for crown lengthening, while CO_2 lasers allow precise mucosal excision. Clinical outcome data consistently demonstrate lower VAS pain scores, reduced bleeding, faster epithelialization, and higher patient satisfaction in laser-treated groups compared to conventional surgery. Conclusions. Laser-assisted preprosthetic surgery offers significant clinical advantages over conventional techniques. The optimal laser selection depends on the target tissue type, clinical indication, and operator experience.

Key words: preprosthetic surgery, lasers, interactions, soft tissues, bone tissue

INTRODUCTION

All surgical procedures performed to prepare the prosthetic field in either fixed or removable prosthodontics for upcoming prosthetic placement. The main aim of these approaches is to achieve a predictable, stable mucosal and osseous support with optimal tissue quality, which is required for long-lasting functional and aesthetic outcomes of the definitive restorations [1,2]. Conventional surgical procedures used in this stage — frenectomies, gingivectomies, vestibuloplasties, soft and hard tissue remodeling — are often associated with significant intraoperative bleeding, postoperative pain and edema, and prolonged healing times. In this context, the development of surgical lasers has emerged as a modern and efficient alternative that can enhance these

DOI : 10.62610/RJOR.2026.2.18.6

interventions, offering superior precision, better hemorrhagic control and favorable biological effects on tissue repair [3,4,5]. This review integrates data from the specialized literature on the application of different categories of surgical lasers (diode laser, Nd:YAG, Er:YAG, Er,Cr:YSGG and CO_2) to preprosthetic surgical procedures in daily clinical practice, with a focus on gingivectomy, frenectomy, vestibuloplasty and prosthetic field preparation.

MATERIALS AND METHOD

The present study represents a narrative analysis of the scientific literature, aiming to evaluate the existing data regarding the use of lasers in preprosthetic surgical interventions, with a focus on clinical efficacy, tissue interaction mechanisms, laser parameter protocols, and postoperative outcomes across the main preprosthetic procedures: gingivectomy, frenectomy, vestibuloplasty, and post-extraction socket biostimulation.

Search Strategy

The identification of relevant studies was carried out by consulting the electronic databases PubMed, Scopus, and Web of Science. The literature search was performed using combinations of keywords and MeSH terms such as: "dental laser", "diode laser oral surgery", "Nd:YAG preprosthetic", "Er:YAG soft tissue", "Er,Cr:YSGG frenectomy", "CO2 laser vestibuloplasty", "laser gingivectomy", "laser frenectomy", "preprosthetic surgery", "laser-assisted crown lengthening", "postoperative pain VAS laser", "laser tissue interaction", "biostimulation post-extraction", and "laser wound healing oral mucosa". Search terms were used both individually and in Boolean combinations (AND/OR) to maximize retrieval of relevant records.

Inclusion and Exclusion Criteria

The main evidence base for laser-tissue interaction or clinical protocols comprised articles published over the previous 20 years.

Selection Criteria

The following study types were selected: original manuscripts (randomized controlled trials, prospective and retrospective observational studies) comparing laser-assisted preprosthetic procedures versus conventional surgical techniques; experimental in vitro and/or in vivo studies investigating laser-tissue interaction, thermal effects, or biological responses of soft and hard tissues to laser irradiation; systematic reviews and meta-analyses addressing the clinical performance of surgical lasers specifically in the field of oral and preprosthetic surgery; narrative reviews and book chapters from recognized reference works in dental laser application [6,7,8]; and studies reporting quantitative outcomes including VAS pain scores, bleeding indices, wound healing scores, histological parameters, and patient satisfaction scales.

The exclusion criteria were: articles published prior to the established time frame that did not contribute foundational or irreplaceable data to the topic; studies with limited or no access to full text, for which the complete data set could not be assessed; case reports involving fewer than five patients, unless providing unique data on a specific laser wavelength or clinical technique not covered by larger studies; papers without

DOI : 10.62610/RJOR.2026.2.18.6

direct relevance to laser use in preprosthetic or oral mucosal surgery; studies focused exclusively on endodontic or restorative laser applications, without transferable implications for surgical preprosthetic management; and publications in languages other than English or Romanian, for which a validated translation was unavailable.

Data Extraction and Quality Assessment

Data were extracted independently and systematically from each selected article. The following variables were recorded for each included study: laser type and wavelength, clinical indication and surgical procedure performed, laser parameters (power in watts, pulse mode, fiber/tip diameter, water/air spray settings), study design and sample size, outcome measures reported (VAS scores, healing indices, complication rates, histological scores), and follow-up intervals. Given the heterogeneity of study designs, outcome measures, and laser parameters across the included literature, a formal meta-analysis was not conducted. A structured qualitative synthesis was performed instead, grouping findings by laser type (diode, Nd:YAG, Er:YAG, Er,Cr:YSGG and CO_2) and by clinical procedure (gingivectomy and crown lengthening, frenectomy, vestibuloplasty, post-extraction biostimulation). Comparative data between laser-assisted and conventional surgical approaches were summarized and evaluated with respect to the consistency of reported outcomes across independent research groups

LITERATURE REVIEW

1. Interactions mechanisms of lasers with oral tissues

Lasers used in preprosthetic surgery act through distinct physical mechanisms, determined by the wavelength and the absorbing properties of the target tissues. Laser energy interacts with oral tissues through four types of phenomena: absorption, reflection, diffusion, and transmission. Photobiological effects include photochemical, photothermal, and photomechanical effects, alongside the biostimulation effect [4,1]. The interaction of the laser beam with the oral mucosa generates graded photothermal effects: photo-hyperthermia (below 45 degrees Celsius, without irreversible damage), photocoagulation (60-100 degrees Celsius), photocarbonization (100-300 degrees Celsius), and photovaporization (above 300 degrees Celsius, through pyrolysis of the tissue matrix). The thermal effects generated by diode, Nd:YAG, and KTP lasers are due to absorption by hemoglobin and melanin, while Er:YAG, Er,Cr:YSGG, and CO2 laser beams act through absorption in water and hydroxyapatite [1,6]. The biostimulation effect plays an important role in accelerating the healing of surgical wounds and reducing postoperative discomfort. This is achieved through fibroblast activation, stimulation of angiogenesis, acceleration of collagen synthesis and neo-osteogenesis, as well as reduction of the degree of inflammation and postoperative edema [1,9,10].

2. Laser categories in preprosthetic surgical interventions: indications, parameters, advantages and limits

DOI : 10.62610/RJOR.2026.2.18.6

2.1. Diode laser (810-1064 nm)

Diode lasers represent the most frequently used category in preprosthetic surgery, due to their relatively low cost, portability, and effectiveness in soft tissue procedures. The laser beam emitted at wavelengths between 808 nm and 1064 nm is selectively absorbed by hemoglobin, oxyhemoglobin, and melanin, being poorly absorbed by hydroxyapatite and water, which explains the indications limited exclusively to soft tissues [11,12,13]. The most studied wavelengths of diode lasers are 808 nm, 810 nm, and 940 nm [14]. The 980 nm diode laser exhibits better absorption in water compared to other diode laser wavelengths, which gives incisions more sharply defined margins and a reduced photothermal effect [15]. The main advantages of this laser category include: excellent hemostasis, reduction of postoperative pain and edema, acceleration of healing, high surgical precision, and elimination of the need for sutures in numerous clinical situations. Limitations include reduced effectiveness on hard tissues, risk of tissue carbonization with incorrect parameters, and possible histopathological artifacts [5,16]. The diode laser sulcus uncovering technique involves placing the beam parallel to the dentinal structure and in contact with the sulcular space, with rapid movement of 3-5 pendulations in each gingival groove. Recommended parameters for sulcus retraction are: power 0.6 W, continuous mode, fiber diameter 400 micrometers [17,6]. This technique ensures a dry operative field, free of blood and saliva, facilitating accurate impression-taking for the future prosthetic restoration.

2.2. Nd:YAG laser (1064 nm)

The Nd:YAG laser (1064 nm) is absorbed in depth by hemoglobin, ensuring excellent hemostasis and deeper tissue penetration than diode lasers. These properties recommend it for preprosthetic interventions of crown lengthening and sulcus uncovering for fixed prosthetic restorations on natural teeth, since it interacts minimally with healthy hard dental tissues and causes dehydration of the sulcus and gingival margin, creating sufficient space for impression material [8]. For crown lengthening at the level of the anterior maxillary arch, the following parameters are recommended: power 100 mJ, frequency 20 Hz, fiber diameter 320 micrometers; at the level of the posterior arch: power 3 W, continuous mode, sapphire tip 250 micrometers [6]. The use of the Nd:YAG laser in frenectomies, frenoplasties, and vestibuloplasties requires caution, as the intense thermal effect can generate deep tissue necrosis with incorrect parameters or in the hands of an inexperienced operator. The Nd:YAG laser is contraindicated in the case of prosthetic restorations on implants, due to harmful effects on the implant surface [8,18]. Comparative clinical studies [19,20,21] demonstrated that frenectomy assisted by Nd:YAG laser is associated with significantly lower VAS scores and reduced masticatory discomfort compared to conventional techniques, with complete healing occurring in 2-6 weeks.

DOI : 10.62610/RJOR.2026.2.18.6

2.3. Erbium lasers: Er:YAG (2940 nm) and Er,Cr:YSGG (2780 nm)

Erbium lasers represent the only category of dental lasers that act effectively on both soft and hard tissues, due to intense absorption in water and hydroxyapatite. The Er:YAG laser (2940 nm) has the highest absorption coefficient in water of all dental lasers, allowing tissue ablation with minimal temperature increases and reduced risk of thermal necrosis. The Er,Cr:YSGG laser (2780 nm) presents similar properties, with enhanced versatility due to the integrated air-water spray system [22,7,6]. In preprosthetic surgery, erbium lasers are indicated for: removal of excess gingival tissue at prosthetic abutment margins, remodeling of gingival margins for crown lengthening, remodeling of edentulous ridges, frenectomies/frenoplasties, vestibuloplasties, and removal of mucosal hyperplasias and hypertrophies [6,7]. The main disadvantage lies in the more limited hemostasis compared to diode and Nd:YAG lasers, determined by reduced absorption in hemoglobin [1]. The Er,Cr:YSGG frenectomy technique comprises two stages: incision in Rapid Cut mode (parameters: 2 W, 50 Hz, contact mode H, air/water spray 20%/60%, MZ5 tip) to the periosteum level, perpendicular to the longitudinal axis of the frenulum, followed by biostimulation in Bandage Laser mode (0.50 W, 30 Hz, non-contact mode, air spray 20%, no water) to form a protective layer by exposing the entire surgical field in a defocused, non-contact mode [17,23]. The erbium laser vestibuloplasty technique includes evaluation of vestibular depth, local infiltration anesthesia, incision (300 mJ, 30 Hz), thermocoagulation (150 mJ, 20 Hz), peripheral sealing, and excess elimination. Studies by Vaderhobli et al. (2010) and Onisor et al. (2013) demonstrated that healing processes after erbium laser vestibuloplasty are faster compared to the conventional technique or CO2 laser, with absence of intra- and postoperative bleeding, and significantly reduced pain and discomfort.

2.4. CO2 laser (10,600 nm)

The CO2 laser presents high absorption in water (well-controlled superficial effect), allowing extremely precise incisions in the oral mucosa, with minimal scarring. It is indicated in excision of extensive mucosal lesions, excisional biopsies, preprosthetic surgery (mucosal remodeling, frenectomies, vestibuloplasties), and therapy of superficial vascular lesions [1,7,6]. The advantages of CO2 laser use in the preprosthetic stage include: absence of intraoperative bleeding, reduction of postoperative pain, discomfort, and edema, elimination of the need for sutures. The main limitations are: bulky and expensive equipment, the need for experience in controlling incision depth, possible histological artifacts, and more pronounced postoperative sensitivity compared to erbium lasers [1,24,25]. The CO2 laser frenectomy technique requires: local infiltration anesthesia, incision to the periosteum level perpendicular to the longitudinal axis of the frenulum (parameters: 3 W, continuous mode, ceramic tip 800 micrometers), verification with a curette of the complete sectioning of muscular fibers. Comparative studies

DOI : 10.62610/RJOR.2026.2.18.6

demonstrate that compared to erbium laser vestibuloplasty, the CO2 technique is associated with a longer healing time, due to delayed fibrin layer formation secondary to tissue carbonization marks [24,25].

3. Clinical performance of lasers in preprosthetic procedures

3.1. Clinical evaluation tools of lasers in preprosthetic surgery

Clinical Outcome Measures

The primary clinical outcome measures examined in this review were: postoperative pain intensity, quantified using the Visual Analogue Scale (VAS, 0–10) at standardized time points — immediately postoperatively (D0), Day 3 (D3), Day 7 (D7), and Day 14 (D14); intraoperative and postoperative hemorrhage control, assessed as absent, self-limited, or requiring intervention; clinical wound healing score, based on the degree of gingival epithelialization: score 0 (absent), 1 (partial <50%), 2 (partial ≥50%), 3 (complete); complication rate, including delayed bleeding, wound dehiscence, infection, and alveolitis; patient satisfaction, where reported, using the Likert scale (1–5) at Day 14; and histopathological healing parameters where available, including degree of inflammation (score 0–3), fibroblastic proliferation (score 0–3), collagen organization (score 0–3), neoangiogenesis (score 0–3), and epithelialization (score 0–3).

Visual Analogue Scale (VAS) and Clinical Parameters

The Visual Analogue Scale (VAS) is the standard instrument for quantifying postoperative pain in clinical studies of laser-assisted surgery. Patients are asked to rate their pain intensity on a scale from 0 (no pain) to 10 (most severe pain imaginable) [26]. VAS scores are recorded at standardized time points — immediately postoperatively and at D3, D7, and D14 [1] — to highlight the dynamics of pain evolution and to provide comparison data with conventional surgical procedures. The VAS scale presents the following advantages: greater sensitivity to small changes compared to descriptive ordinal scales, ease of use, rapid completion (10–15 seconds), and potential for parametric conversion of data. Its main limitations are: strongly subjective nature of evaluation, reduced value for between-group comparisons, and impossibility of verbal administration. The area under the curve (AUC VAS 0–14 days) and the delta variation (ΔVAS) between consecutive time points allow more rigorous analysis of pain evolution over time [26,1].

Histopathological Examinations

Histopathological examination provides an objective means of scoring the therapeutic response at the post-treatment healing site. Microscopic analysis is performed by means of routine stains (hematoxylin-eosin) and special stains (Masson trichrome, immunohistochemistry for markers such as CD31 and Ki67). The histological scores characterize: degree of inflammation (score 0–3), fibroblastic proliferation (score 0–3), collagen fiber organization and maturation (score 0–3), neoangiogenesis (score 0–3), and degree of epithelialization (score 0–3) [27]. Correlation of clinical data (VAS,

DOI : 10.62610/RJOR.2026.2.18.6

inflammation, edema, clinical healing), histological data (inflammation and tissue organization scores), and imaging data (digital photography, OCT) provides a comprehensive view of the healing process following laser-assisted preprosthetic surgery. This approach enables objective comparisons between laser-assisted and conventional surgical procedures, contributing to the determination of clinical performance, indications, and limitations of laser categories used in preprosthetic surgery [1].

3.2. Gingivectomy and crown lengthening

Laser-assisted gingivectomy and gingivoplasty constitute some of the most frequent preprosthetic soft tissue procedures. The use of laser facilitates adherence to the relationship between the final restoration margin and the biological width of the periodontal space, the preservation of which is imperative for the long-term success of fixed prosthetic restorations [28,29,30]. Parameters for operculectomy with 980 nm laser [6]: continuous mode, contact, water 60%/air 40%, power 3.25 W, fiber diameter 440 micrometers. For crown lengthening with 810 nm laser: power 1 W, continuous mode, fiber diameter 400 micrometers. Mucosal remodeling at edentulous sites (810 nm): power 0.8-1 W, continuous mode, diameter 400 micrometers [6]. The study by Kumar et al. [29] demonstrated faster complete healing of laser-assisted gingivectomy compared to conventional electrosurgery, with significant reduction of postoperative bleeding, pain, and edema. In 83.7% of patients, self-limited bleeding was recorded, and 94% presented low-intensity postoperative pain [31].

3.3. Frenectomy

Frenectomy is indicated when the labial or lingual frenulum, inserted close to the alveolar ridge margin, prevents extension of the prosthetic field or favors decubitus lesions. The diode laser-assisted procedure involves: bilateral vestibular local anesthesia with 2% mepivacaine, laser incision to the periosteum, perpendicular to the longitudinal axis of the frenulum, curette verification of complete removal of muscular fibers, biostimulation in defocused (non-contact) mode to accelerate healing, and weekly monitoring for 3-4 weeks [1,17]. Parameters for 980 nm laser in frenectomy: power 3-10 W, continuous mode, fiber diameter 400 micrometers [32]. The 810 nm laser: power 20 W, energy 1.8 J/sec (optimal level - absence of bleeding, maximum cutting efficiency, minimum frequency of postoperative complications), frequency 10 Hz, continuous mode, diameter 400 micrometers [32]. Comparative studies between Nd:YAG laser and conventional technique [21,20] showed significantly lower VAS scores and reduced masticatory discomfort in the laser-treated group. Al-Khatib et al. [33] demonstrated that frenectomy with 940 nm diode laser in pulse mode (mean power 2 W, maximum power 4 W) offers the minimum working session duration (15 minutes), with complete absence of intraoperative bleeding and discomfort,

DOI : 10.62610/RJOR.2026.2.18.6

absence of postoperative pain at 48 hours, and complete healing at 21 days. Compared to continuous mode (1.5-3 W), pulse mode significantly reduces perioperative morbidity, recommending it as the preferred option in practice.

3.4. Vestibuloplasty

Vestibuloplasty is indicated in significant atrophies of edentulous ridges, in patients with mandibular terminal edentations, in order to obtain an edentulous ridge height of at least 5 mm, necessary for adequate prosthetic rehabilitation. The laser-assisted surgical procedure involves initiating ablation at the level of the mucogingival junction, activating the laser beam at the level of the soft tissue band until the desired incision depth is obtained (simultaneously, the lip is retracted outward), biostimulation in defocused mode for hemostasis and acceleration of healing processes, and weekly monitoring for 3-4 weeks [17,31]. The study by Kalakonda et al. [31], comparing 808 nm diode laser (power 1-1.5 W, fiber diameter 400 micrometers) with conventional surgery, demonstrated that pain intensity is approximately 30% lower at 1 day postoperatively and 50% lower at 7 days postoperatively in the laser-treated group compared to conventional techniques. Kacarska et al. [34] obtained similar results in preprosthetic mandibular laser-assisted vestibuloplasty. Comparative studies emphasize that erbium lasers are superior to CO2 laser regarding healing speed (absence of carbonization marks, fibrin layer formed in the first 4-7 days), with complete absence of intra- and postoperative bleeding, and significantly reduced postoperative pain compared to conventional techniques [24,25].

3.5. Biostimulation of the post-extraction socket

Biostimulation of the post-extraction socket using low-level laser therapy (LLLT) or diode laser represents an adjunct procedure frequently used in the preprosthetic stage, aiming to accelerate healing and reduce post-extraction complications (alveolitis, pain, edema). The biostimulatory effects of laser include fibroblast activation, stimulation of angiogenesis, acceleration of collagen synthesis, and reduction of local inflammation [1,9]. Aras et al. [35] demonstrated that Er:YAG laser biostimulation after third molar extractions is associated with reduction of pain intensity, postoperative edema, and trismus compared to the group without laser biostimulation, although the differences did not reach statistical significance. The biostimulatory role is more evident in sockets with risk factors for complications (smoking patients, immunocompromised individuals, patients with associated systemic pathology).

3.6. Postoperative evolution in laser-assisted presprosthetic surgery

The synthesis of data from the specialized literature regarding postoperative evolution after preprosthetic laser-assisted surgical interventions highlights a remarkable consistency of favorable results. Romanos et al. [15], on a cohort of frenectomies, gingival hyperplasias, and vestibuloplasties with 980 nm laser, reported absence of edema,

DOI : 10.62610/RJOR.2026.2.18.6

pain, and scarring in the majority of patients. Ize-Iyamu et al. [36] confirmed significant reduction of postoperative bleeding, pain, and edema at 810 nm. Kalakonda et al. [31] recorded significantly lower VAS scores at 7 days postoperatively in the laser group compared to the conventional group. Angiero et al. [37] recommend the use of diode lasers (808 nm) in excisional biopsies of benign oral mucosal lesions of at least 5 mm diameter, with low-level postoperative pain and complete healing of the surgical site in 2–3 weeks. Amaral et al. [27], in a randomized clinical trial regarding treatment of fibrous hyperplasia, demonstrated significant intraoperative reduction of bleeding and faster healing in the diode laser group compared to scalpel.

More recent evidence has further consolidated these findings. A research group compared conventional frenectomy with diode laser-assisted frenectomy with and without additional periosteal incision. VAS-assessed postoperative pain, discomfort during speaking and chewing were recorded at the 3rd hour and on days 1, 7, 14, 21, and 45. The laser groups demonstrated significantly lower pain and functional discomfort scores throughout the follow-up period, with faster epithelialization and comparable periodontal clinical parameters at 45 days, supporting the superiority of diode laser over conventional scalpel for patient-centered outcomes [38]. A research group compared the perioperative management of frenectomy using scalpel versus laser. The review confirmed that laser-assisted frenectomy was associated with satisfactory healing, reduced intraoperative complications — including significantly less bleeding and reduced need for suturing — and higher patient acceptance compared to conventional surgery. The authors noted that diode laser, CO_2, and Er:YAG lasers all yielded favorable outcomes, with diode laser being the most frequently reported modality [39]. A review analyzed seven studies comparing diode laser gingivectomy with conventional scalpel surgery and nonsurgical periodontal therapy in patients with orthodontic treatment-induced gingival enlargement. Intraoperative and postoperative bleeding and pain were found to be significantly lower in the laser-treated group across the included studies, supporting the routine adoption of diode lasers (810–940 nm) for gingivectomy in the preprosthetic clinical context [40]. A research group evaluated whether laser technique is more effective than conventional surgical technique for labial frenectomy, comparing bleeding, operative time, suture requirement, and analgesic use across different laser types. The review concluded that laser-assisted frenectomy consistently generated less intraoperative bleeding, reduced or eliminated the need for sutures, and was associated with shorter operative time compared to scalpel, regardless of the laser type used. These advantages were most pronounced for diode lasers, which demonstrated the broadest evidence base [41]. A research group, in a randomized controlled clinical trial on 174 patients requiring maxillary labial frenectomy divided into three groups (445 nm diode laser, 980 nm diode laser, and scalpel V-Y plasty), evaluated intraoperative bleeding, chewing and speaking discomfort, pain,

DOI : 10.62610/RJOR.2026.2.18.6

and tissue healing at day 0, day 7, and day 30. Pain scores were significantly lower in the 445 nm diode laser group compared to 980 nm immediately postoperatively and at day 7, with both laser groups outperforming the scalpel group in terms of intraoperative bleeding and absence of sutures [42]. A recent systematic review assessed the effectiveness of laser-assisted gingivectomy compared to surgical methods. Diode lasers (810–940 nm) and Er,Cr:YSGG lasers caused less postoperative pain than conventional flap surgery, while Nd:YAG laser resulted in higher initial pain. The review also highlighted that laser technology offers superior surgical control, reduced analgesic requirements, minimal postoperative inflammation, and suture-free wound healing [43].

Taken together, the evidence from randomized controlled trials, systematic reviews, and meta-analyses consistently confirms that laser-assisted preprosthetic interventions — particularly with diode and erbium lasers — offer statistically and clinically meaningful advantages over conventional techniques across all major outcome domains: pain, bleeding, healing quality, and patient comfort. The growing methodological rigor of recent studies, including multi-arm RCT designs, standardized VAS recording at multiple time points, and histological assessment of wound healing, provides a progressively stronger evidence base for the routine integration of laser technology into preprosthetic surgical protocols [44].

CONCLUSIONS

The specialized literature consistently supports that the use of surgical lasers in preprosthetic procedures - gingivectomy, frenectomy, vestibuloplasty, soft and hard tissue remodeling – with significant advantages: reduction of postoperative pain and edema, superior intraoperative hemostasis, acceleration of tissue healing, and elimination of the need for sutures in numerous situations. The choice of laser type depends on the clinical indication (soft versus hard tissue), equipment accessibility, and operator experience. Diode lasers are the first option for soft tissue interventions due to portability, lower cost, and excellent hemostasis. Erbium lasers (Er:YAG, Er,Cr:YSGG) are indicated in interventions involving both soft and hard tissues. CO2 laser is preferred in excision of extensive mucosal lesions and biopsies, while Nd:YAG laser is useful when deep hemostasis is the priority. Integration of laser technology in preprosthetic surgery contributes to increased clinical predictability, improved patient postoperative comfort, and optimization of conditions for the success of subsequent prosthetic restorations. The need for refinement of standardized protocols and continuous training of medical personnel remains a priority research direction in the field.

REFERENCES

1. Agop-Forna D. *Practical guide in laser applications*. UMF "Grigore T. Popa" Iasi, 2018.
2. Forna N. *Current aspects in the clinical management of extensive partial edentulism. Treatise on dental prosthetics*. Ed. Gr.T.Popa Iasi; 2008.

DOI : 10.62610/RJOR.2026.2.18.6

3. Sanz-Moliner JD, Nart J, Cohen RE, Ciancio SG. The effect of an erbium laser on the quality of the surgical field in mucogingival surgery. *J Periodontol*. 2013;84(12):1766-1771.
4. Parker S, Cronshaw M, Anagnostaki E, et al. Current Concepts of Laser-Oral Tissue Interaction. *Dent J (Basel)*. 2020;8(3):61.
5. Agop-Forna D, Cretu C, Topoliceanu C, Salceanu M, Vasincu D, Forna N. Clinical applications of diode lasers in oral surgery: a review. *Romanian Journal of Oral Rehabilitation*. 2021;13(1):265-269.
6. Convissar RA. *Principles and Practice of Lasers Dentistry*. 2nd ed. Mosby Elsevier; 2016.
7. Fornaini C, Rocca JP. *Oral Laserology*. EDLearning; 2015.
8. Coluzzi DJ, Convissar RA. *Atlas of lasers applications in dentistry*. Quintessence Publ. 2007.
9. Parker S. Laser regulation and safety in general dental practice. *Br Dent J*. 2007;202(9):523-532.
10. Schwarz F, Aoki A, Becker J, Sculean A. Laser application in non-surgical periodontal therapy: a systematic review. *J Clin Periodontol*. 2008;35:29-44.
11. Agop-Forna D, Mihai C, Forna N. Surgical lasers: a review of applications in the therapy of oral mucosa lesions. *Romanian Journal of Oral Rehabilitation*. 2020;12(1):24-31.
12. Asnaashari M, Zadsirjan S. Application of laser in oral surgery. *J Lasers Med Sci*. 2014;5(3):97-107.
13. Luke AM, Mathew S, Altawash MM, Madan BM. Lasers: a review with their applications in oral medicine. *J Lasers Med Sci*. 2019;10(4):324-329.
14. Akbulut N, Kursun ES, Tumer MK, Kamburoglu K, Gulsen U. Is the 810-nm diode laser the best choice in oral soft tissue therapy? *Eur J Dent*. 2013;7:207-211.
15. Romanos GE, Crespi R, Nentwig GH. Diode laser (980nm) in oral and maxillofacial surgical procedures: clinical observations. *J Clin Laser Med Surg*. 1997;17:193-197.
16. Suter VG, Altermatt HJ, Sendi P, et al. CO2 and diode laser for excisional biopsies of oral mucosal lesions: a pilot study. *Schweiz Monatsschr Zahnmed*. 2010;120(8):664-671.
17. Mahler P, Allard Y, Rocca JP. Lasers and Prosthetics. In: Fornaini C, Rocca JP (eds). *Oral Implantology*. EDLearning; 2015.
18. Navarro G, Bezzina ME, Gaultier F. Laser and Periodontics. In: Fornaini C, Rocca JP (eds). *Oral laserology*. Editografica; 2015.
19. Medeiros Junior R, Gueiros LA, et al. Labial frenectomy with Nd:YAG laser and conventional surgery: a comparative study. *Lasers Med Sci*. 2015;30(2):851-856.
20. Akpinar A, Toker H, Lektemur Alpan A, Calisir M. Postoperative discomfort after Nd:YAG laser and conventional frenectomy: comparison of both genders. *Aust Dent J*. 2015.
21. Kara C. Evaluation of patient perceptions of frenectomy: a comparison of Nd:YAG laser and conventional techniques. *Photomed Laser Surg*. 2008;26(2):147-152.
22. Schalter R. The Er,Cr:YSGG laser in various restorative treatments. *J Acad Laser Dent*. 2005;13:26-29.
23. Forna D. *Computer-assisted planning systems for pre-implant and implant surgical preparation (laser vs. conventional)* [Doctoral thesis]. UMF Grigore T. Popa Iasi; 2017.
24. Vaderhobli RM, White JM, et al. In vitro study of the soft tissue effects of CO2 laser parameters during soft tissue incision and sulcular debridement. *Lasers Surg Med*. 2010;42(3):257-263.
25. Onisor I, et al. Clinical study of frenectomy with Er,Cr:YSGG laser. *Photomed Laser Surg*. 2013.
26. Karcioglu O, Topacoglu H, Dikme O, Dikme O. A systematic review of the pain scales in adults: Which to use? *Am J Emerg Med*. 2018;36(4):707-714.

DOI : 10.62610/RJOR.2026.2.18.6

27. Amaral MB, de Avila JM, Abreu MH, Mesquita RA. Diode laser surgery versus scalpel surgery in the treatment of fibrous hyperplasia: a randomized clinical trial. *Int J Oral Maxillofac Surg*. 2015;44:1383-1389.
28. Farista S, Kalakonda B, Koppolu P, et al. Comparing laser and scalpel for soft tissue crown lengthening: a clinical study. *Glob J Health Sci*. 2016;8(10):55-795.
29. Kumar P, Rattan V, Rai S. Comparative evaluation of healing after gingivectomy with electrocautery and laser. *J Oral Biol Craniofac Res*. 2015;5(2):69-74.
30. Parker S. The use of lasers in fixed prosthodontics. *Dent Clin North Am*. 2004;48:971-978.
31. Kalakonda B, Farista S, Koppolu P, et al. Evaluation of patient perceptions after vestibuloplasty procedure: a comparison of diode laser and scalpel techniques. *J Clin Diagn Res*. 2016;10(5):96-100.
32. Awooda EM, Osman B, Nadia Y. Use of laser diode (810nm) in frenectomy. *Sudan JMS*. 2007;2(1):45-47.
33. Al-Khatib AA, Al-Azzawi AS. Comparative study of diode laser 940 nm in performing frenectomy in both continuous and pulsed modes: an in vivo study. *J Dent Lasers*. 2015;9:50-68.
34. Kacarska O, Dimitrovski D, Monevska P. Preprosthetic Laser Assisted Mandibular Vestibuloplasty. *Balkan Journal of Dental Medicine*. 2016;20:182-185.
35. Aras MH, Goregen M, Gungormus M, Akgul HM. Comparison of diode laser and Er:YAG lasers in the treatment of ankyloglossia. *Photomed Laser Surg*. 2010;28(2):173-177.
36. Ize-Iyamu IN, Saheeb BD, Edetanlen BE. Comparing the 810nm diode laser with conventional surgery in orthodontic soft tissue procedures. *Ghana Med J*. 2013;47(3):107-111.
37. Angiero F, Parma L, Crippa R, Benedicenti S. Diode laser (808 nm) applied to oral soft tissue lesions: a retrospective study. *Lasers Med Sci*. 2012;27(2):383-388.
38. Sezgin G, Öztürk Özener H, Meseli SE, Kuru L. Evaluation of Patient's Perceptions, Healing, and Reattachment After Conventional and Diode Laser Frenectomy: A Three-Arm Randomized Clinical Trial. *Photobiomodul Photomed Laser Surg*. 2020;38(9):552–559. doi: 10.1089/photob.2019.4783.
39. Lebret C, Garot E, Pereira MA, Fricain JC, Catros S, Fénelon M. Perioperative outcomes of frenectomy using laser versus conventional surgery: a systematic review. *J Oral Med Oral Surg*. 2021;27(3):36. doi: 10.1051/mbcb/210058.
40. Maboudi A, Fekrazad R, Shiva A, Salehabadi N, Moosazadeh M, Ehsani H, Yazdani O. Gingivectomy with Diode Laser Versus the Conventional Scalpel Surgery and Nonsurgical Periodontal Therapy in Treatment of Orthodontic Treatment-Induced Gingival Enlargement: A Systematic Review. *Photobiomodul Photomed Laser Surg*. 2023;41(9):449–459. doi: 10.1089/photob.2023.0060.
41. Dioguardi M, Ballini A, Quarta C, Caroprese M, Maci M, Spirito F, Caloro GA, Alovisi M, Basile E, Lo Muzio L. Labial Frenectomy using Laser: A Scoping Review. *Int J Dent*. 2023;2023:7321735. doi: 10.1155/2023/7321735.
42. 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. doi: 10.1186/s12903-024-04364-w.
43. Hamadah O, Almahayni S, Ghazzawi R, Mounajjed R, Altayeb W, Khalil M. Effectiveness of laser-assisted gingivectomy compared to surgical methods: a systematic review. *Explor Med*. 2025;6:1001325. doi: 10.37349/emed.2025.1001325.

DOI : 10.62610/RJOR.2026.2.18.6

44. Agop-Forna D, Sălceanu M, Topoliceanu C, Crețu C, Vasincu D, Forna N. Dental Lasers in Restorative Dentistry: A Review. *Romanian Journal of Oral Rehabilitation*. 2021 Apr-Jun;13(2):7-17.
45. Agop-Forna D, Crețu C, Topoliceanu C, Sălceanu M, Vasincu D, Forna N. Clinical Applications of Diode Lasers in Oral Surgery: A Review. *Rom J Oral Rehabil*. 2021 Jan-Mar;13(1):265-270.

DOI : 10.62610/RJOR.2026.2.18.6