COMPARATIVE *IN VITRO* CYTOTOXICITY EVALUATION OF BROMIDE-POTASSIUM MONOPERSULFATE AND TOPICAL ANTIMICROBIAL-REGENERATIVE AGENTS FOR DENTAL APPLICATIONS

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Objectives: this study aimed to evaluate the comparative cytotoxicity of **bromide-potassium monopersulfate** (Br-PPMS), a high-level disinfectant used during the COVID-19 pandemic, against common topical antimicrobial and regenerative agents (LDA-RA). The objective was to determine the potential of Br-PPMS as a safe and effective alternative for the *in vivo* decontamination of infected oral sites, such as ulcers, osteonecrosis, and peri-implantitis.

Materials and methods: cell viability was assessed using the **MTT colorimetric assay** on three non-transformed cell lines: primary equine fibroblasts, human keratinocytes (HaCaT), and rat cardiomyoblasts (H9c2). The cells were exposed to compound concentrations ranging from 6.25 to 100 µg/mL for 24, 48, and 72 hours. The tested compounds included Br-PPMS formulations (EC STER® Powder and Spray ICM srl Portigliola RC Italy), as well as commercially available formulations based on Ozone (Ozosan®. Bioactiva srl Arcugnano VI Italy) and Spermidine (Ubigel A and B®. Pierrel Group Capua CE Italy).

Results: the cytotoxicity analysis revealed a **concentration- and time-dependent** effect for most of the tested compounds. On fibroblasts, Ozosan and Ubigel A/B showed significant toxicity ($p<0.001$) at 50-100 µg/mL. In contrast, EC STER® spray and powder were non-toxic, with the powder even increasing viability at 6.25 µg/mL ($p<0.05$). On keratinocytes, Ozosan, Ubigel B, and EC STER spray showed a milder cytotoxic effect ($p<0.05$) at 25-100 µg/mL, while Ubigel A and EC STER powder were non-toxic. On cardiomyocytes, Ozosan and Ubigel A/B were significantly toxic ($p<0.01$) at 50-100 µg/mL. EC STER spray induced only a minimal viability reduction at 100 µg/mL ($p<0.05$), and the powder formulation was non-toxic.

Conclusions: the data confirm a differential cytotoxicity profile among the compounds. While Ozosan and spermidine-based formulations showed significant cytotoxic effects, **Br-PPMS (EC STER®)** was found to be **non-toxic** or only minimally toxic to all tested cell lines. This high safety profile, combined with its proven microbicidal efficacy, suggests that Br-PPMS is a promising candidate for the local decontamination of infected oral sites. However, further studies, both *in vitro* and *in vivo*, are necessary to fully validate these results and explore the compound's clinical potential.

REFERENCES

1. **Bansal A, Bharti V, Gupta R, Wadhawan N, Kumar A.** Clinical effectiveness of hyaluronic acid in the treatment of chronic periodontitis: a systematic review and meta-analysis. J Investig Clin Dent. 2021;12(4):e12658.

2. **Sagai M, Bocci V.** Mechanisms of action involved in ozone therapy: are there anti-inflammatory actions? Inflamm Res. 2011;60(3):273-9.

3. **Eisenberg T, Abdellatif M, Schroeder L, Primessnig U, Stekovic S, Madeo F.** Cardioprotection by spermidine in ageing Drosophila melanogaster through autophagy and mitochondrial dynamics. Nat Commun. 2016;7:12204.

4. **Guglielmino S, Scardina GA.** Topical antimicrobial agents in the non-surgical treatment of peri-implantitis: a randomized clinical trial. J Oral Maxillofac Surg. 2019;77(11):2295-303.

5. **Kunanusont N, Ruenphet S.** *In vitro* bactericidal activity of potassium peroxymonosulfate against Salmonella enterica and Escherichia coli. J Vet Med Sci. 2020;82(3):329-35.

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FLUORESCENCE-GUIDED SURGERY: A LITERATURE REVIEW

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Objectives: the precision of modern surgical practices is often limited by the inability to visually delineate tumor margins intraoperatively. Despite advances in preoperative imaging like MRI and CT, the rate of positive surgical margins remains a significant clinical challenge.

Conventional intraoperative methods such as frozen sections are constrained by sampling errors and prolonged processing times. In this context, autofluorescence (AF) and fluorescence-guided surgery (FGS) have emerged as promising modalities to enhance surgical precision.

Materials and methods: a systematic literature review was performed to critically evaluate the diagnostic accuracy of AF and FGS in neoplasms. A search was conducted on PubMed, Scopus, and Web of Science, focusing on publications from 1999 to 2024 related to head and neck cancers, surgical margins, and recurrence.

Results: the analysis revealed a statistically significant reduction in fluorescence intensity in malignant tissues compared to healthy counterparts. This phenomenon correlated with histopathological changes characteristic of neoplastic tissues, including hyperkeratosis and fibrosis. FGS facilitated the real-time visualization of tumor margins, improving resection precision. The main diagnostic criterion for identifying neoplastic tissue was the attenuation of fluorescence **(hypofluorescence)** relative to adjacent healthy tissue.

Conclusions: AF and FGS offer distinct advantages over traditional surgical techniques. While they hold great promise, further clinical studies are necessary to fully validate their diagnostic accuracy and standardize procedural protocols. The integration of AF and FGS with complementary imaging modalities and artificial intelligence represents a key future direction, with the ultimate goal of developing multimodal systems for more precise and effective surgical resections.

REFERENCES

1. **Nakayama B, Tanaka H, Tanaka M.** Intraoperative frozen section analysis in oral squamous cell carcinoma: a retrospective study. BMC Cancer. 2028;18:1-7.
2. **Lim SC, Lam AK, Byard RW.** Potential problems and diagnostic pitfalls associated with intraoperative frozen section consultation. Pathology. 2016;48(7):652-8.
3. **Dotto J, Villa A.** Autofluorescence-based technologies for oral cancer detection: a systematic review. Photodiagnosis and photodynamic therapy. 2019;27:269-81.
4. **Schwarz S, Poetschke J, Ziebart T, Püschel K.** Fluorescence angiography for intraoperative margin assessment in head and neck cancer surgery. Oral oncology, 2018;87:86-90.
5. **Yu L, Chen H, Guo Y, Wang X, Li Q.** Deep learning for medical image analysis: a review. Journal of healthcare engineering, 2020.

MONITORING FEMTOSECOND LASER ABLATION PROCESSES ON HUMAN TEETH USING FT-IR SPECTROSCOPY

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Objectives: femtosecond (fs) lasers offer a promising alternative to traditional dental drilling. Their ability to deliver ultra-high-energy pulses in an extremely short timeframe enables "athermal" or non-thermal ablation, minimizing collateral damage such as micro-cracks and carbonization, which are common with longer-pulse lasers. This study aims to evaluate the impact of fs laser ablation on hard dental tissues (enamel and dentin) and to determine the optimal parameters for treatment. To achieve this, researchers used FT-IR spectroscopy to analyze the biochemical and structural changes induced by the laser.

Methodology: slices of human molars were prepared and treated with a fs Yb:KGW laser (1030 nm, ~180 fs, 200 kHz) at different fluences: **0.75 J/cm², 1.0 J/cm²**, and **1.5 J/cm²**. Subsequently, they were analyzed using micro-ATR FT-IR spectroscopy. This technique, which requires direct contact with the sample surface, allowed for the acquisition of spectra from 100 µm diameter areas.

Results: the results showed that fluences of **0.75 J/cm²** and **1.0 J/cm²** did not induce significant changes in the spectral characteristics between the treated and untreated areas. This indicates that at these energy levels, the laser removed material without causing detectable thermal or structural damage. However, at a higher fluence of **1.5 J/cm²**, it was not possible to obtain high-quality spectra. The reason lies in the significant morphological alterations of the sample surface, which prevented proper contact with the internal reflection element (IRE) of the ATR instrument. This limitation highlighted how excessively high fluences can compromise surface integrity, rendering the analysis technique ineffective.

Conclusions: the findings suggest that fluences between **0.75 and 1.0 J/cm²** are the most suitable for fs laser ablation on dental tissues, as they ensure precise action without collateral damage. The study also underscored the importance of using non-contact analytical techniques, such as Raman spectroscopy, to explore higher fluences and overcome the limitations of the ATR technique. FT-IR spectroscopy is confirmed as a valuable tool for evaluating laser treatments in dentistry.

REFERENCES

1. **Gaeta GM, Riccio R, De Rosa A, Camerlingo C, Lepore M.** A comparative study on dentine/resin interface of lased and unlased tooth cavities by micro-Raman spectroscopy. J Oral Laser Appl. 2003;3:243-9.
2. **Beć KB, Grabska J, Huck CW.** Biomolecular and bioanalytical applications of infrared spectroscopy: A review Analytica Chimica Acta 113, 202, 150e177.
3. **Otel I.** Overall Review on Recent Applications of Raman Spectroscopy Technique in Dentistry. Quantum Beam Sci. 2023;7(1):5.
4. **Diez CM, Rojo ÁJ, Marnn-Gil P, Marnn-Ramos M, Garrosa D.** Infrared Spectroscopic Analysis of the Inorganic Components from Teeth Exposed to Psychotherapeutic Drugs. Minerals. 2022;12(1):28.
5. **Anwar Alebrahim M, Krafft C, Popp J.** Raman imaging to study structural and chemical features of the dentin enamel junction IOP Conf. Series: Materials Science and Engineering 92 (2015).

SCOPING REVIEW: HIGH-POWER LASERS FOR DECONTAMINATION OF INFECTED POST-EXTRACTION SOCKETS

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Objectives: this **scoping review** evaluated the efficacy of **high-power lasers** as an adjunctive method for decontaminating **infected post-extraction sockets** immediately prior to **implant placement**. The aim was to synthesize existing clinical and *in vivo* evidence, highlighting methodological limitations and future research needs.

Materials and methods: a comprehensive **systematic search** was conducted up to March 2025 across five key databases: **PubMed, Embase, Web of Science, Google Scholar, and the Cochrane Library**. The search utilized controlled vocabulary (MeSH terms) and free-text terms focused on the intersection of "implants", "infected sockets", "decontamination", and "high-power lasers". Studies were eligible if they involved **adult patients** receiving **immediate implants** in infected sockets following laser decontamination, published in **English** since 2000. This review strictly adhered to the **PRISMA-ScR guidelines** and was structured around a PICO strategy to ensure rigorous data extraction and synthesis.

Results: the body of evidence reviewed demonstrated **heterogeneous protocols**, with the most common systems being **diode, Er:YAG, and Nd:YAG lasers**. Findings overwhelmingly suggest that implants placed in sites previously affected by infection can achieve **survival rates comparable** to those placed in healthy, non-infected sockets, provided that meticulous **decontamination** is achieved via conventional curettage, antimicrobial agents, or laser-assisted protocols. Clinical trials, despite their variability, consistently reported **no significant prognostic differences** in long-term outcomes between implants placed in decontaminated infected sites *versus* those in healthy sites. Furthermore, *in vivo* and observational studies documented high implant survival rates, typically **above 96%**, following laser decontamination. This success and the notably l**ow complication incidence** are often attributed to the powerful **ablative and antimicrobial properties** of the Er:YAG laser, capable of selectively removing contaminated tissue and sterilizing the bone surface.

Conclusions: high-power lasers are a highly promising and effective adjunct for securing **immediate implant placement** in infected post-extraction sites. While clinical outcomes are encouraging, the current reliance on non-standardized and varied **study designs limits firm conclusions**. There is an urgent, confirmed need for **standardized, prospective randomized controlled trials (RCTs)** to define optimal laser parameters and protocols, fully validating this technique for routine clinical use.

PERIODONTAL DISEASE: NON-SURGICAL THERAPEUTIC STRATEGIES USING LOCAL DELIVERY ANTIMICROBIAL-REGENERATIVE AGENTS (LDA-RA)

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Objectives: this paper aims to evaluate the efficacy of topical adjuvants, including hyaluronic acid, equine collagen, ozone, photodynamic therapy, and spermidine, as a supplement to traditional mechanical therapy for periodontal disease. The goal is to improve clinical outcomes, modulate inflammatory responses, and promote tissue regeneration.

Materials and methods: this study explores and evaluates the impact of these adjuvants on key clinical parameters, as well as on pro-inflammatory cytokines such as IL-1β and TNF-α, and biochemical markers including C-reactive protein (CRP) and alkaline phosphatase (ALP). The paper focuses on the therapeutic strategies of local delivery of these antimicrobial and regenerative agents (LDA-RA).

Results: the analysis revealed several beneficial effects: **hyaluronic acid** showed anti-inflammatory and antibacterial properties, promoting tissue healing. **Ozone** acted as a potent antimicrobial and biostimulatory agent. **Spermidine** was identified as an inducer of autophagy and an anti-inflammatory agent, which aids in tissue regeneration. **Photodynamic therapy (PDT)** was effective in selectively reducing bacterial load and inflammation. The combination of **equine collagen** with **resorbable polymers** provided a scaffold for tissue repair and a controlled release mechanism for active substances like ascorbic acid.

Conclusions: when integrated with mechanical therapy, these non-surgical therapeutic strategies offer a promising and advanced approach to managing periodontal disease. While these adjuvants show significant potential, future research should concentrate on optimizing application protocols, establishing long-term efficacy, and developing personalized treatment plans to achieve lasting therapeutic success.

REFERENCES

1. **Sagai M, Bocci V.** Mechanisms of action involved in ozone therapy: are there anti-inflammatory actions? Inflamm Res. 2011;60(3):273-9.
2. **Eisenberg T, Abdellatif M, Schroeder L, Primessnig U, Stekovic S, Madeo F.** Cardioprotection by spermidine in ageing Drosophila melanogaster through autophagy and mitochondrial dynamics. Nat Commun. 2016;7:12204.
3. **Cortellini P, Tonetti MS.** Clinical concepts for regenerative therapy in intrabony defects. Periodontology. 2000;22:107-21.
4. **Chan Y, Lai CH, Cheng L, Yan Q, Ng D, Corbet EF.** Adjunctive photodynamic therapy for chronic periodontitis: a randomized controlled trial. J Clin Periodontol. 2012;39(9):831-39.
5. **Guglielmino S, Scardina GA.** Topical antimicrobial agents in the non-surgical treatment of peri-implantitis: a randomized clinical trial. J Oral Maxillofac Surg. 2019;77(11):2295-303.

PHOTOBIOMODULATION AND ORTHODONTIC MOVEMENT

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Objectives: the aim of this work is to critically assess the effectiveness of LLL PBM as a method to accelerate OTM, by examining current scientific evidence. The study seeks to identify methodological limitations and discuss future clinical perspectives, with attention to biological and management aspects.

Materials and methods: a literature review was conducted on studies published between 2022 and 2025, including systematic reviews and an editorial report. Main laser parameters, clinical protocols, and measurement tools were considered. Protocol differences were analyzed and integrated with biological insights into cellular mechanisms, including hypotheses on mitochondria, cytochrome complexes, and possible photoreceptors. Data on wavelengths, energy densities and irradiation modes were examined.

Results: the analysis revealed that 13.6% of reviews reported exaggerated claims regarding PBM effectiveness in accelerat-

ing OTM. Heterogeneity of lasers and lack of standardized protocols limit study comparability. Procedural differences emerged between protocols for OTM and pain reduction, linked to wavelength selection. Tissue absorption proved variable, with efficacy influenced by bone thickness. Nano Nd:YAG 1064 nm technology appears promising for its high energy flow without tissue heating, though further investigation on adverse events is required.

Discussion and conclusions: based on current evidence (≈0.5 mm/month), PBM use in OTM is not justified and controlled studies are needed. The aim of PBM should be to make orthodontic movement more physiological, not simply faster.

REFERENCES

1. **Huang T, Zhang Y, Li X, Wang Y, Li Y, Liu J.** Efficiency of photobiomodulation on accelerating the tooth movement in the alignment phase of orthodontic treatment: a systematic review and meta-analysis. Heliyon. 2023;9:e13220.
2. **Gandedkar NH, Dalci O, Darendeliler MA, Darendeliler MA.** Accelerated orthodontics (AO): the past, present and the future. Semin Orthod. 2024;30(2):172-82.
3. **Wang S, Ko C-C, Chung M-K.** Nociceptor mechanisms underlying pain and bone remodeling via orthodontic forces: toward no pain, big gain. Front Pain Res. 2024;5:1365194.
4. **Gonçalves A, Monteiro F, Brantuas S, Basset P, Estevez A, Silva FS, *et al.*** Clinical and preclinical evidence on the bioeffects and movement-related implications of photobiomodulation in the orthodontic tooth movement: a systematic review. Orthod Craniofac Res. 2025;28(1):12-53.
5. **Sedej A, Svetina N, Golez A, Cankar K, Ban Frangez H, Frangez I, *et al.*** Effect of led photobiomodulation on tooth movement, gingival hypertrophy and pain in response to treatment with fixed orthodontic appliance. Lasers Med Sci. 2025;18;40(1):200.

LASER TREATMENTS AND SCLERODERMA

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Objectives: systemic sclerosis (SSc) is a rare autoimmune disease characterized by fibrosis, vasculopathy, and immune dysfunction. Oral manifestations include microstomia, dry mouth, telangiectasia, and vascular lesions. The objective is to evaluate the efficacy and safety of diode laser as a minimally invasive treatment for oral vascular lesions in patients with SSc.

Materials and methods: patients with SSc and oral vascular lesions were selected and underwent diode laser treatment (wavelength 830 nm, power 1.6 W, 320 µm fiber). The lesions were treated transmucosally on an outpatient basis. Follow-up included assessment of lesion volume reduction, pain, complications, and recurrences at 7, 30, and 1 year.

Results: diode laser treatment resulted in a significant reduction in the volume of vascular lesions, with no significant complications. Postprocedural pain was modest, and most patients reported improvement. In some cases, for lesions >10 mm, a second session was necessary. The 1-year recurrence rate was low.

Discussion and conclusions: the diode laser represents a valid alternative to traditional surgery for vascular lesions, thanks to its less invasive nature, reduced bleeding, shorter operating times, and improved postoperative comfort. The laser approach does not compromise histopathological diagnosis.

The diode laser is an effective, safe, and minimally invasive tool for the treatment of oral vascular lesions. The use of the laser does not limit histopathological diagnosis, representing a valid option integrated into the multidisciplinary management of these patients.

REFERENCES

1. **Benz K, Baulig C, Knippschild S, *et al.*** Prevalence of Oral and Maxillofacial Disorders in Patients with Systemic Scleroderma-a Systematic Review. Int J Environ Res Public Health. 2021;18(10):5238.
2. **Jung S, Martin T, Schmittbuhl M, Huck O.** The Spectrum of Orofacial Manifestations in Systemic Sclerosis: A Challenging Management. Oral Dis. 2017;23(4):424-39.
3. **Veale BJ, Jablonski RY, Frech TM, Pauling JD.** Orofacial Manifestations of Systemic Sclerosis. Br Dent J. 2016;221(6):305-10.
4. **Burchfield C, Vorrasi J.** Maxillofacial Implications of Scleroderma and Systemic Sclerosis: A Case Report and Literature Review. J Oral Maxillofac Surg: Official Journal of the American Association of Oral and Maxillofacial Surgeons. 2019;77(6):1203-8.
5. **Bacci C, Sacchetto L, Zanette G, Sivolella S.** Diode Laser to Treat Small Oral Vascular Malformations: A Prospective Case Series Study. Lasers Surg Med. 2018;50(2):111-6.

DIODE LASER EXCISION OF BUCCAL FIBROLIPOMA IN AN ELDERLY PATIENT ON ANTICOAGULANTS: CASE REPORT

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Objectives: lipomas are benign mesenchymal tumors that rarely affect the oral cavity. Fibrolipoma is a histological variant characterized by mature adipose tissue interspersed with collagen bundles. This report aims to describe the first diode laser-assisted excision of an oral fibrolipoma in an anticoagulated geriatric patient.

Materials and methods: a 92-year-old male, with hypertension and benign prostatic hyperplasia under chronic apixaban therapy, presented with a painless swelling on the right buccal mucosa interfering with prosthesis use. Examination revealed a pedunculated, soft, well-defined lesion involving superficial and submucosal layers. After informed consent, excision was performed using a dual-wavelength diode laser (645 + 980 nm, 2.8 W).

Results: laser excision was precise, provided immediate hemostasis, and required no sutures or topical hemostatic agents. Histopathology confirmed fibrolipoma. Healing was uneventful, with normal mucosa at 1- and 3-month follow-ups, and no recurrence was observed.

Conclusions: fibrolipoma of the buccal mucosa is uncommon and this is the first report of diode laser excision in an anticoagulated elderly patient. Compared with scalpel surgery, diode laser ensured bloodless resection, reduced operative time, absence of sutures, minimal scarring, and faster recovery. These advantages are especially relevant in fragile patients at high bleeding risk, supporting diode laser as a safe and effective alternative for rare oral fibrolipomas in complex clinical contexts.

REFERENCES

1. **Fregnani ER, Pires FR, Falzoni R, Lopes MA, Vargas PA.** Lipomas of the oral cavity: clinical findings, histological classification and proliferative activity of 46 cases. Int J Oral Maxillofac Surg. 2003;32:49-53.
2. **Manjunatha BS, Pateel GS, Shah V.** Oral fibrolipoma-a rare histological entity: report of 3 cases and review of literature. J Dent (Tehran). 2010;7:226-31.
3. **Manor E, Sion-Vardy N, Joshua BZ, Bodner L.** Oral lipoma: analysis of 58 new cases and review of the literature. Ann Diagn Pathol. 2011;15:257-61.

BENIGN SALIVARY CYST AND LASER REMOVAL

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Objectives: a mucocele is a benign lesion of the oral mucosa caused by trauma to the minor salivary glands, leading to mucus accumulation. If untreated, it may result in chronic local complications. The aim of this study is to evaluate different surgical strategies for the management of oral mucoceles, with particular emphasis on the efficacy of surgical excision.

Materials and methods: case reports and case series of patients treated with conventional excision, laser excision, and marsupialization were analyzed. Data collected included patient age, lesion site, surgical technique, complications, healing time, and recurrence. Technique selection was based on lesion size, location, and clinical features. An initial search identified 442 articles, of which 30 were included according to the Joanna Briggs Institute scoping review methodology, to minimize risk of bias.

Results: complete excision proved highly effective, with a low recurrence rate. Laser excision reduced intraoperative bleeding and improved postoperative comfort, while preserving the possibility of histopathological examination. Marsupialization was useful for large lesions but carried a higher risk of recurrence. In all cases, healing occurred within 2-3 weeks without significant complications.

Conclusions: the choice of surgical technique depends on the location, size, and depth of the mucocele. Conventional

excision remains the gold standard for small, superficial lesions, while laser excision represents a valid alternative for reducing surgical trauma and facilitating outpatient management.

Histopathological assessment is always recommended to rule out other pathologies. Recurrence is rare when the lesion is completely removed. Both conventional and laser excision are safe and effective for the treatment of oral mucoceles. Laser excision provides advantages in terms of hemostasis and postoperative comfort, without limiting histopathological diagnosis. Technique selection should be individualized according to lesion characteristics and patient needs.

REFERENCES

1. **Himelfarb M, Britt MC, Flanagan S, Green MA.** What Factors Influence Mucocele Recurrence? Oral Surg Oral Med Oral Pathol Oral Radiol. 2024;137(5):486-92.

2. **Choi YJ, Byun JS, Choi JK, Jung JK.** Identification of Predictive Variables for the Recurrence of Oral Mucocele. Medicina Oral, Patologia Oral Y Cirugia Bucal. 2019;24(2):e231-5.

PROLIFERATIVE VERRUCOUS LEUKOPLAKIA AND LASER THERAPIES

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Objectives: Proliferative verrucous leukoplakia (PVL) is a multifocal white lesion of the oral mucosa, notable for slow progression, therapeutic resistance, and a strong tendency toward malignant transformation. Its incidence is estimated at ~3%, with transformation risks exceeding 17% and reported rates up to 50%. Early diagnosis and strict monitoring are therefore essential. This paper reports a clinical case of PVL and reviews recent evidence on its therapeutic management.

Materials and methods: a 61-year-old woman presented with a recurrent, painless white lesion of the tongue, diagnosed as PVL according to established clinical-histological criteria. Excisional biopsy with free margins was performed, followed by a 12-month follow-up. A literature review (PubMed, Scopus, Web of Science, 2010-2024) was conducted, focusing on clinical studies, meta-analyses, and guidelines on PVL and oral leukoplakia.

Results: the lesion was completely excised with no complications or recurrence at 12 months. Literature indicates recurrence rates up to 67% after surgical removal, whether scalpel or laser. Laser provides improved local control and postoperative comfort but does not significantly reduce recurrence risk. Malignant transformation is more frequent in multifocal, non-homogeneous lesions, particularly those with epithelial dysplasia.

Conclusions: PVL is clinically challenging due to its aggressiveness, multifocal presentation, and resistance to treatment. Differential diagnosis from other white lesions requires rigorous histopathological confirmation. Surgical excision with free margins remains the treatment of choice, though recurrence is frequent and cancer risk remains high. Laser may be considered for symptomatic management but cannot substitute for close surveillance. Lifelong follow-up with repeated biopsies is necessary for early detection of malignant transformation. PVL carries high risks of recurrence and malignant change. Surgical excision with free margins, combined with strict long-term clinical and histopathological monitoring, is the most effective strategy. Laser therapy may aid local control but does not reduce the need for continuous follow-up. Multidisciplinary management and patient education are crucial to optimize outcomes.

REFERENCES

1. **Mohideen K, Ghosh S, Krithika C, Ali-Hassan M, Chole R, Dhungel S.** Malignant transformation of proliferative Verrucous Leukoplakia - systematic review & meta-analysis. BMC Oral Health. 2025;vol. 25, article number: 175.

2. **Favia G, Capodiferro S, Limongelli L, Tempesta A, Maiorano E.** Malignant transformation of oral proliferative verrucous leukoplakia: a series of 48 patients with suggestions for management. 2021;50(1):14-20.

RAMAN SPECTROSCOPY, ARTIFICIAL INTELLIGENCE AND ORAL CANCER DIAGNOSIS

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Objectives: to assess, through a literature review, the role of Raman spectroscopy integrated with Artificial Intelligence (AI) in the diagnosis of oral squamous cell carcinoma (OSCC), comparing it with the main diagnostic methods currently available.
Materials and methods: studies retrieved from biomedical databases (PubMed, Scopus) on diagnostic techniques for OSCC were analyzed. Methods considered included biopsy (gold standard), exfoliative cytology, vital stains, autofluorescence, Optical Coherence Tomography (OCT), confocal microscopy, radiological imaging, and molecular biomarkers. Evidence on Raman spectroscopy combined with AI models such as Support Vector Machines (SVM) and Deep Neural Networks (DNN) was compared in terms of sensitivity, specificity, and clinical applicability.
Results: alternative techniques show utility in screening or morphological assessment but have variable sensitivity and specificity and often require histological confirmation. Raman spectroscopy, particularly with a 785 nm laser, enables detection of biochemical alterations (increased nucleic acid and protein signals, lipid reduction). When integrated with AI, Raman data allow accurate tissue classification, with sensitivity >90% and specificity close to 95%, outperforming many traditional optical methods and offering potential intraoperative applications.
Conclusions: the literature identifies AI-assisted Raman spectroscopy as a complementary tool for histopathology, being rapid, minimally invasive, and objective. It may support early diagnosis, guide biopsy, and aid in surgical margin assessment. Nevertheless, multicenter prospective studies and standardized protocols remain necessary for its effective clinical translation.

REFERENCES

1. **Weber A, Enderle-Ammour K, Kurowski K, Metzger MC, Poxleitner P, Werner M, *et al.*** AI-based detection of oral squamous cell carcinoma with Raman histology. Cancers (Basel). 2024;16(4):689.

2. **Nambudiri MKK, Sujadevi VG, Poornachandran P, Krishna M, Kanno T, Noothalapati H.** Artificial intelligence-assisted stimulated Raman histology: new frontiers in vibrational tissue imaging. Cancers (Basel). 2024;16(23):3917.

ORAL MUCOSITIS AND PHOTOBIOMODULATION

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Objectives: Oral mucositis (OM) is among the most common and debilitating complications in patients undergoing chemotherapy and radiotherapy. It significantly impairs quality of life, reduces treatment adherence, and increases the risk of infections. Photobiomodulation (PBM), also known as low-level laser therapy, has emerged as a non-invasive approach for the prevention and management of OM. This study aims to synthesize current evidence on the clinical efficacy, safety, and cost-effectiveness of PBM in treating oral mucositis.
Materials and methods: a systematic literature review was conducted in accordance with PRISMA guidelines, including meta-analyses, randomized controlled trials (RCTs), and clinical studies published between 2020 and 2025. The primary outcomes assessed were incidence, severity, pain intensity, and lesion duration. Secondary outcomes included safety profile and cost-effectiveness. Both adult and pediatric oncology populations were considered.
Results: PBM demonstrated a significant reduction in the incidence and severity of OM in both adult and pediatric patients, with a relative risk reduction of up to 64% for severe mucositis compared to control groups. Clinical benefits typically emerged by the second week of therapy and were sustained

throughout the cancer treatment course. PBM also provided meaningful relief from mucositis-associated pain, improved salivary function, and enhanced overall quality of life, with some protocols yielding immediate effects. No serious adverse events were reported. The most effective parameters included He-Ne or InGaAlP lasers operating at 10-25 mW, 660 nm wavelength, and 4 J/cm² energy density.

Discussions: current international evidence - including guidelines from the World Association for Photobiomodulation Therapy (WALT) - strongly supports the efficacy of PBM in both the prevention and treatment of OM in cancer care. Specific recommendations on dosing parameters have been outlined. PBM has also shown efficacy in pediatric settings and among patients undergoing hematopoietic stem cell transplantation. While protocol standardization remains an open challenge, PBM represents a safe, evidence-based, and cost-effective supportive therapy in oncology.

Conclusions: photobiomodulation is a safe and effective intervention for the prevention and treatment of oral mucositis in oncology patients. It provides clinical benefits in terms of reduced incidence and severity, pain relief, and improved quality of life. The adoption of standardized PBM protocols may further enhance clinical outcomes and facilitate its integration into multidisciplinary cancer care pathways.

REFERENCES

1. **Shen B, Zhou Y, Wu D, Liu J.** Efficacy of Photobiomodulation Therapy in the Management of Oral Mucositis in Patients With Head and Neck Cancer: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. Head & Neck. 2024;46(4):936-50.
2. **Al-Rudayni AHM, Gopinath D, Maharajan MK, Veettil SK, Menon RK.** Efficacy of Photobiomodulation in the Treatment of Cancer Chemotherapy-Induced Oral Mucositis: A Meta-Analysis With Trial Sequential Analysis. Int J Environ Res Public Health. 2021;18(14):7418.
3. **Cruz AR, Minicucci EM, Betini M, *et al.*** Efficacy of Photobiomodulation in the Treatment of Oral Mucositis in Patients Undergoing Antineoplastic Therapy: Systematic Review and Meta-Analysis. Supportive Care in Cancer: Official Journal of the Multinational Association of Supportive Care in Cancer. 2023;31(12):645.
4. **Vianna Camolesi GC, Prado-Pena IB, Gómez-Caamaño A, *et al.*** Photobiomodulation for the Prevention of Oral Side Effects Secondary to Head and Neck Cancer Therapy: Results of a Randomised, Single-Blind Clinical Trial. Oral Oncology. 2025;164:107266.
5. **Marques MT, Arêde LT, Rodrigues JVS, *et al.*** Photobiomodulation as a Preventive Strategy for Oral Mucositis in Pediatric Oncology: A Systematic Review and Meta-Analysis. Journal of Dentistry. 2025;106074.

REGENERATIVE AND BIOSTIMULATORY EFFECTS OF PHOTOBIOMODULATION ON EROSIVE ORAL LICHEN PLANUS

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Objectives: to evaluate the regenerative and biostimulatory potential of photobiomodulation (PBM) in tissues affected by erosive oral lichenplanus (OLP).

Materials and methods: randomized controlled trials and meta-analyses assessed PBM *versus* topical corticosteroids in erosive OLP. PBM protocols typically utilized diode lasers (635-980 nm), with energy densities ranging from 6-120 J/cm², applied in single or multiple sessions. Outcomes included pain (VAS), lesion resolution (Thongprasom score), recurrence rates, and adverse events.

Results: PBM demonstrated significant pain reduction and clinical improvement, with efficacy comparable to topical corticosteroids. Meta-analysis revealed PBM reduced recurrence rates (RR = 0.43, 95% CI [0.25, 0.74]) and improved cure rates (RR = 1.47, 95% CI [1.05, 2.05]). PBM maintained lesion resolution and quality of life improvements at follow-up, with no reported adverse effects. Regenerative effects were observed even in recalcitrant cases, with PBM promoting mucosal healing and symptom remission.

Conclusions: PBM is a safe, non-invasive modality with robust regenerative and biostimulatory effects in erosive OLP, offering comparable efficacy to corticosteroids and superior safety. PBM is recommended as an alternative or adjunctive therapy, particularly in refractory or corticosteroid-intolerant patients.

REFERENCES

1. **Liu P, Zhou Q, Bao J, *et al.*** Effect of HighIntensity Laser Therapy and Photobiomodulation Therapy on Oral Lichen Planus-a SystematicReview and Meta-Analysis. Lasers in Medical Science. 2025;40(1):151.
2. **Ferri EP, Cunha KRL, Abboud CS, *et al.*** Photobiomodulation Is Effective in Oral Lichen Planus: A Randomized, Controlled, Dou-

ble-Blind Study. Oral Diseases. 2021;27(5):1205-1216.
3. **Salinas-Gilabert C, Gómez García F, Galera Molero F, *et al.*** Photodynamic Therapy, Photobiomodulation and Acetonide Triamcinolone 0.1% in the Treatment of Oral Lichen Planus: A Randomized Clinical Trial. Pharmaceutics. 2022;15(1):30.
4. **Roccon A, Cavallin F, Zanette G, Bacci C.** Single Session of Laser Photobiomodulation for SymptomManagement of Oral Lichen Planus: A Retrospective Study. Lasers in MedicalScience. 2023;38(1):43.
5. **Dillenburg CS, Martins MA, Munerato MC, *et al.*** Efficacy of Laser Phototherapy in Comparison to Topical Clobetasolfor the Treatment of Oral Lichen Planus: A Randomized Controlled Trial. Journal of Biomedical Optics. 2014;19(6):068002.

MANAGEMENT OF RECURRENT VENTRAL TONGUE MUCOCELE AFTER FAILED LASER THERAPY: A CASE REPORT

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Objectives: the aim of this work is to report the management of a recurrent ventral tongue mucocele after failed laser excision and the rationale for conversion to scalpel surgery in light of current evidence on recurrence risk.

Case description: the patient presented with a 8×6×5 mm painless ventral tongue swelling, later confirmed histologically as a Blandin–Nuhn cyst. Complete excision was performed under local anesthesia (mepivacaine 2% with epinephrine 1:100000) using a 15 C blade, with closure via absorbable 4/0 sutures. Postoperative care included paracetamol 1 g as needed, chlorhexidine rinses, and hyaluronic acid gel.

Materials and methods: a 15-year-old male with a recurrent ventral tongue mucocele after two failed laser excisions was managed at the Oral Surgery Unit, University of Milan, with clinical and histopathological findings, operative details, and follow-up recorded; written informed consent was obtained.

Results: at 7 days the site showed uneventful healing with minimal discomfort, and no recurrence was observed at 90-day follow-up.

Discussion and conclusions: systematic reviews show recurrence remains a concern, with CO_2 laser yielding lower rates than scalpel excision though not always significant. Ventral tongue mucoceles carry higher recurrence risk and, while laser is safe and minimally invasive, it doesn't consistently outperform scalpel surgery long-term. In recurrent cases, cold-bladed excision with careful glandular tissue removal is effective.

Further standardized studies with longer follow-up are needed.

REFERENCES

1. **Hashemi M, Zohdi M, Zakeri E, Abdollahzadeh-Baghaei T, Katebi K.** Comparison of the recurrence rate of different surgical techniques for oral mucocele: a systematic review and meta-analysis. Med Oral Patol Oral Cir Bucal. 2023;28(6):e614-21.
2. **Scribante A, Pellegrini M, Pulicari F, De Martino F, Li Vigni G, Ghizzoni M, *et al.*** Oral cavity mucocele and different surgical treatment strategies: is laser excision effective? A scoping review. Appl Sci. 2023;13(22):12327.
3. **Sadiq MSK, Maqsood A, Akhter F, Alam MK, Abbasi MS, Minallah S, *et al.*** The effectiveness of lasers in treatment of oral mucocele in pediatric patients: a systematic review. Materials (Basel). 2022;15(7):2452.
4. **Choi YJ, Byun JS, Choi JK, Jung JK.** Identification of predictive variables for the recurrence of oral mucocele. Med Oral Patol Oral Cir Bucal. 2019;24(2):e231-5.
5. **Yagüe-García J, España-Tost AJ, Berini-Aytés L, Gay-Escoda C.** Treatment of oral mucocele – scalpel versus CO2 laser. Med Oral Patol Oral Cir Bucal. 2009;14(9):e469-74.

PHOTOBIOMODULATION THERAPY IN BURNING MOUTH SYNDROME: A RANDOMIZED DOUBLE-BLIND CONTROLLED CLINICAL TRIAL

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Objectives: Photobiomodulation Therapy (PBMT) is a low-level laser therapy that promotes tissue repair. Burning Mouth Syndrome (BMS) is an idiopathic orofacial pain disorder with intraoral burning or dysesthesia, without evident mucosal lesions, possibly linked to psychological and neuropathic factors. This study evaluated the efficacy of PBMT in reducing burning pain in patients with BMS.

Materials and methods: a randomized, double-blind, controlled clinical trial was conducted with 76 patients over 19 months. At T0, burning pain was assessed with Visual Analogue Scale (VAS), Numeric Rating Scale (NRS), Short-Form McGill Pain Questionnaire (F-MPQ), Oral Health Impact Profile-14 (OHIP-14). From T1 to T4, 36 patients (Trial) received PBMT with 645 nm and 980 nm wavelengths, while 36 patient (Control) received placebo treatment; all patients completed VAS, NRS, SF-MPQ. After T4, Verbal Rating Scale of Relief (VRSR) and OHIP-14 were administered. From T5 to T13, all tests were repeated. Data were analyzed with R software ($P<0.05$).

Results: differences in VAS between Trial and Control emerged from T2 ($P<0.01$), peaking at T4-T6 ($P<0.0001$). Trial also showed significantly lower NRS scores from T2 ($P<0.01$), with the strongest effect at T4 ($P<0.0001$), but no difference at T13. SF-MPQ scores decreased at T1 ($P<0.05$), peaked at T4 ($P<0.0001$), and was not significant at T13. From T5 onward, VRSR scores were consistently higher in Trial ($P<0.0001$), with significant differences from T4 to T13 ($P<0.0001$).

Discussion and conclusions: PBMT significantly reduced pain and improved quality of life in BMS patients. Future research should refine PBMT parameters, investigating its long-term mechanisms. Comparative and adjunctive studies are needed to expand its clinical use in BMS.

REFERENCES

1. **Dompe C, Moncrieff L, Matys J, Grzech-Leśniak K, Kocherova I, Bryja A, *et al.*** Photobiomodulation-Underlying Mechanism and Clinical Applications. J Clin Med. 2020;9(6):1724.
2. **Tan HL, Smith JG, Hoffmann J, Renton T.** A systematic review of treatment for patients with burning mouth syndrome. Cephalalgia. 2022;42(2):128-61.
3. **Adamo D, Spagnuolo G.** Burning Mouth Syndrome: An Overview and Future Perspectives. Int J Environ Res Public Health. 2022;20(1):682.

LASER TREATMENT OF AN ORAL MESENCHYMAL LESION

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Objectives: to evaluate the clinico-pathological characteristics, management approaches, and outcomes of juvenile ossifying fibroma (JOF) in the maxillofacial region.

Materials and methods: retrospective analyses and systematic reviews of histopathologically confirmed JOF cases were conducted, including demographic, clinical, radiological, and histological data. Surgical interventions and follow-up outcomes were assessed across multiple cohorts.

Results: JOF predominantly affects children and young adults, with a male predilection and frequent mandibular involvement. Two histological variants, trabecular and psammomatoid, differ in age of onset and anatomical distribution. Most lesions present as painless, expansile masses with well-defined radiographic margins. Conservative management (curettage with peripheral ostectomy) yields acceptable recurrence rates (6-10%), while radical resection is associated with lower recurrence but higher morbidity.Recurrence is more common after enucleation alone, and extended resection with reconstruction demonstrates high success rates in aggressive or recurrent cases.

Discussion and conclusions: site should not be the primary determinant in JOF diagnosis. Conservative surgery is recommended as first-line treatment to minimize morbidity, reserving radical resection for extensive or recurrent lesions. Long-term follow-up is essential due to recurrence risk. Surgical planino should be individualized based on lesion extent, growth rate, and patient factors.

PRGF PHOTOBIOMODULATION AND THIRD MOLAR SURGERY

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Objectives: the extraction of impacted third molars is a common oral surgery procedure often associate with postoperative pain, swelling, and trismus. Plasma Rich in Growth Factors (PRGF), an autologous blood derivative, promotes tissue healing by stimulating cell proliferation, angiogenesis, and wound repair. Low-Level Laser Therapy (LLLT) is a non-invasive photobiomodulation method that enhances tissue regeneration and reduces inflammation and pain. This study aimed to assess the combined effect of PRGF and LLLT in reducing postoperative complications after third molar surgery.

Materials and methods: forty patients requiring mandibular third molar extraction were enrolled. Surgical difficulty was evaluated using CBCT, panoramic radiographs, and Winter and Pell & Gregory classifications. Patients were randomly divided into four groups: Group 1: PRGF in the extraction socket + LLLT (intra- and extraoral immediately post-surgery, repeated at 48h and 7d), Group 2: PRGF only, Group 3: LLLT only at T1, T2, T3 (suture site and masseter region), Group 4: Control (standard care). Pain was measured using the Visual Analog Scale (VAS) and McGill Pain Questionnaire. Swelling and trismus were assessed at five intervals: pre-surgery (T0), immediately post-surgery (T1), 48h (T2), 7d (T3), and 15d (T4).

Results: preliminary analysis showed significant reductions in pain, swelling, and trismus in Group 1 compared to all other groups at T2 and T3 ($p < 0.05$). Groups 2 and 3 had improved outcomes versus the control, though not statistically significant. Group 2 showed better edema reduction, whereas Group 3 achieved greater improvements in pain and trismus.

Discussion and conclusions: PRGF combined with LLLT effectively reduced postoperative morbidity compared to either treatment alone. These results support the regenerative potential of platelet concentrates and the photobiomodulatory benefits of LLLT. The combined approach accelerates soft tissue healing and minimizes discomfort. Larger studies with extended follow-up are needed to confirm recurrence rates, cost-effectiveness, and patient-reported outcomes.

LASER THERAPIES AND PERIPHERAL GIANT CELL GRANULOMA

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Objectives: peripheral giant cell granuloma is a benign reactive lesion of the oral mucosa, usually localized to attached gingiva or edentulous alveolar mucosa. It is often misdiagnosed as pyogenic granuloma. The objective is to present a clinical case of PGCG treated with laser excision, highlighting diagnostic and therapeutic aspects.

Materials and methods: a 62-year-old Dominican woman presented for follow-up. Clinical exam revealed a 10-14 mm nodular lesion in the buccal gingiva 2.1-2.2, initially suspected as pyogenic granuloma. A laser-assisted excisional biopsy was performed, with histopathological analysis and radiological imaging to assess surgical outcome and possible recurrence.

Results: histopathology confirmed PGCG. Laser excision enabled complete removal with minimal bleeding and good healing. Radiographs excluded recurrence or bone erosion. Collaboration with the pathologist was crucial for differential diagnosis with other giant cell lesions. Eight-year follow-up confirmed no recurrence.

Discussion and conclusions: PGCG is more frequent in women, in the fifth-sixth decades, and often involves the mandible. Diagnosis requires integrating clinical, radiological, and histopathological data. Excision with periosteal curettage lowers recurrence compared to simple excision. Laser provides hemostatic and healing advantages, though follow-up is essential since recurrence may reach 17-21%. Laser excisional biopsy, combined with curettage and accurate histopathology, is effective, while multidisciplinary collaboration and radiological monitoring optimize management.

REFERENCES

1. **Lester SR, Cordell KG, Rosebush MS, Palaiologou AA, Maney P.** Peripheral giant cell granulomas: a series of 279 cases. Oral Surg Oral Med Oral Pathol Oral Radiol. 2014;118(4):475-82.
2. **Sahingur SE, Cohen RE, Aguirre A.** Esthetic management of peripheral giant cell granuloma. J Periodontol. 2004;75(3):487-92.
3. **Fligelstone S, Ashworth D.** Peripheral giant cell granuloma: a case series and brief review. Ann R Coll Surg Engl. 2024;106(7):649-51.
4. **Ari I, Adiloglu S, Aktas A, Topaloğlu Yasan G, Usman E, Aksoy S.** Incidence, treatment method, and recurrence rate in giant cell granulomas: a retrospective study. J Craniomaxillofac Surg. 2024;52(6):697-703.
5. **Fonseca Orcina B, Schemmfelnnig EA, Chamon RCC, Guimarães DM, da Silva Kataoka MS, de Melo Alves Júnior S, *et al.*** An investigation of the differences in cortactin, MT1-MMP, TKS4, and TKS5 immunoexpression between central and peripheral giant cell granulomas. J Oral Pathol Med. 2025;54(9):884-94.

PERIPHERAL NEUROPATHIES AND PHOTOBIOMODULATION

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Objectives: oral peripheral neuropathies are a frequent complication of surgical procedures, trauma, systemic diseases (e.g., diabetes), and oncology treatments, with a negative impact on sensation, pain, and quality of life. Photobiomodulation (PBM), using low-intensity visible and near-infrared light, is proposed as a noninvasive option for managing neuropathic pain and promoting nerve regeneration. The objective is to evaluate the efficacy and safety of PBM in oral peripheral neuropathies, integrating a brief review of recent literature.

Materials and methods: randomized clinical trials, systematic reviews, and meta-analyses published between 2021 and 2025 regarding the use of PBM in peripheral neuropathies, including those of diabetic, chemotherapy-induced, and post-surgical origin, were analyzed. Efficacy parameters (pain reduction, improvement in nerve conduction, quality of life) and safety (adverse events, tolerability) were considered.

Results: PBM has been shown to be effective in reducing neuropathic pain, improving nerve conduction velocity, and improving quality of life in patients with diabetic and chemotherapy-induced neuropathy. The most commonly used parameters include wavelengths between 630 and 850 nm, with variable dosages. No serious adverse events have been reported.

Conclusions: photobiomodulation represents a promising therapeutic option for oral peripheral neuropathies, with benefits for pain, nerve function, and quality of life, and a favorable-safety profile. Further studies are needed to define optimal protocols and confirm long-term efficacy.

REFERENCES

1. **Fan X, Yan G, Cao J, *et al.*** Effectiveness and safety of photobiomodulation therapy in diabetic peripheral neuropathy: Protocol for a systematic review and meta-analysis. PLoS One. 2024;19(8):e0308537.
2. **Korada HY, Arora E, Maiya GA, *et al.*** Effectiveness of Photobiomodulation Therapy on Neuropathic Pain, Nerve Conduction and Plantar Pressure Distribution in Diabetic Peripheral Neuropathy - A Systematic Review. Curr Diabetes Rev. 2023;19(9):e290422204244.
3. **Santamarina L, de Souza MO, Sassaron LA, *et al.*** Influence of photobiomodulation on sensory symptoms, balance, and gait speed in chemotherapy-induced peripheral neuropathy. Support Care Cancer. 2025;33(4):355.
4. **Wang JY, Huang ZQ, Deng HP, *et al.*** Low level light therapy/photobiomodulation for diabetic peripheral neuropathy: protocol of a systematic review and meta-analysis. BMJ Open. 2022;12(9):e059476.
5. **Anju M, Ummer Velladath S, Arun Maiya G, *et al.*** A single blinded randomized controlled trial assessing the effect of photobiomodulation therapy on neuron specific biomarkers in type II diabetes mellitus patients with peripheral neuropathy. Diabetes Res Clin Pract. 2025;222:112087.

ORAL CANCER AND PHOTOBIOMODULATION

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Objectives: Oral squamous cell carcinoma (OSCC) is the most common oral malignancy. Photobiomodulation (PBM) uses low-intensity light to modulate cellular processes, with well-established applications in the management of oral mucositis but controversial effects on tumor biology. The objective is to summarize the most recent evidence on the effects of PBM on OSCC, with particular attention to molecular mechanisms and clinical safety.

Materials and methods: *in vitro* and *in vivo* studies and clinical trials published from 2019 to 2025, focusing on OSCC and PBM, were analyzed. The most studied irradiation parameters include blue light (420-457 nm, 2.5-70 mW/cm², 3-84 J/cm²), diode laser (660 nm, 100 mW, 6 J/cm²), and LED (660-810 nm). Outcomes related to proliferation, apoptosis, oxidative stress, autophagy, tumor progression, and safety were evaluated.

Results: PBM with blue light (420-457 nm) reduces the viability and proliferation of OSCC cells, induces cell cycle arrest (G2/M phase), endoplasmic reticulum stress, mitochondrial dysfunction, and activation of apoptotic pathways (CHOP, Bcl-2/Bax), in addition to modulating autophagy and inhibiting the PI3K/AKT pathway. *In vivo* and xenograft studies have not shown an increase in tumor progression with PBM at 660 nm, while some data suggest a potential radiosensitizing effect. The cellular response depends on the dose, frequency, and type of light.

Conclusions: photobiomodulation, particularly with blue light (420-457 nm), shows potential in reducing OSCC cell proliferation through specific molecular mechanisms.

REFERENCES

1. **Jiang H, Yang J, Fu Q, Qin H, Liu M.** 457 nm LED blue light inhibits oral squamous cell carcinoma cell proliferation via the PI3K/AKT pathway and autophagy. Photochem Photobiol Sci. 2025;24(7):1079-92.
2. **Jiang H, Fu Q, Yang J, *et al.*** Blue light irradiation suppresses oral squamous cell carcinoma through induction of endoplasmic reticulum stress and mitochondrial dysfunction. J Photochem Photobiol B. 2024;257:112963.
3. **Silveira FM, Schmidt TR, Neumann B, *et al.*** Impact of photobiomodulation in a patient-derived xenograft model of oral squamous cell carcinoma. Oral Dis. 2023;29(2):547-56.
4. **Tabosa ATL, Souza MG, de Jesus SF, *et al.*** Effect of low-level light therapy before radiotherapy in oral squamous cell carcinoma: an in vitro study. Lasers Med Sci. 2022;37(9):3527-36.
5. **Schuch LF, Campagnol D, Schmidt TR, *et al.*** Investigating the safety of photobiomodulation in oral carcinogenesis: insights into cell proliferation, invasion, and apoptosis via the 4NQO model. Sci Rep. 2024;14(1):28303.

CLINICAL EXPERIENCE WITH ND:YAG LASER SURGERY IN THE MANAGEMENT OF SALIVARY STONES

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Objectives: Sialolithiasis is caused by calculi obstructing salivary ducts, mostly the submandibular gland. Conservative management may succeed for small stones, but surgery is often required. This study aimed to evaluate the effectiveness of the Nd:YAG laser (1064 nm) in salivary stone removal, highlighting perioperative benefits compared with conventional surgery.

Materials and methods: from 2020 to 2025, 35 patients (21 men, 14 women, aged between 10 and 83 years) with sialolithiasis underwent outpatient surgery at the Oral Surgery Unit of Parma. Under local anesthesia, Nd:YAG laser incision was followed by duct dissection and dilation, stone removal, and one-week duct catheterization. Postoperative management included soft cold diet, NSAIDs as needed and butylscopolamine. Patients were followed up to 3 months.

Results: stones were located in the submandibular duct (26 cases), minor salivary glands (5) and parotid duct (4), with sizes 0,2-3 cm. Laser removal was successful in all patients, restoring duct patency and complete mucosal healing. The Nd:YAG allowed precise bloodless incisions with excellent vis-

ibility. Patients reported reduced pain and swelling compared with conventional surgery and no infections occurred, likely due to the intrinsic antibacterial effect of the Nd:YAG laser.
Conclusions: the Nd:YAG laser represents a minimally invasive and effective option for salivary stone surgery. It ensures precise surgery, faster recovery, lower postoperative discomfort and high patient satisfaction, supporting its adoption in routine clinical practice.

REFERENCES

1. **Kraaij S, Karagozoglu KH, Forouzanfar T, Veerman ECI, Brand HS.** Salivary stones: symptoms, aetiology, biochemical composition and treatment. Br Dent J. 2014;217(11):E23.
2. **Koch M, Iro H, Zenk J.** Treatment of sialolithiasis: what has changed? An update of the treatment algorithms and a review of the literature. J Clin Med. 2021;10(2):231.
3. **Zenk J, Koch M, Iro H.** New modalities in the management of human sialolithiasis. Erlangen: FAU Univ Press, 2021.

LASER-ASSISTED SURGICAL APPROACH IN MRONJ OF THE JAWS: CLINICAL OUTCOMES OF 479 SITES

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Objectives: medication-related osteonecrosis of the jaw (MRONJ) is a severe complication of antiresorptive and antiangiogenic therapies used in oncology and bone disorders. Its management is challenging due to high morbidity and impact on quality of life. This study evaluated the effectiveness of a laser-assisted surgical approach for MRONJ compared with conventional methods.
Materials and methods: we analyzed 479 MRONJ sites in 387 patients (276 women, 71.3%; 111 men, 28.7%) treated at Parma University Hospital. Among them, 287 (74.2%) had oncologic diseases and 100 (25.8%) osteometabolic disorders. Patients were divided into five groups:

- G1: medical therapy;
- G2: medical + low-level laser therapy (LLLT);
- G3: conventional surgery;
- G4: conventional surgery + LLLT;
- G5: Er:YAG laser surgery + LLLT.

All received antibiotics (Amoxicillin 1 g + Metronidazole 500 mg twice daily for three weeks) and five weekly LLLT sessions (Nd:YAG 1064 nm, 1.25 W, 15 Hz).
Results: clinical improvement occurred in 85.2% of sites, with complete healing in 71.6%. Outcomes:

- G1: 46.7% improvement, 28.9% healing;
- G2: 79.2%, 50.3%;
- G3: 90.9%, 81.8%;
- G4: 96.2%, 90.4%;
- G5: 97%, 91%.

Groups were grouped into T1 (G1+G2+G3) and T2 (G4+G5). Chi-square analysis showed significantly better results in surgical groups (T2) for both improvement and healing ($p<0.001$).
Conclusions: laser-assisted surgery improves MRONJ outcomes, reducing invasiveness, promoting tissue repair, and accelerating healing. Adjunctive laser therapy may enhance results, but surgery remains the key factor for success.

REFERENCES

1. **Vescovi P, De Francesco P, Giovannacci I, Leão JC, Barone A.** Piezoelectric Surgery, Er:YAG Laser Surgery and Nd:YAG Laser Photobiomodulation: A Combined Approach to Treat Medication-Related Osteonecrosis of the Jaws (MRONJ). Dent J (Basel). 2024;12(8):261.
2. **Bedogni A, Mauceri R, Fusco V, Bertoldo F, Bettini G, Di Fede O, *et al.*** Italian position paper (SIPMO-SICMF) on medication-related osteonecrosis of the jaw (MRONJ). Oral Dis. 2024;30(6):3679-709.
3. **Goker F, Grecchi E, Grecchi F, Francetti L, Del Fabbro M.** Treatment of medication-related osteonecrosis of the jaw (MRONJ). A systematic review. Eur Rev Med Pharmacol Sci. 2021;25(6):2662-73.

LASER-ASSISTED SURGICAL APPROACH OF MINOR SALIVARY GLAND CYSTS: A RETROSPECTIVE STUDY

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Objectives: this retrospective study aims to evaluate whether there are differences in the rate of oral mucocele recurrence after its surgical removal by scalpel or Laser (Diodes and Nd:YAG).

Materials and methods: data were collected and analyzed on 120 patients: 71 men (59%) and 49 women (40.8%) treated from 2020 to 2025 at the Odontostomatology department of the Parma University Hospital. Patients ranged in age from 7 months to 88 years.

The location of the mucocele was varied: 94 (78.3%) cases on the lower lip; 14 (11.6%) cases in the oral floor; 5 (4.2%) cases on the genienal mucosa; 4 (3.3%) cases on the ventral surface of the tongue; 1 (0.8%) case on the palatine pillar; 1 (0.8%) case in the oral vestibule; 1 (0.8%) case on the hard palate.

The size of the treated mucoceles has a range of 0.1-4 cm, with an average size of 0.92 cm.

The surgical removal of the lesions was carried out by Nd:YAG Laser (Photona, 3.5 W, 60 Hz, PD 488.281 W/cm^2) and Diode Laser (K Laser Blue Dental©, Eltech K-Laser s.r.l., Treviso, Italy, 3.5 W, continuous wave, 445 nm).

Results: the data obtained from the 120 patients treated at the Odontostomatology Department of Parma showed excellent healing with a low recurrence rate: a reappearance of the lesion was observed in only 7 cases (5.8%) treated by laser-assisted surgery.

Conclusions: the choice of the type of treatment can affect the clinical outcome, in fact, laser-assisted surgery, as reported by the data of the present study, showed a low recurrence rate compared to conventional techniques (traditional scalpel blade).

RECONSTRUCTION OF SURGICAL DEFECTS FROM TONGUE CANCER LASER EXCISION WITH XHYA: 10 CASES

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Objectives: hyaluronic acid (nHA) effect on hard and soft tissue regeneration is documented, and in this regard, it would seem critical its role in modulating inflammation process. A synthetic form of nHA, the cross-linked HA (xHyA), offers better resistance to mechanical stress and degradation processes, making it more suitable for clinical applications. We report the results about the use of xHyA in a surgical setting aimed at promoting regeneration of surgical defects of the tongue following the removal of oral early cancer.

Materials and methods: we report 10 cases of *in situ* or microinvasive tongue cancer. All lesions were excised with safety margins using a Nd:YAG laser. Afterwards, xHyA gel was applied to the bottom of the surgical wound. Lastly, a resorbable membrane, contoured according to the defect margins, was placed over and fixed with resorbable sutures.

Results: at one week-follow-up, all surgical sites were covered with fibrin, with no signs of inflammation. Moreover, no subjects reported functional alterations and only 2 patients complained of post-operative pain. At 3 weeks, the assessments were repeated, also investigating the presence of complications: the results mirrored those at one week.

At the 3-month, 2 of the 10 patients developed a reactive lesion at the surgical site.

In all cases, complete re-epithelialisation was achieved in an average time of three months.

Conclusions: based on cases, it is possible to conclude that the application of xHyA is associated with favorable healing outcomes, like rapid tissue repair, minimal postoperative discomfort, absence of inflammation, and preservation of function.

REFERENCES

1. **Al-Khateeb R, Prpic J.** Hyaluronic Acid: The Reason for Its Variety of Physiological and Biochemical Functional Properties. Applied Clinical Research, Clinical Trials and Regulatory Affairs. 2019;6(2):112-59.
2. **Salbach J, Rachner TD, Rauner M, Hempel U, Anderegg U, Franz S, *et al.*** Regenerative potential of glycosaminoglycans for skin and bone. J Mol Med. 2012;90(6):625-35.
3. **Choi SC, Yoo MA, Lee SY, Lee HJ, Son DH, Jung J, *et al.*** Modu-

lation of biomechanical properties of hyaluronic acid hydrogels by crosslinking agents. J Biomed Mater Res A. 2015;103(9):3072-80.
4. **Iaria R, Giovannacci I, Meleti M, Leão JC, Vescovi P.** Management of a carcinoma in situ of the tongue margin, using a Nd:YAG laser, cross-linked hyaluronic acid (xHyA) gel and a porcine pericardium resorbable membrane: a case report. BMC Oral Health. 2025;25(1):378.
5. **Iaria R, Vescovi P, Corcione L, Sala R, Giovannacci I.** Cross-Linked Hyaluronic Acid and Neodymium-Doped Yttrium Aluminum Garnet Laser for Oral Soft Tissue Regeneration: A Proposal of a New Surgical Technique. Cureus. 2025;17(7):e89045.

EXTRACTION OF IMPACTED LOWER THIRD MOLARS: HISTOMORPHOLOGICAL DIFFERENCES BETWEEN OSTEOTOMY PERFORMED WITH A SURGICAL BUR AND ER:YAG LASER

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Objectives: compare the histomorphological characteristics of osteotomy performed using a surgical bur and Er:YAG laser in QSP mode on an animal model (*ex-vivo*).
Methods: six bone tissue samples (2x2 mm) were analyzed using 3D microscopy, a profilometer, and histology. The samples were taken from the posterior vestibular side of a pig mandible-three obtained using a Lindemann surgical bur at 40,000 rpm and three using an Er:YAG laser in QSP mode (energy: 330 mJ, frequency: 15 Hz, power: 4.95 W).
Results: the results obtained from the animal pilot study show that the Er:YAG laser reduces microfractures and debris, providing a more precise cut compared to the surgical bur. Moreover, at the histological level, the cut made with the Er:YAG laser showed less necrotic tissue and fewer apoptotic cells versus the surgical bur.
Conclusions: the results suggest that the Er:YAG laser is less traumatic than the surgical bur. It is expected that the osteotomy performed with the Er:YAG laser will have a better post-operative course as the absence of debris on the bone surface results in increased inflammatory cells, revascularization, and proliferation of fibroblasts and osteoblasts during the healing phase, all of which lead to the formation of osteoid tissue.

USE OF THE ERBIUM:YAG LASER IN THE TREATMENT OF PERI-IMPLANTITIS: 5 CASE SERIES OF A CLINICAL PILOT STUDY

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Objectives: the present study aims to evaluate differences in post-operative benefits of peri-implantitis surgical treatment using manual instrumentation with curettes and irradiation with Er:YAG laser, compared to only curettes instrumentation. We report five clinical cases of peri-implantitis treated with the combination of curettes and Er:YAG laser, included in the protocol of a clinical pilot study.
Methods: the pilot study, which will include 28 subjects with active peri-implantitis, has received the acceptance of the Ethics Committee of the Area Vasta Emilia Nord (AVEN) (Code: 7083). Study protocol requires that patients are subjected to a dental examination and radiographs to confirm the peri-implantitis diagnosis. The patients will be randomized into two groups: one treated with manual curettes via surgery, the other with manual curettes via surgery and irradiation with Er:YAG laser (LightWalker ST-E, Fotona-Slovenia: 100 mJ, 30 Hz, fluence of 60 J/cm^2). The protocol provides for a full thickness trapezoidal flap to expose peri-implant tissues and remove bacterial deposits with different tools depending on the group, followed by cleansing and suturing of the surgical site.
Results: five cases of peri-implantitis are treated using curettes and Er:YAG laser, following the protocol. The main advantages observed are the effectiveness of the Er:YAG laser in removing bacterial deposits and biofilm from implant surfaces, the ability to clean implant surfaces without altering their macrostructure, the capacity to reduce peri-implant inflammation. The precise and minimally invasive nature of the laser surgery allows for targeted treatment, reducing the trauma to sur-

rounding tissues, postoperative pain, swelling and bleeding. This results in greater comfort for the patient, a lower need for post-operative analgesics and faster recovery times.

Conclusions: based on our preliminary results, Er:YAG seems a safe and promising tool that can be used to manage peri-implantitis infection.

COMBINED PIEZOSURGERY, ER:YAG AND DIODE PHOTOBIOMODULATION IN MRONJ TREATMENT

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Objectives: medication-related osteonecrosis of the jaw (MRONJ) is a severe complication in patients treated with antiresorptive or antiangiogenic drugs. Its management is challenging due to the lack of standardized protocols. This study aims to evaluate the effectiveness of an integrated surgical approach combining piezosurgery with Er:YAG laser for bone ablation and diode laser for photobiomodulation.

Materials and methods: a 58-year-old woman with metastatic breast cancer under Palbociclib, Anastrozole, and Denosumab presented with pain, swelling, and suppuration in the right mandibular premolar area. CBCT confirmed MRONJ stage 2 (AAOMS criteria). Despite multiple cycles of antibiotics (Amoxicillin + Metronidazole) and laser biostimulation, symptoms persisted. The patient underwent local anesthesia surgery including piezosurgery ostectomy, removal of implants (teeth 4.5, 4.6) and tooth 4.7, Er:YAG laser bone vaporization, silk 3/0 sutures, and diode laser photobiomodulation.

Results: the postoperative course was uneventful. Complete mucosal healing without signs of infection was achieved one month after surgery and maintained without recurrence for over three years of follow-up.

Conclusions: the innovative approach combining piezosurgery, Er:YAG, and diode laser photobiomodulation showed promising clinical outcomes in the management of MRONJ. The synergistic effect of these techniques addressed key pathological aspects while reducing postoperative discomfort. The absence of recurrence in the treated case suggests potential long-term efficacy, although larger clinical studies are needed to confirm these findings.

ER:YAG LASER ASSISTED SURGERY AND ADJUVANT THERAPIES IN OSTEOPETROSIS-RELATED OSTEONECROSIS OF THE JAW

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Objectives: osteopetrosis is a rare hereditary disorder due to osteoclasts disfunction, leading to impaired bone remodeling. Jaw osteomyelitis is the most frequent complication, often progressing to osteonecrosis. No consensus exists on the optimal approach; as antibiotics alone are ineffective, surgery is the main treatment. This study evaluates a combined approach of Er:YAG laser-assisted surgery, photobiomodulation and hyaluronic acid in managing Osteonecrosis of the Jaw secondary to osteopetrosis.

Materials and methods: a 59-year-old patient with osteopetrosis presented with a hypertrophic fistula in edentulous site 3.6 and pain of tooth 3.5.

Under antibiotic therapy (amoxicillin 1 g + metronidazole 500 mg/12 h), surgical extraction of 3.5 with osteotomy was performed.

A full-thickness mucoperiosteal flap was raised. Bone margins were delineated using piezosurgery. Tooth 3.5 was extracted, followed by bone block resection with safety margins and excision of reactive tissue. Residual bone was vaporized using an Er:YAG laser (260 mJ, 20 Hz, 5.2 W, 60 J/cm^2), followed by cross-linked hyaluronic acid gel application and 3/0 silk sutures. Photobiomodulation with Nd:YAG laser (300 mW, 15Hz, 1.25W) was applied at surgery and weekly for 4 sessions.

Results: at 2-weeks, healing was moderate. Follow-ups at 4

and 8 months showed complete healing.

Conclusions: this approach proved effective, achieving healing with primary closure and no complications despite the vascular impairment of the disease. It shows promise in lowering recurrence risk and improving outcomes in osteonecrosis secondary to osteopetrosis.

REFERENCES

1. **Carvalho PHA, Moura LB, Real Gabrielli MF, Cabrini Gabrielli MA, Pereira Filho VA.** Maxillary osteomyelitis associated with osteopetrosis: Systematic review. J Craniomaxillofac Surg. 2018;46(11):1905-10.

2. **Infante-Cossio P, Gonzalez-Perez LM, Martinez-de-Fuentes R, Infante-Cossio M, Casta±o-Seiquer A, Jimenez-Castellanos E.** Maxillomandibular osteomyelitis associated with osteopetrosis. J Craniofac Surg. 2014;25(1):e79-82.

EFFECTS OF LASER PHOTOBIOMODULATION ON PARESTHESIA FOLLOWING LOWER THIRD MOLAR EXTRACTION: A TRIPLE-BLIND RANDOMIZED CONTROLLED CLINICAL TRIAL

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Objectives: inferior alveolar nerve injury is a complication of third molar extraction, leading to paresthesia lasting over six months in less than 1% of cases. Photobiomodulation Therapy (PBMT) is a laser therapy that modulates tissue metabolism, promoting nerve regeneration and repair. This study evaluated PBMT in patients with paresthesia following lower third molar extraction.

Materials and methods: a six-week triple-blind randomized controlled trial was conducted with 14 adults with post-extraction paresthesia. At T0, assessments included mapping of the paresthetic area, PinPrick Test (PPT), Semmes-Weinstein Monofilament Test (SWMT), Two-Point Discrimination Test (2-PDT), Visual Analogue Scale (VAS), Thermal Perception Test (TPT), an anamnestic questionnaire (QA), Oral Health Impact Profile-14 (OHIP-14). From T1 to T4, all patients received support therapy; the trial group received 660 nm diode laser PBMT, while the control group received placebo treatment. At T5, all tests were repeated. Data were analyzed with SPSS ($P<0.05$).

Results: statistical analysis showed that TPT ($P = 0.0146$), OHIP-14 ($P = 0.028$) and SWMT ($P = 0.074$) were significant. PPT ($P = 0.1166$), 2-PDT ($P = 0.3531$), VAS ($P = 0.0798$), QA ($P = 0.1241$) were not significant.

Discussion and conclusions: improvements in SWMT, TPT and OHIP-14 indicate enhanced tactile and thermal perception and reduced daily-life impact, supporting BMT effects on post-extraction paresthesia. Synergistic effects of support therapy cannot be excluded. Larger studies with longer follow-up are needed to confirm these results and determine which sensory modalities benefit most from treatment.

REFERENCES

1. **Del Lhano NC, Ribeiro RA, Martins CC, Assis NMSP, Devito KL.** Panoramic versus CBCT used to reduce inferior alveolar nerve paresthesia after third molar extractions: a systematic review and meta-analysis. Dentomaxillofac Radiol. 2020;49(4):20190265.

2. **Hakimiha N, Rokn AR, Younespour S, Moslemi N.** Photobiomodulation Therapy for the Management of Patients With Inferior Alveolar Neurosensory Disturbance Associated with Oral Surgical Procedures: An Interventional Case Series Study. J Lasers Med Sci. 2020 Fall;11(Suppl 1):S113-S118.

3. **Ma Y, Yang M, Chen X, Qu W, Qu X, He P.** The effectiveness of photobiomodulation therapy on inferior alveolar nerve injury: A systematic review and META-analysis. PLoS One. 2023;18(8):e0287833.

LASER-ASSISTED MANAGEMENT OF ORAL MUCOCELE: CLINICAL EFFICACY OF 915 NM DIODE LASER

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Objectives: to describe a clinical case of oral mucocele treated using a 915 nm diode laser, evaluating its clinical effectiveness, advantages over conventional surgery, and postoperative healing quality.

Case description: a 22 y.o. male healthy patient presented with a benign cystic lesion of the lower lip, clinically consistent with a mucocele of the minor salivary glands. The lesion caused discomfort, swelling, and mild functional limitation. Surgical excision using a 915 nm diode laser was selected as the treatment approach.

Materials and methods: the procedure was performed using a diode laser (wavelength 915 nm) in pulsed mode, 2.5 W 200 Hz, 50% duty, ensuring excellent intraoperative visibility and precise control of surgical planes. Minimal bleeding was observed due to the coagulative effect of the laser. The excised specimen was submitted for histopathological examination, which revealed well-preserved tissue architecture and negligible thermal artifacts.

Results: the postoperative course was uneventful. The patient reported minimal pain and mild edema during the first few days. Complete healing was achieved within three weeks, with no scarring or recurrence. Histological examination confirmed the diagnosis of mucocele and the specimen's suitability for evaluation.

Discussion and conclusions: diode laser treatment of oral mucocele represents a valid alternative to conventional surgery. Compared with the traditional scalpel technique, diode lasers offer higher precision, better hemostasis, reduced postoperative discomfort, and faster healing. The outcomes obtained are consistent with the current literature, confirming that diode laser-assisted excision is a safe, effective, and predictable approach, providing excellent functional and aesthetic results while maintaining full histological evaluability of the specimen.

REFERENCES

1. **Scribante A, Pellegrini M, Pulicari F, De Martino F, Li Vigni G, Ghizzoni M, Spadari F.** Oral Cavity Mucocele and Different Surgical Treatment Strategies:
Is Laser Excision Effective? A Scoping Review. Applied Sciences. 2023;13(22):12327.
2. **Ruga E, Garrone M, Calvi RM, Riversa R.** Manual of diode laser in dentistry and stomatology ed. EDRA 2021. 216,224-7.
3. **Sadiq MSK, Maqsood A, Akhter F, *et al.*** The Effectiveness of Lasers in Treatment of Oral Mucocele in Pediatric Patients: A Systematic Review. Materials (Basel). 2022;15(7):2452.
4. **Besbes A, Elelmi Y, Khanfir F, Belgacem R, Ghedira H.** Recurrent Oral Mucocele Management with Diode Laser. Case Rep Dent. 2020;2020:8855759.
5. **Gogoi A, Pawar M, Badarkhe A, Vhatkar B, Bagde H, Kharat S.** Diode Laser Approach for Excision of Solitary Mucocele. J Pharm Bioallied Sci. 2022;14(Suppl 1):S1066-S1069.

STERILIZATION OF CLINICAL SPACES, HIGH-TECH INSTRUMENTS AND LASER OPTICS: INITIAL FINDINGS ON FAST CHEMICAL STERILIZATION SYSTEM BASED ON REDUCING FREE RADICALS

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Objectives: to verify the effectiveness of a spray-based sanitization protocol that releases free radicals in reducing microbical contamination on dental operative surfaces.

Materials and methods: twenty surface samples were collected at the SCDU Odontostomatology Unit, Sant'Andrea Hospital (Vercelli, Italy). Sampling points included: Lamp handles, Control panels, Dental devices, Laser optics, Operator chairs, Keyboards, X-ray tubes. Microbial contamination was measured in **CFU/cm²** before and after disinfection, following **UNI EN ISO 18593:2018** and **UNI EN ISO 4833-1:2022** standards.Statistical analysis was performed using the **Chi-square test** to assess the significance of differences between pre- and post-treatment results.

Results: before sanitization, bacterial loads ranged from **2 to 8**

CFU/cm², with a maximum of **360 CFU** detected on a lamp accessory. After disinfection, all samples showed **<1 CFU/cm²**, indicating almost complete microbial reduction. Statistical analysis ($\chi^2 = 54.55$; df = 18; p = 0.000015) confirmed a **significant difference** between pre- and post-treatment data, demonstrating the **high effectiveness** of the free-radical-based spray protocol.

Discussion and conclusions: the findings indicate that the **fast chemical sterilization system** based on **reducing free radicals** is capable of achieving a substantial decrease in surface bacterial contamination in dental settings. Although the initial data are promising, the **limited sample size** restricts statistical strength. Further **multicenter studies** are required to confirm these results and to evaluate the long-term reliability and rapid action of this system. Overall, the study supports the use of **free-radical-releasing sprays** as a **fast, safe, and reliable method** to enhance **biosafety** and **prevent cross-contamination** in dental and clinical environments.

REFERENCES

1. **WHO.** Practical Guidelines for Infection Control in Health Care Facilities. 2003.
2. **Rutala WA, Weber DJ.** Disinfection and Sterilization in Health Care Facilities: An Overview and Current Issues. Infect Dis Clin North Am. 2016;30(3):609-37.
3. **Ruga E, Garrone M, Calvi RM, Melle A, Agnone AM, Nuzzolese E.** New frontiers for reducing biological risk in dental offices: considerations on disinfection and sterilization of instruments, surfaces, and devices prior to dental, hygiene, and aesthetic medicine treatments. Infomedix Odontoiatria Italiana. 2024;12.
4. **Cirillo C, Botticelli D, Benedicenti S.** Quantitative Suspension Test for the Evaluation of a Cold Sterilization System Based on Reducing Free Radicals Compared to Autoclave Sterilization Cycles. Preprints. 2025;2025091495.

SURGICAL MANAGEMENT WITH PHOTOBIOMODULATION IN MEDICATION-RELATED JAW OSTEONECROSIS

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Objectives: to describe the management of denosumab-related osteonecrosis of the jaw treated with surgery and photobiomodulation (PBM).

Case description: a 77-year-old woman on denosumab therapy developed exposed necrotic bone with vestibular fistula after extraction of teeth 3.5-3.7. CBCT showed a radiolucent area with preserved cortices. She received amoxicillin/clavulanic acid and metronidazole combined with two cycles of eight PBM sessions. As suppuration and bone sequestrum persisted, surgical removal was performed with perioperative PBM protocol. Histology confirmed osteonecrosis with acute osteomyelitis and chronic mucosal inflammation.

Materials and methods: PBM was combined with systemic antibiotics, topical chlorhexidine 0.20%, delicate surgical removal of the naturally separated bone sequestrum and hyaluronic acid gel.

Results: progressive improvement with disappearance of pain, suppuration, and mucosal inflammation were observed. Radiological follow-up (CBCT) showed progressive bone healing with complete re-ossification of the site. At three months the patient achieved restitutio ad integrum with functional recovery and no recurrence.

Conclusions: surgery combined with PBM achieved mucosal and bone healing with restitutio ad integrum. PBM is a validated adjunct in MRONJ, offering analgesic (C-fiber modulation), anti-inflammatory (↓TNF-α, IL-1, histamine), and regenerative (fibroblasts, keratinocytes) effects, supporting both conservative and surgical protocols within an effective therapeutic window of 2-3 J/cm².

REFERENCES

1. **Del Vecchio A, Tenore G, Pergolini D, Palaia G, Rocchetti F, Romeo U.** The role of laser photobiomodulation (PBM) in the management of patients at risk or affected by MRONJ. Narrativi. 2022;2(1):18-28.
2. **Pergolini D, Del Vecchio A, Palaia G, Rocchetti F, Cefalà R, De Angelis R, *et al.*** Photobiomodulation after surgical extraction of the lower third molars: a narrative review. Oral. 2022;2(1):18-28.
3. **Hanna R, Miron IC, Dalvi S, Arany P, Bensadoun RJ, Benedicenti S.** A systematic review of laser photobiomodulation dosimetry and treatment protocols in the management of medication-related osteonecrosis of the jaws: a rationalised consensus for future randomised controlled clinical trials. Pharmaceuticals (Basel). 2024;17(8):1011.

EXTRANEURAL SOFT TISSUE PERINEUROMA OF THE ORAL CAVITY: A RARE CASE REPORT

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Objectives: perineuromas are rare peripheral nerve sheath tumors, exceptionally uncommon in the oral cavity. Each reported case is clinically relevant, improving diagnostic precision among oral health professionals.

Case description: a 68-year-old female was referred for the evaluation of a slow-growing, painless, gingival swelling. The intraoral examination revealed a well-delineated, exophytic, pedunculated, elastic, non-tender mass on the gingival mucosa of 4.2-4.3 area. The covering mucosa appeared similar to the adjacent tissue. The patient reported no history of trauma. The vitality test was positive for tooth 4.3. No cervical lymphadenopathy was detected.

Materials and methods: differential diagnosis included benign soft tissue tumors and reactive lesions such as neurofibroma, schwannoma, pyogenic granuloma, traumatic neuroma, myofibroma, and benign fibrous histiocytoma. An excisional biopsy was performed by a blue light diode laser (λ: 445 ± 5 nm, 2.5 W in CW mode, fluency: 3100 J/cm^2) using a 320 µm fiber. The sample was sent for histological evaluation, and immunohistochemical analysis was requested.

Results: given the results and the differential diagnosis, in accordance with the scientific literature, a final diagnosis of extraneural perineurioma (EPN) was established. No recurrence was observed at 1-year follow-up.

Discussion and conclusions: accurate recognition of EPN in the oral cavity is crucial to avoid unnecessary aggressive surgery. Due to its rarity, precise diagnosis and adequate management are crucial to prevent overtreatment and reduce medico-legal risks from misdiagnosis.

REFERENCES

1. **Schadel CM, Anderson CW, Chi AC, Steed MB.** Perineurioma of the tongue: a case report and review of the literature. J Oral Maxillofac Surg. 2019;77:329.e1–329.e7.
2. **Kurihara J, Yokoo S, Ichikawa M, Shimizu T, Ogawa M, Seki M.** Intraosseous intraneural perineurioma derived from the inferior alveolar nerve with an abnormality of chromosome 22 and expression of the BCR-ABL fusion gene: report of a case and review of recent literature. World J Surg Oncol. 2018;16:189.
3. **Lazarus SS, Trombetta LD.** Ultrastructural identification of a benign perineurial cell tumor. Cancer. 1978;41:1823-9.
4. **D'Errico S, Turillazzi E, Zanon M, Viola RV, Frati P, Fineschi V.** The model of "informed refusal" for vaccination: how to fight against anti-vaccinationist misinformation without disregarding the principle of self-determination. Vaccines (Basel). 2021;9:110.
5. **Pergolini D, Mohsen M, Zaami S, De Paola L, Rocchetti F, Angileri C, *et al.*** Extraneural soft tissue perineurioma of the oral cavity: a rare case with medico-legal implications and literature review. Life (Basel). 2025;15(9):1343.

LASER PHOTOBIOMODULATION: A NARRATIVE REVIEW BASED ON CLINICAL PRACTICE CONSENSUS

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Objectives: this review analyses the current scientific consensus on photobiomodulation (PBM), focusing on its mechanisms, the critical issue of dosimetry, and the future directions needed for its integration into daily medical practice.

Materials and methods: a narrative literature review was conducted to synthesize evidence on the definition, biological mechanisms, and challenges of PBM. The review also examined future prospects for standardizing future treatments.

Results: PBM uses non-ionizing photonic energy to produce non-thermal therapeutic effects. These effects include reducing pain and inflammation, modulating the immune response, and promoting tissue healing.

The primary mechanisms occur at intracellular, membrane, and extracellular levels. Clinical reproducibility is hindered by a biphasic dose curve (hormesis), where both low and high doses are ineffective. The main obstacle to acceptance is that

measuring external irradiation is insufficient to predict the internal biological effect due to individual-specific light-tissue interaction.

Discussion and conclusions: PBM is an effective and safe non-pharmacological therapy, but its spread in the medical field is hindered by the lack of a standard dosimetry. To overcome this problem, research is focusing on new dosing models, such as photon fluence, and the use of digital technologies (simulations and artificial intelligence) to personalize treatments. The goal is to make PBM a more predictable and reliable therapy, thus facilitating its clinical acceptance and reimbursement.

REFERENCES

1. **Mosca RC, Ong AA, Albasha O, Bass K, Arany P.** Photobiomodulation Therapy for Wound Care: A Potent, Noninvasive, Photoceutical Approach. Adv Skin Wound Care. 2019;32(4):157-67.
2. **Pires de Sousa MV, Hamblin MR.** Digital Transformation of Photobiomodulation Therapy: A Step Forward to Become Mainstream? Photobiomodul Photomed Laser Surg. 2021;39(5):309-10.

CURRENT KNOWLEDGE OF PBM APPLICATION IN MANAGEMENT OF MRONJ: NARRATIVE REVIEW AND CASE REPORT

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Objectives: the study aims to provide an overview of the current knowledge on different applications of photobiomodulation (PBM) in the management of medication-related osteonecrosis of the jaw (MRONJ).

Methods: a literature search was conducted in PubMed and Scopus to identify relevant studies published in the last five years. Three clinical cases treated with PBM are presented.

Results: both the literature and the treated cases confirmed the utility of PBM as a palliative approach, providing pain relief, improving tissue healing and promoting bone spontaneous sequestration.

The PBM was successfully proposed as an adjunctive in the management of MRONJ in three conditions: 1) as a palliative approach in compromised MRONJ patients when the surgical approach was not feasible, 2) as an adjunctive for surgical extraction in patients at-risk for MRONJ, and 3) PBM in combination with Leukocyte-and-Platelet-Rich Fibrin (L-PRF) for the surgical management of MRONJ.

Discussion and conclusions: evidence suggests that PBM may stimulate osteogenic growth factor synthesis, support fibroblast differentiation, promote osteoblast proliferation and reduce cytokine and prostaglandin levels. These biological mechanisms, along with the observed outcomes such as pain reduction, progressive mucosal healing, decreased inflammation and oedema, provide a rationale for PBM as both a preventive and therapeutic adjunct.

REFERENCES

1. **Hanna R, Miron IC, Dalvi S, Arany P, Bensadoun RJ, Benedicenti S.** A Systematic Review of Laser Photobiomodulation Dosimetry and Treatment Protocols in the Management of Medications-Related Osteonecrosis of the Jaws: A Rationalised Consensus for Future Randomised Controlled Clinical Trials. Pharmaceuticals (Basel). 2024;17(8):1011.
2. **Tenore G, Mohsen A, Del Vecchio A, Palaia G, Rocchetti F, Borghetti L, *et al.*** Surgical extraction with photobiomodulation as an adjunctive modality in patients at-risk for medication-related osteonecrosis of the jaw: retrospective study. BMC Oral Health. 2025;25(1):627.
3. **Tenore G, Zimbalatti A, Rocchetti F, Graniero F, Gaglioti D, Mohsen A, *et al.*** Management of Medication-Related Osteonecrosis of the Jaw (MRONJ) Using Leukocyte- and Platelet-Rich Fibrin (L-PRF) and Photobiomodulation: A Retrospective Study. J Clin Med. 2020;9(11):3505.
4. **Del Vecchio A, Tenore G, Pergolini D, Rocchetti F, Palaia G, Romeo U.** The Role of the Laser Photobiomodulation (PBM) in the Management of Patients at Risk or Affected by MRONJ. Oral. 2022;2(1),7-15.
5. **Monteiro L, Vasconcelos C, Pacheco JJ, Salazar F.** Photobiomodulation laser therapy in a Lenvatinib-related osteonecrosis of the jaw: A case report. J Clin Exp Dent. 2021;13(6):e626-9.

DIODE LASER EXCISION FOR EXTENSIVE ORAL PAPILLOMATOSIS IN A MULTIMORBID FRAGILE PATIENT

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Objectives: Human Papillomavirus (HPV) involves the stratified squamous epithelium, causing tipical lesions. Diode laser is effective for eradicating HPV lesions minimizing recurrences. This case report describes the use of diode laser in an oncological patient with widespread oral, cutaneous, esophageal, oropharyngeal and hypopharyngeal involvement.

Case description: a 78 y.o. man, suffering from renal failure, heart disease and lung cancer was sent by an infectious diseases specialist for an oral check. The examination revealed multiple lesions on the palate, buccal mucosa and upper labial fornix. A multispecialistic team was involved in the management of the patient regarding the extraoral localizations of other lesions.

Materials and methods: after a local anesthesia, the largest lesions were excised using a diode laser 980 nm, at 2.5 W in CW. Histological examination was performed to confirm the clinical suspect of HPV lesions.

Results: the postoperative course was regular. The 7-day follow-up showed excellent healing without bleeding, swelling, infection or pain. Histology confirmed squamous cell papilloma in all samples. Nowadays, the patient is subjected to continuous follow-up and, when his general health conditions allow it, undergoes multiple laser excisions.

Discussion and conclusions: the diode laser ensured bloodless surgery, optimal soft tissue control and rapid recovery. In this difficult background of extensive oral papillomatosis in a frail patient, laser technology is safe and effective, improving surgical management, healing and patient comfort.

REFERENCES

1. **Angiero F, Buccianti A, Parma L, Crippa R, Benedicenti S, Rossi E, *et al.*** Human papilloma virus lesions of the oral cavity: healing and relapse after treatment with 810-980 nm diode laser. Lasers Med Sci. 2015;30(3):747-51.
2. **Eversole LR.** Papillary lesions of the oral cavity: relationship to human papillomaviruses. J Calif Dent Assoc. 2000;28(12):922-7.

LASER PHOTOBIOMODULATION TO ENHANCE HEALING AFTER DENTAL AUTOTRANSPLANTATION: CASE REPORT

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Objectives: permanent maxillary canine impaction affects 2% of the population, more often in females, and is mainly caused by genetic and environmental factors. Treatment options include surgical exposure, autotransplantation or extraction with prosthetic replacement. A case of an impacted maxillary canine that was surgically repositioned using L-PRF membranes, bone graft, orthodontic stabilisation, and diode laser photobiomodulation (PBM) has been reported.

Case description: a 20-year-old female presented with a missing upper canine. Clinical and radiographic evaluations revealed an impacted maxillary canine with correct axial orientation. Bone-anchored traction via mini screw was attempted without success, leading to a diagnosis of ankylosis.

Materials and methods: surgical extraction and autotransplantation of the canine were performed, using a PRF-based bone regeneration protocol (L-PRF, heterologous bone graft, PRF membranes). Diode laser PBM was applied to support healing (λ: 980 nm, spot area: 0.8 mm, dose: 5 J/cm^2). The protocol consisted of 10 sessions of laser PBM with a scanning movement, administered every other day over 20 days.

Results: the clinical and radiographic follow-up, 8 months after surgery, revealed excellent stability of the canine and successful bone regeneration.

Discussion and conclusions: according to literature, autotransplantation is a valid solution for preserving impacted canines without the need for prosthetics or implants. PBM effectively promoted revascularisation, tissue stimulation and pain control.

REFERENCES

1. **Grisar K, Nys M, The V, Vrielinck L, Schepers S, Jacobs R, *et al.*** Long-term outcome of autogenously transplanted maxillary canines. Clin Exp Dent Res. 2019;5(1):67-75.
2. **Fan Y, Perez K, Dym H.** Clinical Uses of Platelet-Rich Fibrin in Oral and Maxillofacial Surgery. Dent Clin North Am. 2020;64(2):291-303.
3. **Impellizzeri A, Horodynski M, De Stefano A, Guercio-Monaco E, Palaia G, Serritella E, *et al.*** Disinclusion of Palatally Impacted Canines with Surgical and Photobiomodulating Action of a Diode Laser: Case Series. Appl Sci. 2021;11(11):4869.
4. **Tenore G, Mohsen A, Pergolini D, Podda GM, Romeo U.** Impact of single-session intraoral and extraoral photobiomodulation on pain control after extraction of impacted mandibular third molar: A pilot study. Applied Sciences (Switzerland). 2024;14(8):3268.

LASER SURGERY *VS* SCALPEL FOR HPV-RELATED LESIONS: NARRATIVE REVIEW AND CASE REPORT

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Objectives: to review narratively efficacy, postoperative outcome, recurrence rate, and histopathological reliability of laser excision versus scalpel surgery in HPV-related oral lesions.

Methods: a narrative review was conducted via PubMed. Eligible studies were randomized trials, retrospective cohorts, or case reports that compared laser excision (CO_2, Nd:YAG, Er:YAG, Diode) with scalpel surgery published in the last 10 years. Data on efficacy, hemostasis, pain, healing, recurrence, and histopathological assessment were extracted and synthesized. Two clinical cases treated with blue diode laser (445 nm, power of 1.6 W in pulsed mode with fiber diameter of 320 µm) are presented.

Results: laser excision showed lower recurrence than scalpel. Superior hemostasis, less postoperative pain, improved healing process, and better patient comfort were reported. Thermal effects were reported with lasers, without impairment of histopathological evaluation.

Discussion and conclusions: both approaches are effective for treatment of HPV lesions. Lasers offer benefits in soft tissue handling, especially in vascularized, esthetically sensitive, or less accessible areas. Lower recurrence rate with laser might be due to viral inactivation by photothermal activity when margins are adequate. Laser thermal effects can be minimized with appropriate laser parameters.

Evidence supports laser excision as a reliable and minimally invasive treatment of HPV lesions, which may provide improved outcomes, lower recurrence, and less patient discomfort. This was also confirmed by two clinical cases presented.

REFERENCES

1. **Tenore G, Mohsen A, Nuvoli A, Palaia G, Rocchetti F, Di Gioia CRT, *et al.*** The impact of laser thermal effect on histological evaluation of oral soft tissue biopsy: Systematic review. Dent J. 2023;11(2):28.
2. **Nammour S, El Mobadder M, Namour A, Namour M, Romeo U, España-Tost AJ, *et al.*** Success rate of benign oral squamous papilloma treatments after different surgical protocols (conventional, Nd:YAG, CO_2 and diode 980 nm lasers): A 34-year retrospective study. Photobiomodul Photomed Laser Surg. 2021;39(2):123-30.
3. **Toledano-Serrabona J, López-Ramírez M, Sánchez-Torres A, España-Tost AJ, Gay-Escoda C.** Recurrence rate of oral squamous cell papilloma after excision with surgical scalpel or laser therapy: A retrospective cohort study. Med Oral Patol Oral Cir Bucal. 2019;24(4):e435-40.
4. **Angiero F, Buccianti A, Parma L, Crippa R.** Human papilloma virus lesions of the oral cavity: Healing and relapse after treatment with 810-980 nm diode laser. Lasers Med Sci. 2015;30(2):747-51.
5. **Costa JA, Álvarez MB, Monteiro L, Rompante P, Salazar F, Relvas M, *et al.*** Effectiveness of photobiostimulation and ablation with diode laser in oral squamous papilloma: A case report. Case Rep Dent. 2023;2023:6293919.

LASER PHOTOBIOMODULATION FOR PAIN RELIEF IN IMPACTED MAXILLARY CANINES EXPOSURE

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Objectives: this clinical study aimed to evaluate the effectiveness of Photobiomodulation (PBM) in reducing postoperative pain for patients undergoing surgical exposure of impacted maxillary canines.

Materials and methods: eighteen patients (11 females, 7 males) with palatal impacted maxillary canines were included. They were divided into 4 groups: (A) surgical exposure with a diode laser; (B) exposure with a scalpel; (C) laser surgery followed by PBM; (D) scalpel surgery followed by PBM. Patients in groups C and D received three 15-minute PBM sessions using a "LUMIX 2" diode laser (910 nm infrared, 180 J energy, 30 Hz frequency) immediately post-surgery and at one and two months follow-up. Postoperative pain was daily valued for seven days using a modified Visual Analogue Scale (VAS) diary, which also tracked analgesic use.

Results: all groups showed a reduction in pain over the seven-day period. However, the groups receiving PBM reported a more rapid and consistent decrease in pain compared to the non-PBM groups. The scalpel-only group uniquely showed a temporary increase in pain on the fourth day. Analgesic use was slightly lower in the PBM groups, particularly on days two and five, although the difference was minimal.

Conclusions: according to literature, PBM appears to be an effective adjunct therapy for reducing postoperative pain, rapidly after the surgical exposure of impacted maxillary canines. While a slight reduction in analgesic consumption was observed, the primary benefit identified in this study is the consistent and faster pain relief for patients.

REFERENCES

1. **Bishara SE.** Impacted maxillary canines: a review. Am J Orthod Dentofacial Orthop. 1992;101(2):159-71.
2. **Ericson S, Kurol J.** Radiographlc assessment of maxillary canine eruption in children with clinical signs of eruption disturbance. Eur J Orthod. 1986;8(3):133-40.
3. **Annibali S, Pippi R, Sfasciotti GL, *et al.*** Chirurgia orale a scopo ortodontico. In: Chirurgia Orale a Scopo Ortodontico. Elsevier srl. 2007:1-86.
4. **Hamblin MR.** Photobiomodulation or low-level laser therapy. J Biophotonics. 2016;9(11-12):1122.
5. **De Azevedo Kinalski M, de Andrade Leão OA, Post LK, Isolan TMP, dos Santos MBF.** Photobiomodulation therapy reduces postoperative pain after third molar extractions: A randomized clinical trial. Med Oral Patol Oral Cir Bucal. 2020;26(3):e341.

EVALUATION OF THERMAL EFFECTS OF BLUE LASER 445 NM ON ORAL MUCOSA

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Objectives: lasers are increasingly used as surgical tools due to their clinical benefits, but their thermal effect may affect the readability of histological margins, especially in potentially malignant lesions. This study aims to evaluate the thermal impact of a 445 nm diode laser during oral biopsies and to assess differences according to the nature of the lesions.

Materials and methods: patients referred to Sapienza University's Department of Oral and Maxillofacial Sciences underwent incisional or excisional biopsies using a 445 ± 5 nm diode laser. Tissue samples were processed for routine histological analysis. Both qualitative and quantitative evaluations of epithelial and connective tissues were performed using a predefined readability scale. Specimens were divided into Group A (benign lesions) and Group B (oral potentially malignant disorders, OPMDs).

Results: fourteen patients contributed 18 specimens. Group A demonstrated superior histological readability compared to Group B. In the epithelium, Group A showed clearer marginal readability and generally better overall scores. Focal epithelial detachment was more frequently observed in Group B. In connective tissue, Group A also presented higher marginal readability.

Conclusions: the 445 nm diode laser did not compromise histological diagnosis in any specimen. However, the lesion type appears to influence the laser's thermal effect, with benign lesions exhibiting more favorable histological outcomes than OPMDs. Further studies are needed to evaluate additional factors such as lesion accessibility and laser exposure time.

REFERENCES

1. **Tenore G, Mohsen A, Nuvoli A, Palaia G, Rocchetti F, Di Gioia CRT, *et al.*** The Impact of Laser Thermal Effect on Histological Evaluation of Oral Soft Tissue Biopsy: Systematic Review. Dent J (Basel). 2023;11(2):28.

2. **Vescovi P, Corcione L, Meleti M, Merigo E, Fornaini C, Manfredi M, *et al.*** Nd:YAG laser versus traditional scalpel. A preliminary histological analysis of specimens from the human oral mucosa. Lasers Med Sci. 2010;25(5):685-91.

LASER PHOTOBIOMODULATION (PBM) AS A STIMULUS FOR IMPLANT OSSEOINTEGRATION: A CASE REPORT

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Objectives: the objective was to examine the role of PBM as an adjuvant in the tissue healing and osseointegration processes following implant placement in sites with bone deficiencies. Attention was paid to the care of postoperative complications through continued laser treatment.

Case description: we describe the case of a patient with edentulism in region 4.4 and 4.6, resulting in masticatory difficulties. The edentulous bone saddle showed severe horizontal and vertical bone resorption which posed challenges for implant-supported prosthetic rehabilitation.

Materials and methods: the documented clinical case involved the insertion of an implant (Intralock Gold&Blue cylindrical 3.4) in a region with a thin crest, resulting in exposed threads and requiring bone regeneration. A PRF Block graft covered by a three-layer folded membrane was used. PBM was applied using a 980 nm laser with a fluence of 10 J/cm^2, a 0,6 mm spot size, performed with a lawn-mowing motion, daily for 10 days. PBM was continued even after a flap laceration and graft exposure occurred 5 days after surgery.

Results: continued PBM, combined with bioactive action of growth factors, resulted in progressive reconstruction of the epithelial layers, with visible improvements at 8 and 15 days. The final outcome, at 60 days, demonstrated proper maintenance of alveolar ridge thickness.

Conclusions: PBM with a 980 nm laser had proven to be a key tool for helping and accelerating tissue healing, supporting the membrane's biological effect and ensuring the maintenance of regenerative outcomes.