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TERAPIA A LASER NA PREVENÇÃO E NO TRATAMENTO DA PERI-IMPLANTITE: UMA REVISÃO INTEGRATIVA CRÍTICA

LASER THERAPY IN THE PREVENTION AND TREATMENT OF PERI-IMPLANTITIS: A CRITICAL INTEGRATIVE REVIEW

TERAPIA CON LÁSER EN LA PREVENCIÓN Y EL TRATAMIENTO DE LA PERIIMPLANTITIS: UNA REVISIÓN INTEGRATIVA CRÍTICA

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Resumo

A peri-implantite constitui um desafio clínico crescente associado ao aumento do uso de implantes dentários e à complexidade do controle do biofilme em superfícies implantárias. As abordagens terapêuticas convencionais frequentemente apresentam resultados limitados e heterogêneos, incentivando a investigação de estratégias adjuvantes, como a terapia a laser. Esta revisão integrativa crítica teve como objetivo analisar e sintetizar as evidências científicas atuais sobre o uso da terapia a laser como abordagem adjuvante na prevenção e no tratamento da peri-implantite, discutindo mecanismos biológicos, indicações clínicas, protocolos terapêuticos, limitações e perspectivas futuras para subsidiar a tomada de decisão baseada em evidências. Foi conduzida uma revisão integrativa estruturada, reportada conforme as recomendações do PRISMA 2020, com buscas realizadas nas bases PubMed/MEDLINE, Scopus e Web of Science para estudos publicados entre janeiro de 2015 e fevereiro de 2026. Foram incluídos estudos clínicos, revisões sistemáticas e revisões narrativas relevantes que avaliaram aplicações da terapia a

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laser no manejo das doenças peri-implantares, sendo os dados sintetizados qualitativamente conforme delineamento do estudo, tipo de laser, protocolos clínicos e desfechos avaliados. Vinte e cinco estudos atenderam aos critérios de inclusão. A literatura sugere que a terapia a laser, quando utilizada como adjuvante ao tratamento convencional, pode contribuir para redução microbiana, modulação da resposta inflamatória e melhora de curto prazo dos parâmetros clínicos peri-implantares; entretanto, a heterogeneidade metodológica e a ausência de protocolos padronizados limitam comparações diretas e recomendações clínicas definitivas. A terapia a laser pode representar estratégia adjuvante relevante, mas não substitui a terapia mecânica convencional, sendo necessários ensaios clínicos randomizados bem delineados com acompanhamento em longo prazo.

Palavras-chave: Peri-implantite; Terapia a Laser; Fotobiomodulação; Implantes Dentários; Tratamento Adjuvante.

Abstract

Peri-implantitis represents a growing clinical challenge associated with the increasing use of dental implants and the complexity of biofilm control on implant surfaces. Conventional therapeutic approaches often present limited and heterogeneous outcomes, encouraging investigation of adjunctive strategies such as laser therapy. This critical integrative review aimed to analyze and synthesize current scientific evidence regarding the use of laser therapy as an adjunctive approach in the prevention and treatment of peri-implantitis, discussing biological mechanisms, clinical indications, therapeutic protocols, limitations, and future perspectives to support evidence-based clinical decision-making. A structured integrative review was conducted and reported according to PRISMA 2020 recommendations. Searches were performed in PubMed/MEDLINE, Scopus, and Web of Science databases for studies published between January 2015 and February 2026. Clinical studies, systematic reviews, and relevant narrative reviews evaluating laser applications in peri-implant disease management were included, and data were qualitatively synthesized according to study design, laser type, clinical protocols, and reported outcomes. Twenty-five studies met the inclusion criteria. Evidence suggests that laser therapy, when used as an adjunct to conventional treatment, may contribute to microbial reduction, modulation of inflammatory response, and short-term improvement of clinical peri-implant parameters. However, methodological heterogeneity and lack of standardized protocols limit direct comparison among studies and prevent definitive clinical recommendations. Laser therapy may represent a valuable adjunctive strategy but should not replace conventional mechanical therapy, and further well-designed randomized clinical trials with standardized protocols and long-term follow-up are required.

Keywords: Peri-Implantitis; Laser Therapy; Photobiomodulation Therapy; Dental Implants; Adjunctive Treatment.

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Resumen

La periimplantitis representa un desafío clínico creciente asociado con el aumento del uso de implantes dentales y con la complejidad del control del biofilm en las superficies de los implantes. Los enfoques terapéuticos convencionales suelen presentar resultados limitados y heterogéneos, lo que ha estimulado la investigación de estrategias coadyuvantes, como la terapia con láser. Esta revisión integrativa crítica tuvo como objetivo analizar y sintetizar la evidencia científica actual sobre el uso de la terapia con láser como estrategia coadyuvante en la prevención y el tratamiento de la periimplantitis, abordando sus mecanismos biológicos, indicaciones clínicas, protocolos terapéuticos, limitaciones y perspectivas futuras, con el propósito de contribuir a la toma de decisiones clínicas basada en la evidencia.

Se realizó una revisión integrativa estructurada, reportada de acuerdo con las recomendaciones de PRISMA 2020. Se llevaron a cabo búsquedas en las bases de datos PubMed/MEDLINE, Scopus y Web of Science, considerando estudios publicados entre enero de 2015 y febrero de 2026. Se incluyeron estudios clínicos, revisiones sistemáticas y revisiones narrativas relevantes que evaluaran aplicaciones del láser en el manejo de las enfermedades periimplantarias. Los datos fueron sintetizados cualitativamente según el diseño del estudio, el tipo de láser, los protocolos clínicos y los resultados reportados.

Veinticinco estudios cumplieron los criterios de inclusión. La evidencia sugiere que la terapia con láser, cuando se utiliza como complemento del tratamiento convencional, puede contribuir a la reducción microbiana, la modulación de la respuesta inflamatoria y la mejoría a corto plazo de los parámetros clínicos periimplantarios. Sin embargo, la heterogeneidad metodológica y la ausencia de protocolos estandarizados limitan la comparación directa entre los estudios e impiden establecer recomendaciones clínicas definitivas. La terapia con láser puede representar una estrategia coadyuvante valiosa, pero no debe sustituir la terapia mecánica convencional. Se requieren futuros ensayos clínicos aleatorizados bien diseñados, con protocolos estandarizados y seguimiento a largo plazo, para establecer con mayor precisión su eficacia y aplicabilidad clínica.

Palabras clave: Periimplantitis; Terapia con Láser; Terapia de Fotobiomodulación; Implantes Dentales; Tratamiento Coadyuvante.

Introduction

Dental implants have become a predictable and widely adopted therapeutic option for oral rehabilitation, significantly improving functional and aesthetic outcomes for partially and fully edentulous patients. However, the increasing use of implant

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therapy has been accompanied by a substantial burden of peri-implant diseases, particularly peri-implantitis, a biofilm-associated inflammatory condition characterized by progressive loss of supporting bone around osseointegrated implants (DERKS; TOMASI, 2015; BERGLUNDH et al., 2018; DERKS et al., 2018).

Despite advances in implant design, surgical techniques, and maintenance protocols, the management of peri-implantitis remains a significant clinical challenge. Conventional therapeutic approaches primarily rely on mechanical debridement combined with chemical antimicrobial strategies and, in advanced cases, surgical intervention. Nevertheless, clinical outcomes remain variable, largely due to the complex surface characteristics of implants and the multifactorial nature of peri-implant disease progression (SCHWARZ et al., 2011; BERGLUNDH et al., 2018; DOMINIQUE et al., 2024).

In recent years, laser therapy has gained increasing attention as a potential adjunctive approach in peri-implant disease management. Laser applications have been investigated for their antimicrobial effects, ability to decontaminate implant surfaces, and capacity to promote photobiomodulation, potentially contributing to modulation of inflammatory responses and enhancement of tissue repair processes (SCULEAN; SCHWARZ; BECKER, 2005; SILVA et al., 2023; ROMANOS; ESTRIN, 2025). Different laser systems, including high-power lasers such as Er:YAG and Nd:YAG and low-level lasers used for photobiomodulation, have been investigated in the management of peri-implant diseases, with heterogeneous clinical and biological outcomes (SCHWARZ et al., 2005; SCHWARZ et al., 2011; DOMINIQUE et al., 2024).

However, despite growing scientific interest, the available evidence remains heterogeneous regarding treatment protocols, laser parameters, wavelengths, application techniques, and long-term clinical effectiveness. Recent systematic reviews and meta-analyses have demonstrated that laser-assisted approaches may improve selected clinical parameters, such as probing depth and bleeding on probing, but have not consistently demonstrated superiority over conventional mechanical

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debridement. This variability limits the establishment of standardized clinical recommendations and highlights the need for critical synthesis of current evidence (LI et al., 2023; HUANG et al., 2024; DOMINIQUE et al., 2024; SRINIVASAN et al., 2025).

Therefore, the present study aimed to provide a critical integrative review of the scientific literature addressing the role of laser therapy as an adjunctive strategy in the prevention and treatment of peri-implantitis, discussing biological foundations, clinical applications, limitations, and future research perspectives.

Methods

This study was conducted as a critical review designed to synthesize and critically analyze current scientific evidence regarding laser therapy in the prevention and treatment of peri-implantitis. The integrative review design was selected because it allows inclusion of studies with different methodological approaches, enabling a comprehensive evaluation of biological mechanisms, clinical applications, and therapeutic outcomes. To enhance transparency in study identification and selection, the review process followed the PRISMA 2020 recommendations for reporting search and screening procedures, without characterizing a systematic review or meta-analysis. This study followed an integrative review framework allowing inclusion of diverse study designs to provide a comprehensive synthesis of current evidence. The PRISMA checklist is provided as supplementary material.

The research question was structured according to the PICO framework, considering patients presenting peri-implantitis or at risk of peri-implant diseases as the population of interest, laser therapy applications as the intervention, conventional mechanical debridement or standard therapies as comparison, and clinical peri-implant outcomes such as probing depth reduction, bleeding on probing, microbial reduction, inflammatory modulation, and clinical improvement as primary outcomes. Accordingly, the guiding research question was defined as: *What is the effectiveness*

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of laser therapy as an adjunctive approach in the prevention and treatment of peri-implantitis compared with conventional therapies alone?

A comprehensive literature search was performed in PubMed/MEDLINE, Scopus, and Web of Science using controlled vocabulary (MeSH terms) and free-text keywords combined with Boolean operators to maximize search sensitivity, as follows: ("peri-implantitis" OR "periimplantitis" OR "peri-implant disease") AND ("laser therapy" OR "laser treatment" OR "photobiomodulation" OR "low-level laser therapy" OR "LLLT" OR "Er:YAG" OR "Nd:YAG" OR "diode laser") Studies published between January 2015 and February 2026 were considered eligible. Articles written in English, Portuguese, or Spanish were included.

Studies were considered eligible when they evaluated laser application in the prevention or treatment of peri-implantitis, either as a standalone or adjunctive therapy, and reported clinically relevant outcomes related to peri-implant health. Randomized clinical trials, controlled clinical studies, observational studies, systematic reviews, and scientifically relevant narrative reviews were included. In vitro studies, animal studies, isolated case reports, duplicate publications, and studies lacking clear descriptions of laser parameters were excluded.

The search strategy initially identified 285 records across the selected databases. After removal of 67 duplicate records, 218 studies remained for title and abstract screening. Following this stage, 161 studies were excluded for not meeting eligibility criteria. A total of 57 full-text articles were assessed for eligibility, of which 32 were excluded due to absence of relevant clinical outcomes, methodological limitations, or exclusive focus on peri-implant mucositis. Ultimately, 25 studies were included in the qualitative synthesis of this integrative review. Study selection followed a two-stage screening process, including title/abstract screening and full-text assessment, with disagreements resolved by consensus among reviewers.

Methodological quality assessment of randomized clinical trials was performed using the Cochrane Risk of Bias Tool (RoB 2), considering sequence generation,

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allocation concealment, blinding procedures, incomplete outcome data, and selective reporting. Systematic reviews were evaluated according to clarity of search strategy, eligibility criteria, risk-of-bias assessment, and consistency of reported findings.

Data extraction was conducted using a structured framework including author and year, study design, type of laser, application protocol, evaluated clinical outcomes, and principal findings. Data were synthesized qualitatively, considering hierarchy of evidence, methodological consistency, and clinical applicability of reported outcomes. Due to substantial methodological heterogeneity among included studies, quantitative synthesis and meta-analysis were not performed. Classical studies published prior to the selected time frame were included exclusively to support biological rationale and historical context.

Table 1. Summary of studies evaluating laser therapy in peri-implantitis management

Study	Study design	Laser type	Clinical application	Evaluated outcomes	Main findings reported
Clinical studies					
Al-Aali et al., 2014	Randomized clinical trial	Diode laser	Adjunctive therapy after mechanical debridement	Bleeding on probing (BOP), probing depth (PD)	Adjunctive laser therapy reduced bleeding and improved clinical parameters.

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Schwarz et al., 2015b	Clinical trial	Er:YAG	Implant surface decontamination	PD, BOP	Clinical outcomes depended on treatment protocol parameters.
Schwarz et al., 2019	Controlled clinical study	Er:YAG	Laser-assisted surgical therapy	PD, bone level	Short-term clinical improvements observed following adjunctive laser use.
Schwarz et al., 2021	Randomized clinical trial	Er:YAG	Non-surgical therapy	PD, BOP	Initial clinical improvements reported after adjunctive laser therapy.
Schwarz et al., 2023	Clinical trial	Er:YAG	Laser-assisted surgical treatment	PD, implant stability	Short-term improvements reported with adjunctive laser application.

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Al-Qahtani et al., 2019	Clinical study	Diode laser	Photobiomodulation therapy	Pain, inflammation	Reduction of postoperative symptoms and inflammatory response observed.
Nunes et al., 2020	Clinical study	Diode laser	Post-surgical photobiomodulation	Tissue healing	Accelerated soft-tissue healing reported.
Renvert et al., 2009*	Experimental study	Er:YAG	Re-osseointegration protocol	Osseointegration	Experimental findings suggested potential for implant surface re-osseointegration.
Systematic reviews and meta-analyses					
Lin et al., 2018	Systematic review and meta-analysis	Various laser systems	Adjunctive therapy	PD, bone loss	No sustained long-term superiority of laser therapy compared

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					with conventional treatment.
Wang et al., 2020	Systematic review	Diode / Er:YAG	Adjunctive therapy	PD, BOP	Reported heterogeneous clinical outcomes among included studies.
Monje et al., 2017	Systematic review	Various laser systems	Risk factor evaluation	Bone loss progression	Systemic factors associated with peri-implant disease progression.
Carcuac & Derks, 2021	Systematic review	Various laser systems	Combined therapies	PD, bone loss	Highlighted variability of protocols and need for standardization.

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Persson et al., 2024	Systematic review	Various laser systems	Adjunctive therapy	PD, BOP	Insufficient evidence to establish standardized clinical protocols.
Narrative and clinical reviews					
Renvert & Polyzois, 2018	Narrative review	Various laser systems	Adjunctive therapies	Inflammation control	Laser therapy is described as complementary to conventional treatment.
Monje et al., 2019	Narrative review	Various laser systems	Peri-implant therapy evaluation	Disease progression	Limited clinical evidence supporting laser as standalone therapy.
Derks et al., 2022	Narrative review	Various laser systems	Peri-implant therapies	Inflammatory control	Adjunctive therapies may support peri-implant disease

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					management.
Ravidà et al., 2022	Clinical review	Er:YAG	Non-surgical therapy	Inflammation	Variable clinical outcomes reported.
Ramanauskaite & Juodzbalys, 2023	Review	Various laser systems	Therapeutic protocols	Clinical success	Outcomes dependent on protocol selection.
Lin & Wang, 2017	Review	Diode laser	Adjunctive therapy	Inflammation	Limited clinical benefits reported.
Smeets et al., 2014	Narrative review	Various laser systems	Treatment protocols	Peri-implant inflammation	Emphasized importance of biofilm control.
Araujo & Lindhe, 2018	Conceptual review	—	Peri-implant health	Tissue stability	Provided biological basis of peri-implant tissue response.
Foundational studies					

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Romanos & Weitz, 2012*	Critical review	Various laser systems	Laser therapy concepts	Infection control	Discussed early clinical applications and limitations.
Heitz-Mayfield et al., 2012*	Consensus report	Diode laser	Anti-infective therapy	Inflammation	Laser therapy is considered adjunctive to conventional treatment.
Deppe & Horch, 2007*	Narrative review	Various laser systems	Surgical applications	Tissue repair	Established biological rationale for laser use in implant dentistry.

* Classical studies included to support the biological rationale and historical development of laser applications in implant dentistry.

Various laser systems indicate studies including more than one laser modality or wavelength evaluated within the same investigation.

Results

Study selection

The literature search identified a total of 285 records across the selected databases (PubMed/MEDLINE, Scopus, and Web of Science). After removal of 67 duplicate records, 218 studies remained for title and abstract screening. During this

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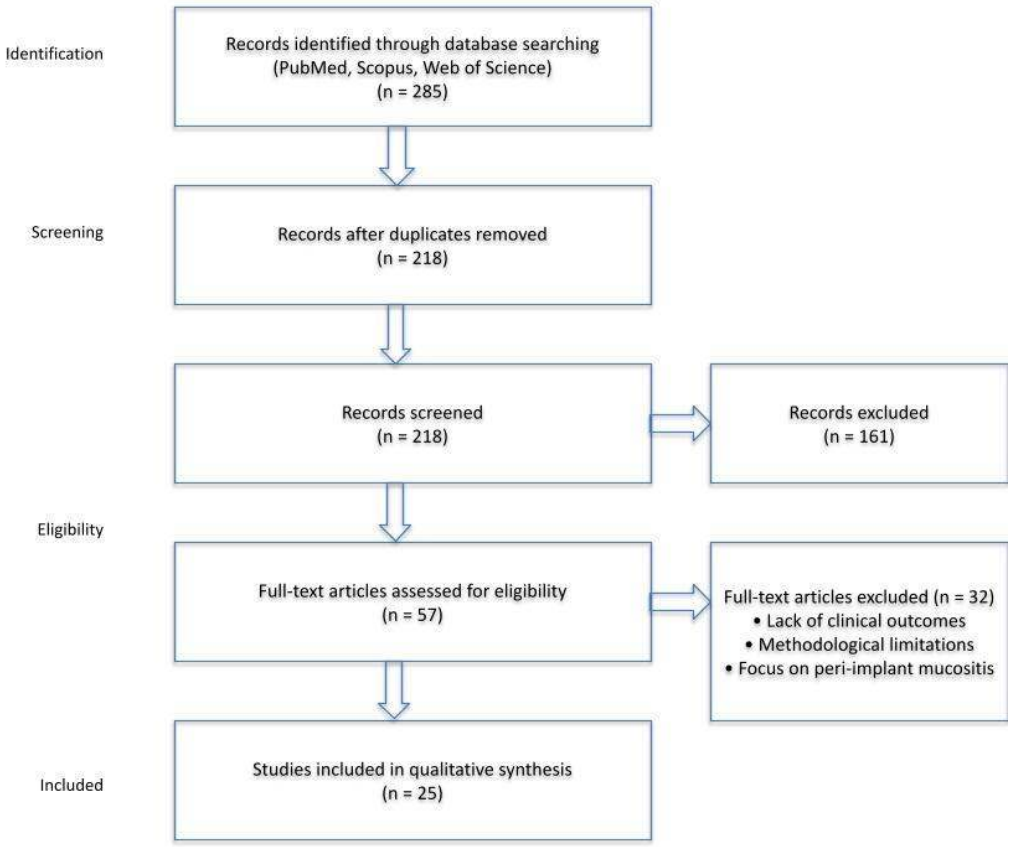
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phase, 161 records were excluded for not meeting the predefined eligibility criteria, primarily due to lack of focus on peri-implantitis, absence of laser therapy as the main intervention, or lack of clinically relevant outcomes.

A total of 57 full-text articles were assessed for eligibility. Following full-text evaluation, 32 studies were excluded because of methodological limitations, insufficient clinical data, or exclusive focus on peri-implant mucositis. Ultimately, 25 studies fulfilled the inclusion criteria and were incorporated into the qualitative synthesis of this critical integrative review.

The study selection process is illustrated in Fig. 1, following PRISMA 2020 recommendations.

Figure 1. PRISMA 2020 flow diagram of study selection process



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PRISMA flow diagram illustrating the study identification, screening, eligibility, and inclusion process for studies evaluating laser therapy in peri-implantitis management.

Although this study followed PRISMA recommendations for transparency, it was conducted as a critical integrative review and therefore did not aim to perform quantitative synthesis.

The included studies comprised randomized clinical trials, controlled clinical studies, experimental investigations, systematic reviews, and narrative reviews addressing biological mechanisms, clinical applications, and therapeutic outcomes related to laser use in peri-implant disease management. A detailed summary of study characteristics and main findings is presented in Table 1.

Evidence synthesis

The included studies demonstrated heterogeneous applications of laser therapy in peri-implant disease management, encompassing antimicrobial decontamination, adjunctive surgical and non-surgical treatment, and photobiomodulation approaches aimed at improving tissue healing and inflammatory control (NATTO et al., 2015; SCHWARZ et al., 2017; DOMINIQUE et al., 2024).

Several clinical studies reported improvements in peri-implant clinical parameters when laser therapy was used as an adjunct to conventional treatment. Reductions in probing depth and bleeding on probing were frequently described, particularly in studies evaluating Er:YAG and diode lasers combined with mechanical debridement or surgical therapy (SCHWARZ et al., 2005; SCHWARZ et al., 2011; LI et al., 2021; HUANG et al., 2024). However, these improvements were predominantly observed in short-term follow-up periods, with limited evidence supporting long-term stability of clinical outcomes (SCHWARZ et al., 2017; DOMINIQUE et al., 2024; SRINIVASAN et al., 2025).

Systematic reviews and meta-analyses consistently emphasized variability among studies regarding laser parameters, treatment protocols, and outcome

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assessment methods. This heterogeneity limited direct comparison between investigations and prevented definitive conclusions regarding superiority of laser therapy over conventional approaches alone (NATTO et al., 2015; LI et al., 2021; DOMINIQUE et al., 2024; HUANG et al., 2024).

Studies investigating photobiomodulation protocols suggested potential benefits related to postoperative comfort, inflammatory modulation, and soft-tissue healing. Nevertheless, reported outcomes varied according to wavelength, energy density, and treatment frequency, highlighting the influence of protocol selection on clinical response (SILVA et al., 2023; ROMANOS; ESTRIN, 2025).

Overall, the evidence indicates that laser therapy may contribute positively as an adjunctive intervention in peri-implantitis management, particularly by enhancing decontamination and early clinical improvement. However, the lack of standardized protocols and methodological diversity across studies remains a major limitation in establishing universal clinical recommendations (SCHWARZ et al., 2017; DOMINIQUE et al., 2024; HUANG et al., 2024; SRINIVASAN et al., 2025).

Discussion

The findings of this critical integrative review indicate that laser therapy presents clinically relevant potential when used as an adjunctive approach in the prevention and treatment of peri-implantitis. However, current scientific evidence suggests that its benefits should be interpreted cautiously due to methodological heterogeneity and variability in treatment protocols across studies.

Peri-implantitis is a multifactorial condition resulting from complex interactions between microbial biofilm, host inflammatory response, and local and systemic risk factors (BERGLUNDH et al., 2018; RENVERT et al., 2018; SCHWARZ et al., 2018). Consequently, therapeutic strategies capable of simultaneously promoting microbial reduction and modulation of inflammation have gained increasing attention. In this

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context, laser therapy has emerged as a complementary modality owing to its antimicrobial effects, ability to decontaminate implant surfaces, and photobiomodulatory properties that may enhance tissue repair processes (SCULEAN; SCHWARZ; BECKER, 2005; NATTO et al., 2015; DOMINIQUE et al., 2024).

Clinical studies included in this review frequently reported improvements in peri-implant clinical parameters, particularly reductions in probing depth and bleeding on probing, when laser therapy was combined with conventional mechanical debridement or surgical approaches (LI et al., 2021; HUANG et al., 2024). Nevertheless, systematic reviews consistently indicate that these benefits are often limited to short-term follow-up periods and do not necessarily translate into sustained long-term clinical superiority compared with conventional therapies alone (SCHWARZ et al., 2017; DOMINIQUE et al., 2024; SRINIVASAN et al., 2025). These findings reinforce the concept that laser therapy should be regarded as an adjunct rather than a replacement for established mechanical treatment strategies.

One of the main therapeutic challenges in peri-implantitis management is effective decontamination of implant surfaces, especially considering the microstructured characteristics of modern implant designs. Laser irradiation offers theoretical advantages by allowing access to microirregularities without direct mechanical contact (NATTO et al., 2015; DOMINIQUE et al., 2024). However, inappropriate energy parameters may lead to excessive thermal effects and potential surface alterations, emphasizing the importance of protocol standardization and operator training (SCHWARZ et al., 2005; SCHWARZ et al., 2011).

Beyond antimicrobial action, photobiomodulation has been increasingly investigated due to its potential to modulate inflammatory pathways, promote analgesia, and accelerate tissue healing. Several studies reported improvements in postoperative comfort and soft-tissue repair following low-level laser therapy applications (SILVA et al., 2023; ROMANOS; ESTRIN, 2025). Despite these promising findings, current evidence remains insufficient to confirm a definitive impact

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on long-term disease resolution, largely because clinical outcomes appear strongly dependent on laser parameters and treatment frequency (HUANG et al., 2024; SRINIVASAN et al., 2025).

Another relevant aspect concerns the potential preventive application of laser therapy within peri-implant maintenance protocols. Some authors suggest that adjunctive laser use may contribute to inflammatory control in high-risk patients, including individuals with a history of periodontitis or systemic inflammatory conditions (BERGLUNDH et al., 2018; DOMINIQUE et al., 2024). However, consensus regarding optimal application intervals, energy settings, and cost–benefit balance has not yet been established.

A major limitation identified across the literature is the substantial heterogeneity in study design, laser wavelength, power settings, irradiation time, and outcome assessment criteria (NATTO et al., 2015; LI et al., 2021; DOMINIQUE et al., 2024; HUANG et al., 2024). Such variability limits direct comparison among studies and represents one of the principal barriers to establishing standardized clinical guidelines. Therefore, interpretation of current evidence should consider these methodological inconsistencies.

Importantly, current evidence does not support laser therapy as a monotherapy for peri-implantitis management. From a clinical perspective, the results support the understanding of laser therapy as part of a multimodal therapeutic strategy. Successful peri-implantitis management continues to depend primarily on effective biofilm removal, risk-factor control, and long-term maintenance therapy. Within this framework, laser application may enhance clinical outcomes when appropriately indicated and integrated into comprehensive treatment planning. From an evidence-based dentistry perspective, current findings reinforce that treatment success in peri-implantitis depends primarily on biofilm control and risk factor management, while adjunctive technologies should be interpreted within a multimodal therapeutic framework (BERGLUNDH et al., 2018; SCHWARZ et al., 2018; SRINIVASAN et al., 2025).

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Future research should prioritize well-designed randomized clinical trials with standardized protocols and extended follow-up periods capable of evaluating clinically meaningful outcomes such as peri-implant bone stability and implant survival rates. Advances in personalized dentistry and minimally invasive approaches may further clarify the role of laser therapy within individualized peri-implant care strategies (HUANG et al., 2024; SRINIVASAN et al., 2025).

Conclusion

Laser therapy may represent a valuable adjunctive approach in the prevention and treatment of peri-implantitis, contributing to microbial reduction, modulation of inflammatory responses, and short-term improvement of clinical peri-implant parameters when combined with conventional therapies. However, current evidence does not support its use as a standalone treatment modality.

The clinical effectiveness of laser therapy remains influenced by variability in treatment protocols, laser parameters, and study design heterogeneity. Therefore, its application should be guided by evidence-based clinical judgment and integrated into comprehensive peri-implant disease management strategies.

Future well-designed randomized clinical trials with standardized methodologies and long-term follow-up are required to clarify the real clinical impact of laser therapy and establish consistent treatment guidelines in implant dentistry.

Importantly, current evidence does not support laser therapy as a standalone treatment for peri-implantitis but rather as an adjunctive modality within comprehensive peri-implant disease management.

Clinical relevance

Laser therapy may represent a clinically relevant adjunctive tool in peri-implantitis management, particularly in enhancing implant surface decontamination and supporting inflammatory control when associated with conventional mechanical

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therapy. Its clinical use should be individualized according to patient risk profile, implant characteristics, and appropriate selection of laser parameters.

Conflict of Interest Statement

The authors declare no conflicts of interest related to this study.

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