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The use of laser therapy as a treatment for peri-implantitis: a literature review

The use of laser therapy as a treatment for peri-implantitis: a literature review

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SUMMARY

The present work aims to describe whether laser therapy is an efficient method for the treatment of peri-implantitis, highlighting the mechanism of action, applicability and effectiveness of the technique. A literature review was conducted using Google Scholar, Scielo, PubMed, and CAPES Periodics, resulting in 22 articles based on the application of inclusion and exclusion criteria. Photodynamic therapy is an important adjunctive treatment for eliminating bacteria around the implant. Therefore, it is a technique that should not be performed alone, but rather in conjunction with other practices such as antibiotic therapy and mechanical debridement. Photodynamic therapy is effective and has several benefits.
benefits making it an excellent treatment option for peri-implantitis, being an innovative treatment on the rise.

Keywords: Laser therapy, Peri-implantitis, Osseointegration, Dental implant.

ABSTRACT

This work aims to describe whether Laser Therapy is an efficient method for treating peri - implantitis, highlighting the mechanism of action, applicability and effectiveness of the technique. A literature review was carried out using Google Scholar, Scielo, Pubmed and CAPES Periodics as electronic databases, which in the end resulted in 22 articles based on the application of inclusion and exclusion criteria. Photodynamic therapy is an important adjuvant treatment for eliminating bacteria around the implant. Therefore, a technique that should not be performed in isolation, but rather with the help of other practices such as antibiotic therapy and mechanical debridement. Photodynamic therapy is effective and hasseveral benefits, making it an excellent treatment option for peri-implantitis, and an innovative treatment on the rise.

Keywords: *Laser Therapy, Peri-implantitis, Osseointegration, Dental Implant, Periodontics.*

1. INTRODUCTION

A dental implant is a fixed treatment solution used to replace one or more teeth lost in various clinical situations, it is inserted into the bone to supply the portion root of the tooth at the end of the osseointegration period. This period is defined as the process of direct structural and functional union between biologically living bone tissue and surface of an implant subjected to occlusal load, thus ensuring the success of the implant

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dental (DIAS., 2021).

However, it is important to be addressed that one of the main causes of failure of dental implants is the bacterial plaque, around the implant, formed by species of bacteria similar to those of periodontal disease, such as *Fusobacterium, Spirochaeta, Actinobacillusactinomycetemcomitans, Porphyromonasgingivalis* species and *Prevotellaintermédia,* and *Campylobacterrectus* (OLIVEIRA, ALCÂNTARA, JUNIOR., 2017).

Therefore, peri-implantitis is defined as an inflammatory process resulting from a bacterial proliferation that affects the tissues around the implant, causing inflammation, loss of bone structure and damage to osteointegration (RIBEIRO et al., 2020).

This accumulation of supra and subgingival plaque and the colonization of the spaces at the interface abutment implant, mainly by gram-negative anaerobic bacteria and other species periodontopathogenic, are etiological factors that corroborate the development of disease. Furthermore, factors such as tobacco and the presence of systemic diseases also influence the evolution of inflammation (FARIAS, FREITAS., 2017).

In view of this, the treatment options for peri-implantitis are surgical and non-surgical methods. surgical. Such treatments include resective and regenerative surgeries, antiseptic therapy with Chlorhexidine Digluconate 0.1 to 0.2%, polishing, antibiotic therapy, debridement mechanical, and currently laser therapy, resulting in bacterial reduction and improvement of the condition clinical of the patient (JUNQUEIRA, ROMEIRO., 2019).

The benefits reported by several studies regarding the use of photodynamic therapy with low-power laser in implantology are: reduction of postoperative edema, improvement in the context of paresthesias, acceleration in the soft tissue repair process when used on sutures, increased rate of osseointegration, accelerated bone repair, promotes formation of more vascularized bone on the surface of the implant, in addition to promoting the proliferation of fibroblasts. Therefore, it is an excellent therapeutic option for peri-implantitis, because it is used to decontaminate implant surfaces. Photosensitization has the mechanism the interaction of three elements: oxygen, light and the photosensitizer, which in the end this integration ends up promoting the production of free radicals that cause damage to microbial cells. (RIBEIRO et al., 2020).

According to Souza (2021), photodynamic therapy is indicated as a complement, making this alternative an important adjuvant to conventional peri-treatment implantitis, contributing to high rates of microbial reduction.

Depending on the points covered, a literature review on the topic becomes relevant. in question not only to deepen knowledge about the use of laser therapy but treatment of peri-implantitis, as well as demonstrate studies that demonstrate its efficiency and

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benefits. This research seeks, through the literature, to provide a theoretical contribution of studies relevant to the topic to promote professional growth for students of the Course of Dentistry in training.

2. THEORETICAL FRAMEWORK

Osseointegration, a central concept in the field of implant dentistry, refers to the integration biomechanics between the surface of an implant and the surrounding bone, being crucial for the long-term success of dental implant treatments. This complex phenomenon is influenced by a variety of biological, mechanical, and cellular factors. The failure of this process and implant are serious consequences of peri-implant tissue pathologies, mainly peri-implantitis, which consists of an inflammatory process that is difficult to reverse (SOUZA., 2021).

Peri-implantitis is an inflammatory process that affects the tissues surrounding the implant. osseointegrated in function, with loss of bone support in surrounding tissues, loss progressive osseointegration and marginal supporting bone, as conceptualized by Albrektsson at the first Periodontics Workshop. Contamination by surface-specific bacteria of the implant is the most important cause of peri-implantitis. Such bacteria are reported to be the cause of peri-implant bone loss in osseointegration failures. The bacteria present in implants affected by active periodontitis are *Fusobacterium, Spirochaeta, Actinobacillus actinomycetemcomitans,* species of *Porphyromonas gingivalis* and *Prevotella intermedia,* and *Campylobacter rectus* (OLIVEIRA, ALCÂNTARA, JUNIOR., 2017).

The main objectives of peri-implantitis treatment are: to restore the health of the mucosa around the implant, reduce the load of microorganisms and regenerate lost bone during the inflammatory process. As therapy options exist, decontamination of the implant surface, mechanical debridement, antibiotics for local and systemic use, resective and regenerative surgeries and laser therapy. Photodynamic therapy is widely explored in modern dentistry, adding benefits for bacterial reduction (RIBEIRO et al., 2020).

This therapy using laser is capable of modulating inflammation, promoting an effect analgesic and stimulate collagen around the implant, with biological action of activation of various proteins, enzymes, transcription factors, and photoreceptors. Thus, the thermal effect photodynamic therapy causes denaturation of bacterial proteins, promoting necrosis cellular, and is therefore indicated as an adjuvant to conventional non-surgical treatment (FARIAS, FREITAS., 2017).

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A therapy that acts locally and non-invasively, and is therefore advocated by scholars as a technique capable of promoting bactericidal effects against microorganisms and other disease-causing agents. The use of this technology must consider parameters such as wavelength, exposure time, power, fluence, number and range of treatments, pulp damage, cracks, carbonization and excessive heating of tissues and periodontal structures. Laser therapy has become a promising mechanism in dentistry due to its passivity and easy combination with other treatment modalities (ASSIS et al., 2019)

3. MATERIAL AND METHOD

The research addresses a bibliographic literature review, based on the literature researched in the electronic databases of Google Scholar, Scielo, Pubmed and CAPES Periodics, through the following descriptors: “Laser therapy”, “Peri-implantitis”, “Osseointegration”, “Dental implant” and “Periodontics” and in the English terms *“Laser Therapy”, “Peri-implantitis”, “Osseointegration”, “Dental Implant”* and *“Periodontics”.*

The combination of descriptors resulted in 77 articles found, which were in accordance with according to the inclusion criteria, which were: in articles published in the periods 2017-2023, in Portuguese and English, with free access, being a literature review, review bibliographic, systematic review and meta-analysis, narrative review of the literature, *in vitro study,* clinical case reports and monographs. The exclusion criteria were based on articles that did not were in accordance with the predetermined publication period, to those who needed pay-per-view and that were not in line with or deviated from the central ideas of the study.

From this, the titles and abstracts of the 77 pre-published articles were read. selected which resulted in 22 scientific articles that fit the objectives of this work and that after that, a table (Table 1) was prepared with the results that present a summary with their main information.

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4. RESULTS AND DISCUSSIONS

TABLE 1 - RESULTS OF THE BIBLIOGRAPHIC REVIEW RESEARCH

AUTHOR	TYPE OF WORK	SAMPLES	OBJECTIVES	RESULTS
SON, CAYANA (2017)	Revision Bibliographical	5 articles	Describe the main etiological agents of peri-implant disease as well as you essential treatments in the rehabilitation of this condition in dental implants, detailing the guiding elements that can trigger this pathology in addition to understanding the etiopathogenesis of peri-implant diseases based on in the development of periodontal disease.	Treatment of peri-implantitis includes laser therapy, debridement, use of antiseptics, use of local or systemic antibiotic therapy such as 12% chlorhexidine, access by making a surgical flap with or without regenerative therapies and supportive therapy.
ANDRADE (2017)	Monograph	55 articles	This work proposes carry out an analysis of published scientific articles and books on the peri-implantitis, presenting clinical and radiographic aspects, diagnosis and also protocol suggestions for the treatment of peri-implantitis.	Peri-implantitis is a disease one multifactorial, and the the presence of biofilm is essential for its development. Its treatment is difficult and the unpredictable prognosis, highlighting the importance of efficient biofilm control in patients with in with osseointegrated implants, starting before surgical installation of the same.
OLIVEIRA, ALCANTRA, JUNIOR (2017)	Review of Literature	22 articles	This work, paper aims to present, through a literature review, the characteristics of this to the technique. and its results. Most of the literature reports that the association of laser therapy with a means of link to	As conclusions From this overview, we consider that photodynamic therapy meets expectations, enabling to the its use for peri-implantitis treatments.

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			with the bacteria results in your elimination partial or total.	
BASTOS (2017)	Revision Systematics of Literature	68 articles	The objective of this study is to evaluate, through a systematic review, the results obtained through of studies that analyzed the effectiveness of using photodynamic therapy as adjuvant treatment of peri-implant disease	This revision systematically concludes that the photodynamic therapy as adjuvant treatment shows results clinical outcomes comparable to conventional node therapy for long-term treatment of peri-implantitis.
FARIAS, FREITAS (2017)	Literature review	17 articles	To evaluate and discuss the application of laser in peri-implantitis treatment from the through a literature review.	According to the literature researched, lasers Diode, Nd:YAG, Er:YAG and CO2 have been reported as a viable therapeutic method the peri-implantitis, as they appear to influence the decontamination of the implant surface and improve clinical signs of inflammation. However, they were controlled clinical studies have been carried out to prove its long-term effectiveness.
SANTOS (2018)	Revision Bibliographical	13 articles	To evaluate the relevance of using laser in the non-surgical treatment of peri-implantitis.	To date, there is insufficient evidence that sustain the therapeutic benefit of the laser in the long term term, node treatment non-surgical treatment of peri-implantitis.
VIEIRA (2018)	Revision Narrative of the Literature	57 articles	Identify the factors etiological aspects of peri-implantitis; Recognize that there are factors of risk for peri-implant disease; Indicate the	Mucositis treatment from the includes mechanical debridement with or without use of

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			main signs and symptoms of peri-implantitis.	antimicrobial adjuvants. Mechanical control, together with the use of local antibiotic therapy and systemic has been shown to be efficient as an node adjunct treatment for peri-implant diseases. peri-implantitis therapy should be associated with regenerative techniques that lead to high success.
FRAGA (2019)	Revision Systematic and Meta-analysis	3 articles	Evaluate the effectiveness of photodynamic therapy antimicrobial (PDT) in the reduction of microorganisms for the treatment of peri-implantitis.	The meta-analysis demonstrated an association between TFd and reduction in bacteria count. It can be concluded that TFDa was effective in reducing bacterial load and has a positive potential as an alternative therapy for peri-implantitis.
RABBIT (2019)	Review of Literature	13 articles	The objective of this work was to review the literature on the etiology and diagnosis this condition discussing available treatment options.	We also conclude that the fact that the patient has peri-implantitis does not mean that the implant will be lost and it can be treated surgically or non-surgical depending on the degree of commitment.
JUNQUEIRA, PILGRIM (2019)	Clinical case report	22 articles	Report a clinical case of peri-implantitis treated with an associated drug protocol the access surgical procedure to remove granulation tissue, application of CO2 laser and	The protocol used to treat peri-implantitis in this case patient was viable to prevent loss of implant and to

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			immediate bone grafting with autogenous bone, followed by membrane coverage resorbable polypropylene.	stabilize the evolution of the observed radiographic clinical parameters.
RIBEIRO., et al (2020)	Review of Literature	Articles indexed on the platforms: PUBMED, SCIELO, LILACS AND GOOGLE SCHOLAR, between the 1960s and 2019.	It's about the use of photodynamic therapy in the peri-treatment from the implantitis.	Several studies indicate that photodynamic therapy is emerging as a new therapy that can have beneficial effects in various areas of dentistry. In implantology, helping in the osseointegration process and preventing peri-implantitis.
DAYS (2021)	Review of Literature	19 articles	Analyze the literature available on the treatment of PI, analyzing the studies carried out in the last decade on the new PDT techniques and evaluating their effectiveness in the treatment of IP.	It can be concluded that the TFDa was effective in reducing bacterial load and has positive potential as an alternative therapy for peri-implantitis
LIMA (2021)	Review of Literature	45 articles	To evaluate the use of different types of laser in the treatment of peri-implant disease, either as as monotherapy or in conjunction with other methods, through the decontamination of infected areas that do not respond to traditional mechanical and chemical treatments used.	With a promising future in the treatment As an adjunct to traditional therapies, the use of laser continues to be an important ally in the complex context of peri-implantitis.
OLIVEIRA, LIMA, SENA (2021)	Review of Literature	26 articles	Read the selected articles in full and enter the information on etiology and treatment into a table to analyze and integrate them.	It is possible to observe that there is no agreement between studies on the cause of peri-implantitis, but the most frequently reported etiological factors for peri-implantitis are: peri-implant mucositis, the smoking, the

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				systemic diseases, perglycemia, the presence of the same factors biological and bacterial causes of periodontitis, lack of decontamination of the implant surface, infectious origin bacterial, caused by negligence in local hygiene, implants inserted immediately after extraction, suppuration, together with the presence of deep periodontal pockets and loss of marginal bone support.
RUIZ (2021)	Monograph	21 articles	To conduct a literature review, discuss the biological, aspects, epidemiological diagnostic and treatment of parameters, and as well as the authors' perspectives on Peri-implantitis.	Treatment can be surgical or non-surgical, both aimed at preventing disease progression and maintaining osseointegration. A combination of both methods is usually produces the best results, as the combination of techniques is valid and, sometimes, necessary.
SOUZA (2021)	Literature review	44 articles	To conduct a literature review to analyze the effectiveness of the proposed photodynamic therapy as an adjunct to peri- as implantitis treatment. from the	The treatment of peri-implant diseases aims to eliminate the microbial load from the surface of implants through mechanical and chemical means. The use of photodynamic therapy offers significant benefits, such as less possibility

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				of side effects, resistance unlikely bacterial , a viable and low-cost option, reducing clinical and microbiological parameters of peri-implantitis.
INFANT (2022)	*In vitro* study	Two periodontopathogenic microorganisms: bacteria E. *faecalis* and the fungus C. *albicans*	Determine the effectiveness of PDT (photodynamic therapy) as a sustainable solution for the treatment of peri-implantitis through the use of porphyrins as photosensitizers and photopolymerizer as a light source.	PDT using ProtoIX and a photopolymerizer was shown to be effective in photoinactivating Candida albicans and Enterococcus faecalis. Although inactivation rates were lower than conventional PDT.
SLENDER (2022)	Review of Literature Integrative	12 articles	Find out how the literature addresses the use of photodynamic therapy as an adjuvant in the treatment of peri-implant diseases as well as analyzing the efficiency demonstrated in the literature regarding this adjuvant therapy in the treatment of peri-implant diseases.	Photodynamic therapy is very promising, in addition to producing microbial death without systemic disturbance and without generating bacterial resistance, it is painless and low cost. Within the aspect of visible light in the red color band such as LEDs and low power lasers there was enhancement of results in relation to conventional therapies applied in isolation.
FREITAS, et al (2022)	Literature review	28 articles	To evaluate the importance of using laser therapy in the non-surgical treatment of peri-implant lesions.	Control of bacterial plaque is one of the main etiological factors of peri-implant diseases and the treatment of peri-

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				implantitis must be done according to the stage of the disease.
WEDGE, GODINHO, GUEDES (2023)	Review of Narrative Literature Descriptive	25 articles	This work aims to create a cluster of information about peri-implant diseases covering etiology, diagnosis and treatment, which can be used as an information source for members your of the dental community.	The study concludes that although osseointegrated implants are an excellent option for rehabilitation, it is crucial that professionals constantly look for new knowledge to improve your rates success. Furthermore, patient cooperation in following professionals' instructions is essential to ensure the longevity of treatment.
ALBERTO, et al., (2023)	Review of Literature	15 articles	To analyze and compare treatments for peri-implantitis involving PDT. This literature review includes studies that compared PDT with and without surgical debridement and medication. associates, pointing out through scientific findings, the method that proved to be most effective for peri-implantitis.	Although the parameters for the treatment of peri-implantitis are not fully established, the reviewed studies suggest that photodynamic therapy associated with debridement surgical was effective, but without significant improvements compared to treatment conventional.

Source: Research authors, 2024.

When analyzing the literature we can highlight that FILHO, CAYANA (2017) exposes the laser therapy as one of the comprehensive steps in the treatment of peri-implantitis, not discarding surgical treatment and antibiotic therapy, but classifying it as supportive therapy. In addition Furthermore, BASTOS (2017) also highlighted that, equally the place of photodynamic therapy as

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adjuvant treatment of periodontal disease, reporting clinical cases that obtained a good long-term prognosis.

In the studies by COELHO (2019) and RUIZ (2021) they concluded that peri-implant disease is not sentenced to be treated surgically, so depending on the degree of impairment of the osseointegration process, treatment can be switched to a non-surgical approach. But, even if the parameters for treating the disease are not established, the author ALBERTO et al (2023) explains in his studies that the treatments do not surgical procedures when associated with surgical procedures become effective, but without improvements significant compared to conventional treatment. Therefore, the authors arrive the same conclusion as VIEIRA et al (2018) where photodynamic therapy associated with other regenerative treatments and techniques lead to a high success rate and an excellent prognosis.

In the bibliographic reviews by LIMA (2021) and RIBEIRO et al (2020) they stated that several studies indicate that the use of lasers is a therapeutic innovation, in addition to presenting benefits in various dental specialties, both stated that has a promising future in the adjuvant treatment of peri-implantitis, being an important combined with traditional therapies, assisting in the osseointegration process. Therefore, DELGADO (2022) also stated that photodynamic therapy is quite promising and effective, and concluded that it has advantages such as: low cost, produces microbial death without causing systemic disturbances and without producing bacterial resistance, and is painless. It was found that there was a significant improvement in results compared to conventional therapies.

It was possible to analyze in the study by SOUZA (2021) that the therapies applied in peri-implantitis, whether through mechanical or chemical resources, aims to eliminate the microbial load of implant surfaces, and he added some advantages of therapy photodynamic: presents satisfactory results, being a low-cost option, smaller possibility of side effects and effective reduction of microbiological parameters of the peri-implantitis. The DIAS (2021) study showed that the results also reflect that the laser has good potential as an alternative treatment for peri-implantitis.

However, FARIAS, FREITAS (2017) and SANTOS (2018) concluded in their studies that there is insufficient evidence to indicate the long-term effectiveness of its use of laser therapy in the non-surgical treatment of peri-implantitis.

FRAGA (2019) attributed the importance of using laser therapy in cases where necessary to eliminate and control bacteria. FREITAS et al (2022) on the other hand, added that it is essential to take into account the stage of the disease, where cases in which the degree of loss bone density is up to 50%, laser therapy may be used as an adjuvant. However, ANDRADE (2017) identifies that this biofilm control must be carried out before

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surgical installation of the implant.

Some studies went deeper to understand and exemplify the functionality of laser, such as the study carried out by INFANTE (2022) who carried out an *in vitro* study in which there was the cultivation and maintenance of microbial species, the procedure to carry out the therapy photodynamics with porphyrins as photosensitizers and photopolymerizer as light source and methods to evaluate its effects, resulting in the efficiency of photodynamic therapy although inactivation rates were lower compared to photodynamic therapy conventional. The case report presented by JUNQUEIRA, ROMEIRO (2019) lists all steps towards a positive prognosis, combining drug treatment, surgical and laser therapy on an implant that presents bone resorption due to peri-implantitis and thus preventing implant loss.

Etiological factors should be considered when talking about peri-implantitis such as smoking, peri-implant mucositis, systemic diseases, hyperglycemia, infectious origin bacterial, local hygiene deficit, implant inserted immediately after extraction, presence periodontal pockets and others, according to OLIVEIRA, LIMA, SENA (2021). With that, CUNHA, GODINHO, GUEDES (2023) states that patient collaboration is essential for the success of osseointegrated implants, especially those with etiological factors of risk. The author also highlights the need for improvement on the part of professionals in order to to increase the success of treatments.

The vast bibliographic search shows that the treatment of peri-implant disease is mainly due to traditional practices such as antibiotic therapy and debridement mechanical, directly combating the bacteria that cause peri-implantitis. In addition, laser therapy has proven to be an adjuvant treatment, reducing the inflammatory process and favors blood flow around the implant, which is very important as it benefits the peri-implant osseointegration process, not becoming the protagonist against bacteria of the disease, but rather an adjuvant.

Therefore, it is clear that implantologists and periodontists need to seek updates and improvements in laser therapy so that there is advancement in existing treatments for peri-implant disease, ensuring an excellent prognosis for patients affected by the disease and the success of implants in the healing process peri-implant. Therefore, it is important that all dentists are aware of the what is peri-implantitis, so that they can indicate the best treatment or refer you to a professional trained/qualified in laser therapy.

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FINAL CONSIDERATIONS

Thus, based on the research carried out, photodynamic therapy is indispensable as an adjuvant technique to the traditional treatment of peri-implantitis and its effects are very positive when compared to the results of existing treatments.

However, it is necessary for more dentists to become qualified or qualified laser therapy, especially professionals in the field of periodontics and implantology, so that laser therapy is increasingly used to benefit the oral health of patients in reestablishment of osseointegration lost due to disease.

Therefore, it is believed that photodynamic therapy is effective and has several benefits. such as reduction of postoperative edema, reduction of microbial load, higher success rate in the process of osseointegration and greater vascularization around the implant, becoming a excellent adjuvant treatment option for peri-implantitis.

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