ISSN: 2230-9926

Available online at http://www.journalijdr.com

IJDR

International Journal of Development Research
Vol. 09, Issue, 08, pp.29041-29044, August, 2019

REVIEW ARTICLE OPEN ACCESS

PHOTODYNAMIC THERAPY IN NON-SURGICAL PERIODONTAL TREATMENT: LITERATURE REVIEW

Juliana Lucindo dos Santos[1], Nilton Rodrigues Alves Peres Domingues[2], Angelica Castro Pimentel[2], Rui Manuel Freire Sampaio[1], José Sani Neto[1] and Caio Vinicius G. Roman-Torres[1,2]

[1]Department of Dentistry, University Metropolitan of Santos, SP, Brazil
[2]Department of Dentistry, University Santo Amaro, SP, Brazil

ARTICLE INFO

Article History:
Received 03rd May, 2019
Received in revised form
17th June, 2019
Accepted 21st July, 2019
Published online 28th August, 2019

Key Words:
Periodontitis, Laser,
Photodynamic therapy,
Periodontal disease.

ABSTRACT

Photodynamic Therapy (PDT) has been used as a new non invasive therapeutic approach for the treatment of bacterial, fungal and viral infections of the oral cavity. The results show that the use of laser as an adjunct to non-surgical periodontal treatment favors repair and has proven action in pathogenic periodontal strains, but many studies show that its use does not bring additional benefits to the periodontal procedures. The present study aims to evaluate through a literature review the efficacy of photodynamic therapy in non-surgical periodontal therapy. Several therapeutic strategies, including mechanical instrumentation and local or systemic antibiotics have been proposed to treat residual pockets of patients undergoing periodontal maintenance. Thus, antimicrobial photodynamic therapy has emerged as a possibility of auxiliary treatment to basic periodontal treatment, mainly because it does not induce bacterial resistance, as well as not producing systemic and side effects. The use of PDT may prove to be an important treatment modality with minimal side effects as opposed to the use of, for example, antibiotics that prevent bacterial proliferation but also cause gastrointestinal effects that may harm the patient's health. In addition, although antibiotics are effective in reducing periodontal disease, there is increasing bacterial resistance to antibiotics, which limits their use in this type of treatment. Laser can be used as an adjunct for non-surgical periodontal therapy, although there are not enough studies to consider the use of lasers as an alternative to conventional treatments. Bactericidal effects, the elimination of stone, the ability to remove plaque, the ability to sculpt soft and hard tissue, faster and more predictable repair of soft and hard tissue, make lasers a promising tool for non-periodontal treatment Surgical.

Citation: Juliana Lucindo dos Santos, Nilton Rodrigues Alves Peres Domingues *et al.* 2019. "Photodynamic therapy in non-surgical periodontal treatment: literature review", *International Journal of Development Research*, 09, (08), 29041-29044.

INTRODUCTION

Laser is short for Light Amplification by Stimulated Emission of Radiation. The first assumptions about light, which would later be the cornerstone of High-Intensity Laser, were developed by Isaac Newton in the mid-1675s and 1704s. In 1960, Theodore H. Maiman created the first device that worked by electron stimulation of the Ruby crystal and in 1965 Leon Goldaman first employs laser therapy terapia. A laser is a device that, when excited by a power source, generates a beam of light called a "laser beam". The laser beam is made up of photons of the same color, concentrated and emitted with the same energy charge, same frequency and wavelength making it monochrome[2]. The beam of light is a form of light energy that, when emitted on the tissue and, at the right dose, this light interferes with cellular functions, such as decreased prostaglandins, increased cellular activity, variation in the production of growth factors and increased DNA synthesis, leading to beneficial effects on laser tissues 3. Periodontal disease is a multifactorial chronic pathology where genetic susceptibility, individual immune response and environmental factors are involved4. It is characterized as a disordered infectious-inflammatory disease, produced by biofilm microorganisms that occupy the supra and / or subgingival surface, which release enzymes, endotoxins and cytotoxic factors, resulting in the destruction of the supporting bone and periodontal ligament, characterizing mainly the loss of bone

***Corresponding author:* Juliana Lucindo dos Santos,**
Department of Dentistry, University Metropolitan of Santos, SP, Brazil

insertion and increased depth of the gingival sulcus, resulting in periodontal pocket formation, which may lead to loss of the dental element 5,6. The microorganisms responsible for the onset of periodontal disease include: Actinobacillus actinomycetemcomitans, Porphyromonas gingivalis, Tannerella forsythia, Prevotella intermedia, Fusobacterium nucleatum, Treponema denticola, among others that play an important role in the colonization and establishment of periodontitis 7. The advantages of using laser in non-surgical periodontal treatment are: reduction in the number of pathogenic microorganisms due to the bactericidal effect of this treatment, better hemostasis, shorter healing time, less postoperative pain, ensuring greater patient comfort 8. Several therapeutic strategies, including mechanical instrumentation and local or systemic antibiotics have been proposed to treat residual pockets of patients undergoing periodontal maintenance. Thus, antimicrobial photodynamic therapy has emerged as a possibility of auxiliary treatment to basic periodontal treatment, mainly because it does not induce bacterial resistance, as well as not producing systemic and side effects.

According to Rotundo et al., In 2010, the high intensity diode laser was studied in periodontics to reduce subgingival bacteria in non-surgical treatment. In this study, the effect was evaluated, as well as the changes in the periodontal clinical parameters promoted by the dimension and root planing associated with the wavelength. Twenty-seven randomly assigned patients divided into two groups underwent local root sizing and planing tested, and only the experimental group received diode laser irradiation. Among the clinical parameters studied, clinical probing depth and clinical insertion level resulted in significant improvement in the control group when compared to the experimental group. Results were similar for both groups regarding plaque index and bleeding on probing. There was no significant difference in microbiological parameters between the control and experimental groups. Thus, it was concluded that the high-power diode laser combined with non-surgical periodontal treatment did not promote additional effects to conventional periodontal treatment 9. According to Bringel Coelho et al., In 2013, a research was conducted to report information on the applicability, efficiency and use of Photodynamic Therapy (PDT) as an adjunct in periodontal therapy. The Pubmed, Lilacs and Scielo databases were consulted using the keywords Periodontitis, Photodynamic, Therapye Dentistry. We obtained 46 articles that best expressed the relationship between periodontal treatment and PDT. They obtained the certainty that Photodynamic Therapy is a beneficial option because it promotes bacterial reduction without side effects, being less traumatic to the patient because there is no need for anesthesia. The reduction of periodontal pathogens and the search for methods that do not promote bacterial resistance are the primary reasons for the inclusion of photodynamic therapy in non-surgical periodontal treatment 10.

According to Andrade et al., In 2015, the efficacy of low-level laser therapy in controlling pain, edema and discomfort associated with periodontal plastic surgery in ten patients with gingival recessions ≥ 3mm was evaluated. The following parameters were assessed using a visual analog scale (VAS): pain, discomfort, edema and interference in daily life after surgery. The patients' pain perception results showed a frequency of total pain absence ranging from 50 to 80% in the first 8 hours, a minimum pain ranging from 20 to 50% and a moderate pain that reached 10% of patients during this period. There were no reports of severe pain within the first 8 hours at 24, 48 or 72 hours. TLBP associated with the treatment of gingival recession with coronary repositioned flap and connective tissue graft had an adjunct effect on morbidity and interference in patients' lives 11. There is a wide variety in the treatment parameters and protocols used, making it impossible to compare and critically and rigorously analyze the results collected in the studies analyzed12. The low power laser has positive effects on its final result by leading to bacterial lysis of species resistant to conventional mechanical therapy of periodontal disease and accelerating the formation of repaired tissue. In addition, it is comfortable for the patient and has a low cost to the dentist 13. The results show that the use of laser as an adjunct to non-surgical periodontal treatment favors repair and has proven action in pathogenic periodontal strains, but many studies show that its use does not bring additional benefits to the procedures established in the literature such as scraping and root crown straightening (RAR) and oral hygiene instruction. This literature review aims to elucidate the role of laser in non-surgical periodontal therapy. Within this context and in view of the divergences and lack of conclusive results between the studies in the literature about PDT as a complementary procedure in the treatment of residual periodontal pockets, the present study aims to evaluate through a literature review the efficacy of photodynamic therapy in non-surgical periodontal therapy.

METHODOLOGY

This study had as methodology the active search for information in the databases of the MEDLINE, LILACS and BBO, as well as the SciELO virtual library. It was sought to carry out the bibliographic research on the two central themes of this work: laser and / or dentistry; laser and / or periodontal disease; periodontal treatment, periodontal scaling, periodontal non surgical treatment, 1986 and 2019.

DISCUSSION

Non-surgical treatment of scraping and root planing (RAR) may achieve a temporary decrease in subgingival pathogen periodontal levels14. However, mechanical therapy has some limitations regarding the complete and effective elimination of microbial and mineralized deposits in the subgingival environment. Some factors such as initial periodontal pocket depth, root anatomy, periodontal instrument design and operator skill may influence this effectiveness 15. It is important to know this interaction between the laser and the target tissue. It must absorb the laser energy for the desired benefit. There are erbium lasers such as Er: YAG and Er, Cr: YSGG, for example, which are most often used in hard tissues such as enamel, dentin and bone. Already CO2 lasers are more used in soft tissues, in surgeries, being widely used in semiology. Low power lasers are best used for anti-inflammatory effect, analgesia, biomodulation and tissue repair. Each equipment has a specific wavelength, and this wavelength determines its interaction with the various biological tissues and their indication1. Photodynamic Therapy (PDT) has been used as a new non invasive therapeutic approach for the treatment of bacterial, fungal and viral infections of the oral cavity 16. The biological principle of PDT is based on inactivation of target cells, microorganisms or molecules. by the use of a photosensitizer (photoactivated dye)

and a light, usually the laser, low power visible light of an appropriate wavelength17. PDT aims to cause microbial destruction without antibiotics17. Low-power lasers trigger events that result in improved metabolism, increase collagen synthesis, increase leukocyte activity, and release growth factors, thereby accelerating, tissue repair 13. Thus, in addition to helping to remove the cause of periodontal disease, the laser also acts in an analgesic, anti-inflammatory, reducing edema and better healing.

Mechanical removal of contaminants is the most effective method to treat periodontal disease. However, some diseased sites do not respond positively to treatment due to factors that hinder mechanical debridement. These are: tissue invasion, difficulty in accessing furcation areas, operator skill, concavity regions and very deep pockets. When initial treatment is not effective, some complementary approaches are needed19. The use of laser in the treatment of periodontitis improves the level of insertion by restructuring cementum, periodontal ligament and part of adjacent support tissues; significantly decreases the number of subgingival pathogenic microorganisms, and predisposes the formation of an environment favorable to the remodeling of both hard and soft tissues20. Thus, PDT does not lead to bacterial resistance, causes no side effects and is activated only in the presence of light. The use of PDT may prove to be an important treatment modality with minimal side effects as opposed to the use of, for example, antibiotics that prevent bacterial proliferation but also cause gastrointestinal effects that may harm the patient's health. In addition, although antibiotics are effective in reducing periodontal disease, there is increasing bacterial resistance to antibiotics, which limits their use in this type of treatment. Laser can be used as an adjunct for non-surgical periodontal therapy, although there are not enough studies to consider the use of lasers as an alternative to conventional treatments. Bactericidal effects, the elimination of stone, the ability to remove plaque, the ability to sculpt soft and hard tissue, faster and more predictable repair of soft and hard tissue, make lasers a promising tool for non-periodontal treatment. Surgical 22.

Several studies have demonstrated the effectiveness of lasers in periodontal procedures for soft or hard tissues, and in some cases surpassing conventional procedures23-26. Lasers are more effective than abrasive air for the treatment of peri-implantitis after six months of treatment, both in clinical and microbiological aspects. There was also an improvement in the healing process in studies that used laser in soft tissue surgeries 24. The effectiveness of PDT in reducing periodontopathogens has been confirmed by animal studies and a significant reduction in osteoclastic activity has been observed in both scraped and PDT-treated rats 20, 23-25. Bacterial reduction with surgical laser may be observed in some clinical studies with association of non-surgical periodontal treatment to treat chronic periodontitis and aggressive periodontitis 24-26. Surgical laser was also associated with periodontal treatment with ultrasound, but did not show good results for tissue repair, only for bacterial reduction 27. This may have been due to the characteristics of the laser and the protocol used because it is known that the success of Tissue repair is related to the effects of laser photobiomodulation, ie low power without thermal effect28. Through laser photobiomodulation, bacterial reduction may be associated with photodynamic therapy, as used in the treatment of aggressive periodontitis and the treatment of chronic periodontitis 29, 30. PDT can be applied in areas that are difficult to reach for RAR such as furcations and concavities, making it a perfect complement to periodontal therapy, because the protocol employed is quick and simple and has been shown to eliminate bacteria or inactivate remaining bacterial products or virulence factors in periodontal tissues even after RAR 14, 23. Although there is scientific evidence showing the effects of PDT, its application is still very restricted due to the lack of knowledge of the dentist, either in the mechanism of action, its effectiveness and bacterial destruction. And even with this lack of knowledge, PDT appears to be a relevant and rising proposal for a therapeutic alternative for dental treatment; however, further studies with well-designed research and the standardization of its application are necessary.

Conclusion

Within the limits of the present study, it can be concluded that PDT used as a complementary treatment to non-surgical periodontal treatment demonstrates effectiveness in periodontal procedures for soft or hard tissues as it results in reduction of periodontal pathogens, analgesic and anti-inflammatory effect, better healing and in less time, ensuring greater comfort for the patient. It is also emphasized the importance of the dentist's knowledge about the mechanism of action and interaction between the laser and the target tissue in order to have the desired benefit in the treatment.

REFERENCES

Akram, Z. 2018. How effective is adjunctive antimicrobial photodynamic therapy in treating deep periodontal pockets in periodontal disease? *A systematic review.J Investig Clin Dent.* 4:e12345.

Almeida, J.M., Garcia, V.G., Theodoro, L.H., Bosco, A.F., Nagata, M.J.H., Macarini, V.C. 2006. Terapia fotodinâmica: uma opção na terapia periodontal. *Arquivos em Odontologia.* 42(3):161-256.

Almeida, R.F., Pinho, M.M., Lima, C., Faria, I., Santos, P., Bordalo, C. 2006. Associação entre doença periodontal e patologias sistêmicas. *Revista Portuguesa de Medicina Geral e Familiar.* 22: 379-90.

Andrade, G., Villalpando, K.T. 2015. Avaliação clínica do laser de baixa potência no controle da dor, edema e do desconforto após cirurgia plástica periodontal. Anais do XX Encontro de Iniciação Científica e Anais do V Encontro de Iniciação em Desenvolvimento Tecnológico e Inovação.

Assaf, M., Yilmaz, S., Kuru, B., Ipci, S.D., Noyun, U., Kadir, T. 2007. Effect of the Diode Laser on Bacteremia Associated with Dental Ultrasonic Scaling: A Clinical and Microbiological Study. *Photomedicine and Laser Surgery.* 25(4): 250-256.

Borrajo, J.L., Varela, G.L., Castro, G.L., Nunes, I.R., Torreira, M.G. 2004. Diode Laser (980 nm) as Adjunct to Scaling and Root Planing, Photomedicine and Laser Surgery. 22(6): 509-512.

Bringel, A.C.C., Freitas, S.A.A., Pereira, A.F.V. 2013. Terapia Fotodinâmica como coadjuvante ao tratamento periodontal não cirúrgico. *Revista de Pesquisa em Saúde.* 14(3): 184-188.

Ferreira, A.V., Ferreira, A.C., Queiroz, A.P., Barbosa, O.L. 2017. Terapia fotodinâmica como coadjuvante ao tratamento periodontal não cirúrgico na periodontia

clinica atual: uma breve revisão de literatura. *Brazilian Journal of Surgery and Clinical Research*. 20(1): 134-138.

Gündoğar, H., Şenyurt, S.Z., Erciyas, K., Yalım, M., Üstün, K. 2016. The effect of low-level laser therapy on non-surgical periodontal treatment: a randomized controlled, single-blind, split-mouth clinical trial. Lasers MedSci. 31(9):1767-1773.

Hokari, T., Morozumi, T., Komatsu, Y., Shimizu, T., Yoshino, T., Tanaka, M. 2018. Effects of Antimicrobial Photodynamic Therapy and Local Administration of Minocycline on Clinical, Microbiological, and Inflammatory Markers of Periodontal Pockets: A Pilot Study. *Int J Dent.* 5; 2018:1748584.

Jorge, A.C.T., Cassoni, A., Rodrigues J.A. 2010. Aplicações dos lasers de alta potência em odontologia. Revista Saúde – UNG-SER 4(3).

Kamma, J.J., Vasdekis, V.G.S., Romanos, G.E. 2009. The Effect of Diode Laser (980 nm) Treatmenton Aggressive Periodontitis: Evaluation of Microbial and Clinical Parameters. *Photomedicine and Laser Surgery.* 27(1): 11-19.

Lins, R.D., Dantas, E.M., Lucena, K.C., Catão, M.H., Granville-Garcia, A.F., Carvalho Neto, L.G. 2010. Efeitos bioestimulantes do laser de baixa potência no processo de reparo. Na Bras Dermatol. 85(6): 849-55.

Lopes, C.B. 2007. The Effect of the Association of NIR Lasertherapy BMPs, and Guided Bone Regeneration on Tibial Fractures Treated with Wire Osteosynthesis: Raman Spectroscopy Study. *Journal of Photochemistry and Photobiology B: Biology*. 89: 125-130.

Meimandi, M., Talebi Ardakani, M., Esmaeil Nejad, A., Yousefnejad. P., Saebi, K., Tayeed, M. 2017. The Effect of Photodynamic Therapy in the Treatment of Chronic Periodontitis: A Review of Literature. *J Lasers Med Sci.* 8(Suppl 1):S7-S11.

Moritz, A., Gutknecht, N., Doertbudak, O., Goharkhay, K., Schoop, U., Schauer, P., Sperr, W. 1997. Bacterial Reduction in Periodontal Pockets Through Irradiation with a Diode Laser: A Pilot Study. *Journal of Clinical Laser Medicine & Surgery.* 15(1): 33-37.

Mouzinho, J.F., Pereira, J.F., Cabral, C.T. 2010. Aplicações do Laser na Terapia Periodontal Não- Cirúrgica: Revisão. Revista Portuguesa de Estomatologia, Medicina Dentária e Cirurgia Maxilofacial. 51(1): 35-40.

Oliveira, R.R., Schwartz-Filho, H.O., Novaes Jr, A.B., Taba, Jr. M. 2007. Antimicrobial Photodynamic Therapy in the Non-Surgical Treatment of Aggressive Periodontitis: A Preliminary Randomized Controlled Clinical Study. *J Periodontol*.

Pavone, C., Oliveira, G.J.P., Perussi, L.R., Marcantonio, E., Marcantonio, R.A.C. 2010 Aplicação do Laser ER, CR:YSGG em periodontia e implantodontia: revisão de literatura. Revista Periodontia. 20(3): 13-19.

Reddy, G. 2003. Comparison of the photostimulatory effects of visible He-Ne and infrared Ga-As lasers on healing impaired diabetic rat wounds, Lasers Surg. Med. 33: 344-351.

Renvert, S., Dahlen, G., Wikstrom, M. 1996. Treatment of periodontal disease based on microbiological diagnosis. Relation between microbiological and clinical parameters during 5 years. *J. Periodontol.* 67:562–571.

Rotundo, R., Nieri, M., Cairo, F., Franceschi, D., Mervelt, J., Bonaccini, D., Esposito, M., Pini-Prato, G. 2010. Lack of adjunctive benefit of Er:YAG laser in non-surgical periodontal treatment: a randomized split-mouth clinical trial. *Journal of Clinical Periodontology*. 37(6):526-33.

Sena, L.S.B., Silva, N.S., Andrade, J.M., Sousa, J.N.L. 2017. Associação de técnicas cirúrgicas periodontais para recobrimento de recessões múltiplas e controle da dor pós operatória com laserterapia: relato de caso. Revista Periodontia. 27(4):86-90.

Silva, E.M., Gomes, S.P., Ulbrich, L.M., Giovanini, A.F. 2007. Avaliação histológica da laserterapia de baixa intensidade na cicatrização de tecidos epitelial, conjuntivo e ósseo: estudo experimental em ratos. Ver. Sul-Bras Odontol. 4: 29-35.

Silva, S.C.P., Lima, V.F., Dietrich, L., Júnior, J.J.V., Mendes, E.M. 2017. Os efeitos da laserterapia no tratamento periodontal. Revista de Odontologia Contemporânea. 1(1):49-57.

Silveira, V.R.S., Alves, A.P.N. 2009 Perfil celular e mediadores químicos na doença periodontal associada ao biofilme dental – Revisão de Literatura. Revista Periodontia. 19(3): 73-79.

Souza, E., Medeiros, A.C., Gurgel, B.C., Sarmento, C. 2016. Antimicrobial photodynamic therapy in the treatment of aggressive periodontitis: a systematic review and meta-analysis. Lasers Med Sci. 31(1):187-96.

Steffens, J.P., Marcantonio, R.A.C. 2018. Classificação das Doenças e Condições Periodontais e Periimplantares 2018: Guia Prático e Pontos-Chave.Revista de Odontologia da UNESP. 47(4): 189-197.

Theodoro, L., Assem, N., Longo, M., Alves, M., Duque, C., Stipp, R. 2018. Treatment of periodontitis in smokers with multiple sessions of antimicrobial photodynamic therapy or systemic antibiotics: A randomized clinical trial. Photodiagnosi PhotodynTher. 22:217-222.

Yamada, Jr.A.M., Hayek, R.R.A., Ribeiro, M.S. 2004. O emprego da terapia fotodinâmica na redução bacteriana em periodontia e implantodontia. Rev. GO. 52(3):207-210.

****