

Publicado em 07 de agosto de 2023
REVISTA SOCIEDADE CIENTÍFICA, VOLUME 6, NÚMERO 1, ANO 2023

THE USE OF LASER THERAPY IN PULP REVASCULARIZATION USO DA LASERTERAPIA NA REVASCULARIZAÇÃO PULPAR

Geovana Borba de Albuquerque¹; Luanna Karina Marinho de Assis Dantas²; Arthur Araújo de Souza³; Marvin Gonçalves Duarte⁴; Luísa Montenegro Brayner de Moraes⁵; Luciano Barreto Silva⁶

^{1,2,3,4,5,6}Faculdade de Odontologia do Recife, Brazil

geovanaborba311@gmail.com¹

luannaassisdantas@gmail.com²

arthuraraujo2612@gmail.com³

marvingduartee@gmail.com⁴

Luisamoraes338@gmail.com⁵

lucianobarreto63@gmail.com⁶

ABSTRACT

This literature review studies the use of laser therapy in pulpal revascularization, since this therapeutic method has been gaining more and more space in dentistry. This procedure consists of the use of low power laser rays that will be absorbed by the pulp tissue present in the biostimulation of these cells, thus promoting the restoration of cell function and tissue repair. When talking about laser in dentistry, its importance in regenerative endodontic procedures is indisputable, in addition to promoting bone repair, as well as reducing the microbiota of root canals. It also acts in the prevention of a painful postoperative period, when applied soon after the endodontic session. It is important to emphasize that the application of this therapy requires further studies and

¹ORCID: <https://orcid.org/0000-0001-9962-9420>

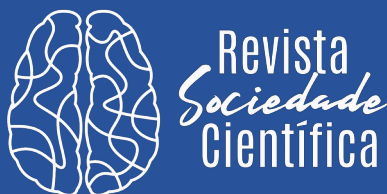
²ORCID: <https://orcid.org/0000-0001-6233-3351>

³ORCID: <https://orcid.org/0000-0002-4315-4304>

⁴ORCID: <https://orcid.org/0000-0001-7507-925X>

⁵ORCID: <https://orcid.org/0000-0003-0251-0867>

⁶ORCID: <https://orcid.org/0000-0003-0251-0867>



Publicado em 07 de agosto de 2023
REVISTA SOCIEDADE CIENTÍFICA, VOLUME 6, NÚMERO 1, ANO 2023

prior training by the dentist in order to ensure, in addition to its greater effectiveness, adequate protection for the patient.

Keywords: laser therapy, therapeutic method, laser and dentistry.

O USO DA LASERTERAPIA NA REVASCULARIZAÇÃO PULPAR

RESUMO

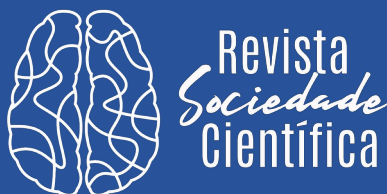
Essa revisão de literatura faz um estudo sobre o uso da laserterapia na revascularização pulpar, uma vez que esse método terapêutico vem ganhando cada vez mais espaço na odontologia. Esse procedimento consiste no uso de raios laser de baixa potência que será absorvido pelo tecido pulpar atuando na bioestimulação dessas células, promovendo assim a restauração da função celular e reparo tecidual. Quando se fala de laser na odontologia é indiscutível a sua importância nos procedimentos endodônticos regenerativos, além de promover a reparação óssea, assim como reduzir a microbiota dos canais radiculares. Atua também na prevenção de um pós-operatório doloroso, quando aplicado logo após o término da sessão endodôntica. É importante salientar que a aplicação desta terapia requer estudos mais aprofundados e treinamento prévio por parte do cirurgião dentista a fim de garantir além da sua maior eficácia, a proteção adequada ao paciente.

Palavras chaves: laserterapia, método terapêutico, laser e odontologia.

EL USO DE LA TERAPIA LÁSER EN LA REVASCULARIZACIÓN PULPAR

RESUMEN

Esta revisión bibliográfica estudia el uso de laserterapia en la revascularización pulpar, ya que este método terapéutico ha ido ganando cada vez más espacio en la odontología. Este procedimiento consiste en el uso de rayos láser de baja potencia que serán absorbidos por el tejido pulpar actuando sobre la bioestimulación de estas células,



favoreciendo así el restablecimiento de la función celular y la reparación tisular. Cuando se habla de láser en odontología, es indiscutible su importancia en los procedimientos de endodoncia regenerativa, además de favorecer la reparación ósea, así como reducir la microbiota de los conductos radiculares. También actúa en la prevención de un postoperatorio doloroso, cuando se aplica inmediatamente después de finalizada la sesión de endodoncia. Es importante señalar que la aplicación de esta terapia requiere de estudios más profundos y entrenamiento previo por parte del odontólogo para asegurar, además de su mayor efectividad, una protección adecuada para el paciente.

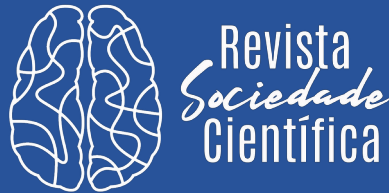
Palabras claves: laserterapia, método terapêutico , laser y odontologia.

1. INTRODUCTION

Pulp revascularization was introduced by Nygaard-Ostby, a Norwegian dentist who in 1961 aimed, through his clinical studies, at the attempt to regenerate pulp tissue in vital and non-vital teeth, however, it was only mentioned in the literature a few years later, due to the technological limitations of the time it began to be developed. It took a while to become popular with health professionals. It was inserted in regenerative endodontics, with clinical reports in 2001 with protocols comparable to those currently applied [22], [23].

Revascularization aims to allow the continuity of root development, treating teeth that were affected by pulp necrosis or incomplete rhizogenesis, thus avoiding the appearance of future problems to the detriment of the more fragile root. Performed from sections that present beneficial effects, fast and without the presence of pain. [21].

In recent years, there has been a popularization of laser therapy in the clinical and hospital environment, but the development of scientific work is almost non-existent, especially when we analyze its effectiveness in a systemic way. Thus, the objective of this work is to carry out a literature review with the purpose of describing the functioning and performance of this treatment method, thus being able to promote a greater knowledge on the subject [20].



Publicado em 07 de agosto de 2023

REVISTA SOCIEDADE CIENTÍFICA, VOLUME 6, NÚMERO 1, ANO 2023

2. METHODOLOGY

All information was collected using descriptors on the Web of Science, BVS/BIREME, PUBMED Central, The Cochrane Library and Google Scholar, as well as books on the subject, through the descriptors registered on the BVS/BIREME platform corresponding to (DESCRIPTORS) to provide scientific support to the testimonies. Inclusion criteria were human studies and clinical situations, to the same extent that exclusion criteria eliminated animal and laboratory studies. To carry out this work, we analyzed the main articles on the subject, including the clinical experience in the monitoring and analysis of treatments performed in contrast to laser therapy.

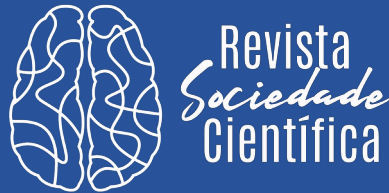
3. LITERATURE REVIEW

3.1 PULP REVASCULARIZATION

Regenerative endodontic therapy can be described as a procedure that allows tissue to be reestablished within the pulp space and root development that has been interrupted, making the tooth more resistant to fractures [18]. The endodontic treatment of elements that carry pulpal necrosis and incomplete rhizogenesis is a challenge for professionals because it consists of maintaining the tooth and allowing complete root development even with necrotic pulp with or without periradicular lesion, evidencing the increase in the thickness of the dentin wall and root involvement, it also consists of stimulating the penetration of periradicular tissue inside the root canal [16].

It is increasingly common to use procedures that aim to regenerate tissues, highlighting pulp revascularization [17].

With this, innovative treatments have been gaining ground and being more accepted in clinics, as they are scientifically proven easy and highly effective methods [15].



3.2 LASER THERAPY

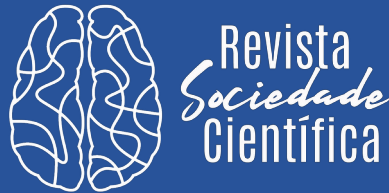
Laser therapy is one of the new methods that has stood out for bringing benefits to patients, such as immediate pain relief, reduction of inflammatory processes, faster tissue recovery, prevention of infections. It is a minimally invasive procedure, of low intensity, does not produce heat and is capable of penetrating tissues and causing bacterial deaths [19].

Consisting of electromagnetic waves that contain a high concentration of energy, given by the large amount of photons, when absorbed by the body this energy stimulates numerous cells that activate transcription factors. These factors will promote increased expression of genes related to protein synthesis, anti-inflammatory actions and cell proliferation, consisting of the speed of multiplication of cells in the affected area, increasing cell division and thus causing tissue repair of the injured area [14].

With this, the development and constant improvement of the laser, it can be used in all specialties of dentistry, from diagnosis and microbial reduction, to surgery. It has therapeutic properties, that is, it has anti-inflammatory, analgesic and biostimulant action, coming from a light source with several wavelengths [13].

Low power laser, when associated with a photosensitizing agent (methylene blue), results in the formation of singlet oxygen, cytotoxic to bacteria by acting on the fluid membrane, causing intracanal microbial reduction, equivalent to those achieved with high power lasers.

It could be cited as advantages: treatment with higher rates of microbial reduction, painless, without side effects, allows the antimicrobial action to reach places inaccessible to traditional endodontic techniques, increases the probability of root canal treatment being in a single session, reducing the need to change dressings with intracanal medication [11].



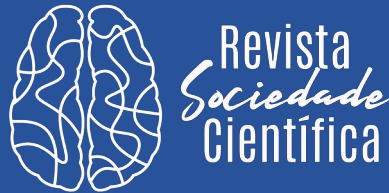
3.3 APPLICATION OF LASER THERAPY IN DENTISTRY

The accurate use of light for therapeutic purposes has enabled Dentistry to have numerous clinical applications. With the exponential development and constant improvement of phototherapy using laser, it was noted that it could also be applied to other clinical areas, including endodontics, during and after conventional endodontic treatment, as well as in local and periapical surgeries [3].

The clinical use of laser as an adjunct to conventional endodontic treatment has enabled even more satisfactory results with regard to postoperative pain control, disinfection of the root canal system, periapical surgery, postoperative tissue repair and tissue repair injured by the extrusion of root remains. However, laser therapy should be well indicated and performed based on previously established protocols, and clarified, between the doctor and the patient, since the use of Laser therapy requires knowledge of the applied dosage and the application of a correct protocol [10]. Some authors ask the dentist to use it safely and effectively [8]. In direct pulp capping, it is expected to find the functions of the lasers, which are the de inflammatory action and high capacity for tissue restoration [9].

The performance of pulpotomy in deciduous and permanent teeth shows positive results both with the high-power laser, which has hemostatic power and improves the view of the operative field, leaves a more peaceful environment, facilitating the dentist's work, and the power laser, which will use its anti-inflammatory properties and its biostimulation to the accurate adjustment of the tissue to bring pulp revitalization. However, some researches investigate the application of lasers in tissues that have their potential to increase healing, stimulate dentinogenesis and preserve pulp vitality [7].

In addition, endodontic treatments are painful and have great pulp exposure, pulp revitalization combined with the positive effects of laser therapy biofunction, will enable better double comfort, patient and dentist, delivering a more complete work to the population [5].



Publicado em 07 de agosto de 2023
REVISTA SOCIEDADE CIENTÍFICA, VOLUME 6, NÚMERO 1, ANO 2023

The "start" of systemic diseases is in the mouth, the exposed pulp is an acceptable path for bacteria to reach the transmission of the human body, nothing, however, endodontic treatments are painful and of great pulp exposure, that part explained combined with the positive effects of the biofunction of laser therapy, will enable comfort to the patient and dentist in their operating area, delivering a more accurate and fast work, causing pathologies such as: pneumonia, ischemic the population within dental clinical environments [6].

4. CONCLUSION

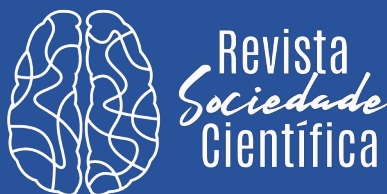
It is concluded, therefore, that the use of laser therapy has been fundamental in dentistry, it is very effective in the treatment, its applications as adjuncts in traditional endodontic treatment showed efficient and positive results in patients, thus contributing to the studies found, which had as main objective the issues of postoperative tissue repair and injured tissues, disinfection of the root canal system, among others [4].

However, there were negative results found in the reviewed studies, which, when using low or high doses, obtained errors in the patient's diagnosis, due to the insufficient number of sessions or the lack of frequency in the applications, therefore, causing damage to the dental and adjacent tissues, related to the high-power laser [1].

In view of this, it is necessary to have more studies on the subject, due to the updates and progress in the use of this new tool, mainly to achieve the ideal protocol and management of the use of low-power laser for pulp revascularization by the dental surgeon and thus achieve efficacy and safety for the patient [2].

5. REFERENCES

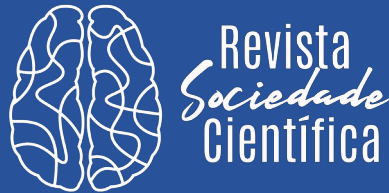
- [1] Alcade MP, Guimarães BM, Fernandes SM, Amoroso-Silva PA, Bramante CM, Vivian RR, et al. Revascularização Pulpar: Considerações Técnicas e Implicações Clínicas. *Salusvita*. 2014; 33(3): 415-432.



Publicado em 07 de agosto de 2023

REVISTA SOCIEDADE CIENTÍFICA, VOLUME 6, NÚMERO 1, ANO 2023

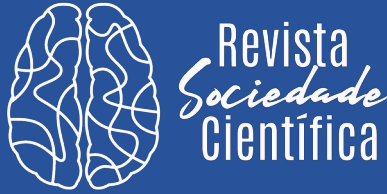
- [2] Albuquerque MTP, Nagata JY, Soares AJ, Zaia AA. Pulp revascularization: an alternative treatment to the apexification of immature teeth. *Rev Gaúch Odontol.* 2014; 62(4): 401-410.
- [3] Arslan H, Doğanay E, Karataş E, Ünlü MA, Ahmed HMA. Effect of Low-level Laser Therapy on Postoperative Pain after Root Canal Retreatment: A Preliminary Placebo-controlled, Triple-blind, Randomized Clinical Trial. *J Endod.* 2017;43(11):1765-69.
- [4] BANCHS, F. E; TROPE, M. Revascularization of immature permanent teeth with apical periodontitis: new treatment protocol. *J Endod.* v.30, n.4, p.196- 200. 2004.
- [5] Biel, P., Mohn, D., Attin, T., & Zehnder, M. (2017). Interactions between the tetrasodium salts of EDTA and 1-hydroxyethane 1, 1-diphosphonic acid with sodium hypochlorite irrigants. *Journal of endodontics.* 01;43(4):657-661.
- [6] Bramante CM, Duque JA, Cavenago BC, Vivian RR, Bramante AS, de Andrade FB, Duarte MA. Use of a 660-nm Laser to Aid in the Healing of Necrotic Alveolar Mucosa Caused by Extruded Sodium Hypochlorite: A Case Report. *J Endod.* 2015; 41(11):1899-902.
- [7] Bruschi, L. S., Guadagnin, V., Arruda, M. E. B. F., Duque, T. M., & Peruchi, C. T. R. (2015). A revascularização como alternativa de terapêutica endodôntica para dentes com rizogênese incompleta e necrose pulpar: protocolos existentes. *BJSCR.* 12(1):50-61.
- [8] Cabral, C. S. L., Genizelli, L. O., Cruz, R. G. Z., Pereira, A. C., Moreira, E. J. L., & Silva, E. J. N. L. (2016). Tratamento de dentes com rizogênese incompleta após procedimentos regenerativos ou de apicificação: uma revisão sistemática de literatura. *Rev. Bras. Odontol.*;73(4):336-9.
- [9] Carroll JD, Milward MR, Cooper PR, Hadis M, Palin W. Developments in low level light therapy (LLLT) for dentistry. *Dent Mater.* 2014; 30(5):465-75.



Publicado em 07 de agosto de 2023

REVISTA SOCIEDADE CIENTÍFICA, VOLUME 6, NÚMERO 1, ANO 2023

- [10] Carnaúba, R. K. L. V., Oliveira, P. C., Pereira, P. L. R., Fagundes, D. S., Bueno, C. S. P., & Oliveira, D. P. (2019). Revascularização pulpar: Revisão de Literatura. *RvACBO*. 8(1):25-32.
- [11] Castro, A. N., Oliveira, D. C. R. S., Diniz, L. N., Eulalia, A. S., Paulillo, L. A. M. S., & Pereira, G. D. S. (2011). Avaliação da utilização de MTA como plug apical em dentes com ápices abertos. *Rev. bras. Odontol.* 68(1):59-63.
- [12] Cehreli ZC, Isbitiren B, Sara S, Erbas G. Regenerative Endodontic Treatment (Revascularization) of Immature Necrotic Molars Medicated with Calcium Hydroxide: A Case Series. *Journal of Endodontics*. 2011; 37(9): 1327-1330.
- [13] Chow RT, David MA, Armati PJ. 830nm laser irradiation induces varicosity formation, reduces mitochondrial membrane potential and blocks fast axonal flow in small and medium diameter rat dorsal root ganglion neurons: implications for the analgesic effects of 830nm laser. *J Peripher Nerv Syst*. 2007;12:28-39.
- [14] DAEMON, Fernanda Xavier Moreira. Follow-up de Tratamento Endodôntico – Protocolo Clínico. 2019. Dissertação de Mestrado (Mestrado Integrado em Medicina Dentária)- Universidade do Porto, Porto, 2019.
- [15] DANISH, S. H.; REZA, Z.; SOHAIL A. A. Case reports and their importance in Medical Literature. *J Pak Med Assoc*, v. 67, n. 3, p. 451-453, 2017.
- [16] DIOGENES, A. et al. An update on clinical regenerative endodontics. *Endod Top*. v.28, p.2-23. Jun. 2013.
- [17] HOSHINO, E. et al. In-vitro antibacterial susceptibility of bacteria taken from infected root dentine to a mixture of ciprofloxacin, metronidazole and minocycline. *Int Endod J*, v. 29, n. 2, p. 125-30, março, 1996
- [18] HUANG, G. T. A paradigm shift in endodontic management of immature teeth: conservation of stem cells for regeneration. *J Dent*, v. 36, n.6, p. 379-86, junho, 2008.



Publicado em 07 de agosto de 2023

REVISTA SOCIEDADE CIENTÍFICA, VOLUME 6, NÚMERO 1, ANO 2023

- [19] LIMOEIRO, A. G. S. et al. Revascularização pulpar: relato de caso clínico. *Dent Press Endod*, n. 5, v. 2, p. 74-7, maio/agosto, 2015.
- [20] LUMLEY, P. J.; WALMSLEY, A. D.; WALTON, R. E.; RIPPIN, J. W. Cleaning of oval canals using ultrasonic or sonic instrumentation. *J Endod*, v.19, n.9, p.453-457, 1993.
- [21] MACHIDA, T.; WILDER-SMITH, P.; ARRASTIA, A. M.; LIAW, L. H. L.; BERNIS, M. W. Root canal preparation using second harmonic KTP:YAG laser: a thermographic and scanning electron microscopic study. *J Endod*, v.21, n.2, p.88-91, 1995.
- [22] MOREIRA, E. J. L. Influência do comprimento do segmento curvo do canal radicular na fratura por flexão dos instrumentos endodônticos de níquel-titânio acionados a motor. Estudo in vitro. Rio de Janeiro, 2001. 120p. Tese (Doutorado). Universidade do Estado do Rio de Janeiro. Faculdade de Odontologia.
- [23] SOUSA-NETO, M. D. Estudo in vitro do efeito da aplicação do laser Er:YAG sobre a dentina humana na adesividade de diferentes cimentos obturadores dos canais radiculares. 1999. Tese de Livre Docência, Faculdade de Odontologia de Ribeirão Preto, Universidade de São Paulo.