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Optimization of the dental implant with the use of ILIB: major considerations

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Abstract

Introduction: In the context of implantology and osseointegration for the stabilization of dental implants, the use of ILIB (Intravascular Laser Irradiation of Blood) to stimulate tissues, cells, and molecules at the systemic level stands out. In this sense, ILIB can be used with postoperative applications in the osseointegration and stability of dental implants. **Objective:** Conducted a concise systematic review of the main findings of using the ILIB to improve dental implant practices. **Methods:** The research was carried out from May 2021 to June 2021 and developed based on Scopus, PubMed, Science Direct, Scielo, and Google Scholar, following the Systematic Review-PRISMA rules. The quality of the studies was based on the GRADE instrument and the risk of bias was analyzed according to the Cochrane instrument. **Results:** A total of 58 studies were analyzed, with only 10 medium and high-quality studies selected, according to GRADE rules, and with risks of bias that do not compromise scientific development. After analyzing the major studies, it was analyzed that, with the use of ILIB, several bone regeneration factors can be promoted and optimized for implant dentistry. Other authors have shown that ILIB therapy has oral sterilization properties, facilitating tissue healing after surgical procedures and the osseointegration process for placement of stable implants. Despite this, low-intensity laser irradiation may have limitations, as it requires specific dosimetry and few published studies on the use of ILIB in Dentistry. **Conclusion:** Literary findings point to the safety and efficacy of ILIB in dental implant treatments. The ILIB power is included as an eligibility criterion equal to other low power lasers. Furthermore, ILIB enables local and systemic treatment, optimizing the benefits of its use by dentists, mainly to improve the stabilization of osseointegrated implants and prevent or eliminate contamination.

Keywords: Intravascular Laser Irradiation of Blood. ILIB. Dental implant. Osseointegration.

Introduction

In the context of implantology and osseointegration for the stabilization of dental implants, the use of ILIB (Intravascular Laser Irradiation of Blood) or laser therapy (photobiomodulation) that uses non-ionizing or infrared light to stimulate tissues, cells, and molecules at the systemic level [1]. This occurs through the application of ILIB in the radial artery, stimulating microcirculation with an increase in the production of adenosine triphosphate (ATP), nitric oxide (NO), and reactive oxygen species (ROS) [1].

In this sense, ILIB can be used with postoperative applications in the osseointegration and stability of dental implants [2]. Thus, the benefits in aiding patient comfort are evident, as it is a painless therapy compared to the application of high-intensity lasers. In this context, the ILIB uses wavelengths 633 and 685 nm [3,4]. This low-intensity application provides comfort to the patient due to its associated anti-inflammatory, analgesic, and healing properties [5].

In this scenario, the success of the implants mainly

depends on the osseointegration success, and this can be optimized with the use of ILIB low-intensity laser therapy. The effect of ILIB improves vascularization, increases collagen synthesis and to bone, modulates inflammation, accelerates cell proliferation [1]. Thus, it was demonstrated that ILIB stimulates bone stem cells and accelerates their repair process, improving the bone environment for immediate implant loading, avoiding the need for a second surgery [6].

Also, to make laser therapy more promising, it is important to limit its exposure time [1,5]. Also, when using the proper wavelength, titanium does not absorb but reflects laser energy. Another excellent use of laser is for the removal of any peri-implant hyperplastic tissue [5,6].

Therefore, the present study performed a concise systematic review of the main findings of the use of ILIB for the improvement of dental implant practices.

Methods

Study Design

This was followed by a systematic literature review model, according to the PRISMA rules [7].

Data sources and research strategy

The search strategies for this review were based on the descriptors: "*Intravascular Laser Irradiation of Blood. ILIB. Dental implant. Osseointegration*". The research was carried out from June 2021 to July 2021 and developed based on Google Scholar, Scopus, PubMed, Scielo, and Cochrane Library. Also, a combination of the keywords with the Booleans "OR", "AND", and the operator "NOT" were used to target the scientific articles of interest.

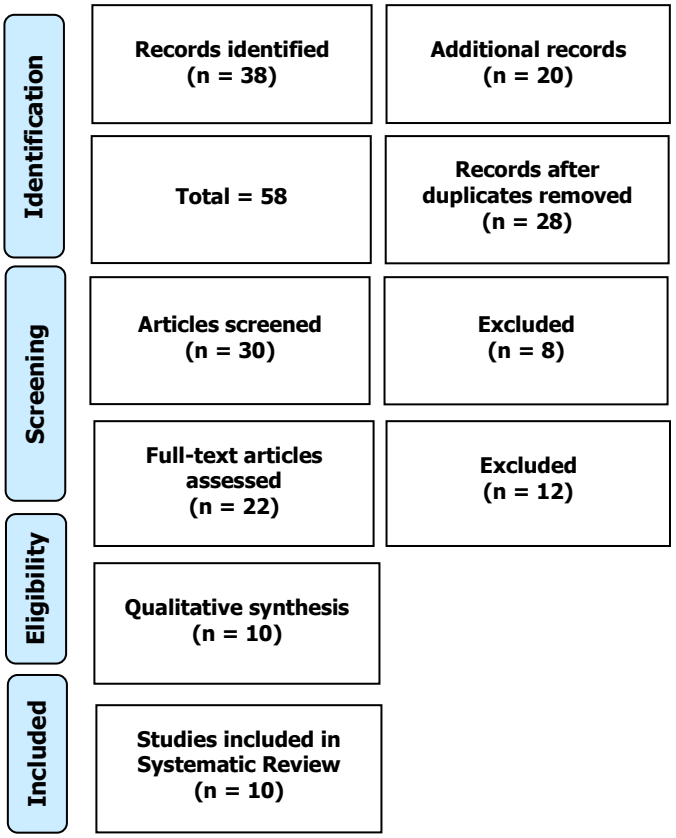
Study quality and risk of bias

The quality of the studies was based on the GRADE instrument [8], with guidelines, randomized controlled clinical studies, prospective controlled clinical studies, and studies of systematic review and meta-analysis listed as the studies with the greatest scientific evidence. The risk of bias was analyzed according to the Cochrane instrument [9].

Results and Discussion

After the selectivity of articles and literary findings through the following descriptors *intravascular laser irradiation of blood, ILIB, dental implant and osseointegration*, a total of 58 studies were analyzed, with only 10 medium and high-quality studies selected, according to GRADE rules, and with risks of bias that do not compromise scientific development, based on the Cochrane instrument (**Figure 1**).

Figure 1. Study selection scheme.



After analyzing the major studies, it was analyzed that, with the use of ILIB, several bone regeneration factors can be promoted and optimized for implant dentistry. In this context, the use of ILIB is associated with the reduction of wounds in the mouth region, reduction of inflammation (inhibition of cyclooxygenase). Still, the successful application of the ILIB laser is related to the size of the surface, that is, it must be small for the result to be satisfactory [1,2].

Other authors have shown that ILIB therapy has the property of oral sterilization, facilitating tissue healing after surgical procedures and the osseointegration process for placement of stable implants [10,11]. Also, photobiomodulation has benefits related to the reduction of oral mucositis in patients with head and neck cancer [3,4]. Other authors have shown that the postoperative application of laser therapy is positive for the osseointegration and stability of dental implants [2]. These findings show the effects related to anti-inflammatory, analgesic, and healing capacities with the application of low-intensity laser. Despite this, low-intensity laser irradiation may have limitations, as it requires specific dosimetry [3,4] and few published studies on the use of ILIB in Dentistry [2,5].

In this context, a study evaluated primary and

secondary stabilization and bone density in the peri-implant area after the ILIB protocol (635 nm diode laser). The survey included 40 implants placed in the posterior region of a mandible in 24 patients (8 women and 16 men; age: 46.7 ± 8.7 years). Patients were randomly divided into 2 groups G1 (n = 12, 18 implants) and G2 (n = 12, 22 implants). As a result, the mean implant stability showed greater stability after 635 nm laser irradiation compared to a control group in the first week. After 12 weeks, no differences were observed between groups. The mean grayscale value at the apical, middle, and cervical level of the titanium implants showed a reduction in the pixel grayscale value after 2 weeks, being lower for the G1 group compared to the G2 group. The grayscale value after 12 weeks was significantly higher at the medium and apical level of the implants in group G1 compared to group G2. Thus, the application of ILIB improved the secondary stability of the implant and bone density [12].

Furthermore, a study evaluated the radiodensitometric effect of ILIB on the osseointegration of immediate loading dental implants in patients undergoing treatment with vitamin C, omega-3, and calcium therapy. In the group without laser, the healing phase was allowed to progress spontaneously without any intervention, while in the laser group, low-intensity laser therapy of 904 nm wavelength was applied in contact mode, continuous wave, an output power of 20 mW, and exposure time of 30 seconds at a dose 4.7 J/cm2. Patients in both groups received vitamin C, calcium, and omega-3 from one month preoperatively. As a result, significant increased differences were observed on the mesial, distal, and apical sides around the implants of both groups. However, the rate of increase was significantly higher in the laser group. Thus, irradiation with ILIB significantly promoted bone consolidation and accelerated the osseointegration process [6].

Finally, a randomized controlled trial evaluated the effectiveness of using a 940 nm diode laser in second-stage implant surgery compared to a conventional scalpel approach. A total of 21 patients with a total of 112 dental implants were identified as having bone-integrated dental implants. The use of ILIB resulted in little postoperative pain, decreased edema with less inflammatory response, increased homeostasis, and regular wound healing. It also reduced the time required for the final impression and improved the patient's quality of life compared to surgical exposure with a conventional scalpel [13].

Conclusion

Literary findings point to the safety and efficacy of ILIB in dental implant treatments. The ILIB power is included as an eligibility criterion equal to other low power lasers. Furthermore, ILIB enables local and systemic treatment, optimizing the benefits of its use by dentists, mainly to improve the stabilization of osseointegrated implants and prevent or eliminate contamination.

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Data sharing statement

No additional data are available.

Conflict of interest

The authors declare no conflict of interest.

Similarity check

It was applied by Ithenticate@.

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