



Photobiomodulation therapy weaknesses

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Since the first observations of Endre Mester in his research on the effects of the ruby laser in the treatment of malignant neoplasm [1], the application of low-intensity lasers has been shown to be a therapy of great value for dentistry and health in general. The results of this study were different from those hypothesized by Mester, the application of the ruby laser had not destroyed neoplasm cells, but on the contrary, had a biostimulative effect on the healing of the surgical wound performed for the implantation of the tumoral cells into the rats' subcutaneous tissue [2]. These results were attributed to the fact that Mester used a low-power laser. Their later studies, now aiming at evaluating wound healing in humans [3], showed that lasers applied at low power can improve wound healing. And today, based on countless studies, from in vitro to clinical trials, the therapy based on the application of low-intensity lasers has supported the Mester findings.

The therapy based on the application of low-intensity lasers has had several names since the Mester studies, such as low-intensity laser therapy (LILT), laser phototherapy (LPT), LED (light-emitting diodes) phototherapy (LEDPT), among others. Thus, the compilation of scientific evidence related to the use of low-intensity lasers in its various therapeutic applications was impaired, not allowing to show the real importance of this therapy. Having this in mind, a group of researchers in this field got together and proposed that a unified term should be used from then on. The proposed term was “photobiomodulation (PBM) therapy” and an appropriate and comprehensive definition of this therapy was then published in 2015 [4]. According to Anders et al.

[4], PBM therapy was defined as “A form of light therapy that utilizes non-ionizing forms of light sources, including lasers, LEDs, and broadband light, in the visible and infrared spectrum. It is a nonthermal process involving endogenous chromophores eliciting photophysical (i.e., linear and nonlinear) and photochemical events at various biological scales. This process results in beneficial therapeutic outcomes including but not limited to the alleviation of pain or inflammation, immunomodulation, and promotion of wound healing and tissue regeneration.” [4].

PBM therapy, based on its properties, can be applied as an adjunct therapy to almost all therapeutic procedures in Dentistry, from physiological ones, such as healing of surgical wounds, until cases of oral pathologies. Searching the bibliographic sources, we observed that Dentistry contributed in about 20% of the publications on the use of PBM therapy. PBM has been applied in tissues involved in clinical conditions within the most varied dental specialties, namely: periodontology; endodontics; restorative Dentistry (dentin hypersensitivity, gingival retraction); management of soft tissues conditions (wound healing, trismus, ulcers); bone (dental implants, orthodontics); nerves (paresthesia, myalgias, myofascial pain dysfunction syndrome, facial paralysis, neuralgia) and oral pathologies, such as xerostomia, herpes labialis, oral mucositis, lichen planus, medication-related osteonecroses of the jaws (MRONJ), among others.

For a long time, the literature has focused in demonstrating that PBM was a worth therapy to improve the conventional Dentistry. Later, the researchers and clinicians were looking for the best protocols to be applied. Finally, the dental community has accepted PBM as a good adjuvant therapy for some dental applications. But researchers and even the most experienced clinicians of the laser in Dentistry fields are still testing different protocols, showing that beneficial effects can be achieved with a range of laser irradiation parameters.

Taken into consideration the levels of scientific evidence, one can find in the literature several publications since in vitro and animal studies, ideas, editorials, opinions, case reports, cases series, and case-control studies until

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randomized controlled double-blind studies showing the benefits of PBM therapy in different Dentistry areas. Thus, PBM should be recommended as adjuvant therapy for clinical application in almost all dental procedures. However, this cannot be done. Because although the beneficial effects of PBM therapy have been widely presented in the publications of all levels of evidence, when it comes to the conclusions of the highest level, the systematic reviews and meta-analyses, it cannot be confirmed. But why? Because the most of systematic reviews were not able to collect enough data for meta-analyses. And why it has happened? Because there is a huge variability in the laser irradiation protocols. This is a remarkable weakness of PBM therapy. Another weakness of PBM therapy resides in the lack of information about the irradiation protocols, what make difficult to reproduce the studies.

It is clear that small changes in the laser irradiation protocols can result in different degrees of success. On the other hand, most of similar protocols can result in similar final clinical effects of PBM. Thus, to circumvent the weaknesses of PBM therapy, it would be of importance to stick to a narrow range of successful protocols, in order to produce a bulk of good publications that ultimately could be collected and analyzed in systematic reviews that finally could support the clinical application of PBM in Dentistry. Moreover, the publications must present all laser parameters and other information of the treatment protocol for making the studies clear and reproducible.

Even with problems related to the protocols (extensive variations and lack of information of parameters) in the publications on the effects of PBM in their different applications

in Dentistry, it is undeniable that when applied with indications based on correct clinical diagnosis of the conditions, as well as with adequate parameters for each one of these conditions, PBM has been shown to be safe and effective in its intended treatment goals. These goals are the most requested by dentists and their patients (e.g., controlling inflammation, accelerating the healing process and providing pain relief). Thus, we claimed to the researchers and clinicians of the laser in Dentistry field to think about these weaknesses and from now on publish solid and reproducible studies for the future establishment of PBM therapy as a valuable adjuvant therapy in Dentistry.

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