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Laser Therapy is Safe but not Superior to Conventional Treatment of Peri-implantitis

SUMMARY

Selection Criteria
Two reviewers independently performed an electronic search of the PubMed database of the US National Library of Medicine, the EMBASE database, and the Cochrane Central Register of Controlled Trials (CENTRAL) from January 1990 up to and including June 2013. The electronic search was complemented by a manual search of specific journals related to the topic. Eligible studies were limited to human controlled clinical studies with data from at least 10 patients with a minimum of 6 months of follow-up.

Key Study Factor
Use of laser therapy as mono-therapy or as an adjunct in the treatment of peri-implantitis with a report of clinical indices of peri-implant disease, including clinical attachment level (CAL) and probing depth (PD).

Main Outcome Measure
The main outcomes were CAL gain and reduction in PD after at least 6-months post-treatment as compared to baseline.

Main Results
One hundred and thirty seven articles were obtained after de-duplication following the electronic and manual search. After the first and second phases of selection, 122 and 9 articles, respectively, were excluded, leaving a total of 6 included articles.

Four articles that reported on the same laser wavelength (Er:YAG) were included in the meta-analysis. The pooled effect sizes in CAL after 6 months for the non-surgical group, for the surgical group, and for all studies, where treatment was performed with Er:YAG laser were found to be non-significant ($p = 0.90, 0.14,$ and 0.86, respectively). The 95% confidence interval for postoperative gain in CAL was $[-0.47$ to $0.40]$. No statistically significant evidence for treatment effects in reducing PD level was found for the non-surgical group, surgical group, and all studies ($p = 0.97, 0.16,$ and $0.7,$ respectively). There was no evidence for subgroup differences between surgical and non-surgical Er:YAG treatments in CAL and PD reduction ($p = 0.12$ and $0.17,$ respectively).

No major adverse events were noted except for persistent chronic inflammation that eventually led to implant loss in four cases.

When combined with soft tissue resection, carbon dioxide (CO₂) laser irradiation (10.6 μm) was found to be effective in reducing PD and increasing attachment gain significantly compared to conventional treatment.

Conclusions
Based on the limited number of controlled clinical studies, any superiority of laser treatment in comparison to conventional treatment of peri-implantitis could not be definitively identified. However, non-surgical laser...
therapy may be investigated as phase I therapy for the treatment of peri-implantitis.

Commentary and Analysis

The systematic review and meta-analysis by Kotsakis et al. is currently the study with the highest level of evidence available in the literature on the effect of laser therapy on the treatment of peri-implantitis. The authors concluded that based on the limited information currently available, any superiority of laser treatment in comparison to the conventional treatment of peri-implantitis could not be identified. Considering the high heterogeneity and the low number of included studies, the authors cautiously concluded that non-surgical laser therapy should be investigated as phase I therapy for the treatment of peri-implantitis. Future research should emphasize the detailed description of the specific laser characteristics and power settings in clinical studies. However, in the present systematic review, there was no information on the use of surgical treatment and amount of bone fill achieved with the laser treatment.

There is limited clinical information on the application of CO2 lasers and surgical treatment for peri-implant defects in conjunction with bone grafting techniques; however, their use seems to be promising. The authors appropriately identified the lack of available information regarding this very promising treatment modality. A representative example of the potential usefulness of non-contact CO2 laser with low power can be found in the results of case series. In this case series, clinical and radiographic outcomes showed complete healing and even complete bone fill in very deep defects. Thus further studies should emphasize the positive effects of the CO2 laser (10.6 μm) on peri-implantitis. This may not be applicable for the 9.3-μm CO2 laser or other wavelengths.

The authors also emphasized in their discussion that there is no information available regarding the efficacy of specific laser wavelengths. This is an important factor that should be addressed in future studies because of the potential risk of overheating when using specific laser wavelengths. Although information regarding laser wavelength is essential, it is inadequate to express sufficient information on how the laser treatment was performed. Recent in vitro studies confirm that overheating of the implant body is possible when using diode lasers as well as the Er:YAG laser, and this may be the main reason why the studies included in this systematic review with the Er:YAG laser have heterogenic results. In contrast, the use of the CO2 wavelength reduces the risk of temperature-induced tissue damage because the laser is minimally absorbed in the implant surface due to its excellent absorption in water.

This article contributes to the evidence that lasers may be used as decontamination methods for the treatment of peri-implantitis. This systematic review and meta-analysis is the first study to qualitatively and quantitatively synthesize the information from available studies on the effect of various laser wavelengths for the treatment of peri-implantitis. This study showed there is a distinct difference among various laser wavelengths (i.e., Er:YAG, CO2, or diode lasers) and clinical efficacy, thus underlining the importance of reporting laser characteristics such as wavelength, energy settings, and mode of application in future studies. This study also clearly pointed out the need to identify optimal laser settings for the treatment of peri-implantitis through clinical and pre-clinical studies and to avoid the “all-inclusive” term “laser treatment,” by focusing on the distinct response of each individual wavelength and developed protocols. Special attention should be paid to the goal of the treatment, such as improving the clinical parameters and/or bone fill.

Previous canine studies focused on the treatment of peri-implantitis and showed a re-osseointegration of dental implants after CO2 laser irradiation and guided bone regeneration (GBR) technique.

There is no evidence for use of diode lasers (810 and 980 nm) and Nd:YAG laser in the treatment of peri-implant diseases. Potential risks, such as overheating of the implant body, may be the main reason for the lack of such studies.

Readers should realize that each laser wavelength and its specific power settings (pulse energy at the tip, average power, irradiation period, application mode, and specific laser–tissue interactions of the different wavelengths) are important parameters that define a singular treatment modality.

Another critical factor that could have influenced the outcome of studies included in the systematic review is the underreported tobacco smoking status of the study participants. It is known that habitual smoking jeopardizes the outcomes of oral surgical interventions. In addition, habitual tobacco smoking has a dose-dependent negative influence on the surgical treatment of peri-implantitis. It is therefore tempting to speculate that the outcomes of laser therapy (regardless of the laser parameters used) are compromised in habitual tobacco smokers as compared to non-smokers.

New bone formation may occur to some extent around dental implants following treatment for peri-implantitis; however, a “complete” re-osseointegration may be difficult to achieve without GBR. Therefore surgical treatment of peri-implantitis in conjunction with decontamination methods should be used to improve the long-term stability of ailing implants.

References


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