

Introduction

Dental implants are the standard of care for partial and complete edentulism with more than 90% success rates in most patients. However, dental implants are susceptible to bone loss and failure due to peri-implantitis. Peri-implantitis is a chronic inflammatory process caused by plaque biofilm that leads to bone loss around dental implants similar in nature to the pathogenesis of bone loss around teeth in periodontal disease. When peri-implantitis is diagnosed at an early stage then treatment and subsequent implant retention may be possible through resective surgery or bone augmentation procedures.

A major factor that influences surgical treatment success is the ability to effectively decontaminate the implant surfaces to reduce or eliminate the plaque biofilm present. Decontamination of implant surfaces is challenging due to the nature of the moderately rough surface of implants and due to exposure of the implant threads. Many decontamination protocols for treatment of peri-implantitis have been suggested including airflow debridement, implantoplasty, titanium brushes, local antimicrobials, scalers and lasers.

However, limited evidence exists to support a gold standard treatment for periimplantitis. Laser therapies are promising due to their ability to selectively target microbes while potentially limiting damage to exposed implant structures.



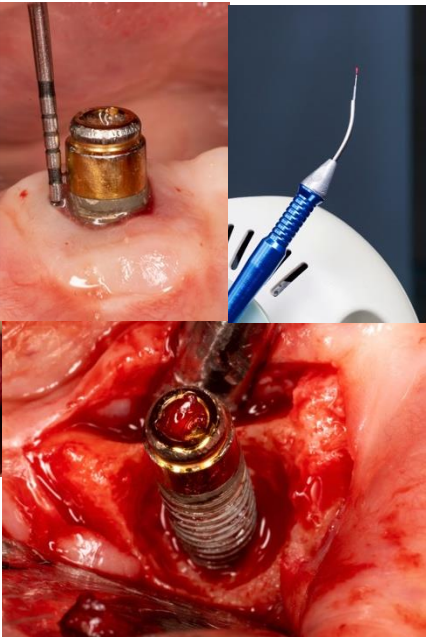
Aim

This systematic review aims to evaluate the efficacy of laser therapies in the treatment of peri-implantitis, a prevalent inflammatory condition affecting dental implants and surrounding tissues.

Methods

A systemic search using PubMed, Ovid, Cochrane library used to look for different method of treating peri-implantitis using different laser for purpose of regeneration. Studies reviewed included use of different lasers to treat peri-implantitis July 2013 to 2023. All human and animal studies were included.

Twenty-one studies met the proposed inclusion criteria; six systemic reviews, ten case studies and five human and animal studies.



Results

Primary outcome result was radiographic bone level changes with peri-implantitis. Secondary outcome was changes of probing depth and bleeding. Most studies did not show changes in radiographic bone level, but bleeding was significantly reduced ($p=0.05$) Those studies looked at a different type of laser. Statistical results were not consistently reported.

Author(s), Year	Study Design	Types of Laser and Type of Treatment	Comparison Groups, Outcome Measures	Results
Malloa J, Lin GH, Chan HL, MacEachern M, Wang HL 2014	Systematic Review (7 human prospective clinical trials and 2 animal studies included)	Laser Types: CO2 (3 studies), Er:YAG (5 studies), Diode laser (1 study) Treatment Type: Surgical and nonsurgical	Comparisons: Hand curettage, air abrasives Outcome Measures: PD, CAL, BOP	Noted similar PD reduction with laser decontamination compared to conventional methods (curettes, air abrasives, saline, chx rinse)
Natto ZS, Aladmany M, Lew PA Jr, Wang HL 2015	Systematic Review (13 studies included, 5 RCTs, 3 case reports, 1 case series, 4 controlled clinical studies)	Laser Types: CO2 (2 studies), Er:YAG (9 studies), Er,Cr:YSGG (1 case report), Diode laser (1 study) Treatments: Surgical and nonsurgical treatment	Comparisons: minocycline, plastic curettes, air abrasives, curettes with 0.2% chx Outcome Measures: PD, CAL	Found limited evidence to suggest that Er:YAG and CO2 lasers may improve outcomes of peri-implantitis treatment, surgical treatments have more favorable outcomes than nonsurgical
Kotsakis GA, Konstantinidis I, Karousis IK, Ma X, Chu H 2014	Systematic Review and Meta-Analysis (6 controlled clinical studies were included)	Laser Types: PDT (diode laser and phenothiazine chloride) (1 study), Er:YAG (4 studies), CO2 (1 study) Treatment Type: Surgical (n=2) and nonsurgical (n=4)	Comparisons: minocycline, plastic curettes, air abrasives, curettes with 0.2% chx Outcome Measures: PD, CAL	Mild improvements in PD and CAL but not statistically significant. Meta-analysis could only be performed for Er:YAG laser but no statistically significant difference in reduction in PD and CAL levels
Roncati M, Lucchese A, Carinci F 2013	Case Report (1 patient)	810nm Diode Laser with piezoelectric ultrasonic curettage and 0.5% chx gel application Nonsurgical treatment of an implant with 7mm PD and 4 threads of bone loss	No comparison group Outcomes- PD and BOP	Authors noted a significant reduction in PDs and BOP at 1 and 5 years post op.
Wang CW, Ashnagar S, Gianfippo RD, Annett M, Kinney J, Wang HL 2021	Randomized Control Clinical Trial (24 pts)	Laser Type: Er:YAG Treatment Type: Surgical (treatment-OFD, suprapericardial implantoplasty, and bone grafting)	Control (n=12): mechanical debridement w/ bone graft and membrane Treatment (n=12): mechanical and Er:YAG laser debridement, bone graft and membrane Outcome Measures: PD, CAL, GI, bone gain and defect fill at 3 months and 6 months	Both groups showed reductions in PD, GI, CAL gain. Er:YAG group showed significantly higher PD reductions than control (2.65mm vs 1.85mm). No statistically significant difference in CAL gain, GI reduction, bone gain.
Ashnagar S, Nowzari H, Nakhbatolfighahai H, Yaghoub Zadeh B, Chinforush N, Choukachi Zadeh N 2014	Literature Review (15 clinical human studies included)	Laser Type: Er:YAG (9 studies), CO2 (3 studies), Diode laser (3 studies) Treatment Type: surgical (n=7) and nonsurgical (n=8)	Comparisons: minocycline, plastic curettes, air abrasives, curettes with 0.2% chx Outcome Measures: PD, CAL, BOP	Limited evidence to show improvement to PD, CAL gain and BOP. More evidence available for Er:YAG compared to other laser types.
Li L, Deng J, Ren S 2021	Systematic Review (7 RCTs, 3 controlled clinical trials)	Laser Type: Er:YAG (11 studies) Treatment Type: nonsurgical (n=7) and surgical (n=3)	Comparisons: mechanical debridement, minocycline, plastic curettes, air abrasives, curettes with 0.2% chx Outcome Measures: PD, CAL, BOP	Er:YAG laser use was superior to mechanical debridement in the treatment of peri-implantitis with statistically significant increases in PD reductions.
Li L, Lu Y, Guo J, Zhang X, Jin Z, Zhang J 2023	Systematic Review (5 RCTs)	Laser Type: Er:YAG (5 studies) Treatment Type: Surgical (n=6)	Comparisons: mechanical debridement, minocycline, plastic curettes, air abrasives, curettes with 0.2% chx Outcome Measures: PL, PD, CAL, BOP	Due to methodological heterogeneity, such as non-standard control groups and laser parameters, this systematic review demonstrated inconclusive findings in terms of the efficacy of Er:YAG laser as a debridement method in surgical treatment of advanced peri-implantitis.

Conclusion

Some studies showed CO2 laser with low power setting has better result for treating peri-implantitis.

With limited information that we could collect. Laser treatment significantly reduces bleeding, but the change of the radiographic bone level was not significant. ($p=0.05$).

Within the scope of this review, it appears that one session of laser treatment is inadequate to effectively treat peri-implantitis

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