Laser Treatment of Peri-Implantitis: A Literature Review

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Abstract:

Peri-implantitis is a state defined as an inflammatory reaction around osseointegrated implants, leading to progressive loss of supporting bone. Various treatment methods are suggested in the treatment of peri-implantitis and clinicians have to choose a method over a large number of treatment protocols. Lasers have shown promising therapeutic effect in treatment of peri-implantitis. However, some controversies have been found in clinical outcomes after using lasers. Therefore, we aimed to review the current literature over the past ten years for the use of lasers in treatment of peri-implantitis, via the Pubmed electronic database of the US National Library of Medicine. Fifteen human studies were reviewed. Er:YAG (Erbium-Doped Yttrium Aluminum Garnet), CO2 (Carbon Dioxide Laser) and Diode lasers were used. Despite inconsistencies and disharmonies among studies in terms of study design, positive treatment outcomes were obvious among the majority of them. However, short period of follow-ups and poor control of plaque index, as a critical confounding factor, were the major problems which these studies suffered from. It seems that one session laser therapy is not adequate for achieving optimal clinical outcome. Further studies with longer periods of follow-ups, intense control of plaque index, and various sessions of laser treatments are needed to clearly illustrate the clinical privilege of laser therapy.

Keywords: peri-implantitis; lasers; dental implants
inflammatory response in host and inhibits bone cells reattachment to the implant surface. When treating this condition in order to reestablish health of the periimplant tissue, it is crucial to not only eliminate the inflamed tissue, but also decontaminate the infected implant surface.

Several approaches for implant decontamination are available, with the ideal one still remaining to be determined. Mechanical debridement, disinfection with chemotherapeutic agents, smoothing implant surface and surgeries aimed to eliminate bacteria and laser therapy should be noted. Mechanical debridement can be done with carbon, plastic or titanium currets, ultrasonic scaling or powder air abrasion. Chlorhexidine digluconate, tetracycline fibers and minocycline microspheres seem to have strong disinfecting and bactericidal potential. Efficacy of mechanical or chemical modalities seems to be limited due to resistant bacterial strains, limited access to inflamed area and pharmacologic limitations like in site drug dosage or insufficient anti bacterial effect. Also mechanical strategies like metallic curretts, ultrasonic metal tip scalers and air powder abrasion may develop a roughened implant surface, which itself increases bacterial colonization and biofilm formation.

Recently, a noticeable tendency has urged scientists toward application of laser in order to decontaminate periimplant inflamed area. Lasers can efficiently irradiate small areas of the implant surface which mechanical methods are unable to reach. Improved clinical outcomes are predictable due to selective calculus removal, bactericidal and haemostatic effects of lasers. In vitro models have proven the efficacy of Er:YAG(Erbium-Doped Yttrium Aluminum Garnet), CO₂ (Carbon Dioxide Laser) and Diode lasers in high or even complete elimination of bacteria loaded titanium disks. Also microscopic evaluations have ensured that proper application of these lasers do not disturb titanium surface

When considering utilization of lasers in treatment of periimplantitis, practitioner must take a number of decisions. Type of lasers which include Er:YAG, CO₂, Diode, Er,Cr:YSGG(Erbium, Chromium doped Yttrium Scandium Gallium Garnet) and Nd:YAG (Neodymium-Doped Yttrium Aluminium Garnet). Next is power setting which must disinfect the implant, while being safe for surface texture. Combining laser therapy with other treatment modalities might be indicated.

Inconsistencies in previous studies concerning clinical outcomes and in the settings with which the lasers were operated, led us to review the current literature and provide a concise summary to help while planning treatment strategies.

**Methods**

To compile this review, a search of the PubMed database of the US National Library of medicine was carried out. The literature search was done on articles published from March 2004 to March 2014. International peer reviewed journal articles related to the use of lasers in the treatment of peri-implantitis were searched. The key words used in this search were: peri-implantitis or periimplantitis or peri implantitis or periimplant or peri-implant or periimplant lesions) and (laser or lasers)

During the search in PubMed database, the following filters were applied:

1. Language: English language.
2. Human studies
3. Type of article: randomized-controlled trial, clinical trial, controlled clinical trial, case study, meta-analysis

The search identified a total of 125 articles. Abstracts were read by the authors, and studies, investigating the effect of laser therapy on peri-implantitis were included. Animal studies and review articles were excluded; however bibliographies were searched for any relevant articles. This resulted in 15 articles to analyze.

The following information was extracted from the selected studies:

- Publication details (title, author(s), journal, year, volume, issue number, pages)
- Number and type of implants
- Laser settings
- Experimental Procedures
- Follow up period
- Bleeding on probing
- Plaque index
- Probing depth
- Clinical attachment level
- Gingival recession
- Bone level

**Results**

Fifteen human studies were selected for review. A multitude of treatment regimens, including laser irradiation, had been used. Human studies included 9 studies on Er:YAG laser, 3 studies on CO₂ laser and 3 studies on Diode laser. Most of the studies presented positive clinical outcomes in 6 months follow-up.
# Table 1. Clinical studies using Er:YAG laser on oral implant surfaces

<table>
<thead>
<tr>
<th>Authors-year</th>
<th>Type of laser</th>
<th>Number of patients and implants</th>
<th>Implant type</th>
<th>Laser characteristic</th>
<th>Experimental procedures</th>
<th>Follow up</th>
<th>BOP</th>
<th>Plaque index</th>
<th>Pocket probing depth</th>
<th>Clinical attachment level</th>
<th>Gingival recession</th>
<th>Bone level</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Renvert et al. 2011</td>
<td>Er:YAG</td>
<td>42 patients, 100 implants</td>
<td>Not reported</td>
<td>Laser Group: machined surface: 41, medium rough surface: 14, Control group: machined surface: 29, medium rough surface: 16</td>
<td>Removal of Implant suprastructures ± Submucosal Glynice (Powder air polishing) ± Laser irradiation</td>
<td>6 months</td>
<td>Baseline=100% of implants 6m=No BOP in 31% (p&lt;0.001) (But no difference by intervention)</td>
<td>Reduced plaque index (but not statistically significant) Mean 0.8±0.5 mm reduction (p&lt;0.05) Not reported Not reported No significant change</td>
<td>Significant BOP reduction was observed in both groups, however, Pocket probing depth reduction was not significant.</td>
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<tr>
<td>2 Schwarz et al. 2006</td>
<td>YAG</td>
<td>12 patients, 12 implants 2 patients and 2 implants at each time interval</td>
<td>Titanium implants (Sandblasted and acid etched (SLA), Screw Vent, Screw Line, Ticer, Frialiti)</td>
<td>100 mj Pulse 10 HZ</td>
<td>supragingival professional implant/tooth cleaning + open flap debridement using plastic curettes + Augmentation + Laser irradiation</td>
<td>1.3, 6, 9, 12, 24 months</td>
<td>Mean reduction 0-24 m Mean increase 6-24 months Increased mean values of Pl as observed between 6 and 24 months Mean decrease to 6 months Decrease from 6-24 months Mean gain at 6 months Decrease from 6-24 months Mean increase from 1-24 months No decrease in radiolucency</td>
<td>Although plaque index increased between Baseline to 3 months, all other variables improved.</td>
<td></td>
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<tr>
<td>3 Schwarz et al. 2006B A</td>
<td>Er:YAG</td>
<td>20 patients, 40 implants 20 patients and 20 implants in each group (parallel design)</td>
<td>Titanium implants (SLA and Titanium plasma sprayed (TPS) surface) Strauman (Intraosseous Cylinder (IMZ))</td>
<td>100 mj Pulse 10 HZ</td>
<td>Implant scaling (curette) + chlorhexidine (0.2%) + irrigation + chlorhexidine gel in pocket + Laser irradiation</td>
<td>3, 6, 12 months</td>
<td>Reduction after 3, 6, 12 m (p&lt;0.01 and 0.001)</td>
<td>Plaque index was significantly higher at 12 months as compared to baseline in both groups Reduction after 3, 6, 12 m (p&lt;0.01) Gain after 3 m and 6 m (p&lt;0.05) 12 months no significant difference (p&gt;0.05) Decrease after 3 m (p&gt;0.05) Then remained stable in next follow ups (p&gt;0.05) Not reported</td>
<td>In group (a) : 2 patients with 4 implants were discontinued from the study due to persisting pus between 4 and 12 weeks</td>
<td></td>
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<tr>
<td>4 Schwarz et al. 2005</td>
<td>YAG</td>
<td>20 patients, 32 implants 10 patients and 16 implants in each group (parallel design) All rough surface.</td>
<td>Titanium implants (Strauman)</td>
<td>100 mj Pulse 10 HZ</td>
<td>Plastic curette + chlorhexidine irrigation (0.2%) + chlorhexidine gel in pocket or laser irradiation</td>
<td>6 months</td>
<td>Baseline=83% Unchanged (PI increased at 3 months and was unchanged at 6 months)</td>
<td>Base line: 5.4±1.2 mm 6m: 4.6±1 mm (p&lt;0.001) Base line: 5.8±0.9 mm 6m: 5.1±0.9 mm (p&lt;0.001)</td>
<td>No significant change</td>
<td>Not reported</td>
<td>In spite of unchanged Plaque index, both therapies resulted in significant improvements of BOP, Pocket depth and Clinical attachment level</td>
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</tr>
<tr>
<td>5 Badran et al. 2011</td>
<td>Er:YAG</td>
<td>Case study, 1 implant</td>
<td>Not reported</td>
<td>120 mj Pulse 10HZ</td>
<td>Stage 1: non-surgical ultrasonic scaling Stage 2: surgical exposure, granulation tissue curettage synthetic bone grafting</td>
<td>6 months</td>
<td>Total reduction no BOP after 3 m Not reported (The patient had maintained satisfactory oral hygiene.)</td>
<td>2-5 mm reduction 6 m after non-surgical therapy. Additional 0.2 mm reduction 3 m after augmentation Not-reported</td>
<td>Mkl Recession occurred 1-2 mm</td>
<td>Radiographic evidence of bone formation</td>
<td></td>
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<tr>
<td>Authors-year</td>
<td>Type of laser</td>
<td>Number of patients and implants</td>
<td>Implant type</td>
<td>Laser characteristic</td>
<td>Experimental procedures</td>
<td>Follow up</td>
<td>BOP</td>
<td>Plaque index</td>
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<tr>
<td>6 Schwarz et al. 2011</td>
<td>Er: YAG</td>
<td>32 patients, 38 implants</td>
<td>Titanium Implants (Ankylos, Astra, Branemark, Camlog, ITI, KSI (Nobel Replace, Tapered Screw Vent, Xive))</td>
<td>100 mJ/Pulse 10 Hz, 11.4 J/cm²</td>
<td>Surgical exposure, granulation tissue removed+implantoplasty with diamond burs+Augmentation with natural bone mineral and collagen membrane + plastic curets plus cotton pellets and sterile saline</td>
<td>6 months</td>
<td>47.8±35.5% Reduction (p&lt;0.001)</td>
<td>Plaque index reduced at 6 months (p&lt;0.01)</td>
<td>Reduction of 1.7±1.4 mm (p&lt;0.001)</td>
<td>Increase of 1.5±1.4 mm (p&lt;0.001)</td>
<td>0.2±0.2 mm recession (p&lt;0.05), but no significant difference between groups.</td>
<td>Increased radioopacity in 14/15 implants</td>
<td>Short term improvements in clinical characteristics were observed</td>
</tr>
<tr>
<td>7 Schwarz et al. 2012</td>
<td>Er: YAG</td>
<td>24 patients, 26 implants</td>
<td>Titanium Implants (Ankylos, Astra, Branemark, Camlog, ITI, KSI, Nobel Replace, Tapered Screw Vent, Xive) (21 rough surface, 5 smooth surface)</td>
<td>100 mJ/Pulse 10 Hz, 11.4 J/cm²</td>
<td>Surgical exposure, granulation tissue removed+implantoplasty with diamond burs+Augmentation with natural bone mineral and collagen membrane + plastic curets plus cotton pellets and sterile saline+Laser irradiation</td>
<td>24 months</td>
<td>75.0±32.6% Reduction (p&lt;0.001)</td>
<td>Plaque index reduced at 24 months, but not significant</td>
<td>1.7±1.2 mm reduction in 12 months (p&lt;0.001)</td>
<td>But not significant reduction in 24 months (1.1±2.2 mm)</td>
<td>0.4±0.2 mm recession in 24 months (0.1±0.4 mm)</td>
<td>Not reported</td>
<td>Although significant improvements in Pocket probing depth, BOP and Clinical attachment level was observed in 12 months, but only BOP remained significantly better in 24 months.</td>
</tr>
<tr>
<td>8 Persson et al. 2011</td>
<td>Er: YAG</td>
<td>42 patients, 100 implant</td>
<td>30 rough surface, 70 smooth surface</td>
<td>100 mJ/Pulse 10 Hz, 12.7 J/cm²</td>
<td>Air abrasion or Laser irradiation</td>
<td>6 months</td>
<td>42.4% reduction, but not significant</td>
<td>Not reported</td>
<td>0.9±0.8 mm reduction, but not significant</td>
<td>Not reported</td>
<td>No significant change</td>
<td>Although there was some bactericidal effects in Laser group, but at 6 months, there was no bacterial reduction</td>
<td></td>
</tr>
<tr>
<td>9 Yamamoto et al. 2013</td>
<td>Er: YAG</td>
<td>1 patient, 5 treated implants (case report)</td>
<td>Not reported</td>
<td>50 mJ, 20 Hz</td>
<td>Removal of granulation tissue by laser irradiation+decontamination of implant surface by laser</td>
<td>3 years</td>
<td>Not reported</td>
<td>Not reported</td>
<td>Not reported</td>
<td>Not reported</td>
<td>After 3 years, apparent bone regeneration was radiologically confirmed.</td>
<td>Er: YAG can be a treatment alternative for peri-implantitis.</td>
<td></td>
</tr>
</tbody>
</table>
However these initial outcomes seemed not to be everlasting and found to be similar to conventional therapies, at longer periods of follow-up.

**Er:YAG laser for treatment of Human peri-implantitis (Table 1)**

Nine studies used Er:YAG laser in treatment of peri-implantitis, while four of them used it in combination with surgical exposure. (Table 1) Laser characteristics used in these studies were almost similar (100 mj, pulse mode, 10 Hz), except Badran et al. (120 mj, pulse mode, 10 Hz), and Yamamoto et al. (50 mj, pulse mode, 20Hz). Only four studies reported energy density which was either 11.4 j/cm\(^2\) or 12.7 j/cm\(^2\). Distance from which laser was irradiated or time of exposure was not mentioned in the studies. At the start of the interventions, all studies provided a healthy hygiene ranged from Schwarz studies in 2011 and 2012. Two studies had not significant reduction in PI, two higher than baseline and a slight increase was obvious. Out of three reviewed studies, only Deppe et al. managed to maintain the oral hygiene, by reminding instructions and demonstrations to professional all studies provided a healthy hygiene ranged from Schwarz et al. studies in 2012 and 2012. Except for Romanos et al., in which Plaque index was not reported, other studies showed reduced PI at the end of the monitoring, but they were not significant. Deppe et al. reported a significant decrease in PI after 4 months, but it was not maintained until the last follow-up and a slight increase was obvious. Out of three reviewed studies, only Deppe et al. managed to maintain the oral hygiene, by reminding instructions and demonstrations during the study.

**CO\(_2\) laser for treatment of Human peri-implantitis (Table 2)**

The number of three studies found on topic of using CO\(_2\) laser for treatment of peri-implantitis, with only one of them being a clinical trial. The others were a case series and a case study. Power of the laser was in a range of 2w to 4w, mostly around 2w. Continuous mode of application was used in two of them, while Romanos et al. study did not determine the mode. Duration of laser emission was 1 minute in Romanos et al. study and twelve episodes of 5 second laser exposures in Deppe et al. study. None of them noted the distance at which laser was applied. Deppe et al. provided comparison groups of air abrasion and bone augmentation. All of the studies, exposed defect area surgically and removed granulation tissue. Except for Romanos et al., in which Plaque index was not reported, other studies showed reduced PI at the end of the monitoring, but they were not significant. Deppe et al. reported a significant decrease in PI after 4 months, but it was not maintained until the last follow-up and a slight increase was obvious. Out of three reviewed studies, only Deppe et al. managed to maintain the oral hygiene, by reminding instructions and demonstrations during the study.

Deppe et al. found that despite noticeable improvement
<table>
<thead>
<tr>
<th>Authors-year</th>
<th>Type of laser</th>
<th>Number of patients and implants</th>
<th>Implant type</th>
<th>Laser characteristic</th>
<th>Experimental procedure (procedures prior to and post irradiation)</th>
<th>Control procedure</th>
<th>Follow up</th>
<th>BOP</th>
<th>Pocket probing depth</th>
<th>Clinical attachment level</th>
<th>Gingival recession</th>
<th>Bone level</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Romanos et al. 2009</td>
<td>CO₂</td>
<td>1 patient (case study)</td>
<td>Not reported</td>
<td>2-4 w continuous</td>
<td>Surgical exposure granulation tissue cured (case study)</td>
<td>Not reported</td>
<td>Not reported</td>
<td>Not reported</td>
<td>Not reported</td>
<td>Not reported</td>
<td>Not-reported</td>
<td>Not-reported</td>
<td>Good healing and new bone formation compared to baseline</td>
</tr>
<tr>
<td>2 Romanos and Nentwig 2008</td>
<td>CO₂</td>
<td>15 patients, 19 implants (case series)</td>
<td>Titanium implants (Ankylos, ITI, IMZ)</td>
<td>19 rough surface</td>
<td>Surgical exposure + granulation tissue cured + Xenogenic or autogenous grafting</td>
<td>27.1±17.83 months</td>
<td>Sulcus bleeding index reduced from 2.76±0.35 to 1.03±0.85 (P&lt;0.01)</td>
<td>Plaque index was slightly reduced, but not significant</td>
<td>Mean reduction from 6.0±2.03mm to 2.48±0.65mm (P&lt;0.01)</td>
<td>Slight, but not significant increase in width of keratinized mucosa.</td>
<td>Not-reported</td>
<td>Complete fill with xenogenic grafting. 2/3 fill with autogenous grafting</td>
<td></td>
</tr>
<tr>
<td>3 Deppe et al. 2007</td>
<td>CO₂</td>
<td>32 patients, 73 implants (IMZ, Friadent, Branemark, ITI)</td>
<td>67 rough surface, 6 smooth surface</td>
<td>1060 nm 2.5 w Continuous mode, 5-second exposure</td>
<td>Removal of granulation tissue, supra crestal cleaning with air-powder abrasive + Laser ± bone augmentation</td>
<td>1) 4 months 2) 5 to 59 after initial surgery</td>
<td>Sulcus bleeding index reduced dramatically after 4m, but was slightly decreased in last followup compared to baseline. Reduction of 42.4±52.2% (p value not reported)</td>
<td>Plaque index was reduced dramatically after 4m, but was slightly decreased in last followup compared to baseline.</td>
<td>3.2±0.52mm reduction (p value not reported)</td>
<td>3.6±0.47mm gain (p&gt;0.05)</td>
<td>Not reported</td>
<td>40.8% bone fill (p&gt;0.05)</td>
<td></td>
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</tbody>
</table>

Table 2. Clinical human studies using CO₂ laser on oral implant surfaces.
in PPD and CAL at fourth month observation, these result
did not last until next follow-up. PI and BOP measures
followed a meaningful pattern in accordance with latter
findings, which decreased significantly, but increased at
the next follow-up.

An overall conclusion on utilization of CO₂ laser
implies that unstable clinical outcomes concurrent with
uncontrolled plaque index still holds this laser in a vague
situation and further clinical trials are needed to achieve
a certain verdict.

Diode Laser for treatment of Human peri
implantitis (Table 3)

Three studies were found, implementing Diode laser in
a photodynamic therapy. (Table 3) Two were clinical trials
36, 38 and one was a case report. 37 Two studies used similar
laser characteristics, including implementation of a 660
nm diode laser with 100mW power for 10 seconds. 36,
38 Mode of application was not mentioned in neither of
them. One study used a 810 nm diode laser with 1.96
W power in continuous mode for 6 minutes.37 Distance
from which laser was applied was only mentioned in
Roncati et al.37 study which was 1mm from the most apical
portion of the pocket. During all three studies, hygiene
instructions were given to the patients and reinforcement
of oral hygiene was followed until 1 to 2 months.

Schar et al.36 and Bassetti et al.38 used diode laser with
exactly the same instructions, including laser irradiation
in combination with Phenothiazine chloride (HELBO),
3 minutes after hand curettage, air powder abrasion and
irrigation with hydrogen peroxide. Adjunctive PDT
(Photodynamic Therapy) was carried out one week later.

Plaque index was only reported in two studies,
presented as modified plaque index (mPlI). 36, 38 mPlI
was statistically reduced at the end treatment follow ups
(6 and 12 months). Schar et al.36 reported a plaque free
environment in the laser group at month 6.

BOP was significantly reduced at the end of follow
ups in all three studies. Roncati et al.37 and Schar et al.36
reported some cases with no BOP positive sites.

PPD was reduced in all three studies. However, in
Roncati et al.37 study, 4mm PPD reduction was ascribed
to formation of long junctional epithelium. Also, in
Bassetti et al.38 study, PPD reduction was not statistically
significant any more at month 12. CAL was only reported
in two studies 36, 38 which did not show any significant
change in both studies. These two studies showed
remarkable reduction in mucosal recession until month
6 and 9. However, this significant reduction was not
stable until month 12 in Bassetti et al.38 study. (p>0.05)

There was no report on hard tissue assessments, except
radiologic assessments of Roncati et al.37 study, which
showed only some improvement of the bone level.

Conclusively, diode laser seems to have some
advantages in treating peri-implantitis. However, positive
clinical outcomes appear to last for short periods of
time. Also, hard tissue examinations are needed to
prove efficacy of this treatment option in treating bony
lesions.

Discussion

Through the assiduous search that has been performed,
a disharmony was found in studies regarding application
of laser in treatment of peri-implantitis. Study designs
had a significant diversity. Clinical parameters and
indices were different in some cases, thus a clear and
reliable inference could not be made. Some studies used
a combination of laser therapy and other procedures. The
relative effect of the laser application could therefore
not be assessed.

Some studies suffered from small number of patients
which might be relevant to low incidence of peri-
implantitis. Sample size calculation to estimate minimal
number of patients and implants are needed to achieve
a statistically significant positive therapeutic outcome,
and were only reported in a few studies. Blinding of the
examiner was only documented in a few studies. Smoking
is identified as a confounding factor that adversely affects
results of periodontal therapies 39 and according to our
survey, some studies did not even notice the smoking
situation of the patients. However, some excluded smoker
patients and some tried to distribute them in a random
way.

The most important part that should be discussed is
that a healthy periodontal environment is absolutely
required after decontamination of implant surface
to achieve desirable treatment outcomes. Failure in
controlling plaque index in most of the studies can be
a serious confounding factor that led to inconsistencies
in the results. Enormous efforts are needed to motivate
patients in order to maintain their oral hygiene and
follow instructions. Regular maintenance sessions are
to be scheduled.

Despite the inconsistencies in results of the previous
studies, therapeutic potential of the lasers has to be noted.
Positive treatment outcomes provide a foundation for
future research to tune a delicate and efficient treatment
protocol.
Table 3. Clinical human studies using Diode laser on oral implant surfaces

<table>
<thead>
<tr>
<th>Authors-year</th>
<th>Type of laser</th>
<th>Number of patients and implants</th>
<th>Implant type</th>
<th>Laser characteristic</th>
<th>Experimental procedures</th>
<th>Follow up</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1 Schar et al. 2013</td>
<td>Diode laser + Phenothiazine chloride (HELBO)</td>
<td>40 patients, 40 implants</td>
<td>ITI (SLA)</td>
<td>660 nm 100 mw 10 seconds repeated 1 week later</td>
<td>Mechanical debridement with titanium curetes and glycine-based powder air polishing and irrigation with 3% hydrogen peroxide +Photodynamic treatment (Diode laser and HELBO) + Local delivery of minocycline microspheres</td>
<td>6 months</td>
<td>63% reduction in BOP sites, at 6 months. 30% of the cases were free of inflammation.</td>
<td>Significant and complete reduction in modified plaque index was observed, at 6 month. (p&lt;0.03)</td>
<td>0.36 mm reduction at 6 months (p&lt;0.005)</td>
<td>No significant change in attachment level. (p&gt;0.05)</td>
<td>Significant reduced mucosal recession at month 6. (p&lt;0.02)</td>
<td>Not reported</td>
<td>PhotoDynamic Therapy can be a treatment alternative in management of initial peri-implantitis</td>
</tr>
<tr>
<td>2 Roncati et al. 2013</td>
<td>Diode laser</td>
<td>1 patient, 1 implant</td>
<td>Titanium implant (Nobel Biocare)</td>
<td>810-nm, 0.5 W, 1.96 J/cm2 continuous mode total time of 360 sec</td>
<td>0.2% Chlorhexidine mouthwash + laser irradiation + titanium curetage + ultrasonic device with plastic tip + 0.5% Chlorhexidine gel in sulcus (all procedure repeated at day 2)</td>
<td>5 years</td>
<td>No BOP</td>
<td>Not reported</td>
<td>PPD reduced from 7mm to 3 mm.</td>
<td>No reported</td>
<td>Not reported</td>
<td>Some improvement of the bone level</td>
<td>Laser can be an alternative modality in treating peri implantitis. However, reduction of the pocket seems to be related to re-epithelialization, with formation of a long junctional epithelial attachment.</td>
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<td>3 Bassetti et al. 2013</td>
<td>Diode laser + Phenothiazine chloride (HELBO)</td>
<td>40 patients, 40 implants</td>
<td>ITI (SLA)</td>
<td>660 nm, 100mW, 10 seconds repeated 1 week later</td>
<td>Mechanical debridement with titanium curetes and glycine-based powder air polishing and irrigation with 3% hydrogen peroxide +Photodynamic treatment (Diode laser and HELBO) + Local delivery of minocycline microspheres</td>
<td>12 months</td>
<td>57% to 63 % reduction of BOP sites in laser groups after 12 months</td>
<td>Statistically significant reduction at 9 months. was significant (0.30 mm) (p&lt;0.04), but at 12 months, it was not significant. (0.11 mm) (p&gt;0.2)</td>
<td>No statistically significant changes (P &gt; 0.05) were observed over time</td>
<td>Significant reduced mucosal recession at month 6. (p&lt;0.02), but not stable till month 12. (p&gt;0.05)</td>
<td>Not reported</td>
<td>PhotoDynamic Therapy may represent an alternative approach in the non-surgical treatment of initial peri-implantitis</td>
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Laser and Peri-Implantitis

Conclusion

Lasers showed an initial positive outcome after a 6 months follow-up. Longer periods of follow-up revealed that initial results were somehow unstable and some degrees of relapse were reported. According to the review, Er:YAG seems to have more reliable documentation and degrees of relapse were reported. According to the review, that initial results were somehow unstable and some months follow-up. Longer periods of follow-up revealed.

References

Laser and Peri-Implantitis


