The TwinLight® approach to peri-implantitis

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As the number of dental implants being placed increases, reported cases of peri-implantitis are becoming more frequent. The available data suggest that one in five implant patients will develop peri-implantitis, an irreversible inflammatory condition characterised by bone loss around the site of an implant, while four in five will exhibit peri-implant mucositis, an early stage of the disease in which the inflammatory reaction is still reversible.[1]

With peri-implant mucositis, the inflammation is limited to the peri-implant mucosa, while with peri-implantitis the infection also spreads to the peri-implant bone. Both conditions include the presence of bacterial plaque and calculus, oedema and redness of tissues, and involve bleeding on probing. In the majority of cases, classical treatment methods for peri-implantitis are inadequate due to a number of complicating factors, including

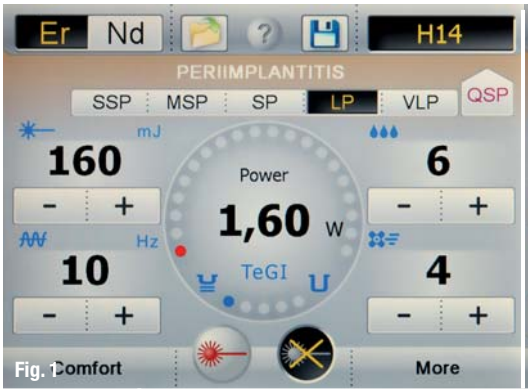

Fig. 1

Fig. 2

Fig. 3a

Fig. 3b

Fig. 4

Fig. 1_Removal of the soft-granulation tissue with Er:YAG in LP mode.
Fig. 2_Removal of the bacterial biofilm on the implant surfaces with Er:YAG in MSP mode.
Fig. 3a_Ablation of the infected bone with Er:YAG in QSP mode.
Fig. 3b_Bacterial reduction in the bone tissue with Nd:YAG in MSP mode.
Fig. 4_Biostimulation with Nd:YAG in VLP mode.

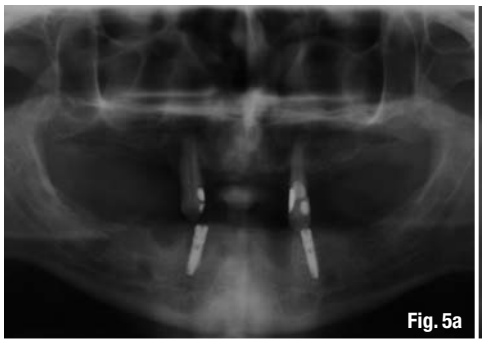
Fig. 5a

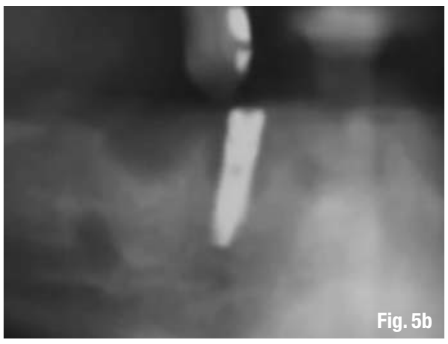
Fig. 5b


Fig. 5c

resistant bacterial strains, difficult debridement procedures and the presence of biofilm on the implant surface.[2]

The most prevalent reason for the development of peri-implantitis appears to be poor occlusal load distribution, with either primary contacts or cantilever bridges in implant-supported prostheses. Good oral hygiene on the patient's part is mandatory, however, the position and design of prostheses that are difficult to manage may limit the effectiveness of mechanical cleaning. Once the underlying reason has been determined and recurrence is prevented, laser therapy can help to treat peri-implantitis.

_The TwinLight® peri-implantitis treatment

A new laser treatment called TwinLight® from Fotona is proving to be one of the most effective methods for fighting peri-implantitis, successfully meeting the objectives of controlling infection by surface decontamination and halting the disease's progression. TwinLight® is a minimally invasive technique combining dentistry's two gold-standard laser wavelengths (Er:YAG and Nd:YAG) in a synergistic process designed to improve peri-implantitis treatment success rates and shorten healing time.

With TwinLight®, the Er:YAG laser is used in a non-surgical procedure to remove microbial composition and in a surgical procedure to treat the damaged alveolar bone around the implant. Using Er:YAG, it is possible to clean the granulation tissues, both on the bone and implant surfaces, and thoroughly decontaminate the site. Removal of granulation tissue from the alveolar bone and connective tissue with Er:YAG laser is highly effective. The erbium laser targets the water content to remove the granulation tissue selectively, due to its long pulse duration and lower peak power, while ablating the microorganisms on the surface of the bone.

The bactericidal effect of Er:YAG on the surgical site is effective against lipopolysaccharides, and the implant surface is completely cleaned without chemicals. The subsequent Nd:YAG treatment step promotes faster healing by bacterial reduction and biostimulation of the bone tissue. The same principles apply also with more severe treatments that require surgical therapy.

Fig. 5a_Pre-op X-ray.
Fig. 5b_Pre-op X-ray zoomed.
Fig. 5c_Pre-op clinical.

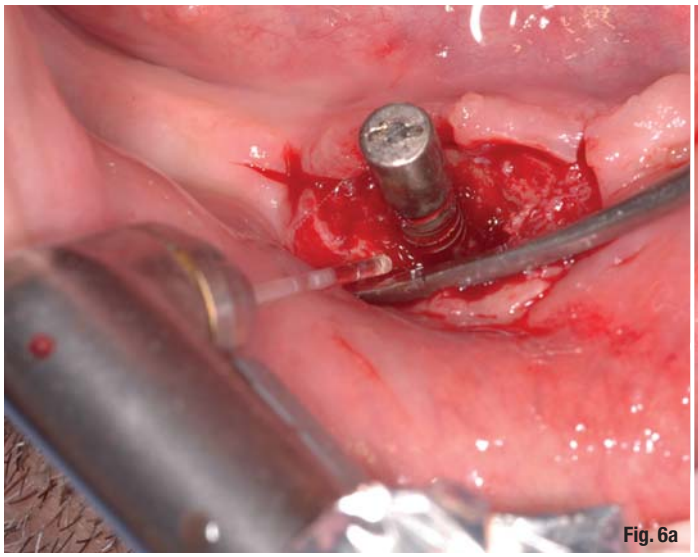
Fig. 6a

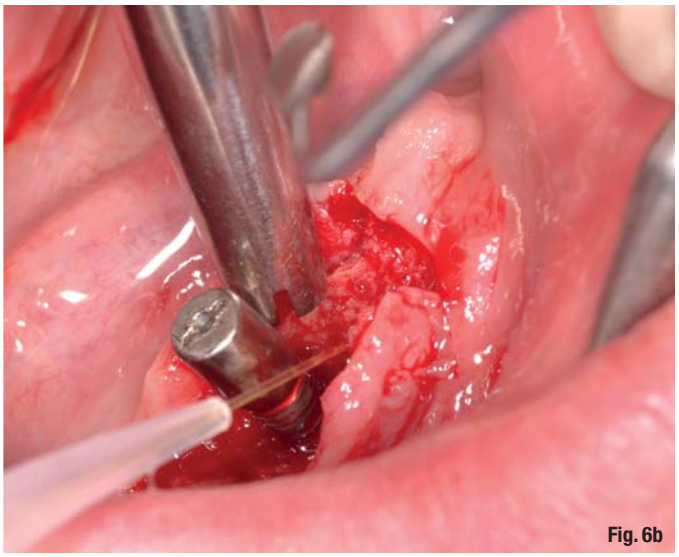
Fig. 6b

Fig. 6a_De-granulation and disinfection of the implant surface with Er:YAG laser.
Fig. 6b_Bacterial reduction and biostimulation of the bone with Nd:YAG laser.

_The TwinLight® procedure

The TwinLight® procedure is performed according to the following five steps:

Step 1: Removal of the soft-granulation tissue with Er:YAG in LP mode (Fig. 1).
Step 2: Removal of the bacterial biofilm on the implant surfaces with Er:YAG in MSP mode (Fig. 2).
Step 3: Ablation of the infected bone with Er:YAG in QSP mode (Fig. 3a).
Step 4: Bacterial reduction of the bone with Nd:YAG in MSP mode (Fig. 3b).
Step 5: Biostimulation with Nd:YAG in VLP mode (Fig. 4).

For treatment of peri-implant mucositis, only step 2 is performed.

Because the Er:YAG wavelength is used with an optimal modality, there is no danger of thermal damage to the highly fragile surrounding bone and no significant alterations of the implant surface, as is frequently the case with other lasers.[3, 4] The effect of the laser energy on the implant surface is dependent on the amount of energy density, power and pulse duration. The parameters should be chosen cautiously—lowering the settings may make the procedure slower but safer for re-osseointegration. Non-surgical use of Er:YAG is also possible if the problem is not extensive.

_Clinical Case

In the accompanying clinical case, a removable prosthetic with two ball attachments was planned. Due to the patient's request, the implants were immediately loaded, which most probably is the reason for the resorption seen around the implant on the right lower jaw (Fig. 5). The site was directly accessed to clean the granulation tissue and disinfect the implant surface with Er:YAG laser, while bacterial reduction and biostimulation were executed with Nd:YAG laser (Fig. 6). The defect was augmented with synthetic bone substitute.

After 3 years of follow up with very good healing (Fig. 7), the patient demanded a fixed prosthetic, which was delivered with an additional placement of implants in both jaws. X-rays taken 5 years after the peri-implantitis treatment can be seen in Fig. 8. Two more implants were placed distally when the patient could afford more treatments after one year.

There are a number of advantages of using lasers in this type of case. One of them is that there is no mechanical, chemical or any other means of trauma while removing the granulation tissue around the implant—neither to the implant nor to the bone tissue. In addition to being safe, both wavelengths are known to promote healing by bacterial reduction and biostimulation of the tissue. Shorter pulses are used on the surface of the

Fig. 7a_3 years post-op X-ray.
Fig. 7b_3 years post-op X-ray zoomed.
Fig. 8a_5 years post-op X-ray.
Fig. 8b_5 years post-op clinical.


Fig. 7a

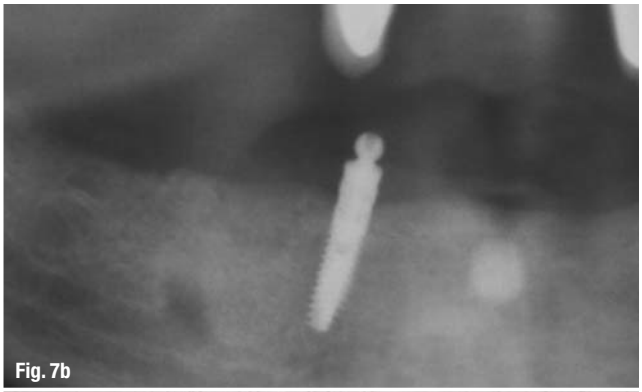
Fig. 7b

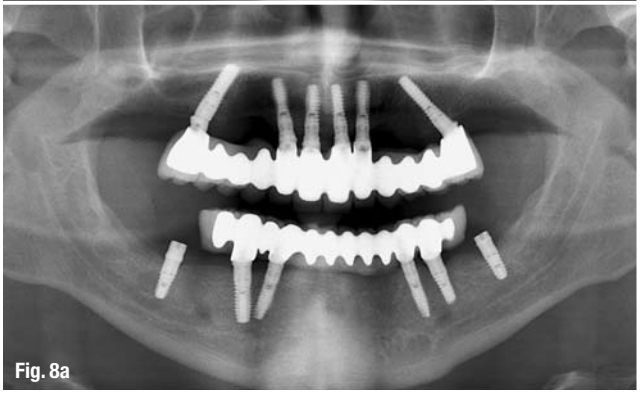
Fig. 8a


Fig. 8b

implant to avoid thermal effects, but with lower energies, so as to not have a too high peak power and thereby damage the surface. With short pulses and higher peak power (higher energy), we can create bleeding spots on the bone to improve healing of the augmentation material.

The penetration of Nd:YAG through bone helps the achievement of bacterial reduction and biostimulation. Care should be taken to avoid contacting the implant surface with Nd:YAG because the absorption in titanium is high and could cause a rise in temperature. It is also important to use a fast, sweeping motion with high suction to avoid heat accumulation on one spot. Too much bleeding would block the penetration of the Nd:YAG laser. Nd:YAG can also be used on the incision line, vestibular, the oral side of the surgical site and extra-orally after suturing, and every second day for faster and better healing, with less pain and swelling._

Editorial note: A list of references is available from the publisher.

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Kurz & bündig

Eine der sinnvollsten Anwendungen des Lasers innerhalb der Implantologie ist die Behandlung von Periimplantitis. Diese Erkrankung stellt die Zahnmedizin vor eine echte Herausforderung und ist mit klassischen Techniken schwierig zu behandeln. Mit zunehmender Zahl platzierter Implantate steigt auch die Zahl der Periimplantitis-Fälle. Laut aktueller Datenlage entwickelt einer von fünf Patienten mit Implantat eine Periimplantitis, eine irreversible Entzündung, die durch Knochenverlust um das Implantat charakterisiert ist. Vier von fünf Patienten entwickeln eine periimplantäre Mukositis, eine frühe Stufe der Erkrankung, in der die Entzündungsreaktion noch reversibel ist.[1]

Der verbreitetste Grund für die Entwicklung einer Periimplantitis scheint eine schlechte okklusale Lastverteilung zu sein, mit entweder Primärkontakten oder freitragender Brücke bei implantat-gestützten Prothesen. Eine gute Mundhygiene aufseiten des Patienten ist zwingend. Dennoch können die schwer zu bestimmende Position und das Design der Prothese die Effektivität einer mechanischen Reinigung einschränken. Ist der ursächliche Grund jedoch erkannt und ein Wiederauftreten verhindert, kann eine Lasertherapie bei der Behandlung hilfreich sein.

Die Laserbehandlung TwinLight® von Fotona hat sich dabei als eine effektive Methode zur Bekämpfung von Periimplantitis bewährt. Die Methode vereint die Vorgaben der Entzündungskontrolle durch Oberflächendekontamination und verhindert ein Fortschreiten der Erkrankung. TwinLight® ist eine minimalinvasive Technik, die die zwei zahnmedizinischen Goldstandard Laser-Wellenlängen (Er:YAG und Nd:YAG) in einem synergetischen Prozess zusammenbringt, um die Erfolgsraten der Periimplantitis-Behandlung zu verbessern und die Einheilungszeit zu verkürzen. Die Prozedur erfolgt in fünf Schritten:

Schritt 1: Entfernung des weichen Granulationsgewebes mit Er:YAG im LP-Modus (Abb. 1).
Schritt 2: Entfernung des bakteriellen Biofilms auf der Implantatoberfläche mit Er:YAG im MSP-Modus (Abb. 2).
Schritt 3: Abtragung des infizierten Knochens mit Er:YAG im QSP-Modus (Abb. 3a).
Schritt 4: Bakterielle Reduktion am Knochen mit Nd:YAG im MSP-Modus (Abb. 3b).
Schritt 5: Biostimulation mit Nd:YAG im VLP-Modus (Abb. 4).

Zur Behandlung einer periimplantären Mukositis ist lediglich Schritt 2 erforderlich.

Im vorgestellten klinischen Fall wurde eine herausnehmbare Prothese mit zwei Kugelkopf-Attachements geplant. Auf Wunsch des Patienten wurden die Implantate sofort belastet, was wahrscheinlich auch der Grund für eine Resorption um das Implantat im rechten, unteren Kiefer war (Abb. 5). Die Behandlung erfolgte analog der fünf Schritte der TwinLight®-Lasertherapie. Im Follow-up nach drei Jahren mit sehr guter Heilung (Abb. 7) verlangte der Patient nach einer festen Prothese, die mit der Platzierung zusätzlicher Implantate in beiden Kiefern erfolgte. Die Röntgenbilder fünf Jahre nach der Periimplantitis-Behandlung sind in Abb. 8 zu sehen – nach einem Jahr wurden zwei weitere Implantate distal platziert.

Die Verwendung des Lasers in einem solchen Fall hat viele Vorteile, u.a. gibt es kein mechanisches, chemisches oder anderweitiges Trauma bei der Entfernung des Granulationsgewebes um das Implantat. Zusätzlich zur Sicherheit sind beide Wellenlängen dafür bekannt, die Heilung durch bakterielle Reduktion und Biostimulation des Gewebes zu fördern.