LASER IN PERIODONTOLOGY - A REVIEW

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Abstract: Lasers are used in implant and periodontal field practices. Laser has various periodontal applications including calculus removal, decontamination of root and implant surfaces and bio stimulation, incision and ablation, osseous surgery, excision of the soft tissue, and bacterial reduction. There is a strong evidence that laser is used for surgical and nonsurgical periodontal therapies including root bio modification, bacterial decline and decontamination of infected implant surface, and removal of the pocket epithelium. Waterlase® and Periowave™ systems are recent devices that have further revolutionized the laser technology for its favorable clinical applications; however, the procedural cost with the laser device constitutes an obstacle for its routine application.

Keywords: laser, biomodulation, fluorescence, LANAP

Introduction:

LASER, an acronym for Light Amplification by Stimulated Emission of Raditaion, was first developed by Maiman,(1) a scientist with the Hughes Aircraft Corporation, using ruby crystal that emits a coherent radiant light when stimulated by energy based on theory originally postulated by Albert Einstein. Goldman ,(2) a dermatologist experimenting laser for tattoo removal, showed painless surface crazing of enamel after focusing two pulses of red light beam from ruby crystal. Following experiments by Stern and Sognaes,(3) pendulum shifted from ruby laser to CO2 and Nd:YAG lasers for better interactions with dental hard tissues. 1970s and 1980s sought use of lasers for soft-tissue surgical procedures, and Lenz et al(4) were among the pioneers to report oral surgical application of CO2 laser, together with Frame (5), Pecaro , and Pick who used the same for oral soft-tissue lesions and periodontal procedures. Myers and Myers described the use of modified ophthalmic Nd:YAG laser for removal of dental caries and received The US FDA’s permission for selling of Nd:YAG laser device in 1989 (6). After Myers’s suggested use in soft tissue surgery, Nd:YAG laser was eventually used in periodontal procedures(7), and since then lasers have been used largely by researchers and clinical periodontal parctioners.

Basic science and concept

Fundamental of laser

As already stated, the word LASER stands for light amplification by stimulated emission of radiation. Let us first try to understand the five words used to describe laser.

Light

Light is a form of energy manifesting itself as electromagnetic radiation and is closely related to other forms of electromagnetic radiations such as radio waves, radar, microwaves, infrared
and ultraviolet radiations, and X-rays. The basic unit of this radiant energy is called a photon. Light can be defined by two basic properties: **Amplitude** and **Wavelength**. **Amplitude** is defined as the vertical height of the wave oscillation from the zero axis to its peak. Wavelength is the horizontal distance between any two corresponding points on the wave. Frequency is a measurement of how many cycles can happen in a certain amount of times (cycles per second). Frequency is inversely proportional to **wavelength**: the shorter the wavelength, the higher the frequency, and vice versa. These properties of light waves are very important because they determine the energy of the laser beam and its effect on the soft and hard tissues.

**Amplification by stimulated emission:**

To understand how amplification by stimulated emission occurs, we should know the components of laser instrument. A laser unit is made up of an optical cavity, the core of which is made up of chemical elements, molecules, or compounds called the active median. An excitation source surrounds the core of the optical cavity which may be a flash lamp strobe device, an electrical circuit or an electrical coil. This excitation source pumps the energy into the active medium. On the two ends of the optical cavity two mirrors are placed parallel to each other. In the case where semiconductors are used as the active medium, polished surfaces replace the mirrors. The mirrors act as resonators and help to collimate and amplify the developing beam. Other components of the laser unit are a cooling system, focusing lenses and some other controls.

To understand stimulated emission we must also know the basics of quantum physics. Max Planck and Neils Bohr described the quantun theory of physics according to which a quantum is the smallest unit of energy emitted from an atom. Later on, Einstein further theorized this concept and stated that an additional quantum of energy may be absorbed by the already energized atom and that would result in release of two quanta.

These released quanta are in the form of identical photons, traveling, as a coherent wave. These photons when come in contact with other atoms in the surrounding, they energize them, resulting in the emission of more photons. This results in the amplification of light energy and thus producing a laser beam.

**Radiation:**

Radiation is a form of electromagnetic energy. The electromagnetic spectrum is composed of a wide spectrum of waves which have different wavelengths and energies. The smallest wavelength is that of gamma rays (10-12 meters) and largest wavelength is for radio waves ranging up to thousands of meters. (8,9)

![Figure 1: radiation, stimulated, light amplification.](image-url)
Characteristics of laser light

The laser light is collimated (parallel) and coherent (temporally and spatially constant) electromagnetic radiation of a single wavelength. Laser light is monochromatic because it only generates a laser beam of a single color, which is sometimes invisible. Laser light is produced by pumping (energizing) a certain substance, or gain medium, within a resonating chamber. The laser light is produced when an excited atom is stimulated to emit a photon. The spontaneous emission of a photon by one atom stimulates the release of a subsequent photon and so on. In this way, a very coherent and synchronous wave, of a single wavelength in a collimated form is produced.

There are two basic modes of wavelength emission for dental lasers, based on the excitation source: continuous wave emission and pulsed emission. In continuous wave emission the laser energy is emitted continuously as long as the laser is activated (example CO₂ laser). The pulsed emission may be delivered in two different modalities: a free-running pulse, in which pulsation is stored for a certain time and the emission has a peak power greater than the power selected on the panel (example ND: YAG, Er:YAG, and Er,Cr: YSGG Lasers), or gated pulse, in which a continuous wave beam is interrupted at various rates by a shutter, emitting the laser beam with the same power as set on the control panel. (8,9)

Classification of lasers

The lasers can be classified on the basis of the type of active medium and characteristics of the laser light. On the basis of active medium or gain medium, they are classified into four classes: Excimer lasers, Gas lasers, Diode lasers and Solid-state lasers. On the basis of the characteristics of the laser light, they can be classified as soft and hard lasers. Soft laser irradiation takes place at thermal, low-energy settings at wavelengths believed to stimulate circulation and cellular activity. Hard lasers (through thermic or ablative effects) have been used extensively for surgical applications. (8,9)

<table>
<thead>
<tr>
<th>Laser type</th>
<th>Active medium</th>
<th>Wave length</th>
<th>color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excimer Lasers</td>
<td>Argon fluoride(ArF)</td>
<td>193nm</td>
<td>Ultraviolet</td>
</tr>
<tr>
<td></td>
<td>Xenon chloride (XeCl)</td>
<td>308nm</td>
<td>Ultraviolet</td>
</tr>
<tr>
<td>Gas Lasers</td>
<td>Argon</td>
<td>488nm</td>
<td>Blue</td>
</tr>
<tr>
<td></td>
<td>Helium-neon (HeNe)</td>
<td>514nm</td>
<td>Infrared</td>
</tr>
<tr>
<td></td>
<td>CO₂</td>
<td>10,600nm</td>
<td>Infrared</td>
</tr>
<tr>
<td>Diode Laser</td>
<td>Indium Gallium Arsenide Phosphorus (InGaAsP)</td>
<td>655nm</td>
<td>Red</td>
</tr>
<tr>
<td></td>
<td>Gallium Aluminium Arsenide(GaAlAs)</td>
<td>670-830nm</td>
<td>Red-Infrared</td>
</tr>
<tr>
<td></td>
<td>Gallium Arsenide(GaAS)</td>
<td>840nm</td>
<td>Infrared</td>
</tr>
<tr>
<td></td>
<td>Indium Gallium Arsenide (InGaAs)</td>
<td>980nm</td>
<td>Infrared</td>
</tr>
<tr>
<td>Solid state Lasers</td>
<td>Frequency doubled Alexandrite</td>
<td>337nm</td>
<td>Ultraviolet</td>
</tr>
<tr>
<td></td>
<td>Potassium Titanyl Phosphate(KTP)</td>
<td>532nm</td>
<td>Green</td>
</tr>
<tr>
<td></td>
<td>Neodymium-YAG (ND:YAG)</td>
<td>1064nm</td>
<td>Infrared</td>
</tr>
<tr>
<td></td>
<td>Holmium YAG (Ho:YAG)</td>
<td>2100nm</td>
<td>Infrared</td>
</tr>
<tr>
<td></td>
<td>Erbium Chromium: YSGG (Er,Ch:YSGG)</td>
<td>2780nm</td>
<td>Infrared</td>
</tr>
<tr>
<td></td>
<td>Erbium: YSSG (Er:YSGG)</td>
<td>2790nm</td>
<td>Infrared</td>
</tr>
<tr>
<td></td>
<td>Erbium: YAG (Er:YAG)</td>
<td>2940nm</td>
<td>Infrared</td>
</tr>
</tbody>
</table>
Effect of lasers on soft and hard tissue

There are four things which may happen when the laser light strikes the tissue:

- Reflection.
- Transmission.
- Scattering.
- Absorption.

**Figure 2: effects of laser on soft and hard tissue.**

**Reflection** occurs when the laser beam is simply redirected off the tissue surface, exerting no effect. When used on the tissue, the minimum amount of laser radiations is reflected from the surface. Second is the transmission, which refers to the passage of laser through the tissue without exerting any effect on the target tissues. **Transmission** of laser light depends on the composition of tissue. For example, water is relatively transparent to the diode and Nd:YAG wavelengths. On the other hand, Erbium and Carbon dioxide laser beams are readily absorbed by tissue fluid and a very little energy is transmitted to the adjacent tissues. **Scattering** is the dispersion of the laser beam into low energy radiations which have no biological effect on the tissues. The scattering of the laser beam causes unwanted heat transfer to the tissues adjacent to the surgical site causing damage. In biologic tissues, the energy is primarily absorbed; scattering occurs only with deep tissue penetration.

The fourth effect is **absorption**, which refers to the absorption of the laser beam energy by intended target tissue, resulting in its usual desirable effect. Absorption of the laser beam depends on various factors such as the wavelength of the laser beam, water content of the tissue, pigmentation, and emission mode. The absorption coefficient strongly depends on the wavelength of the incoming laser irradiation. Neodymium: Yttrium Aluminum Garnet (Nd:YAG) and diode lasers are preferentially absorbed by pigmented tissues. The CO2 laser is well suited for soft tissue surgery, as its energy is highly absorbed by water. Other parameters which affect the absorption of the laser radiation are power, pulse duration, duration of exposure, angle of energy delivery and waveform (i.e., pulsed or continuous).

Biologically, five types of effects can be seen when the laser beam photons enter a tissue. These are,

1. Fluorescence.
2. Photothermal effect.
3. Photodisruptive effect.
4. Photochemical reaction.
5. Photobiomodulation.

Let us now discuss these effects of laser radiation on tissues in detail.

**Fluorescence:**
Fluorescence is the property of an object of absorbing light of short wavelength and emitting light of longer wavelength. In laser application on the tooth structure, fluorescence occurs when the carious lesion is exposed to the 655 nm visible wavelength. It helps in the diagnosis of early carious lesions.

**Photothermal effects:**

When the energy of the laser beam is converted into heat, it is referred to as a photothermal effect. This heat produced is used to perform functions such as incising tissue or coagulating blood. The heat produced by the laser beam has variable effects on tissues which depend on the energy of the laser beam. When a laser heats oral tissues, certain reversible or irreversible changes can occur:

**Table 2: Effects of temperature on soft tissue.**

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Visual change</th>
<th>Biological change</th>
</tr>
</thead>
<tbody>
<tr>
<td>37-60 °C</td>
<td>No visual change</td>
<td>Warming</td>
</tr>
<tr>
<td>60-65 °C</td>
<td>Blanching</td>
<td>Coagulation, hemostasis</td>
</tr>
<tr>
<td>65-90 °C</td>
<td>White/gray</td>
<td>Protein denaturation, Drying, tissue desiccation</td>
</tr>
<tr>
<td>90-100 °C</td>
<td>Puckering</td>
<td></td>
</tr>
<tr>
<td>100 °C</td>
<td>Smoke plume</td>
<td>Vaporization</td>
</tr>
</tbody>
</table>

Irreversible effects such as denaturation and carbonization result in thermal damage that causes inflammation, pain, and edema in the tissue.

**Photodisruptive effect:**

Photodisruptive or photoacoustic effect results when the laser beam with extremely high power interacts with water, causing rapid thermal expansion of the water molecules. It results in a thermo-mechanical acoustic shock wave that is capable of disrupting enamel and bony matrices, quite efficiently. The micro-explosions which are created in the hard tissue matrix lead to its disruption and thus creating micro-fractures. This shock wave creates the distinct popping sound heard during erbium laser use.

**Photochemical reaction:**

Photochemical reactions occur when the photon energy causes a chemical reaction. These reactions are implicated in some of the beneficial effects found in biostimulation.

**Photobiomodulation:**

Photobiomodulation or biostimulation refers to the modulatory effect of laser radiation on cellular response. Many studies have exhibited effects such as increased collagen synthesis, fibroblast proliferation, increased osteogenesis and enhanced leukocyte phagocytosis with various wavelengths of laser. 

10, 11, 12

![Figure 3: photomodulation](image-url)
Types

- Neodymium Yttrium Aluminum Garnet Laser
- Carbon Dioxide Laser
- Diode Laser
- Erbium Laser

Neodymium yttrium aluminum garnet laser - The Neodymium Yttrium Aluminum Garnet Laser (Nd:YAG) wavelength is strongly absorbed by the pigmented tissue. There has been research on using the Nd:YAG laser for nonsurgical sulcular debridement in periodontal disease control. Neodymium Yttrium Aluminum Garnet laser is a very effective surgical laser for coagulating and cutting periodontal soft tissues, with good hemostasis. In addition Nd:YAG laser is used in laser-assisted new attachment procedure (LANAP).(13,14,15)

Carbon dioxide laser - The CO2 laser has the advantage of rapid soft tissue elimination and hemostasis with a very shallow depth of penetration, and this advantage is due to its wavelength which has a great affinity for water. Carbon dioxide laser has the highest absorbance of any laser, but it is associated with several disadvantages including its high cost, relative large size, and its interactive destruction to the hard tissue.(16)

Diode laser - Diode wavelengths are absorbed mainly by hemoglobin and pigmented tissue (melanin). On the other hand, they are poorly absorbed by the enamel and hydroxyapatite. Laser wavelengths, ranging from 810 to 980 nm, are produced from the active medium of the diode laser which is a solid-state semiconductor made of gallium, aluminum, arsenide, and infrequently indium. Diode laser is used in particular procedures including soft tissue crown lengthening, aesthetic gingival (gingivoplasty), removal of inflamed soft tissue, exposure of soft tissue impacted teeth, frenectomies, and photostimulation of the herpetic and aphthous lesions.(17)

Erbium laser - The erbium wavelengths have the highest absorption of water in any dental laser wavelengths and have a great affinity for hydroxyapatite. Two distinct wavelengths of erbium lasers had been developed, including
Er:YAG (Yttrium Aluminum Garnet) Lasers and Er:Cr:YSGG (Yttrium Scandium Gallium Garnet) lasers. Because of its great affinity for hydroxyapatite, it is the laser of choice for dealing with dental hard tissues, and because of its high absorption of water, erbium lasers can be used for periodontal soft tissue ablation, as dental soft tissue is composed of a high proportion of water.(18)

**Figure 7: Er,Cr:YSGG**

**Laser applications in periodontology**

Different lasers penetrate to different tissue depths, depending on their wavelength and the type of tissue at which they are directed. For instance, when applied to soft tissues, Nd: YAG lasers (1064 nm) have a penetration depth of approximately 2–3 mm, compared to CO₂ lasers (10,600 nm), which affect the tissue only superficially (0.1–0.3 mm). In addition, CO₂ lasers have a high absorption from the water.(19)

Lasers can be used in a focused beam (for excisions and incisions) and in an unfocused beam (for ablation and coagulation). Some evidence suggests that lasers used as an adjunct to scaling and root planing (SRP) may provide additional benefits.

Lasers in periodontal therapy have been demonstrated to be beneficial for control of bacteremia, better removal of the pocket epithelium in the pockets, bacteria reduction, efficient subgingival calculus removal (using Er:YAG lasers) and improvement of periodontal regeneration in animals and humans without damaging the surrounding bone and pulp tissues. (20)

There is no doubt that specific protocols must be used to achieve specific goals. Aoki et al. compared various power settings of an Er: YAG laser used for calculus removal in vitro and found that ablation of the tooth substance after laser scaling was generally observed within the cementum. They concluded there is potential for clinical application of the Er: YAG laser in subgingival scaling. The Er: YAG laser is able to remove calculus [Figure 8], an increased loss of cementum and dentin which should be taken into account in clinical situations.(21,22,23)

**Figure 8: Extraoral root planing using an Er:YAG laser**

A recent prospective, randomized, controlled multicenter study of the two different methods of treatment
(Er: YAG laser versus sonic debridement) of persistent periodontal pockets also showed no significant differences in the clinical and the microbiological outcomes.(19)

**Removal of the pocket epithelium**

Lasers are also used for soft tissue periodontal applications. The Nd: YAG was the first laser wavelength to be compared to the scalpel for treating periodontal pockets and controlling bacteremia and gingival bleeding. (26) The probing pocket depth and bleeding index scores were reduced using the pulsed Nd: YAG laser. Furthermore, clinical evaluation of soft tissue biopsies taken from human subjects using the Nd: YAG laser versus a curette presented a complete removal of the epithelium of the pocket after use of the pulsed Nd: YAG laser compared to the curette. Similar effects presented in pig jaws *(in vitro)* after the use of a 980 nm diode laser with 2–4 W power settings and continuous wave compared to the conventional curette.(27)

There are advantages in the postsurgical outcomes with the removal of pocket epithelium. A recent clinical study in India showed that the modified Widman flap with removal of the pocket epithelium was more effective in reducing mean probing depth compared to access flap with intrasulcular incision. It showed greater gain of clinical attachment and demonstrated less gingival recession.(28)

When deep periodontal pockets are present, removal of the pocket epithelium using a glass laser fiberoptic offers benefits. With or without flap elevation and a conventional periodontal access flap procedure, the pocket epithelium will be removed from the inner and the outer part of the pocket. Depending on how the patient heals, the epithelium can later be ablated every 7–10 days from the outer part of the pocket, usually under the use of topical anesthesia, in order to control apical migration. This can result in long-term, stable connective tissue attachment, without gingival recession [Figure 9]. The principle underlying this approach is guided tissue regeneration; it has been called “laser-assisted guided tissue regeneration.”(29) This approach should be evaluated in different prospective clinical studies involving many patients and following exactly the same protocol in order to establish that it is a technological improvement that should be incorporated routinely in daily practice.

![Figure 9: a b, Flexible optical fiber can be extended several millimeters past the end of the bendable cannula tip, which allows for delivery of pulsed Nd:YAG laser energy to difficult-to-access areas, such as the distal of second molars (a). Example of the optical fiber placed within a periodontal pocket during the LANAP protocol, removing the diseased, inflamed epithelium without removing outer gingival epithelium (b)](image)

Both clinical case series and clinical research have shown the potential of this application using the CO2 laser, since the noncontact handpiece is able to ablate tissues very quickly, controlling the epithelial cell proliferation and further apical migration of a long junctional epithelium. Israel *et al.* were able to demonstrate histologically the effects of this de-epithelialization technique in humans. The technique involves using the CO2 laser to remove (ablate) the inner part of flap after conventional periodontal flap elevation [Figure 10] and then using the same method in the outer part of the flap to achieve epithelial retardation. (30)Case series in patients with generalized advanced periodontal disease have shown that the laser de-epithelialization technique leads to good results [Figure 11] without the need for multiple membrane therapy.(31,32)
Figure 10: CO2 laser de-epithelialization immediately after flap closure. The tissue ablation of the superficial layer of the epithelium is responsible for the epithelial retardation and further improvement of the connective tissue attachment.

Figure 11: Follow-up 1-year after surgical treatment (PPD = 3 mm) using the CO2 laser de-epithelialization method; (a) compared to apical repositioning flap for pocket elimination; (b) observe the significant gingival recession at the control site.

Laser root conditioning

The use of CO2 lasers to decontaminate root surfaces has been investigated, providing more information about the exact power settings and parameters required to avoid root damage. Barone et al. showed that a defocused, pulsed CO2 laser is able to create smooth and clean root surfaces compared to a focused, continuous wave; the latter leads to melting and root surface damage. Later studies using the same parameters for CO2 lasers reported root conditioning with a better fibroblastic activity, cellular proliferation, and greater fibroblast attachment. Different clinical case reports have demonstrated these advantages of CO2 laser de-epithelialization.

This technique has also been used in clinical studies and has shown that coronal flap advancement in conjunction with CO2 laser root conditioning leads to improvements in clinical parameters and long-term tissue stability after 15 years, compared to the modified Widman periodontal flap procedure. The authors concluded that this laser technique seemed to have greater effects and should be used in treating deep periodontal pockets (more than 7 mm deep)(31,32).

Bacterial reduction.

A laser application that has been especially promoted in the past is for the reduction of bacteria in pockets, due to the high absorption of specific laser wavelengths by the chromophores. Initially, the use of an Nd: YAG laser was shown to reduce the load of *Porphyromonas gingivalis* and *Prevotella intermedia*. (33)

A study by Assaf et al. is of special interest. Using a diode laser in conjunction with ultrasonic scaling for treatment of gingivitis, they were able to show a significantly lower incidence of bacteremia in the diode + ultrasonic group (36%) compared to the ultrasonic only group (68%). They suggested that diode lasers should be used to prevent bacteremia, especially in immunocompromised patients.

Using a 980 nm-diode laser to reduce periodontopathogenic bacteria in patients with aggressive periodontitis has also been investigated. Kamma et al. confirmed that it was possible to reduce the total bacterial load in pockets without use of any systemic antibiotic therapy.(34,35)

Clinical case series with 10 patients using in the same patient (in a randomized protocol) SRP in
conjunction with 980 nm-diode laser, SRP and an Nd: YAG laser and SRP with photodynamic therapy (PDT), showed that the PDT was able to reduce significantly the bacteria in the pockets and provide a predictable clinical outcome for 3 months. In contrast to that, the use of Nd: YAG laser was not very beneficial and was similar to the control (SRP) group. Due to the bacteria reduction, and the reduced bleeding on probing provided by the PDT, the PDT was recommended for periodontal patients especially for the maintenance appointments. (36)

**Laser applications in implant dentistry.**

The use of lasers in implant dentistry has been discussed extensively. Many clinicians want to know if lasers can be used to treat peri-implantitis, but it is impossible today to investigate this question using randomized clinical trials due to the lack of comparable test and control sites. (37) However, there are applications for lasers in implant dentistry, including for second stage surgery, removal of peri-implant soft tissues, and decontamination of failing implants. Serious concerns about the implant overheating followed by melting of the implant surface have been raised, along with concerns about a lack of re-osseointegration following treatment of peri-implantitis with lasers. (38,39) Recent systematic reviews have focused on the latter question and provided more information about how implants can re-stabilize following implant surface laser decontamination. Deppe et al. showed that CO2 laser decontamination of the surface of implants placed in dogs allowed new bone to grow and be in contact with the implant surface (re-osseointegration). In vitro studies of osteoblasts have confirmed these effects for CO2 and Er, Cr: YSGG lasers.

Previous clinical case series were able to demonstrate new bone fill [Figure -12] and long-term success of failing implants that were decontaminated with a CO2 laser.

**Figure 12:**

(a) Peri-implant infrabony defect due to peri-implantitis; (b) after cleaning of the defect with conventional curettes, CO2 laser irradiation of the implant surface and surrounding bone allows sufficient decontamination to enable further bone grafting; (c) immobilization of a collagen membrane around the defect in order to stabilize grafting material (bovine mineral, cancellous bone) immediately before flap closure; (d) preoperative radiograph demonstrating the peri-implant defect before laser decontamination; (e) postoperative radiograph at the 6 months follow-up shows significant bone fill (asymptomatic lesion)

The main advantage of using CO2 laser irradiation on implant surfaces is that this wavelength does not pose the risk of overheating, unlike other wavelengths, such as that of diode, Nd: YAG, and Er: YAG lasers. A significant increase of the implant surface temperature has been demonstrated when irradiating implant surfaces with a diode laser in vitro for more than 10 s. It is possible that authors have presented unsuccessful and nonpredictable clinical results from their studies because of overheating resulting from inconsistent power settings. Recent systematic reviews have shown that there is limited information available about laser-assisted decontamination of implant surfaces, with high
heterogeneity of results and a low number of included studies. However, although information is limited about the clinical application of CO\(_2\) (10.6 µm) lasers in the surgical treatment of peri-implantitis, its use appears promising. (40,41)

Further clinical trials and multicenter studies should be performed to improve the effects of laser treatment of periodontal and peri-implant diseases and to develop standardized protocols so that lasers may be used in a predictable way in daily practice.

The following summary of advantages and disadvantages of using lasers for periodontal therapy is based on the literature and the author's experience.(43,44)

**Advantages of laser**
- Relatively bloodless surgical and postsurgical course
- The ability to coagulate, vaporize, or cut tissue
- Sterilization of wound tissue
- Minimal swelling and scarring
- No requirement of sutures
- Little mechanical trauma
- Reduced surgical time
- Decreased post-surgical pain
- High patient acceptance

**Disadvantages of laser**
- Relatively high cost of the devices.
- Need for additional education
- Do not eliminate the need for anesthesia.
- Every wavelength has different properties
- Need for implementation of safety measures (i.e., goggle use, etc.)

**Conclusion**

With conventional mechanical instruments, complete access and disinfection may not be achieved during the treatment of periodontal pockets. Lasers have the potential advantages of bactericidal effect, detoxification effect, and removal of the epithelium lining and granulation tissue, which are desirable properties for the treatment of periodontal pockets. Thus, laser systems, applying the ablation effect of light energy which is completely different from conventional mechanical debridement, may emerge as a new technical modality for periodontal therapy in the near future.

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