

Laser-Assisted Non-Surgical Treatments of Periodontitis

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This entry explores the innovative use of lasers in the non-surgical treatment of periodontitis, shedding light on the advantages, effectiveness, and limitations of this approach. There has been a massive eruption of innovations and technologies to assist in the treatment of periodontal diseases over the past 30 years. The use of lasers has opened new horizons and possibilities that can enhance periodontal treatments. However, their use is not always based on validated concepts and evidence-based protocols. Hence, this entry aims to describe, summarize, and assess the available evidence on the current laser-assisted protocols in the non-surgical treatment of periodontitis. Four distinct laser-assisted approaches are addressed: (1) the use of lasers for the removal of subgingival calculus, (2) the use of lasers in photodynamic therapy/photoactivated disinfection, (3) the use of lasers in photobiomodulation therapy, and (4) the use of high-power lasers. Based on the available studies and on the current guidelines and recommendations, the use of lasers exhibits several advantages, such as the increased disinfection of periodontal pockets and the junctional epithelium and connective tissue, the removal of calculus and biofilm, and the bactericidal effect on periodontal pathogens. Moreover, photobiomodulation therapy seems to play a positive role in the management of the inflammatory process of periodontitis. Although promising, the use of lasers in the non-surgical treatment of periodontitis needs to be further investigated.

Keywords: periodontitis ; lasers ; periodontal treatment ; disinfection ; periodontal pathogens

Periodontitis is a chronic inflammation induced by the biofilm affecting the integrity of the periodontium and ultimately resulting in its destruction ^{[1][2][3]}. Periodontitis depends mainly on the action of specific periodontal pathogens ^{[2][4]}. These specific pathogens or periodontal pathogens were described by Marsh et al. ^[5] as red complexes, including: *Porphyromonas gingivalis* (*P.g.*), *Aggregatibacter actinomycetemcomitans* (*A.a.*), *Tannerella forsythia* (*T.f.*), and *Prevotella intermedia* (*P.i.*) ^[5]. Moreover, Hajishengallis et al. ^[3] discussed the concept of keystone pathogens and defined *P.g.* as one of these. The keystone-pathogen hypothesis suggests that the presence of *P.g.* can orchestrate the inflammatory process and periodontitis progression ^[3].

Treatment of periodontal pathologies, notably periodontitis, consists primarily of the elimination of the primary etiology that is the biofilm ^{[6][7]}. The aim of the non-surgical management of periodontitis is ultimately to eradicate the supragingival and subgingival biofilm, leading to an attenuation of the inflammation ^{[6][7][8]}. Hence, mechanical debridement consisting of manual instrumentation or ultrasonic instrumentation is currently the standard of care ^[6]. Clinically, this manifests in an absence of bleeding on periodontal probing, a reduction of pocket depth (PD), and an increase in clinical attachment level (CAL). However, mechanical removal of subgingival calculus and biofilm is limited, in some cases, because of some systematic and local limitations, such as the presence of a deep probing pocket or furcation involvement. This can lead to an unresolved inflammation, with the risk of further progression of periodontitis ^{[9][10][11]}.

Laser-assisted protocols are increasingly indicated in dentistry, with various treatment modalities ^{[12][13][14]}. In fact, lasers have been shown to be efficient in eradicating periodontal pathogens. For instance, the energy of the laser absorbed by the bacteria will result in the overheating, disruption of the bacterial cell and membrane, hence destruction of the bacteria ^{[12][13][14]}. In addition to photothermal therapy, lasers can be used in combination with photosensitizing agents in a process called photodynamic therapy leading to the production and activation of reactive oxygen species that can have a bactericidal effect on the periodontal pathogens.

The enormous development of lasers has led to uncertainty among clinicians about the scientific indications and the evidence of their use ^[15]. The question of what is considered professionally right and what is deemed professionally wrong has become harder to determine. On the other hand, education on the use of the laser in different fields of dentistry, notably in periodontology, is not well established in the majority of undergraduate and postgraduate studies at worldwide faculties of dentistry. Hence, the aim of this entry is to explain the evidence-based data available in the literature on laser-assisted approaches in the non-surgical treatment of periodontitis. It is important to note that this entry aims to help readers understand the available literature, but do not serve as a guideline. In this context, readers are advised to consult

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