Laser versus conventional therapies

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Introduction
In recent years, several studies have been conducted on the clinical applications of laser in dentistry. At the same time, there has been a marked emergence of organisations in support of the use of laser in dentistry. In the last decades, laser therapy has been used in dentistry as an adjunct or alternative to conventional approaches. In this paper, the following topics will be reviewed: the application of laser in caries prevention and diagnosis, hard- and soft-tissue treatments, and periodontal and endodontic procedures. There is a large research effort into new indications for laser in dentistry. It is expected that laser will become an essential component of the dentist’s armamentarium.

While the technology was regarded as complex and of limited use in clinical dentistry in the past, a growing awareness of the usefulness of laser in the modern dental practice has been observed. Laser can be used as an adjunct or alternative to conventional approaches. When comparing the use of laser with conventional therapies, three important areas must be considered: safety, efficacy and effectiveness. From an ethical standpoint, it is important to use the best available evidence when making clinical decisions.

Diagnostic laser applications
The most common methods for caries detection are visual and radiographic examination. However, visual examination is a subjective method that depends on the knowledge and clinical experience of the examiner. Several studies have demonstrated that radiographic examination demonstrates poor sensitivity to non-cavitated lesions.

For this reason, fluorescence-based methods have been developed, aiming at the detection of occlusal and approximal carious lesions, for example DIAGNODent 2095 (KaVo; LF; Figs. 1a-c) and DIAGNODent 2190 (LF pen; Figs. 2a & b). They rely on the same principle: a laser diode emits red light at 655nm and a photodetector quantifies the reflected fluorescence from bacterial metabolites (fluorophores) in carious lesions, showing values ranging from 0 to 99.

A study that assessed the performance of a visual method, radiographic examination and fluorescence-based methods in detecting occlusal caries in primary teeth found that the visual method and VistaProof fluorescence camera (Durr Dental; FC) exhibited better accuracy in detecting enamel and dentine carious lesions, whereas the visual method combined with LF, LF pen and FC better detected dentine lesions on occlusal surfaces in primary teeth, with no statistically significant difference among them.

Another study compared the performance of fluorescence-based methods (FC, LF and LF pen), radiographic examination, and another visual method called the International Caries Detection and Assessment System (ICDAS) II on occlusal surfaces. This study demonstrated that the combination of ICDAS and bite-wing radiographs yielded the best performance for detecting caries on occlusal surfaces.

Caries prevention: Enhancing enamel resistance
In the past, several in vitro studies have shown that enhancing enamel demineralisation resistance can be achieved by irradiation with lasers. In a blind in vitro study, Ana et
anatomy of the root-canal system that consists of small canals diverging from the main canal. This complex system does not allow direct access during biomechanical preparation because of the canals’ positioning and diameter.

New antimicrobial approaches to disinfecting root canals have been proposed; these include the use of high-power lasers and photodynamic therapy, which works by dose-dependent heat generation. However, in addition to killing bacteria, they have the potential to cause collateral damage such as charred dentine, ankylosed roots, melted cementum, root resorption and periradicular necrosis.

In order to compare the effectiveness of antimicrobial photodynamic therapy with standard endodontic treatment and combined treatment to eliminate bacterial biofilms present in infected root canals, a study was conducted on ten single-rooted freshly extracted human teeth inoculated with stable bioluminescent Gram-negative bacteria. It found that endodontic therapy alone reduced bacterial bioluminescence by 90%, while photodynamic therapy alone reduced bioluminescence by 95%. The combination reduced bioluminescence by up to 98%, and, importantly, the bacterial regrowth observed 24 hours after treatment was much less for the combination group than for the treatment groups individually.

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Alternatives to conventional therapies to improve the disinfection of root canals are Nd:YAG and Er:YAG lasers. One study evaluated the bactericidal efficacy of Nd:YAG and Er:YAG lasers in experimentally infected curved root canals and concluded that in the straight root canals the
the use of the diode laser as an adjunctive therapy to conventional non-surgical periodontal therapy did not provide additional clinical benefit. However, given that few studies were included in the analysis, the results should be interpreted with caution. Important issues that remain to be clarified include the influence of smoking on clinical outcomes, the effectiveness of the adjunctive use of the diode laser on microbiological outcomes, and the effect of adverse events. Future studies are required to assess the effectiveness of the adjunctive use of the diode laser, as well as the appropriate dosimetry and laser settings.

Soft-tissue applications

There are numerous soft-tissue procedures that can be performed with laser. Two key advantages of this are reduced intra-operative bleeding and less post-operative pain compared with conventional techniques, such as electrosurgery. Certain procedures in patients with bleeding disorders are better suited to lasers with greater haemostatic capabilities. 5

Conclusion

Although the results of laser therapy are similar (in safety, efficacy and effectiveness) to those obtained with conventional methods, new techniques and devices have been developed. Laser could thus be an evidence-based and well-supported treatment option for the dentist in daily dental practice.

References


Figure 2a: Cylindrical tip for occlusal surfaces.

Figure 2b: Wedge-shaped tip for proximal surfaces.

Figure 3: Infra-red laser therapy for treatment of a primary herpetic infection in an adolescent patient undergoing chemotherapy (Therapy XT, DMC).


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