

## Laser Use in Endodontics: A Fact or a Myth?

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Laser as a word is the acronym of Light Amplification by Stimulated Emission of Radiation. Light energy is emitted by the lasers can interact enamel, dentin, gingiva and dental pulp as the biologic tissues. Lasers introduced into dentistry since 1994 and used to treat various dental problems. Lasers were introduced to the field of endodontics to improve the results achieved with traditional procedures by using the light energy to increase cleaning efficacy and the removal of debris and the smear layer from the root canals besides improving the decontamination of the endodontic system. Root canal treatment is currently performed using a combination of hand and rotary instruments to remove the soft tissue, clean the root canal space, prepare and shape the space to be filled by an obturating material, drying the root canal as well as smear layer removal. Ongoing studies are evaluating the efficacy of a new laser techniques that use a newly designed both radial and tapered stripped tip for removal of not only the smear layer, but also bacterial bio-film. Lasers, in the root canal procedures, have some advantages and disadvantages. Laser use in root canal disinfection seems more promising than in root canal preparation. For disinfection, laser energy can be used directly or can be combined with a photosensitive chemical that, when bound to microorganisms, may be activated by low-energy laser light to essentially kill the microorganism Photodynamic Therapy (PDT). Also acoustic waves emanating from pulsed-low energy laser distributing disinfecting solutions more effectively across the root canal system Photon Induced Photoacoustic Streaming (PIPS). Besides the advantages of the lasers in endodontics, we should notice some disadvantages and limitations. Root canal spaces are not always straight and more often are curved in at least two dimensions. Root canal instruments used in endodontic procedures for filing and shaping the root canals can be curved to follow the curvatures in a tooth root but laser light beam goes on a straight path; laser probes should be fabricated in a way that the laser light emerges laterally, uniformly interacting with the root canal wall. Root canal preparation using laser light has not been proven to be more effective than mechanical shaping. The interactions between laser energy and the tissue can cause a rise in the temperature. The increased temperature can char the canal space, damaging it to the point that the tooth may be lost. The increased temperatures also may extend to the outer surfaces of the tooth, damaging the soft tissue (PDL) that connects the tooth to the surrounding bone and high temperature may adversely affect the entire area, which can result in ankylosis.

The essential question is whether a laser can provide equal or improved treatment over conventional care. Secondary issues include treatment duration and cost/benefit ratio. This article reviews the role of lasers in endodontics In this short editorial note on lasers we will discuss the use of lasers in endodontics, their limits, advantages, disadvantages and potentials. The most important advantages of the lasers in endodontics seem are: improved disinfection efficacy, more effective root canal cleaning, reduction of permeability, reduction of micro-leakage, and elimination of the need to use toxic solvents. Moreover, Laser Doppler Flowmetry, a non-invasive method to assess and measure the rate of blood flow in pulpal tissues, can be used as a thermal test method. In addition, lasers can be used for direct and indirect pulp capping based on their effects on dentin and control of bleeding as well as lasers' analgesic effects.

A summary of the uses of lasers in endodontics can be as follows: disinfection, canal sterilization and eradicating microorganisms from the root canals, diagnostic, removal of pulp, pulp capping, laser analgesia, preparation of root canal walls but has risk of charring the dentinal walls in some wavelengths, root canal sweeping and irrigation with lasers, removal of pulp remnants and debris, obturation by using gutta-percha or resin by laser based on warming and melting effect of lasers, removal of temporary cavity sealing materials, root canal sealing materials, and retreatment, laser use in apicoectomy, retrograde and endodontic apical cavity preparation, some hard and soft tissue applications during the endodontic surgery. Furthermore, some authors state the use of lasers for removal of fractured instruments in root canals but it seems not very efficient. In addition to the above mentioned uses, lasers can be used in treatment of periapical lesions and sinus tracts are possible.

We can categorize lasers based on power, more than 500 mW lasers are high power lasers and we name them as warm or hard lasers. Besides their therapeutic effects they have heat effect and this effect may cause necrosis, carbonization, evaporation, coagulation and protein denaturation. Lasers with moderate power (250-500 mW) their therapeutic effect is without including heat as strong as high power lasers. Low power or cold lasers (less than 250 mW) have no thermal effect to tissues. They have photobiostimulation effect and can create photochemical reactions without heat. Also we can classify the lasers based on their wavelength (ultraviolet range 300-400 nm, visible light range 400-700 nm, near infrared 700-1200 nm and far infrared more than 1200 nm). Lasers can be classified according to their nature as gas or liquid. Gas lasers (CO<sub>2</sub>, He, Ne), liquid lasers (Dye lasers), Solid lasers (Ruby etc) and semi-conductor lasers GaAllnP, GaAs, GaALAs.

Generally the lasers which are used in endodontics are low lasers. They are very helpful to eliminate the tooth sensitivity at cervical area and overall. Also they contribute to wound healing and less inflammation after the endodontic procedures. Less inflammation contributes to a better wound healing because of increasing angiogenesis and neuro-vascularisation also moves metabolism towards more aerobic, reduces pain and decreases secretion of pain mediators and synthesis of collagens. Low dose lasers have anti oedematous effects and reduce the permeability of blood vessels.

One of the limitations of uses of lasers in practice is its contraindications with cardiac pacemakers' patients, pregnancy, epileptic patients, arrhythmia, glandular diseases such as thyroid. Also, it is contraindicated in patients with tumors or at malignancy risk in the related area, and with lupus kind autoimmune diseases. In endodontics depending on the narrow canals and the curvatures (the laser tips not flexible) instrument removal or limitation of inserting the tips into the canals questions the versatility of lasers and may not be as efficient as manual or ultrasonic applications in removal of fractured instrument parts also because of the reflection from the metallic objects.

Lasers were introduced in 1960 by Theodore Maiman and in many fields of the medicine and were used effectively. In dentistry mostly were used for hard and soft tissue surgeries, and sterilization. For more than fifty years, lasers were tried and applied to be used in dentistry and recently in endodontics. It even seems promising, yet not an efficient solution for every challenge or problem we face during our daily routines, particularly in endodontics. The main reasons of that is the straight nature of the laser beam (not flexible in the curved root canals) and heat and carbonization effect of the lasers in such a small space. In addition, reflection, ablation, evaporation and many other factors limit the use of lasers in endodontics, and hence not being as efficient as manual, rotary or ultrasonic techniques. Some authors may say (or claim) less chair side time necessary for some applications or it helps in reducing the dental anxiety. Also proper safety measurements must be taken during the laser use in dental applications.

Lasers can also be used for caries removal however for amalgam removal lasers are not indicated because of light reflection and the potential release of mercury vapor as it seems risky. The use of lasers in etching, bleaching and caries prevention is also possible. But for the essential endodontic manipulations i.e. filing, reaming, passing the curves, and efficient preparation techniques, removal of fractured instruments and post removal lasers seem not efficient and not yet filled the place of any classical or used techniques. In the future (or if

you would like in the near future) depending on the advances, lasers maybe become more efficient and may become the preferred method of treatment. It also seems promising and effective in the field of retreatment and removal of Gutta Percha from the root canals.

In conclusion, improvements in laser technology has great reflections to the field of dentistry but specifically in endodontics, we need more milestones for the lasers to be more effective and more practical in daily routine therapy. In the time being, lasers may not be a very fast solution for problem solving in endodontics when compared against the manual techniques (or conventional if you would like) and other techniques in terms of root canal preparation, filing, shaping and managing the procedural errors during the endodontic treatments. The hopes and expectations for the future are strong and positive but we may not yet pronounce the laser use in fundamental endodontics is a panacea.

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