



LIGHT IN THE CANALS: LASERS

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ABSTRACT

Laser was introduced in the field of dentistry in 1960 by Miaman, which have the capacity to interact with the biological tissues in our body through the light energy that they emit which is used in the field of dentistry. The use of laser in endodontics lasers in root canal treatment is to remove the dental pulp and any organic debris, and at the same time alter the dentinal walls by the melting and re-solidification cycle, which results in the widening of the walls of the tooth. However, the use of laser over the conventional methods has not shown its superiority and needs further research.

Key words:

Lasers, Endodontics, Interaction,
Radiation, Emission, Absorption

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INTRODUCTION

In today's modern tech savvy world, technological progress is taking place at an unbelievable pace. Over the years, modern machinery has made life faster and easier. Lasers have gained lot of importance in all the fields with dentistry being no exception.

Laser was introduced in the field of dentistry in 1960 by Miaman, after which its use and research was inexorable.¹ The word laser stands for Light Amplification by Stimulated Emission of Radiation and its use in the field of dentistry was advocated more than five decades ago.^{1,2} The energy which was generated by light forms the basis to either manipulate or remove the hard and soft tissues during diagnostic or treatment protocols.³

The use of laser is highly acclaimed world wide and also sanctioned by the food and drug administration as they are non-ionizing in nature and do not have any stochastic or deterministic effects as seen in x-rays. This makes laser the equipment of choice.

Lasers as per their wavelength have varied uses which include soft tissue applications like removal of diseased gingival tissues, and elimination of dental caries, as assistance device in insertion of tooth-colored restorations and also an aide in root canal procedures (pulpotomies).^{1,3,4}

Lasers have the capacity to interact with the biological tissues in our body through the light energy that they emit which is used in the field of dentistry for tissues such as the enamel, dentin, gingiva and the pulp of the tooth.^{1,4,5} Hence, lasers can either be used for the removal or manipulation of the tissue in the body. This feature of laser can be attributed to the inherent properties of the laser light that are enlisted in table 1.

S.I No	Properties of Laser
1.	Monochromaticity The light is all the same color (similar wavelength)
2.	Coherence The waves of light are all in phase
3.	Collimation The light rays are parallel to each other and do not diverge

The application of lasers in root canal treatment is to remove the dental pulp and any organic debris, and at the same time alter the dentinal walls by the melting and re-solidification cycle, which results in the widening of the walls of the tooth. Further lasers may be used to unstiffen and mold the obturating material as per the requirement of the prepared tooth during the obturation phase. These changes by the use of laser can either be photo-thermal or photochemical in nature.^{4,5} The changes that are seen with the use of laser depends on the amount of laser energy which is scattered or absorbed and also the interaction between the laser, tooth and the material used for obturation. Laser parameters that should be taken into consideration include its wavelength, level of energy, mode of application and the tissue characteristics also determine the type of interaction that will occur with lasers.^{4,5}

Conventionally root canal treatment involves the use of hand and rotary instruments to remove the soft tissues and

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decontaminate the root canal area and silhouette the area as per the requirement for the obturation process.^{6,7} The most commonly used biocompatible obturation material is guttapercha which is placed in adjunct with a cement to make sure that there is comprehensive closing of the root canals with the help of special instruments. The FDA has currently approved the diode laser for its use in procedures such as pulpectomy and apicectomy.^{6,7,8}

The adjunctive use of Laser energy in root canal procedures has its own advantages and disadvantages. During root canal procedures canal area is uncontaminated by mechanical removal as well as by chemical decontamination. The addition of lasers in disinfecting the root canal area is highly desirable as the success rates of root canal treatment increases.^{6,7,8,9}

The use of lasers in root canals can be either direct, in photodynamic therapy or in Photon Induced Photoacoustic Streaming.⁵

The process of disinfection of the canal can be carried out directly by laser or in combination with a photosensitive chemical which binds to the microorganisms and is activated by low-energy laser light to principally eradicate the microorganism. This indirect binding and treatment with the laser light is termed Photodynamic Therapy (PDT).⁵

Further research has shown that the dissemination of acoustic waves with its origin from a pulsed-low energy laser helps in dispensing the disinfecting solutions more efficiently within the root canal area, which is better known as the Photon Induced Photoacoustic Streaming.⁵

Evidence of laser as an adjunct in the disinfection procedure has been investigated with in vivo and vitro studies examining the antibacterial effectiveness of high-power laser and photodynamic therapy,^{10,11,12,13,14} and in vitro experiments with PIPS33-35 in root canals, but currently lack any clinical data to substantiate the same.^{9,10,11,15,16,17}

But the limitations of the use of lasers in the root canal area are that the root canals are seldom straight and found to be curved more frequently,^{18,19,20,21} with access for the root canal instruments better than that for lasers with the added advantage of better debridement of the root canal area all through its curvy path of the canal till the root apex at the apical third of the root.^{22,23} Also root canal preparation by mechanical shaping is still found to be more superior than with the use of lasers.^{24,25} Hence, lasers should be used as an adjunct and not as a primary instrument in root canal preparation.^{26,27}

This can be overcome with the advent of lasers with lateral laser light dispersion which will help in better interaction and treatment of the laser light with the root canal walls.^{28,29,30,31,32,33}

Another limitation is the increased temperature that can not only char the canal space but also cause extensive damage to the tooth which might make the extraction of the tooth a necessity.^{32,33,34,35} Further the transfer of the high temperature to the soft tissue is a common scenario wherein the gingiva and other tooth supporting structures such as the periodontal ligament may be destroyed with the end result being the loss of the tooth supporting structures leading to ankyloses of the tooth, when lasers create such high temperatures.³⁶

CONCLUSION

Over the years enormous research has been done and loads of data are available. However, the use of laser over the conventional methods has not shown its superiority. Hence there is need for more research which can cover up the lagging areas which still drag behind laser and its uses and makes it an adjunct to other methods rather than a standalone instrument of choice.

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