APPLICATIONS OF LASER IN ORTHODONTICS – A REVIEW

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Abstract

In the recent years Lasers have gained immense popularity and completely revolutionized the field of dentistry. The field of orthodontics has witnessed a number of changes and has accepeted a number of innovations be it in appliance design, mechanics or armentaurium to reach greater heights in dentistry. In orthodontic practice, lasers have many common applications, including acceleration of tooth movement, bone remodelling, enamel etching prior to bonding, debonding of ceramic brackets, pain reduction after orthodontic force and prevention of enamel demineralization. Tissue problems also create challenging situations to orthodontists during treatment or post treatment. Soft tissue applications such as cosmetic gingival contouring, exposure of teeth to facilitate eruption, frenectomies, gingivectomy, gingivoplasty, operculectomy, removal of redundant tissue due to poor oral hygiene or space closure and removal of soft tissue to uncover temporary anchorage devices. The use of lasers in orthodontic practice enable us to achieve better treatment results.

Key Words Lasers, Orthodontics, Adjunctive soft tissue procedures, Tooth movement

INTRODUCTION

Laser is an acronym for "light amplification by stimulated emission of radiation." A laser is a single wavelength (or color) of light travelling through a collimated tube delivering a concentrated source of energy. In 1960, the first laser using a ruby medium was developed by physicist Theodore H. Maiman.[1] In 1968, carbon dioxide was used to perform the first soft-tissue surgery. In 1997, the US Food and Drug Administration approved the erbium laser for hard-tissue surgery. The next year, the first diode laser with a medium of gallium, aluminium, and arsenide was approved for soft-tissue surgery.[2]

A laser offers numerous advantages compared with scalpel surgery. The benefits of laser surgery are best summarized by Sarver and Yanosky: "[Soft-tissue lasers] result in a shorter operative time and faster postoperative recuperation." The primary disadvantage of laser surgery is the operatory and upkeep expense.

Lasers cut by thermal ablation—decomposition of tissue through an instantaneous process of absorption, melting, and vaporization.The cells of the target tissue absorb the concentrated light energy, rapidly rise in temperature, and produce a micro-explosion known as spallation.

Application of laser in orthodontics

Lasers have wide range of applications in orthodontics and there are numerous studies which prove the same. Soft tissue lasers are also used during minor surgical procedures like exposure of impacted teeth, frenectomy,

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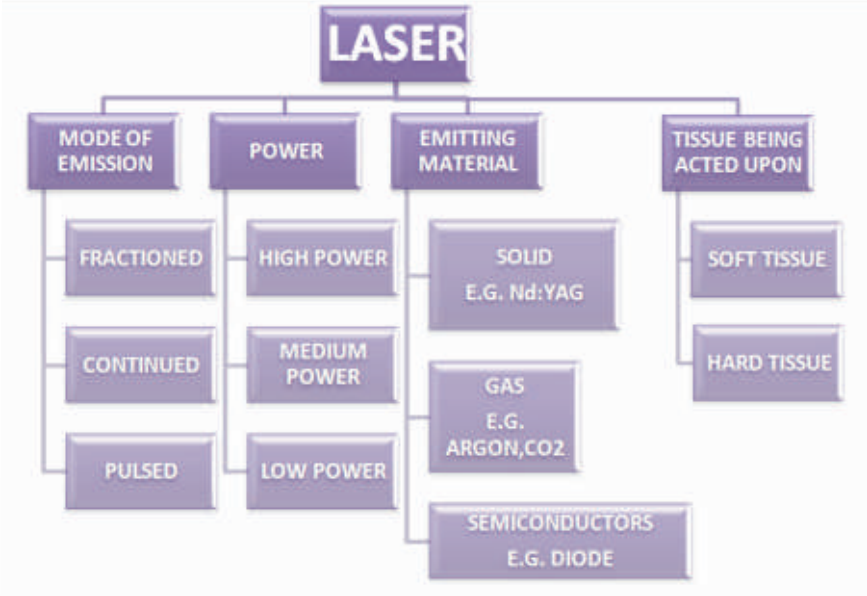
CLASSIFICATIONS OF LASERS



operculectomy and atraumatic Implant placement procedures in orthodontics [3]

(1) the laser cut is more precise than that of a scalpel, (2) the cut is more visible initially because the laser seals off blood vessels and lymphatics, leaving a clear dry field, (3) the laser sterilizes as it cuts, reducing the risk of blood-borne transmission of disease, (4) minimal postoperative pain and swelling have been reported, (5) less postoperative infection has been reported because the wound is sealed with a biological dressing, (6) less wound contraction occurs during mucosal healing, thus scars do not develop, and (7) less damage occurs to adjacent tissues.

Accelerates the velocity of tooth movement [4,5,6]

Orthodontic treatment usually last for a long duration because it depends on the rate of tooth movement. It is based on alveolar bone remodelling and periodontal ligament reorganization. Therefore successful reduction in orthodontic treatment requires increasing the rate of tooth movement. LLLT have the potential to accelerate tooth movement by means of influencing remodelling of alveolar bone without unwanted impact on tooth and periodontium and facilitation of reorganization of connective tissue.

Pain reduction [7,8,9]

Orthodontic treatment may be accompanied with pain especially during the initial stages of treatment. The main way to relieve consists on the employment of analgesic and anti-inflamatory medication. However, studies have shown that, besides the side effects inherent to medicine, dental movement may be inhibited by the administration of non-steroidal anti-inflammatory drugs. Laser therapy has been subject of many speculations concerning pain inhibition, because there are few contra indications and no side effects. Laser is thus advantageous over analgesia and analgesics for pain reduction during orthodontic treatment.

Laser ethching of tooth surface [10,11]

Literature reveals etching of the tooth surface with laser is advantageous over 37% phosphoric acid as it does not produce a smear layer, inhibits caries and also there is no requirement for water spray and air drying. Thus the procedural errors are reduced and time is saved.

Laser curing

Several studies suggest that use of argon laser beam is capable of reducing the chiarside time in placement of orthodontic brackets and more efficient curing process owing to its more consistent wavelength. Lasers are being used in orthodontics for curing because of ease of application, easy manipulation and the extended time they offer for concise bracket placement compared to previously use chemically-cured adhesives.

Laser debonding of ceramic bracketes [12]

Ceramic brackets are brittle and can cause problems such as enamel tear out, pain at the time of removal, shattering of bracket etc. Thus different laser devices have been introduced as an adjunct in removal of these brakcets.

AUTHOR	TYPE OF LASER	APPLICATION	RESULT
Cruz DR,Kohara et al (2004)	Diode laser	Rate of orthodontic tooth movement	Accelerates
Limpanichkul et al (2006)	GaAlAs	Rate of orthodontic tooth movement	No significant difference
Gauri Doshi et al (2012)	AlGaAs	Rate of orthodontic tooth movement	Increaserd
Lim et al (1995)	GaAsAl	Orthodontic pain reduction	Reduced
Fujiyama et al (2008)	Carbon dioxide	Orthodontic pain reduction	Reduced
Fernanda Angelieri et al (2011)	Diode	Orthodontic pain reduction	Reduced
Serdar,Metin et al (2002)	Er,Cr:YSGG	Laser enamel etching	Time saving
Kwon OW et al (2005)	Er:YAG	Laser enamel etching	Good bond strength
Oztoprak MO et al (2010)	Er:YAG	Debonding ceramic brackets	Effective
Dostalova et al (2016)	Er:YAG	Debonding of ceramic brackets	Effective

CONCLUSION

Laser is widely being used in dentistry and orthodontics is no exception. The use of this technology has made it possible for orthodontists to address various challenges faced in clinical practice. Laser today offers orthodontists not only a window but a door into its hi-tech, rewarding and potentially profitable arena.

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