

Journal of Dentistry and Oral Hygiene

Volume 8 Number 1, January 2016

ISSN 2141-2472



ABOUT JDOH

The **Journal of Dentistry and Oral Hygiene (JDOH)** is published monthly (one volume per year) by Academic Journals.

Journal of Dentistry and Oral Hygiene (JDOH) is an open access journal that provides rapid publication (monthly) of articles in all areas of the subject such as endodontics, prosthodontics, Oral Pathology, dento-maxillofacial Radiology, periodontics etc.

The Journal welcomes the submission of manuscripts that meet the general criteria of significance and scientific excellence. Papers will be published shortly after acceptance. All articles published in JDOH are peer-reviewed.

Contact Us

Editorial Office: jdoh@academicjournals.org

Help Desk: helpdesk@academicjournals.org

Website: <http://www.academicjournals.org/journal/JDOH>

Submit manuscript online <http://ms.academicjournals.me/>

Editors

Dr. Denise Evans

*University of Johannesburg
4 Vlei street, Southcrest Alberton, 1449 Gauteng
South Africa.*

Prof. Azza A El-Housseiny

*Faculty of Dentistry, Alexandria university
1 Shamplion St, Massarita, Alexandria.
Egypt .*

Dr. Fawad Javed

*Karolinska Institutet
Box 4064, SE 14104 Huddinge. Stockholm.
Sweden*

Dr. Muneer Gohar Babar

*International Medical University
No. 126, Jalan 19/15B, Bukit Jalil, 57000 Kuala
Lumpur,
Malaysia.*

Dr. Janine Owens

*University of Sheffield, Department of Oral Health
and Development
Claremont Crescent, Sheffield S10 2TU
United Kingdom*

Dr. Satyabodh S.Guttal

*SDM College of Dental Sciences and Hospital
Sattur, Dharwad
India .*

Prof. E.J. Sauvetre

*Université Libre de Bruxelles (Faculty of Medicine)
10 rue bavastro 06300 Nice France
France.*

Dr. Olfat Shaker

*Faculty of Medicine Cairo University
Department of Medical Biochemistry,
Egypt .*

Prof. Ayyaz Ali Khan

*Riphah International University
IIDC&H, Off 7th Ave., G-7/4, Islamabad,
Pakistan.*

Dr. Pei-Yi Chu

*Diagnostic and research pathologist,
Department of Surgical Pathology,
Changhua Christian Hospital/
135 Nan-Shiao Street, Changhua 500-06,
Taiwan.*

Dr. Abeer Gawish

*Al-Azhar University Faculty Of Dental Medicine
4 elsheikh Makhlof Street. Misr Elgedida, Cairo
Egypt.*

Dr. Murali Srinivasan

*Jebel Ali Hospital
PO Box 49207, Dubai,
UAE .*

Dr. Scardina Giuseppe Alessandro

*University of Palermo Department of Oral Sciences
"G. Messina"
Via del Vespro, 129 90127 Palermo
Italy.*

Prof. Hussam M. Abdel-Kader

*Faculty of Dental Medicine, AlAzhar University, Cairo,
Egypt Madent Nasr 11884, Cairo,
Egypt.*

Dr. Mahmoud K. ALiri,

*BD-OmS, PhD, FDS RCS (England),
Jordanian Board, DCE (Ireland).
Associate Professor and Consultant
Faculty of Dentistry, The University of Jordan,
P.O. Box 710193, Amman 11171,
Jordan .*

Dr. Imtiaz Wani

*S.M.H.S Hospital
Srinagar, Kashmir,
India.*

Editorial Board

Dr. Santhosh Kumar

*Darshan Dental College and Hospital
Udaipur,
India .*

Prof. Sharon Struminger

*2350 Broadhollow Road Farmingdale, NY 11735/
Farmingdale State College of State
University of New York
USA.*

Dr. Saurab Bither

*Christain Dental College
C.M.C, Ludhiana. Punjab.
India.*

Dr. Ramesh Chowdhary

*HKE's S.Nijalingappa Institute of Dental Sciences and
Research
Ring Road, Gulbarga-585104,
India.*

Journal of Dentistry and Oral Hygiene

Table of Content: Volume 8 Number 1 January 2016

ARTICLE

Use of lasers in endodontics	1
Aysenur Kamaci and Tan Firat Eyuboglu	

Short Communication

Use of lasers in endodontics

Aysenur Kamaci and Tan Firat Eyuboglu

¹Private Practice Istanbul/Turkey.

²Department of Endodontics, Faculty of Dentistry, Medipol University, Istanbul/Turkey.

Receive 28 September, 2015; Accepted 21 December, 2015

LASER (light amplification by stimulated emission of radiation) devices transform light of various frequencies into chromatic radiation that is capable of mobilizing heat and power when focused at a close range. They are usually named after the active medium employed, which can either be a container of gas, a crystal, or a solid-state semi conductor.

Key words: LASER, light, radiation, semi conductor.

INTRODUCTION

Laser energy is a form of electromagnetic energy that moves in waves at a constant speed, and its basic unit of energy is known as 'photons'. These photons have two major properties: wavelength and amplitude (Coluzzi, 2008). The amplitude and intensity of laser waves are directly related with larger amplitude, resulting in a greater amount of work done (Coluzzi, 2008). Wavelength (λ) is defined as the horizontal distance between any two corresponding points on the wave. Although it is usually measured in metres, dental lasers use smaller units such as nanometres or micrometres. This measurement is important for the delivery of laser light as well as its reaction with tissues (Convissar, 2010). Moreover, wavelength helps identify the type of laser suitable for a particular tissue type (Parker, 2007). Dental lasers function by producing waves of photons that are specific to each wavelength (Miserendino and Pick, 1995). The first laser was created by Maiman in 1960 (Mathew and Thangaraj, 2010) and used in endodontics

for the first time by Weichman and Johnson (1971) who attempted to seal the apical foramen *in vitro* using a high powered infrared laser (Weichman and Johnson, 1971). Technology has improved considerably since then, and dental lasers have now become a crucial part of clinical practice. The purpose of this paper was to summarize the applications of lasers in endodontics.

APPLICATIONS

Determination of pulp vitality

Laser doppler flowmetry is a device used to determine pulp vitality based on red blood cell flux in the pulp tissue. Light beams from the optical fibre enters the tissue, is absorbed to some extent by the blood cells and another fibre tip collects the scattered light and provides information about pulp vitality. It is a non-invasive

*Corresponding author. E-mail: a.kamaci@windowslive.com. Tel: +905346137213.

technique and allows painless diagnosis of the tooth (Gazelius et al., 1986). It is also reproducible and has become well-recognized as the gold standard for pulpal blood flow determination (Wilder-Smith, 1988). It is particularly useful for the detection of pulp vitality in traumatized and/or immature teeth (Singh et al., 2013). However, it takes longer than other vitality determination techniques, and also requires a special device. Therefore, it is not conducted as a routine procedure in clinical practice.

Direct pulp capping and pulp amputation

Lasers can be used for haemostasis and cavity disinfection during pulp capping and amputation. Yazdanfar et al. (2015) used diode lasers during pulp capping and found that this technique was more effective than the conventional one. Similarly, the erbium chromium laser was also found to be more successful (Olivi and Genovese, 2006; Jayawardena et al., 2001). Lasers can also be used to decrease dentin permeability insensitive teeth with no pulp exposure (Stabholz et al., 2004).

Pulpotomy and root canal preparation

There are several studies that report about root canal wall preparation using dental lasers. Shoji et al. (2000) reported that Er-YAG created cleaner dentin surfaces than drilling during root canal preparation, and this was corroborated by Moogi et al. (2010). However, some studies have reported the side effects of using lasers in root canal dentin. Ebihara et al. (2002) showed that using Er:YAG laser on root canal dentin without water cooling can cause minor cavities and ablation. Altundasar et al. (2006) showed that Er,Cr:YSGG laser can cause melting and carbonization of root canal dentin, and these findings were similar to those reported by Harashima et al. (1997). Moreover, root canal surfaces may often be left untouched as laser light moves in a linear direction (Stabholz et al., 2004). Therefore, it was only recommended for straight and slightly curved root canals (Singh et al., 2013). These limitations also play a role in the limited uptake of lasers for root canal shaping in dental practice.

Root canal disinfection and irrigation

The ability of lasers to disinfect root canals is well-reported (Gutknecht et al., 2004; Maden et al., 2013; Wang et al., 2007). Gutknecht et al. (2004) showed that 980 nm diode lasers could reduce *E. faecalis* up to 97% from infected bovine dentin disks, while Maden et al. (2013) obtained similar results using Nd:YAG lasers on

dentin surfaces infected with *Candida* species. Photo-activated disinfection (PAD) is another laser-activated disinfection technique requiring a photosensitizing dye and a specific wavelength. This combination has the ability to kill bacteria in planktonic suspensions (Williams et al., 2003). It causes bacterial membrane disruption by releasing free radicals or reactive oxygen species (Bhatti et al., 2002). Bago et al. (2013) used the PAD technique, high power diode lasers, sonic activated irrigation and conventional irrigation to remove *E. faecalis* from straight root canals and reported that PAD and sonic activated irrigation had better effects than the other techniques. Despite the efficacy of lasers in disinfection, their use in direct contact with root canal walls may result in the side effects mentioned. PAD techniques have a lower risk of causing root canal wall deformation as they use low power lasers. However, it involves an additional step of dyeing the root canal wall and the laser light is only effective on stained root canal. Therefore, laser assisted root canal irrigation has gained popularity.

Er-YAG lasers can activate irrigants and also have a cavitation effect on them (Matsumoto et al., 2011). Although Deleu et al. (2013) showed no significant differences between laser activated irrigation and ultrasonically activated irrigation, several other studies have reported that the former produced better results than the latter (De Moor et al., 2009; De Moor et al., 2010; de Groot et al., 2009).

Although laser activated irrigation presented good results, apical extrusion of the irrigation solution was reported to be suspicious. George and Walsh (2008) claimed that laser activated irrigation had a high risk of apical extrusion, leading to the development of the photon-initiated photoacoustic streaming (PIPS) technique. This method involves the introduction of a special fibre tip through the root canal orifice, decreasing thermal damage and the risk of apical extrusion (DiVito et al., 2011). Arslan et al. (2014a; b) found that the PIPS system had superior effects compared to the sonic and ultrasonic systems when used for calcium hydroxide and debris removal. On the other hand, Deleu et al. (2013) did not observe any differences between the PIPS technique and ultrasonically activated irrigation.

Vertical root fracture diagnosis and treatment

Vertical root fractures have become increasingly common among endodontically treated teeth, and they are difficult to diagnose accurately and treat effectively. However, there are very few studies examining the use of lasers in diagnosing vertical root fracture cases. Although Kimura et al. (2009) used diagnodent for vertical root fracture detection *in vivo*, this technique appears to be impractical for clinical use. Vertical fractures can be treated using a surgical approach on the fracture side, which involves cleaning of the fracture line and filling with composite

resin or bioactive materials. Thereafter, lasers can be used to accelerate soft tissue repair, and this has been performed previously using low power laser therapy (Nogueira et al., 2012)

Conclusion

Although there are several improvements in laser technology, laser energy requires extra procedures and materials for application and protection, and this can extend the clinical time for both patients and doctors. Moreover, the side effects of laser light in root canals have been reported in several studies. Thus, we conclude that these devices do not seem very practical compared to the manual techniques.

Conflict of Interests

The authors have not declared any conflict of interests.

REFERENCES

- Altundasar E, Ozcelik B, Cehreli ZC, Matsumoto K (2006). Ultramorphological and histochemical changes after ER,Cr: YSGG laser irradiation and two different irrigation regimes. *J. Endod.* 32:465-468.
- Arslan H, Akcay M, Capar ID, Saygili G, Gok T, Ertas H (2014a). An *in vitro* comparison of irrigation using photon-initiated photoacoustic streaming, ultrasonic, sonic and needle techniques in removing calcium hydroxide. *Int. Endod. J.* 48(3):246-251.
- Arslan H, Capar ID, Saygili G, Gok T, Akcay M (2014b). Effect of photon-initiated photoacoustic streaming on removal of apically placed dentinal debris. *Int. Endod. J.* 47(11):1072-1077.
- Bago I, Plecko V, Gabric Panduric D, Schauperl Z, Baraba A, Anic I (2013). Antimicrobial efficacy of a high-power diode laser, photo-activated disinfection, conventional and sonic activated irrigation during root canal treatment. *Int. Endod. J.* 46:339-47.
- Bhatti M, MacRobert A, Henderson B, Wilson M (2002). Exposure of *Porphyromonas gingivalis* to red light in the presence of the light-activated antimicrobial agent toluidine blue decreases membrane fluidity. *Curr. Microbiol.* 45:118-22.
- Coluzzi DJ (2008) Fundamentals of Lasers in Dentistry: Basic Science, Tissue Interaction, and Instrumentation. *J. Laser Dent.* 16:4-10.
- Convissar RA (2010). Principles and Practice of Laser Dentistry. New York: Mosby.
- de Groot SD, Verhaagen B, Versluis M, Wu MK, Wesselink PR, van der Sluis LW (2009). Laser-activated irrigation within root canals: cleaning efficacy and flow visualization. *Int. Endod. J.* 42:1077-83.
- De Moor RJ, Blanken J, Meire M, Verdaasdonk R (2009). Laser induced explosive vapor and cavitation resulting in effective irrigation of the root canal. Part 2: evaluation of the efficacy. *Lasers Surg. Med.* 41:520-3.
- De Moor RJ, Meire M, Goharkhay K, Moritz A, Vanobbergen J (2010). Efficacy of ultrasonic versus laser-activated irrigation to remove artificially placed dentin debris plugs. *J. Endod.* 36:1580-1583.
- Deleu E, Meire MA, De Moor RJ (2013). Efficacy of laser-based irrigant activation methods in removing debris from simulated root canal irregularities. *Lasers Med Sci.* 30(2):831-835.
- DiVito E, Colonna MP, Olivi G (2011). The photoacoustic efficacy of an Er:YAG laser with radial and stripped tips on root canal dentin walls: an SEM evaluation. *J. Laser Dent.* 19:5.
- Ebihara A, Majaron B, Liaw LH, Krasieva TB, Wilder-Smith P (2002). Er:YAG laser modification of root canal dentine: influence of pulse duration, repetitive irradiation and water spray. *Lasers Med. Sci.* 17:198-207.
- Gazelius B, Olgart L, Edwall B, Edwall L (1986). Non-invasive recording of blood flow in human dental pulp. *Endod. Dent. Traumatol.* 2:219-21.
- George R, Walsh LJ (2008). Apical extrusion of root canal irrigants when using Er:YAG and Er,Cr:YSGG lasers with optical fibers: an *in vitro* dye study. *J. Endod.* 34:706-8.
- Gutknecht N, Franzen R, Schippers M, Lampert F (2004). Bactericidal effect of a 980-nm diode laser in the root canal wall dentin of bovine teeth. *J. Clin. Laser Med. Surg.* 22:9-13.
- Harashima T, Takeda FH, Kimura Y, Matsumoto K (1997). Effect of Nd:YAG laser irradiation for removal of intracanal debris and smear layer in extracted human teeth. *J. Clin. Laser Med. Surg.* 15:131-5.
- Jayawardena JA, Kato J, Moriya K, Takagi Y (2001). Pulpal response to exposure with Er:YAG laser. *Oral Surg. Oral Med. Oral Pathol. Oral Radiol. Endod.* 91:222-229.
- Kimura Y, Tanabe M, Amano Y, Kinoshita J, Yamada Y, Masuda Y (2009). Basic study of the use of laser on detection of vertical root fracture. *J. Dent.* 37:909-12.
- Maden M, Gorgul G, Sultan MN, Akca G, Er O (2013). Determination of the effect of Nd:YAG laser irradiation through dentinal tubules on several oral pathogens. *Lasers Med. Sci.* 28:281-6.
- Mathew S, Thangaraj D (2010). *Lasers In Endodontics* JIADS. 1:7.
- Matsumoto H, Yoshimine Y, Akamine A (2011). Visualization of irrigant flow and cavitation induced by Er:YAG laser within a root canal model. *J. Endod.* 37:839-43.
- Miserendino L, Pick R (1995). *Lasers in dentistry*. Quintessence Publishing Co, Inc. Chicago, Berlin, London, Tokyo, Sao Paulo, Moscow and Warsaw.
- Moogi PP, Rao RN (2010). Cleaning and shaping the root canal with an Nd: YAG laser beam: A comparative study. *J Conserv Dent.* 13:84-8.
- Nogueira Leal da Silva EJ, Romao Dos Santos G, Liess Krebs R, Coutinho-Filho Tde S (2012). Surgical alternative for treatment of vertical root fracture: A Case Report. *Iran Endod. J.* 7:40-4.
- Olivi G, Genovese MD (2006). Erbium chromium laser in pulp capping treatment. *J. Oral Laser Appl.* 6:291-299.
- Parker S (2007). Laser-Tissue Interaction. *Br. Dent. J.* 202:73-81.
- Shoji S, Hariu H, Horiuchi H (2000). Canal enlargement by Er:YAG laser using a cone-shaped irradiation tip. *J. Endod.* 26:454-8.
- Singh CV, Sharma N, Soi S (2013). *Lasers in endodontics*. JDSOR, 2.
- Stabholz A, Sahar-Helft S, Moshonov J (2004). *Lasers in endodontics*. Dent. Clin. North Am. 48(4):809-832.
- Wang QQ, Zhang CF, Yin XZ (2007). Evaluation of the bactericidal effect of Er,Cr:YSGG, and Nd:YAG lasers in experimentally infected root canals. *J. Endod.* 33:830-832.
- Weichman JA, Johnson FM (1971). Laser use in endodontics. A preliminary investigation. *Oral Surg. Oral Med. Oral Pathol.* 31:416-420.
- Wilder-Smith PE (1988). A new method for the non-invasive measurement of pulpal blood flow. *Int. Endod. J.* 21:307-12.
- Williams JA, Pearson GJ, Colles MJ, Wilson M (2003). The effect of variable energy input from a novel light source on the photoactivated bactericidal action of toluidine blue O on *Streptococcus Mutans*. *Caries Res.* 37:190-193.
- Yazdanfar I, Gutknecht N, Franzen R (2015). Effects of diode laser on direct pulp capping treatment: A pilot study. *Lasers Med. Sci.* 30:1237-1243.

Journal of Dentistry and Oral Hygiene

Related Journals Published by Academic Journals

- *Journal of Medicinal Plant Research*
- *Journal of Parasitology and Vector Biology*
- *Clinical Reviews and Opinions*
- *Journal of AIDS and HIV Research*
- *Journal of Cell Biology and Genetics*
- *Medical Practice and Reviews*