Review Article

Disinfection of Contaminated Canals by Different Laser Wavelengths, while Performing Root Canal Therapy

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Abstract:

Removal of smear layer and disinfection of canals are important objectives of teeth root canal cleaning. In order to achieve this purpose, rinsing substances, intra canal drugs as well as ultrasound are used. Today, use of laser to remove smear layer and to disinfect root canals has increasingly attracted the attentions. Till now different lasers such as CO2, Nd:YAG, Er:YAG, Er,Cr:YSGG have been used for debris and smear removal from the canals. Numerous studies have shown that Er:YAG is the most appropriate laser for intra canal debris and smear removal. In addition different laser wavelengths have been used directly or as an adjunctive to disinfect canals. Laser light can penetrate areas of canals where irrigating and disinfecting solutions cannot reach, like secondary canals and deep dentinal tubules and also can eliminate microorganisms. Different studies have confirmed the penetration of Nd:YAG laser in deep dentin and reduction of microorganisms penetration. But studies on comparison of antibacterial effects of Nd:YAG laser with sodium hypochlorite showed effectiveness of both, with a better effect for sodium hypochlorite. Studies performed in relation with anti-microbial effects of Diode laser with various parameters show that this laser can be effective in reducing intra canal bacterial count and penetration in the depth of 500 microns in dentin. In studies performed on Diode laser in combination with canal irrigating solutions such as sodium hypochlorite and oxygenated water better results were obtained.

Although studies on disinfection by the Erbium laser family show that use of this laser alone can be effective in disinfecting canals, studies evaluating the disinfecting effects of this laser and different concentrations of sodium hypochlorite show that the latter alone is more effective in disinfecting canals. And better results were obtained when Erbium laser was used in combination with sodium hypochlorite irrigating solution in canals. Results of the aforementioned articles indicate that this laser is effective in combination with a rinsing solution such as sodium hypochlorite.

Results from studies including several types of the different Er:YAG, Ho:YAG, Nd:YAG, Er,Cr:YSGG lasers in disinfecting canals showed that all wavelengths used in disinfection for different thicknesses of dentin were efficacious without damaging thermal effect. Considering that use of different lasers in canals can be accompanied with temperature increase which can sometimes lead to damages to teeth and surrounding tissues, thus the use of photochemical phenomenon for elimination of microorganisms have attracted attention of many researchers. Studies in this field imply the efficacy of this method in reducing canal bacterial count and recommend its use as an adjunctive after biomechanical preparation of canals. Results from performed studies show removal of intra canal debris and smear layer by different lasers and particularly the Erbium laser family. Furthermore various laser wavelengths, particularly of Diode and Nd:YAG lasers can be effective in reducing intra canal microbial count. Maximum effect is obtained when laser light is used in canals in combination with sodium hypochlorite irrigating substance in appropriate concentration. Therefore use of laser energy can improve success rate of root canal treatments.

Keywords: root canal therapies; Nd:YAG; diode laser

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Introduction

Root canal therapy is one of endodontic branches that deals with the diseases related to tooth pulp and its surrounding conservative tissues. Treatments of root canal lead to preservation of natural teeth as a result of function and appearance of the patient's masticating system (1). One of the most important steps of root canal therapy is canal preparation. This step comprises cleaning, disinfecting and shaping the root canal system in order to fill it with an appropriate substance. Recent studies reported a success rate of 95% for teeth with pulpitis and 85% for necrotic teeth (2). The amount of improvement after renewal of non-surgical root canal treatment was 74% and in ideal conditions with sufficient equipment (microscope) increased to 98% (3). In apical surgery success rate was 60%, and if surgery was performed in appropriate conditions with an appropriate file and treatment renewed, success rate increases to 80%. This statistics show that the success rate depends on the probable presence of bacteria. In vital teeth where the number of bacteria in the canal is low, success rate is high. In necrotic teeth and teeth with lesions around the roots, success rate decreases due to the high presence of microorganisms inside the canal (4). Different types of microorganisms such as bacteria, fungi, and probably viruses can infect dental pulp and lead to periodontitis. Spread of infection to the surrounding area of the teeth root significantly reduces the treatment success. Therefore, microorganisms have a major role in the treatment failure of the teeth roots (5,6). Ideal irrigating solutions such as sodium hypochlorite dissolve vital and necrotic tissues and eliminate bacteria but are not able to sterilize the canals (7). Thus there is the need for adjunctive substances and equipment like lasers.

A number of scholars insist on the importance of cleaning secondary canals for successful teeth root treatment (6). Another issue is dentinal tubules infection by bacteria and fungi which can act as a source for endodontic recurrent infection. Cases mentioned cause the disinfection of infected canals to become more complicated (8,9).

Presence of Enterococcus Faecalis in cases of root treatment failures are of particular importance (10). Prevalence of this microorganism is 22 to 77% of cases (11). Because of its ability to sustain PH=11/5 this microorganism can resist the calcium hydroxide which is disposed in the canals between treatment sessions. Enterococcus Faecalis can stay alive while starving for a long time and grow alone without support from coexistence with other bacteria in treated canals (12). Candida Albicans is the most common fungus separated from root canal treated teeth affected by apical periodontitis (13). In addition to fungi, Actinomyces has also been separated from canals in cases of root canal treatment failure (14,15). Many studies have shown that preparation of canals with manual and rotary devices whether stainless steel or nickel titanium cannot sufficiently disinfect root canals (16,17). Therefore in cases of microbial resistance to routine treatment procedures, laser can be efficient as an adjunct modality for elimination and reduction of microorganisms. In recent years, laser energy with different wavelengths has attracted the researchers' attention for debris and smear layer removal as well as for canal disinfection. Laser energy can eliminate microorganisms existing in main canal, lateral canals and dentinal tubules which may cause pulp and peri-apical infection.

Review of Literature

Studies performed for elimination of intra canal microorganisms by laser can be divided into two groups. First group are studies, focused on intra canal debris and smear layer removal. In the studies of the second group, laser is targeted directly on microorganism.

1- Debris and smear layer removal by laser

Researchers have shown that following canal preparation a layer of 1-2 microns forms on the canal walls named smear layer containing organic and inorganic substances with microbes which can penetrate to a depth of 40 microns in dentin (6).

Removing the smear layer or not, has been a controversy for years. Some scientists have reported that presence of a smear layer delays the disinfection work, but doesn't completely prevent it, and when the canal is infected between the treatments sessions, it acts as an appropriate barrier to block entry of microorganisms inside the dentinal tubules. On the opposite, some other researchers believe this barrier to be an obstacle for passage and penetration of rinsing solutions in the dentinal tubules (17,18). Pashley stated that smear layer contains bacteria and their products, and can act as an intra canal stimulus. In consequence its removal can help root canal treatment and seal to

succeed (20).

Right now 5/25% sodium hypochlorite, 17% EDTA solution, citric acid, MTAD, ultrasonic and laser devices are used in endodontic treatments to remove the smear layer; but no one of them has succeeded to completely remove it and studies performed led to conflicting results (21). Several previous studies showed that Er,Cr:YAG, Argon, Nd:YAG, CO2 and Er:YAG lasers can remove debris and smear layer from root canal walls following canal filing, and that Er:YAG laser is more effective in debris and smear layer removal (22-24). Although in areas where laser light do not reach canal surface, regions covered by remaining debris are observed.

Initial studies performed on smear layer removal by Nd:YAG laser showed a reduction in amount of smear layer (25,26). In Goya et al study, light and electronic microscopic investigation reported 60% amount of leakage in the group without irradiation (control) and 20% in the Nd:YAG laser group without black ink and 0% in the Nd:YAG laser group with black ink, showing a significant reduction in amount of leakage for the latter group (27).

Wang et al in their study on the effects of Diode laser on smear layer removal from canal walls and apical leakage after canal filling demonstrated that this laser is effective in debris and smear layer removal from canals and leads to reduced apical leakage after filling (28). According to Tekada et al in their study on comparison of CO2 laser with a canal rinsing solution, the results showed that irrigation with17% EDTA, 6% phosphoric acid and 6% citric acid did not completely remove intra canal smear layer, while CO2 laser can be useful in removing smear layer from root canal walls (29). In another study by the same researcher, results showed that Er:YAG laser is the most effective device for debris and smear layer removal from root canal walls (20).

In a study on apical cavity preparation by Er:YAG laser and ultrasonic devices without taking into account the substance used for filling, the amount of leakage was lower in the laser group (30).

The study by Harashima et al showed that Er:YAG laser was more effective compared to Nd:YAG laser in removal of debris and smear laser (31). Because Er:YAG laser and Er,Cr:YSGG laser characteristics are similar and close, therefore they are called Erbium family (32).

Altundasar et al in a study assessed morphologic and histologic changes in radicular dentin after Er,Cr:YSGG laser irradiation in combination with two canal irrigating solutions. Laser irradiation led to complete or partial removal of smear layer and convenient seal was achieved in teeth dentin. While small areas of damage consecutive of raised temperature accompanied by carbonization and fusion of parts of dentin can be observed (33). In a SEM study, observation showed that surfaces of cavities irradiated with Er,Cr:YSGG were rough, smear layer was inexistent and dentinal tubules were open (34). Another study performed by Yamazaki et al demonstrated that laser irradiation with water spray is a useful method for debris and smear layer removal from root canals (35).

2- Disinfection of root canal by laser

According to Oguantebi opinion, the most common irrigating solutions and drugs which are used for disinfection of canals have a limited spectrum of bacteria and some of them have limited capacity of diffusion in the dentinal tubules (36). On the other hand Peters et al showed that following canal preparation by 4 techniques with nickel titanium rotary files, 35% of dental surfaces remained intact (37). Thus laser can be considered as an adjunctive device in disinfection of root canals. Laser systems existing in dentistry can be transferred in dental canals via fiber optics like Nd:YAG (38), Argon and Diode lasers (39,40) or by hollow tubes such as CO2 Er:YAG (41,42) lasers, and by doing so benefit from biomechanical intra canal cleaning as well as bactericidal ability of laser radiation will be achieved.

Nd:YAG was one of the first lasers to be used for canal disinfection, therefore we will start by reviewing studies performed on disinfecting effects of this laser. Koba et al used Nd:YAG laser with 1/064 nm wavelength to disinfect infected canals of dog teeth. Teeth were irradiated with 1 to 2W by 30 pulses per second (pps) for 1 to 2 seconds. Amount of root inflammation between 2 to 8 weeks was significantly lower in control group (43). The same scientist used Nd:YAG laser (1W, 15pps, duration:1s) in the final stages of canal preparation in order to disinfect canals in another study. In the laser group, amount of pain and sensitivity to percussion was significantly lower (44).

Moshomov compared the effects of Nd:YAG laser and sodium hypochlorite for canal disinfection. Results showed that although Nd:YAG laser precisely reduces canal bacterial count, sodium hypochlorite was more effective (38). In another study antimicrobial effect of

Nd:YAG laser (1/5W, 15pps with 200 micron optic fiber for 10 to 20 seconds) in different thicknesses of dentin. The results demonstrated that microbial count was reduced in all infected dentinal thicknesses and even in 1000 micron thickness (45). Moritz et al assessed the effect of Nd:YAG laser on dentin contaminated by 2 types of microorganisms E.Faecalis and Escherichia coli, and observed reduction of both types of microorganisms (46). In their study, Piccolomini et al compared the disinfecting effects of Nd:YAG and 5/25% hypochlorite solutionin in canals. Results showed that although laser is effective in canal disinfection, 5/25% sodium hypochlorite had more antimicrobial effects than Nd:YAG laser (47). In another study on extracted teeth, disinfecting effect of Pulsed Nd:YAG laser without use of photosensitizing colors was evaluated. Antimicrobial effect of this laser without the presence of photosensitizing colors along with significant increase in heat was observed (48). Bergmans et al evaluated the ability of Nd:YAG laser in eliminating intra canal bacteria after direct and indirect irradiation on 1mm dentin disks. Results demonstrated that Nd:YAG laser (1/5W,15Hz, 4 times for 5sec) was able to eliminate 99/7% of E.Faecalis bacterial population, but the canal was not sterilized. Pathogens which grow as biofilm can hardly be eliminated by direct laser irradiation. Laser light can affect bacteria further than 1mm in dentin (49).

Also use of CO2 laser was evaluated for disinfection in endodontics. Le Goff et al used laser and sodium hypochlorite to disinfect canals in extracted teeth. Results indicates an 85% decrease in microbial colony formation in the laser group, but sodium hypochlorite was more effective (50).

In a study on extracted teeth, Diode laser with 810nm wavelength (4W power, every time for 5seconds) was used to reduce intra canal bacteria. Results showed that this laser is effective for sealing dentinal tubules and eliminating Escherichia coli and Enterococcus Faecalis (39). Diode laser with 810nm wavelength and 3W power on continuous mode (CW) for 30 seconds was used to eliminate E.Faecalis. A moderate 74% reduction in amount of bacteria for a dentinal thickness of 500 micron was observed (51). A group of researchers designed a study in order to disinfect canals via the use of Gallium Aluminum Arsenide (Diode 809nm) alone and in combination with sodium hypochlorite and oxygenated water. Laser parameters were continuous mode (CW) at 1/5, 3 and 4/5W power with 20 microns diameter fiber for 60 seconds. Results showed that in the laser in combination with irrigating solution group bacterial reduction was more remarkable. So it is recommended to use this laser with the aforementioned rinsing solution for canal disinfection (52). In their study Gutknecht et al used Diode laser for disinfection of contaminated canals by E.Faecalis in different dentin thicknesses up to 500 microns depth. Results demonstrated that Diode laser with 980nm wavelength can eliminate bacteria which have penetrated to a depth of 500 microns in dentin (53). de Souza et al contaminated canals of extracted teeth with E.Faecalis. Then divided the teeth in two groups, in the first group after canal preparation with rotary system and 0/5% sodium hypochlorite as well as 17% EDTA, Diode laser with 830nm and 3W power was used. In the second group like group 1, canals were prepared but laser wasn't used. Results showed that in the laser group 100% disinfection occurred while in the second group 98/39% of samples were disinfected. This study demonstrated that the use of Diode laser after biomechanical preparation leads to an increased amount of canal disinfection (54).

Studies performed on the disinfecting effects of Erbium laser family are as follows:

Results of Dostalova et al study showed that Er:YAG laser (100mJ energy, 30 pulses and 4Hz) is effective in disinfecting canals (55). Perin et al assessed the antimicrobial effect of Er:YAG laser and 1% sodium hypochlorite in eliminating 4 types of bacteria and one type of fungus. Results demonstrated that Er:YAG laser (7Hz, 100mJ, 80 pulses/canal, 11sec) and 1% sodium hypochlorite if used throughout the canal length are effective against 5 types of microorganisms, and if laser and irrigating solutions are used 3mm shorter than the canal apex, 70% of the samples would remain contaminated (56).

Kangarloo and Fekrazad in a study investigated the effect of Er,Cr:YSSG on E.Faecalis with 2% chlorhexidine solution in dentinal tubules of extracted teeth. Results showed that both laser and chlorhexidine solution were effective in reducing bacterial count, but chlorhexidine was significantly more effective (57). In a study, disinfecting effect of Er:YAG laser with different frequencies in roots of extracted teeth,which were voluntarily contaminated, was evaluated. Frequencies used were 7, 10 and 16Hz with 1%, 2/5% sodium hypochlorite irrigating substances. Results showed that all frequencies were effective in disinfecting canals but none completely eliminated microorganisms. 2/5% sodium hypochlorite was a little more effective but this

difference wasn't statistically significant (58). Gordon et al studied antimicrobial effect of Er,Cr:YSGG laser on dentinal walls infected by E.Faecalis and reached the conclusion that Er,Cr:YSGG laser under the study conditions led to a 99/7% reduction in microbial count (59). A comparative study on the effectiveness of Er,Cr:YSGG laser with 3% sodium hypochlorite indicated that Er,Cr:YSGG laser (0/5W power, 20% water and air) resulted in reduction of bacterial count, but bacteria were not completely eliminated. Hypochlorite solution was able to prevent E.Faecalis growth and efficiently sterilize canals (60). In a study Schoop et al assessed the effects of Er,Cr:YSGG on two types of microorganism cultures in root canals. They stated that this laser can eliminate intra canal bacteria. Also SEM evaluation showed that this laser can remove intra canal debris and open dentinal tubules entries (61).

Some researchers have studied the disinfecting effects of several different lasers in canals, which will be reviewed here.

A study on extracted teeth contaminated with E.Faecalis and Escherichia coli, cleared that Nd:YAG, Ho:YAG and Er:YAG lasers without inappropriately increasing temperature led to elimination of more than 99% of microorganisms. Therefore they concluded that laser is an appropriate device for disinfection of canals (62). Schoop et al performed a study named antibacterial effect of different lasers in the depth of dentin layers contaminated by E.Coli and E.Facaelis. In this study Diode (810nm), Er:YAG (2940nm), Er,Cr:YSGG (2780nm) and Nd:YAG (1064nm) were used. The results showed that all the wavelengths aforementioned were efficacious for dentin disinfection even in different thicknesses. Therefore laser is a convenient device as an adjunct to canal disinfection without the harmful effects of heat increase (63).

Considering the importance of eliminating intra canals microbes and the problems created by the increase of temperature when using the different lasers, scientists addressed elimination of microbes via photochemical phenomenon and the use of low level lasers.

In a study, anti-bacterial effects of photodynamic

Table 1. Studies performed on canal disinfection by laser

Title	Year of Publication	Researcher Name	Row
Nd:YAG laser irradiation in root canal disinfection	1995	Moshonov J, Orstavik D	1
The efficiency of root canal disinfection using a holmium:yttrium-aluminum-garnet laser in vitro.	1997	Gutknecht N, Nuebler-Moritz M	2
Antibacterial effects of Nd:YAG laser irradiation within root canal dentin.	1997	Klinke T, Klimm W	3
In vitro irradiation of infected root canals with a diode laser: results of microbiologic, infrared spectrometric, and stain penetration examinations.	1997	Moritz A, Gutknecht N	4
An evaluation of the CO2 laser for endodontic disinfection	1999	Le Goff A, Dautel-Morazin A	5
The bactericidal effect of Nd: Yag,Ho:YAG,and Er:YAG laser irradiation in the root canal : an in vitro comparison	1999	Moritz A, Schoopu	6
Morphologic changes correlating to different sensitivities of Escherichia coli and enterococcus faecalis to Nd:YAG laser irradiation through dentin.	2000	Moritz A, Jakolitsch S	7
Diode laser radiation and its bactericidal effect in root canal wall dentin.	2000	Gutknecht N, van Gogswaardt D	8
Bacteriologic Evaluation of the Effect of Nd: YAG Laser Irradiation in Experimental Infected Root Canals	2002	Piccolomini Raffaele	9
	2002	Folwaczny Mathias	10
Endodontic treatment with application of Er:YAG laser waveguide radiation disinfection.	2002	Dostálová T, Jelínková H	11
Efficacy of NaOCl/H2O2 irrigation and GaAlAs laser in decontamination of root canals in vitro.	2003	Kreisler M, Kohnen W	12
Bactericidal Effect of different laser Systems in the Deep Layers of Dentin	2004	schoop U, Wolf Kluger	13
Evaluation of the antimicrobial effect of Er:YAG laser irradiation versus 1% sodium hypochlorite irrigation for root canal disinfection.	2004	Perin FM, França SC	14
Bactericidal effect of a 980 -nm diode laser in the root canal wall dentin of bovine teeth	2004	Gutknecht	15
	2005	Kangarloo.A, Fekrazad. R, Salar	16
Disinfection of root canals using Er:YAG laser at different frequencies.	2006	- Vezzani MS, Pietro R	17

therapy on pulps of human teeth with periapical and necrotic lesions, the results indicated that application of photodynamic therapy in root treatment is an appropriate solution for treating canal infections (64). Fosehi et al used photodynamic therapy to eliminate E.Faecalis from root canals. For this purpose they used a Diode laser (665nm-60J/cm2) and methylene blue and reached the conclusion that laser alone had a 40/5%, while methylene blue alone had a 19/5% reduction in microorganisms. Methylene blue with Diode laser appropriate parameters led to a 77/5% reduction of bacteria (65). In a study, photodynamic therapy was used on extracted teeth for intra canal poly microbial infections. Root canals were contaminated by Actinomyces Israelii, Fusobacterium Nucleatum, Porphyromonas Gingivalis and Prevotella Intermedia. Canal systems were incubated for 10mn in 25microg/ml methylene blue and then irradiated by Diode red light (660nm, 30J/cm2 energy) via a 250 microns fiber optic. Photodynamic therapy (PDT) led to a reduction of 80% of constituted colonies. Researchers concluded that PDT can be a good antibacterial adjunctive device for root treatment, particularly when PDT parameters are optimum (66). In a study on the reduction of E.Faecalis in the canals of extracted teeth, PDT was used then toluidine blue for 5mn was applied. Diode laser (Ga-Al-As) with 660 wavelength and 50mW power was also used. In the test group 99/9% reduction of bacterial count was observed, while this reduction in the control group was only 2/6%. Results showed that PDT is effective in disinfection of canals contaminated by E.Faecalis (67).

Meire et al investigated the efficacy of Nd:YAG, KTP lasers, PAD and 2/5% sodium hypochlorite in eliminating E.Faecalis in distilled water and in infected teeth. Results demonstrated that none of the lasers and PAD was as effective as 2/5% sodium hypochlorite (68).

Discussion

Debris and smear layer removal leads to a better seal of canal filling substance and reduction of microleakage (7). Till now many lasers such as CO2, Nd:YAG, Er:YAG and Er,Cr:YSGG have been used to remove debris and smear layer from infected canals. Several studies showed that Er:YAG is the most appropriate laser for intra canal removal of debris and smear layer (22-24,34). It appears that Erbium lasers, because of their effect on minerals existing in debris and smear layer, can be more effective in removing these two components from the canals. In this respect Erbium laser competes with canal irrigating solutions in debris and smear layer removal.

As said before, laser can, directly or as an adjunctive device, be effective in disinfecting canals. Laser light can penetrate area of canals where rinsing solutions have no access like secondary canals and depth of dentin tubules, and eliminates microorganisms. Different studies confirmed penetration of Nd:YAG laser in the depth of dentin, resulting in the decrease of microorganisms penetration (38,43,48). But in studies comparing anti-bacterial effect of Nd:YAG laser with sodium hypochlorite, results indicated the effectiveness of both of them with superiority for sodium hypochlorite (38,47).

Studies performed in relation to the antimicrobial effect of Diode laser with different parameters showed that this laser can be efficacious in reduction of intra canal bacteria and penetrates to a depth of 500 microns in dentin (39,52). In studies in which Diode laser was used in combination to canal irrigating solutions like sodium hypochlorite and oxygenated water, better results were obtained (52).

Studies performed in relation to disinfection by Erbium laser family show that use of this laser alone can be effective in canal disinfection (55,56,59,61). Studies which evaluated the disinfecting effect of this laser with sodium hypochlorite in different concentrations demonstrated that sodium hypochlorite is more effective than Erbium laser alone in disinfecting canals (58). But when Erbium laser is used in combination with sodium hypochlorite in canals, better results are obtained (56). The results of the aforementioned studies clears that this laser in combination with a standard root treatment and an appropriate rinsing solution is effective. Results of studies in which many types of lasers were used in disinfection of canals showed that all wavelengths used for disinfection in different thicknesses of dentin were effective without inappropriate heat effect (62,63).

Considering that use of different lasers in canals can be accompanied by augmentation of temperature which can sometimes lead to surrounding tissue damages. Thus the use of photochemical phenomenon for elimination of microorganisms has attracted many scientists' attention. Studies in this field indicate that this modality is effective in reducing microbial count of the canals (64-68), and it is recommended as an adjunctive device after biomechanical preparation of canals.

Limitations in laser applications can be the increase of temperature with the use of some laser types and the fact that it is not possible for laser to reach some surfaces (69). Another issue is the eventual damage to the periapical area, particularly when the roots are close to anatomic regions like mental foramen, canal of the inferior alveolar nerve or maxillary sinus. Passage of laser beam through the apex of the roots can damage this anatomic region (69).

In a case report, a patient with a previous history of trauma had a fistula in the chin due to the periapical lesion around the apex of the teeth no 24 and 25. In this case, Diode laser with the wavelength of 810 nm for canal disinfection and low level laser with the wavelength of 685 nm for better repair of the fistula was used.

The results showed that Diode laser application for canal disinfection along with low level laser can increase the quality of endodontic treatments in such cases (70).

One of the factors influencing the use of laser in canals is the exit of laser beam from the apex of tips used to transfer laser. So the lateral surfaces of main canals as well as lateral canals cannot be affected by laser. Therefore Stabholz et al presented a new endodontic tip called "Side firing". This device can be used with Er:YAG laser, by which laser light can laterally exit from the tip sides. By elimination of these limitations the application of laser in canal disinfection is getting more practical everyday (69,71).

Conclusion

Studies performed have shown intra canal debris and smear layer removal by laser particularly the Erbium family. Also various wavelengths, particularly those of Nd:YAG can be effective in reducing microbial population in canals. Maximum effect is obtained when laser light in combination with sodium hypochlorite irrigating solution with appropriate concentration, is used in canals. Therefore use of laser energy can increase the success rate of teeth root treatments.

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