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Clinical Assessment of Microbial Count in Laser-Assisted Endodontic Therapy of Dual Wavelengths in Ga as Diode Laser (Randomized Clinical Trial)

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Abstract:

Objective: The aim of this study was to evaluate the effectiveness of dual wavelengths 980/810 nm InGaAs diode laser as disinfectant aid during pulpectomy in deciduous teeth.

Background:successful pulpectomy mandate eradication of microorganisms in root canal of deciduous teeth. A well-known fact that mechanical cleansing of the canals cannot ensure optimal sterilized environment. Thus, the need of finding suitable aids to perform disinfection to canal system to enhance successful rates of pulpectomy. The availability of diode laser devices in many clinics, the specific characteristics of laser beam and the high energycontinents of diode laser has been proposed laser application as an aid in endodontic therapy for disinfect and clean the root canal syste.

Results: dual wavelength diode laser was able to disinfect of 88% of the sample in comparing to only 48% in conventional treatment protocol.

Conclusion:dual wavelengths 980/810 nm InGaAs diode laser with 800mW output power in chopped mode 25 ms on followed by 75 ms can be suitable aid to disinfect root canal system in deciduous teeth.

Keywords:pulpectomy, root canal disinfection, deciduous teeth.

Introduction:

Successful pulpectomy mandate elimination of bacteria in root canal system. It's well known that all available irrigation solution is not optimized to eliminate all bacteria due to surface tension of liquids, which prevent these liquids to penetrate more than 100 μm in dental tissue, whereas bacteria can do much more penetration in dentin which may reach ten folds of irrigation liquids depth. Therefor additional disinfection protocol is needed to eliminate microbes in dentinal tubules to increase success rates of root canal treatment(1)

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the effective disinfection and if possible sterilization of root canals is the main factor that affect The outcome of endodontic therapy(2). Currently the cleansing process is accomplished through combined mechanical instrumentation plus different irrigation solutions. truly instrumentation may decrease bacterial count through mechanical removal of bacteria as well as infected dentine particles, but this process cannot ensure clean and sterile canal (3). Thus using of chemical solutions to aid mechanical instrumentation can add much help, various chemicals had been used for this prepose such as; potassium iodine, chlorhexidine, MTAD, QMix(4), and the gold standard solution (Sodium hypochlorite(5). Unfortunately, the combination of mechanical and chemical disinfection proceduresdoes not provide optimally clean canal every time, and thus may lead to failure of root canal therapy(6). Many assisting methods had been suggested to optimize root canal therapy, such as sonic activated irrigation, Passive ultrasonic irrigation, new irrigant agitation techniques and laser assisted endodontic therapy(7–10).

laser therapy is one of the most promising endodontic aid, Due to high energy content and specific characteristics of laser light, laser treatment has been proposed for cleaning and disinfecting the root canal system(2).Till now laser assisted endodontic therapy didn't get enough clinical acceptance and need to through investigated (11). The aim of this study was to investigate the effectiveness of dual wavelengths 980/810 nm InGaAs diode laser as disinfectant to root canal system.

.**Methods:**fiftydeciduous teeth (lower first molar) were randomly assigned intotwo groups: laser assisted and the control group, 25 teeth in each group. All teeth were suffering from chronic pulpitis, without periapical changes. In the control group carries removal followed by access opening were made followed by pulp tissue removal and irrigation of sterile normal saline solution.(12), sampling made by placement of Three sterile paper-points were put into the root canal one mm shorter than full canal length depending on radiographs, to dry the canal. Each one of these papers were left for 1 minute. All three Paper points were then stored into tubes of reduced transport fluid of 500µl (13).In the study group (laser group), the same procedure was used plus sterilization of the root canals using laser irradiation of dual wavelengths 980/810 nm InGaAs diode laser (Quicklase, UK), using a 200µm fiber, 800mW output power with chopped mode 25 ms on followed by 75 msoff for 5 second with moving of the fiber tip at 3mm per second (1). After laser application another three paper point were inserted exactly as in the control group to obtain the samplesofthe study group and delivered to laboratory to microbiological analysis. After finish sampling the root canals were obturated with zinc oxide eugenolpulpectomy paste.

Within 15 minutes all bottles containing the sample were transferred to the laboratory for samples processing, Samples were dispersed with a vortex for thirty seconds and tenfold serial dilutions to 10^{-3} then all samples were madein pre-reduced anaerobically sterilized buffered salt solution. Aliquots of100 µL from the undiluted suspension and the highest dilution wereeach spread onto Brucella agar plates supplemented with 5% defibrinated sheep blood,hemin (5 mg/L) and menadione (1 mg/L), and Mitis-salivarius agarplates. Plates were incubated anaerobically

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withinanaerobic at 37°C for14 days. After incubation, the total colony-forming units (CFUs) werecounted, and actual counts were calculated based on the known dilutionfactors(13).

Effectiveness of laser irradiation into root canal was assessed through counting the percentage of cases yielding negative cultures, comparing to the results of control group Quantitative data were statistically analyzed for differences by using the McNemar's. Significance level was always set at 5% ($p < 0.05$).

Results:the result of this study showed that only 4 of 25 samples treated with laser still contain microbes, where as in the control group 13 of 25samples still retain microbes after the incubation period. Meaning 88% disinfection effectiveness of laser eradiation in comparing to 48% of conventional protocol.

Column	Size	Missing	Mean	StdDev	Std. Error	C.I. of Mean
study group	25	0	0.160	0.374	0.0748	0.154
control group	25	0	0.520	0.510	0.102	0.210

Column	Skewness	Kurtosis	K-S Dist.	K-S Prob.	SWilk W	SWilkProb
study group	1.975	2.061	0.506	<0.001	0.445	<0.001
control group	-0.0853	-2.174	0.347	<0.001	0.639	<0.001

Column	Sum	Sum of Squares
study group	4.000	4.000
control group	13.000	13.000

Comparing the two groups using McNemar's Test showed that Chi-square= 4.923 with 1 degrees of freedom. (P = 0.027) which mean the proportion of observations in the different categories which define the contingency table is significantly different than is expected from random occurrence.

Discussions: the development of periapicalpathosis is a direct result from microorganisms in root canal system, this fact had been proofed through numerous animal and human studies(14)**,** but, proper disinfection of canal system is still challenging, and various method have been suggested to remove or at least decrease microorganism load in the canal, such as advanced instrumentation equipment , powerful irrigations , and various medicaments. A clean and

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sterilized canal cannot be ensured by mechanical instrumentation only (15). thus, the use of additional protocols is mandatory to ensure a relative cleansing, such as chemicals or laser to eliminate organism as possible(16).
Laser is a coherent lightwithmonochromic frequency which have low or no divergence. It is well known that laser beam can concentrate energy to deliver it to specific points to produce good effect, unlike natural light the photons of laser are identical(17).Laser can remove necrotic tissue from root canal also melt dentinal tubules to form smooth crackles surface(18).

In this study 88% microbial eradication was established, this result was significantly higher than control group, but wasn't reach the optimal 100% disinfection by other authors (12), this might be due relatively lower power used in this study to avoid periodontal damage, Gutknecht proposed that the minimum laser power to ensure smear layer removal and sealing dentinal tubules is 1 Watt which is more that that used in this study and that might explain the incomplete microorganism removal found in this study (19)others proposed the application of laser power over the tooth through opening cavity would give better antimicrobial effect (20,21), There are two presumed theories about the antimicrobial effect of laser in near infra-red spectrum, either by heat absorption by substrate in which microorganism is lived or by direct absorption by microorganism itself (22),

Blood may lead to porphyrins and melanin pigments in microorganism thus, increase disinfection effects , furthermore affected or infected dentine can enhance heat absorption over intact dentine so it would be better in bactericidal aspect (23).

Pervious studies had showed effectiveness of diode laser in canal disinfection with various wavelengths (21,24), some studies concluded that the Nd:YAG laser was much more effective than diode laser as antiseptic agent (25), others found similar effectiveness in both diode and Nd:YAG laser (21).

The variability of reported results in previous studies can be due to the variability of environment and equipment used in these studies such as different laser fiber diameter, pulse frequency, energy or variable study designs (26).

Conclusions:dual wavelengths 980/810 nm InGaAs diode laser with 800mW output power in chopped mode 25 ms on followed by 75 ms can be suitable aid to disinfect root canal system in deciduous teeth. Although this parameters didn't achieved the optimal microorganism eradication but it relatively effective aid in providing clean environment in root canal in deciduous teeth.

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