

# Antimicrobial Efficiency of NaOCl and Helbo Laser against Enterococcus faecalis

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**Abstract:** The aim was to compare the efficacy of antimicrobial therapy, applying photodynamic therapy in different time intervals and the conventional method of irrigation of channel with sodium hypochlorite NaOCl 2.5 %. **Material and Methods:** In our study were used 32 extracted teeth with single root. For inoculation are used types of bacteria Enterococcus faecalis ATCC 29212. In the first group of teeth (n=7) for the channel disinfection was used 2.5% NaOCl, while in the second group (n = 21) were divided 7 channels (n = 7) were treated with Helbo laser for 1 minute, 7 channels (n = 7) of the second group were treated with Helbo laser for 3 minutes and other 7 channels were treated with Helbo laser for 5 minutes. In liquid cytometer at the same time controls are performed over 4 untreated teeth. **Results:** For statistical analysis of the results is used ANOVA with post-test Hock, the program IBM SPSS Statistics 20. In our study at the group of channels treated with 2.5 % NaOCl, the number of dead cells after irrigation of the channel is 92, 55(p=0.087 %). At the PDT group with the application of laser in the duration of 5 minutes the number of dead cells is 80, 06 % (p = 0.003). With the application of laser in the duration of 3 minutes the number of dead cells is 83, 53 % (p = 0.009). With application of laser in 1 minute duration the number of dead cells for E. faecalis is 72.10 % (p < 0.001). **Conclusion:** Irrigation with 2.5 % NaOCl should always be used for the treatment of chronic infections of tooth root canals with E. faecalis. Photodynamic therapy diode laser with X = 665 nm with a duration of 5 minutes has been relatively efficient

**Keywords:** Enterococcus -faecalis, Minilaser Helbo, NaOCl, Mtwo, comparison

## 1. Introduction

Enterococcus species play an important role in endodontic micro flora because they show permanent resistance to microbial agents influencing the process of infection. It is very difficult to be treated [6], [8], [11]. This infection often persists even after endodontic treatments by re invaded canal spaces in which previously was eliminated [7]. The success of endodontic treatment depends directly from the elimination of microorganisms from infected tooth canal. Applying irrigative solutions during preparation of tooth root canal is very important because it helps in cleaning the canal and lubrication of instruments [15]. Sodium hypochlorite is used more in endodontic because the mechanism of action causes biosynthetic alterations in cellular metabolism and destruction of fatty acids [3]. Another way for disinfecting the infected channel is the use of laser action with great force and application of photodynamic therapy.

## 2. Aim

To verify the efficacy of 2.5 % NaOCl in disinfecting tooth root canal infected with Enterococcus faecalis compared with the efficiency of photodynamic therapy at different intervals of time.

## 3. Material and methods

In our study were used 32 extracted teeth. After we explore channels until apex with a manual lime number 10 in steel, we have continued with the gradual expansion of all channels using Mtwo instruments which reach up to apex without modifying the morphology of the channel itself [13].

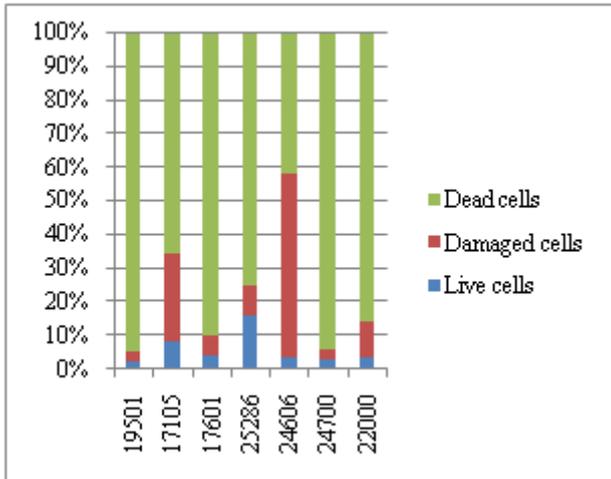
## Analysis Sp

The methodology of work is based on the cultivation of bacteria. For inoculation are used types of bacteria Enterococcus faecalis ATCC 29212. The concentration of bacteria is measured with Nefelometer. At the first group infected teeth with biofilm of these microorganisms with Photodynamic Systems Helbo which is left to act for 1 minute. After that at the tooth root canal is applied laser Helbo 2075 F Minilaser dent in different time intervals of 1, 3 and 5 minutes. At the same time controls are performed over laser treatment and 2.5% NaOCl in blood agar compared with the cytometer of liquid. For determining the concentration is used The Cell Viability Kit with Liquid Counting Beads.

## 4. Results

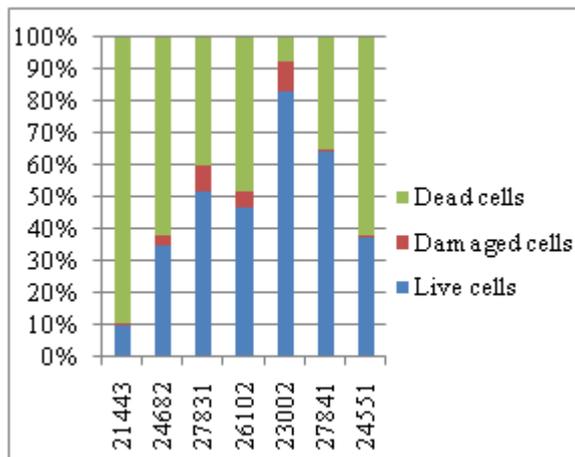
In our study is compared antimicrobial action of conventional methods and photodynamic therapy to E. faecalis. The results obtained are presented in the figure. At the same time checks are made for sterilization of dental in the agar plates. Were made controls of the biofilm growth in tooth root canals with SEM and controls of the reaction of microorganisms against irrigants action: NaOCl 2.5 % and Photodynamic Therapy in the liquid cytometria.

From the figure 1 is determined that the highest percentage of dead cells of E. faecalis after irrigation with 2.5 % NaOCl is 92,55%, the highest rate of living cells after irrigation with 2.5 % NaOCl is 18,71 % and the highest percentage of damaged cells is 47,94%.



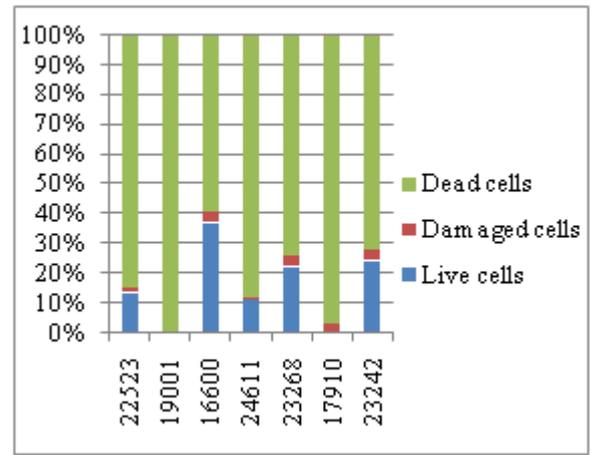
**Figure 1:** The percentage of dead cells, live cells and damaged cells of Enterococcus faecalis in 7 root canals after NAOCL 2.5% irrigation.

From the figure 2 is proved that the highest percentage of dead cells of E.faecalis after application of PDT in 1 minute duration is 72.10 %, the highest rate of living cells is 56.85 % and the highest rate of damaged cells after application of PDT in 1 minute duration is 8.58 %.



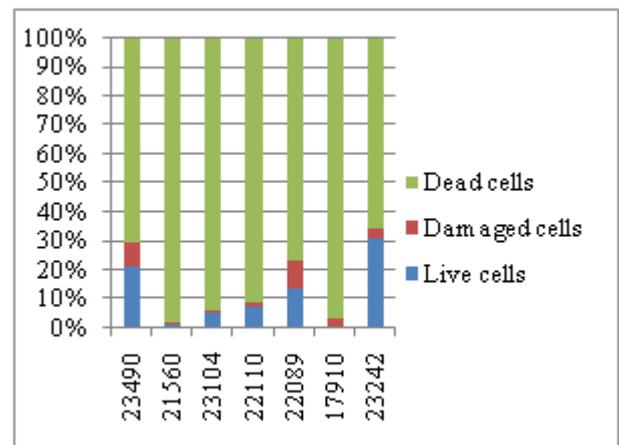
**Figure 2:** The percentage of dead cells, live cells and damaged cells of Enterococcus faecalis in 7 root canals after the application of TFD 1 minute duration.

From the figure 3 is proved that the highest percentage of dead cells of E.faecalis after application of PDT with the duration of 3 minutes 83.53% is the highest percentage of living cells is 31.90 % and the highest rate of damaged cells after application of PDT with the duration of 3 minutes is 3.79 %.

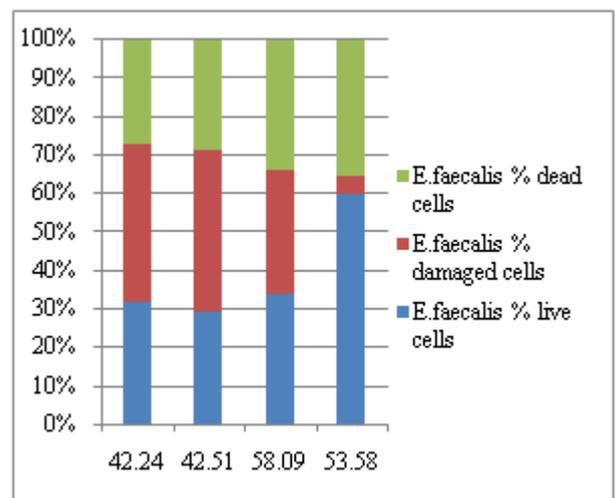


**Figure 3:** The percentage of dead cells, live cells and damaged cells of Enterococcus faecalis in 7 root canals after the application of TFD 3 minute duration.

From the figure 4 is showed that the highest percentage of dead cells after application of PDTE.faecalis for the duration of 5 minutes is 80, 06%, the highest rate of living cells is 31.24 % and the highest rate of cell damaged after application of PDT with the duration of 5 minutes is 7.36 %.



**Figure 4:** The percentage of dead cells, live cells and damaged cells of Enterococcus faecalis in 7 root canals after the application of TFD 5 minute duration



**Figure 5:** The percentage of microorganisms to dead E.faecalis, living E.faecalis and the percentage of E.faecalis

damaged cells in positive controls in liquid cytometer analyzed in untreated teeth.

The method of the laser treatment on duration of 1 minute is shown to be the weakest in eliminating microorganisms. For statistical analysis of the results is used ANOVA with Hokcpost- test, program IBM SPSS Statistics 20 (IBM, USA) comparing the percentage of dead cells of *E. faecalis* and for all methods of disinfection of infected channels. The degree of significance was  $p < 0.05$ . With this result is confirmed that our results are accurate 95% of samples. The p-value of statistical analysis has been smaller than (0.05) then we have proven that there is a statistically significant difference in percentage in some specific groups. With ANOVA test has been confirmed no statistical significant difference between the methods used ( $p < 0.001$ ,  $F = 29.992$ ). The average percentage of dead cells of *E. faecalis* in the control group without any treatment has been significance small ( $p < 0.001$ ). The method of laser treatment on duration of 1 minute is shown the weakest in eliminating microorganisms.

## 5. Discussion

Our study demonstrates that in the group of root canals treated with 2.5 % NaOCl the number of dead cells after channels irrigation is 92, 55 %. The results obtained in our study after application of 2.5 % NaOCl are similar to the results obtained from studies done by Gomes [5], Sena [12], Valera [16] and Tirali. [14]. Our results are similar to Bago's results [1]. At the PDT group with the application of laser in duration from 5 minutes shows that the number of dead cells is 80,06 % for *E. faecalis* and the p-value is  $p = 0.003$ . With the application of laser in the duration of 3 minutes the number of dead cells for *E. faecalis* is 83.53 % and the p-value is  $p = 0.009$ . With application of laser in 1 minute duration the number of dead cells for *E. faecalis* is 72.10 % and the p-value is  $p < 0.001$ . The comparison of results obtained by radiation with PDT in duration from 5 minutes to 1 minute of time indicates statistical difference  $p = 0.003$  and shows no statistical difference compared with the time of 3 minutes  $p = 0.009$ . During laser treatment for 1 minute duration seems that there is no disinfection efficiency in enterococcus cells and therefore is needed greater duration of the treatment with the laser. There is no significant difference between 3 and 5 minutes duration. Better antimicrobial efficacy of PDT is shown by the results of Saukos [10], Garcez [4], Bergmans [2], Rio [9] and Bago's studies [1]. According Bergman [2] PDT and laser treatment of 60 teeth root canals infected with several types of bacteria, resulted in the reduction of 88.4% of *E. faecalis* bacteria, this result was not identical with the results of our study.

## 6. Conclusions

Irrigation with 2.5 % NaOCl should always be used for the treatment of chronic infections of tooth root canals with *Enterococcus faecalis*. Photo dynamic therapy diode laser with  $\lambda = 665$  nm with a duration of 5 minutes was relatively effective at destroying microorganisms.

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