Evaluation of Anti-biofilm Efficacy of Nano-based Intra-canal Medicaments during Endodontic Retreatment (Randomized Clinical Trial)

Thesis submitted to the Faculty of Dentistry Ain Shams University

For

Partial Fulfillment of the Requirement of PhD degree in Endodontics

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2019

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DEDICATION

TO MY FATHER'S SOUL AND MY MOTHER

TO MY INSPIRING FAMILY AND DEAR WIFE

TO MY DEAR FRIENDS AND COLLEAGUES

ACKNOWLEDGEMENT

First, I would like to thank **Allah** for everything in my life

Then I wish to express my sincere gratitude toward my dear supervisor, **Prof.Dr Shehab El Din Saber**, for his unlimited willingness for advice and guidance.

I also wish to thank **Prof.Dr. Walid Faisal Ahmed**, for his continuous support and encouragement.

Special thanks for **Dr.Mohamed Mokhtar Nagy** for his help and guidance throughout this work.

I would also to thank **Dr Akram Nader** for helping me in the practical part of the thesis

Great thanks as well to my dear collegues **Noor El Din Ahmed & Mahmoud Atef** for helping me in sampling and immediate transferring of these samples to the microbilogical lab

Finally, I would like to thank **all members of Endodontic Department,** Ain Shams University for their great effort.

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MTAD	Mixture of tetracyclin, acid and detergent
MTADN	Mixture of tetracyclin, acid and detergent modified with nisin
E. faecalis	*Enterococcus faecalis*
TSB	Tryptic soy broth
TSBG	Tryptic soy broth with glucose
NRS	Numerical rating scale
SEM	Scanning electron microscope

A growing interest in endodontic retreatment has been noticed recently due to the increased demand to preserve teeth.

The main cause of root canal treatment failure is the persisting microorganisms or reinfection of the canal system due to inadequate apical or coronal seal. Retreatment requires the removal of the original root canal filling, further disinfection, followed by three dimensional obturation of the root canal.

Failed endodontically treated teeth are proved to harbor many bacterial and fungal species with high capabilities of biofilm formation and resistant infections.

Biofilm was found to be responsible for chronicity of the disease[(1)], as it makes bacteria within it resistant to antibiotics, enable it to evade immune system and also enables genetic material exchange between different microorganisms which results in the increase in the virulence of the microbiota. The mean inhibitory concentration for biofilm induced infection was found to be 1000 time more than that for planktonic form[(2)].

Obtaining a sterile root canal system in previously heavily infected canals is not applicable by any of the current means of disinfection protocols.

Intracanal medicaments applied between endodontic visits act as a temporary filling for the canals as they prevent regrowth of

the remaining microbiota within the root canal system and also increase the level of disinfection[3].

The application of nanoparticles in the medication applied between visits is supposed to improve its antibacterial effect.

Post-operative pain and flare ups which are encountered after root canal retreatment procedures are highly concerned by both patients and clinicians. This pain is multifactorial in origin and may be due to the endodontic procedure itself[4].

These high-lightened the need for evidence based practice as randomized clinical trials (RCTs) which is the most rigorous scientific method for evaluating the effectiveness of health care interventions[5].

The main goal of endodontics is disinfection of the root canal and prevention of its reinfection, so the antibacterial effect of various intracanal medications is of high concern. Since nanotechnology has been infiltrating the field of medicine with its high antibacterial potential, its use in endodontics is highly prompted. Despite the importance of chemo-mechanical root canal preparation step, it usually results in post-operative pain and discomfort.

1- Antibacterial effects of different medications and their evaluation methods

Sundqvist et al[6] aimed to determine what microbial flora were present in teeth after failed root canal therapy, patients with persisting periapical lesion were selected and samples were taken after filling material removal, they found that the microbial flora was mainly single species of predominantly gram-positive organisms. The isolates most commonly recovered were bacteria of the species *Enterococcus faecalis*.

Costerton et al[1] studied the aggregation of bacteria that can attach in a hydrated polymeric matrix of their own synthesis to form biofilms, they found that these sessile communities and their resistance to antimicrobial agents are at the root of many persistent bacterial infections, this leaded to directing therapeutic targets toward these that may provide means for the control of biofilm infections.

Rocas et al[7] aimed to investigate the prevalence of *E. faecalis* in endodontic infections and to determine whether this species is associated with particular forms of periradicular diseases. Samples were taken from cases of untreated teeth with asymptomatic chronic periradicular lesions, acute apical periodontitis, or acute periradicular abscesses, and from root-filled teeth associated with asymptomatic chronic periradicular lesions. DNA was extracted from the samples, and a 16S rDNA-based nested polymerase chain reaction assay was used to identify *E. faecalis*. This species occurred in seven of 21 root canals associated with asymptomatic chronic periradicular lesions, in one of 10 root canals associated with acute apical periodontitis, and in one of 19 pus samples aspirated from acute periradicular abscesses. Statistical analysis showed that *E. faecalis* was significantly more associated with asymptomatic cases than with symptomatic ones. *E. faecalis* was detected in 20 of 30 cases of persistent endodontic infections associated with root-filled teeth. When comparing the frequencies of this species in 30 cases of persistent infections with 50 cases of primary infections, statistical analysis demonstrated that *E. faecalis* was strongly associated with persistent infections.