

**Bacterial reduction after root canal preparation  
using single and multifile preparation systems  
with different activation methods  
(An *in vitro* study)**

Thesis submitted to the Department of Endodontics,  
Faculty of Dentistry, Ain Shams University  
for Partial Fulfillment of Requirements of  
the master degree in Endodontics

By  
**Sherien Ali Ibrahim Ahmed Orabi**  
B.D.S.  
(Ain Shams University, 2005)

Department of Endodontics  
Faculty of Dentistry  
Ain Shams University  
2016

## **Supervisors**

### **Dr. Shehab El-Din Mohamed Saber**

Associate Professor of Endodontics  
Faculty of Dentistry, Ain Shams University

### **Dr. Mohamed Mokhtar Nagy**

Lecturer of Endodontics  
Faculty of Dentistry, Ain Shams University

### **Dr. Soha Abdelrahman Al Hady**

Associate Professor of Microbiology  
Faculty of Medicine, Ain Shams University

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا  
إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ  
الْعَلِيمُ الْحَكِيمُ

صدق الله العظيم  
سورة البقرة الآية (32)

**التقليل البكتيرى بعد تحضير القنوات الجذرية باستخدام نظام  
أحادى ومتعدد المبرد باستخدام طرق مختلفة من تنشيط  
الإرواء  
(دراسه معملية)**

رسالة مقدمه إلى قسم علاج الجذور  
وفقاً لمتطلبات نيل درجة الماجستير في علاج الجذور  
كلية طب الأسنان - جامعة عين شمس

مقدمة من

**شيرين على إبراهيم أحمد عرابي**

بكالوريوس طب وجراحة الفم والأسنان  
جامعة عين شمس (٢٠٠٥)

قسم علاج الجذور  
كلية طب الأسنان  
جامعة عين شمس

٢٠١٦

## تحت إشراف

**د/ شهاب الدين محمد صابر**

أستاذ مساعد قسم علاج الجذور  
كلية طب الأسنان – جامعة عين شمس

**د/ محمد مختار ناجي**

مدرس قسم علاج الجذور  
كلية طب الأسنان – جامعة عين شمس

**د/ سها عبد الرحمن الهادي**

أستاذ مساعد قسم الميكروبيولوجي  
كلية الطب – جامعة عين شمس

## ***Dedication***

*I would like to dedicate my Master thesis to my Father & Mother, who have given me day by day support and helped me to reach this level.*

*I dedicate it also to my dear Husband without him none of my success would be possible.*

*I dedicate it also to my lovely daughter*

*I also would like to dedicate it to my sisters who always gave me help and support*

## ***Acknowledgement***

*I am greatly honoured to express my thankful gratitude and sincere appreciation to **Dr. Shehab El-Din Mohamed Saber** associate Professor of Endodontics, Faculty of Dentistry, Ain Shams University. His guidance helped me to overcome the obstacles and difficulties that arose along the way until my thesis got completed.*

*I would like to thank **Dr. Mohamed Mokhtar Nagy** Lecturer of Endodontics, Faculty of Dentistry, Ain Shams University for offering me much of his time, effort and support throughout the whole work.*

*I would like also to thank **Dr. Soha Abdelrahman Al Hady** Associate Professor of Microbiology, Faculty of Medicine, Ain Shams University for her help and support.*

***Sherien Ali Orabi***

## List of Contents:

List of figures .....	I
List of tables .....	IV
Introduction .....	1
Review of literature .....	4
I) Effect of instrumentation techniques on bacterial reduction....	4
II) Effect of methods of irrigant activation on bacterial reduction.....	14
Aim of the study .....	41
Materials and methods .....	42
Results.....	64
Discussion .....	87
Summary and Conclusion .....	100
References .....	103
Arabic summary.....	١

## **List of Figures**

<b>Figure No.</b>	<b>Title</b>	<b>Page No.</b>
1	The mesial root	43
2	Samples in sealed vials	43
3	Gold coated samples	46
4	Sputter coater	46
5	Scanning Electron Microscope	46
6	SEM of 3 weeks biofilm under 10,000 magnification	47
7	SEM of 3 weeks biofilm under 10,000 magnification	48
8	SEM of 3 weeks biofilm under 20,000 magnification	49
9	SEM of 3 weeks biofilm under 40,000 magnification	50
10	SEM of 3 weeks biofilm under 20,000 magnification	51
11	SEM of 3 weeks biofilm under 40,000 magnification	52

<b>Figure No.</b>	<b>Title</b>	<b>Page No.</b>
12	SEM of 3 weeks biofilm under 20,000 magnification	53
13	SEM of 3 weeks biofilm under 40,000 magnification	54
14	Neoniti system	58
15	C1 and A1 of Neoniti	58
16	Irrisafe tip	60
17	The Vibringe	60
18	Bacterial sampling	61
19	Column chart of mean values of percent of bacterial reduction after instrumentation	67
20	Column chart of mean values of percent of bacterial reduction after application of activation methods of irrigation	72
21	Column chart of mean values of total percent of bacterial reduction of G I and G II.	77
22	Column chart of mean values of total percent of bacterial reduction for different groups	79

23	SEM of Group IA under 10,000 magnification	81
24	SEM of Group IB under 10,000 magnification	82
25	SEM of Group IC under 10,000 magnification	83
26	SEM of Group IIA under 10,000 magnification	84
27	SEM of Group IIB under 10,000 magnification	85
28	SEM of Group IIC under 10,000 magnification	86

## **List of Tables**

<b>Table No.</b>	<b>Title</b>	<b>Page No.</b>
1	Bacterial count before instrumentation (S1) and after (S2) instrumentation, bacterial reduction % and their means and SD of Group I (protaper).	65
2	Bacterial count before instrumentation (S1) and after (S2) instrumentation, bacterial reduction % and their means and SD of Group II (Neoniti).	66
3	Mean & standard deviation values of percent of bacterial reduction (S1 - S2) of G I (Protaper) and G II (Neoniti).	67
4	Bacterial count after instrumentation (S2), after activation method (S3), bacterial reduction % and their means and SD of group I (protaper).	70
5	Bacterial count after instrumentation (S2), after activation method (S3), bacterial reduction % and their means and SD of group II (Neoniti).	71
6	Mean and standard deviation values of percent of bacterial reduction (S2 - S3) of G I and G II.	72
7	Bacterial count before instrumentation (S1), after activation method (S3), total % of bacterial reduction and their means and SD of group I (Protaper).	75

<b>Table No.</b>	<b>Title</b>	<b>Page No.</b>
8	Bacterial count before instrumentation (S1), after activation method (S3), total % of bacterial reduction and their means and SD of group II (Neoniti).	76
9	Mean and standard deviation values of total percent of bacterial reduction (S1 -S3) of G I and G II.	77
10	Mean and standard deviation values of total percent of bacterial reduction (S1-S3) of all experimental groups.	79

## **Introduction**

The outcome of root canal treatment is dependent on mechanical preparation, irrigation, microbial control and complete obturation of the root canal system. Root canal preparation is a chemomechanical procedure.

The main microbiologic goals of this chemomechanical procedure of infected root canals are to completely eliminate intracanal bacterial populations or at least to reduce them to a level below that required to induce or sustain diseases. Bacteria persisting after chemomechanical procedures at levels detectable by culturing techniques might influence negatively the treatment outcome. Therefore, efforts should be driven to establish chemomechanical protocols that predictably promote negative cultures.

*Enterococcus faecalis* (*E. faecalis*) are normally found in the human intestine, but may temporarily be found in the oral cavity, where they have been associated with pathogenic oral manifestations such as mucosal lesions in immunocompromised patients, as superinfecting organisms in periodontitis and, most importantly, in persistent root canal infections.<sup>1</sup>

*E. faecalis* are gram positive anaerobic facultative cocci, have the ability to withstand prolonged periods of nutrient limitation, allowing them to persist as a pathogen within the root canal and this explain their resistance to various intracanal treatment procedures.

Mechanical instrumentation is the core method for bacterial reduction during endodontic treatment of infected root canals.<sup>2</sup> but due to the complex

nature of root canal anatomy, some areas can not be reached by mechanical instrumentation like lateral canals, isthmi, fins, webs and anastomoses.

Therefore, instrumentation must be combined with adequate irrigation to complete the cleaning process and decrease the microbial load within the root canal system.<sup>3</sup>

The introduction of rotary NiTi enlarging instruments has revolutionized the old method of canal instrumentation. These recent systems offer an easy, efficient and safe method for canal enlargement.

Rotary NiTi instruments can be divided into single file systems and multifile systems.

There are 2 factors directly correlated with efficient irrigation, the irrigant and the delivery system.<sup>3</sup>

Root canal irrigation systems can be divided into 2 broad categories, manual agitation techniques and machine-assisted agitation devices.

Manual techniques include positive pressure irrigation, which is commonly performed with a syringe and a sidevented needle. On the other hand, machine-assisted agitation techniques include sonic and ultrasonic devices.<sup>3</sup>

Recently, the Vibringe System, an irrigation device that combines manual delivery and sonic activation of the solution, has been introduced.<sup>4</sup>

Two important factors that should be considered during the process of irrigation are whether the irrigation system can deliver the irrigant to the whole extent of the root canal system, particularly at the apical third, and whether it is capable of reducing bacteria and debriding areas that could not be reached with mechanical instrumentation, such as lateral canals, isthmi and apical deltas.<sup>3</sup>