

سامية محمد مصطفى



شبكة المعلومات الجامعية

# بسم الله الرحمن الرحيم



سامية محمد مصطفى



شبكة المعلومات الجامعية



# شبكة المعلومات الجامعية التوثيق الالكتروني والميكروفيلم



سامية محمد مصطفى



شبكة المعلومات الجامعية

# جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

## قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها  
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات



## يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار



سامية محمد مصطفى



شبكة المعلومات الجامعية



# بعض الوثائق الأصلية تالفة



سامية محمد مصطفى



شبكة المعلومات الجامعية



# بالرسالة صفحات لم ترد بالأصل



# **Canal Shaping Ability And Wear Resistance**

## **Of NiTi LightSpeed Instruments:**

### **Effect Of Rotational Speed.**

(An invitro study)

A thesis submitted to the Faculty of Oral and Dental Medicine,  
Cairo University, in partial fulfillment of requirements of the  
Master of Dental Science (Endodontics).

Presented by:

**Reham Mohammad Said Abdullah Siam.**

B.D.S. (Cairo University).

Department of Endodontics

Faculty of Oral and Dental Medicine

Cairo University

2003

B  
1077.

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

# **Supervisors**

**Prof. Dr. Madiha M. Gomaa**

**Professor of Endodontics**

***Faculty of Oral and Dental Medicine***

***Cairo University***

**Prof. Dr. Inas S.A. Sami**

**Professor of Dental Biomaterials**

***Faculty of Oral and Dental Medicine***

***Cairo University***

## *Acknowledgement*

**Praise to Allah, the Most Gracious and the Most Merciful who guides us to the right way.**

I would like to express my sincere gratitude and deep appreciation to Prof. Dr. Madiha M. Gomaa, Professor of Endodontics, Faculty of Oral and Dental Medicine, Cairo University for her patience, kindness and unlimited support. It was a great honor to work under her meticulous supervision.

I acknowledge with gratitude and love Prof. Dr. Inas S.A. Sami, Professor of Dental Biomaterials, Faculty of Oral and Dental Medicine, Cairo University, for her guidance and support.

Special thanks are due to Dr. Inas El Attar for her generous help with the achievement of the statistical aspect of this study.

Thanks are also due to engineer Saleh Attia at the AUC for his help in designing and constructing the metal muffle used in this study.

Endless thanks to all my professors, staff members and colleagues in the Endodontic department for their friendly support and concern.

Very special thanks to my beloved little sister Menna for her generous help in the computer work for this thesis and endless patience and support.

Finally, I would like to thank my family, especially my mother, for their prayers, love and support, and to all who helped me throughout this work.

## CONTENTS

| <i>Contents</i>                                                            | <i>Page</i> |
|----------------------------------------------------------------------------|-------------|
| <b>List of Figures</b>                                                     | <b>iv</b>   |
| <b>List of Tables</b>                                                      | <b>vi</b>   |
| <b>I-Introduction</b>                                                      | <b>1</b>    |
| <b>II-Review of Literature</b>                                             | <b>5</b>    |
| <b>II.1. Cleaning and shaping</b>                                          | <b>5</b>    |
| <b>II.2. Cutting efficiency and wear resistance</b>                        | <b>24</b>   |
| <b>II.3. Effect of rotational speed on performance of NiTi Instruments</b> | <b>37</b>   |
| <b>III-Aim of the study</b>                                                | <b>41</b>   |
| <b>IV-Materials and Methods</b>                                            | <b>42</b>   |
| <b>V-Results</b>                                                           | <b>53</b>   |
| <b>VI-Discussion</b>                                                       | <b>70</b>   |
| <b>VII-Summary and Conclusions</b>                                         | <b>78</b>   |
| <b>VIII-References</b>                                                     | <b>80</b>   |
| <b>Arabic summary</b>                                                      |             |

## LIST OF FIGURES

| <i>Figure</i>                                                                                                                                | <i>Page</i> |
|----------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| (1): Representative LightSpeed instrument set.                                                                                               | 43          |
| (2): The LightSpeed technology assembly.                                                                                                     | 43          |
| (3): Schematic drawing representing canals curvature measurement.                                                                            | 45          |
| (4): A photograph showing the embedded, cut root sections.                                                                                   | 45          |
| (5): A composite photograph showing top views of root and canals cross sections.                                                             | 45          |
| (6): Photograph showing top view of the metal muffle.                                                                                        | 48          |
| (7): Schematic drawing showing different computer calculations made on canals before and after instrumentation.                              | 48          |
| (8): Composite photograph showing the holding chuck for Light speed instrument.                                                              | 51          |
| (9): Composite stereo microscopic photograph representing root sections before, and after, LightSpeed preparation with two different speeds. | 56          |
| (10): Bar chart of the mean area after LightSpeed preparation at 750 and 2000 r.p.m.                                                         | 57          |
| (11): Bar chart of the mean length of canal center displacement at 750 and 2000 r.p.m.                                                       | 57          |
| (12): Diagram showing length and angle direction of canal center displacement.                                                               | 58          |
| (13): Stereomicroscopic photographs showing difference in Light Speed instruments' design.                                                   | 62          |

## *Figure*

## *Page*

- (14): SEM photomicrograph showing no visible defects in sizes #27.5 and #35 unused LightSpeed instruments. 63
- (15-18): SEM photomicrograph showing defects in unused LightSpeed instruments. 63
- (19): Line chart showing criteria of instruments wear. 64
- (20): Composite SEM photomicrograph showing wear signs after 5 and 9 canals 65
- (21): Photograph showing fractured #40 LightSpeed instrument 66
- (22): SEM photomicrograph showing cross section of instrument fracture. 66
- (23): SEM photomicrograph showing LightSpeed instrument  
a) before use, b) after 9 canals. 67
- (24): composite SEM photomicrograph showing instrument's pitting and microfracture. 67
- (25): SEM photomicrograph showing microfractures of the blade of used instrument. 68
- (26): SEM photomicrograph showing fretting and turnover of the blade after use. 68
- (27): SEM photomicrograph showing wear of the blade and corrosion after use. 68
- (28): Stereo and SEM microphotograph showing increase in instrument's wear by use. 69

## LIST OF TABLES

| <i>Table</i>                                                                                                                                                                        | <i>page</i> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| (1): Criteria for testing wear qualitatively.                                                                                                                                       | 52          |
| (2): Mean area and standard deviation after canal preparation<br>at 750 and 2000 r.p.m.                                                                                             | 55          |
| (3): Mean and standard deviation of the length of canal center<br>displacement at the two specified speeds (750 and 2000 r.p.m.)<br>at the three section levels (2mm, 4mm, and 6mm) | 55          |
| (4): Criteria of instruments' wear detected in the unused<br>state, after preparation of 5 canals, and after preparation of<br>9 canals.                                            | 61          |

# I-Introduction

## I-Introduction

Biomechanical preparation is the most important factor in the success of endodontic treatment. Instrumentation objectives include debriding the root canal system, maintaining the apical foramen in its original position, keeping the apical foramen as small as practical and developing a continuously tapering conical form as stated by Schilder.

These objectives are easily achieved in straight root canals with the traditional stainless steel files. However, they have shown to create aberrations in the root canals due to canal morphology (curvature) and instrument limitation (stiffness and design).

There is a degree of canal curvature present in most of the teeth of the human dentition. The stiffness of the instrument and its design tend to straighten these curved canals. It also may lead to difficulty in debridement, ledge, transportation of apical foramen, root perforation, apical zipping and strip perforation which in turn may lead to failure of endodontic therapy.

To reduce these procedural errors, modifications were done in instrumentation technique as well as in instrument design. Some of the instrumentation technique modifications are the step-back, anti-curvature filing, step down and balanced force technique for root canal preparation. Where as in instrument design, modifications were made in cross section and tip configuration. The change in cross section of the instrument was to increase its flexibility and maintain its centrability inside the canal e.g. K-Flex, Uni-file and S-file. Also, the change to a non-cutting pilot tip as Flex-R files was found to reduce the risk of perforation and ledging. However, the use of these modified stainless steel files in curved canals is still risky and