

**Comparison of two instrumentation
techniques on stress distribution and
fracture susceptibility of curved root
canals
(Finite element study)**

Thesis
Submitted to the Faculty of Dentistry,
Ain Shams University

For

Partial fulfillment of requirements of the master degree in
Endodontics

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**B.D.S.
(Faculty of dentistry, Ain Shams University,2003)**

2010

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أعوذ بالله من الشيطان الرجيم

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

صدق الله العظيم

سورة البقرة – الآية ٣٢

Dedication

To my Lovely Mother

*(For her spiritual support, may Allah bless her
in his heaven)*

To my Dearest Father

To my sweet Sisters

Acknowledgement

I would like to express my deep gratitude to
Professor Doctor Salma Hassan Elashry
Professor of Endodontics, Faculty of Dentistry, Ain
Shams University
For her valuable guidance and effort throughout my
academic and clinical work.

My sincere gratitude to Dr. *Shehab Eldeen M.Saber*
Lecturer of endodontics, Faculty of dentistry, Ain Shams
University
For his sincere help and co operation during this
study.

I would like to express my great thanks to *Dr. Ahmed Elragi*, Lecturer of Civil Engineering, Fayoum University
for his cooperation and guidance in a very generous
manner.

My deep appreciation to *Professor Doctor Hossam Tawfik*, Chairman of endodontic department, and *all the staff & members of the endodontic department*, Faculty of dentistry, Ainshams university for their valuable help and
co operation.

List of Contents

Introduction.....	1
Review of literature.....	3
○ Instrumentation techniques and shaping ability...	3
○ Finite element analysis	10
○ Fracture resistance	23
Aim of the study.....	32
Materials and methods.....	33
○ Finite element analysis.....	40
○ Fracture resistance.....	52
Results.....	57
○ Finite element analysis results.....	57
○ Fracture resistance results.....	100
Discussion.....	110
Summary and Conclusion.....	121
References.....	125
Arabic summary	

List of Figures

Figure 1	Computed Tomography Machine	41
Figure 2	a- CT of the four teeth in mesio-dital direction. b- CT of the four teeth in bucco-lingual direction. c- CT of the four teeth in coronal direction. d- Four dried teeth 3D picture.	43
Figure 3	a- CT of one tooth in mesio-dital direction. b- CT of one tooth in bucco-lingual direction. c- CT of one tooth in coronal direction. d- 3D model of one tooth.	43
Figure 4	Remeshing procedure.	44
Figure 5	Model areas of the tooth and MB canal.	46
Figure 6	Model areas of the tooth and bone cylinder.	46
Figure 7	Model volumes of the tooth.	46
Figure 8	Model volumes of the tooth and bone cylinder.	46
Figure 9	SOLID72 3D – 4Node tetrahedral Structural Solid with rotation.	47
Figure 10	Load application site (central fossa)	48
Figure 11	Model nodes with solid base in last 3 layers	48
Figure 12	Showing shear stress in MPa within the tooth Model 2 group 2A under loading with the spectrum of colors.	51
Figure 13	Showing compressive stress in MPa within the tooth Model 2 group 2A under loading with the spectrum of colors.	51
Figure 14	The sample holder and the prefabricated copper ring.	52
Figure 15	Top view of the root refixed in the acrylic block by light body impression material.	53
Figure 16	The loading fixture.	54
Figure 17	The fractured root.	55
Figure 18	Loading the sample in the testing machine.	55

List of Figures

Figure 19	The load deformation curve of a sample from group 1A showing a value of force equal (76.4 N).	53
Figure 20	Bar chart showing the highest tensile stresses on the tooth in MPa for all groups.	58
Figure 21	Showing tensile stress within the tooth Model 4 group 2B under loading.	59
Figure 22	Showing tensile stress within the tooth Model 3 group 1B under loading.	59
Figure 23	Showing tensile stress within the tooth Model 1 group 1A under loading.	60
Figure 24	Showing tensile stress within the tooth Model 2 group 2A under loading.	60
Figure 25	Bar chart showing the highest compressive stresses on the tooth in MPa for all groups.	61
Figure 26	Showing compressive stress within the tooth Model 4 group 2B under loading.	62
Figure 27	Showing compressive stress within the tooth Model 3 group 1B under loading.	62
Figure 28	Showing compressive stress within the tooth Model 1 group 1A under loading.	63
Figure 29	Showing compressive stress within the tooth Model 2 group 2A under loading.	63
Figure 30	Bar chart showing the highest shear stresses on the tooth in MPa for all groups.	64
Figure 31	Showing intensity stress within the tooth Model 4 group 2B under loading.	65
Figure 32	Showing intensity stress within the tooth Model 3 group 1B under loading.	65
Figure 33	Showing intensity stress within the tooth Model 1 group 1A under loading.	66
Figure 34	Showing intensity stress within the tooth Model 2 group 2A under loading.	66
Figure 35	Bar chart showing the highest von Mises' stresses on the tooth in MPa for all groups.	67
Figure 36	Showing von Mises' stress within the tooth Model 4 group 2B under loading.	68
Figure 37	Showing von Mises' stress within the tooth Model 3 group 1B under loading.	68
Figure 38	Showing von Mises' stress within the tooth Model 1 group 1A under loading.	69

List of Figures

Figure 39	Showing von Mises' stress within the tooth Model 2 group 2A under loading.	69
Figure 40	Bar chart showing the highest tensile, compressive, shear and von Mises' stresses on the tooth model in MPa for all groups.	71
Figure 41	Bar chart showing the highest tensile stresses on the mesiobuccal canal in MPa for all groups.	72
Figure 42	Showing tensile stress within the mesiobuccal canal of Model 1 group 1A under loading.	73
Figure 43	Showing tensile stress within the mesiobuccal canal of Model 2 group 2A under loading.	73
Figure 44	Showing tensile stress within the mesiobuccal canal of Model 3 group 1B under loading.	74
Figure 45	Showing tensile stress within the mesiobuccal canal of Model 4 group 2B under loading.	74
Figure 46	Bar chart showing the highest compressive stresses on the mesiobuccal canal in MPa for all groups.	75
Figure 47	Showing compressive stress within the mesiobuccal canal of Model 1 group 1A under loading.	76
Figure 48	Showing compressive stress within the mesiobuccal canal of Model 3 group 1B under loading.	76
Figure 49	Showing compressive stress within the mesiobuccal canal of Model 4 group 2B under loading.	77
Figure 50	Showing compressive stress within the mesiobuccal canal of Model 2 group 2A under loading.	77
Figure 51	Bar chart showing the highest shear stresses on the mesiobuccal canal in MPa for all groups.	78
Figure 52	Showing intensity stress within the mesiobuccal canal of Model 4 group 2B under loading.	79
Figure 53	Showing intensity stress within the mesiobuccal canal of Model 1 group 1A under loading.	79
Figure 54	Showing intensity stress within the mesiobuccal canal of Model 2 group 2A under loading.	80
Figure 55	Showing intensity stress within the mesiobuccal canal of Model 3 group 1B under loading.	80
Figure 56	Bar chart showing the highest von Mises' stresses on the mesiobuccal canal in MPa for all groups.	81
Figure 57	Showing von Mises' stress within the mesiobuccal canal of Model 1 group 1A under loading.	82

List of Figures

Figure 58	Showing von Mises' stress within the mesiobuccal canal of Model 2 group 2A under loading.	82
Figure 59	Showing von Mises' stress within the mesiobuccal canal of Model 4 group 2B under loading.	83
Figure 60	Showing von Mises' stress within the mesiobuccal canal of Model 3 group 1B under loading.	83
Figure 61	Bar chart showing the highest tensile, compressive, shear and von Mises' stresses on the mesiobuccal canal model in MPa for all groups.	85
Figure 62	Bar chart showing the highest tensile stresses on the bone cylinder in MPa for all groups.	86
Figure 63	Showing tensile stress within bone cylinder surrounding the roots of Model 4 group 2B under loading.	87
Figure 64	Showing tensile stress within bone cylinder surrounding the roots of Model 1 group 1A under loading.	87
Figure 65	Showing tensile stress within bone cylinder surrounding the roots of Model 3 group 1B under loading.	88
Figure 66	Showing tensile stress within bone cylinder surrounding the roots of Model 2 group 2A under loading.	88
Figure 67	Bar chart showing the highest compressive stresses on the bone cylinder in MPa for all groups.	89
Figure 68	Showing tensile stress within bone cylinder surrounding the roots of Model 1 group 1A under loading.	90
Figure 69	Showing compressive stress within bone cylinder surrounding the roots of Model 4 group 2B under loading.	90
Figure 70	Showing compressive stress within bone cylinder surrounding the roots of Model 3 group 1B under loading.	91
Figure 71	Showing compressive stress within bone cylinder surrounding the roots of Model 2 group 2A under loading.	91
Figure 72	Bar chart showing the highest shear stresses on the bone cylinder in MPa for all groups.	92
Figure 73	Showing intensity stress within bone cylinder surrounding the roots of Model 4 group 2B under loading.	93
Figure 74	Showing intensity stress within bone cylinder surrounding the roots of Model 1 group 1A under loading.	93

List of Figures

Figure 75	Showing intensity stress within bone cylinder surrounding the roots of Model 3 group 1B under loading.	94
Figure 76	Showing intensity stress within bone cylinder surrounding the roots of Model 2 group 2A under loading.	94
Figure 77	Bar chart showing the highest von Mises' stresses on the bone cylinder in MPa for all groups.	95
Figure 78	Showing von Mises' stress within bone cylinder surrounding the roots of Model 4 group 2B under loading.	96
Figure 79	Showing von Mises' stress within bone cylinder surrounding the roots of Model 1 group 1A under loading.	96
Figure 80	Showing von Mises' stress within bone cylinder surrounding the roots of Model 3 group 1B under loading.	97
Figure 81	Showing von Mises' stress within bone cylinder surrounding the roots of Model 2 group 2A under loading.	97
Figure 82	Bar chart showing the highest tensile, compressive, shear and von Mises' stresses on the bone cylinder model in MPa for all groups.	99
Figure 83	Bar chart showing the Mean force in Newtons required to fracture the roots of the four subgroups.	100
Figure 84	The deformation curve of a sample from group 1A showing the maximum value of force (86.7 N).	101
Figure 85	The deformation curve of a sample from group 1A showing the minimum value of force equal (61 N).	102
Figure 86	The deformation curve of a sample from group 2A showing the maximum value of force (98.1 N).	102
Figure 87	The deformation curve of a sample from group 2A showing the minimum value of force (31.5 N).	103
Figure 88	The deformation curve of a sample from group 1B showing the maximum value of force (83 N).	104
Figure 89	The deformation curve of a sample from group 1B showing the minimum value of force equal (43.2 N).	104
Figure 90	The deformation curve of a sample from group 2B showing the maximum value of force equal (83.5 N).	105

List of Figures

Figure 91	The deformation curve of a sample from group 2B showing the minimum value of force equal (44 N).	105
Figure 92	Bar chart showing fracture patterns for the samples of all groups.	107
Figure 93	Sample from group 1A showing bucco lingual fracture pattern.	108
Figure 94	Sample from group 2A showing compound fracture pattern.	108
Figure 95	Sample from group 2B showing compound fracture pattern with apex fracture.	109

List of Tables

Table 1	The factorial design of the study.	36
Table 2	Protaper universal system: instruments sequence, tip diameter, taper and depth of penetration.	38
Table 3	Summary of scan parameter.	41
Table 4	Material properties.	47
Table 5	Showing all types of stresses induced in the tooth models with their highest magnitudes in MPa for all groups.	70
Table 6	Showing all types of stresses induced in the mesiobuccal canal models with their highest magnitudes in MPa for all groups.	84
Table 7	Showing all types of stresses induced in the bone cylinder models with their highest magnitudes in MPa for all groups.	98
Table 8	The maximum, the minimum, the mean value (measured in Newton) and standard deviation required for root fracture for all groups.	100
Table 9	Fracture patterns for the samples of all groups.	107

Root fracture is an important clinical problem leading to extraction or root amputation. It has been observed clinically that root fracture occurs commonly in endodontically treated teeth. Endodontic procedures have been blamed as a frequent cause of root fracture. Numerous experimental studies have challenged this conclusion.

Although root fracture of endodontic origin is an infrequent event, the consequent tooth loss makes it a significant clinical concern. Factors predisposing to root fracture have been investigated using a variety of experimental approaches and are now reasonably well understood. Whilst many variables are outside the control of the clinician (natural root morphology, canal shape and size, dentine thickness), other factors can be addressed during treatment to reduce fracture susceptibility. These factors include final canal shape, extent of canal enlargement, and elimination of irregularities that serve as sites of stress concentration.

Dentin of endodontically treated teeth does not exhibit mechanical properties that are significantly different from those of vital teeth. It has been shown that access cavity preparation has non-significant effects on tooth stiffness. The load generated during lateral condensation is generally far lower than the load required to fracture the roots. Thus, obturation should not be regarded as a major cause of root fracture except in very weak roots.

On the other hand, Cleaning and shaping involves dentin removal which might compromise the fracture strength of the prepared roots.

The introduction of rotary nickel-titanium (Ni-Ti) instruments for canal preparation has changed canal shape, size, and taper compared to hand instrumentation. Canal shape after preparation with hand files can be quite irregular. From a fracture

mechanics point of view, the presence of structural defects, cracks, or canal irregularities is likely to play a major role in determining fracture resistance. With rotary NiTi preparation, canal shapes are more likely to be rounder and smoother.

Experimental fracture studies using extracted teeth are plagued by a wide variability within groups, which makes it difficult to demonstrate statistically significant effects of treatment procedures. On the other hand, numerical methods such as finite element analysis offer considerable advantages in the systematic investigation of experimental variable.

Carefully constructed models can provide valuable insights into patterns and mechanisms of clinical failure.

Therefore conducting a study for comparison of two instrumentation techniques on stress distribution and fracture susceptibility of curved root canals was thought to be of value.