

Ain Shams University Faculty of Dentistry Department of Endodontics

Effect of Surfactant Addition to Three Irrigating Solutions on Canal Cleanliness and Resin Sealer Adaptation

Thesis submitted to the Endodontic Department,
Faculty of Dentistry, Ain Shams University

For

Partial fulfillment of the requirements of the master degree in Endodontics.

By

Sarah Hossam Mahmoud Fahmy

B.D.S. Ain Shams University, 2008

Supervisors

Prof. Salma Hassan El Ashry

Professor of Endodontics -Faculty of Dentistry

Ain Shams University

Assoc. prof. Abeer Abdel Hakim EL Gendy

Associate professor of Endodontics-Faculty of Dentistry

Ain Shams University

2013

ACKNOWLEDGEMENTS

First of all, I am thanking *Allah* Almighty for accomplishing this modest work.

It is with immense gratitude that I acknowledge the support and help of my honorable Professor *Dr. Salma Hassan El Ashry* for her valuable instructions and for being my ideal ethically and scientifically.

I owe sincere and earnest thankfullness to Associate Professor *Dr.Abeer Abdel Hakim El Gendy* for her patience and useful guidance.

Words cannot convey my gratitude to Associate Professor Dr.Shehab El Din Saber, Dr. Mohamed Mokhtar Nagy and Dr.Hebatullah Adel Saleh for all their undeniable help in the technical phase of this study.

My heartfelt thanks to my parents who are credited with what I am until now and forever. With patience and wisdom, they were my greatest support all my lifetime.

Last but not least, I would like to convey my thanks to all my colleagues at the Department of Endodontics, Faculty of Dentistry, Ain Shams University who have been a constant support to me throughout the way.

TABLE OF CONTENTS

TABLE OF CONTENTS	iv
List of Figures	iii
List of Tables	viii
INTRODUCTION	1
LITERATURE REVIEW	3
SURFACTANTS INFLUENCE ON IRRIGANTS PROPERTIES.	16
EFFECT OF ROOT CANAL IRRIGANTS ON ADAPTA OF OBTURATION MATERIALS	
AIM OF THE STUDY	48
MATERIALS AND METHODS	49
RESULTS	79
PILOT STUDY RESULTS FOR TWEEN 80 CONCENTRATIONS	79
ROOT CANAL CLEANLINESS	85
PUSH OUT BOND STRENGTH RESULTS	104
MODE OF FAILURE	117
DISCUSSION	120
SUMMARY AND CONCLUSIONS	112
REFERENCES	127
ARABIC SUMMARY	126

List of Figures

Figure 1 . Du Nuoy ring tensiometer for interfacial surface tension
measurement
Figure 2 Gradual insertion and withdrawal of the platinum ring till
detachment of the fluid lamella
Figure 3 . Surface tension values vs. logarithms of Tween 80
concentrations. The arrow points to the CMC value57
Figure 4. Experimental design scheme highlighting the grouping of
samples as a function of the irrigation protocols60
Figure 5 . Diagramatic explantation of the basic steps in image J software
analysis63
Figure 6 . Scale set up
Figure 7. Canal outline demarcation (first step)64
Figure 8. Canal outline demarcation (second step)65
Figure 9. Active image conversion into 8 bit greyscale65
Figure 10. Greyscale image thresholding into pixels of interest and
background. The highlighted areas in red are the debris
aggregates that are to be measured. The arrow points to the
range of the highlighted66
Figure 11. Scale set up prior to diameter measurement. Measurement
selection (Feret diameter)
Figure 12.A representative sample showing a canal cross-section with
diameter and radius measurements71
Figure 13. Schematic presentation of the loading fixture for push out bond
strength measurement72
Figure 14 .Lower part of the loading fixture for bond strength
measurement73
Figure 15 .Upper and lower compartments of the loading fixture for push
out bond strength assessment
Figure 16.Sample under loading for push out bond strength
measurement74
Figure 17. Lloyd instrument for push out bond strength testing74

Figure 18 . Scanning Electron Microscope for qualitative mode of failure
evaluation
Figure 19 . Sputter coating procedure of samples prior to SEM
examination 78
Figure 20 .Line graph showing 2.5 %NaOCl contact angle values vs.
Tween 80 logarithmic concentrations
Figure 21 . Line graph showing 2.5% NaOCl surface tension values vs
Tween 80 logarithmic
concentrations82
Figure 22 . Line graph showing EDTA contact angle values vs. Tween .80
logarithmic concentrations83
Figure 23. Line graph showing EDTA contact angle values vs. Tween 80
logarithmic concentrations83
Figure 24.Line graph showing maleic acid contact angle values vs Tween
80 logarithmic concentrations
Figure 25 .Line graph showing 7 % maleic acid surface tension values vs
Tween 80 logarithmic concentrations
Figure 26 . Column chart representing the mean percentage of debris at
the same root canal third among the EDTA irrigation protocols
and the control group88
Figure 27. Column chart representing the overall mean percentage of
debris among the EDTA irrigation protocols and the control
group
Figure 28 . Column chart representing the mean percentage of debris at
the root canal thirds among the EDTA irrigation
protocols90
Figure 29. Column chart showing the mean percentage of debris at the
same root canal segment among the Maleic acid irrigation
protocols and the control group
Figure 30 .Column chart showing the overall mean percentage of debris
values among the Maleic acid irrigation protocols and the
control group93
Figure 31 .Column chart showing the mean percentage of debris at the
different root canal segments among Maleic acid irrigation
protocols95

EDTA and Maleic acid irrigation protocols97
Figure 33 . Stereophotomicrographs (magnification 40 X) of root canal
walls irrigated with distilled water at the coronal (A), middle (B)
and apical (C) thirds highlighting the debris fraction (red) before
and after submission to image J analysis. Second column shows
results of manual thresholding, third column shows results of
automatic thresholding (Binary
process)
Figure 34 . Stereophotomicrographs (magnification 40 X) of root canal
walls irrigated with plain 17% EDTA followed by plain 2.5%
NaOCl at the coronal (A), middle (B) and apical (C) thirds
highlighting the debris fraction before and after submission to
image J analysis. Second column shows results of manual
thresholding, third column shows results of automatic
thresholding (Binary process) 99
Figure 35 . Stereophotomicrographs (magnification 40 X) of root canal
walls irrigated with 17% EDTA with 1% Tween 80 followed
by 2.5% NaOCl at the coronal (A), middle (B) and apical (C)
thirds highlighting the debris fraction before and after
submission to image J analysis. Second column shows results
of manual thresholding, third column shows results of
automatic thresholding (Binary process) 100
Figure 36 . Stereophotomicrographs (magnification 40 X) of root canal
walls irrigated with 7% plain 7% Maleic acid followed by
2.5% NaOCl and 0.6 %Tween 80 (A), middle (B) and apical
(C) thirds highlighting the debris fraction before and after
submission to image J analysis. Second column shows results
of manual thresholding, third column shows results of
automatic thresholding (Binary process) 101
Figure 37 . Stereophotomicrographs (magnification 40 X) of root canal
walls irrigated with 7% Maleic acid and 1% Tween 80
followed by plain 2.5% NaOCl at the coronal (A), middle (B)
and apical (C) thirds highlighting the debris fraction before
and after submission to image J analysis. Second column
shows results of manual thresholding, third column shows

results of automatic thresholding (Binary process)102
Figure 38 . Stereophotomicrographs (magnification 40 X) of root canal
walls irrigated with 7% Maleic acid and 1% Tween 80
followed by 2.5% NaOCl and 0.6% Tween 80 at the coronal
(A), middle (B) and apical (C) thirds highlighting the debris
fraction before and after submission to image J analysis.
Second column shows results of manual thresholding, third
column shows results of automatic thresholding (Binary
process)
Figure 39. Column chart showing the mean push out bond strength values
of gutta percha/AH Plus among the EDTA irrigation protocols
at the same root canal level
Figure 40 . Column chart showing the mean overall push out bond
strength values of gutta percha/ AH plus resin sealer among the
different EDTA irrigation protocols107
Figure 41. Column chart showing the mean push out bond strength values
of gutta percha/AH plus resin sealer to dentin among the EDTA
irrigation protocols and the control group at the different root
canal levels
Figure 42 . Column chart highlighting the mean push out bond strength
values of gutta percha/AH Plus among the maleic acid irrigation
protocols and the control group at the same root canal
level
Figure 43. Column chart highlighting the overall mean push out bond
strength values of gutta percha/AH Plus to root canal dentin
among the Maleic acid irrigation protocols and the control
group
Figure 44. Column chart highlighting the push out bond strength values
of gutta percha/AH Plus to root canal dentin among the Maleic
acid irrigation protocols and the control group at the different
root canal levels
Figure 45 . Column chart showing the overall push out bond strength
values among the EDTA and Maleic acid irrigation
protocols

Figure 46. Stereomicrographs showing the different mode of bond failure			
at 40 X magnification. (A) Adhesive failure at sealer/sentin			
interface. (B) Cohesive failure within gutta percha. (C) Mixed			
failure; cohesive and mixed at sealer/dentin interface, note			
sealer and gutta percha remnants on canal			
walls 118			
Figure 47. Scanning electron photomicrographs showing the differnet			
modes of failure: (A) Cohesive failure. (B) Mixed failure. (C)			
and (D) Higher magnifications for (B) showing one side of			
root canal lumen with adhesive mode of failure at the sealer/			
dentin interface and mixed failure; adhesive at sealer/gutta			
percha interface and cohesive within gutta percha			
respectively			

List of Tables

Table 1. Contact angle values vs. logarithmic concentrations of Tween
80 .80
Table 2. Surface tension values vs. Tween 80 logarithmic
concentrations81
Table 3. Mean percentage of debris at the same root canal third among the
EDTA irrigation protocols87
Table 4. Mean percentage of debris at the different root canal segments
among the EDTA irrigation protocols and the control
group 89
Table 5. Mean percentage of debris at the same root canal level among
Maleic acid irrigation protocols92
Table 6. Mean percentage of debris at the different root canal levels
among the Maleic acid irrigation protocols and the control
group 94
Table 7. Overall mean percentages of debris of the two main
groups 96
Table 8. Mean push out bond strength values of gutta percha/AH Plus to
root canal dentin among the EDTA irrigation protocols and the
control group at the same root canal level106
Table 9. Mean push out bond strength values of gutta percha/AH Plus to
root canal dentin among the EDTA irrigation protocols and the
control group at the different root canal levels108
Table 10. Mean push out bond strength values of gutta percha/AH Plus to
root canal dentin at the same root canal level among the Maleic
acid irrigation protocols and the control group111
Table 11. Mean push out bond strength values of gutta percha/AH Plus
among the Maleic acid irrigation protocols and the control group
at the different root canal segments113
Table 12. Overall mean push out bond strength values of the two main
groups
Table 13. Different modes of failure among the different irrigation
protocols

INTRODUCTION