Evaluation of silica as dentin surface treatment for sealing rootend preparations

THESIS Submitted to Faculty of Dentistry Ain Shams University

In Partial Fulfillment of The Requirement For Doctor Degree In Endodontics

By

Elham Ibrahim Elshaboury B.D.S M.D.Sc Faculty of Dentistry Ain Shams University 20

20

2009

Supervisors

Prof. Dr. Ehab El-Sayed Hassanien

Professor of Endodontics Faculty of Dentistry Ain Shams University

Prof. Dr. Mohamed Mohamed Selim

Professor of Physical Chemistry National Research Centre

Dr. Shehab El Din Mohamed Saber

Lecturer of Endodontics Faculty of Dentistry Ain Shams University



و قل ربى ادخلنى مدخل صدق و اخرجنى مخرج صدق و اجعل لى من لدنك سلطانا نصيرا "



سورة الإسراء الآية (80)

THANKS GOD

I want to THANK GOD for supporting and guiding me through out my life, asking for his mercy and forgiveness.

Dedicated to

To my dear mother

My lovely Yasmine and

Mohamed

Shank you for enduring me

all the times.

Acknowledgement

I would like to express my deep appreciation and gratitude to **Professor Dr. Ehab El-Sayed Hassanien** Professor of Endodontics, Faculty of Dentistry - Ain Shams University, for his academic supervision, guidance and valuable advice, which were essential for completion of this study.

My sincere gratitude to **Professor Dr. Mohamed Mohamed selim** Professor of physical chemistry National Research Centre for his continuous support and encouragement through the entire course of the work. His valuable suggestions and guidance are highly appreciated.

Many thanks and appreciation to **Dr. Shehab El Din Mohamed,** Lecturer of Endodontics, Faculty of Dentistry - Ain Shams University, for his unforgetable helps, generosity in giving his time, effort and advise.

Many thanks and appreciation to **Dr.Eman helmy**. Assoiciate Professor of Oral Pathology, Faculty of Dentistry - Ain Shams University, for her grateful assistance during the course of reseach.

I would like to thank all members of Endodontic department, Faculty of Dentistry - Ain shams university, for their help and support.

CONTENTS

Subject	Page	
I- Introduction	1	
II- Review of Literature	3	
i- Root-end resection	3	
ii- Root -end cavity preparation	4	
iii- Retrograde filling materials and leakage pattern	11	
iv- Bioactive Silica gel	23	
v- Laser	24	
III-Aim of The Study	36	
IV-Materials and Methods		
i- Permeability Test	37	
ii- Evaluation of dentin Surface topography	48	
iii- Evaluation of leakage pattern	53	
iv- Evaluation of subcutaneous tissue reaction	56	
V- Results		
i- Permeability Test	64	
ii- Evaluation of dentin Surface topography	74	
iii- Evaluation of leakage pattern	84	
iv- Evaluation of subcutaneous tissue reaction	90	
VI-Discussion	101	
VII- Summary and Conclusion	109	
VIII- References	114	
IX-Arabic Summary	-	

LIST OF FIGURES

	Figure	Page
Fig(1)	: Photographs showing The fluid transport apparatus assembly	40
Fig(2a)	: Photograph showing opened split Teflon chamber device with a pair of "O" rubber ring and a dentin disk. A: female part, B: male	41
Fig(2b)	: Diagram of an opened split Teflon chamber device A: female part, B: male part	41
Fig(3)	: Photograph showing closed split Teflon chamber device attached to a glass pipette from one side and to the hollow metallic extension from the other side	42
Fig(4)	: Mechanism of measuring the dentin permeability	43
Fig(5a)	: Photograph showing CO ₂ Laser Surgical System (Model: ML025-CA. Italy)	46
Fig (5b)	: CO ₂ Laser Surgical System hand piece (Model: ML025-CA. Italy)	46
Fig(6)	: Photograph showing root end cavity and resected root surface	52
Fig(7)	: Photograph showing silica and IRM	53

	Figure	Page
Fig(8)	: Photograph showing custom made Teflon tube	58
Fig (9)	: Photograph showing the surgical site after shaving	60
Fig(10)	: Photograph showing the subcutaneous pouch	60
Fig(11)	: Photograph showing the subcutaneous placement of Teflon tube	61
Fig (12)	: Photograph showing closure of the surgical site	61
Fig (13)	: Diagram showing Mean changes in dentin permeability for the samples treated with the bioactive silica gel at the different observation periods	68
Fig(14)	: Diagram showing Mean changes in dentin permeability for the samples treated with CO ₂ Laser at the different observation periods	72
Fig(15)	: Diagram showing The percentage change in dentin permeability in the two groups at all observation periods	73
Fig (16)	: Scanning electron micrograph of a sample from group IA (resected without surface treatment) showing scattered debris with some patent dentinal tubules	75

		Figure	Page
Fig(17)	•	Scanning electron micrograph of a sample from group IB (resected with bioactive silica gel surface treatment) showing even precipitation over the entire surface	75
Fig(18 a,b)	:	Scanning electron micrograph of a sample from group IB (resected with bioactive silica gel surface treatment) showing the uneven size of the crystals with intermediate voids	76
Fig(19)	:	Scanning electron micrograph of a sample from group IB (resected with bioactive silica gel surface treatment) showing patent dentinal tubules between the silica crystals	77
Fig(20)	:	Scanning electron micrograph of a sample from group IC (resected CO_2 Laser application) showing marked reduction in the patency of the dentinal tubules	77
Fig(21-a,b)	:	Scanning electron micrograph of a sample from group IC (resected CO_2 Laser application) showing evidence of dentinal melting	78
Fig(22-a,b)	•	Scanning electron micrograph of a sample from group IIA (retro cavity filled with IRM) showing even precipitation over the entire surface	80

		Figure	Page
Fig(23-a,b)	•	Scanning electron micrograph of a sample from group IIB (retro cavity treated with bioactive silica gel then filled with IRM) showing complete surface coverage with IRM and absence of any dentinal structures	81
Fig(24)	:	Scanning electron micrograph of a sample from group IIB (retro cavity treated with bioactive silica gel then filled with IRM) showing the discrepancy in size between the IRM particles and the bioactive silica particles	82
Fig(25)	:	Scanning electron micrograph of a sample from group IIC (retro cavity treated with CO ₂ Laser then filled with IRM) showing complete surface coverage with IRM Photomicrograph from group II	82
Fig(26-a,b)	•	Scanning electron micrograph of a sample from group IIC (retro cavity treated with CO ₂ Laser then filled with IRM) showing complete surface coverage with IRM at higher magnifications	83
Fig(27)	:	The mean values of dye penetration for all groups	86

	Figure	Page
Fig(28) :	Microphotograph of a sample from group IA (resected without surface treatment) showing marked dye penetration	87
Fig(29) :	Microphotograph of a sample from group IB (resected with bioactive silica gel surface treatment) showing minimal dye penetration	87
Fig(30) :	Microphotograph of a sample from group IC (resected with CO ₂ Laser application) showing minimal dye penetration	88
Fig(31) :	Microphotograph of a sample from group IIA (filled with IRM only) showing minimal dye penetration	88
Fig(32) :	Microphotograph of a sample from group IIB (Bioactive silica gel + IRM) showing minimal dye penetration	89
Fig(33) :	Microphotograph of a sample from group IIC (CO ₂ Laser +IRM) Showing minimal dye penetration	89
Fig(34) :	Diagram showing The mean inflammatory cells count in the four groups at the three observation periods	92
Fig(35) :	The changes in mean inflammatory cell counts of all groups throughout the observation periods	93

	Figure	Page
Fig(36)	: Photomicrograph of normal tissues after 2 days	94
Fig(37)	: Photomicrograph of normal tissues after 2 weeks	94
Fig(38)	: Photomicrograph of normal tissues after 3 weeks	95
Fig(39)	: Photomicrograph of tissues adjacent to Teflon tube filled with bioactive silica gel after 2 days	95
Fig(40)	: Photomicrograph of tissues adjacent to Teflon tube filled with bioactive silica gel after 2 weeks showing few infiltration of inflammatory cells of subcutaneous layer	96
Fig(41)	: Photomicrograph of tissues adjacent to Teflon tube filled with bioactive silica gel after 2 weeks showing mild tissue reaction in subcutaneous layer	96
Fig(42)	: Photomicrograph of tissues adjacent to Teflon tube filled with bioactive silica gel after 3 weeks few infiltration of inflammatory cells of subcutaneous layer	97
Fig(43)	: Photomicrograph of tissues adjacent to Teflon tube filled with bioactive silica gel after 3 weeks few infiltration of inflammatory cells of subcutaneous layer	97

	Figure	Page
Fig(44)	: Photomicrograph of incised tissues after 2 days showing subcutaneous tissue infiltrated with inflammatory cells	98
Fig(45)	: Photomicrograph of incised tissues after 2 weeks	98
Fig(46)	: Photomicrograph of incised tissues after 3 weeks	99
Fig(47)	: Photomicrograph of tissues adjacent to an empty Teflon tube after 2 days	99
Fig(48)	Photomicrograph of tissues adjacent to an empty Teflon tube after 2 weeks	100
Fig(49)	: Photomicrograph of tissues adjacent to an empty Teflon tube after 3 weeks	100

LIST OF TABLES

	Table	Page
Table (1)	: The immediate percentage change in dentin permeability of the dentin discs treated with the bioactive silica gel	65
Table (2)	: The percentage change in dentin permeability of the dentin discs treated with the bioactive silica gel after 5 minutes	66
Table (3)	: The percentage change in dentin permeability of the dentin discs treated with the bioactive silica gel after 15 minutes	66
Table (4)	: The percentage change in dentin permeability of the dentin discs treated with the bioactive silica gel after 30 minutes.	67
Table (5)	: Statistical analysis of the mean change in dentin permeability for the samples treated with the bioactive silica gel at the different observation periods	68
Table (6)	: The immediate percentage change in dentin permeability of the dentin discs treated with CO ₂ Laser	69
Table (7)	: The percentage change in dentin permeability of the dentin discs treated with CO ₂ Laser after 5 minutes	70