



تم رفع هذه الرسالة بواسطة / منى مغربى أحمد

بقسم التوثيق الإلكتروني بمركز الشبكات وتكنولوجيا المعلومات دون أدنى

مسئولية عن محتوى هذه الرسالة.

ملاحظات:

[illegible]

Technique Sensitivity of Two Universal Adhesives with Different Chemical Formulations: An In Vitro Study

Thesis

Submitted to Faculty of Dentistry

Biomaterials Department

Ain-Shams University

In partial fulfilment of the requirements for the Master degree in
Dental Biomaterials

By

Mohamed Abdel-Halim Mahmoud Hamouda

BDS (Cairo University 2011)

Biomaterials Department

Faculty of Dentistry

Ain Shams University

Biomaterials Department

Faculty of Dentistry

Ain-Shams University

2022

Supervisors

Dr. Mohamed Salah Nassif

Professor of Dental Biomaterials

Biomaterials Department

Faculty of dentistry

Ain-Shams University

Dr. Mohamed Mahmoud Kandil

Lecturer of Dental Biomaterials

Biomaterials Department

Faculty of dentistry

Ain-Shams University

Acknowledgment

I would like to express my sincere respect and gratitude to **Prof.Dr. Mohamed Salah Nassif**, Professor of Dental Biomaterials, Faculty of Dentistry, Ain-Shams University, for his great support and precious experience in guiding and teaching me. Thanks Dr. Mohamed for your endless support and your valuable guidance. I am really proud to be your student.

I wish to faithfully express my deep respect and appreciation to **Dr. Mohamed Mahmoud Kandil**, Lecturer of Dental Biomaterials, Faculty of Dentistry, Ain-Shams University, for his great effort in guiding me and his continuous encouragement throughout my work. Thanks Dr. Mohamed for your guidance and for treating me as one of your family.

Thanks are extended to all of my professors and colleagues in the Biomaterials Department for their spiritual support and help throughout my work.

Dedication

I would like to dedicate this work to my mother for her unconditional love and without whom I wouldn't have reached this point. I can't be more thankful for having you in my life.

I would also like to thank my sisters for their continuous support and encouragement. You have always been there for me whenever I needed you.

Special thanks to my beloved wife for her endless support. It is a rare privilege to be married to someone so understanding.

I dedicate this work to my daughters; you are such a huge blessing that I will always be thankful for.

Finally, I would like to dedicate this work to my father, God bless his sole. Hope my accomplishment will honor his memory .

List of Contents

	Page
List of contents	i
List of tables.....	iii
List of figures.....	iv
List of abbreviations.....	vi
Introduction.....	1
Review of literature.....	4
1. General composition of dental adhesives.....	4
2. Principles of adhesion.....	7
3. Classification of dental adhesives.....	8
3.1. Classification according to generation.....	8
3.2. Classification according to adhesion mechanism.....	12
4. Development of universal adhesives.....	22
4.1.Composition of universal adhesives.....	23
4.2.pH of universal adhesives.....	26
4.3.Bond strength of universal adhesives to enamel and dentin.....	27
4.4.Durability of universal adhesive.....	29
5. Evaluation of Bonding agents.....	30
5.1.Micro-tensile bond test.....	31
5.2.Micro-shear bond test.....	32

	Page
6. Scanning electron microscopic (SEM) evaluation.....	34
Aim of the study.....	36
Material and methods.....	37
1. Materials.....	37
2. Methods.....	38
2.1. Micro-tensile bond strength testing.....	40
2.2. Scanning electron microscopic evaluation of the tooth/ restoration interface.....	45
3. Statistical analysis.....	47
Results.....	48
I. Micro-Tensile bond strength (MPa) results	48
II. Scanning electric microscope (SEM) evaluation results.....	54
Discussion.....	60
Summary and Conclusions.....	76
References.....	79

List of tables

Table 1	Materials used in the study, their description, composition and lot no.....	37
Table 2	Three-way ANOVA showing the effect of different Variables: Adhesives (Single Bond Universal vs Prime&Bond Universal), Technique (Etch and rinse vs. Self-etch), and water content (Dry vs. wet,moist)on the Micro-tensile bond strength.....	48
Table 3	Mean and standard deviation of Micro- tensile bond strength for different tested adhesives.....	49
Table 4	Mean and standard deviation of Micro-tensile bond strength for water content.....	51
Table 5	Mean and standard deviation of Micro-tensile bond strength for different techniques.....	53

List of figures

Figure 1	Materials used in the study.....	38
Figure 2	Flow chart of specimen grouping.....	40
Figure 3	Showing composite restoration	43
Figure 4	Operating parameter of the diamond saw machine.....	43
Figure 5	Sectioning the tooth in the bucco-lingual direction- perpendicular to the first cut.....	44
Figure 6	Beams 1*1 mm ² for each group.....	44
Figure 7	Beam mounted on Geraldeli's jig.....	45
Figure 8	Jig mounted on the Universal testing machine.....	45
Figure 9	Scanning Electron microscope.....	46
Figure 10	Bar chart showing the mean of micro-tensile bond strength for different tested adhesives.....	50
Figure 11	Bar chart showing the mean micro-tensile bond strength for different water content.....	52
Figure 12	Bar chart showing the mean micro-tensile bond strength for different techniques.....	53
Figure 13	SEM image 2000X showing tooth /restoration interface for SBU and P&BU in etch and rinse mode (dry dentin surface).....	54

Figure 14	SEM image 2000X showing tooth /restoration interface for SBU, P&BU in etch and rinse mode (wet dentin surface).....	55
Figure 15	SEM image 2000X showing tooth /restoration interface for SBU and P&BU in etch and rinse mode (moist dentin surface).....	56
Figure 16	SEM image 2000X showing tooth /restoration interface for SBU and P&BU in self-etch mode (dry dentin surface).....	57
Figure 17	SEM image 2000X showing tooth /restoration interface for SBU and P&BU in self-etch mode (wet dentin surface).....	58
Figure 18	SEM image 2000X showing tooth /restoration interface for SBU and P&BU in self-etch mode (moist dentin surface).....	59

List of Abbreviations

Bis-GMA: Bisphenol A glycidyl methacrylate.

HEMA: Hydroxyethyl methacrylate.

MDP: Methacryloyloxydecyl dihydrogen phosphate.

TEGDMA: Triethylene glycol dimethacrylate.

UDMA: Urethane dimethacrylate.

PEGDMA: Polyethylene glycol di-methacrylate

PENTA: Di-pentaerythritol penta-acrylate phosphate.

ER: Etch and rinse approach.

SE: Self-etch approach.

SEE: Selective enamel etching.

GPDM: Glycero-phosphate di-methacrylate

MMPs: Matrix metalloproteinases.

4- META: 4-Meth-acryloyloxy-ethyl trimellitate anhydride.

μTBS: Micro-tensile bond strength test.

μSBS: Micro-shear bond strength test.

μPO: Micro-push out bond strength test.

SEM: Scanning electron microscope evaluation.

SBU: Single Bond Universal

P&BU: Prime & Bond Universal

SiC: Silicon Carbide Paper