



شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم



MONA MAGHRABY



شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم



شبكة المعلومات الجامعية التوثيق الإلكتروني والميكروفيلم



MONA MAGHRABY



شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

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



MONA MAGHRABY

**Effect Of Different Adhesives And Surface
Treatments Of CAD/CAM Resin Composite
Blocks On Dentin Bond Strength**

Thesis

Submitted to Operative Dentistry Department, Faculty of
Dentistry, Ain Shams University in Partial Fulfillment of
the Requirements for Master Degree in Operative
Dentistry.

By

Lina Sameh Samy Hamed

B.D.S., Ain Shams University (2012)

Demonstrator, Operative Dentistry Department,
Ain Shams University.

2021

Supervisors

Prof. Dr. Farid Mohammed Sabry El-Askary

Professor of Operative Dentistry

Faculty of Dentistry, Ain Shams University

Dr. Aya El-Sayed Samaha

Lecturer of Operative Dentistry

Faculty of Dentistry, Ain Shams University

Acknowledgement

I would like to express my deepest gratitude and appreciation to ***Prof. Dr. Farid Mohammed Sabry El-Askary***, Professor of Operative Dentistry, Faculty of Dentistry, Ain Shams University, for his fatherly advice, his endless support, encouragement, and guidance throughout this thesis. I am honored to be one of his candidates.

Also, I am grateful to ***Dr. Aya El-Sayed Samaha***, Lecturer of Operative Dentistry, Faculty of Dentistry, Ain Shams University, for her efforts throughout this thesis.

My Dear Dad

*I wish he was here with me. May his soul rest
in peace.*

My Dear Mom& lovely Sisters

*Thank you for everything, I am here now
because of you.*

*To My lovely Husband and
adorable kids*

*You have been with me every step of the way
with your love, support, help and motivation.*

Thank you for being an amazing husband.

List of Contents

List of Tables	i
List of Figures	ii
Introduction	1
Review of literature.....	3
Introduction to CAD/CAM materials.....	3
CAD/CAM resin composite surface treatment.....	8
Dental adhesives systems.....	14
Universal or multi-mode adhesives	17
Influence of application modes of universal adhesives.....	19
Incompatibility between dual-cured composite and self-etching adhesives.....	20
Dual-cured and self-cured adhesives.....	21
Resin composite cements.....	22
Shear bond strength.....	25
Aim of the study.....	27
Materials and methods	28
Results	40
Discussion	49
Summary and conclusion	58
References	60
Arabic summary	

List of Tables

Table No.	Table Title	Page
Table 1:	Materials/Description (Lot #), Composition and Manufacturer	28
Table 2:	Experimental variables investigated	36
Table 3:	Interactions between experimental variables	36
Table 4:	Two-way ANOVA for the different adhesives, different surface treatments, and their interactions	40
Table 5:	Means $\pm$ Standard Deviations for shear bond strength in MPa of different adhesives system and surface treatment	41
Table 6:	Percentage of adhesive, mixed, and cohesive failures of all tested groups	43

Figure No.	Figure Title	Page
1	a: Each molar tooth was vertically sectioned into mesial and distal halves, b: Flat dentin sample.	29
2	a: Dentin sample inside mold hole, and b: Dentin samples with their acrylic blocks.	30
3	a: LT CAD/CAM resin composite blocks (size14). b: Sectioning of the blocks using IsoMet device, and c: Rectangular rods.	31
4	a: CAD/CAM rods were sandblasted using 50µm aluminum oxide particles perpendicular to the surface, and b: Rinsing.	32
5	a: The rods surfaces were ultrasonically cleaned following sandblasting procedure.	32
6	a: The rods surfaces were acid etched following sandblasting procedure, and b: Rinsing.	33
7	a: Dispensing a drop into a well, b: The adhesive was applied on the treated CAD/CAM rod surfaces, and c: Light curing for 20 seconds using LED light curing unit.	33
8	a: Acid-etching, b: Rinsing, c: The adhesive mix was applied on dentin, and d: The adhesive was light cured for 10 seconds using LED light curing unit.	34
9	a: Dispensing a drop from adhesive A bottle, b,c: Dispensing a drop from adhesive B bottle and mixed them well, and d: The adhesive mix was applied on dentin and remained for self-cure.	35

10	a: Duo-cem resin cement was applied on the dentin surface, and b: The resin cement was light cured for 20 seconds from each rod surface.	37
11	a, b: Acrylic block with composite rod mounted to universal testing machine.	38
12	Bar chart showing the effect of different adhesive system within each surface treatments on shear bond strength.	41
13	Bar chart showing the effect of different surface treatments within each adhesive system on the shear bond strength.	42
14	Bar chart representing the percentage of adhesive, mixed, and cohesive failures of all tested groups.	44
15	Representative stereo-microscopic images for DC-E&R/SB group. a: Dentin side showed cohesive failure in both dentin, and CAD/CAM rod. b: CAD/CAM rod side. D: Dentin and RC: CAD/CAM rod.	45
16	Representative stereo-microscopic images for DC-E&R/SB-US group. a: Dentin side, and b: CAD/CAM rod side revealed predominate cohesive failure in resin cement. C: Resin cement.	45
17	Representative stereo-microscopic images for DC-E&R/SB-AE group. a: Dentin side, and b: CAD/CAM rod side showed adhesive type of failure with remnants of adhesive layer remained attached to the dentin, and resin cement attached to the rod surface. A: Adhesive, and C: Resin cement.	45

18	Representative stereo-microscopic images for group DC-SE&SB group. a: Dentin side, and b: CAD/CAM rod surface showed mixed type failure. In a: Part of the dentin was detached with remnants of resin cement attached to the dentin surface. In b: Part of the fractured dentin remain attached to the rod surface with resin cement covered the CAD/CAM rod surface. D: Dentin, and C: Resin cement.	46
19	Representative stereo-microscopic images for group DC-SE&SB-US group. a: Dentin side, and b: CAD/CAM rod side showed mixed type of failure. In a: Part of the dentin was detached with part of resin cement remain attached to the dentin. b: Part of fractured dentin and remnants of resin cement attached to the rod surface. D: Dentin, and C: Resin cement.	46
20	Representative stereo-microscopic images for DC-SE&SB-AE group. a: Dentin side, and b: discovered the adhesive type of failure. A: Adhesive, and C: Resin cement.	46
21	Representative stereo-microscopic images for group SC-E&R/SB group. a: Dentin side, and b: CAD/CAM rod side. Mixed type of failure was detected, adhesive failure between resin cement and both dentin and CAD/CAM rod associated with cohesive failure in resin cement. C: Resin cement.	47
22	Representative stereo-microscopic images for group SC-E&R/SB-US group. a: Dentin side, and b: CAD/CAM rod side. Mixed type of failure was observed, adhesive failure between resin cement and both dentin and CAD/CAM rod accompanied with cohesive failure in resin cement. C: Resin cement.	47

23	Representative stereo-microscopic images for group SC-E&R/SB-AE group. a: Dentin side, and b: CAD/CAM rod side. Predominate cohesive failure in resin cement was observed. C: Resin cement.	47
24	Representative stereo-microscopic images for SC-SE/SB group. a: Dentin side, and b: CAD/CAM rod side showed predominate adhesive type of failure. A: Adhesive, and C: Resin cement.	48
25	Representative stereo-microscopic images for SC-SE/SB-US group. a: Dentin side, and b: CAD/CAM rod side showed mixed type of failure. C: Resin cement, and RC: CAD/CAM rod surface.	48
26	Representative stereo-microscopic images for SC-SE/SB-AE group. a: Dentin side, and b: CAD/CAM rod side showed mixed type of failure. Adhesive failure between resin cement and both dentin and rod surfaces accompanied with cohesive failure in resin cement was observed. C: Resin cement, D: Dentin and RC: CAD/CAM rod.	48

Introduction

Adhesives are commonly used with conventional resin cements to achieve a strong and durable bond between tooth/resin cements/indirect restoration. Universal adhesives were introduced essentially as self-etching adhesives, which by the operator's preference can be also used in the etch-and-rinse mode.¹ In the light of their application modes, light-and dual-cured universal adhesives showed similar bond strength values when, used in etch-and-rinse and self-etching modes.^{2,3} However, the cumulative retention rate after 24-month clinical evaluation periods of universal adhesives in the etch-and-rinse mode was significantly higher compared to the same adhesives used in the self-etching mode.⁴

The incompatibility between simplified adhesives and dual- and self-cured resin composites was explained in the previous studies,⁵⁻⁸ which encouraged dental manufacturers to switch light-cured adhesives to dual-cured ones. This is achieved by providing the so-called “self-cured activators” to be mixed with the light-cured adhesives.⁹⁻¹¹ The dual-cured adhesives polymerize basically by light activation, which in areas of difficult light access, their bonding effectiveness could be compromised.¹² For this reason, some manufacturers developed self-cured adhesives to be used in areas with deficient light activation. Self-cured adhesives depend on the chemical initiator/co-initiator system using the benzoyl peroxide as the initiator and tertiary amine as the co-initiator.¹³

Achieving a reliable bonding between CAD/CAM resin composites and adhesive resin cements has always been a challenge. The higher degree of resin polymerization in CAD/CAM composites, with no residual C=C for chemical bonding is thought to be the