# بسم الله الرحمن الرحيم



HANAA ALY

شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

# شبكة المعلومات الجامعية

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# جامعة عين شمس

## التوثيق الإلكتروني والميكروفيلم

## قسم

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تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

HANAA ALY

# Influence of Different Surface Treatments of CAD/CAM Ceramic Materials on Micro Shear Bond Strength of Resin Cement to Two Hybrid Ceramic Materials

Thesis

Submitted for Partial Fulfillment of the Master Degree of Science Requirement in Fixed Prosthodontics, Faculty of Dentistry, Ain Shams University

By

**Norhan Yehia Taher**

*Ain Shams University (2013)*

*E-mail Address: norhanyehia91@gmail.com*

Faculty of Dentistry - Ain Shams University

2019

Supervisors:


**Dr. Tarek Salah Morsi**

*Professor of Fixed Prosthodontics*
*Head of Fixed Prosthodontics Department*
*Faculty of Dentistry, Ain Shams University*

**Dr. Maged Mohamed Zohdy**

*Associate Professor of Fixed Prosthodontics*
*Faculty of Dentistry, Ain Shams University*

بسم الله الرحمن الرحيم

وَأَنْزَلَ اللهُ عَلَيْكَ

الْكِتَابَ وَالْحِكْمَةَ

وَعَلَّمَكَ مَا لَمْ

تَكُنْ تَعْلَمُ وَكَانَ

فَضْلُ اللهِ عَلَيْكَ

عَظِيمًا

صدق الله العظيم

(١١٣)

# Acknowledgments

*First and foremost, I feel always indebted to **Allah** the Most Beneficent and Merciful.*

*I wish to express my deepest thanks, gratitude and appreciation to **Dr. Tarek Salah Morsi**, Professor of Fixed Prosthodontics, Head of Fixed Prosthodontics Department, Faculty of Dentistry, Ain Shams University, for his meticulous supervision, kind guidance, valuable instructions and generous help.*

*Special thanks are due to **Dr. Maged Mohamed Zohdy**, Associate Professor of Fixed Prosthodontics, Faculty of Dentistry, Ain Shams University, for his sincere efforts, fruitful encouragement.*

*I would like to express my hearty thanks to all my family for their support till this work was completed.*

Norhan Yehia Taher

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# List of Abbreviations

| Abb. | Full term |
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| *$Al_2O_3$* | *Aluminum oxide* |
| *C* | *CERASMART* |
| *CAD/CAM* | *Computer-aided design/computer aided-manufacturing* |
| *E* | *VITA enamic* |
| *Er,Cr:YSGG laser* | *Erbium, Chromium: Yttrium-Scandium-Gallium-Garnet laser* |
| *HF* | *Hydrofluoric acid* |
| *Nd:YAG laser* | *Neodymium-doped Yttrium Aluminum Garnet laser* |
| *PICN* | *Polymer infiltrated ceramic network* |

# INTRODUCTION

Computer-aided design/computer-aided manufacturing (CAD/CAM) has widely been known and gained popularity in dental applications, especially over the last 10 years.

CAD/CAM systems providing high quality restorations have dramatically enhanced dentistry, as they have many advantages including standardized manufacturing processes of dental restorations, they also alternated the impression and casting procedure steps to provide faster and easier indirect restorations. [1] Regarding CAD/CAM restorative materials; many materials such as aluminum oxide, yttrium tetragonal zirconia polycrystals, feldspathic glass ceramics, leucite-reinforced glass ceramics, lithium disilicate glass ceramics, and composite blocks can be used. Generally, nonmetal CAD/CAM restoratives are currently divided into two main groups: ceramics and composites. [2]

Comparing composites to ceramics, composite indirect restorations are softer and less wear resistant but on the other hand have easy finishing and polishing properties, are less abrasive for opposing dentition, and are more accepting to the idea of add-on adjustments, although they experience high wear. [3] However, esthetic properties of ceramic restorations are outstanding to those of composite materials. [4] Plus, ceramics are more wear-resistant, more biocompatible, and more resistant to discoloration; however, they have their own drawbacks as they are more brittle, causing excessive wear to opposing natural dentition and are more liable to fracture due to the formation of flaws or cracks in the intaglio surfaces.

Combining both materials' advantages, which as a result enhance the properties and durability of indirect restorations, a new material named polymer-infiltrated-ceramic network material has been introduced. [3]This new material, also known as hybrid ceramic, composed mainly of a dominant ceramic network (86 wt.%) strengthened by an acrylate polymer network (14 wt.%). These two networks are mixed uniformly with each other. [5] The ceramic part of the currently available material (Vita Enamic; VITA Zahnfabrik, Bad Sackingen, Germany) has aluminum oxide enriched, fine-structure feldspar matrix infused by polymer including urethane dimethacrylate (UDMA) and others. [6] It has been reported that this new material is expected to have many advantages including less brittleness, hardness, and rigidity; more flexibility; and better machine handling and fracture toughness than ceramics.[3] It creates a material with desired mechanical properties of ceramics and composites, which are considered to be the conventional restorative materials. [6]

The adhesion of indirect restorations to the tooth structure is a very critical step influencing the durability and success of treatment. Bonding between indirect restorations and tooth, fulfilling high retention, preventing micro leakage, and creating good marginal adaptation are challenging problems to the operator. [7] Also, providing strong, durable bond could increase the restored tooth's resistance to fracture as well as indirect restorations. [8]

Therefore, in order to have higher bond strength, easy, harmless, and applicable methods should be used, to increase surface properties of indirect restorations. [9] Many studies that used different methods like hydrofluoric acid (HF) etching, air-particle abrasion, and/or silanization for surface treatment before cementation have enhanced certain indirect restorations' bond strengths. [8,10] On the other hand few studies have been conducted on the effect of surface treatments to increase the adhesion of the recently used CAD/CAM hybrid ceramics to resin cement. [5,11,12]

In recent studies, Er,Cr:YSGG (erbium, chromium: yttrium scandium gallium garnet) laser has been found to be effective in bond strength enhancement as a surface treatment method. [13,14] As for the surface treatment of new hybrid ceramics, no research has used an Er,Cr:YSGG laser.

There is deficiency in the research about the newly introduced CAD/CAM material mentioned above and their most ideal reparability techniques that can be applied clinically in the most simple and with the least cost.

This study aims to assess and compare the impact of 3 different surface treatments including hydroflouric acid etching, alumina particle sandblasting and Er,Cr:YSGG laser on the shear bond strengths of dual-cure self-adhesive resin cement and novel CAD/CAM hybrid ceramic.