# The Effect of Non-Thermal Plasma Treatment on the Shear Bond Strength of Monolithic Zirconia

**A thesis submitted for the partial fulfillment of the requirements of Master's Degree in fixed prosthodontics, Faculty of Dentistry, Ain-Shams University**

Presented by:


**Nancy Adel Hamed El-Gohary**

B.D.S (Misr International University 2010)


Faculty of Dentistry
Ain-Shams University

2020

# Supervisors

**Dr/Marwa Mohamed Wahsh**

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

**Dr/Ahmed Ezzat Sabet**

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

# Acknowledgment

# Acknowledgement

First and forever thanks and gratitude to ALLAH for guiding me to the right way.

It's a great honor to express my sincere gratitude and appreciation to my professor Dr/ Marwa Mohamed Wahsh, Associate professor of fixed prosthodontics, faculty of Dentistry, Ain-shams University for her guidance, motivation , patience and for sharing knowledge.

I am greatly thankful to my advisor Dr/Ahmed Ezzat Sabet, Associate professor of fixed prosthodontics, faculty of Dentistry, Ain-shams University for his great support, patience, encouragement and help during this research.

I would like to thank Dr/Khaled Keraa Biostatistics and Quality management specialist, faculty of Dentistry, Misr international university for his sharing in the statistical analysis part in the thesis.

A very special gratitude goes to the department of fixed prosthodontics at Misr International University &Ain-Shams University.

To my best friends and sisters Sara El-debeeky and Omnia Ismail for their support and assistance throughout this work.

# Dedication

# Dedication

To my grandmother, our family support system. Your prayers and unconditional love will be always surrounding me throughout my life.

To my beloved father and mother who are my source of power, giving me strength and emotional support in my weak moments. You are the reason of what I become today.

To my lovely sisters, life is full of changes but sisters' love is forever.

To my husband, friend and soul mate. Thank you for being my strength when I am weak, my calm when I am angry, and my everything I need.

To my lovely son, you will always be my sunshine and my little angel.

To my dear friends, you are the best part of me.

# List of Contents

# List of Figures

# List of Tables

# Introduction

# Introduction

For many years, it was known that metal ceramic restorations used in dentistry combine both the esthetic properties of ceramic material and mechanical properties of metals. But with the use of metals either as a full metal restoration or in combination with ceramics, some drawbacks have been showed that lead to patient dentist un-satisfaction.

All ceramic restorations are metal free alternatives from the metal ceramic restorations. Zirconium oxide ($ZrO_2$) ceramics is considered the strongest ceramic material that has been used in the recent years. It is characterized by high fracture resistance and durable viability in comparison to porcelain or metallic substrates [1].

High strength ceramic restorations have been popularly used in dentistry due to increasing patient's demands for a more esthetic restoration with the new era of dental technology and research. They are biocompatible materials, highly esthetic, and fulfill highly mechanical properties.

With the evolution of zirconia materials, zirconia-based restorations have been more frequently used. Until even a few years ago it was challenging to produce a zirconia restoration that accurately replicates the natural translucency and opalescence of real teeth. Now, the newest generation of materials can provide patients with even better treatment outcomes due to increased translucency, better wear characteristics, and strength with significantly improved translucency, the technician can fabricate restorations that more closely replicate natural teeth. [2]

This ceramic restorative material by the help of computer aided design and computer aided manufacturer(CAD/CAM) innovation has been widely used in dentistry, zirconia can be used in so many clinical aspects as orthodontic brackets, post and cores, implants, and fixed partial dentures [3].

Adhesive cementation of dental restorations is highly requested, since it enhances retention, marginal adaptation, fracture resistance, and decreases the possibility of recurrent decay and require more conservative tooth preparation. Different surface treatments are launched to improve the adhesion and retention to the tooth structure.

The conventional way of cementation which includes H-F acid and salinization treatment for the surface of zirconia before adhesive cementation is not effective to achieve proper adhesion due to the lack of silica and glass phase in the microstructure. Due to the difficulty in achieving chemical and mechanical bonding with zirconia, alternative methods have been performed.

The most commonly used micromechanical surface treatment method is air abrasion using alumina oxide particles to improve mechanical bonding with abrasive particle size ranging from 50 to 250 µm. [1] Another form of surface treatment to zirconia ceramics is the use of non-thermal plasma treatment (NTP) to improve the surface chemistry of zirconia for bonding/cementation mechanism. Non thermal plasma is a partially ionized gas containing mixture of ions, electrons, free radicals in non-equilibrium state to be applied to the ceramic surface. This treatment produces a thin silica layer that chemically changes the surface of ceramics improving its wettability and enhancing the bond strength by creating chemical active sites. [4]

# Review of Literature