Evaluation of Color Stability, Water Sorption, Solubility and Bond Durability of an Adhesive after Adding Epigallocatechin-Gallate in Two Different Concentrations

Thesis Submitted to Biomaterials Department The Faculty of Dentistry Ain-Shams University

In partial fulfillment of the requirements for the Master Degree in Biomaterials Science

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2019

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Acknowledgement

*First, I would like to express my greatest gratitude to the Almighty **ALLAH** for giving me the strength, knowledge, ability and opportunity to undertake this research study and to complete it satisfactorily. Without his blessings, this achievement would not have been possible.*

However, conducting the research and writing this thesis required the patience, persistence and motivation of many people whom I would like to personally acknowledge. First, I would like to extend my deepest thanks to my supervisors:

***Prof. Dr. Tarek Salah El Dine Hussein**, Professor of Biomaterials, Faculty of dentistry, Ain-Shams University, for his highly appreciated guidance and endless support throughout this work. His valuable experience and honorable supervision will always be remembered with a lot of gratitude.*

***Dr. Mohamed Salah Nassif**, Associate Professor of Biomaterials, Faculty of dentistry, Ain-Shams University, for sparing no effort or time in guiding me throughout this work. The door to his office was always open for me. His constant encouragement, understanding, patience and healthy criticism added considerably to my experience.*

*These acknowledgements would be incomplete without expressing my deepest thanks and appreciation to all my professors and colleagues in the Biomaterials department for always supporting and guiding me especially **Dr. Aliaa Hazem***

***Sakr**, Assistant Lecturer of Dental Biomaterials, Faculty of Dentistry, Ain-Shams University and **Dr. Lamia Mostafa Abd El-Aziz**, Assistant Lecturer of Dental Biomaterials, Faculty of Dentistry, Ain-Shams University*

*I would also like to acknowledge **Dr. Ahmed Abdou**, Teaching Assistant of Dental Biomaterials, Faculty of Dentistry, Modern University for Technology and Information for his great help in this thesis statistics.*

Dedicated to

My dad

Who raised me to be a hard worker, my support system who always pushes me forward

My mom

My comfort zone, who always loves, supports and inspires me in every step I take

My brother

My backbone, who helps me a lot with his love, encouragement, patience and hi-tech services

My husband

My life partner and best friend who is always there for me

My children

Ibrahim and Celine who are the source of my joy and happiness

My grandmother

Who is always there for me with her love, prayers and blessings

My aunt

Who is always a source of love and support trying to make things easier for me

My cousins

Who always support and help me in every possible way

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ACP: Amorphous calcium phosphate

Bis-GMA: Bisphenol A diglycidyl methacrylate

BHT: Butylated hydroxy toluene

BAC: Benzalkonium chloride

BPDM: Biphenyl dimethacrylate

CHX: Chlorhexidine

CQ: Camphroquinone

HEMA: 2-hydroxyethyl methacrylate

EDC: 1-ethyl-3-(3-dimethylaminopropyl) carbodiimide

EDTA: Ethylene diamine tetraphosphonic acid

EGCG: Epigallocatechin gallate

EGDMA: Ethylene glycol dimethacrylate

FEA: Finite element analysis

GAGs: Glucosaminoglycans

GTase: Glucosyltransferase

GBR: Guided bone regeneration

H3PO4: Phosphoric acid

MDPB: 12-methacryloyloxydodecylpyridinium bromide

MEP: 2-methacryloyloxyethyl dihydrogen phosphate

MEHQ: Monomethyl ether hydroquinone

MMA: Methyl methacrylate

Mpa: Mega pascal

MMPs: Matrix metalloproteinases

NaOCl: Sodium hypochlorite

PENTA: Dipentaerythritol pentaacrylate monophosphate

phenyl P: 2-methacryloxyethyl phenyl hydrogen phosphate

PPD: 1-phenyl-1,2propanedione

PVPA: Polyvinyl phosphonic acid

SIC: Silicon carbide

SD: Standard deviation

SEM: Scanning electron microscope

TCB: Butan-1,2,3,4-tetracarboxylic acid di-2-hydroxyethylmethacrylate ester

TCP: Tricalcium phosphate

TBB: Tri-n-butyl borane

TEGDMA: Triethylene glycol dimethacrylate

TPO: 2, 4, 6-Trimethylbenzoyldiphenylphosphine oxide

UDMA: Urethane dimethacrylate

4-MET: 4-methacryloyloxyethyl trimellitic acid

10-MDP: 10-methacryloyloxydecyl dihydrogenphosphate

μTBS: Micro tensile bond strength

Introduction

Nowadays adhesives are used in most of the dental practices and their development led to many improvements in restorative and preventive dentistry.(1)

In 1955, Buonocore(2) succeeded in bonding resin to enamel surface through acid etching of the enamel by 85% phosphoric acid to provide a good surface for resin bonding and to improve retention of resin to pits and fissures and in late 1960 Buonocore proposed that bonding to dentin can be done too. Bonding to dentin is more difficult than bonding to enamel due to its organic and humid nature, the density of dentinal tubules and the water content differs according to the dentinal depth, also dentin undergoes change with age in an asymmetrical physiological aging process, leading to an increase of dentin thickness and decrease in dentin permeability. (3)

In 1970 Eick used scanning electron microscope (SEM) to identify the smear layer that block the adhesion to dentin and the etch and rinse concept was then introduced in 1980.(3) Nakabayashi, in 1982 described the hybrid layer and how the resin infiltrates the acid etched dentin forming a hybrid layer that is reinforced with collagen fibrils.(2)

Dental adhesives have developed a lot since then but some problems arised that could affect the durability of the bond such as, water sorption resulting in plasticization of the dental adhesive with hydrolytic degradation and decreasing its physical properties and bond strength(4), also incomplete resin infiltration into dentin which is due to the discrepancy between both dentin demineralization and resin infiltration leading to nanoleakage within the hybrid layer and the adhesive layer.(5)

MMPs are released from odontoblasts in the form of proenzymes that require activation to degrade extracellular matrix components.The degradation of exposed collagen produced by matrix metalloproteinases (MMPs) affects the durability of resin dentin bond and many techniques were developed to overcome it as using MMPs inhibitors and collagen cross linking(6,7)

Flavonoids are considered one of the MMPs inhibitors and green tea extract is an important source of flavonoids , it is composed of