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بسم الله الرحمن الرحيم

MONA MAGHRABY

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Effect Of Aging On Mechanical Properties, Fluoride Release And Recharging, Water Sorption And Solubility Of Ceramic Reinforced Glass Ionomer: An In Vitro Study

Thesis Submitted to the Faculty of Dentistry, Ain-Shams University for partial fulfillment of the requirements for the Master Degree in Dental Biomaterials

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Acknowledgement

I would like to express my sincere respect and gratitude to **Prof. Dr. Dalia Ibrahim El-Korashy** Professor and Head of Biomaterials Department, Faculty of dentistry, Ain-Shams University, for her continuous encouragement and endless support. Her precious experience always guides me throughout this work. Thanks Dr. Dalia for your support and treating me as one of your family.

I deeply thank and express my respect to **Dr. Mohamed Mahmoud Kandil,** Lecturer of Dental Biomaterials, Faculty of Dentistry, Ain-shams University, for his continuous guidance and help in this work. I have really learnt a lot from your valuable experience.

Thanks, are extended to all my professors and colleagues in the Biomaterials Department whom I consider my second family.

Dedication

I would like to dedicate this work to my mother and father, to whom I owe everything. They are my backbone and without their prayers, I cannot reach any achievements in my life. I would also like to thank my sister Marwa. She is my supporter and my best friend

I deeply thank my husband Mahmoud, my life partner my everything, for his endless care and support in all hard times and my adorable son, Adam, the main source of happiness in our life.

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Introduction

Recurrent caries at the tooth/restoration interface is one of the most common reasons for replacement of existing restorations. When dental materials release fluoride, it is expected that, besides restoring function, they may control the recurrence of caries and contribute to reduction of caries incidence in the entire dentition.(1)

The incorporation of fluoride in materials used for restoring tooth structure, attracts the attention of many researchers for using such materials as a source of fluoride release to the teeth.(2) Fluoride is an anticariogenic agent that leads to the formation of fluoroapatite which is more resistant to acid attacks compared to hydroxyapatite and thus reducing recurrent caries especially in patients with high risk of caries.(3)

Since the evolution of silicate cements, it was observed that recurrent caries around silicate cements was significantly reduced, and this reduction was attributed to the substantial generation of fluoride by this restorative material. Glass ionomer, which was generated from silicate cement can increase the resistance of teeth to recurrent caries because of fluoride release and its ability to recharge fluoride. This has been the hallmark feature that lead to the enormous clinical success of this material along with its ability for chemical bonding to tooth structure, close coefficient of thermal expansion to that of tooth structure and satisfactory biocompatibility. Two major disadvantages of conventional glass ionomer cement are its insufficient translucency resulting in bad esthetics and poor mechanical characteristics such as brittleness, low strength, toughness and wear resistance which limit its extensive use as a restorative material in stress bearing areas.[4]

Therefore, different trials have been introduced to overcome these limitations. The incorporation of polymerizable hydrophilic resins to the conventional glass ionomer cements resulted in the development of resin-modified glass ionomer. In general, resin modified glass ionomers were reported to show better mechanical properties than conventional ones however, the polymerization shrinkage and low wear resistance constitute major drawbacks.[5]

High-viscosity or packable glass ionomer cements have been introduced showing fast setting and higher viscosity attributed to their finer glass particles, high molecular weight polyacrylic acids and high powder-to-liquid ratio. Their setting reaction is the same as that of conventional glass ionomer cements.[6]

A more recent innovation of glass ionomer was the incorporation of ceramic fillers into glass ionomer. Amalgomer CR is a ceramic reinforced posterior GIC containing 17% by weight zirconia fillers with an average particle size of 0.8 micron. The manufacturer claimed that the material possesses compressive, tensile and flexural strength close to that of amalgam. In addition, a sustained high level of fluoride release, modulus of elasticity close to that of dentin, superior aesthetics, and superior radio-opacity have also been claimed. It still retains the ability for chemical bonding to tooth structure and it has good working time. The material is also claimed to be dimensionally stable, lacks thermal conductivity and have excellent wear resistance.[7]