Effect of Different Surface Coatings on Flexure Strength and Surface Roughness of Glass Ionomer Restorations

Thesis

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By

Noha Mohamed Abd El-Kader Anany

B.D.S., Ain Shams University (2013)

Demonstrator, Operative Dentistry Department,

Ain Shams University.

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Supervisors

Prof. Dr. Hanan Abdel Aziz Niazi
Professor of Operative Dentistry,
Faculty of Dentistry, Ain Shams University

Dr. Aya Elsayed Samaha
Lecturer of Operative Dentistry,
Faculty of Dentistry, Ain Shams University

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Dedication

To my Great Mom

I stand tall because of you. I owe you everything and I would be nothing without you.

To The Soul of my Dad

I kept my word, Rest in peace and be proud of your faithful daughter.

To My Lovely brother

You have always been my backbone, my second father and my closest friend. Thanks amillion for your endless love and support.

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Introduction

Glass ionomer restorative materials (GIRM) are widely used in clinical dentistry due to their many advantageous properties, such as fluoride ion release and recharge from external sources, biocompatibility, chemical adhesion to dental tissues, coefficient of thermal expansion similar to that of the dentin and less technique sensitivity with minimal number of steps (1). These positive properties are unfortunately dwarfed by inferior mechanical and physical properties, high surface porosity and poor surface polish compared to resin-based restorative materials (2).

The main constituent of the GIRM is a basic alumino-silicate ion leachable glass powder that interacts with polymeric acid in the presence of water forming a viscous paste. This acid-base reaction results in formation of soluble salts such as calcium polyacrylates which is responsible for the immediate hardening process. These salts are gradually replaced by insoluble aluminum polyacrylate salts, leading to the maximum hardening of the restoration (3).

These restorative materials present some peculiarities that must be respected to gain the maximum benefits from their use. They are very sensitive to moisture especially in the first 24 hours. If prematurely exposed to moisture, they may lose some of their ions, which is clinically perceived as surface wear and reduced translucency (4). Also, their setting reaction is relatively slow which delays the development of their final strength (3).

The fact that GIRM are water-based and set by reaction of water-soluble ions means that they are susceptible to attack by aqueous solutions before they fully set. Therefore, it is clear that incomplete setting reactions and water contamination during the first stage of GIRM setting result in a soft, porous, and fragile cement surface vulnerable to crack formation (1). The presence of surface pores and cracks in the GIRM are considered a drawback of this material, since the previous studies reported that the

propagation of these cracks may result in internal fragility and reduced wear resistance, leading to restoration failures (5).

For these reasons many protective surface coatings were developed to protect GIRM from water contamination with the additional advantage of occluding any surface cracks or porosities commonly found in this material (3), possibly resulting in an increased wear resistance of the restorations (6). Consequently; many companies began to launch different materials recommending their use as a surface varnish for their GIRM products claiming that they will provide the highest wear resistance and hardness (7). But, for economic reasons, other alternatives showed up in the dental field. Literature has proved that some of these alternatives lack biocompatibility and therefore their use was not recommended (7). While others started to gain popularity and became trendy in the dental practice (8).

One of these popular materials is petroleum jelly which has been commonly used by clinicians as a surface coat due to its reasonable price and promising results in enhancing different mechanical properties of the GIRM restorations (9). Other practitioners chose to use different bonding systems owing to their higher retentive features compared to petroleum jelly. This drew the attention of many researchers to conduct studies aiming to test their effect on the overall mechanical and physical properties of GIRM's (9,10).

Through the continuous attempts of improving the mechanical and physical properties of glass ionomer restorations, it was found that flexure strength has a great impact on the durability of the restoration against the biological and mechanical challenges of the oral cavity (11). Literature has proved that flexure strength of GIRM increases gradually during the setting reaction and reaches its highest value when the reaction is complete, but this might be affected differently by different surface coatings (8,11).

As important; the increased surface roughness of GIRM might result in rapid stain accumulation (12), faster colonization of the surface and faster maturation of plaque, thereby increasing the risk of recurrent caries (13). It can also increase the wear rate resulting in poor optical properties of the restorations (14).

Therefore; this study was conducted to spot the light on how some materials commonly used as a GIRM surface coat affected the flexure strength and surface roughness of the glass ionomer restorations and thereby enhance their mechanical and physical properties.