Shear Bond Strength of Resin Cement to Two Modern Nano Zirconia Materials with Different Surface Treatments

Thesis

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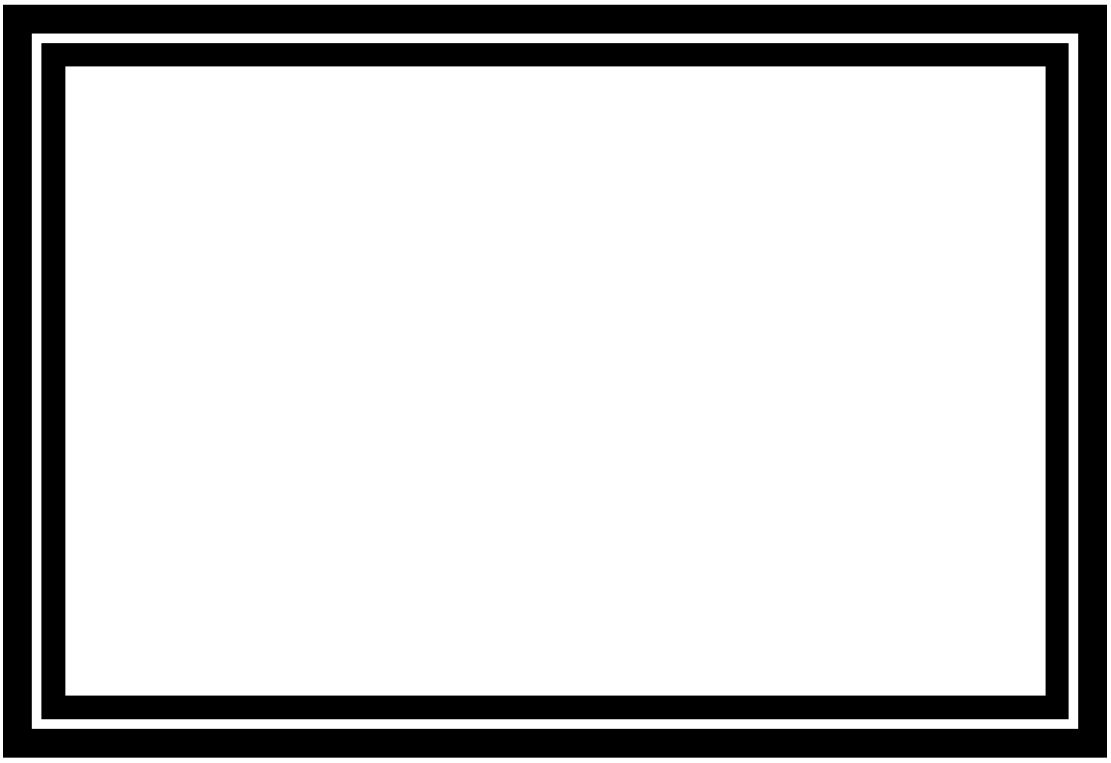

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Dedication

To my father & my mother, my best love of my life, who did care for me and gave me all kinds of kindness and to provide me all means in order to complete a master's degree.

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Introduction

For many years the most predictable and durable esthetic correction of anterior teeth has been achieved by the preparation of complete crowns. With the increase in the aluminum oxide (Al_2O_3) content of feldspathic ceramics, there has been a significant improvement in the mechanical properties of these materials, allowing metal-free restorations to be used more predictably. One of the most commonly used all-ceramic materials for conventional and resin-bonded fixed partial dentures and complete coverage crowns is yttrium tetragonal zirconia.(1)

The high mechanical properties of high content alumina and zirconia based ceramics make them attractive as potential materials for all-ceramics restorations in high stress-bearing areas. The use of Zirconia frameworks has gained popularity for long-span and extensive fixed dental prostheses. Zirconia is a densely sintered ceramic that offers chemically stable restorations with improved esthetics. Yttria stabilized tetragonal zirconia (Y-TZP) offers good mechanical properties, including high flexural strength, relatively low elastic modulus, and high fracture toughness.

Zirconia does not contain amorphous silica glass like feldspathic porcelain, leucite-reinforced ceramics, and lithium disilicate ceramics; thus, traditional ceramic surface treatments such as HF etching followed by silane application are ineffective.(2)

Internal surface treatment of dental ceramics is one of the important factors that determine the success of the ceramic restoration by increasing its retention and improving its mechanical and physical properties. The success

of the cementation process is dependent on the composition and surface texture of ceramic material and tooth texture.

Both hydrofluoric acid etching and airborne aluminum oxide particle abrasion produce irregular surfaces necessary for micromechanical bonding of the ceramics. However , zirconia and in-ceram based ceramics resist hydrofluoric acid etching and sandblasting with aluminium particles so, alternative conditioning systems were introduced .[3]

Tribochemical silica coating was introduced to embed silica particles on the ceramic surface, and thus rendering the silica-modified surface chemically reactive to the resin cements through the application of silane coupling agents. Recently laser technique which worked by delivering energy in the form of light, with very high energy density, was introduced as a way of changing surface texture and enhancing bond strength. A few studies have also been performed on the carbon dioxide laser treatment of zirconium oxide ceramics.[4]

There are several tests for assessments of bond strength of resin-based materials to dental ceramics namely shear. These test methods are based on the application of a load in order to generate stress at the adhesive joints until failure occurs.[4] Surface topography was evaluated using a surface roughness tester and scanning electron microscope.[5]

Review of Literature

Dental ceramics are appreciated as a highly esthetic restorative material with an optimal esthetic property that simulates the natural dentition appearance. Other desirable characteristics include translucency, fluorescence, chemical stability, biocompatibility, high compressive strength, and a coefficient of thermal expansion similar to tooth structure[(6)]. In spite of their many advantages, ceramics are fragile under tensile strain[(7)]. Many different ceramic systems have been introduced in recent years for all types of indirect restorations. Porcelain is a mixture of glass and crystal components.

The zirconia systems currently available for use in dentistry include ceramics with 90% or higher content zirconium dioxide, which is the yttrium, stabilized tetragonal zirconia (Y-TZP) and glass infiltrated ceramics with 35% partially stabilized zirconia.[(8)]

Zirconia based all ceramic restorations:

Zirconia ceramic material has been available for use in restorative dentistry for several years, and there has been an increased interest recently in these materials. Zirconia was introduced into dental medicine in different versions as a replacement for metal. This material possesses extraordinary properties such as high bending strength (above 1000 MPa), hardness (1200–1400 Vickers) and color of Zirconia similar to teeth and its biotechnical characteristics allow the manufacture of biocompatible, qualitatively high-grade and aesthetic tooth and implant reconstructions. Zirconia-based