Effect of Surface contamination on Bond Strength of Repair Composite to Lithium Disilicate Ceramic, Enamel and Dentin

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By

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Dedication

I wish to dedicate this work to

my Family ,

my supporting Wife,

and my Lovely Son.

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All-ceramic restorations, including inlays, onlays, veneers, all-ceramic crowns and all-ceramic bridges, have been extensively used nowadays due to the increased patient's esthetic demands [(1)]. Lithium disilicate ceramic is one of the most commonly used ceramics to fabricate veneers, inlays, onlays and crowns. The monolithic use of this ceramic has been adopted rather than the bi-layered restorations due to its higher resistance to fracture, although fracture may still occur to this type of restorations [(2)]. All-ceramic restorations are adhesively cemented to tooth structure, therefore in case of fracture or chipping it will be difficult to remove such restorations for total replacement or indirect repair without causing damage to the restoration itself or the tooth structure [(3)]. Intraoral repair of all-ceramic restoration represents a good treatment option due to the decreased chair-side time, cost and the amount of tooth structure which may be sacrificed during removal of the restoration for total replacement or indirect repair [(4)].

Resin composite has been widely used as a repair material in case of fractured all-ceramic restoration due to its good esthetics, cost and ease of manipulation [(4)]. The durability of resin composite as a repair material has two aspects; its bond strength to the ceramic material mediated by different surface treatments for the ceramic surface, and its bond strength to tooth structure mediated by different adhesive systems [(5, 6)]. Different repair methods have been used such as hydrofluoric acid etching, airborne particle abrasion, silica coating and grinding using a bur.

Meanwhile, a new family of adhesive systems has been introduced into the markets known as "multi-mode" or "universal adhesives" [(7)]. These adhesives give the dentist the opportunity to decide whether to implement the

etch-and-rinse or the self-etch approach [8-10]. Also, these universal adhesives may contain silane which enhance bonding to ceramics [11].

Although many studies have been presented to investigate the repair bond strength of composite to lithium disilicate ceramics few if any studies were directed to investigate the effect of different bonding protocols on the bond strength of resin composite to the ceramic surface after different repair protocols. Also, this study was planned to investigate the effect of different ceramic repair protocols on bond strength of the "multi-mode" or "universal" adhesives to enamel and dentin.

Ceramic Reapir:

The increasing demand for esthetic restorations has led to the popularity of using all-ceramic restorations [12]. All-ceramic restorations offer highly esthetic appearance, wear resistance, biocompatibility, and color stability [13,14]. All-ceramic restoration have always suffered from the extension and growth of microscopic surface flaws which have always been one of the major damaging mechanisms, therefore leucite, fluormica, or alumina crystals were incorporated in the glass matrix to improve the resistance of the ceramics to crack propagation leading to its reinforcement [15]. Lithium disilicate ceramics were first introduced 1998 by Ivoclar vivadent as IPS Empress II which is now called IPS e.max Press to become one of the most commonly used ceramics in the fabrication of esthetic and fracture-resistant restorations [12].

IPS Empress II, (Ivoclar Vivadent; Schaan, Liechtenstein) represented the first generation of lithium disilicate ceramics. It was fabricated in the form of glass pellets which were used in the lost wax technique, where melted glass pellets were injected under pressure to fill the mold cavity [16].The second generation was introduced (IPSe.max, Ivoclar Vivadent; Schaan, Liechtenstein) which was characterized by more homogenous and finer crystals due to its method of fabrication which was known as double nucleation based on controlling the crystallization process This modification led to an increase in the flexural strength from 330 MPa to 440 MPa [17]. IPS e.max has two forms; either IPS e.max Press for the lost wax technique or IPS e.max CAD blocks for the use with CAD/CAM milling machines.

Lithium disilicate ceramics scanning micrographs revealed closely packed, multidirectional and interlocking elongated lithium disilicate crystals