Effect of Surface Treatment Protocols on Bonding of Resin Luting Agents to Zirconia Based Ceramics

Shereen Nossair ,Tarek Salah

Abstract

Purpose: Establishing a reliable adhesive bond to zirconia-based materials is always a challenge. The purpose of this study was to
evaluate the micro-shear bond strength of conventional and self-adhesive resin cements to zirconium oxide ceramic after different
surface treatments.
Material and Methods: Yttrium stabilized zirconia ceramic plates of dimensions 10 mm width Ĭ 10 mm length Ĭ 1 mm thickness
were fabricated by a CAD/CAM process. The plates were divided into three groups according to surface treatments performed: (1) no
treatment (NT); (2) airborne-particle abrasion with 110-εm alumina particles (SB); (3) silica coating with Cojet system (CT) (3M/
ESPE, USA). Each group was then divided into two subgroups according to type of resin cement; Panavia F 2.0 (Kurary, Japan) and
RelyXUnicem (3M/ESPE, USA). Ten composite resin cylinders (0.75 - mm diameter Ĭ 0.5 - mm height) were bonded to each ceramic
plate (N = 10), and each specimen was subjected to a shear load at a crosshead speed of 0.5 mm/min until fracture occurred. The
fracture sites were examined with scanning electron microscopy (SEM) to detect the mode of failure. Data were statistically analyzed
using two-way ANOVA and multiple comparisons were made using Fisherôs test at $p < 0.05$.
Results: Micro-shear bond strength was significantly affected by the surface treatment and by the type of resin cement. Panavia F
2.0 showed higher significant results in comparison to RelyXUnicem. Surface treatment with CT was highly significant with both cements, followed by SB and then by NT. SEM examination revealed predominantly cohesive failures within the resin cements for CT
group, mixed failures within SB group and predominantly adhesive failure at the interfacial area within NT group.

Introduction

The use of high-strength zirconium oxide ceramics for oral rehabilitation has grown in recent years. It has become a material
of choice for esthetic restorations, because of its unique properties and biocompatibility. CAD/CAM technology has simplified the
fabrication of zirconia restorations. Additionally, adhesively bonded zirconia restorations, have recently surfaced as a conservative
treatment option for minimally invasive approaches. They depend
entirely on resin adhesive cementation for retention, marginal adaptation and resistance against masticatory loads [1-7].

Surface treatment is essential for bonding to ceramics. However, zirconia is resistant to hydrofluoric acid etching because of
its crystallinity and the limited glassy phase (below 1%) [7-11]. As
a consequence, other conditioning methods have been suggested.

Airborne abrasion was reported by many studies to be an effective way of increasing the surface area and producing a degree of
roughness that can lead to an acceptable resin/ceramic micromechanical interlocking [12,13].

Conclusions: The micro-shear bond strength of resin cement to partially stabilized zirconia ceramics varied significantly depending
on the type of resin luting agent and surface treatment method. The tribochemical silica coating of zirconia surfaces in combination
with MDP-containing resin cement (Panavia F 2.0) showed a superior performance.