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Fracture resistance and survival of implant-supported, zirconia-based hybrid-abutment crowns: Influence of aging and crown structure

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Abstract: Aim: The aim of the present study was to investigate fracture resistance of implant-supported zirconia-based crowns (monolayer vs bilayer) cemented to hybrid abutments. Methods: Monolayer and bilayer zirconia crowns were constructed and cemented to zirconia hybrid abutments. Crowns were divided into two subgroups: (a) untreated control group; and (b) experimental group, which underwent thermal-cycling mechanical loading in a chewing simulator. Up to 1.2 million stress cycles with simultaneous thermocycling (5 and 55?C) were applied. Samples were finally subjected to static load to fracture. Data were analyzed using one-way analysis of variance and t test. Fractured surfaces were observed using scanning electron microscopy. Results: Monolayer zirconia crowns had a 100% survival rate upon completion of the thermal mechanical loading, whereas bilayer zirconia crowns had a 50% survival rate. The fracture load of monolayer zirconia crowns was significantly higher than that of bilayer crowns. Moreover, the fracture load was significantly reduced in monolayer zirconia crowns after aging. Monolayer zirconia crowns showed bulk fracture within the monolayer, while bilayer crowns exhibited cohesive fracture within the veneering porcelain only. Conclusions: Monolayer implant-supported hybrid-abutment crowns exhibit significantly higher fracture resistance compared to bilayer crowns, making them better suited to handle higher masticatory loads encountered in the posterior region of the mouth.