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The Impact of Core/Veneer Thickness Ratio and Cyclic Loading on Fracture Resistance of Lithium Disilicate Crown

Authors:

Abstract: Abstract Purpose To investigate the effect of core/veneer thickness ratio on the fracture strength of lithium disilicate crowns subjected to cyclic loading in a simulated oral environment. Materials and Methods A typodont molar tooth received a standard complete crown preparation according to the manufacturer's instructions. Sixty lithium disilicate crowns were prepared and assigned to three groups with the following core/veneer thickness ratios A: 0.7 (0.6/0.9), B: 1.1 (0.8/0.7), and C: 2 (1.0/0.5). The cores were milled from lithium disilicate e.max CAD blocks and hand-layered using e.max Ceram. Ten specimens from each group acted as control, while the remaining ten specimens were subjected to thermal mechanical loading in a chewing simulator. All specimens were then subjected to the single load to fracture test at 1 mm/min crosshead speed. Data were analyzed using two-way ANOVA, Tukey multiple comparison test, Pearson correlation test, and quadratic regression ($p < 0.05$). Results All crowns survived fatigue testing with no signs of fractures or chipping, resulting in a 100% survival rate. The mean fracture load values for control and corresponding fatigued specimens (N) were 1075 and 987 for group A, 1548 and 1482 for group B, and 1455 and 1163 for group C. Increasing the core/veneer thickness ratio from 0.7 to 1.1 significantly increased the fracture load of the crowns; however, a further increase in the ratio up to 2 did not affect the fracture load compared to the 1.1 ratio ($p > 0.05$). The increase in core thickness significantly positively correlated with the fracture force for control specimens ($r = 0.76$; $p < 0.05$). After single load to fracture, crowns predominantly failed by bulk fracture, including the whole thickness of the crowns. Fracture modes were categorized according to fracture path and number of fractured pieces. Conclusions Crowns with a 1.1 (0.8/0.7) core/veneer thickness ratio showed the optimum fracture load among control and fa