

Influence of substructure design and spacer settings on the in vitro performance of molar zirconia crowns.

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OBJECTIVES: The aim of this study was to evaluate the in vitro behaviour of all ceramic zirconia molar crowns in regard to different core designs and marginal fit. **METHODS:** Identically shaped methacrylate molars were prepared according to ceramic restoration directives resulting in a 1mm deep circular shoulder preparation. They were embedded in polymethylmethacrylate resin after covering their roots with a polyether layer to simulate periodontal mobility. The crown cores were made of yttria-stabilized zirconia veneered with a corresponding veneering ceramic. The crowns were divided into 5 groups (n=8) which differed in core design and cement gap thickness: #1: simple core, 40µm cement; #2: core with minimal occlusal support, 40µm cement; #3: core with optimized cusp support, 40µm cement; #4: core with optimized cusp support, 30µm cement; #5: core with optimized cusp support, 10µm cement. All crowns were cemented with zinc oxide phosphate cement and thermo mechanically loaded (1.2x10⁶x50N; 6000x5 degrees C/55 degrees C) with identical metal ceramic restorations as antagonists. Crown failures were monitored and described. Area and direction of the chipping failures of the veneering ceramic were documented by means of scanning electron micrographs. **RESULTS:** All core designs showed chipping during chewing simulation with different numbers (defect areas). #1: 6 chippings (8.1mm²); #2: 2 chippings (3.5mm²); #3: 2 chippings (2.1mm²); #4: 3 chippings (5.7mm²); #5: 3 chippings (7.3mm²). **CONCLUSIONS:** An optimized core design reduced number and surface area of occurring chippings. A variation of the gap thickness showed no significant influence on the in-vitro performance.