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In vitro Simulation of Periodontal Ligament in Fatigue Testing of Dental Crowns

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Abstract: Objective Fatigue testing of restorative material has been appreciated as an appropriate method to evaluate dental restorations. This study aims to investigate the influence of periodontal ligament (PDL) simulation on fatigue and fracture tests results of zirconia crowns. Materials and Methods A standard tooth preparation for all ceramic zirconia crown was made on a typodont mandibular molar. The prepared master die was duplicated using epoxy resin to produce 40 replicas. PDL simulation was made by surrounding the root of 20 dies with a 0.3-mm thick silicon layer. The other 20 specimens had no PDL simulation. Zirconia crowns were fabricated using computer-aided design/computer- aided manufacturing technology and cemented to the epoxy resin dies. Ten crowns from each group were subject to chewing simulation with simultaneous thermocycling (5?55?C). All specimens were then loaded until failure in universal testing machine. Statistical Analysis Statistical analysis was conducted using SPSS software. Shapiro? Wilk test confirmed the normal distribution of data. Descriptive statistic was performed and differences between the groups were analyzed using paired samples t -test. Results All fatigued crowns survived chewing simulation; no failure was observed after finishing simulation. The highest mean fracture load recorded was 3,987 ? 400 N for the no fatigue/no periodontal simulation group. Comparing the mean fracture load of the two groups with periodontal simulation and the two groups with no periodontal simulation showed no statistically significant difference ($p > 0.5$). Conclusion Considering the testing set-up applied in this study, simulating PDL using resilient materials does not affect the in vitro survival and fracture resistance of zirconia crowns.