

# Effect of different pattern construction techniques on the marginal adaptation, internal fit and fracture resistance of IPS-emax press crowns

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## Abstract

**Purpose:** The purpose of this study was to evaluate the effect of pattern construction technique on the marginal accuracy, internal fitness and fracture resistance of E-max crowns.

**Materials and methods:** Thirty caries-free human maxillary first premolars were selected, cleaned by scaling, and stored in 0.9% standardized saline solution at room temperature. Using an industrial lathe machine, the teeth were prepared to receive all ceramic crowns with standardized dimensions of 6 degrees angle of convergence. The preparation had 5mm occluso-cervical height, 6mm cervical diameter and 1 mm deep chamfer finish line. The prepared teeth were divided into three groups (n=10) according to the pattern fabrication techniques used: Group1: Conventional wax patterns. Group2: CAD/CAM wax patterns. Group3: 3D Printing of resin patterns. All patterns were invested to construct E-max crowns. The ceramic crowns were seated on their corresponding prepared teeth and the vertical marginal gap was measured with a binocular microscope (90X). Then internal gap of each ceramic crown was measured using the silicone replica technique. After cementation, each ceramic crown was statically, compressively and axially loaded until fracture at a cross head speed of 1 mm/min using a steel rod placed centrally at the occlusal surface of the crowns to evaluate the fracture resistance of the crowns.

**Results:** Group 1 showed the largest marginal gap mean (796.47  $\mu$ m) followed by group 2; (962.85  $\mu$ m) and then group3 (857.03  $\mu$ m). These differences were statistically significant among the groups. The results of internal gap distances in group 1 (334.90  $\mu$ m) followed by group 2 (322.70  $\mu$ m) and then group3 (407.2  $\mu$ m), the differences between the groups were statistically significant. The mean fracture resistance values of groups 1, 2 and 3 were 728.90  $\pm$  47.52N, 322.30  $\pm$  69.28N and 363.40  $\pm$  40.4N respectively. Post hoc test revealed that the differences between groups 1 and 2 as well as between groups 2 and 3 were statistically insignificant; however, the difference between groups 1 and 3 was statistically significant. Spearman's rank correlation coefficient showed value of -0.781. The negative sign indicates that the fracture resistance of the samples decreased as the internal gaps increased.

**Conclusions:** The 3D printed pattern resulted in an E-max crown with better marginal adaptation and internal fitness. The fracture resistance of E-max crown was improved as its internal adaptation was enhanced.

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