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In-Vitro Comparison Of Loads To Fracture Monolithic Zirconia Anatomical Contour Crown Restorations With Variations Of Marginal Thickness

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Purpose:

To investigate and compare the loads required to fracture monolithic zirconia anatomical contour crown restorations with variations of marginal thickness.

Materials and Methods:

A mandibular first molar typodont was sequentially prepared to receive a monolithic zirconia anatomical contour crown restoration but with three different finish line depths; feather-edge (FE: 0.3mm); chamfer (Ch: 0.5mm); deep chamfer (DCh: 1mm) and duplicated in type IV gypsum die stone to form three master stone dies. The master stone dies were then scanned to construct tooth-form analogues made from Tufnol 10G/40 to receive four variations of zirconia anatomical crowns (n=80). Test groups of zirconia anatomical crowns exhibiting the different marginal thicknesses comprised of deep chamfer (DCh: 1mm), chamfer (Ch: 0.5mm), feather-edge (FE: 0.4mm) and feather-edge adjusted (FEAd: 0.3mm). The crowns were cemented to their corresponding tooth-form analogues using resin-modified glass-ionomer cement and after 24 hours subjected to load testing in a Dartec servo-hydraulic machine at a crosshead speed of 0.5mm/min until fracture occurred. A one-way analysis of variance was used to analyse the data and post-hoc multiple comparisons tests were applied to ascertain where the differences existed at a $P=0.05$ significance level.

Results:

The mean (\pm standard deviation) fracture loads were 2419.75N (\pm 401.44N), 2352.30N (\pm 348.57N), 2947.65N (\pm 554.83N) and 2530.05N (\pm 528.72N) for the DCh, Ch, FE and FEAd groups respectively. One-way analysis of variance showed significant differences between the test groups and post-hoc multiple comparisons demonstrated a significantly greater failure load between the FE group and the DCh ($P=0.004$), Ch($P=0.001$) and FEAd ($P=0.036$) groups. There were no significant statistical differences found between the DCh, Ch and FEAd groups ($P>0.999$).

Conclusion:

The load to fracture monolithic zirconia anatomical contour crown restorations regardless of marginal thickness exceeded clinically exerted forces.