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## **Fracture strength of three-unit fixed partial denture cores (Y-TZP) with different connector dimension and design.**

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### **Abstract**

True crystalline ceramic materials presently used in restorative dentistry are Al<sub>2</sub>O<sub>3</sub> (alumina) and yttrium-oxide stabilised tetragonal polycrystalline zirconium-dioxide (Y-TZP). To ensure optimal clinical performance, the dimensions of the Fixed Partial Denture (FPD) framework in general and of the connectors in particular, must be adequate. Considered recommendations for connector dimensions for Y-TZP FPDs vary from 2 to 4 mm in occluso-gingival height and 2 to 4 mm in bucco-lingual width. In order to reduce the fracture probability when designing all-ceramic FPDs, the shape of the connector is an important factor to consider. The radius of curvature at the gingival embrasure plays a significant role in the load-bearing capacity. FPDs with small gingival embrasure radii are subjected to high stress concentrations in the connector area during loading, compared to FPDs with large embrasure radii. The aim of this in-vitro study was to investigate how different radii of curvature in the embrasure of the connector area and different connector dimensions could affect the fracture resistance of 3-unit all-ceramic FPDs made of Y-TZP. Forty-eight FPDs in 6 groups of 8 FPDs with different connector design were produced in Procera Zirconia Bridge material. The FPD cores were subjected to heat treatment to simulate veneering. Following cementation, the FPDs were firstly thermocycled for 5,000 cycles, then preloaded for 10,000 cycles and finally loaded to fracture. All the FPDs fractured in the connector area. All the crack propagation which led to fracture started at the gingival embrasure of the connector. Within the limitations of this in-vitro study, the recommended minimum dimension of an anterior 3-unit all-ceramic FPD of Y-TZP is 3 mm in incisal-cervical direction and 2 mm in buccal-lingual direction. By increasing the radius of the gingival embrasure from 0.6 to 0.9 mm, the fracture strength for a Y-TZP FPD with connector dimension 3 x 3 mm increases by 20%.