Fracture Strength of Zirconia Posterior Fixed Partial Dentures.

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 # 110

Introduction:

The use of high strength hot isostatic pressed (hip) or partly stabilised zirconia ceramics in combination with computer aided manufacturing (CAM) allows to enlarge the indication of all-ceramics to replace posterior teeth and fabricate tooth-coloured restorations. The concepts reach from manufacturing "green" or "white", pre-sintered ceramics (Cercon, Degussa-Dental; Lava, 3M Espe) to the milling of high strength hipped zirconia (Digizon, Girrbach). All systems use CAM, but modelling may follow a different philosophy, such as scanning a wax-up (Cercon) or computer aided design (CAD- Lava, Digizon). The aim of this in-vitro study was to determine the fracture strength of tooth colored zirconia fixed partial dentures (FPDs) with a different kind of cementation.

Materials and methods:

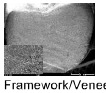
96 human molars were inserted in PMMA resin to create three-unit (10mm) oral situation. The roots of the teeth were covered with an about 1mm thick layer of polyether to simulate the periodontium. Human antagonists were used and antagonist/totth relation was adjusted in the dental articulator (Girrbach, G). 2x8 bridges of each series were made of the zirkonia materials and fixed with an adhesive bonding system (Syntac classic/Variolink2; Ivoclar-Vivadent, FL) and recommended conventional cementation.

A.) Digizon/GC Initial (Fuji Plus, Girrbach, G),
B.) Lava/Lava Ceram (Ketac Cem, 3M Espe, G) and
C.) Cercon/Cercon Ceram S (Harvard, DeguDent, G).

Cercon/Cercon Ceram S (DeguDent, G).

Digizon/GC Initial (Girrbach, G)

Lava/Lava Ceram (3M Espe, G)



Framework/Veneering ex.: Cercon

48 three-unit FPDs

adhesive bonding 3x8 FPDs

conventional cementation 3x8 FPDs

thermal cycling and mechanical loading (6000 thermal cycles/1.2x10⁶ mastication cycles)

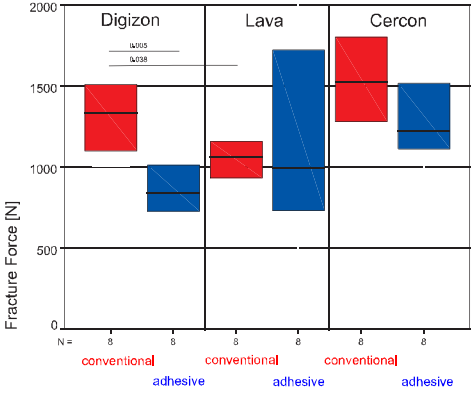
fracture test

Testing design includes: simulation of periodontium, tooth bonding to dentine or enamel, human antagonist, Youngs-modulus of tooth tissue

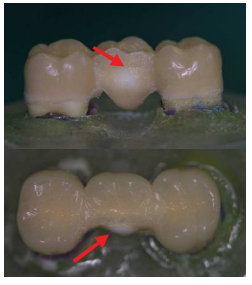
After thermal cycling and mechanical loading (TCML; 1.2x10⁶ mastication cycles [50N]) and 6000 thermal cycles [5°C/55°C] fracture strengths (UTM 1446; Zwick; v=1mm/min) of 8 FPDs of each series were determined.

Statistical analysis was performed with the Mann-Whitney U-test (p=0.05).

Results:



Fracture of the veneering



Fracture of the core

Failure design after fracture test, example

fracture force [N]	Digizon		Lava		Cercon	
Cementation :	Fuji Plus	Variolink	Ketac Cem	Variolink	Harvard	Variolink
median	1332	843	1062	992	1525	1227
25 % percentile	1131	738	941	815	1323	1115
75 % percentile	1474	945	1146	1596	1802	1467

Conclusion:

There were no statistical differences between the different zirconia FPDs with conventional cementation. All FPDs showed lower fracture results with adhesive bonding, but only for Digizon the difference was statistically significant. The fracture forces of all zirconia FPDs were at a level where clinical application in posterior areas seems promising.