

Introduction:

The aim of this study was to test whether the design or the fit of a zirconia core have a significant influence on the chipping of ceramic veneering.

Materials and methods:

The roots of PMMA molars (Morita, 46, G) were coated with a 1mm thick layer of polyether material (Impregum, 3M Espe, G) for simulating the human periodontium. All teeth were prepared using a 1mm deep circular shoulder.

Five series of molar copings (n=8) of the yttria-stabilized zirconia (Cercon Base; DeguDent, G) were fabricated.

The cores differed in design and thickness (group 1-3) as well as in crown fit (groups 3-5). The thickness of core plus veneering (Cercon Ceram Kiss) was 2.5 ± 0.1 mm.

All crowns were cemented using ZnO-Ph-cement (Harvard, Hoffman&Richter, G). Identical antagonists were used (CoCr-alloy; Wirobond LFC, Bego, G/ veneered with ceramic Duceram Kiss, Degudent, G). Thermal cycling and mechanical loading (TCML) was performed for aging (1,200,000 mechanical loadings [ML] x 50N and 6000 thermal cycles [TC] -2min between 5°C and 55° C).

During TCML appearing failures (chipping, fracture, etc.) were reported. Crowns with failures were excluded from further simulation process and investigated. The type of crown failure was analyzed in detail by means of a scanning electron microscopy (SEM; Quanta; FEI-Philips, Eindhoven, NL).

Statistics: One-way ANOVA ($\alpha=0.05$).

Group	Core design	Core Thickness [mm]	Spacer area [%]	Cement Gap [μ m]
1	Simple	0.5	90	40
2	Modified minimal occlusal support Small cusp support	0.6-0.8	90	40
3	Optimized	0.7-1.3	90	40
4	Optimized occlusal support		80	30
5	Optimized cuspdesign		70	10

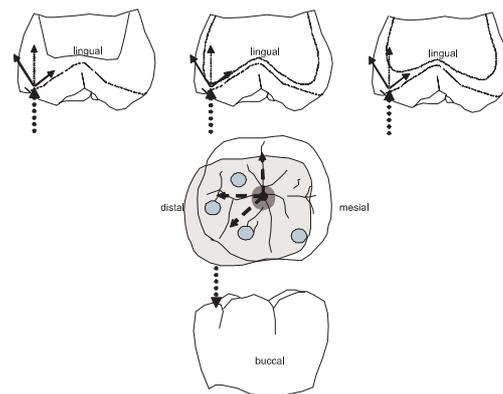


Table 1: Description of examination groups and specimen scheme

Figure 1: Explanation of chipping origin/cause/surface area

Results:

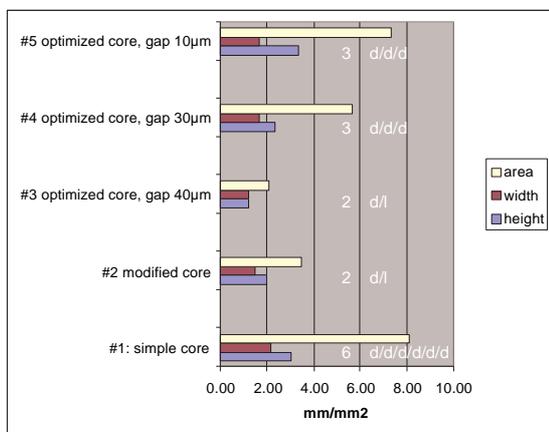


Figure 2: Failure description: number, location and size of chipping areas
d = distal; l = lingual

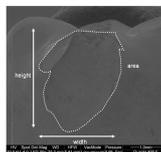


Figure 3: Overview scanning electron micrograph: marked surface (width, height) of chipping area

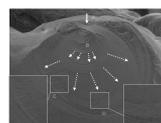


Figure 4: Detail scanning electron micrograph:
A = point of origin;
B = crack propagation;
C = wake hackles;
D = arrest lines

Discussion:

All results showed that both, amount and size of chipping was dependent on the design of the core: the better the support of the veneering ceramic, the lower the chipping rates.