Restoring Severely Compromised Anterior Teeth with Zirconia Crowns and Feather-Edged Margin Preparations: A 3-Year Follow-up of a Prospective Clinical Trial

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This prospective clinical trial sought to evaluate the 3-year clinical results of anterior teeth restored with 0.3-mm-thick zirconia copings and feather-edged marginal preparations. Ten patients received 19 single-tooth restorations in the anterior maxilla to restore severely decayed teeth. After a mean observation period of 39.2 months, no material fracture occured and all crowns had acceptable surfaces. A survival and success rate of 100% was recorded, which suggests that the clinical method may be a reliable treatment modality for restoring severely compromised anterior teeth. *Int J Prosthodont 2010;23:107–109.*

The increased demand for all-ceramic restorations may be attributed to their excellent biocompatibility and enhanced esthetics. Regrettably, however, scientifically robust and long-term treatment outcome studies are lacking.

The aim of this pilot prospective clinical study was to assess the medium-term clinical efficacy of anterior all-ceramic crowns with reduced dimensional thickness in the marginal area associated with a feather-edged preparation design.

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Materials and Methods

This prospective clinical investigation was approved by the university ethics committee (no. 3061) and was conducted at Dental Clinic 2-Department of Prosthodontics, Friedrich-Alexander-University Erlangen-Nuremberg, Germany.

A total of 19 crowns were placed in 10 consecutively selected patients (6 women, 4 men; mean age: 42.1 years) who presented with severely morphologically compromised maxillary teeth. The study sample included 9 central and 10 lateral incisors.

Eight of these teeth were vital while the remaining 11 required zirconium dioxide posts (Cerapost, Brasseler) and core buildups (Clearfil Core, Kuraray), which were made by one experienced clinician (Figs 1 and 2). Adhesion was achieved via ED Primer (Panavia 21, Kuraray). Preparation with a feather-edged finish line was chosen for all abutment teeth because of a severe loss of the tooth structure. Yttria-stabilized zirconium dioxide crown copings were fabricated using the Lava computer-aided design/computer-assisted manufacturing system (3M ESPE) to a marginal wall thickness of 0.3 mm, which gradually increased in the incisal area to 0.5 mm, and a conventional core design. Veneering was performed without further surface treatment of the zirconia ceramic by one dental technician (Lava Ceram, 3M ESPE).

Fig 1 Severe loss of the dental hard tissue.

Fig 2 Preparation of the post and core buildup.

Table 1 Surface, Color, Anatomical Form, and Margin Integrity Scores After a Mean Observation Period of 39.2 Months (n = 17)[1]

	Suface n (%)	Color n (%)	Anatomical form n (%)	Margin integrity n (%)
Adequate				
Excellent (Romeo)	14 (82%)	13 (76%)	17 (100%)	15 (88%)
Acceptable (Sierra)	3 (18%)	4 (24%)	0 (0%)	2 (12%)
Insufficient				
Reparable (Tango)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Irreparable (Victor)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Fig 3 Restored maxillary right lateral incisor 48 months after cementation.

Following cementation (Ketac-Cem, 3M ESPE), two dentists, neither of whom were involved in the restorative treatment protocol, examined the patients independently at baseline and at annual follow-up visits for technical and biologic complications according to the California Dental Association quality evaluation criteria.[1] Further periodontal parameters and Plaque Index scores were assessed.

Data analysis consisted of descriptive statistics and the Wilcoxon rank sum and McNemar tests.

Results

From 2003 to 2005, 10 patients had their anterior maxillary teeth restored with a total of 19 zirconia copings. One patient dropped out after the 12-month follow-up due to personal reasons. By then, the two restorations in that patient had been rated as excellent. With regard to the clinical fracture resistance of the core and veneering ceramic after a mean observation period of 39.2 months, the success and survival rates were 100% (Table 1, Figs 3 and 4). In one patient, minor chipping of the veneering ceramic was recorded at the incisal edge. Two further restorations were rated as Sierra after 36 months because of a slightly rough surface. Gingival bleeding on probing was reported more often for restored teeth than for control teeth at recall visits ($.22 \leq P \leq .55$). Differences in Plaque Index scores were statistically significant at 36 months, in favor of the restored teeth ($P = .01$).

Discussion

Despite the reduced coping thickness in the marginal area and the feather-edged preparation design, the recorded results compare favorably with published reports for crowns with an aluminum oxide ceramic core and chamfer finish line after medium-term service.[2] An

Figs 4a and 4b **(a)** Preparation and **(b)** baseline photographs of a vitally restored maxillary right central incisor.

Fig 4c Regenerated papilla observed at the 36-month follow-up.

in vitro investigation also assessed a reduced coping thickness layer of 0.3 mm and feather-edged preparation design and found higher failure loads for 0.3-mm copings compared with copings of 0.5-mm thickness on chamfer finish lines.[3] One minor chipping of the veneering ceramic was recorded, and other authors have reported only a few minor chips on anterior crowns with alumina oxide cores.[4]

The higher Plaque Index scores observed for control teeth is in accordance with previous clinical findings of lower plaque adhesion to ceramic compared to enamel.[5]

Conclusion

This preliminary study's limitations of a small sample size and medium-term observation preclude definitive conclusions. However, it appears that zirconia copings with a marginal wall thickness of 0.3 mm and manufactured for a feather-edged preparation design provide sufficient mechanical stability in the maxillary anterior region.

References

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