Short Communication

Clinical Evaluation of All-Ceramic Posterior Three-Unit FDPs Made of In-Ceram Zirconia

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This prospective study evaluated the clinical outcome of three-unit posterior fixed dental prostheses (FDPs) made of In-Ceram Zirconia. All 65 FDPs were inserted at the Department of Prosthodontics, School of Dentistry, Kiel, Germany, and cemented with glass-ionomer cement. Follow-ups were performed annually. During a mean observation time of 54.4 months, two FDPs failed (one technical and one biologic failure). Two FDPs debonded and the veneering ceramic fractured in four cases. Three abutment teeth needed endodontic treatment and two additional abutment teeth exhibited secondary caries. Results suggest that posterior three-unit all-ceramic FDPs made from In-Ceram Zirconia may be a viable prosthetic treatment option with an outcome comparable to metal-ceramic FDPs. *Int J Prosthodont 2009;22:490–492.*

In-Ceram Zirconia (Vita) is a glass-infiltrated alumina ceramic reinforced with 33% cerium oxide–stabilized zirconium oxide. Based on its flexural strength of more than 500 MPa, the manufacturer recommends cementation with conventional cements.

The aim of the present study was to evaluate the clinical outcome of posterior crown-retained fixed-to-fixed three-unit fixed dental prostheses (FDPs) fabricated from In-Ceram Zirconia. The null hypothesis was that the survival rate of these FDPs does not differ from those calculated in a meta-analysis for metal-ceramic FDPs.[1]

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Materials and Methods

Sixty-five FDPs were inserted into 58 patients (36 women, 22 men; mean age: 46.8 ± 12.7 years). FDPs were used to replace either a second premolar (n = 12) or first molar (n = 53). According to the manufacturer's instructions, the proximal connector size was 12 or 16 mm^2 for the premolar and molar, respectively. Despite these connector dimensions, accessibility of interdental brushes for oral hygiene could be ensured. The minimum abutment height was 3 mm and was prepared with a 1.0-mm-wide rounded shoulder or chamfer and a tapering angle of about 12 degrees. All restorations were constructed as three-unit FDPs. No cantilever FDPs were included. Frameworks were produced using the Cerec 3 computer-aided design/computer-assisted manufacture system (Sirona). The minimal framework thickness was 1.0 mm occlusally and 0.7 mm at the vertical crown walls. All FDPs were cemented with glass-ionomer cement after air-abrading the inner retention surfaces with 50-μm alumina particles at a pressure of 0.25 MPa. During annual follow-ups, technical and biologic complications were evaluated. Cumulative survival rates were calculated using the Kaplan-Meier nonparametric method. Descriptive statistics were used for evaluation of the clinical outcome.

Table 1 Descriptive Analysis of Total Failures and Complications

Patient and category	Sex	Age (y)	Replaced tooth*	Time to failure (mo)	Failure mode	Clinician†
1- Lost	F	60	36	24	t- Fracture of the distal connector at tooth 37, FDP replaced	1/36/9
2- Lost	M	56	46	30	b- Caries at tooth 47, FDP removed	15/2/4
3- Partial success	F	37	36	28	t- Loss of retention at tooth 37, no retention loss at tooth 35, recemented, still in situ at 41.2 mo	4/19/6
4- Partial success	F	37	35	51	t- Loss of retention at tooth 36, no retention loss at tooth 34, recemented at last follow-up	1/36/9
5- Partial success	M	63	36	8	t- Chipping at tooth 36, in need of repair	9/46/4
6- Partial success	M	66	35	33	t- Repair of tooth 34 after chipping, still in situ at 57.6 mo	9/46/4
7- Partial success	M	41	16	39	t- Chipping at tooth 17, in need of repair	16/41/5
8- Partial success	F	52	46	66	t- Chipping at tooth 45, in need of repair	18/49/1
9- Partial success	F	32	36	21	b- Endo of tooth 37, still in situ at 41.2 mo	4/19/6
10- Partial success	F	41	46	23	b- Endo of teeth 45 and 47, still in situ at 56.3 mo	19/61/3
11- Partial success	F	36	36	34	b- Caries at the buccal part of tooth 35, still in situ at 43.9 mo	11/16/5
12- Partial success	M	65	36	50	b- Caries at the buccal part of tooth 37 at last follow-up	1/36/9

M = male; F = female; t = technical; b = biologic; endo = endodontic treatment.
*FDI tooth-numbering system.
†Identification number of the clinician, his or her vocational experience (in mo), and total number of restorations performed in the study.

Fig 1 *(left)* An FDP that fractured at the distal connector after 24 months in service (patient 1 in Table 1). Pieces of the veneering ceramic are missing.

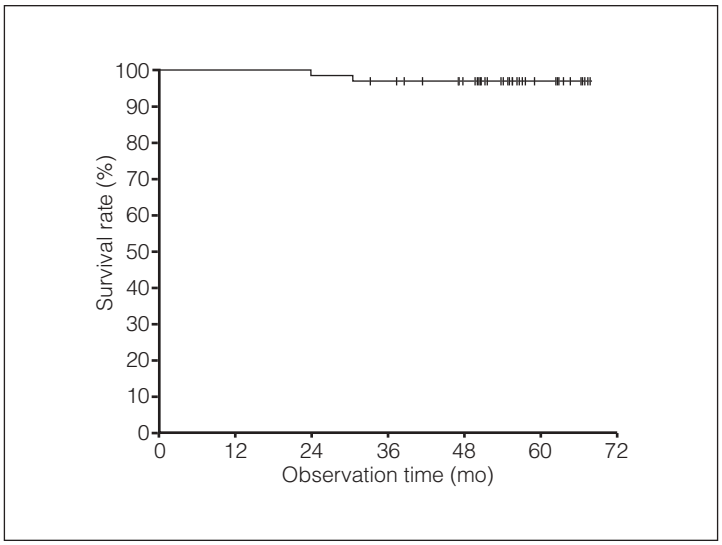

Fig 2 Kaplan-Meier analysis demonstrating the cumulative survival for FDPs regarding loss as a total failure.

Results

The mean observation time was 54.4 months (range: 24.0 to 67.5 months). One patient did not appear for the follow-up examinations and the corresponding data were censored. Complications were assigned as either technical or biologic.[2] All types of complications that did not impair the function of the restoration were defined as a partial success.

Table 1 gives detailed information about lost restorations (total failure) and complications (partial success) that occurred. One FDP fractured at the distal connector (Fig 1) and one FDP had to be removed due to caries. The Kaplan-Meier analysis demonstrates the cumulative survival of the FDPs (Fig 2). The calculated survival rate of the FDPs after 60 months was 96.8%.

Fig 3 Example of an FDP where the veneering ceramic fractured after 33 months in service and the framework was exposed (patient 6 in Table 1). The FDP was repaired with a resin-bonded glass-ceramic veneer.

Overall, 10 (15.6%) biologic and technical complications occurred, which did not result in the loss of any restoration. In 2 cases (3.1%), loss of retention occurred and the FDPs were recemented. In 4 cases (6.3%), fracture of the veneering ceramic occurred. The framework surface was exposed in all cases (Fig 3). In 2 cases (3.1%), endodontic treatment was necessary. Secondary caries were detected in 2 additional cases.

Discussion

Relating to the loss of a restoration, a recent systematic review[1] comparing all-ceramic and metal-ceramic FDPs assessed a 5-year survival rate of 88.6% for all-ceramic FDPs, compared to 94.4% for metal-ceramic FDPs. Therefore, the calculated 5-year survival rate of 96.8% in this study is compatible with that of metal-ceramic FDPs. Regarding total failure of the framework, the results show that the replacement of single posterior teeth with In-Ceram Zirconia FDPs involves no significant risks.

Four FDPs (6.3%) showed a fracture of the veneering ceramic with the framework material exposed, which required repair. None of them, however, impaired the function of the FDPs. Unfortunately, chipping or fracture of the veneering ceramic was not reported or evaluated in any of the studies regarding In-Ceram FDPs.[3–5] Therefore, no comparison with the current data was possible. Missing support of the veneering ceramic by the framework could explain the fracture of the veneering ceramic in these cases.[1] The rate of complications such as caries (3.1%), debonding (3.1%), and loss of vitality (2.3%) in the current study is comparable to other data.[1]

Conclusion

Three-unit fixed-to-fixed dental prostheses made of In-Ceram Zirconia using the Cerec 3 computer-aided design/computer-assisted manufacture system seem to present a viable treatment alternative for all-ceramic posterior FDPs.

References

1. Sailer I, Pjetursson BE, Zwahlen M, Hämmerle CHF. A systematic review of the survival and complication rates of all-ceramic and metal-ceramic reconstructions after an observation period of at least 3 years. Part II: Fixed dental prostheses. Clin Oral Implants Res 2007;18(suppl 3):86–96.
2. Strub JR, Stiffler S, Schärer P. Causes of failure following oral rehabilitation: Biological versus technical factors. Quintessence Int 1988;19:215–222.
3. Olsson KG, Fürst B, Andersson B, Carlsson GE. A long-term retrospective and clinical follow-up study of In-Ceram Alumina FPDs. Int J Prosthodont 2003;16:150–156.
4. Suárez MJ, Lozano JF, Paz Salido M, Martínez F. Three-year clinical evaluation of In-Ceram Zirconia posterior FPDs. Int J Prosthodont 2004;17:35–38.
5. Vult von Steyern P, Jönsson O, Nilner K. Five-year evaluation of posterior all-ceramic three-unit (In-Ceram) FPDs. Int J Prosthodont 2001;14:379–384.