Five-Year Clinical Evaluation of All-Ceramic Posterior FDPs Made of In-Ceram Zirconia

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The aim of this prospective study was to evaluate the clinical outcomes of three- and four-unit posterior fixed dental prostheses (FDPs) made of In-Ceram Zirconia. Twenty FDPs were inserted in 15 patients. Over a mean observation period of 74.6 months, the survival rate was 85%. Sixty-five percent of cases did not allow for connector dimensions that met the manufacturer's recommendations without the use of surgical procedures (eg, crown lengthening). Posterior all-ceramic FDPs made of In-Ceram Zirconia appear to be a viable prosthetic treatment option to replace a missing tooth. *Int J Prosthodont 2012;25:622–624.*

In-Ceram Zirconia (Vita Zahnfabrik) is a glass-infiltrated alumina ceramic. Compared to In-Ceram Alumina, approximately one-third of the aluminum oxide is replaced by zirconium oxide, resulting in a significant increase in fracture toughness und flexural strength.[1] The aim of this study was to evaluate the clinical outcomes of posterior three- and four-unit fixed dental prostheses (FDPs) with a framework made using In-Ceram Zirconia. The null hypothesis was that the survival rate of In-Ceram Zirconia FDPs would be comparable to that of porcelain-fused-to-metal (PFM) restorations.

Materials and Methods

Fifteen patients (8 women, 7 men; mean age: 39.5 ± 12.7 years) were treated with 20 end-to-end FDPs replacing a first molar (n = 14), first premolar (n = 1), or second premolar (n = 5). All abutment teeth for the 17 three-unit and 3 four-unit FDPs were prepared with a 0.8- to 1.0-mm-wide chamfer, occlusal reduction of 1.5 to 2.0 mm, and tapering angle of approximately 10 to 12 degrees. All FDPs were cemented using zinc phosphate cement (Harvard Cement, Harvard Dental). Frameworks were produced using the DENTform Software and DCS Precident System (Bien-Air Dental). Along with the connector dimensions (height/width), other common parameters (eg, vitality of abutment teeth, core build-up material) were documented before cementation. All follow-up examinations were conducted by one experienced clinician and included commonly used parameters (secondary caries, Gingival Index, probing depth, etc). Events were divided into either biologic and technical complications, meaning the FDP could remain in situ, or biologic and technical failures, which required removal of the FDP. Biologic complications comprised secondary caries, loss of vitality/endodontic complication, and fracture of abutment teeth. Technical complications included chipping of the veneering ceramic and loss of retention.

The statistical analysis included cumulative survival rates using the Kaplan-Meier nonparametric method and descriptive statistics for evaluation of the clinical outcome. For calculation of the survival rate, only framework fracture was defined as failure. Biologic failures (n = 1) were not considered in the statistical analysis.

Results

Over a mean observation period of 74.6 months (range: 24 to 101 months), three technical complications and four failures were detected. All complications involved chipping of the veneering ceramic, which did not gravely impair the function of the FDP. The chipped areas were either polished or repaired intraorally with composite resin. No biologic complications arose. In three cases, framework fractures occurred after 30, 54, and 66 months and were considered as failures

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Fig 1 Fracture of the veneering ceramic with framework exposure after 47 months.

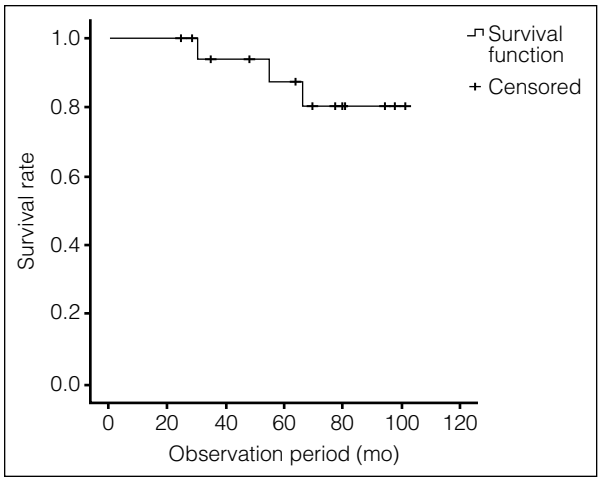

Fig 2 Kaplan-Meier survival rate regarding framework fractures.

Table 1 No. of FDPs Meeting the Manufacturer's Recommended Connector Dimensions at 0% and 10% Tolerance

	Below recommendation			
	Height and width	Height	Width	Met recommendation
0% tolerance	4	4	5	7
10% tolerance	1	5	4	10

since they required renewal of the restoration (Fig 1). All fractured frameworks replaced a first molar, and the connector dimensions were 6.7% to 28.9% below the manufacturer's recommendation. In one case, an endodontic problem resulted in the partial removal of the FDP.

In 7 of 20 cases, the manufacturer's recommendations regarding height and width of the connector could be met. Depending on the span width, the connector size should range from 9 to 25 mm^2. For the 13 restorations that could not meet this recommendation, the mean deviation was 13.5% (Table 1).

Kaplan-Meier analysis showed a cumulative survival rate of 90% after 5 years and 85% after 6 years (Fig 2). The statistical analysis of the other clinical parameters revealed no significant results.

Discussion

In terms of the survival rate, only technical failures were considered since the main focus of this research was framework stability. From a historical point of view, In-Ceram Zirconia represents an intermediate step between glass-infiltrated oxide ceramics and zirconia frameworks. Since the flexural strength of this material is inferior to that of frameworks made using zirconia, the manufacturer's recommend connector dimensions up to 25 mm^2, which can often only be achieved using surgical measures such as crown lengthening. This additional operation may lead to the patient refusing treatment. To evaluate the clinical performance under realistic conditions, all FDPs were cemented even if the dimensions of the connector were below the manufacturer's recommendation. Regardless of the connector dimensions, it should be noted that In-Ceram Zirconia is very susceptible to subcritical crack propagation when exposed to wet environments.

A comparable study reported an estimated survival rate of 96.8% for In-Ceram Zirconia, which is slightly better than the results of the present trial.[2] However, the calculated survival rate of 90% after 5 years found in this study is comparable to that of PFM restorations (93.8%) and high-strength zirconia-based restorations (94.3%).[3,4]

Compared to the chipping rate of 6.3% described by Eschbach et al,[2] the present study found a higher chipping rate of 15%. However, Schley et al[4] calculated

a 5-year chipping-free rate of 79.44% (95% confident interval: 44.28% to 93.44%) for zirconia-based FDPs. Sailer et al[5] reported a 2.9% chipping rate for metal-ceramic FDPs after 5 years and further stated that none of the published studies using In-Ceram FDPs reported on chipping of the veneering ceramic.

Conclusion

With survival rates comparable to those of PFM restorations, In-Ceram Zirconia FDPs provide an additional treatment option for the replacement of lost teeth; however, it can be difficult to achieve the recommended connector dimensions under normal clinical conditions. Oxide ceramics offer outstanding mechanical properties with smaller connector dimensions and similar esthetic results. The potential advantages of In-Ceram Zirconia frameworks include reduced chipping rates, reduced costs, and superior esthetic results.

References

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Literature Abstract

Do perioperative antibiotics decrease implant failure?

A literature review on the use of antibiotics in implant therapy was done to investigate the likelihood of implant failure in patients receiving perioperative antibiotic therapy. Eight studies were reviewed in which the antibiotic regimen was categorized into three groups: *(1)* a single preoperative dose, *(2)* single preoperative dose and multiday postoperative therapy, and *(3)* no antibiotic therapy. A single preoperative antibiotic dose showed a 1.3% to 2.0% reduction in implant failure when compared with no antibiotic therapy. Comparing pre- and postoperative antibiotic therapy and no antibiotic therapy, a 4.2% decrease to a 1.1% increase in implant failure was seen. Postoperative infection was found to range from 0.6% to 3.0% when no antibiotics were used and 0.6% to 1.0% when antibiotics were used. Overall, the absolute risk reduction of using perioperative antibiotics ranged from 1.3% to 5.4%. From studies reviewed, there is evidence to suggest that a single preoperative dose of antibiotics may reduce the likelihood of implant failure. However, evidence is lacking as to whether any additional benefit was found when postoperative antibiotics were administered. It should also be noted that the studies presented excluded patients with systemic diseases and other confounding factors such as smoking and radiation to the head and neck region. Therefore, the clinician's own judgment is essential in assessing each patient and administering the appropriate antibiotic regimen for that patient.

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