

Three-Year Clinical Evaluation of In-Ceram Zirconia Posterior FPDs

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Purpose: The purpose of this study was to evaluate the clinical performance of In-Ceram Zirconia posterior fixed partial dentures (FPD) after 3 years in service. **Materials and Methods:** Eighteen In-Ceram Zirconia FPDs were fabricated in 16 patients. The FPDs were placed between January and April 1999. The CDA quality evaluation system was used for assessment of surface and color, anatomic form, and marginal integrity. Bleeding on probing was also recorded. **Results:** One of the 18 posterior FPDs was lost because of a root fracture. All remaining FPDs were rated as either excellent or acceptable after the observation period. Bleeding was more often recorded at crowned abutments with In-Ceram Zirconia than at contralateral teeth. **Conclusion:** In-Ceram Zirconia posterior FPDs seem to be an acceptable treatment alternative in a 3-year perspective. However, more clinical long-term follow-up studies must be performed before the system can be recommended as an alternative to conventional FPDs. *Int J Prosthodont 2004;17:35–38.*

The demand for esthetic restorations has resulted in an increased use of dental ceramics for anterior and posterior restorations. A few decades ago, all-ceramic restorations were restricted to treatment in the anterior region, but now all-ceramic restorations can be made anywhere in the dentition.¹ The properties of traditional ceramic materials, however, have limited their use to single crowns; larger restorations have been inadvisable because of insufficient strength.

In attempts to meet the requirements for dental materials and improve strength and toughness, several

new ceramic materials and techniques have been developed during the past few decades.^{2–6} The In-Ceram system (Vita) is an example of such a metal-free restorative alternative that has been widely researched. The core is fabricated using a split casting technique from which a porous, partially sintered alumina structure results. Low-viscosity glass is then infiltrated through the porous network of sintered alumina particles.³ This results in a high-strength, interpenetrating phase composite structure.⁷

In-Ceram Alumina has proven to be an acceptable treatment alternative for single crowns as well as anterior fixed partial dentures (FPD).^{8–11} However, it is not recommended for posterior FPD restorations.^{12–14} With the introduction of In-Ceram Zirconia, posterior FPDs may be feasible. Zirconia is a high-strength ceramic, and it is used as an orthopedic material.^{15,16} The fabrication procedure is similar to that of In-Ceram Alumina; the difference is the addition of 35% partially stabilized zirconium oxide to the split composition (33% ZrO₂ stabilized by 16% CeO₂).¹⁷ In-Ceram Zirconia is reported to have higher flexural strength than In-Ceram Alumina.^{17–19} However, documentation of FPDs with both systems is still limited, and more clinical long-term follow-up studies are needed.

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This study was presented at the 26th Annual Conference of the European Prosthodontic Association, Sept 2002, Cavtat/Dubrovnik, Croatia.

Table 1 Extension and Location of the 18 Posterior FPDs

Jaw	Posterior FPDs*
Maxilla	17 ¹⁶ 15, 17 ¹⁶ 15, 17 ¹⁶ 15, 16 ¹⁵ 14, 16 ¹⁵ 14, 24 ²⁵ 26, 24 ²⁵ 26 ²⁷ , 24 ²⁵ 26 ²⁷ , 25 ²⁶ 27, 25 ²⁶ 27
Mandible	34 ³⁵ 36, 34 ³⁵ 36, 34 ³⁵ 36 ³⁷ , 44 ⁴⁵ 46, 44 ⁴⁵ 46, 44 ⁴⁵ 46 ⁴⁷ , 45 ⁴⁶ 47, 45 ⁴⁶ 47

*Fédération Dentaire Internationale tooth-numbering system; superscripts denote pontics.

The purpose of the present study was to report on the clinical performance of In-Ceram Zirconia posterior FPDs after 3 years. The null hypothesis was that the results would not differ from earlier findings regarding conventional FPDs.

Materials and Methods

Patients

Twenty-five patients referred to the Department of Prosthodontics, Faculty of Odontology, University Complutense of Madrid, Spain, who were between 23 and 50 years old, with indications for FPDs replacing premolars or molars, were examined for participation in the study. The patients were informed about the risks of and alternatives to the proposed therapy. Patients were excluded if they required more than a four-unit FPD, a combination of fixed and removable partial dentures, or if they had poor oral hygiene, high caries activity, active periodontal disease, or bruxism. Of the 25 patients, 16 fulfilled the inclusion criteria, 12 women and 4 men, who gave their written consent to make the In-Ceram Zirconia FPDs. The restorations were placed between January and April 1999.

FPD Preparation and Placement

Eighteen posterior FPDs were fabricated. Fourteen were constructed with one pontic and two abutments, and four were made with two pontics and two abutments (Table 1). Two of the authors performed the treatment.

The abutment teeth were prepared with a 1-mm chamfer finish line, and the occlusal reduction was approximately 2 mm. The preparation margins were placed at the level of the gingival margin. The impressions were made with a rigid standard tray with A-silicone putty soft- and light-body materials (Aquisil, Dentsply).

The laboratory procedures were performed by a laboratory authorized by the manufacturer, where the dental technician made the FPDs from model to finished construction in accordance with the instructions of the manufacturer. The occlusogingival height of the core material connector between crown and pontic was 4 mm.

Two types of luting materials were used, one for each operator. Zinc phosphate cement (Fortex, Faciden) was used in ten cases, and glass-ionomer cement (Ketac Cem, ESPE) was used in eight cases.

Clinical Follow-up

The patients were scheduled for a final evaluation 1 week after cementation, and they were then scheduled for follow-up evaluation annually. Clinical evaluation of the patients and FPDs was performed by two of the authors who were experienced in the use of the California Dental Association's (CDA) quality evaluation system.²⁰ Neither of the examiners was involved in treatment of the patients. Surface and color, anatomic form, and marginal integrity were examined with the CDA system, in which restorations are given a rating of satisfactory (excellent or acceptable) or not acceptable (correction or replacement). In the case of divergence in opinion between the two examiners, a reexamination and discussion followed, and a joint decision was made for the final score. The presence or not of fractures and/or cracks and marginal caries detectable by probing was also registered. The gingival conditions were recorded for the crowned abutment and the contralateral tooth (control). Bleeding was diagnosed when a periodontal probe was gently moved in the marginal part of the gingival pocket around the tooth. Bleeding (or none) was recorded. Descriptive statistics were used for evaluation of the data.

Results

Eighteen FPDs in 16 patients were examined at baseline. At the evaluation 1 week after cementation of the FPDs, no adjustments had to be done. At the 1- to 3-year follow-up evaluation, no fracture of the FPDs was observed, and all but one of the FPDs were in function at the end of the observation period. One FPD had to be removed 28 months after cementation because of root fracture in an endodontically treated mandibular molar that needed extraction. No caries was recorded at abutment teeth.

For the factor surface and color, 100% of the FPDs were judged satisfactory at the 3-year follow-up. Discrepancies from optimal form were mainly found to result from a slight overcontouring. Marginal integrity showed a change from excellent to acceptable

because of slight marginal discrepancy in two cases and discoloration between the restoration and tooth structure in another. No repair was judged necessary. In all cases, the registered changes between baseline and 3 years were within the satisfactory interval (Table 2). The cumulative FPD success rate after 3 years was 94.5%. Gingival bleeding on probing was observed in 28% of the abutments with In-Ceram Zirconia and in 18% of the contralateral natural teeth at the 3-year evaluation.

Discussion

Metal-ceramic restorations are currently the most widely and successfully used option for FPDs, and available data show a survival rate of approximately 95% to 98%,²¹ 90%,²² and 85%²³ at 5, 10, and 15 years, respectively. All-ceramic FPDs are a relatively new treatment option. There are a lot of studies about all-ceramic crowns, but to date, studies on the clinical performance of all-ceramic FPDs are few. The clinical success of all-ceramic FPDs has been questioned and to some extent found disappointing, especially for the posterior region, when compared with metal-ceramic restorations.^{13,14,24}

In the present study, no fractures were observed during the examined period, which could be due to the high fracture strength of In-Ceram Zirconia, as reported in several *in vitro* studies.^{17,25–28} During the 3-year follow-up period, one abutment tooth was lost because of root fracture; thus, the survival rate was 94.5%. Previous studies classified failures as biologic or technical, and the biologic failures were predominant.^{23,29–31} This is in agreement with the present findings. The most frequently reported causes of failure for fixed prostheses are loss of retention^{30,32–35} and carious lesions.^{29,34–39} In the present study, none of the abutments were lost because of caries or loss of retention. According to CDA ratings, there was a slight change from excellent to acceptable during the 3-year follow-up for all parameters examined, in agreement with previous studies.^{29,40} The choice of cement did not seem to have influenced the results. Bleeding had increased during the observation period and was slightly more often recorded at abutment teeth, in agreement with previous studies,^{29,35,40,41} indicating an increased risk for gingival inflammation around crowned teeth.

Conclusions

An observation time of 3 years, as in the present study, is short in relation to the longevity of FPDs, so conclusions must be drawn with some caution. Observation periods exceeding 5 years are desirable to evaluate the long-term success prior to the system's recommendation for general clinical use.

Table 2 Technical Quality of the 18 Posterior FPDs at 3-Year Follow-up According to CDA Criteria (%)

Parameter	Satisfactory		Not acceptable
	R	S	T/V
Surface and color	88	12	0
Anatomic form	88	12	0
Margin integrity	82	18	0

R = range of excellence; S = range of acceptability; T = replace or correct for prevention; V = replace statim.

1. The In-Ceram Zirconia FPD seems to be an acceptable treatment modality in the posterior region, according to this 3-year study.
2. No FPDs fractured, but one FPD was lost because of a root fracture of an abutment tooth.
3. Only small CDA rating changes were observed during the 3-year follow-up period.
4. Long-term studies must be performed before the system can be recommended as an alternative to conventional FPDs.

Acknowledgments

This study, part of a research program ("Experimental Study of Fracture Strength of All-Ceramic FPDs") of the University Complutense, was supported partially by a Research Project Grant (No. 49/98-7799) through the first author. The authors would like to thank Vita for providing the necessary material and dental technicians Fernando de las Casas and José Luis Andrés for their technical advice and for manufacturing the FPDs.

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