Clinical Survival of Anterior Metal-Ceramic and All-Ceramic Cantilever Resin-Bonded Fixed Dental Prostheses over a Period of 60 Months

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> **Purpose:** To evaluate the survival of maxillary anterior cantilever resin-bonded metalceramic (MC) and all-ceramic (AC) fixed dental prostheses (RBFDPs). **Materials and Methods:** Between August 2007 and December 2009, 40 patients received 40 RBFDPs made of either cobalt-chromium-ceramic (n = 20) or glass-infiltrated alumina (In-Ceram, Vident; n = 20) and were followed up until December 2012. Restorations were adhesively cemented (Panavia 21, Kuraray). **Results:** Two fractures were observed with AC. No debondings were observed with MC (n = 0) but were observed with AC (n = 3). The difference in survival rates of MC and AC was not significant (MC: 100%; AC: 90%; P = .15) (Kaplan-Meier method, confidence interval = 95%). **Conclusions:** Cantilever AC RBFDPs could be a promising alternative to MC RBFDPs for replacement of missing anterior incisors, provided that no mechanical complications were experienced with the latter. Int J Prosthodont 2014;27:422–424. doi: 10.11607/ijp.3776

Although implant-supported crowns do not require preparation of teeth adjacent to the edentulous area, the availability of bone volume, occlusal considerations, systemic disorders, and socioeconomic status of patients may preclude this approach. While a full-coverage fixed dental prosthesis (FDP) requires preparation of the abutment teeth, and a risk of adverse, long-term biological changes, resinbonded FDPs (RBFDPs) require no or minimal tooth preparation.¹

A retrospective 13-year follow-up study showed that metal-ceramic RBFDPs may serve as long-term or semipermanent restorations.² Early reports with all-ceramic RBFDPs showed fractures in one-third

Correspondence to: Dr Samah Saker, Mansoura University, Faculty of Dentistry, Conservative Dentistry Department, Mansoura, Egypt. Email: samah_saker@hotmail.com of the restorations within the first year of clinical service.^{3,4} In most instances, framework failure was at one connector, leaving the pontic attached. Surprisingly, these prostheses continued to function as cantilevered FDPs during 5 years of follow-up examinations.⁴ A clinical study of single and tworetainer FDPs showed survival of 94.4% and 73.9%, respectively in 10 years.⁵

This clinical study evaluated the clinical performance of cantilever RBFDPs made of either metalceramic or glass-infiltrated alumina ceramic. The null hypothesis tested was that metal-ceramic and allceramic RBFDPs would not show significant difference in terms of clinical survival.

Materials and Methods

Between August 2007 and December 2009, 40 patients (22 women, 18 men; mean age: 36.1 years) with one missing maxillary incisor were enrolled in this study, and they were followed up until December 2012.

All patients were treated after signing the appropriate informed consent form approved by the university institutional review board. The patients having no periodontal or pulpal diseases with good oral hygiene were included in the study, and those with parafunctional habits at the time of diagnosis were excluded.

The patients received 40 RBFDPs made of either nonprecious alloy (Wirocast cobalt-chromium [Co-Cr] alloy, Bego)-ceramic (Vita VM13, Vident) (MC; n = 20)

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Table 1	Distribution and Location of the Metal-Ceramic and All-Ceramic Resin-Bonded Fixed Dental Prostheses						Survival functions 1.0					
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-	Metal-ceramic		All-ceramic		- Total		ival					
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Total	20		20		40		- 4.0 Jal			.00		
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Fig 1 (left) Event-free survival rates of metal-ceramic and all-							0.0-					

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20

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Months

Fig 1 (*left*) Event-free survival rates of metal-ceramic and all-ceramic resin-bonded fixed dental prostheses (metal-ceramic: 100%, n = 20, events, n = 0; In-Ceram alumina: 90%, n = 20, events, n = 2). 0 = all-ceramic; 1 = metal-ceramic.

 Table 2
 Maximum Observation Duration and the Total Number of Metal-Ceramic and All-Ceramic Resin-Bonded Fixed Dental Prostheses

	Evaluation Period								
Туре	6-12 months	12-24 months	24-36 months	36-48 months	48-60 months				
Metal-ceramic	-	-	2	3	15				
All-ceramic	2	_	1	1	16				

or glass-infiltrated alumina all-ceramic (In-Ceram, Vident) (AC; n = 20). When the lateral incisor was missing, the central incisor acted as the abutment, and when the central incisor was missing, the other central incisor acted as the abutment.

The teeth were prepared minimally at the lingual aspect with a supragingival finish line, and the preparation ended approximately 1 mm below the incisal edge of the abutment tooth on the palatal side. A shallow groove (2 mm length, 1 mm width, 0.5 mm depth) was prepared at the mesial side of the abutment tooth that aided the path of insertion. No cingulum rest seat was prepared as the groove was already helpful for the insertion path. Both types of prosthesis materials had retainer-wing thickness of approximately 0.5 mm without veneering ceramic.

Bonding surfaces of retainers were airborne particle-abraded with 50- μ m Al₂O₃ and ultrasonically cleaned in 96% alcohol for 1 minute. After isolation of the prepared teeth, they were cleaned with a rubber cup and a fluoride-free polishing paste, rinsed, and dried. Then, the lingual enamel surface of the abutment tooth was etched with phosphoric acid (K Etchant gel, Kuraray) for 30 seconds, rinsed, and dried. The RBFDP was bonded to the abutment tooth (Panavia 21, Kuraray). An air-blocking gel (Oxyguard II, Kuraray) was applied (7 minutes). The rubber dam was removed, premature contacts were evaluated using articulation paper, and adjustments were made on the restoration.

The patients were recalled 1 week after cementation for the control of excess cement. Two independent calibrated operators followed up the patients at 6 months and thereafter annually up to 5 years. The evaluation protocol involved technical (chipping, debonding, or fracture of tooth/restoration) and biological failures (caries).

Survival analyses were performed (SPSS 14.0, SPSS) using Kaplan-Meier and Log Rank (Mantel-Cox) tests ($\alpha = .05$).

Results

Mean observation period was 34 months. No patient dropouts were experienced up to 60 months. Distribution of RBFDPs is presented in Table 1.

Two fractures were observed with AC at 6 and 12 months. No debonding was observed with MC (n = 0) but was observed with AC (n = 3) during the observation period. Debonded restorations were recemented and remained functional. The survival rates with MC and AC RBFDPs did not show significant differences (MC: 100%; AC: 90%) (P = .15; Fig 1). Annual failure rates were 0% for MC and 0.05% for AC RBFDPs, respectively. Maximum observation period of each RBFDP type is presented in Table 2.

Survival rate was not significantly affected by the location (maxillary central incisor replacement: 67.5%; maxillary lateral incisor replacement: 32.5% of the whole (*P* = .987; Kaplan-Meier, log rank [Mantel-Cox]

test; confidence interval [CI] = 95%). Secondary caries, endodontic complications, and tooth fractures were not observed in any of the restored teeth.

Discussion

The null hypothesis could be accepted because no significant difference was observed in the survival rates of MC and AC RBFDPs. The lack of fracture with the MC suggests its reliability versus AC RBFDPs. Apparently, adhesion of the resin cement used was also more favorable to MC because no debondings were observed during the observation period. In this study, Co-Cr alloy was used for the fabrication of the MC framework due to concerns of the cost. Higher elastic modulus even in thin sections and the affinity of the metal for oxygen to form oxides on the metal surface may have facilitated bonding with resin.

The reason for debonding and the higher fracture rate of AC was attributed to torque movements of the abutment teeth, especially during protrusive and lateral movements under tooth contact in the case of two-retainer RBFDPs.^{1,4} However, in single-retainer RBFDPs, the pontic always moves with the one abutment tooth, which eventually prevents shear and torque forces on the pontics and the connectors. In the present study, the two fractures and the debonded cases may still indicate that, even in cantilever design, failures could not be completely eliminated. One possible explanation for this is the higher elastic modulus of the AC as opposed to the tooth material. This may also lead to unfavorable stress distribution at the cementation interface and ultimately to debonding. Even though AC and MC RBFDPs performed statistically similarly in terms of clinical survival, 20 RBFDPs per material group could be considered a small sample size and the mean observation period of 34 months rather brief. Both of these factors could be deemed as limitations of this study. In addition, in this study, only anterior RBFDPs were of interest, where more shear forces could be expected during chewing function. The clinical performance of posterior RBFDPs should be compared to anterior ones in future studies.

Conclusions

Cantilever AC RBFDPs may be regarded as a promising alternative to MC RBFDPs for replacement of missing anterior incisors, provided that no mechanical complications were experienced with the latter.

Acknowledgments

The authors reported no conflicts of interest related to this study.

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Literature Abstract

Relationship between adjusted body mass index percentile and decayed, missing, and filled primary teeth

This retrospective cohort study aimed to determine if there was a significant relationship between the adjusted body mass index (BMI) percentile and the number of decayed, missing, and filled primary teeth (DMFT) in a group of 3- to 5-year-old children. The data was collected from 215 children, with either an American Society of Anesthesiologists class I or II physical status, who had received dental treatment under general anesthesia at the University of North Carolina at Chapel Hill Children's Hospital between 2007 and 2008. A pediatric dentist confirmed the dental diagnosis at the time of treatment by a clinical oral and full-mouth radiographic examination. The relationship between BMI percentile and DMFT was found to be statistically significant, with higher BMI percentiles associated with higher dmft. As compared to children with normal or lower weights, overweight children had a higher prevalence of dental caries value. This study concluded that there is a common risk factor for dental caries in primary teeth and being overweight. However, this study was retrospective, and diagnoses of clinical caries were uncalibrated. An inclusion of socioeconomic status might also aid in further studies.

Powell JC, Phillips CL, Koroluk LD, Roberts MW. J Dent Child (Chic) 2013;80:3. References: 39. Reprints: School of Dentistry, UNC Chapel Hill, Department of Pediatric Dentistry, Chapel Hill, NC 27599, USA. Email: mike_roberts@dentistry.unc.edu—Sheralyn Quek, Singapore

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