Prospective Clinical Study of Press-Ceramic Overlap and Full Veneer Restorations: 7-Year Results

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The aim of this prospective clinical study was to investigate the long-term performance of all-ceramic veneers with overlap (OV) and full veneer (FV) preparation designs. Twenty-five patients were restored using 42 OV restorations (incisal/palatal butt-joint margin) and 24 FV restorations (palatal rounded shoulder margin). All restorations were leucite-reinforced glass-ceramic anterior veneers. The 7-year Kaplan-Meier survival rate was 100% for FV restorations and 97.6% for OV restorations. The all-ceramic veneers revealed significant deterioration over time according to United States Public Health Service criteria, irrespective of the preparation design. Based on the 7-year results of this study, both preparation designs can be considered reliable treatment options for anterior teeth with extended deficits. *Int J Prosthodont 2014;27:355–358. doi: 10.11607/ijp.3679*

All-ceramic veneers are widely used and well documented in the literature.¹ One factor that influences the success of all-ceramic veneers is the preparation design. Defect-oriented preparation designs have been developed to restore large morphologic and structural deficits in anterior teeth. However, limited clinical data on this treatment approach are currently available. Thus, the purpose of this study was to investigate the long-term behavior of pressceramic veneers with two extended tooth-coverage preparations: modified overlap (OV) and full veneer (FV). The null hypothesis was that the preparation design has no influence on the long-term clinical performance of all-ceramic veneers.

Materials and Methods

This prospective trial comprised a convenience sample of 25 patients (12 women, age range: 19 to 64 years; 13 men, age range: 20 to 45 years) who required veneer treatment.² The study was conducted according to the Declaration of Helsinki for clinical investigations and was approved by the local ethics committee (Albert-Ludwigs-University Freiburg, Freiburg, Germany). Forty-two OV restorations (incisal edge reduction: 0.5 to 1.5 mm; palatal butt-joint margin) and 24 FV restorations (0.5- to 0.7-mm palatal rounded shoulder margin) were investigated. Both designs had a buccal (0.5 mm) and proximal (0.5 to 0.7 mm) chamfer preparation (Fig 1). Patients with nonvital teeth, poor oral hygiene (pocket depth > 3 mm and papillary bleeding index > 35%), or pronounced parafunction (eg, bruxism) were excluded. Full-arch impressions (Permadyne, 3M ESPE) were taken. Leucite-reinforced glass-ceramic veneers (IPS Empress, Ivoclar Vivadent) were adhesively cemented by experienced prosthodontists with a dual-polymerizing composite resin material (Variolink II, Ivoclar Vivadent) under rubber dam. At baseline, after 6 months, and annually for 7 years, the veneers were examined for postoperative hypersensitivity, debonding, and fractures and evaluated according to the modified United States Public Health Service (USPHS) criteria³ (Table 1). Two independently calibrated investigators who were not involved in the treatment procedures performed all recall evaluations. Kaplan-Meier survival and success rates were calculated to account for absolute failures (unacceptable fractures, secondary caries, and endodontic complications) and relative failures (minimal cohesive acceptable fractures, loss of adhesion, and Charlie ratings in any of the USPHS criteria), respectively. The success and survival rates of the two preparation designs were statistically compared by calibrating confidence intervals (CIs). A random-intercept logistic regression model was fitted for each outcome of the modified USPHS criteria using the PROC/GLIMMIX procedure (SAS).

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Table 1	USPHS Criteria for Classification of
	Partial-Coverage Restorations

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Rating	Characteristic								
Seconda	Secondary caries								
Alfa	No evidence of caries contiguous with the margin of the restoration								
Bravo	Caries evident contiguous with the margin of the restoration								
Marginal	adaptation								
Alfa	No visible evidence of crevice along margin; no catch or penetration of explorer								
Bravo	Visible evidence of crevice and/or catch of explorer; no penetration of explorer								
Charlie	Visible evidence of crevice; penetration of explorer								
Marginal discoloration									
Alfa	No discoloration on the margin between the restoration and tooth structure								
Bravo	Superficial discoloration on the margin between the restoration and tooth structure; does not penetrate in pulpal direction								
Charlie	Discoloration has penetrated along the margin of the restorative material in pulpal direction								
Surface r	roughness								
Alfa	Fine, polished, glossy surface; no palpable roughness								
Bravo	Slight, visible, and palpable roughness								
Charlie	Coarse, visible, and palpable roughness; unglazed surface								
Color ma	tch								
Alfa	No mismatch in color, shade, and/or translucency between restoration and adjacent tooth								
Bravo	Mismatch between restoration and tooth structure within the normal range of color, shade, and/or translucency (< 1 shade off; VITA shade guide, VITA Zahnfabrik)								
Charlie	Mismatch between restoration and tooth structure outside the normal range of color, shade, and/or translucency (> 1 shade off; VITA shade guide)								
Anatomic	cal form								
Alfa	Restoration is continuous with tooth anatomy								
Bravo	Restoration is not continuous with tooth anatomy; restoration is slightly under- or overcontoured								
Charlie	Restoration is not continuous with tooth anatomy; restoration material is missing; a surface concavity is								



ascertainable

Fig 1 (a) Buccal view of the extended veneer preparation design. (b) Proximal view of the OV preparation design. (c) Proximal view of the FV preparation design (Stappert²).

Table 2 Modified USPHS Criteria and Clinical Evaluation of the Veneer Restorations Over 7 Years of Follow-up (%)

	Base (25 pa	eline tients)	6т (24 ра		
	OV	FV	OV	FV	
Parameters	(n = 42)	(n = 24)	(n = 39)	(n = 24)	
Secondary caries					
Alfa	100	100	100	100	
Bravo	-	-	-	-	
Marginal adaptation					
Alfa	100	100	98	96	
Bravo	-	-	2	4	
Charlie	-	-	-	-	
Marginal discoloration					
Alfa	100	100	77	96	
Bravo	-	-	23	4	
Charlie	-	-	-	-	
Color match					
Alfa	100	100	98	100	
Bravo	-	-	2	-	
Charlie	-	-	-	-	
Anatomical form					
Alfa	100	100	92	100	
Bravo	-	-	8	-	
Charlie	-	-	-	-	
Endodontic complication	ons				
Vitality negative	-	-	-	-	
Percussion positive	-	-	-	-	
Fracture					
None	100	100	100	100	
Minimal/acceptable	-	-	-	-	
Extensive/unacceptable	-	-	-	-	
Crack					
None	100	100	100	100	
Minimal/acceptable	-	-	-	-	
Extensive/unacceptable	-	-	-	-	
Retention of the venee	r				
Bonded	100	100	100	100	
Rebonded	-	-	-	-	
Lost	-	-	-	-	

Results

Of the 25 enrolled patients, 11 patients (12 FV and 10 OV restorations) were lost during the 7-year follow-up for reasons unrelated to treatment. Five patients could not attend the recall examinations due to work-related problems, 5 patients relocated, and 1 patient died. The 7-year Kaplan-Meier survival rate was 100% for FV restorations and 97.6% for OV restorations. One OV restoration fractured (Fig 2a). No secondary caries, endodontic complications, or postoperative complaints were observed. Minimal

356 | The International Journal of Prosthodontics

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12 (22 pa	mo tients)	25 (14 pai	mo tients)	39 (13 pa	mo tients)	48 (13 pa	mo tients)	60 (14 pa	mo tients)	70 (12 pa	mo tients)	82 (9 pat	mo ients)
OV (n = 30)	FV (n = 22)	OV (n = 27)	FV (n = 8)	OV (n = 29)	FV (n = 11)	OV (n = 25)	FV (n = 7)	OV (n = 32)	FV (n = 12)	OV (n = 20)	FV (n = 8)	OV (n = 18)	FV (n = 10)
100	100	100	100	100	100	100	100	100	100	100	100	100	100
-	-	-	-	-	-	-	-	-	-	-	-	-	-
93	90	81	88	69	64	40	43	50	42	25	25	28	20
7	10	19	12	31	36	60	57	50	58	75	75	72	80
_	_	_	_	-	_	_	_	-	_	_	_	_	_
63	64	81	75	45	55	28	14	40	33	20	50	22	20
37	36	19	25	55	45	72	86	60	67	80	50	78	80
-	-	-	-	-	-	-	-	-	-	-	-	-	-
97	100	96	100	93	100	92	86	90	92	95	88	78	100
3	-	4	-	7	-	8	14	10	8	5	12	22	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-
97	100	96	75	97	82	96	100	97	83	100	75	67	80
3	-	4	25	3	18	4	-	3	17	-	25	33	20
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	_	-	-	-	-	-	-
100	100	85	100	97	100	84	100	88	83	75	100	67	100
-	-	11	-	3	-	16	-	22	17	25	-	33	-
-	-	4	-	-	-	-	-	-	-	-	-	-	-
100	100	96	100	100	91	100	100	92	100	95	88	100	90
-	-	4	-	-	9	-	-	8	-	5	12	-	10
-	-	-	-	-	-	-	-	-	-	-	-	-	-
100	100	96	100	100	100	100	100	94	100	100	100	100	100
-	-	-	-	-	-	-	-	6	-	-	-	-	-
-	-	4	-	-	-	-	-	-	-	-	-	-	-

cohesive ceramic fracture and crack formation within the restoration material were noted in 12 patients. All affected restorations were observed carefully and revealed no deterioration over time; therefore, the restorations remained in situ (Table 2). One patient showed debonding of an OV restoration after 61 months. The estimated 7-year Kaplan-Meier success rate was 0.85 (Cl: 0.70 to 1.00) for the FV restorations and 0.70 (Cl: 0.45 to 0.95) for the OV restorations (Fig 2b). Statistical comparison of these success rates showed overlapping of the Cls. The difference was not significant (P = .05). Both preparation designs revealed significantly decreasing Alfa ratings for all USPHS criteria over time (baseline to 7 years) (P < .05), especially regarding marginal adaptation and discoloration (Fig 3). No differences between the investigated preparation designs were found.

Discussion

During the 7-year observation period, all-ceramic veneers with OV and FV preparations showed promising survival rates of 97.6% and 100%, respectively. Other studies on glass-ceramic veneers revealed

Volume 27, Number 4, 2014

357









Fig 3 OV restoration (left incisor) with marginal discoloration after a service time of 82 months.

comparable survival rates of 97.5%⁴ and 93.5%⁵ after 7 and 10 years, respectively. Ceramic fractures are commonly reported as the most frequent cause of clinical failure.⁵ In the present study, however, only one OV restoration showed a clinically unacceptable ceramic bulk failure (maxillary canine).² Minimal ceramic cohesive fractures were mainly observed at the incisal edge or palatal aspect, but none of these fractures required removal of the restorations. The survival and success rates of the two preparation designs revealed no significant differences. The observed decrease in marginal adaptation, which was accompanied by an increase in marginal discoloration, is in agreement with previous reports.⁵ Possible explanations for this degradation include aging of the adhesive luting materials and application of a dual-cure composite resin.⁴ The marginal deterioration did not require clinical intervention or replacement of the restorations. No secondary caries was observed.

It should be noted that the limitations of this prospective longitudinal study include its small sample size and loss of patients during recall.

Conclusions

All-ceramic veneers with OV and FV preparation designs revealed favorable survival rates after 7 years. Both preparation designs can be recommended for the restoration of extended lesions in anterior teeth. Reliable, fatigue-resistant adhesive cementation protocols should be the aim of future research.

Acknowledgments

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358 | The International Journal of Prosthodontics

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