Retrospective Study of Extensive Heat-Pressed Ceramic Veneers after 36 Months

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ABSTRACT

Statement of the Problem: The clinical performance of ceramic veneers is influenced by various clinical and material-related factors.

Purpose: Retrospective evaluation of extensive anterior ceramic veneers in the upper and lower jaw 36 months after placement in a private practice.

Materials and Methods: Thirty-seven patients (21 female, 16 male) were restored with adhesively luted extensive ceramic veneers made from a heat-pressed ceramic (Cergo, DeguDent, Hanau, Germany). One dentist restored a total of 130 teeth (maxilla $N=76$, mandible $N=54$). Adhesive cementation was performed with an etch-and-rinse adhesive (Optibond FL, Kerr Hawe, Karlsruhe, Germany) and a dual-curing composite cement.

Results: After 36 months, the survival rate (in situ criteria) according to Kaplan–Meier was 95.1% (95% confidence interval [CI]: 0.88; 1). Reasons for failure were four ceramic fractures and one biological failure in five restored teeth. Of the restorations, 92.8% (95% CI: 0.86;1) were in service without any clinical intervention and rated successful after 36 months. Interventions were necessary in five cases (three recementations, two endodontic treatments). Clinical performance was not influenced by the veneer position (maxillar/mandibular, survival $p=0.3$/success $p=0.4$). Veneers with more than 50% of exposed dentin demonstrated a significantly increased risk (hazard ratio 10.6, $p=0.026$) for a clinical intervention (recementation, endodontic treatment), whereas no effect on the survival rate could be detected ($p=0.17$).

Conclusions: After 36 months of clinical service, extensive veneer restorations made of a pressable ceramic showed a comparable survival and success rate in the upper and lower jaw. Large areas of exposed dentin (>50%) were associated with lower success rates.

CLINICAL SIGNIFICANCE

Mandibular ceramic veneers made using a heat-pressed ceramic offer the same clinical reliability as do veneers on anterior maxillary teeth. Dentin exposure significantly affects the clinical performance of heat-pressed ceramic veneers.

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INTRODUCTION

Adhesively luted, etched anterior ceramic veneers have been a significant component of esthetic dentistry for over 20 years.[1,2] Several studies have testified to the clinical performance of ceramic veneers.[3–5] A review of the literature in 2000 including 13 studies reported failure rates between 0% and 5% over observational periods of between 1 and 5 years.[5] Several reasons for the inconsistent results among the different clinical

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trials have been discussed. Static and dynamic occlusion, preparation design, the presence of composite fillings, the amount of dentin exposure, the adhesive technique, the experience of the operators, and patient-related factors such as age and gender were reported to be covariables that could contribute to the clinical outcome of veneer restorations.[6–13] The majority of clinical trials that have examined the clinical performance of ceramic veneers were retrospective[1,2,6,7,9,12–17]; only a small number of prospective trials have been performed.[10,18–20] A variety of failure criteria were applied in these previous studies. For example, in certain studies, only fractures were counted as failures,[9] whereas subsequent investigations also included debondings[16,21,22] or esthetic failures[10,13,14,20] in this category.

The majority of clinical studies have used feldspathic porcelains for the fabrication of the veneers, with preparations primarily confined within the enamel.[6,7,9–11,20,23,24] Certain studies excluded teeth if a certain amount of dentin was exposed following the preparation.[7,10,12,21,24] The development of ceramic materials with improved mechanical properties, as well as progress in adhesive luting techniques, has led to a wider range of all-ceramic veneer applications.[25,26] These broadened indications include more extensive veneers and partial coverage anterior restorations, which are characterized by a more aggressive preparation and less emphasis on the importance of the enamel as the bonding substrate. The first results with extensive veneers made from heat-pressed ceramic are very promising and demonstrate a survival rate of 97.5 to 100% following 5 years of observation. Given that these data were generated in a university setting in a prospective clinical trial with standardized conditions, it is unclear how successful this treatment concept will be in the typical environment of a private practice.

Although the veneer application technique is applicable for both maxillary and mandibular teeth, there are limited data from clinical studies with respect to the success of veneer placements for the restoration of mandibular incisors. The majority of previous trials included only very few, if any, mandibular veneer restorations.[5,9,12–14,16,18–21,27,28] This limitation precludes a calculation of separate time-dependent survival rates and the evaluation of a possible association between the veneer position and long-term clinical performance. Therefore, based on the current clinical data, no statement can be made regarding the clinical performance of mandibular compared with maxillary veneers.

The aim of this study was to perform a retrospective evaluation of the clinical performance of heat-pressed extensive veneers placed on mandibular and maxillary teeth with various degrees of exposed dentin. All of the veneers were placed by a single dentist in a private practice. As a null hypothesis, we assumed that the clinical survival of the veneers was independent of (1) the jaw position of the veneers and (2) the amount of exposed dentin.

METHODS/MATERIALS

Subjects and Teeth

The teeth examined in this study were restored with extensive anterior veneer restorations in the maxillary and mandibular regions (teeth #6–11 and #22–27) between July 1, 2002 and June 30, 2008. The study was evaluated by the Ethics Committee of the Medical Faculty of Georg-August-University Göttingen, Germany, and approved on February 17, 2009 (application number 16/1/09). All of the veneers were placed at the general private practice of the first author according to the following exclusion criteria:

- The teeth requiring restoration were nonvital
- The preexisting restoration was too large to be completely covered by the new restoration
- Large wedge-shaped defects were observed
- Clinical signs of bruxism were observed

Only teeth with one of the following indications were veneered:

- Misalignment
- Diastema

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- Discolorations
- Coronal fractures
- Morphologic modifications, including prolongation of the incisal edge
- Malformations

Preparation and Ceramic Materials

Different preparation designs were chosen based on the clinical preconditions and the specific patient requirements. Nevertheless, all of the preparations followed several common steps. The teeth were prepared with a labial chamfer (minimum preparation depth: 0.3 mm) and a labial reduction of at least 0.5 mm. The incisal reduction was at least 1.0 mm. The incisal edge was slightly beveled, resulting in an angle of 110° to 130° between the labial surface and the incisal platform, creating a palatal overlap that was kept clear of tooth contact in habitual occlusion (Figure 1A). If this was not possible, the palatal overlap continued at least 1 mm past the occlusal contact, resulting in a palatal chamfer preparation. The interproximal contacts were removed during the preparation and rebuilt with the ceramic veneers. For the closure of a diastema or in teeth with preexisting proximal fillings, the preparations were extensive beyond the interproximal contact to the palatal side to allow a correct buildup of the tooth contour (Figure 1B).

To maintain the previously mentioned minimum cutting depths and design parameters, two techniques were used in combination with a standardized set of diamond instruments (Ergo-Prep-Set veneer 4395, Gebr. Brasseler, Lemgo, Germany). In all of the patients for whom no changes in tooth contour or position were necessary, three horizontal grooves were prepared with a self-limiting wheel-shaped diamond instrument, providing a cutting depth of 0.5 mm. The incisal reduction was marked by completely sinking a cylindrical diamond burr with a diameter of 1.0 mm. All of the preparations were finished with fine-grit (30 µm grain size) diamond instruments.

In patients with malpositioned teeth or morphological modifications (diastema, fractures), an ideal wax-up was fabricated. A vacuum-formed transparent template was used to form a chairside mock-up using an auto-curing temporary crown and bridge material (Luxatemp, DMG, Hamburg, Germany). The required labial and incisal cutting depths were marked as described earlier; the teeth were subsequently prepared from this idealized situation. Dentin exposure routinely occurred during the preparation, especially in the cervical area or when misaligned teeth were being prepared. The extent of the exposed dentin or filling material was rated by the operating dentist and documented in the patient file according to the following scale:

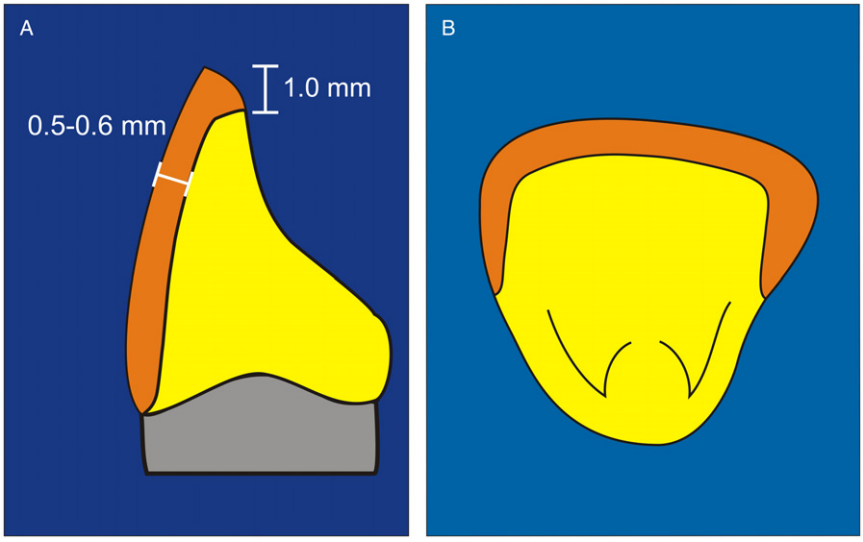

FIGURE 1. A, Main principles of the veneer preparation with a cervical chamfer preparation. B, Modified proximal preparation design for extended veneers used for teeth with proximal defects, malpositioned teeth, restoration for the closure of a diastema.

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Grade 1: A dentin and filling exposure of less than 50% of the preparation surface (Figure 2A)
Grade 2: A dentin or filling exposure of greater than 50% of the preparation surface (Figure 2B)

The presence of a substantial degree of exposed dentin did not preclude ceramic veneer restoration. The dental impressions were made with a polyvinylsiloxane material in a one-stage, two-component procedure using a customized rim-lock tray. The temporary restorations were fabricated using an auto-curing BIS-GMA material (Luxatemp) and were fixed using a labial spot-etching technique and a flowable composite. All of the veneers were fabricated from a heat-pressed ceramic (Cergo, DeguDent GmbH, Hanau, Germany) according to the manufacturer's directions.

Adhesive Luting of the Restorations

The veneers were luted adhesively under rubber dam. A dentin-bonding agent (Optibond FL, Kerr Hawe, Karlsruhe, Germany) was used for the etch-and-rinse technique. One of two dual-curing composite cements was used according to the manufacturer's directions. As all of the preparations exhibited a varying degree of dentin exposure, a dentin-bonding agent (Optibond FL primer and adhesive) was used for the cementation of all veneers. The internal surfaces of the veneers were etched using hydrofluoric acid (5% Vita ceramics Etch, Vita Zahnfabrik, Bad Säckingen, Germany) for 60 to 90 seconds. Following the cleaning, the veneers were silanized (Monobond S, Ivoclar Vivadent, Schaan, Liechtenstein or Calibra Silane, Dentsply DeTrey GmbH, Konstanz, Germany), covered with an adhesive (Optibond FL adhesive), and immediately air-thinned. The bonding was not light-cured prior to the application of the luting agent.

The luting composites (Variolink, Ivoclar Vivadent or Calibra, Dentsply DeTrey) were applied to the preparations, and the veneers were subsequently placed. The luting agents were selected for each patient at the discretion of the operating dentist; no tooth- or indication-related material assignments were performed. Differences in the available shades required the application of two types of resin cement. Following the removal of the excess material, the adhesive/composite complex was polymerized for 120 seconds in each restoration. The occlusion was redesigned in accordance with the findings prior to treatment and was performed with anterior protrusive and canine laterotrusive or group guidance.

Clinical Evaluation

Follow-up examinations (one per patient) were performed between 2009 and 2010. These examinations were performed by a skilled dentist (different from the clinician who placed the restorations) who was trained by one of the authors (DZ) with respect to both the survival and success criteria and the modified United States Public Health Service (USPHS) criteria. All of the available restorations were clinically assessed using mirrors, probes, and intraoral photographs. Pulp vitality was verified with a CO_2 test. Each restoration was examined for cracks, fractures, debonding, caries, and

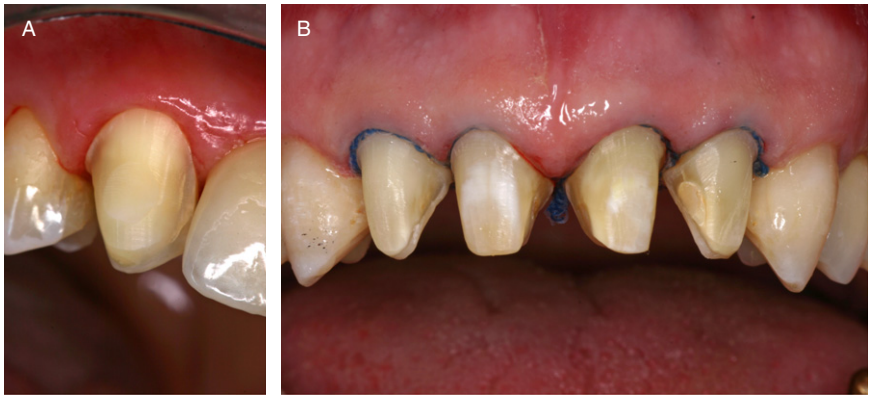

FIGURE 2. A, Preparation with less than 50% of exposed dentin. After application of phosphoric acid, exposed dentin is visible in the cervical area. B, Clinical example for extended anterior veneers in the upper jaw with more than 50% of dentin exposed. Proximal extension of the preparation was necessary for covering the preexisting composite restorations.

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marginal discoloration according to modified USPHS criteria.[29] The mean observational period was 38.6 ± 20.6 months (minimum: 6.2 months; maximum: 84.7 months).

Failures that occurred in advance respectively negative events, e.g., the loss of a restoration (recementation if required), ceramic fractures, and biological complications, were documented in the patients' documentation files and considered in the final results.

Statistical Analyses

Information regarding the survival and success of the reconstructions was used for the statistical evaluations. Survival was defined as the reconstruction remaining in situ at the follow-up examination visit without presenting an absolute failure (i.e., the in situ criterion).[22] Absolute failure was defined as a clinically unacceptable fracture of the ceramic or a biological event (caries, tooth fracture, periodontal reason) that required a replacement of the entire restoration or tooth extraction. Success was defined as a reconstruction that remained unchanged and did not require any intervention to maintain function during the entire observational period.[14,23] Necessary interventions to maintain function were divided into technical complications (minor chipping of the ceramic, recementation of a debonded but intact restoration) and biological complications (caries, endodontic treatments, and periodontal interventions). The survival time of a restoration was defined as the period between the day of cementation and either the final follow-up appointment or, in the case of a failure, the appointment scheduled to address the failure as documented in the patient's file. The time-dependent survival rates of the restorations (based on the in situ criterion) and the success (intervention-free) rates of the extensive veneers were calculated using Kaplan–Meier survival analyses.

The position of the veneer (mandibular/maxillary) and the amount of exposed dentin following the final preparation (i.e., less than or more than 50% exposed dentin or filling) were included as possible covariables for time-dependent survival and success rates.

Different observations from the same patient (several veneers per patient) were considered dependent based on the adjusted variance estimation in the Cox regression model. Thus, a marginal model was applied for the data analysis.[30] Univariate Cox regression was performed for each influence factor. A *p*-value of less than 0.05 was accepted as statistically significant. The statistical analyses were performed using the R programming environment (version 2.8, http://www.r-project.org).

RESULTS

Study Population

Of the 41 restored patients, 37 (21 female/16 male) patients participated in the follow-up examination and were included in the statistical sample. Three patients relocated out of the area, and one patient was suffering from a serious chronic disease and was unable to attend the follow-up. The mean age of the patients at the time of insertion was 46.1 ± 12.7 years (minimum: 23, maximum: 70). A total of 130 teeth were treated with extensive veneer restorations. The patients received from 1 to 12 veneers; the average number of veneers per patient was 3.5 ± 2.7. Seventy-six veneers were placed in the maxilla, and the remaining restorations were performed on the anterior mandibular teeth (*N* = 54) (Table 1). Seventy-three (56%) preparations

TABLE 1. Distribution of the inserted heat pressed ceramic veneers

Maxilla (*N* = 76)					
6	**7**	**8**	**9**	**10**	**11**
n = 20	*n* = 26	*n* = 32	*n* = 34	*n* = 38	*n* = 12
n = 16	*n* = 18	*n* = 18	*n* = 18	*n* = 20	*n* = 18
27	**26**	**25**	**24**	**23**	**22**
Mandibula (*N* = 54).					

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exhibited a dentin or filling surface exposure of less than 50% of the complete preparation area; the remaining 57 restorations (44%) were performed on preparation areas consisting of more than 50% exposed dentin or filling material.

Survival Rate

The results of the Kaplan–Meier analysis indicated that the survival probability according to the in situ criteria of the extensive veneers was 95.1% (95% CI: [0.88;1]) at 36 months. Over the entire observational period, 5 of 130 restorations failed completely. Four ceramic veneers fractured and had to be removed, and one additional tooth had to be removed for biological reasons (periapical lesion) (Table 2). Three ceramic fractures occurred in one patient (tooth #12 after 13 months, tooth #21 after 19.5 months, and tooth #22 after 48 months). The fourth ceramic fracture occurred on tooth #22 in another patient after 48 months (Figures 3A–3D). The specific survival rate for the extensive maxillary ceramic veneers after 3 years was 94.2% (95% CI: 0.87;1). The respective survival of the extensive mandibular veneers was 96.7% (95% CI: 0.88;1) (Figure 4). The statistical analysis using a Cox regression model revealed no significant influence of the veneer position (maxilla versus mandible) (hazard ratio [HR]: 0.55, $p = 0.3$). With respect to the degree of dentin exposition, an HR of 5.32 was calculated, indicating a tendency for an increased risk of complete

TABLE 2. Reasons for complete failures and clinical interventions

Complete failures	Patient (gender/age)	Tooth	Cases per failure type	Relation to number of units
Ceramic fracture	Female/23 years	10	4	3.1%
	Male/46 years	7, 9, 23		
Biological reasons	Female/36 years	7	1	0.8%
Interventions			**Cases per intervention**	
Recementation	Female/63 years	23	3	2.3%
	Male/68 years	10, 8		
Endodontic treatment	Female/70 years	9	2	1.5%
	Male/34 years	8		
Total			**10**	**7.7%**

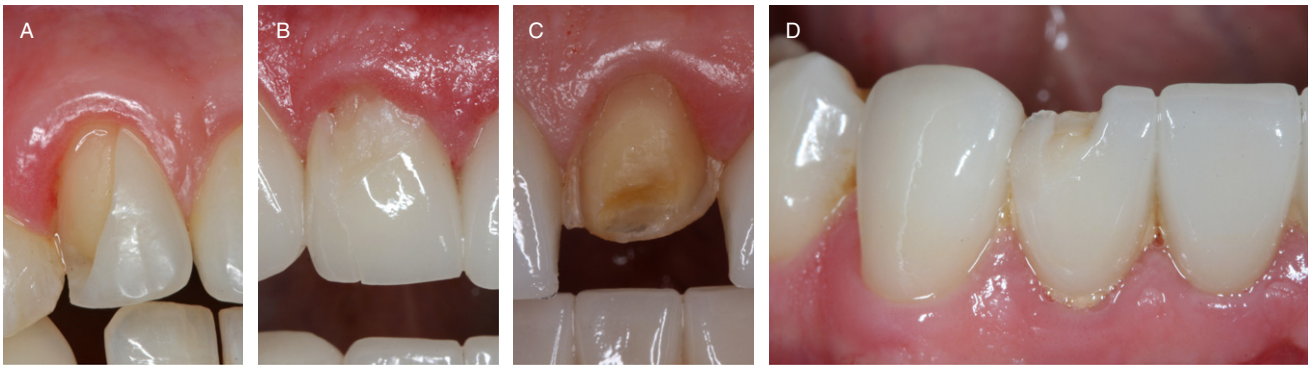

FIGURE 3. A–D, Photographic documentations of the four ceramic fractures leading to a complete failure.

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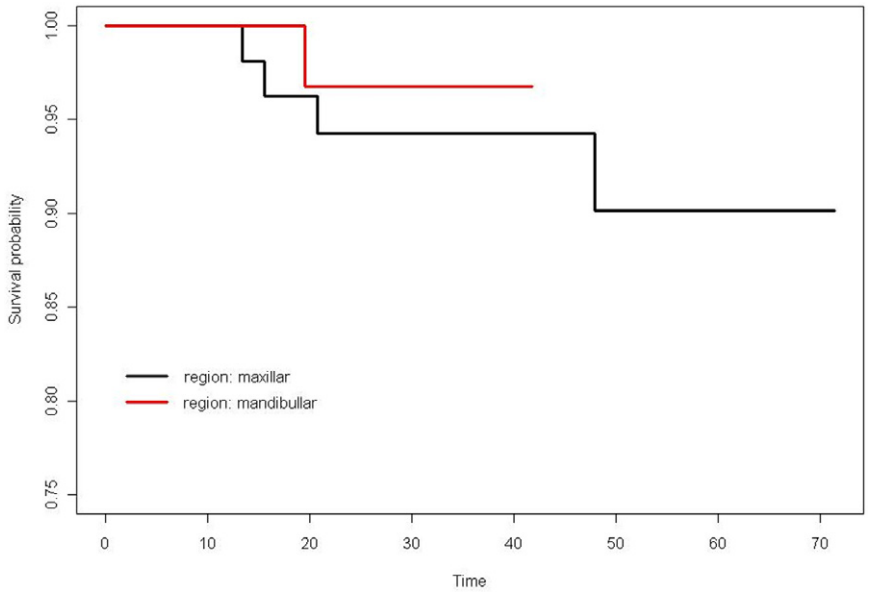

FIGURE 4. Time-dependent (months) survival probability of mandibulary and maxillary veneers.

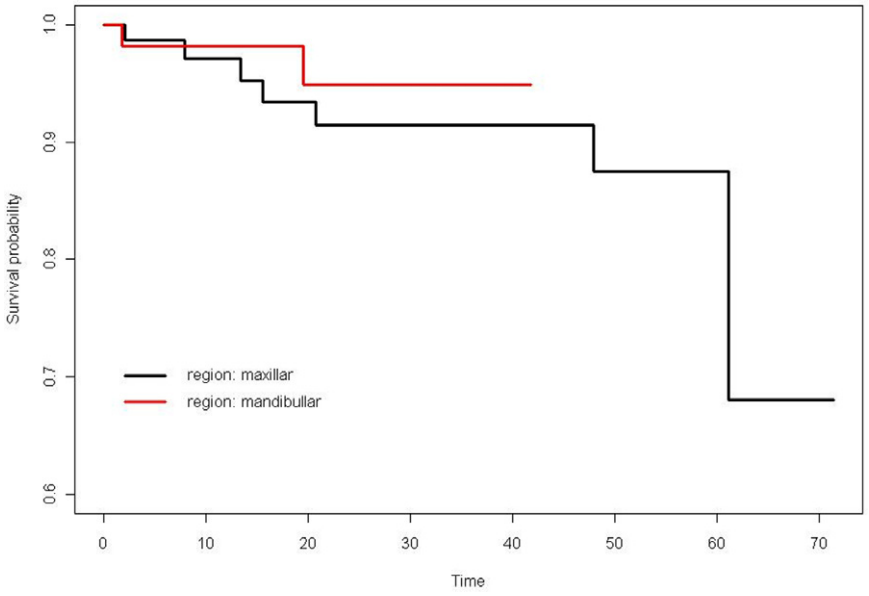

FIGURE 5. Time-dependent (months) success probability of mandibulary and maxillary veneers.

failures of veneers exhibiting greater than 50% exposed dentin. Nevertheless, this effect was not significant ($p = 0.17$).

Success Rate

Apart from the five complete failures, five additional restorations (four patients) required clinical intervention to maintain function. Three veneers in two different patients required recementing following complete debonding. Another two teeth from different patients required endodontic treatment, which was performed without damaging the ceramic restoration. During the observational period, 10 restorations completely failed or required clinical intervention, resulting in a time-dependent success rate (intervention-free survival) of 92.8% (95% CI: 0.86;1) after 36 months.

The specific success rate of the extensive maxillary veneers after 36 months was 91.5% (95% CI: 0.83;1), whereas the extensive mandibular veneers exhibited a success probability of 94.9% (95% CI: 0.62;1) after 36 months at clinical risk (Figure 5). Based on the Cox

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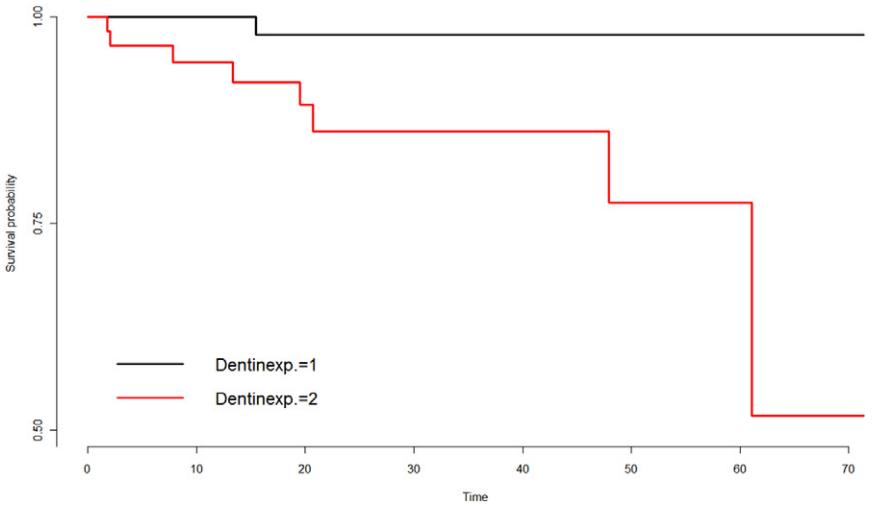

FIGURE 6. Time-dependent (months) success probability of ceramic veneers with different amounts of exposed dentin. Group 1: less than 50% of exposed dentin. Group 2: more than 50% of exposed dentin.

regression model, the success rate was independent of the veneer position (maxilla versus mandible, $p = 0.4$). An HR of 10.6 was calculated for veneers with a dentin exposure of over 50%, indicating an increased risk for complications that required clinical intervention (recementation, endodontic treatment). This association was statistically significant ($p = 0.026$) (Figure 6).

No carious lesions were detected on the veneer-restored teeth over the entire observational period. Eight of 130 veneers (Variolink 5, Calibra 3) exhibited a slight marginal discoloration (Bravo rating) that did not require clinical intervention. One veneer exhibited an approximately 2 mm-long fissure of the ceramic without mobility of the ceramic. Again, no clinical intervention was required.

DISCUSSION

The inherent limitations of a retrospective study should be considered when interpreting the results of the present study, which examined ceramic veneers placed in a broad field of indications with a variety of preparation designs. Compared with a prospective trial, less strict inclusion and exclusion criteria were applied. Furthermore, all of the restorations were placed by a single operator, which limits the potential generalization of the results, as operator-related effects on the clinical performance cannot be evaluated. Another typical complication of retrospective studies is the availability of analyzable, consistent data. However, this limitation did not apply to the present retrospective study as the clinical findings were recorded in a single private practice that has used a standardized procedure since the beginning of 1998. An additional limitation of retrospective studies involves follow-up examinations in that inferences can only be generalized to the population segment that participates in the study. Only 4 of the 41 patients whose teeth were restored with veneers and who were contacted did not participate, resulting in a response rate of 90.2%. Therefore, a possible selection bias toward patients who were satisfied with the entire treatment is minimized. Furthermore, the study is limited because of the relatively short mean observational period of 36 months. Because the number of participants who were available for follow-up examinations decreased over time and all of the restorations were performed by a single operator, these findings should be interpreted with caution.

This study demonstrated a cumulative survival probability of 95.1% after 3 years according to the in situ criterion. The results of this study should be compared with trials using similar survival criteria.

Fradeani[15] reported a survival rate, according to the in situ criterion, of 98.8% after 5 years for veneers with primarily intra-enamel preparations. The slightly lower cumulative survival rate observed in the present study may be explained by the less strict inclusion criteria,

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which allowed for veneer restorations on teeth with more than 50% exposed dentin. Guess and colleagues[19] also used the in situ criterion for the evaluation of extensive ceramic veneers that were fabricated from heat-pressed ceramic. In this previous study, a survival rate of 97.5% after 5 years was determined. Similar to the present study, extensive veneers with a high degree of exposed dentin were included. Despite the different study designs (retrospective versus prospective) and clinical settings (practice based versus university based), both studies demonstrated high survival rates for heat-pressed ceramic veneers, even for extensive indications. As the in situ criterion is widely used in clinical investigations of the long-term performance of crowns and bridges, the results from these previous trials and those of the present study can be compared. In a systematic review of 34 studies, Pjeturrson and colleagues[22] calculated a cumulative 5-year survival rate of 93.3% for all-ceramic crowns and a 95.6% survival rate for metal-ceramic crowns. Based on the present findings, the survival rate of mandibular and maxillary heat-pressed ceramic veneers is comparable with the published rates for conventional crowns, even in teeth with large areas of exposed dentin.

In the present study, the primary motivation for veneer replacements was a clinically unacceptable fracture of the restoration (four out of five failures), leading to a fracture rate of 3%. This finding is in accordance with the results of other investigations, which identified material fractures as the primary motivation for replacements.[8,12,14,17,18,20] The fracture rate for veneer restorations made from feldspathic porcelains with various observational periods ranges from 0 to 14%.[5,6] Heat-pressed ceramic veneers exhibited a rate of 1.2 to 2.3% for fractures that led to a replacement of the restoration.[15,19] Thus, material fractures are the most frequently cited reason for failure, a finding that is confirmed by the present study.

In the present study, the overall probability of success after 3 years was 92.8%. A restoration was rated as successful if its function was maintained without any clinical intervention. These findings are in good accordance with the results of a meta-analysis that included 15 studies and over 2,000 veneer restorations. In this previous analysis, veneers without fractures and debondings were rated as successful, and the calculated success rate according to these criteria was 92% after 3 years. Five-year success rates ranging from 90 to 96% are also reported from more recently published clinical trials.[10,13,16,20] The 5-year success rate of extensive heat-pressed ceramic veneers is reported to be in the range of 72 to 85%.

In the present study, the debonding rate was 2.3%, and debonding always occurred at the tooth–cement interface. All of the restorations were recemented and remained functional. Veneer debonding is a complication that has been described in earlier studies, with rates as high as 11%.[9,12,18] In other studies, debonding or a total interface failure occurred only when large portions of the preparation involved dentin or existing fillings.[7,9,12]

Increased debonding rates were also observed when the veneers were bonded to unprepared enamel or when the veneers were not etched with hydrofluoric acid prior to cementation.[12,21] In the present study, all of the teeth were prepared, the veneers were acid-etched, and all of the margins were placed over healthy tooth structures only. This process led to a comparatively low debonding rate. Furthermore, extensive veneers were also placed if larger dentin areas, amounting to over 50% of the preparation surface, were exposed. Especially with respect to teeth with preexisting fillings, the surface area of the enamel was often minimal (or in case of mesial and distal defects, only present at the margins); in these patients, the veneers were therefore primarily adhered to the dentin. The statistical analysis supports an association between larger areas of exposed dentin and an increased risk for technical and biological complications ($p = 0.026$). The determined HR of 10.6 indicates a 10-fold higher risk for technical complications for veneers that exhibited dentin over more than 50% of the preparation surface than for veneers for which less than 50% of the preparation surface area consisted of exposed dentin or filling material. Other studies have also documented that failures were more likely when veneers are partially bonded to dentin.[7,9,19,20]

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During the observational period, 2 of 130 teeth (1.5%) lost pulp vitality and required endodontic treatment to maintain function. As the majority of similar clinical trials have not included endodontic complications in their outcome measurements,[7,10,12,13,16,18,27] the available information regarding this type of biological complication is limited. In a retrospective study that evaluated 617 CAD/CAM-fabricated ceramic veneers, the endodontic complication rate was 0.8% after a mean observational period of 4.7 years.[17] Based on the results of a recent systematic review, the 5-year rate for the loss of abutment vitality for all-ceramic and metal-ceramic crowns was 2.1%.[22] Thus, the results of the present study demonstrate an incidence of endodontic complication that is within the range of complication rates that are reported for full crowns. As the present study also included the analysis of extensive veneers with more aggressive preparation designs, this biological complication may be related to the specific veneer procedure and the preparation size. Secondary caries did not occur at maxillary or mandibular veneer restorations; this finding concurs with the majority of other clinical studies, in which caries rates ranging from 0 to 2% have been reported.[7,10,14,17,20,23,24,27]

A specific design aspect of the present study is the evaluation of the effect of the independent variables "jaw position" and "dentin exposure" on the survival and the success rates of the extensive veneer restorations. Data from clinical studies on the success rates of veneer restorations of mandibular teeth are limited as most published studies included only a small number of mandibular ceramic veneers, if any.[1,5,6,10,16,18,19] In the present study, a relatively high percentage of the veneers were placed on mandibular incisors (41.5%). The statistical analyses identified no statistically significant association between the survival ($p = 0.3$) or success ($p = 0.40$) of the restoration and the jaw position of the veneers. Based on these findings, mandibular veneers appear to exhibit a clinical prognosis comparable with previously documented findings for maxillary veneers. Considering the determined survival and success rates, extensive ceramic veneers are a reasonable alternative to full crown restorations, even in the anterior mandibular region. At present, the null hypothesis must be rejected as dentin exposure exhibited a significant association with the success rate of the heat-pressed ceramic veneers. The limited number of failures does not allow for an analysis of any possible confounding factors, e.g., age, gender, preparation design, and tooth position.

CONCLUSIONS

After 36 months of clinical service, extensive anterior veneer restorations made using a pressable ceramic demonstrated a survival rate of over 95%. The primary cause of failure was a fracture of the ceramic material. Technical and biological complications were significantly associated with a larger amount of exposed dentin (over 50% of the preparation surface). Based on this study, ceramic veneers in the mandible are likely to be as successful as veneer restorations placed on maxillary anterior teeth.

DISCLOSURE

The authors do not have any financial interest in the companies whose materials are included in this article.

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