Short Communication

Metal-Ceramic Failure in Noble Metal Crowns: 7-Year Results of a Prospective Clinical Trial in Private Practices

Bernd Reitemeier, Dr Med Dent[a]/Kristina Hänsel, Dr Med Dent[b]/Christian Kastner, Dr Oec Publ[c]/Michael H. Walter, Dr Med Dent[d]

Purpose: The aim of this study was to evaluate the clinical performance of metal-ceramic crowns placed in 10 private practices. ***Materials and Methods:*** In this prospective clinical trial, 95 patients were provided with 190 noble-metal metal-ceramic single crowns. ***Results:*** The 7-year survival rates of the crowns were 95.5% (target event: any removal), 99.5% (target event: removal because of defective veneer), and 92.4% (target event: metal-ceramic complication of any kind). No significant explanatory variables for metal-ceramic complications could be detected by bivariate and multivariate testing. The consequences resulting from metal-ceramic defects were of minor clinical significance in most cases. ***Conclusion:*** The findings support previous claims that metal-ceramic restorations perform very well clinically, including in practices outside academic environments. *Int J Prosthodont 2006;19:397–399.*

Little information is available, except for some retrospective data, on the performance of metal-ceramic restorations in a general private practice setting. In an Australian specialist prosthodontic practice, the repair and failure rates of metal-ceramic crowns after 5 to 10 years in clinical service were both 3%.[1] With single crowns, a meta-analysis found that porcelain veneer fracture was among the 3 most common complications.[2] The aim of this trial was to evaluate the risk of metal-ceramic failure in routine treatment outside the typical specialized study environment.

Materials and Methods

In this prospective clinical trial, 10 previously trained general practitioners provided patients with 2 metal-ceramic single crowns each. All of the practitioners had the former East German specialization in general dentistry, a German doctoral degree, and 12 to 30 years of clinical experience. Inclusion criteria comprised vital premolars and molars needing full crowns. Removable dentures in the arch to be restored were the exclusion criterion. Informed consent was obtained from all study participants. Prosthetic treatment followed a standard protocol comprising chamfer preparation. The dental laboratory and the alloy were chosen randomly. Three dental laboratories that had received detailed instructions were involved. Four alloys were used: Degudent H (Au84Pt8Pd5), Biocclus 4 (Au86Pt11), Deva 4 (Au51Pd39In9), and Degupal G (Pd77Ag7Ga6) (all manufactured by DeguDent). Complete veneering was carried out with feldspathic ceramic (Duceram, DeguDent). Follow-up examinations were conducted at 2 weeks and annually. All complications were recorded, regardless of their nature. The dried crown surfaces were checked for any damage to the veneer.

Survival analyses were conducted for different target events. The 2-sided Pearson chi-square test was used to detect relationships between the dependent variable metal-ceramic complications of any kind and the independent variables alloy, dental laboratory, jaw, side, and signs or symptoms of bruxism. To reduce confounding effects, a multivariate stepwise logistic regression analysis with the same variables using the backward method was also conducted.

[a]*Professor, Department of Prosthetic Dentistry, School of Dentistry, Dresden University of Technology, Dresden, Germany.*
[b]*Dentist, Department of Prosthetic Dentistry, School of Dentistry, Dresden University of Technology, Dresden, Germany.*
[c]*Statistical Consultant, Waldershof, Germany.*
[d]*Professor and Director, Department of Prosthetic Dentistry, School of Dentistry, Dresden University of Technology, Dresden, Germany.*

Correspondence to: *Dr Bernd Reitemeier, Department of Prosthetic Dentistry, Medical Faculty Carl Gustav Carus, Dresden University of Technology, Fetscherstraße 74, D-01307 Dresden, Germany. Fax: +49 351 4584368. E-mail: bernd.reitemeier@uniklinikum-dresden.de*

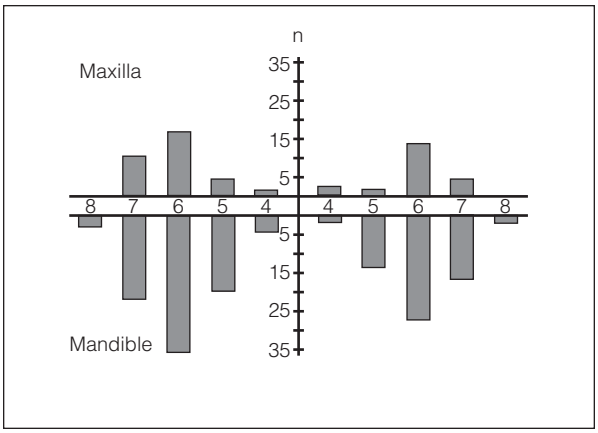

Fig 1 Distribution of metal-ceramic crowns.

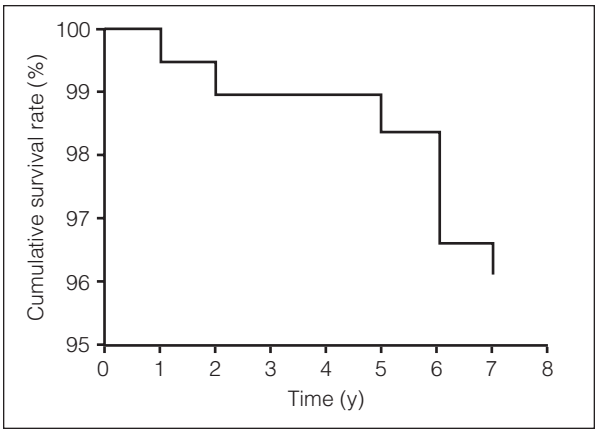

Fig 2 Life table survival function. Target event: any removal.

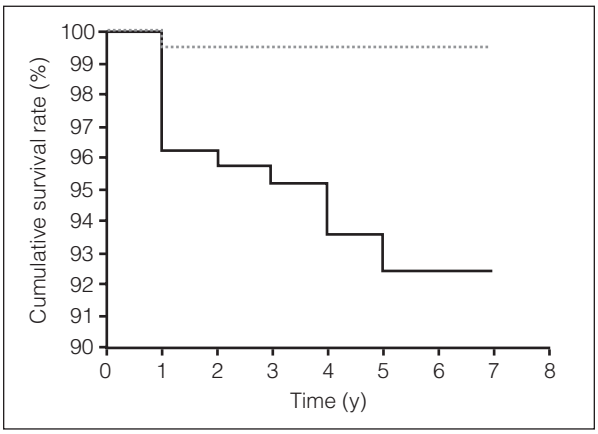

Fig 3 Life table survival functions. Target events: removal because of defective veneer (*dotted line*) and metal-ceramic complication of any kind (*solid line*).

Results

The study group comprised 95 patients (65 women, 30 men) and 190 single crowns (Fig 1). Thirty-six patients were under 35 years of age, 45 were from 35 to 54 years of age, and 14 were over 55 years of age. Over a 7-year period, 9 patients (9.5%) were lost to further follow-up for reasons not related to dental treatment. Six crowns had to be removed for reasons other than metal-ceramic complications, including tooth fracture, endodontic complications, secondary caries, and prosthetic reasons. One crown had to be removed because of a metal-ceramic defect. The life table survival rate related to any removal regardless of the reason was 96.1% at 7 years (Fig 2). This percentage is a statistical estimation of the cumulative probability of survival for this target event under the consideration of dropouts and the number of crowns exposed to risk.

Only 1 crown had to be removed because of a defective veneer, resulting in a survival rate of 99.5% at 7 years for this target event. Regarding metal-ceramic complications of any kind, such as the fracture of veneer, chipping, or cracking, as a target event, there were 14 events, including the 1 removal. Thirteen of these defects were considered clinically acceptable. They were left untreated, smoothened, or repaired. The respective survival function showed a steady decline from the first to the fifth year. The cumulative survival rate for the target event metal-ceramic complication of any kind at 7 years was 92.4% (Fig 3). The influence of alloy, dental laboratory, jaw, side, and signs or symptoms of bruxism remained insignificant in both bivariate and multivariate testing ($P > .05$).

Discussion and Conclusion

In this study, the multicenter approach and the involvement of private practitioners limited the possibilities for clinical standardization. This can be considered a weakness. On the other hand, the results obtained can be regarded as being more realistic than those achieved in highly standardized trials.

The overall survival rate was high and similar to published meta-analytic data.[3,4] Regarding removal because of a defective veneer, the data are in line with previous studies.[1,5] This target event proved to be extremely rare. Regarding any metal-ceramic complication, the survival rates were lower. When appraising these results, the special focus on metal-ceramic defects and the protocol of dried surfaces have to be considered. They might have led to the detection of defects that otherwise would have gone undetected. Additionally, the general practice setting, which is different from the usual study environment, might have influenced the results. Considering the minor influence

of all of the tested potential explanatory variables, metal-ceramic complications can be considered rare and predominantly random events with minor clinical consequences in most cases. Overall, the results strengthen the role of metal-ceramic restorations as the standard treatment under routine conditions.

Acknowledgments

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Literature Abstract

Load-fatigue performance of gold crowns luted with resin cements

This research studied the load-fatigue performance of full gold crowns cemented with 4 types of resin cement. Four resin cements (C & B Opaque [CBO], Calibra Esthetic [CE], RelyX Unicem [RU], and Panavia F [PF]) and a control, zinc phosphate cement (HY-Bond [HBZPC]) were tested. Fifty human maxillary premolars were prepared to an gingivo-incisal height of 4 mm at a convergence angle of 20 degrees. Full gold crowns were cast (Strator 3) and cemented with 1 of the 5 cements (n = 10). A total of 50 gold crowns were involved. A fatigue load of 73.5 N was applied at an angle of 135 degrees to the long axis of each specimen. The number of cycles to failure and the cement failure location were determined. Significant differences in cycles to failure were assessed by the nonparametric Kruskal-Wallis test, with follow-up Mann-Whitney tests. The results indicated that: *(1)* group CE had the highest rank of cycles to failure, and HBZPC had the lowest cycles to failure; *(2)* group CE was not significantly different from CBO, but had a significantly higher failure cycle count compared to PF, RU, and HBZPC; and *(3)* no significant difference was noted in the failure cycle count between RU and HBZPC. The authors concluded that not all tested resin cements had a superior fatigue life when compared with zinc phosphate cement. The authors, however, did not explain why the specimens were prepared to 20 degrees convergence.

Uy JN, Chiew Lian JN, Nicholls JI, Tan KBC. *J Prosthet Dent* 2006;95:315–322. **References:** 35. **Reprints:** Dr Joanne N. Uy, Department of Restorative Dentistry, Faculty of Dentistry, National University of Singapore, 5 Lower Kent Ridge Rd, Singapore 119074. Fax: 65-67785742–*Ansgar C. Cheng, Singapore*