The Performance of Zirconium Dioxide Crowns: A Clinical Follow-up

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Thirty-two patients who had been treated with 71 computer-aided design/computer-assisted manufacture–fabricated Cercon crowns were followed to assess clinical performance by time-to-event analysis. Clinical examinations consisted of a complete dental and oral hygiene examination and a quality assessment by modified California Dental Association criteria. Four patients (6 crowns) were lost to follow-up; another 11 crowns had to be excluded from evaluation for comparability reasons. Six of 54 evaluated crowns experienced complications (P_C = 11.1%) throughout a mean observation time of 21 months. Survival was estimated at 0.98 over 24 months. The good overall clinical performance was affected predominantly by technical complications of the veneering ceramic (P_{TC} = 9.3%). *Int J Prosthodont 2010;23:429–431.*

Zirconia-based restorations are reported to yield a promising overall survival rate of 90% to 100% over 2 to 5 years. Nevertheless, chip-off and partial fractures of the veneering ceramic seem to be a problem affecting 5% to 15% of observed units.[1–3] However, there are still few data available. The aim of this investigation was to evaluate the clinical performance of zirconia-based single-tooth crowns.

Materials and Methods

Thirty-two patients were treated with computer-aided design/computer-assisted manufacture–fabricated zirconia-based crowns (Cercon Smart Ceramics, Degudent; n = 71, Table 1). After the completion of treatment, patients were enrolled in a systematic follow-up to observe the clinical long-term behavior of the crowns. The sample consisted of patients requesting treatment in the Department of Prosthodontics, Center of Dentistry, Oral Medicine, and Maxillofacial Surgery Tübingen, in need of single-tooth crowns. If the abutment teeth had a sound clinical prognosis and the patient consented to receive zirconia-based crowns, abutment teeth were prepared with a 0.8- to 1-mm-deep circular chamfer in close relation to the gingival margin. The zirconia crown copings were fabricated according to the manufacturer's instructions. After clinical try-in, the zirconia frameworks were veneered using a layering technique (Cercon Ceram Kiss, Degudent). All crowns were inserted using a conventional cementation protocol. The preferred luting agent (n = 46, 85%) was a self-etching resin-based material (RelyX Unicem, 3M ESPE). A conventional cement was used for 8 crowns.

The clinical follow-up examinations consisted of a complete dental and oral hygiene evaluation and a clinical quality assessment of the zirconia crowns by a modified California Dental Association ranking. The main variable of interest was the occurrence of any adverse event affecting the crown's clinical quality. All clinical findings were recorded using case report forms as the source data. Data were evaluated using statistical standard software (JMP 6.0.3 for Macintosh, SAS).

The prevalence (P) of all adverse events (AE) and findings as observed was calculated as follows:

$$(P_{AE} = n_{AE} / n_{crowns})$$

Observations were rated as "complication" or "failure" (need for replacement) according to their clinical impact regarding the lifetime prognosis of the restoration or abutment tooth. The occurrence of a complication was used as a censor for a time-to-event analysis to estimate the complication rate and survival via Kaplan-Meier.

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Table 1 Characterization of the Clinical Cohort

	No. of crowns	No. of patients	Comment
Cohort size treated	71	32	
Lost to follow-up	6	4	Moved, noncompliant
Exluded from evaluation	1	1	Independent endodontic problem
or analysis	8	2	Temporarily luted
	2	–	Crown block (among other crowns)
Cohort size evaluated	54	25	7 men, 18 women; mean age: 45 years, range: 18 to 79 years

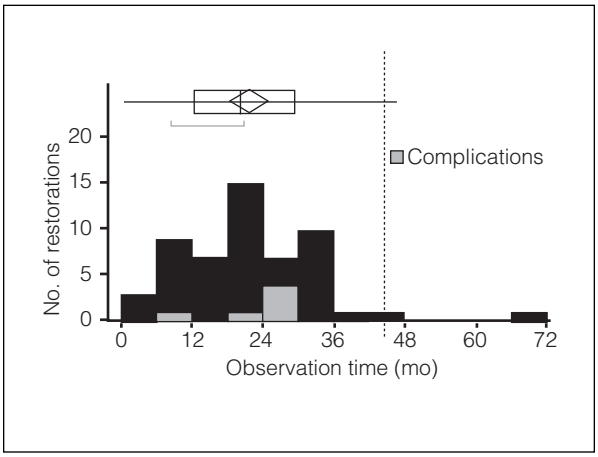

Fig 1 Distribution of the observation time ranging from nearly 1 up to 68 months (standard deviation: 11.4 months). The majority of all observations were made between 1 and 3 years of clinical service.

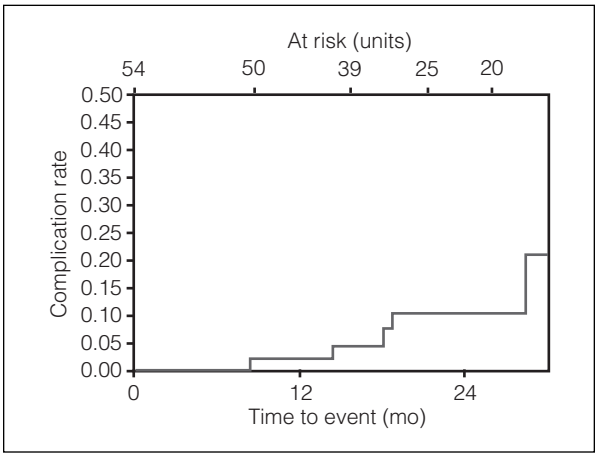

Fig 2 Failure plot estimating the complication rate via time-to-event analysis. A service time of 24 months was set as the cut-off point, since less than half of the crowns (n = 54) were still at risk.

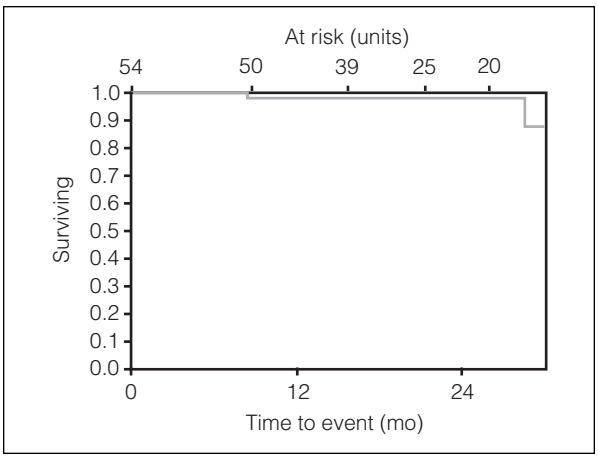

Fig 3 Kaplan-Meier plot estimating survival. Only complications rated as failures were considered. A service time of 24 months was set as the cut-off point, since less than half of the crowns (n = 54) were still at risk.

Results

Four patients (6 crowns) were lost to follow-up. The observed cohort of 28 patients (65 crowns) was followed over a mean observation time of approximately 21 months (Fig 1). Eleven of those 65 crowns were excluded from analysis because of a lack of technical comparability (Table 1). One (7%) of the 11 crowns excluded from evaluation experienced a veneering chip-off.

In the evaluated cohort of 25 patients with 54 crowns, 13 adverse events and findings were observed ($P_{AE} = 24\%$), mainly between a clinical service time of 1 to 2 years. Six of these observations were classified as complications ($P_C = 11.1\%$, Fig 1) and affected 3 patients; 5 complications were of a technical nature ($P_{TC} = 9.3\%$). The complication rate was estimated at 0.104 over approximately 24 months according to Kaplan-Meier analysis (Fig 2). Among the affected crowns, 1 premolar was removed after 8 months due to irreversible pulpitis, and 2 molars experienced fracture of the ceramic veneering material after 19 and 28 months and still needed replacement. Thus, these 3 crowns were assessed as failures (5.6%). Survival was estimated at 0.98 over 24 months (Fig 3).

Discussion

As reported by other researchers, zirconia-based restorations appeared to be especially susceptible to chipping and partial fractures in this investigation.[1–3] However, this phenomenon is obviously not limited to zirconia.[4,5] Nevertheless, complications seem to occur quite early in a crown's clinical lifetime. The other 7 of the 13 adverse findings were assessed as transient flaws or changes over time in clinical service, with a negligible clinical impact (13% overall). This is in line with recent data, reporting 1 failure (1 of 15 Cercon crowns, approximately 7%) and 26% of negligible findings within 2 years.[3]

Conclusion

Zirconia-based single-tooth crowns showed good clinical survival, but they are still affected by chip-off or partial fractures of the veneering ceramic. This problem needs further investigation and development to be explained and solved. Nevertheless, zirconia-based crowns might have the potential to become a fully recognized restorative treatment option.

References

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