Survival Rates of Porcelain Molar Crowns–An Update

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The aim of this study was to identify recent studies that dealt with the clinical performance of porcelain molar crowns and to explore the possibility of grouping the findings from similar studies together to draw overall conclusions. A MEDLINE literature search was conducted in early 2009 covering the preceding 12 years. Seventeen studies were indentified. However, only seven met the specific inclusion criteria and were analyzed. Among seven studies, five European countries were covered. Five studies reported on Procera AllCeram molar crowns while one reported on In-Ceram Alumina and Spinell crowns and another on CEREC crowns. For comparison, one additional study that reported on premolar crowns was included. In the five Procera AllCeram studies, 235 molar crowns were evaluated for 5 or more years, of which 24 failed. When the results of the five studies on the performance of Procera AllCeram molar crowns were considered collectively, an overall failure rate of 10.2% was found at 5 or more years. *Int J Prosthodont 2010;23:60–62.*

Currently, nonmetallic crowns can be made as single-phase (monolithic) crowns milled out of a block using the CEREC computer-aided design/computer-assisted manufacturing technology or as twophase crowns through fabrication of a coping, which is subsequently sintered and then finished with veneering porcelain. A variety of blocks are available for use with the CEREC chairside machine, including feldspathic porcelain, leucite-reinforced glass ceramic, or

composite resin. Blocks used for the two-phase in-lab technique are composed of alumina or zirconia, with zirconia being used more frequently for molar applications. Zirconia blocks are provided partially sintered (presintered) for ease of milling, and are subjected to milling in a high-accuracy digital milling machine. They are then subjected to final sintering in a furnace, a process accompanied by a precalculated volumetric shrinkage of about 20%. The veneering porcelain can be added manually by a technician.

The aim of this study was to identify clinical trial studies conducted recently on nonmetallic molar crowns in an attempt to group similar ones together and draw overall conclusions about the survival rates of molar crowns.

Materials and Methods

A MEDLINE search was conducted in early 2009 to identify clinical trial studies that were performed to evaluate the clinical performance of ceramic molar crowns. The search was limited to studies published in the last 12 years. Only studies published in English and those

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Study	Duration(y)	Female	Male	Study conditions	Crown material	Cement used
Fradeani et al	1 5	59	47	3 dentists in private practice; crowns fabricated by 3 technicians	Procera AllCeram	Resin cement and glass- ionomer cement
Zitzmann et a	l ² 8	39 partic	ipants	Undergraduate and post- graduate students in a university clinic	Procera AllCeram	Resin cement and glass- ionomer cement
Odman and Andersson ³	10.5	28	13	12 dentists in 9 private dental clinics	Procera AllCeram	Zinc-phosphate cement and glass-ionomer cement
Odén et al ⁴	5	38	20	4 general dental practitioners	Procera AllCeram	Zinc-phosphate cement and glass-ionomer cement
Naert et al ⁸	5	119 partic	ipants	Graduate students supervised by a senior prosthodontist in a university clinic	Procera AllCeram	Glass-ionomer cement
Bindl et al⁵	5	79	57	Clinical procedures performed by the authors in a university clinic	Vitabloc Mark-II, CEREC	Composite resin
Bindl and Mörmann ⁶	5	18	8	6 clinicians operated in the authors' clinic	In-Ceram Alumina and Spinell	Resin cement
Walter et al ⁷	6	41	29	3 clinicians in a dental school	Procera AllCeram	Glass-ionomer cement

Table 1Details of the Included Studies

 Table 2
 Extracted Data on Premolar and Molar Crowns from the Included Studies

Studies	Premolar crowns	Molar crowns	No. of failures	Mode of failure	Survival (%)*
Fradeani et al ¹	76	79	4 M	2 fractures of both veneering porcelain and alumina core (M); 1 delamination of veneering porcelain (M); 1 fracture of veneering porcelain only (M)	Overall: 97.42% M: 94.9% P: 100%
Zitzmann et al ²	38	56	7 M 1 P	1 crown fracture(M); 2 root fractures (1M, 1P); 4 caries in root (M); 1 periapical lesion requiring root canal treatment (M)	Overall: 91.5% M: 89.2% P: 98.8%
Odman and Andersson ³	24	25	3 M 2 P	3 fractures of both veneering and coping (1M, 2P); 1 caries (M); 1 crack in occlusal porcelain (M)	Overall: 89.8% M: 88%; P: 97.7%
Odén et al ⁴	28	55	6 M 1P	3 fractures of veneering porcelain with the coping (M); 1 caries (M); 1 endotherapy (crown still in service) (M); 2 fractures of the veneering porcelain only (1M, 1P)	Overall: 91.6% M: 89.1% P: 96.4%
Naert et al ⁸	37	-	1 P	Fracture of the coping and veneering porcelain (P)	97.3%
Bindl et al⁵	63	145	27 M 10 P	7 fractures of the crowns into 2 halves (5M, 2P); 8 vertical root fractures (5M, 3P); 14 adhesive failures (9M, 5P); 5 endodontic therapy (M); 2 periodontitis (M); 1 interradicular osteitis (M)	Overall: 82.2% M: 81.4% P: 84.1%
Bindl and Mörmann ⁶	4 (S) 2 (A)	15 (S) 22 (A)	2 M (A)	2 fractures of the veneering porcelain and the coping (M)	Overall: 95.3% M: 94.6%; P: 100%
Walter et al ⁷	26	20	4 posterior (not specified M or P)	3 fractures of veneering porcelain with the coping; 1 fracture of the veneering porcelain only	Overall: 91.3% M: 80% P: 84.6%

*Survival rates were calculated based on the recorded failures.

M = molar; P = premolar; S = Spinell; A = Alumina.

that lasted 5 or more years were included. Data were derived from the included studies¹⁻⁷ and tabulated for summary. Included studies provided data on both molar and premolar crowns. These were separated and tables were generated accordingly. Failure rates were calculated per tooth type (premolar or molar) from the reported information. Data from an additional study that met the selection criteria but reported on only premolar Procera AllCeram crowns instead of both premolar and molar crowns were included separately.⁸

Results

Seventeen studies were identified, 10 of which were excluded since they did not meet one or more of the inclusion criteria (4 because of language and 6 because of short duration). The 7 included studies were thoroughly reviewed and analyzed.¹⁻⁷ Five dealt with Procera AllCeram crowns, 1 with CEREC computeraided design/computer-assisted manufactured crowns made with Vitabloc Mark-II (feldspathic porcelain), and 1 with In-Ceram Alumina and In-Ceram Spinell crowns. The studies were conducted in Italy, Switzerland, Sweden, Belgium, and Germany and were published between 1998 and 2007. Study duration ranged from 5 to 10.5 years.^{3,6} Table 1 lists the details of the included studies with the extracted data on premolar and molar crowns listed in Table 2.

In the five Procera AllCeram studies, 235 molar crowns were evaluated for 5 or more years, of which 24 failed. Therefore, the overall failure rate at 5 or more years was 10.2% (range: 5.1% to 20%).^{1,7} In contrast, failure rates reported for 229 Procera AllCeram premolar crowns ranged from 0% to 15.9%.

For the other two included studies, CEREC crown failure rates were reported to range from 5.4% to 12.9%, based on a total of 145 molar crowns reported in one study.⁵ In the other study, 22 In-Ceram alumina molar crowns had a failure rate of 9.1%, while none of 15 In-Ceram Spinell crowns underwent failure.⁶

Discussion

In one of the included Procera crown studies, the authors used both molar (n = 20) and premolar (n = 26) crowns for their clinical trial. However, no breakdown was given regarding which crowns failed. Rather, the authors gave an overall figure of four total failures. In the present analysis, a worst-case scenario was assumed that all four failures belonged to the molar crown group, hence the highest failure rate (20%). If molar failures were less than four, this would significantly reduce the highest percentage of failure. For example, if only two of the four crowns that failed belonged to the molar group, this would change the range of failure rates to 5.1% to 12%.^{1,3}

Conclusions

When results of five clinical trial studies on the performance of Procera AllCeram molar crowns were considered collectively, an overall failure rate of 10.2% was found at 5 or more years. Crown failure rates were generally higher in molars compared to premolars.

References

- Fradeani M, D'amelio M, Redemagni M, Corrado M. Five-year follow-up with Procera all-ceramic crowns. Quintessence Int 2005;36:105–113.
- Zitzmann NU, Galindo ML, Hagmann E, Marinello CP. Clinical evaluation of Procera AllCeram crowns in the anterior and posterior regions. Int J Prosthodont 2007;20:239–241.
- Odman P, Andersson B. Procera AllCeram crowns followed for 5 to 10.5 years: A prospective clinical study. Int J Prosthodont 2001;14:504–509.
- Odén A, Andersson M, Krystek-Ondracek I, Magnusson D. Fiveyear clinical evaluation of Procera AllCeram. J Prosthet Dent 1998;80:450–456.
- Bindl A, Richter B, Mörmann WH. Survival of ceramic computeraided design/manufacturing crowns bonded to preparations with reduced macroretention geometry. Int J Prosthodont 2005;18:219–224.
- Bindl A, Mörmann WH. An up to 5-year clinical evaluation of posterior In-Ceram CAD/CAM core crowns. Int J Prosthodont 2002;15:451–456.
- Walter MH, Wolf BH, Wolf AE, Boening KW. Six-year clinical performance of all-ceramic crowns with alumina cores. Int J Prosthodont 2006;19:162–163.
- Naert A, Van der Donck A, Beckers L. Precision of fit and clinical evaluation of all-ceramic full restorations followed between 0.5 and 5 years. J Oral Rehabil 2005;32:51–57.

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