

A survey of the distribution and types of full crowns prescribed in Melbourne, Australia

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Abstract

The full crowns made by 11 commercial dental laboratories in Melbourne, Australia, were surveyed over a two-month period. The survey was designed to find which teeth were crowned and what types of full crowns were prescribed. Maxillary central incisors were found to be the most frequently crowned teeth (15.6 per cent) and porcelain-fused-to-metal crowns were the most commonly prescribed type of crown (82.9 per cent). This study may form a baseline with which other Australian studies may be compared and contrasted.

Key words: Crowns, survey, epidemiology, statistics.

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Introduction

A full crown is 'an extracoronal restoration covering the clinical crown'¹ of a tooth. It may be used to restore function and/or aesthetics to a tooth, while protecting the remaining tooth structure. Artificial full crowns may be indicated where aesthetic or mechanical demands are not adequately met by direct restorative materials or more conservative indirect restorations.

Full crowns may be made from a variety of materials. There are five broad categories of crowns available to the clinician: all-metal, all-ceramic, resin composite, porcelain-fused-to-metal (PFM) and resin-bonded-to-metal. PFM crowns may be made with a cast or non-cast metal substructure. All-ceramic crowns may be conventional, cast or pressed. The type of crown chosen may depend upon aesthetic and mechanical considerations, patient preference, dentist preference and material availability.

Information on prescribing patterns has come from many sources. The Dental Practice Board of England and Wales produces an annual statistical report detailing services rendered under the National Health Service (NHS).² For the 12-month period ending March 1997, over 1.4 million crowns were provided. PFM crowns were the most used, comprising 94.7 per cent of all crowns. All-ceramic crowns were the second most used (2.9 per cent), followed by all-metal (1.9 per cent), porcelain-fused-to-non-cast metal (0.2 per cent), resin (0.2 per cent) and the remainder were classed as 'other'. This report indicates the increased popularity of PFM crowns, compared with 1988, when 62 per cent of full crowns were PFM crowns.³ Farrell and Dyer³ noted the most commonly provided crown type under the NHS has varied with the availability of materials.

A longitudinal study examining the provision of crowns in Scotland between 1978 and 1988 demonstrated how crown types chosen can vary with time.⁴ In the study, 62.4 per cent of the crowns were all-ceramic, 31 per cent PFM crowns and 6.6 per cent all-metal. While the majority of the crowns were all-ceramic, the number of PFM crowns increased each year, until they accounted for over 50 per cent of the crowns placed in each of the final two years. The number of metal crowns placed each year remained approximately the same. The study also examined the distribution of the crowns. Most crowns were for maxillary anterior teeth (67.7 per cent); 17.4 per cent were for maxillary posterior teeth; 11.8 per cent were for mandibular posterior teeth; and 3.3 per cent were for mandibular anterior teeth. Little difference was observed between the distribution of the crowns on the left and right sides.

Silness⁵ examined the distribution of crowned teeth among patients at the University of Bergen, Norway. Most crowns were for maxillary anterior teeth (49.7 per cent); 21.9 per cent were for mandibular posterior teeth; 19.6 per cent were for maxillary posterior teeth; and 9.1 per cent were for mandibular anterior teeth.

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Valderhaug and Karlsen⁶ conducted a review of patients' records from the Department of Prosthetics at the University of Oslo. Their study encompassed patients attending the clinic between 1,967 and 1,973, providing data for 3,275 crowns received by 2,145 patients. Most crowns were for maxillary teeth (65.7 per cent) and the maxillary central incisor was the most frequently crowned tooth. In the mandible, the premolars were the most frequently crowned teeth.

Berge and Silness⁷ conducted an investigation into the types of crowns made in Bergen, both in private practice and at the University of Bergen. The data for the crowns made for private practice were obtained in 1987 and the data for the dental school were obtained from patients' records from 1982 to 1987. Most crowns were for maxillary teeth and maxillary incisors and premolars were the most commonly crowned teeth, followed by maxillary canines and molars. The distribution of crowned mandibular teeth varied between the private practice patients and the dental school patients. Premolars and first molars were the most crowned mandibular teeth in private practice, followed by canines, second molars and incisors. At the dental school, premolars were the most commonly crowned mandibular teeth, followed by canines, incisors and first molars.

The purpose of the study was twofold: first, to determine the types of artificial full crowns prescribed in Melbourne; and, second, to investigate which teeth were receiving crowns.

Materials and methods

The survey involved dental laboratories with an existing sponsorship arrangement with the University of Melbourne's School of Dental Science. Twelve of the 13 laboratories involved with this arrangement agreed to participate in the survey. The survey was facilitated through the Australian Commercial Dental Laboratory Association (ACDLA), of which 11 laboratories were members. There are 43 commercial dental laboratories in the Victoria branch of the ACDLA, of which

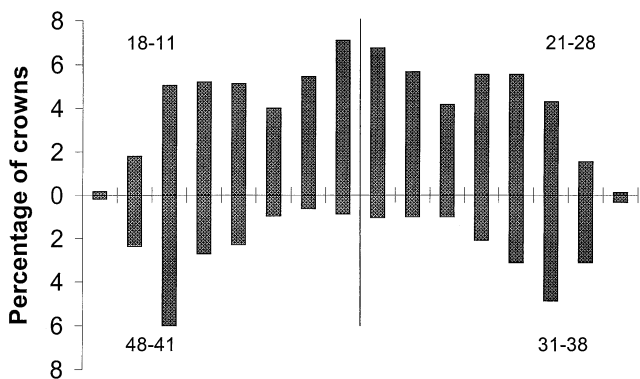


Fig 1. - The percentage distribution of PFM crowns.

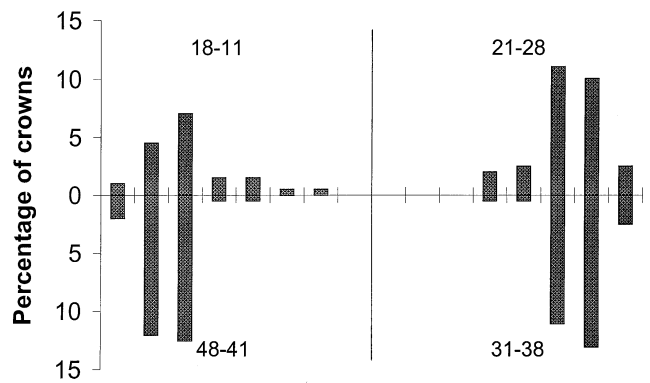


Fig 2. - The percentage distribution of all-metal crowns.

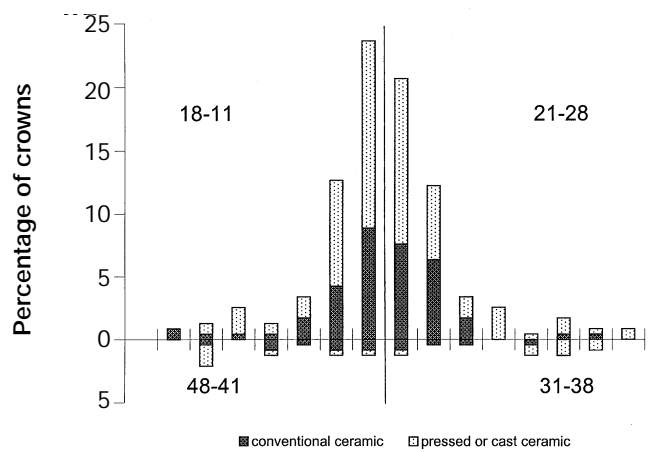


Fig 3. - The percentage distribution of all-ceramic crowns.

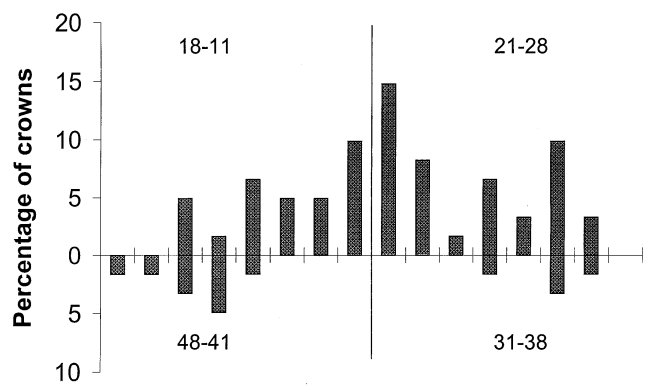


Fig 4. - The percentage distribution of resin composite crowns.

approximately 80 per cent make crowns. The 12 laboratories recruited varied in size and output and included the three largest laboratories in Melbourne.

The laboratories were requested to record details of the tooth to be crowned and the type of crown prescribed on survey forms supplied by the researchers. After two months, the laboratories were asked to mail back the survey sheets anonymously, in prestamped envelopes. Reminder letters and telephone calls were made at the conclusion of the survey to ensure the surveys were returned. Eleven of the laboratories returned their completed surveys.

Table 1. The percentage distribution of maxillary crowns

	PFM	All-metal	All-ceramic	All-resin	Total
Central incisors	11.5	0	3.6	0.5	15.6
Lateral incisors	9.2	0.03	2.0	0.3	11.6
Canines	6.8	0.03	0.6	0.1	7.5
First premolars	8.8	0.2	0.3	0.3	9.7
Second premolars	8.9	0.3	0.2	0.1	9.5
First molars	7.7	1.2	0.2	0.3	9.5
Second molars	2.8	1.0	0.1	0.1	4.0
Third molars	0.2	0.2	0.1	0	0.6
Total	55.9	3.1	7.2	1.7	67.9

The survey data were subsequently collated and then examined.

Results

Data were collected for a total of 2,899 crowns. The most prescribed type of crown was the PFM crown (82.9 per cent), followed by the all-ceramic crown (8.2 per cent) and the all-metal crown (6.9 per cent). The least-prescribed type of crown was the resin composite crown (2.1 per cent). No resin-bonded-to-metal or porcelain-fused-to-non-cast-metal crowns were reported by the laboratories. Figures 1-4 show the distribution of each of these crown types.

Most of the crowns prescribed were for the maxillary arch, comprising 67.9 per cent of the sample. The total distribution of crowns prescribed was similar on both the left (50.5 per cent) and right (49.5 per cent). The most frequently crowned tooth was the maxillary central incisor (15.6 per cent). Maxillary anterior teeth were crowned more than maxillary posterior teeth. In the mandibular arch, the first molar was the most frequently crowned tooth (11 per cent). Mandibular posterior teeth were crowned more than mandibular anterior teeth. Tables 1 and 2 detail the distribution and types of crowns prescribed for each tooth type.

Discussion

Crown Distribution

Most crowns were for maxillary teeth, a consistent finding in other studies.⁴⁻⁷ Maxillary anterior teeth were the most commonly crowned teeth, as also previously reported.⁴⁻⁷ This study did, however, differ from European studies regarding the proportions of crowns prescribed. In the study, 34.6 per cent of the crowns were for maxillary anterior teeth, 33.2 per cent for maxillary posterior teeth, 27.2 per cent for mandibular posterior teeth and 5 per cent for mandibular anterior teeth. Silness reported a differing distribution in his 1970 study.⁵ Fyffe⁴ reported the same ordering, but with a far greater proportion of maxillary anterior crowns. Unlike the study of Berge and Silness,⁷ mandibular premolars

Table 2. The percentage distribution of mandibular crowns

	PFM	All-metal	All-ceramic	All-resin	Total
Central incisors	1.6	0	0.2	0	1.8
Lateral incisors	1.4	0	0.1	0	1.5
Canines	1.6	0	0.1	0	1.7
First premolars	3.6	0.1	0.1	0.1	3.9
Second premolars	4.8	0.1	0.1	0.1	5.1
First molars	9.0	1.6	0.3	0.1	11.0
Second molars	4.6	1.7	0.1	0.1	6.4
Third molars	0.4	0.3	0	0.03	0.8
Total	27.0	3.8	1.0	0.4	32.2

were not found to be the most frequently crowned mandibular teeth in this study.

It has been proposed that the distribution of crowned teeth reflects the relative susceptibility of particular teeth to decay and loss of function and aesthetics.⁷ It is interesting to note that, despite posterior teeth being more severely affected by decay than anterior teeth, maxillary anterior teeth were found to be the most frequently crowned teeth.⁸ Perhaps patients are more willing to pay for crowns that improve their appearance. Furthermore, maxillary central incisors are at the greatest risk of trauma, which may also result in the need for crown placement.⁹ The contribution of endodontic treatment necessitating crown placement is unclear, with very little information available pertaining to endodontic epidemiology.⁹

The restorative cycle of repeated placement and replacement of restorations results in progressive loss of tooth structure and weakening of the tooth.¹⁰ This cycle may lead to crown placement where direct restorative materials can no longer meet the functional or aesthetic demands required for successful restoration. It is possible that anterior teeth have a shorter restorative cycle before crown placement is required, due to problems with the retention and physical properties of direct aesthetic restorative materials. The use of amalgam posteriorly may allow for prolonged direct restoration prior to crown placement.¹¹⁻¹²

While patient and mechanical factors are important in selecting the type of crown to be used, factors related to the clinician are also likely to have a bearing on the type of crown selected. Clinical knowledge, experience and undergraduate training may influence the types of crowns dentists prescribe and the availability of crown materials and laboratory services may also be influential.⁷

The data from this study came from 11 laboratories. It is not known what proportion of the crowns prescribed in Melbourne during the survey period are represented by this survey. The varied geographic locations and the inclusion of several large laboratories

were intended to provide a representative sample of crown prescription in Melbourne.

Crown types prescribed

PFM crowns were the most popular type of full crown in this survey. This popularity has been reported in other recent studies^{2,4} and is most likely due to their versatility.¹³ The PFM crown combines the aesthetics of porcelain with the strength of metal, making it suitable for use in the restoration of both anterior and posterior teeth.

None of the laboratories reported making porcelain-fused-to-non-cast-metal crowns. Several techniques have been developed to fabricate porcelain crowns with non-cast metal substructures. However, most are technically demanding and slow to fabricate.¹⁴ Discussion with the laboratory owners indicated these types of crowns are rarely asked for. The Dental Practice Board of England and Wales² reported a very low utilization of these crowns (0.2 per cent).

All-ceramic crowns offer potentially excellent aesthetics and they are often more conservative than PFM crowns as there is no need to prepare a margin that accommodates both porcelain and metal. However, PFM crowns may be more conservative in the amount of lingual tooth reduction required. As all-ceramic crowns are metal-free, it has been claimed there are no problems associated with corrosion and biocompatibility or interferences in translucency.¹⁵ More recently, advances in dentine bonding have resulted in the so-called dentine-bonded all-ceramic crown. Advantages of these crowns include excellent aesthetics, conservative tooth preparation and resistance to fracture.¹⁶ Dentine-bonded all-ceramic crowns are technique-sensitive and are not suitable where margins extend subgingivally. The integrity of the dentine bond is critical to the success of these crowns, making their longevity uncertain.

Most of the all-ceramic crowns in the survey were intended for maxillary incisors (78.5 per cent), which reflects the importance of aesthetics in this part of the dentition (although most of the anterior crowns surveyed were PFM crowns). In this study, 45 all-ceramic crowns were also placed posteriorly, 75.6 per cent of which were cast or pressed ceramic crowns. Ceramics processed in this manner have flexural strengths superior to feldspathic ceramics and they may be dentine-bonded.¹⁷ These factors are likely to be influential in material selection for the clinician seeking a metal-free aesthetic crown.

All-metal crowns can be cast as thin veneers that are resistant to both occlusal forces and fracture if they are made from dental gold alloys.¹³ This strength in thin section is advantageous as it allows for conservative and adaptable tooth preparation. A

disadvantage of all-metal crowns is their appearance, which normally limits their use to the restoration of posterior teeth, a finding supported by this study, in which nearly all of the all-metal crowns were placed posteriorly. The majority of all-metal crowns were for mandibular molars. It is interesting to note the higher proportion of all-metal crowns prescribed in this study as compared with recent NHS figures for England and Wales.²

Several indirect resin composite systems, which the manufacturers claim may be used to make full crowns, are currently available.¹⁸ These systems have been attributed various names by both the manufacturers and authors alike, including second-generation laboratory composite resins, ceramic polymers and polyglasses.¹⁷ Possible advantages of these materials include high flexural strength, biologically compatible wear and acceptable aesthetics.¹⁷⁻¹⁸ Furthermore, it is claimed the crowns are relatively easily made, repaired and adjusted.¹⁷⁻¹⁸ The long-term clinical performance of these materials is unknown and may partially account for their low current usage. This may change as clinical experience with these materials increases.

None of the laboratories made resin-bonded-to-metal crowns during the survey period, suggesting this form of crown is not widely used in Melbourne.

Conclusion

This study has shown the pattern of distribution of teeth crowned in Melbourne, Australia, and the types of crowns used. The data may serve as a baseline with which future Australian studies may be contrasted and compared.

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