Contemporary dental practice in the UK in 2008: indirect restorations and fixed prosthodontics

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IN BRIEF

- Amalgam is still the preferred material for the core build up of vital teeth.
- Fibre posts are being increasingly used.
- Veneers as opposed to full coverage crowns are preferred for the restoration of anterior teeth.

Objectives To investigate, by postal questionnaire, various aspects of primary dental care provision in the United Kingdom. Additionally, to compare the results of this survey with a similar survey completed four years previously. **Methods** A questionnaire containing 89 questions was sent to 1,000 general dental practitioners selected at random from databases of practitioners throughout the United Kingdom. Non-responders were sent another questionnaire after a period of four weeks had elapsed. **Results** Overall a response rate of 66.2% was achieved. Amalgam was the preferred material for the core build up of vital teeth for 65% of the respondents. Dentine pins were still being used by practitioners, with stainless steel pins being preferred by 34% of respondents. 39.7% of dentists that had graduated between 0–10 years previously reported using no pins. Indirect posts were still used most widely, by 55% of the practitioners in the study, with increasing use of fibre posts noted (34%). Addition cured silicone impression materials were still the most frequently used impression material (71%) with reduced use (10%) of condensation cured silicone impression materials recorded. Glass ionomer luting cements (48%) and zinc phosphate (28%) were the most commonly used luting cements. **Conclusions** Within the limitations of this study, the following conclusions can be drawn: amalgam is still the preferred material for the core build-up of vital teeth; dentine pins are still used widely, but not by younger practitioners; fibre posts are being increasingly used by practitioners; addition cured silicone is still the most widely used impression material; traditional glass ionomer cements are still the most widely used luting cements; veneers are still the preferred indirect restoration for restoring anterior teeth; and CAD/CAM systems are increasingly being used by practitioners.

INTRODUCTION

A questionnaire, designed to seek information about various aspects of primary dental care in the UK, was circulated to a random sample of primary care practitioners in 2008. This questionnaire was circulated previously in 2004 and the results were reported subsequently.^{1–3} The questionnaire, which comprised of 89 questions, had been piloted by a group of practitioners in the North West and for reasons of comparison no questions were

changed except those relating to hardware and IT capability, where the questions were updated to reflect changes in provision. Surveys of this type provide valuable information about the prescribing habits of general dental practitioners. The evidence base for primary dental care is weak at best but where evidence exists it is both helpful and informative to ascertain whether actual practice is in accordance with, or at variance to, the evidence available. In addition, by comparing the results of this survey with those of the previous survey, helpful information can be gleaned about changes in actual practice. The aim of this study therefore, was to investigate, by questionnaire, the selection and use of materials and techniques for indirect restorations and fixed prosthodontics by general dental practitioners in the United Kingdom. A further aim was to compare the results of this survey with the previous survey to investigate changes in practice over the elapsed four year period.

MATERIALS AND METHODS

The questionnaire was sent by post to a randomly selected group of primary care practitioners who were selected by post-code to allow for an even distribution across the UK. The questionnaire was sent with a covering letter and a stamped, addressed envelope for return. After a period of four weeks another questionnaire with a covering letter was sent to non-responding practitioners.

A number of questions were asked that related to the provision of indirect restorations and fixed prostheses which included the following:

- Material selection for core build-up in vital teeth
- Whether there is continued use of dentine pins
- The types of post and core systems used and whether posts are widely used
- Impression materials, alloys and luting cements used

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- Preference for full or partial coverage restorations
- Use of metal-free restorations.

The data from the returned questionnaires were analysed using Minitab (version 15, Minitab Inc.) and StatXact (version 8, Cytel Inc.). Possible associations between materials and techniques used for procedures of the type being investigated and the following were investigated using appropriate statistical tests:

- Years since qualification
- Gender
- Practice location
- Type of practice (ie mainly NHS, private etc).

Cross-tabulations were created and Fisher's exact test and the exact version of chi-squared tests were performed as appropriate. The level of significance was set at 1% because of the number of tests being carried out, and to reduce the chance of getting false positive results.

RESULTS

Six hundred and sixty-two useable questionnaires were returned, giving an overall response rate of 66.2%. The demographic details of the respondents have already been described.⁴

Core build-up for vital teeth

The majority of respondents (65%; $n = 430$) reported using amalgam for the core build-up of vital teeth, with light cured resin composite (48%; $n = 317$), glass ionomer (38%; $n = 252$) and resin modified glass ionomer cements (28%; $n = 186$) as preferred alternatives (Table 1). 76.5% of females reported using amalgam, compared to 63.2% of males, while 13.8% of females reported using dual cured resin composite, compared to 24.3% of males. 11.5% of those who graduated between 0-10 years previously reported using dual cured resin composite compared to 16.4% of those who graduated 31 or more years ago. 14.1% of practitioners who were mainly NHS reported using dual cured resin composite compared to 30.5% of private practitioners.

Dentine pins

A majority of practitioners indicated that they used dentine pins (67%; $n = 445$),

however, a large number (32%; $n = 211$) elected not to use pins. The use of stainless steel (34%; $n = 223$) and titanium alloy pins (18%; $n = 122$) predominated, while pure titanium (11%; $n = 75$) and gold anodised stainless steel (3.8%; $n = 25$) were used less frequently (Table 2). 39.7% of those who had graduated between 0-10 years previously reported using no pins compared to 41.7% of those who were 11-20 years graduated, 21.2% of those who were 21-30 years graduated and 12.3% of those who graduated 31 or more years ago.

Post systems

Indirect cast posts either from a precious (55%; $n = 361$) or a non-precious (38%; $n = 249$) alloy were preferred by most practitioners in this study (Table 3). A large proportion used fibre posts (34%; $n = 226$). Less frequently used systems were titanium alloy (14%; $n = 91$), stainless steel (11%; $n = 71$) and pure titanium (4%; $n = 24$). A small proportion of practitioners (3%; $n = 17$) elected not to use posts. There were 46 types of fibre post systems reported to be in use. 49.4% of those who were 0-10 years graduated reported using non-precious posts compared to 36% of those who were 11-20 years graduated, 28.7% of those who were 21-30 years graduated and 34.2% of those who were 31+ years graduated. 50.3% of mainly NHS practitioners reported using non-precious posts compared to 22% of other practitioners practising in a non-NHS environment. 25.9% of mainly NHS practitioners reported using fibre posts compared to 50.4% of non-NHS practitioners.

Impression materials

Addition cured silicone (71%; $n = 471$) and polyether impression materials (17%; $n = 109$) were the most commonly used impression materials (Table 4). Eleven percent ($n = 75$) of practitioners reported using alginate. Less frequently used impression materials were condensation cured silicone (10%; $n = 63$) and polysulphide impression materials (3%; $n = 18$). In the previous questionnaire, a greater number of practitioners (20%; $n = 143$) reported using condensation cured silicones, and fewer reported using polyether (9%; $n = 61$). 7.4% of females reported using polyether compared to 22.1% of males. 82.1% of those who were 0-10 years graduated

Table 1 Core-build up for vital teeth

Material	Number of respondents (%)
Amalgam	430 (65)
Light cured resin composite	317 (48)
Glass-ionomer cements	252 (38)
Resin modified glass-ionomer	186 (28)
Dual cured resin composite	131 (20)
Compomer	97 (15)
Chemically cured resin composite	67 (10)
Other	12 (1.8)

Table 2 Dentine pins

Pin used	Number of respondents (%)
Stainless steel	223 (34)
Titanium alloy	122 (18)
Pure titanium	75 (11)
Gold anodised stainless steel	25 (4)
Pins not used	211 (32)

Table 3 Post systems

Post used	Number of respondents (%)
Precious indirect cast	361 (55)
Non-precious indirect cast	249 (38)
Fibre	226 (34)
Titanium alloy	91 (14)
Pure titanium	24 (4)
Stainless steel	71 (11)
Do not place posts	17 (3)

reported using addition cured silicone compared to 81.3% of those who were 11-20 years graduated, 69.9% of those who were 21-30 years graduated and 60.3% of those who were 31+ years graduated.

Alloys for bonding to ceramic or metal ceramic crowns and bridges

When asked about alloys for fixed prosthodontics, the majority of practitioners reported using a precious alloy (69%; $n = 438$) and non-precious alloys were used less frequently (27%; $n = 167$).

Luting cements

Luting cements based on traditional glass-ionomer cements were used to cement single and multiple unit porcelain fused to metal reconstructions by a majority (single – 48%;

Table 4 Impression materials

Impression materials	Number of respondents (%)
Addition cured silicone	471 (71)
Polyether	109 (17)
Alginate	75 (11)
Condensation cured silicone	63 (10)
Polysulphide	18 (3)
Other	25 (4)

Table 5 Luting cements

Material	Number of respondents (%)	
	Single	Multiple
Glass ionomer cement	317 (48)	297 (45)
Zinc phosphate	186 (28)	175 (26)
Resin modified glass ionomer	122 (18)	123 (19)
Resin composite	70 (11)	71 (11)
Resin based (metal)	71 (11)	62 (9)
Resin composite (self-adhesive)	61 (9)	53 (8)
Compomer	7 (1)	5 (1)

n = 317, multiple – 45%; n = 297) of the practitioners in this study (Table 5). These cements were also used to cement resin composite (13%; n = 83), ceramic (30%; n = 197) and gold (47%; n = 310) restorations and also cast metal posts and cores (55%; n = 361). Luting cements based on resin modified glass-ionomer cements were used to cement single and multiple unit porcelain fused to metal reconstructions by fewer practitioners in this study (single – 18%; n = 122, multiple – 19%; n = 123).

For single unit porcelain fused to metal reconstructions, luting cements based on resin composite with (11%; n = 71) or without (11%; n = 70) a special affinity for metal were used infrequently (Table 5). Compomer (1%; n = 7), resin modified glass-ionomer (18%; n = 122) and self adhesive resin (9%; n = 61) based luting cements were therefore not used by many practitioners.

For multiple unit porcelain fused to metal reconstructions luting cements based on resin composite with (10%; n = 62) or without (11%; n = 71) a special affinity for metal were used infrequently. Compomer (1%; n = 5), resin modified glass-ionomer (19%; n = 123) and self adhesive resin (8%; n = 53) based luting cements were not used by many practitioners.

Zinc phosphate cements (single units – 28%; n = 186, multiple units – 26%; n = 175) were still used by a significant number of practitioners. Resin based cements were also used to cement resin composite (45%; n = 296), ceramic (52%; n=340) and gold (15%; n=102) restorations and cast metal posts and cores (22%; n=144). 37.3% of females were reported using zinc phosphate compared to 25.1% of males. 15.2% of females were reported using resin composite luting cements for metal restorations compared to 7.0% of males. 64.7% of those who were 0–10 years graduated reported using resin based luting cements for ceramics restorations compared to 32.9% of those who graduated 31 or more years ago.

Choice of indirect restoration for anterior teeth

The preferred choice of indirect restoration for anterior teeth was laminate veneers (41%; n = 250), the majority of practitioners (81%; n = 506) favoured the use of laboratory fabricated porcelain veneers, other methods of veneering reported on were direct resin composite veneers (14%; n = 89) and laboratory made resin composite veneers (2.4%; n = 15). All ceramic crowns (31%; n = 187) and porcelain fused to metal crowns (17%; n = 105) were also used for the indirect restoration of anterior teeth. One practitioner reported not restoring anterior teeth. In the previous questionnaire, fewer practitioners (20%; n = 138) reported using all ceramic crowns and the number of respondents opting for porcelain fused to metal was higher (23%; n = 161). Ten percent of mainly NHS practitioners reported using direct resin veneers compared to 20.2% of non-NHS practitioners.

Use of tooth-coloured inlays/onlays and metal free crowns

Seventy-nine percent (n = 414) of tooth coloured inlays/onlays were produced on a refractory die, while a much lower proportion of inlays/onlays were produced using both refractory die and CAD/CAM (5%; n = 27) or CAD/CAM technology alone (3%; n = 18). When questioned about choice of material for tooth coloured inlays in molars and premolars the responses were very similar; the materials chosen were ceramic (molars – 41%; n = 253, premolars

– 34%; n = 214), composite (molars – 21%; n = 133, premolars – 23%; n = 172), either (molars – 10%; n = 63, premolars – 11%; n = 68) or practitioners were unsure (molars – 28%; n = 175, premolars – 28%; n = 175).

Metal free crowns were never provided by some practitioners (15%; n = 94), however the majority of practitioners (69%; n = 433) provided them occasionally, while others provided them routinely (17%; n = 105). In the previous questionnaire, a smaller percentage of practitioners reported never providing metal free crowns (9%; n = 66), fewer provided them routinely (22%; n = 153) and similar numbers provided them occasionally (66%; n = 463). 1.7% of mainly NHS practitioners reported using CAD/CAM to produce restorations compared to 5% of non-NHS practitioners. 19.4% of mainly NHS practitioners reported never providing metal free crowns compared to 7.8% of non-NHS practitioners.

DISCUSSION

This study provides valuable information on the prescribing habits of the general dental practitioners who participated in this study. The response rate of 66.2% is such that results can be interpreted with confidence and the findings could be considered to be representative of general dental practice within the UK in 2008. There were no significant associations ($p > 0.01$) between practice location and any of the areas investigated by this part of the questionnaire.

Amalgam is still the preferred material for core build up of vital teeth before the provision of a full coverage restoration. This is in keeping with the results of the last survey.³ It would seem that practitioners remain convinced of the durability of this material and its proven track record in clinical service.⁵ An interesting trend to note is the increased use of resin composite at the expense of glass ionomer as a core material for vital teeth. The practitioners in this survey seem to have increasingly recognised the superior physical properties of resin composite materials, or perhaps their practice is being informed by early failure in clinical service of crowns retained by cores built up of glass ionomer cement. Again there was a significant ($p < 0.01$) association, similar to that of the last survey, in that female practitioners were more

likely to use amalgam and least likely to use a dual cured resin composite system for the core build up of vital teeth. This represents an anomaly in that the female practitioners surveyed seem to be less evidence based in terms of amalgam use but more evidence based when it comes to the use of dual cured composites than their male colleagues. Further research is needed to investigate possible factors that might have influenced this decision making. In contrast younger (<10 years qualified) and older (>31 years qualified) practitioners were less likely to use dual cured resin composite materials for core build than those in the middle years of their practising life. This difference, which was statistically significant ($p < 0.01$) might reflect the more traditional teaching of the undergraduate schools, where amalgam is the core material of choice, and the reluctance of older practitioners to change to the newer material systems available. It would seem that practitioners in the NHS were more likely to use amalgam core materials and less likely to use a dual cured resin composite for core build up in vital teeth. This is most likely explained by the need to contain cost within NHS treatment provision or possibly because practitioners are aware of the clinical data that supports using amalgam in this way.

Dentine pins are not recommended for routine use as they have some significant disadvantages which are well documented. The declining use of dentine pins as highlighted by this survey is in line with recommended practice. There was a significant association with respect to both the use of dentine pins and the type of pin used, and the contractual basis on which dentistry was provided with stainless steel pins, making them more likely to be used in NHS based practices. A possible explanation for this is the new contract introduced in 2006⁷ whereby the placement of pins no longer attracted a fee. This has heralded a significant increase in the number of direct restorations placed. It would seem possible that practitioners might be changing prescribing habits so as to reduce the need for indirect restorations with all their attendant costs. It may well be that this change has been driven by recent changes in contractual arrangements. There was also a significant association ($p < 0.01$) with years since qualification and

the use of dentine pins. More recent graduates were unlikely to use pins while older graduates were more likely. This possibly represents the changes in undergraduate teaching driven by evidence based practice, which are slowly trickling into main stream general dental practice. Further research investigating the dynamic and driving factors for such changes would be of interest.

Precious alloy indirect cast posts were still preferred by the majority of practitioners in the study but reduced usage was noted. Reduced usage could be explained by a general reduction in the number of indirect restorations provided, but also by an increased use of direct posts where their use is indicated. Fibre posts are now used by a significant number of the dentists, in contrast to the last survey where the use of fibre posts was negligible.³ It would seem that practitioners have recognised the considerable advantages of fibre posts and the growing evidence base to support their use in clinical practice.⁸ It was of interest that over 48 different fibre post systems were being used by the practitioners in this study. Time will tell if any of these systems have significant advantages over the other systems available and this is an area where further research would be helpful to inform clinical practice. Practitioners in the NHS were more likely to prescribe a non-precious cast type of post and least likely to prescribe a fibre post. This difference was significant and further research is needed to establish why this might be, given that cost is unlikely to be a factor as a fibre post would typically be cheaper to place. Younger (<10 years qualified) and NHS practitioners were also more likely to use a non-precious cast type of post, which is most likely explained by the fact that newer graduates largely start their careers with the NHS general dental services; notably within the first two years as foundation trainees.

Addition cured impression materials are used by the majority of practitioners, which should come as no surprise given the dimensional accuracy of this group of impression materials.⁹ A decrease in the use of condensation cured silicone impression materials is heartening and almost certainly reflects a greater understanding of the inherent inaccuracies attendant in using this group of impression materials. The increasing use of polyether type

impression materials in part probably reflects the increased placement of dental implants in practice and the recognition of the benefits of this type of impression material for implant procedures. Female practitioners were less likely to use a polyether impression material. Is this because female practitioners prescribe fewer implants or is it that this group of practitioners have failed to recognise the considerable advantages of this group of impression materials, notably their rigidity, when prescribing dental implants? Older (>30 years qualified) practitioners were less likely to use an addition cured silicone impression material, possibly favouring more traditional impression materials such as condensation cured silicone impression materials. While these materials have some disadvantages principally in terms of accuracy it could be that considerable experience of using such inferior materials could compensate for such limitations, or that this group of practitioners have failed to recognise the advantages of newer impression materials, or that possibly inertia and a general reluctance to reflect on and change personal practice is at play. Interesting to note was that generally the use of condensation cured silicone impression materials had reduced by 50% when compared with the results of the previous survey.

When comparing the use of luting cements with the previous survey two changes are striking. Firstly, no practitioners are using polycarboxylate based luting cements, which is almost certainly due to the recognition that more superior luting cements are available. Secondly, the emerging use of self adhesive resin based luting cements, as this technology is increasingly being accepted in clinical practice but less so in NHS practice, which is probably due to the increased cost of these cements. There was no difference with respect to the cement used when single or multiple units were luted into place it would seem, which parallels the results of the previous survey. Interestingly, female practitioners were more likely to use more traditional cements such as zinc phosphate but less likely to use resin based cement with a special affinity for metal when cementing metal based restorations. Younger practitioners (<10 years qualified) were more likely to use resin based composite luting cements than older practitioners (>30 years

qualified) generally, especially for the luting of ceramic restorations, with older practitioners more likely to cement a ceramic restoration with a cement other than one based on resin composite. It would seem that the older group of practitioners in this survey, in contrast to the survey 4 years ago, are not recognising the benefits of using resin based luting cements in providing for additional retention of ceramic restorations. Also the fact that the literature indicates firm evidence for the use of resin luting materials for ceramic restorations does not seem to have filtered through to practitioners.¹⁰

Veneers were still the preferred choice for the restoration of anterior teeth, which is in accordance with the previous survey. Veneers are restorations recommended for teeth which are fundamentally sound yet discoloured. The increased use of whitening techniques has largely reduced the need for veneer techniques but when indicated they are the least interventive restorations for the restoration of anterior teeth and this it would seem is recognised by practitioners. Given that an analysis of a database of 500,000 restorations placed within the NHS in England and Wales indicated a 20% lower survival rate at 10 years than crowns, it is surprising that veneers remain so popular.^{11,12} The majority of veneers prescribed were ceramic restorations rather than the use of directly placed laminate veneers made from resin-composite, however, NHS practitioners were less likely to use resin composite when veneers were prescribed. The use of resin composite in this way is a very effective way of restoring the appearance of anterior teeth, which is less destructive of tooth tissue than an indirect technique. It would seem that NHS practitioners in part have not recognised this or possibly are being driven by patient demands for ceramic veneers, which is fuelled by the media and the mistaken belief that the use

of resin composite in this way is somehow a second rate or cheap skate treatment option. Further research regarding the longevity and clinical performance of resin composite veneers is urgently required. All ceramic crowns have increased in use at the expense of porcelain fused to metal crowns, when the results of this survey are compared with the last survey. Indeed metal free crowns seem to be used more widely with increased usage in non-NHS practices when compared with the last survey. This is probably due to an increasing acceptance of these restorations as treatment alternatives and a patient's desire for a metal free restoration coupled with a belief, possibly mistaken, that all ceramic crowns are more aesthetic than porcelain fused to metal crowns.

CAD/CAM systems are increasingly available to practitioners in the United Kingdom and when the results of this survey are compared with those of 4 years previously, increased use can be seen particularly by private practitioners. In terms of material selection there has been an increase in the degree of uncertainty, particularly among female practitioners, as to which material to use in which situation. There continues to be little research that could inform practitioners when making these decisions and such uncertainty will continue until evidence has been established as to which material performs more favourably for a given clinical situation. The increasing use of metal free crowns is partly due to patient demand and also because of the superior aesthetic result that can be obtained, possibly leading to practitioners selecting them more frequently. In addition a greater number of systems are available and this has driven the costs of such restorations down.

CONCLUSIONS

Within the limitations of this study the following conclusions can be drawn:

- Amalgam is still the preferred material for the core build-up of vital teeth
- Dentine pins are still used widely but not so much by younger practitioners
- Fibre post are being increasingly used by practitioners
- Addition cured silicone is still the most widely used impression material
- Traditional glass ionomer cements are still the most widely used luting cements
- Veneers are still the preferred indirect restoration for restoring anterior teeth
- CAD/CAM systems are increasingly being used by practitioners.

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