A study of endodontic treatment carried out in dental practice within the UK

S. M. Jenkins, S. J. Hayes & P. M. H. Dummer
Department of Adult Dental Health, University of Wales College of Medicine, Cardiff, Wales, UK

Abstract


Aim The purpose of this study was to gather both qualitative and quantitative information on the nature of root canal treatment carried out by a group of dentists working within the United Kingdom.

Methodology A two-part questionnaire was posted to 720 dentists who graduated from the Dental School, Cardiff, Wales, UK. The first part requested basic information regarding age, year of qualification, field of practice, etc. The second part consisted of 15 questions on endodontic practice and root canal treatment.

Results The response rate was 41.5%. Two hundred and ninety-nine questionnaires contained useful information. The majority of practitioners did not use rubber dam during root canal treatment. The vast majority (89%) exposed a radiograph with an instrument of known length in situ to gauge the ‘working length’, a small number relied upon tactile sensation. Most practitioners used local anaesthetic solution as an irrigant during instrumentation of the root canal. A wide variety of instruments were used for root canal treatment; a stepback technique was preferred by almost half the practitioners. Antiseptic solution was preferred as an interappointment dressing. More than half of the respondents used laterally condensed gutta-percha to obturate root canals in anterior teeth but only one-third used the same technique in posterior teeth. Less than half the respondents exposed a radiograph to check the fit of the master point prior to obturation. Two-thirds of practitioners used a zinc oxide based material as their root canal sealer. Three-quarters of the practitioners exposed a post obturation radiograph.

Conclusions The results of this study suggest that although some dentists are using the techniques taught during their undergraduate careers, a large percentage now use techniques with no evidence of clinical effectiveness.

Keywords: dental practice, endodontics, UK.

Received 4 October 1999; accepted 21 December 1999

Introduction

Endodontic treatment encompasses procedures that are designed to maintain the health of all or part of the pulp. When the pulp is diseased or injured, treatment is aimed at preserving normal periradicular tissues. When pulpal diseases have spread to the periradicular tissues, treatment is aimed at restoring them to health. This is usually achieved by root canal treatment (European Society of Endodontology 1994).

Every dental undergraduate receives instruction in the techniques of root canal treatment as part of their training. However, a survey of undergraduate endodontic teaching carried out in 1991 revealed marked differences between centres in the United Kingdom and other countries (Dummer 1991). Though the techniques for preparing and obturating the canal were broadly similar to those used in Europe and the USA, undergraduate instruction in endodontics was given a lower priority in the United Kingdom. Indeed, at that time, it was reported that there was an average of 14.3 h devoted to preclinical laboratory practice in Britain compared with 45 h in other European countries and 34 h in the USA. Furthermore, the minimum requirements for completed
between the development of new methods and their incorporation into clinical practice, there will be an inevitable delay in their acceptance. It is therefore useful to take stock of progress, from time to time, in order to measure both the pace of change and the impact that new treatments may have on the quality of service provided to patients.

The purpose of this study was to gather information on the nature of root canal treatment carried out by a group of dentists who graduated from the Dental School, Cardiff, Wales, UK and the ways in which new ideas may have shaped such practice. It was hoped the study would not only provide useful baseline data but also insight into potential problems with undergraduate endodontic teaching. To this end, it was hoped to collect both qualitative and quantitative information on those aspects of root canal treatment regarded by endodontic educators as essential to both safe and successful practice.

Methodology

A total of 720 alumni of the Dental School, University of Wales College of Medicine, Cardiff, Wales, UK were sent a questionnaire with an explanatory note indicating the purpose of the investigation along with a stamped addressed, return envelope. Respondents were not asked for their names, nor were there any identification numbers or marks on the forms, thereby guaranteeing anonymity.

Those practitioners who did not engage in endodontics were asked to indicate this on the questionnaire and return it uncompleted. Practitioners who stated they did carry out root canal treatment on permanent teeth were asked to indicate how they performed this treatment.

The first part of the questionnaire requested basic information regarding age, year of qualification, type of practice (i.e. general dental, community service, hospital service and armed forces) and the average number of root fillings completed per month. The second part of the questionnaire consisted of 15 questions, most of which included a list of possible answers. The questions were constructed in such a way as to avoid leading the respondent to a particular answer. Information sought included the use of rubber dam or other means of airway protection; methods to establish working distance; methods and instruments used to prepare canals; use of canal irrigants and medicaments; choice of filling material; choice of sealer and the use of immediate pre- and postobturation radiography.

Where a list of possible responses was given, practitioners were invited to choose the answer that best fitted their clinical practice. Each answer was categorized as follows:
Endodontic treatment in dental practice  
Jenkins et al.

• Always (100%);
• Generally (90–99%)
• Frequently (50–89%)
• Sometimes (10–49%)
• Rarely (1–9%)
• Never (0%)

Respondents were asked to circle one category only.

Space was also provided on the questionnaire for clinicians to make additional comments in the event of their usual practice not being adequately covered by the choices given.

All returned forms were coded by a single operator and the data processed using Minitab (Minitab, State College, PA, USA), an interactive statistical package. The frequency of the use of rubber dam or other means of safeguarding the airway; methods used to establish the working distance; types of instruments; methods of canal preparation and obturation; irritants; types of medicaments; sealants and the use of immediate pre- and postobturation radiography was calculated for the sample as a whole on a percentage basis.

In order to make a more detailed comparison of the data, the sample was then divided, first according to age, as follows: group A, up to 29 years; group B, 30–39 years; group C, 40–60 years, and secondly, according to the average number of root fillings completed per month, as follows: group 1, 1–9; group 2, 10–19; group 3, 20–29; group 4, 30–39, group 5, 40–49; group 6, 50–60.

Results

Of the 720 questionnaires sent out, 22 were returned by the Post Office marked ‘addressee unknown’, 19 practitioners returned the form indicating that either they did not carry out or only rarely carried out root canal treatment and one questionnaire was excluded from the study because the responses were incomplete.

A total of 299 questionnaires containing useful information were returned: 41.5% of the total. Statistical analysis of the results was not appropriate.

A total of 299 questionnaires containing useful information were returned: 41.5% of the total. Statistical analysis of the results was not appropriate.

In order to make a more detailed comparison of the data, the sample was then divided, first according to age, as follows: group A, up to 29 years; group B, 30–39 years; group C, 40–60 years, and secondly, according to the average number of root fillings completed per month, as follows: group 1, 1–9; group 2, 10–19; group 3, 20–29; group 4, 30–39, group 5, 40–49; group 6, 50–60.

Rubber dam

Less than 19% of individuals stated that they used rubber dam routinely (i.e. in over 90% of cases treated); 44.5% of practitioners replied that they never used rubber dam. There was a trend for older clinicians to use rubber dam more than their younger counterparts but no relationship existed between its use and the number of root fillings completed per month.

Looking at the sample as a whole, the most common methods used to safeguard the patient from the accidental inhalation or ingestion of a root canal instrument were the use of dental floss, parachute chains and the use of handpiece mounted files, the latter method being more commonly chosen by older practitioners from group C (40–60 years) and by those carrying out more than 30 root fillings per month.

Working distance

Most practitioners (89%) took a radiograph with some kind of instrument in situ to determine canal length. Radiography was more commonly used by dentists from group A (up to 29 years) with 94% of younger clinicians using this method to establish the working distance compared with 83% and 86% of practitioners from groups B and C, respectively. Those carrying out very few root fillings (< 9 per month) were least likely to take a radiograph.

The next most popular method to establish the working distance was the use of an electronic apex locator, though this was sometimes used in conjunction with a radiograph. Three clinicians relied on tactile sense alone. Of these, one was from group B (30–39 years) and two from group C (40–60 years).

Instruments

Nearly a quarter of clinicians reported that they always or generally used a reamer to prepare the apical portion of the root canal. Another 20% used K-Flex files (Sybron/Kerr, Romulus, MI, USA) and a further 16% used K-files. The routine use of K-files was found to be three times greater with younger clinicians from group A (up to 29 years), though the complete reverse was found for K-Flex files (Sybron/Kerr).

The remaining 40% of the sample were evenly divided between the use of Flexofile (Dentsply Maillefer Instruments SA, Ballaigues, Switzerland), Hedstrom files, Giromatic (Micro-Mega, Besançon, France) and Endosonic files. A very small number were using lasers.
There was a trend for practitioners carrying out more than 30 root fillings per month to favour the use of Giromatic (Micro-Mega) files.

Similarly, reamers were a popular instrument to prepare the coronal portion of canals with over one-fifth of practitioners reporting their routine use. A further 20% stated that they always or generally used Gates Glidden burs or Peeso reamers and another 14% used Hedstrom files. Most of the remainder of the sample were divided evenly between the use of K-files, K-Flex files (Sybron/Kerr) and Endosonic files. Very few (<3%) reported using Flexofiles (Denstply Maillefer).

Practitioners from group A (up to 29 years) used K-files or Hedstrom files more frequently than older clinicians. In contrast, practitioners from groups B (30–39 years) and C (40–60 years) and those carrying out more than 30 root fillings per month were more likely to use Gates Glidden burs or Peeso reamers.

Overall, nearly 50% of practitioners stated that they always or usually used the stepback technique (Schilder 1974) for canal preparation, 25% used a ‘standardized’ method (Ingle 1961) whilst a minority of practitioners (7%) stated that they routinely used the stepdown technique (Goerig et al. 1982). Thirteen per cent either frequently or generally used no definite or recognized technique to shape the canal.

The use of the stepback technique was more popular with dentists from group A (up to 29 years) with 65% of those in this group either always or generally using it compared with 35% from group B (30–39 years) and 53% from group C (40–60 years) and those carrying out more than 30 root fillings per month were more likely to use Gates Glidden burs or Peeso reamers.

Irrigation/medication

Local anaesthetic solution was the most popular choice as a canal irrigant amongst all age groups with 39% of the sample using it routinely; a further 19% used sodium hypochlorite. Most of the remainder were divided evenly between the use of saline, distilled water and hydrogen peroxide. Interestingly, 9% of individuals failed to use any irrigating solution at all. Dentists from group C (40–60 years) were twice as likely not to use an irrigant than those from the other two age groups. Though, in general, there was no relationship between the choice of irrigant and the number of root fillings completed per month.

Canal filling

Anterior teeth

Most practitioners used gutta-percha to obturate canals in anterior teeth. Fifty-five per cent of respondents routinely used laterally condensed gutta-percha, whilst 17% used a full-length ‘single-cone’ technique. Comparison of the various age groups revealed that those from group A (up to 29 years) were nearly twice as likely to use laterally condensed gutta-percha as those from groups B and C.

A small number of individuals were using heat to promote the compaction of gutta-percha into the canal system. Few dentists (<3%) reported using paste type filling materials such as Endomethasone (Septodont, St. Maur, France) and even fewer (<0.3%) sectional silver points; none reported using full length silver points.

Posterior teeth

Similarly, laterally condensed gutta-percha (14%) and full-length ‘single-cone’ (16%) were the most frequently used methods for obturating canals in posterior teeth, though a further 16% reported using full length
silver points in at least 50% of cases treated. Several dentists commented that they found the latter easier to use in very narrow canals. Comparison of the various age groups revealed that, once again, younger practitioners were more likely to favour the use of laterally condensed gutta percha as opposed to a single-cone technique.

As before, a small number of dentists were using a variety of systems to generate heat to aid the compaction of gutta-percha. Few individuals (<3%) were using paste type root fillings and even fewer (<1%) sectional silver points.

There was a wide variety of root canal sealers being used but Tubliseal (Sybron/Kerr) (63%) and Endomethasone (Septodont) (15%) were the clear favourites. Comparison of the various age groups revealed that older practitioners from groups B (30–39 years) and C (40–60 years) were twice as likely to use Endomethasone (Septodont) as a sealer than those from group A.

Pre- and postoperative radiograph

Of those practitioners using a ‘point technique’ to obturate the canal, less than a quarter exposed a ‘try-in’ radiograph. Only over 50% of dentists either rarely or never did. There was no relationship between the age of the practitioner or the number of root fillings carried out per month and the use of radiography to check the position of the root filling prior to cementation. Over 75% of clinicians routinely took a postoperative film to check the position of the root filling following cementation, though 6% reported that they either rarely or never did. Younger practitioners from group A (up to 29 years) took more postoperative radiographs than those from groups B or C. In fact, every clinician who reported never taking a postoperative film was from group C (40–60 years). There was no relationship between the number of fillings completed per month and the use of postoperative radiography.

Discussion

The cohort selected in this study were all alumni of Cardiff Dental School and may not be truly representative of the general dental population throughout the UK. However, the advantage of using this group was that the information obtained could be related to the teaching of endodontics, the techniques and the materials of which were known. Thus, the information gathered is still important and useful, particularly as it relates to changes that have been introduced in dental practice.

The response rate for this study is disappointingly low but compares favourably with that of a previous postal survey of the practice of endodontics in general practice (Pitt Ford 1983). An incentive was offered to encourage a response but no attempt was made to follow up the questionnaires that were not returned. The majority of respondents (84%) were practitioners in general dental practice, reflecting the fact that this is the area where the majority of dental treatment is provided in the United Kingdom.

Current expert opinion and medico-legal advice is that use of rubber dam is essential during root canal treatment and the use of rubber dam is taught in all of the Dental Schools in the UK (Dummer 1991, Qualtrough & Dummer 1997). The primary roles of rubber dam are the protection of the airway from accidental inhalation of foreign bodies, e.g. endodontic instruments, materials, etc. and the protection of the oral tissues from damage caused by leakage of noxious materials, e.g. sodium hypochlorite irrigant solution that may be used during endodontic procedures. Other methods used for airway protection, e.g. parachute chains, dental floss or the use of handpiece mounted files are less satisfactory than rubber dam in respect of its secondary role of maintaining asepsis of the operating site by preventing ingress of saliva and crevicular fluid. In the present study very few clinicians ever used rubber dam, and the majority never used it. This finding agrees with that of other studies that evaluated the use of rubber dam (Pitt Ford 1983, Gergely 1989, Marshall 1990).

One objective of root canal treatment is the thorough cleaning and shaping of the root canal system in order to remove bacteria and any organic tissue that may act as a substrate for further bacterial proliferation (Schilder 1974). Correct estimation of the length of the canal(s) is therefore essential and this is usually performed by measuring from a radiographic image of the tooth with an instrument of known length in situ (Saunders & Saunders 1997). In the present study this was the method of working length estimation favoured by the majority of respondents. Modern electronic apex locators can be accurate (De Moor et al. 1999), but are often used in conjunction with radiographs because of the additional information about tooth anatomy that a radiograph allows and because it provides a permanent record. The use of tactile sensation to determine the working length cannot be recommended, because the instruments may bind against the canal walls at any position along their length (Dummer et al. 1984), or may perforate apically.
Current opinion favours the use of triangular cross-sectioned files manipulated using the balanced force technique (Saunders & Saunders 1992). This has been shown to maintain the existing canal form better, and result in less transportation of the apical portion of the root canal than other techniques using stainless steel hand instruments. Clearly, the use of hand instruments can be both physically taxing and time consuming and so the fact that practitioners who carry out many root fillings tend to favour the use of handpiece energized files is not surprising.

The balanced force technique of manipulating files is used in a ‘crown-down’ approach (Roane et al. 1985). The initial widening of the coronal aspects of the root canal allows irrigant to penetrate deeper into the canal, and also removes obstructions that may deflect or impede the file. The intention is that the files are only active in the apical few millimetres. This should improve tactile awareness of instrumentation and focus the area of action.

Many of the older practitioners would have been taught the standardized method of canal preparation (Ingle 1961) and the use of a single-point technique for filling. Clearly, many of these still use these techniques. The younger practitioners were taught either a stepback technique (Schilder 1974) with orifice enlargement or, more recently, the modified double-flared technique (Saunders & Saunders 1992). Interestingly, there was a trend for the practitioners to use the technique they were taught. On the other hand, the use of reciprocating devices was never taught but was used by those who tended to complete a large number of root fillings per month.

Root canal systems are complex and accessory anatomy such as fins and apical deltas will not normally be cleaned by mechanical means, i.e. filing. Thus, the use of an antimicrobial irrigant solution is recommended to debride the accessory anatomy by chemical means. The ideal irrigant should combine antimicrobial action and a capacity to dissolve organic and inorganic remnants. Sodium hypochlorite solution (1–5%) is the preferred irrigant as it is antimicrobial and will dissolve organic tissue. It is inexpensive and freely available in a ready-to-use form but has a caustic effect on oral tissues. Since so few practitioners use rubber dam it is not surprising sodium hypochlorite was rarely used. Local anaesthetic solution, though readily available in the standard delivery form, is a poor substitute for sodium hypochlorite, as it has no antimicrobial action or tissue-digesting properties. However, the mechanical effect of flushing with any irrigant is preferable to no irrigant at all.

Interappointment medicaments are intended to reduce bacteria, control pain and reduce inflammation. Currently, biocompatible dressings such as calcium hydroxide pastes are favoured (Chong & Pitt Ford 1992). In the present study the use of calcium hydroxide was limited and mainly employed by younger practitioners. Comments were received reporting difficulty in obtaining supplies of calcium hydroxide for use as interappointment medication; this is surprising as a dispensing chemist should be able to make-up the required preparation at low cost. The most popular choice for an interappointment medicament was an antiseptic solution. Paramonochlorophenol is readily available commercially in a preparation combined with thymol and dexamethasone (Cresphene, Septodont). It is, however, cytotoxic and there are further concerns about use of the material (Ayhan et al. 1999).

Cold lateral condensation of gutta-percha in conjunction with a root canal sealer is the most widely accepted technique for obturating root canals and is the technique currently taught in Cardiff Dental School. It is a relatively simple and versatile technique that does not require expensive equipment. It is therefore not surprising that it is the technique used by the majority of responding practitioners (especially the younger ones) in their general practice. Single-cone/point techniques cannot reliably fill all the root canal space in three-dimensions and are not recommended, although this technique was taught at one time. Similarly, paste only root fillings are difficult to control with the obvious risk of under- or over-filling of the canal. This is particularly problematic with paraformaldehyde-based sealers, as they can cause extensive damage to the periradicular tissues (Kaufman & Rosenberg 1980, Erison et al. 1993). The trend is toward the use of warm gutta-percha techniques to improve the filling of accessory anatomy such as fins and apical deltas.

A postoperative radiograph is important as a medico-legal record. It is also good practice because it provides baseline information for follow-up and assessment of the outcome of treatment. In the present study the majority of practitioners took postoperative radiographs; only some of the older clinicians reported that they never took a postoperative film.

Conclusions
It is clear that whilst some dentists use the techniques taught in dental schools, a large proportion use techniques and materials which are not currently favoured by expert opinion.
References


