A SURVEY OF ATTITUDES, MATERIALS AND TECHNIQUES USED IN ENDODONTIC TREATMENT BY SOUTH AFRICAN DENTISTS.

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A research report submitted to the School of Oral Health Science, University of the Witwatersrand, Johannesburg, in partial fulfillment for the degree Master of Science in Dentistry

Johannesburg, 2006

DECLARATION

I, Lushen Manickum Naidoo declare that this research report is my own work. It is being submitted for the degree of Master of Science in Dentistry in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other University.

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Lushen Manickum Naidoo

24 May, 2006

DEDICATION

To my family for their unconditional support throughout this journey.

ABSTRACT

Guidelines for endodontic procedures and practice have been described, but in South Africa there is no information on the adherence of practitioners to such guidelines. The aim of this study was to provide this information by administering a questionnaire to 1367 members of the South African Dental Association. Although the response rate was poor, 111 replies could be used. The majority of these respondents had more than 5 years experience. Half used a rubber dam, which is favourable relative to the global practice of endodontics. The majority use engine-driven instruments for canal preparation and all the respondents use radiographs. Lateral condensation and gutta percha were the preferred choices for canal obturation. Single-visit treatment was performed with varying frequency. The conclusion of this study is that South African dentists do adhere to most international and current standards. However, there is a need to develop quality assurance guidelines for endodontic treatment for South Africa, and which can also be applicable for developing countries.

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CHAPTER 1 INTRODUCTION AND LITERATURE REVIEW

1.1 INTRODUCTION

Endodontic treatment is aimed at maintaining and managing the health of the pulp and periradicular tissues (Gulabivala 1995).

Certain fundamentals, however, form the core of what is considered to be good endodontic practice (Qualtrough and Dummer 1997). According to the European Society of Endodontology (ESE 1994), when patients receive care of a specialized nature such as endodontic treatment, they need and deserve treatment that meets the standard of care generally given by competent practitioners. One way of measuring standards of care is through conducting surveys of practitioners.

A Medline search, however, showed no previous studies providing information on the quantity and quality of endodontic treatment performed by dental practitioners in South Africa. This research report is a survey of attitudes, as well as materials and techniques used in endodontic treatment by South African dentists.

1.2 LITERATURE REVIEW

1.2.1 Epidemiology of endodontic treatment

Although epidemiological studies have shown that in many developed countries the caries prevalence rate has decreased, the number of root canal treatments performed has risen significantly (Barbakow 1996).

Chivian (1984) showed that in the US alone the number of root filled teeth increased from 3 million in 1950 to 17 million in 1980 and was projected to be over 30 million past the year 2000. Similarly in the UK, 1.2 million teeth were root treated in 1996 versus 800 000 in 1978 (Qualtrough and Dummer 1997). Some of the reasons for these increases could be that people are living for longer and are encouraging their dentists to retain as many of their natural teeth as possible (Barbakow 1996).

Few studies have been carried out in developing countries. A survey of endodontic treatment in Kenya revealed that only 67% of dentists performed endodontic therapy (Maina and Ng'ang'a 1991). In Sudan, endodontic treatment is performed mainly via the private sector and a survey of dentists revealed that 85% of respondents carried out endodontic procedures (Ahmed, Elseed and Ibrahim 2000). Resources (Akpata 1984), socio-economic status of patients (Ahmed, *et al*. 2000), and the level of training of dentists (Maina and Ng'ang'a 1991), seemed to be the factors that affected the quality of endodontic services provided in developing African countries.

A review of three national oral health surveys in South Africa (SA), (van Wyk and van Wyk 2004) concluded that there had been a significant reduction in the severity and prevalence of dental caries in children under the age of 12 years over the past 20-30 years. However, these results are questionable as some of the surveys were carried out in the apartheid era. A Medline search revealed no studies related to caries prevalence rates in adults in SA. In addition, no data regarding the quantity of endodontic treatment performed in SA are available, thus no association between caries prevalence rates and endodontic treatment can be made.

1.2.2 Endodontic Treatment: Standards and Global Practice

In order to report on, and compare the materials, methods and techniques used by practitioners around the world, it is important to discuss the opinions and debates that relate to the standards of care in endodontics. A Medline literature search yielded very few studies and reports with regards to endodontic practice guidelines. Research performed by Dummer (1991) revealed that the endodontic teaching at undergraduate level in the UK was unacceptable when compared with other parts of Europe and the US. According to Dummer (1991) the time devoted to pre-clinical endodontic teaching in the UK was inadequate. Endodontic treatment guidelines were subsequently published by the European Society of Endodontology (ESE) in 1994 (ESE 1994). A Medline search did not detect any other formal, recent set of endodontic guidelines in Europe.

The American Association of Endodontists (AAE) also developed clinical practice guidelines that were last updated in 2004 (AAE 2004), but they do not explore in any detail, the materials and techniques employed in non-surgical endodontic treatment.

1.2.2.1 Use of the Rubber dam

Rubber dam has been part of endodontic treatment protocol as far back as the 19th century, and its placement is considered the gold standard in terms of field isolation (Koshy and Chandler 2002). The advantages of rubber dam usage have been extensively documented over the intervening years. Some of these include (ESE 1994):-

- Field isolation and airway protection.
- Prevention of the inhalation and ingestion of materials and instruments.
- Prevention of bacteria and salivary contamination of the root canal system.
- Prevention of irrigants from escaping into the oral cavity.

The ESE (1994) recommended that rubber dam should be used for all types of endodontic treatment except in specific cases where access is affected or harm could be inflicted, as in the case of various surgical procedures around the working field.

The advantages of rubber dam usage as a determinant of success or failure is such that states in New Zealand had ruled that its usage be mandatory in endodontic treatment (Koshy and Chandler 2002). Practitioners in the US show one of the highest percentages of rubber dam usage with 59% compliance (Whitten, Gardiner, Jeansonne, *et al*. 1996). In the UK Jenkins, Hayes and Dummer (2001) reported that less than 19% of dentists used a rubber dam routinely. Surveys conducted in North Jordan (Al-Omari 2004), Kenya (Maina and Ng'ang'a 1991) and Sudan (Ahmed *et al*. 2000) have shown very low to non-existent compliance with regards to rubber dam usage: in North Jordan (Al-Omari 2004) and Sudan (Ahmed *et al*. 2000) there was less than 5% compliance.

Some researchers (Ahmed *et al*. 2000; Al-Omari 2004; Whitworth, Seccombe and Steele 2000) have tried to explain the reluctance amongst practitioners to use rubber dam. Patient intolerance (Slaus and Bottenberg 2002), additional time taken (Al-Omari 2004), and the "apparent" cost issue (Whitworth *et al*. 2000) seem to be the major disincentives for compliance.

1.2.2.2 Instrumentation

In 1991, Dummer reported that endodontic instrumentation techniques had changed frequently between 1961 and 1985. Table 1.1 lists the different instrumentation techniques and the references cited by Dummer (1991).

Table 1.1 Instrumentation techniques (Dummer 1991)

- Standardised	(Ingle 1961)
- Step-back or flared	(Schilder 1974, Weine *et al*. 1975, Mullaney 1979)
- Anticurvature	(Abou-Rass *et al*. 1980)
- Step-down	(Goerig *et al*. 1982)
- Canal orifice enlargement	(Leeb 1983)
- Double-flared	(Fava 1983)
- Crown-down pressureless	(Morgan &Montgomery 1984)
- Balanced force	(Roane *et al*. 1985)

The step-back technique was very popular and taught at undergraduate level for many years across dental schools in the UK (Dummer 1991). The crown-down technique, however, has been reported to produce excellent access and a tapered canal preparation (de Leon Del Bello, Wang and Roane 2003).

The advent of engine-driven instruments has changed the way many clinicians perform endodontic treatment (Buchanan 2000). The inclusion of nickel titanium in rotary endodontic files has meant that these files conformed to canal curvature, and thus resisted permanent deformation more readily than stainless steel files (Ingle, Himel, Hawrish *et al*. 2002). A study by Schäfer and Lohmann (2002), however, suggested that neither hand nor mechanical instrumentation is the superior method, and recommended that the method used be based on the clinical scenario.

A valid assumption may be that due to the perceived advantages of mechanical instrumentation, a significant percentage of practitioners would tend to use this for daily root canal instrumentation. Surveys conducted in Sudan (Ahmed *et al*. 2000), Kenya (Maina and Ng'ang'a 1991) and Nigeria (Akpata 1984), showed a greater than 90%

preference rate amongst dentists in favour of hand instrumentation for canal preparation. However, the studies in Kenya (Maina and Ng'ang'a 1991) and Nigeria (Akpata 1984) were conducted more than a decade ago and may not be representative of current advances in endodontic treatment.

1.2.2.3 Working Length

There has been considerable debate in the literature on the ideal working length. As one cannot visually identify the point at which the working length should finish, its determination has for many years been a trial and error method. According to the ESE (1994), the working length should end 0.5 – 2.0mm from the radiographic apex. Ricucci and Langeland (1998) proposed that instrumentation should cease at the apical constriction of the canal. The apical constriction represents the narrowest part of the canal which promotes the best healing potential (Ricucci and Langeland 1998). Flanders (2002), suggested that the working length be established at the canal terminus with the aid of an electronic apex locator. According to Ricucci and Langeland (1998), preparation beyond the apical constriction would signify the worst prognosis for root canal treatment as it would lead to tissue destruction.

The ESE (1994) recognises both radiographic and electronic methods of apex location. The literature does not support one method over the other, although a recent study concluded that one specific apex locator was accurate up to 90% (Welk, Baumgartner and Marshall 2003). The ESE (1994), however, recommends taking a radiograph even though electronic length has been determined. Working length determination seems to remain a controversial issue and there appears to be insufficient research to definitively recommend any one method.

The majority of practitioners in the US (Whitten *et al*. 1996) were found to determine their working length at 0.5mm short of the radiographic root apex, whereas Flemish (Slaus and Bottenberg 2002) dentists chose their working length within 1mm short of the radiographic apex. Dentists in Kenya (Maina and Ng'ang'a 1991) used a trial and error method, or radiographs and a formula to determine working length. In Sudan (Ahmed *et al*. 2000), only 75% of dentists used any radiographs to determine length, and no practitioners relied on electronic devices.

1.2.2.4 Radiographs

The ESE (1994) recommends taking radiographs at various stages throughout the endodontic treatment procedure. The radiographs usually taken are at the diagnostic, working length, master apical file and post-obturation stages. Besides being an aid during the endodontic treatment procedure, accurate radiographs are essential for medico-legal purposes (Stock 1995). The studies that were reviewed did not focus on the frequency of use of radiographs at the various stages of treatment.

1.2.2.5 Irrigant Selection

Internal canal anatomy and the presence of accessory canals cause organic residues and bacteria to penetrate the dentinal tubules and these cannot be removed mechanically (Ercan, Özekinci, Atakul, *et al*. 2004). An irrigant, due to its viscosity and fluid state, is able to negotiate the intricacies of the root canal system (Weber, McClanahan, Miller, *et al*. 2003). Although not ideal, sodium hypochlorite (NaOCl) is considered the gold standard in the field (Siqueira 2001, Ørstavik 2003). The major shortcomings of NaOCl are that it is toxic to biological tissues and is a strong corrosive (Ercan *et al*. 2004). More recently, chlorhexidine gluconate has shown encouraging results. In a recent study comparing the

effectiveness of 2% chlorhexidine and 5,25% NaOCl, it was concluded that 2% chlorhexidine gluconate had superior antimicrobial activity (Ercan *et al*. 2004). The same study also showed that NaOCl was more effective at dissolving the contents of the root canal.

Ethylenediaminetetraacetic acid (EDTA), a chelating agent, has been used in dentistry for approximately 50 years. Chelators decalcify dentine thus removing the smear layer allowing the irrigant to penetrate the dentinal tubules (Hülsmann, Heckendorff and Lennon 2003)

Sodium hypochlorite is recognized as being the irrigant of choice in endodontics (ESE 1994), yet its use seems to be quite low and varied (Al-Omari 2004). Sodium hypochlorite was the irrigant of choice in the US (Whitten *et al*. 1996), yet studies conducted in developing countries such as North Jordan (Al-Omari 2004), Nigeria (Akpata 1984) and Sudan (Ahmed *et al*. 2000) have shown that less than 20% of general practitioners employ sodium hypochlorite during routine endodontic treatment. Practitioners in Sudan (Ahmed *et al*. 2000) were found to prefer hydrogen peroxide over sodium hypochlorite as their irrigant of choice. Dentists who worked for the National Health Service in the UK (Whitworth *et al.* 2000), however, preferred using local anaesthetic for canal irrigation. In that same study, a strong correlation was found between the use of rubber dam and irrigant selection. Practitioners who used sodium hypochlorite (NaOCl) on a regular basis were more likely to use a rubberdam. A similar finding was reported from a survey of practitioners in New Zealand (Koshy and Chandler 2002).

1.2.2.6 Intracanal Medication

It seems to be impossible to achieve complete eradication of micro-organisms from the root canal with a chemo-mechanical canal preparation (Siqueira 2001; Siqueira, Rôças and Lopes 2002; Basrani, Ghanem and Tjäderhane 2004). It is thus recommended that during multi-visit treatment, an appropriate intracanal medicament be placed between treatments in order to promote biological healing and prevent multiplication of micro-organisms within the root canal system (ESE 1994). According to the ESE (1994), an interappointment disinfectant should have the following properties:

- It should be non-irritating to the periapical tissues
- It should have a disinfectant action
- It should have no systemic effects
- It should be easily removable and not damage tooth structure.

Although not ideal, calcium hydroxide has been the intracanal medicament of choice thus far (Siqueira 2001). This is because it creates a highly alkaline environment within the root canal system that inhibits the growth of the vast majority of the micro-organisms present in the canal (Siqueira 2001). However, the ability of certain micro-organisms to survive at extremely high pH levels, and the isolation of these organisms from the canals of failed treatments, has raised questions about the efficacy of calcium hydroxide (Siqueira 2001). Spångberg, Rutberg, Rydinge, *et al*. (1979) found that formaldehyde and phenol-containing compounds were desirable for their antimicrobial properties, but were also highly toxic biologically. More recently, Lin, Zuckerman, Weiss, *et al*. (2003) reported success using chlorhexidine as an intracanal medicament. There is insufficient evidence for the efficacy of any one, or even any of the currently used medicaments.

Although the use of non-setting calcium hydroxide is taught at more than half the dental schools in the UK (Qualtrough and Dummer 1997), only 10% of one particular sample of dentists routinely used calcium hydroxide as an inter-appointment medicament (Jenkins *et al*. 2001). The majority of practitioners in the US (Whitten *et al*. 1996), similar to their UK counterparts, preferred using phenolic based compounds rather than calcium hydroxide. In complete contrast to the teaching in the UK dental schools, most dental students in the Philippines were taught to use phenolic and eugenol compounds as opposed to non-setting calcium hydroxide (Cruz, Jimena, Puzon, *et al*. 2000). Studies in other developing countries like Sudan (Ahmed *et al*. 2000) and North Jordan (Al-Omari 2004) have shown that phenolic compounds are still the inter-appointment medicament of choice. The above-mentioned surveys suggest a global preference toward phenolic and aldehyde containing compounds even though the use of phenolic compounds is not recommended by the ESE (1994).

1.2.2.7 Single-visit versus multi-visit endodontics

The previously accepted method of performing endodontic treatment was in multiple visits (Oginni and Udoye 2004). This perception has changed, although the treatment of necrotic pulps in one session still remains a controversial issue (Siqueira Jr. 2001).The potential advantage of single-visit endodontics apart from the decreased number of appointments, is the decreased chance of inter-appointment contamination (Siqueira Jr. 2001).

However, the decision to perform single treatment seems to be influenced by the expected probability of post-operative pain and endodontic flare-up (Inamoto, Kojima, Nagamatsu, *et al*. 2002). The factors involved in the prediction of post-operative pain are influenced by the presence of pre-operative pain, tooth type, systemic steroid therapy and pre-operative

swelling (Glennon, Ng, Setchell, *et al*. 2004). Inamoto *et al*. (2002) found that endodontists in the US reported post-operative pain following single-visit treatment. However, a study by Glennon *et al*. (2004) reported that two thirds of the patients experienced post-operative pain following multi-visit treatment. Oginni and Udodye (2004) found that patients treated in a Nigerian hospital experienced more pain after single-visit treatment than those treated in multiple visits.

Walton and Fouad (1992) suggested that no correlation existed between flare-ups and the number of visits to complete endodontic treatment. Jurcak, Bellizzi and Loushine (1993) reported that single-visit treatment was as successful as multi-visit treatment. Pekruhn (1986) suggested that the incidence of failure for single-visit treatment was higher in teeth with periapical lesions.

There is thus no general consensus regarding the number of visits to complete endodontic treatment, but it seems that careful case selection is essential in order to help achieve predictable results.

Practitioners in the US perform single-visit endodontic treatment on a regular basis (Whitten *et al*. 1996). This is probably because approximately 70% of teaching institutions in the US encouraged the practice of single-visit treatment (Sathorn, Parashos and Messer 2005). In Sudan (Ahmed *et al*. 2000) and Nigeria (Akpata 1984), practitioners are reluctant to perform single-visit treatment. According to Al-Omari (2004), the lack of post-graduate programmes in North Jordan could be one of the reasons for dentists not performing single-visit treatment there. Practitioners in developing countries (Akpata 1984, Ahmed *et*

al. 2000, Al-Omari 2004) seem less likely to perform single-visit treatment compared with their counterparts in developed countries (Whitten *et al* 1996, Slaus and Bottenberg 2002).

1.2.2.8 Obturation materials and techniques

Root canal shaping provides a preparation that will allow for complete obturation of the root canal system in three dimensions (Ruddle 2002).

The ideal requirements for an obturating material as set out by the ESE (1994) are:

- Biocompatibility
- Dimensional stability
- Ability to seal the entire root canal system
- Insolubility and unaffected by tissue fluids
- Bacteriostatic or bactericidal if possible
- Radiopaque
- Easily removable from the canal

According to the AAE (AAE 2004), obturation materials should be either a solid or semi-solid material. Gutta Percha (GP) is a solid material that fulfills most of the requirements of the ideal material (Gutmann and Witherspoon 2002). It is used as part of four obturation techniques. These are: (Gutmann and Witherspoon 2002)

- Cold compaction of GP
- Compaction of GP that has been heat softened in the canal and cold compacted thereafter
- Cold compaction of thermoplasticised GP
- Compaction of GP that had been softened by mechanical means

The single-cone GP technique is an example of a cold technique and its use is discouraged, as it is thought to foster coronal leakage (AAE 2002). The cold lateral condensation GP technique is one of the oldest and most widely used obturating techniques in dentistry (Clinton and Himel 2001). The critics of this technique have argued that because cold lateral condensation requires the use of "rigid" GP points, a homogenous mass of GP is never accomplished, as the GP is unable to move out of the main canal area (Gilhooly, Hayes, Bryant, *et al*. 2000, Clinton and Himel 2001).

A study comparing the sealing ability of a heated technique to cold lateral condensation, found that the heated technique produced a much better obturation purely from a three dimensional point of view (Clinton and Himel 2001). To date, there seems to be very little clinical evidence proving the superiority of one technique over the other.

Resin and synthetic polymer systems have recently been introduced. Endorez (Ultradent Products.Inc, Utah, USA) for example, is a resin material that can be used as an obturating material as well as a sealer (Kardon, Kuttler, Harginan, *et al*. 2003), but further research is necessary to evaluate its effectiveness.

One of the similarities that is apparent in previous surveys, is a global preference for GP as the obturation material of choice (Whitten *et al*. 1996, Al-Omari 2004, Jenkins *et al*. 2001, Ahmed *et al*. 2000, Akpata 1984, Maina and Ng'ang'a 1991). There seem to be many similarities in both the developed and developing countries with regards to materials used and techniques practiced during the obturation process. The cold lateral condensation technique is the most popular technique in the US (Whitten *et al*..1996), UK (Jenkins *et al* 2001) and Belgium (Slaus and Bottenberg 2002). In a 1997 survey, all the dental schools in

the UK still taught the cold lateral condensation technique (Qualtrough and Dummer, 1997). Lateral condensation was also the preferred obturation technique in developing countries like North Jordan (Al-Omari 2004) and Sudan (Ahmed *et al*. 2000). There seemed to be a growing trend for practitioners in the US, ten years ago, to favour thermoplasticized GP techniques (Whitten *et al*. 1996).

There is, however, a significant percentage of practitioners who obturate well below the minimum standard of care. For example, certain practitioners in Switzerland favoured the single cone GP technique (Barbakow 1996). A similar parallel could be drawn with dentists in developing countries such as North Jordan (Al-Omari 2004) and Sudan (Ahmed *et al*. 2000), where the single cone technique was the second most preferred method of obturation.

Surprisingly enough, silver points were still in use by some practitioners in the UK (Jenkins *et al*. 2001) and US (Whitten *et al*. 2001). Silver points also formed part of the armamentarium of many dentists in Nigeria (Akpata 1984) and Kenya (Maina and Ng'ang'a 1991).

1.2.2.9 Root Canal Sealers

The rationale for root canal sealant usage is that the sealer fills voids and penetrates lateral canals. It has been found that root canal sealers shrink and that ultimately results in the formation of voids and thereafter possible leakage (Wu, Fan and Wesselink 2000). Leakage is one of the major reasons for failed endodontic treatment (AAE 2002). Zinc oxide-eugenol, calcium hydroxide, glass ionomer, resin and silicones are all examples of

the major groups of available sealers. Sealers containing paraformaldehyde are, however, not recommended by the ESE (1994) and AAE (2004) due to their potential toxicity.
The use of root canal sealers in developing and developed countries was not dissimilar. Zinc oxide-eugenol based sealers were preferred by dentists in the US (Whitten *et al*. 1996), UK (Jenkins *et al*. 2001) and North Jordan (Al-Omari 2004). It is interesting to note that certain Flemish (Slaus and Bottenberg 2002) and Swiss (Barbakow 1996) dentists preferred using aldehyde-containing sealers even though their use is not recommended (AAE 2004). Endomethasone, a steroid containing material, was the preferred sealer by dentists in Kenya (Maina and Ng'ang'a 1991).

1.2.2.10 Referral of endodontic cases

Few studies have examined referrals of endodontic cases. Ree, Timmerman and Wesselink (2003) showed that the majority of Dutch practitioners would refer endodontic cases to other colleagues, whereas practitioners in North Jordan were reluctant to refer any cases (Al-Omari 2004).

1.2.2.11 Undergraduate teaching of endodontics

Dummer (1991) showed that although the endodontic teaching at dental schools across the UK was not dissimilar to that in the US and other European countries, fewer pre-clinical hours were devoted to endodontic teaching. A follow-up study (Qualtrough and Dummer 1997) showed that more hours were subsequently devoted to this.

1.3 The practice of endodontics in South Africa

In South Africa, where most of the endodontic treatment is performed by general dental

practitioners, no information is available on the adherence to standards of endodontic practice, as a Medline search was negative for any publications and a search utilising the Union Catalogue of Theses and Dissertations also yielded no success for such studies.

It is imperative for planners of endodontic course programmes to be armed with such knowledge in order for them to be able to design continuing education programmes that could improve areas of practice where there is low compliance. This information would be of value to planners of undergraduate curricula in endodontics. It is thus essential from both scientific and educational aspects to obtain data on the practice of endodontic treatment by South African dentists.

1.4 Aim

The aim of this study was therefore to provide qualitative and quantitative information regarding the practice of endodontics in South Africa.

1.5 Objectives

a) To determine whether or not South African practitioners adhered to accepted endodontic quality assurance guidelines.
b) To assess whether South African dentists keep abreast with current endodontic trends.
c) To evaluate the need for post-graduate endodontic teaching programmes in South Africa.

CHAPTER 2 METHOD

The sample comprised 1367 members who had supplied e-mail addresses to the South African Dental Association (SADA). The SADA register did not discriminate between general dentists and dental specialists. Thus, the actual number of general dental practitioners was unknown. The SADA list comprised practitioners in eleven regions representing all 9 provinces in South Africa (Table 2.1).

Table 2.1 Geographical distribution of e-mail addresses

Region	**Potential Participants**
1. Gauteng Province(excluding Pretoria)	329
2. Pretoria	170
3. Kwa-Zulu Natal	284
4. Western Province	292
5. Eastern Cape(West)	65
6. Mpumulanga	47
7. Free State	51
8. Eastern Cape (East)	30
9. Northern Cape	23
10. Limpopo Province	32
11. North West Province	44
TOTAL=	**1367**

Although Mavis and Brocato (1998) showed that the response rate with postal surveys was superior to that of e-mail surveys, time and financial considerations militated against this. An electronic mailing system was chosen as the medium of communication and data

retrieval. Mavis and Brocato (1998) showed that e-mail surveys produced a quicker response and were financially more viable compared with postal surveys.

An information sheet (Appendix A) provided information to the participants regarding the nature and purpose of the research. A questionnaire (Appendix B) comprised 30 questions and consisted of multiple choice as well as open ended questions. The questions were devised using the following sources:

- Current literature (see literature review)
- The European Society of Endodontology guidelines (ESE 1994)
- The American Association of Endodontists guidelines (AAE 2004)

The questions focused on three key areas:

- Demographics
- Materials and techniques employed
- General attitudes of dentists with regards to performing endodontic treatment

Participants were encouraged to return the completed questionnaire as an e-mail attachment. A dedicated e-mail address was created through the Computer Services Network (CNS) division of the University of the Witwatersrand. An impartial volunteer collated the responses in order to ensure confidentiality. Ethical approval (Appendix C) for this study was obtained from the Committee for Research in Human Subjects of the University of the Witwatersrand.

2.1 Data Analysis

The following key was devised in order to standardize the recording of data:

- Responses containing multiple answers, where only one answer was required, were considered to be invalid.

- In instances in which respondents were asked to elaborate, the preferred/first response was considered.
- Responses related to materials used were grouped according to their active ingredient/s.

The data were inserted and recorded in spreadsheet format. Descriptive statistics were prepared that sought associations mainly between experience and endodontic treatment techniques and materials. Cross tabulations were done between experience (Question 5) as defined by the 3 age cohorts, and selected questions (Questions 11, 16, 26, 8). An association was also sought between field isolation method (Question 8), and irrigant selection (Question 16).

CHAPTER 3 RESULTS

Approximately 300 e-mail addresses of the original sample of 1367 were rejected by the respective internet servers. The main reasons for rejection were incorrect addresses, or the recipients' mailboxes were full. Of the 140 replies that were received, only 111 replies could be interpreted, as twenty nine replies contained viruses or formatting errors. The response rate was calculated at 13%. Because nearly all the non-responses were due to server rejection, it was felt that it would be futile to send any follow-up e-mails.

The responses to the questions were divided into two broad categories:

- Demographics, which included attitudes of practitioners towards performing endodontic treatment (Table 3.1).
- Endodontic procedures, techniques and materials (Table 3.2)

Table 3.1 Demographics

Demographics
- Practice location - Experience of practitioners - Institution of undergraduate training - Attitudes toward endodontic treatment

Table 3.2 Choice of techniques and materials

Endodontic procedure	
- Scope of treatment - Field isolation methods - Instrumentation - Radiographs - Irrigation - Intracanal medication - Systemic medication - Frequency of single-visit treatment	- Detection of the 2nd mesiobuccal canal - Obturation techniques - Obturation materials - Obturation sealers - Commencement of final restoration

3.1 Demographics

Eighty-eight percent (n = 98) of the respondents performed endodontic treatment. The subsequent analyses were therefore based on these 98 responses.

Only one practitioner in this study restricted his/her practice to endodontic treatment.

3.1.1 Post-graduate training

Forty-two percent of the respondents reported having had some form of postgraduate training in endodontics, 71% of which was by attending continuing dental education (CDE) courses as shown in Fig 3.1. Seventeen percent (other) of the respondents had either a Masters degree in dentistry or did not specify the type of post-graduate training they received.

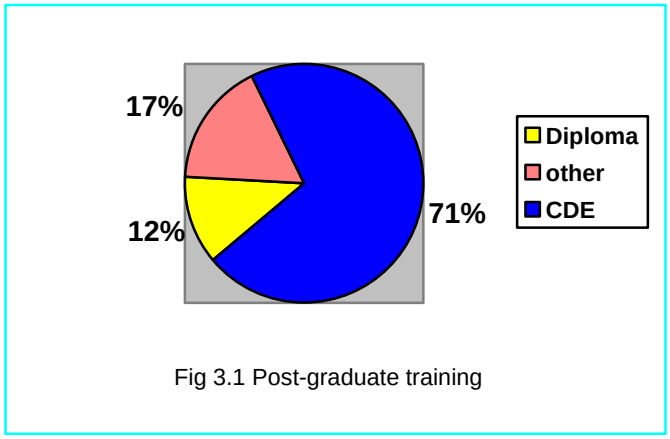

Fig 3.1 Post-graduate training

3.1.2 Practice location

Of the 98 respondents, 88% practiced in an urban setting.

3.1.3 Experience of practitioners

The respondents were placed into 3 cohorts according to the number of years of experience (Fig 3.2). The responses reflected that 94% (n= 92) of practitioners have been in practice for 5 years or longer.

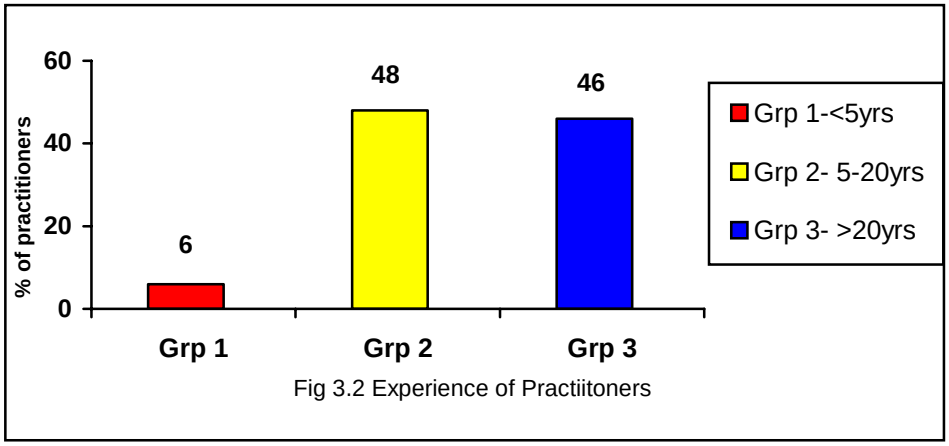

Fig 3.2 Experience of Practiitoners

3.1.4 Institution of undergraduate training

The respondents were asked to indicate the university at which they completed their undergraduate dental training. Sixty-six (68%) of the respondents in this survey graduated either from the University of the Witwatersrand or the University of Pretoria. The remainder of the respondents graduated from the Universities of Stellenbosch, Western Cape, or overseas. There were no respondents from The Medical University of Southern Africa .

3.1.5 Attitudes toward endodontic treatment

Seventy nine percent of the respondents indicated that they enjoyed performing endodontic treatment and 91% of these, believed that their work could be improved. Only 50% felt the need to refer endodontic cases to other colleagues. When asked whether they believed that there is a greater need for continuing educational programmes in endodontics in South Africa, 87% responded in the affirmative.

3.2 Techniques Employed

3.2.1 Scope of Treatment

Ninety-three percent indicated that they performed endodontic treatment on all teeth except

third molars, and 3% acknowledged that they would treat third molars.

3.2.2 Field Isolation Methods

Ninety-eight percent of the respondents used field isolation during treatment. Fifty-three percent of the total respondents used a rubber dam solely, or in combination with other methods (Table 3.3). More than one field isolation method was indicated, thus the values shown in Table 3.3. are not mutually exclusive.

Table 3.3 Field Isolation Methods

Method of Isolation	Percentage of Respondents
None	2
Cotton Rolls (CR)	44
Rubberdam (RD)	29
CR+RD	24
Other	4

3.2.3 Instrumentation

Sixty-five percent of those who used endodontic access burs preferred using the Endo-Z bur (Dentsply Maillefer, Ballaigues, Switzerland). Three respondents indicated a preference for non-rotary engine-driven instruments. A hybrid combination of hand and engine-driven instruments was preferred by 88% of respondents. When asked about hand instrumentation technique, 61% of the respondents favoured the crown-down technique.

When asked about choice of engine-driven instruments, half of the respondents to this question preferred using the Protaper (Tulsa Dental Products, Tulsa, USA) rotary system for mechanical canal preparation (Table 3.4). A preference for more than one instrument was indicated, thus the values shown in Table 3.4 are not mutually exclusive.

An endodontic microscope was used by only 5 of the respondents.

Table 3.4 Choice of Mechanical Instrumentation

Mechanical Instrument of choice	Percentage of Respondents
Profile	29
Protaper	50
Hero 642	17
Hero Shaper	10
Other	16

3.2.4 Radiographs taken

The respondents were asked to indicate the radiographs they took at the various stages of endodontic treatment. Respondents who took diagnostic, working length and post-op radiographs exceeded 90%.

All respondents used one or more radiographs as an aid during their treatment procedures (fig 3.3). Forty-two percent took radiographs at the diagnostic, working length and master apical cone stages, and 57% relied solely on the radiograph to determine the working length. The values indicated in Figure 3.3 are not mutually exclusive as most respondents took more than one radiograph.

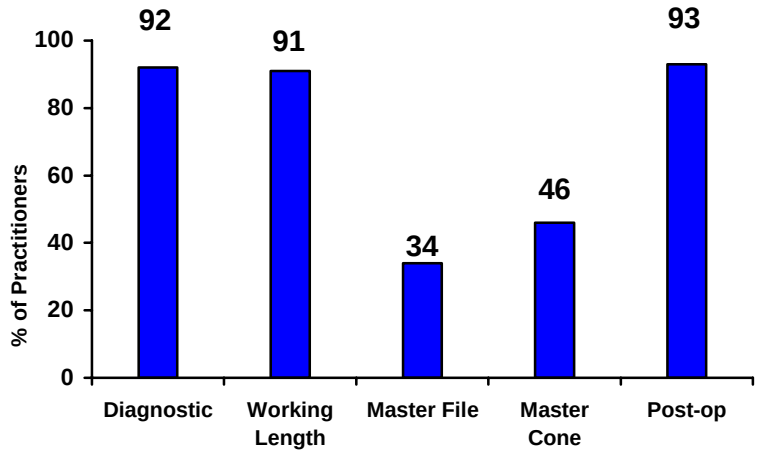

Fig 3.3 Stage of Radiographic Analyses

3.2.5 Irrigation

The respondents were asked to either choose, or specify their preferred root canal irrigant/s. Table 3.5 illustrates the variety of irrigants used by the respondents; 90% used sodium hypochlorite solely or in combination with other irrigants. EDTA was the second most commonly used irrigant, used by 39% of the respondents.

Table 3.5 Irrigant preference by the respondents

Irrigant Selection	Percentage of respondents
- Sodium hypochlorite (NaOCl)	90
- EDTA	39
- Saline	6
- Hydrogen peroxide	14
- Other: Chlorhexidine	5
Local anaesthetic	7
Water	3
Ozone	1
Alcohol	1
unspecified	1

3.2.6 Intracanal Medication

Ninety percent (n=87) of the respondents indicated that they used or would use an intracanal medicament between visits. Calcium hydroxide was the medicament of choice amongst 55% of these. Phenol and aldehyde-based compounds were used by 18% of those respondents who placed intracanal medication between visits (Table 3.6). The respondents indicated the use of more than one intracanal medicament, thus the values shown in table 3.6 are not mutually exclusive.

Table 3.6 Choice of Intracanal Medication

Intracanal Medicament	Percentage of Respondents
Calcium Hydroxide- $Ca(OH)_2$	55
Phenol & Aldehydes	18
Antibiotic paste	32
Chlorhexidine + $Ca(OH)_2$	5
Unspecified	11

3.2.7 Systemic Medication

All respondents prescribed systemic medication for their patients, 96% of whom prescribed antibiotics only in severe infections, with 77% of the respondents preferring to prescribe penicillin or a penicillin derivative. Only 5 of the respondents routinely prescribed analgesics for their patients. Combination drugs that contained paracetemol, ibuprofen and codeine were prescribed by 77% of respondents. Only one respondent indicated the use of opioids and steroids (Fig 3.4).

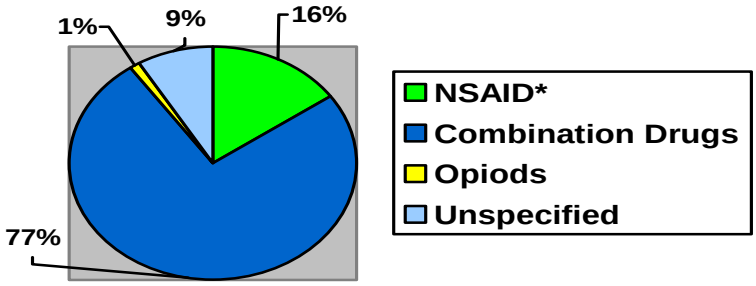

Fig 3.4 Analgesic Choice *Non steroidal Anti-inflammatory drugs

3.2.8 Frequency of single-visit endodontics

When asked about the percentage of treatments completed in a single visit, 80% of the respondents indicated that they performed single-visit endodontics with varying frequencies as shown in Fig 3.5. The remaining 20% of respondents indicated that all their cases were treated in more than one visit.

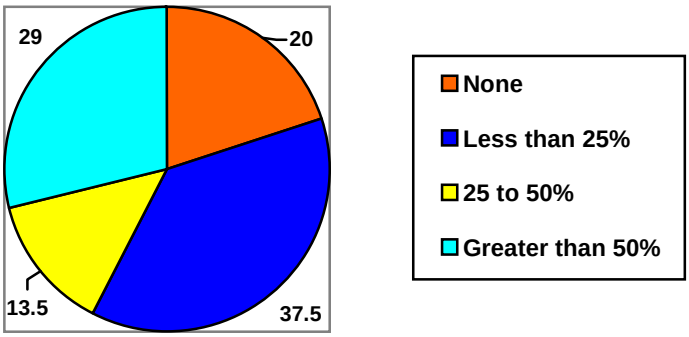

Fig 3.5 Frequency of single-visit endodontics

3.2.9 Detection of the second mesiobuccal canal

The respondents were asked how often they detected the second mesiobuccal canal in the maxillary first molar, and 81% reported that they seldom found this canal.

3.2.10 Obturation techniques

The respondents were asked to choose their preferred obturation technique. This question was answered by 97 respondents. Sixty-eight percent preferred using the lateral condensation technique (fig 3.6), 24% preferred to use the single cone GP technique and 13% used a combination of cold and heated techniques. Of the 32% of respondents who preferred heated GP techniques, 61% preferred using the heated carrier Thermafil (Tulsa Dental Products, Tulsa, USA). A preference for more than one technique was indicated, thus the values shown in Fig 3.6 are not mutually exclusive.

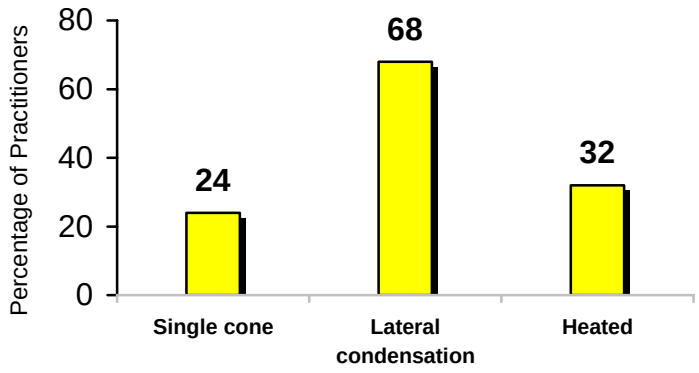

Fig 3.6 Choice of Gutta Percha obturation technique

3.2.11 Obturation materials

The respondents were asked to indicate the type of obturation material that they preferred to use. There were a total of 98 respondents who answered this question, 96% of whom used Gutta Percha (GP) and sealer. No respondents indicated the use of silver points or of cement only. Only 3% used GP alone. One respondent indicated a preference for a resin obturation material. Synthetic polymer was the obturation material of choice for one other respondent.

3.2.12 Obturation sealers

A total of ninety respondents indicated the use of a variety of sealers during the obturation process (Fig 3.7). Calcium hydroxide and resin based sealers were the materials of choice of 28 and 42 percent of the respondents respectively. Twenty five percent of the respondents indicated a preference for the use of aldehyde, phenol or steroid based sealers. One practitioner used a glass ionomer sealer.

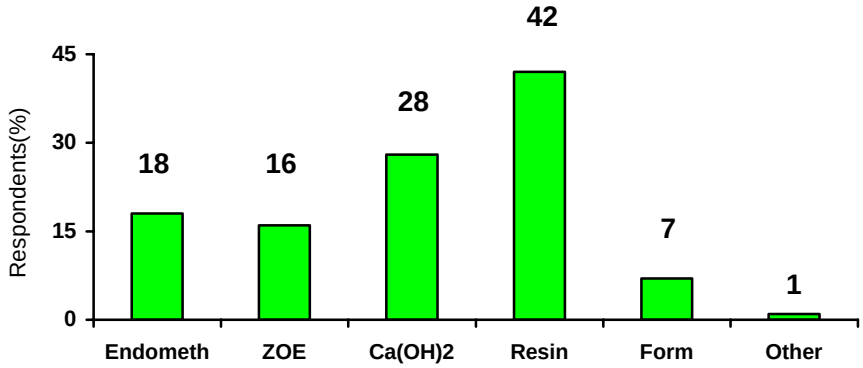

Fig 3.7 Choice of Sealer

(Key: **Endometh**- Endomethasone; **ZOE**- Zinc-oxide eugenol; **Form**- Formaldehyde)

3.2.13 Timing of commencement of final restoration

The respondents were asked to indicate how long they would wait before commencing final restoration of the endodontically treated tooth. Forty-one percent of the 90 who answered the question preferred restoring the tooth immediately after completion of the endodontics. Figure 3.8 shows the waiting periods preferred by the remaining 59% of respondents. The length of the waiting period ranged from 1 week to 6 months.

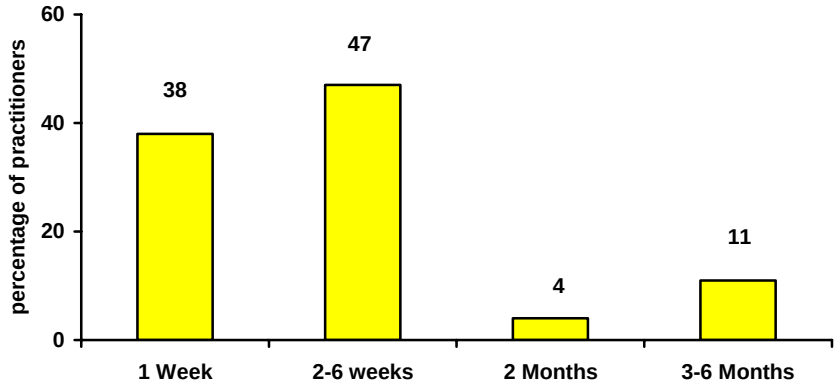

Fig 3.8 Commencement of final restoration

3.3 Associations

Cross tabulations were carried out between experience (Question 5), and hand instrumentation technique (Question 11), field isolation method (Question 8), irrigant selection (Question 16), and referrals of cases (Question 26). No significant associations were found, except for the use of rubberdam and irrigant selection. The majority of respondents, who irrigated with NaOCl, preferred using a rubber dam as well (Table 3.7).

Table 3.7 Cross-tabulation between NaOCl and field isolation method

Field isolation method	NaOCl usage (%)
None	2.3
Cotton rolls	40.7
Rubber dam	57.0

An example whereby no significant association could be sought is shown in the cross-tabulation between root canal instrumentation technique and practitioner experience (Table 3.8).

Table 3.8 Cross-tabulation between instrumentation technique and practitioner experience.

Practitioner experience	Instrumentation technique (%)		
	Crown-down	Step-down	Step-back
Less than 5 yrs	5.2	0	17.9
5 – 20 yrs	44.8	66.7	53.6
Greater than 20 yrs	50.0	33.3	28.6

The data did not allow for any statistical comparison other than these cross-tabulations.

CHAPTER 4 DISCUSSION

This was a descriptive study, designed to be a national survey of attitudes, as well as materials and techniques used by South African dental practitioners when performing non-surgical endodontic treatment.

Surveys of dentists in Sudan (Ahmed, *et al*. 2000), and North Jordan (Al-Omari 2004) recorded response rates of over 50 percent. However, studies amongst dentists in the UK (Jenkins *et al*. 2001) and Belgium (Slaus and Bottenberg 2002) yielded response rates of 42 and 25 percent respectively. The response rate for this survey was 13% and could possibly be attributed to the fact that this study was conducted via e-mail, which has been shown to yield inferior response rates compared with postal surveys (Mavis and Brocato 1998).

It was a challenging task to identify and obtain quality assurance guidelines for non-surgical endodontic treatment techniques. The guide to endodontic treatment obtained from the AAE (2004) was not comprehensive in non-surgical endodontic procedures and was probably not intended to act as a detailed guide for endodontic materials and techniques. Although the ESE (1994) guidelines were comprehensive with regards to techniques, it had limited value because it predated rotary instrumentation. A possible explanation could be that mechanical instrumentation was a fairly new concept even in 1994. As these (AAE 2004 and ESE 1994) were the only guidelines available, they were used for comparative purposes.

The lack of an endodontic speciality programme at post-graduate level in South Africa, could possibly account for the fact that only one practitioner limited his/her practice to

endodontic treatment. The majority of respondents in this survey indicated that they would perform treatment on all teeth except third molars. This is, however, inconsistent with findings in other African countries. Maina and Ng'ang'a (1991), for instance, reported that only 13% of dental practitioners in Kenya would treat molar teeth.

Although routine rubber dam usage is considered mandatory (ESE 1994), it was only employed by 53% of the respondents in this study. This study did not, however, test how often a rubber dam was used. Within the limitations of this study, as reflected by its poor response rate, the trend of rubber dam usage in South Africa (53%) tends to be closer to that in the US (59%) (Whitten *et al*.1996).

The preference for sodium hypochlorite as an irrigant by a majority of the respondents was in accord with similar studies in the US (Whitten *et al*. 1996) and UK (Whitworth *et al*. 2000). Although associations between demographics and techniques used were sought, none were found. However, it was interesting to find that the majority of respondents who preferred sodium hypochlorite also used a rubber dam. This relationship between NaOCl usage and rubber dam placement mirrored findings of dentists in the UK (Whitworth *et al*. 2000) and New Zealand (Koshy and Chandler 2002). EDTA was the second most used irrigant. This was encouraging as the lubrication effect of EDTA on instruments facilitates ease of use (Hülsmann *et al*. 2003). Due to the high percentage of respondents who used NaOCl (90%) and EDTA (39%), it is possible that many use these irrigants in combination with each other.

Crown-down, the preferred instrumentation technique in this study and widely taught in the UK (Dummer 1991) is an ideal shaping method that enhances irrigation (de Leon

Del Bello *et al*. 2003).

A high percentage of the respondents in this study used engine-driven instruments in contrast to Flemish (Slaus and Bottenberg 2002) and UK (Jenkins, *et al*. 2001) dentists, although the prevalence in those areas may be different now. Nevertheless, the choice of instruments and techniques by the respondents in this study does show an initiative to incorporate modern instrumentation techniques into routine endodontic practice.

Over 90% of the respondents took pre-operative radiographs, although it is recommended that these be taken in all cases (ESE 1994). More than half did not verify their canal preparation prior to obturation. A possible reason could be the use of rotary instruments and heated GP techniques, which may exclude the use of a master apical file. It could also be due to a lack of understanding of the value provided by radiographic analysis throughout the endodontic treatment procedure, as the ESE (1994) recommends that one should verify the canal preparation prior to obturation.

Although 88% of the respondents indicated the use of intracanal medicaments between visits, less than half of these preferred using calcium hydroxide which has generally been the accepted material of choice (Ørstavik 2003). The use of phenolic compounds for intracanal medication by 14% of the respondents cannot be justified and deviates from accepted standards of care (ESE 1994), even though the use of phenol based materials remains prevalent in the US (Whitten *et al*. 1996), North Jordan (Al-Omari 2004) and UK (Jenkins *et al*. 2001).

The fact that only 4% of the respondents in this study prescribed antibiotics routinely was

good, as systemic antibiotics should only be prescribed when there is a reasonable chance of locating microorganisms outside the root canal system (Eleazer 2002).

The selection of penicillin as the first choice antibiotic is consistent with findings of dentists in the US (Whitten *et al*. 1996). Although the spectrum of activity of penicillin does not cover the entire root canal microbiota, it is still regarded as the first choice antibiotic in infections of endodontic origin (Siqueira Jr. 2001). It must also be emphasized that antibiotics are only an adjunct in some cases for the management of endodontic infections (Siqueira Jr. 2001).

Dentists in developed countries seemed to welcome the practice of single-visit endodontics more readily (Inamoto *et al*. 2002) than their colleagues in developing countries (Al-Omari 2004). Eighty percent of respondents in this survey, followed the trend in developed countries and are performing single-visit treatment where indicated. This study was not associated with the factors surrounding the choice of single versus multi-visit treatment, and the global practice of endodontic treatment seems to be influenced by many clinical parameters (Inamoto *et al*. 2002). Further studies need to be carried out in SA in order to examine the clinical situations under which single-visit treatment is preferred.

The respondents in this survey favoured traditional forms of canal obturation. GP was the material of choice and the most frequently used technique was lateral condensation. The older respondents would have been taught the silver point obturation technique at an undergraduate level, but fortunately none of the respondents in this survey reported the use of silver points for obturation. Although conventional obturation techniques were applied by the majority, a third of the respondents used modern heated GP techniques.

Similar to their counterparts in developed countries, South African dentists in this study used a variety of root canal sealers. However, 25% deviated from accepted international standards (ESE 1994) by their use of formaldehyde, phenol and steroid based sealers. Ninety-one percent of respondents believed that their work could be improved, but only half of them felt the need to refer to other colleagues. One of the reasons could be that there are no specialist postgraduate training programmes in endodontics in South Africa. This was confirmed by 87% of the respondents who believed that there should be more higher learning programmes in endodontics. A Belgian survey (Slaus and Bottenberg 2002) found that their less experienced practitioners followed current trends more regularly compared with their more experienced colleagues. However, the majority of the respondents in this study were very experienced, and seem to be *au fait* with current endodontic trends.

Although endodontic treatment has been practiced for a long time, the quality of evidence for the use and application of endodontic techniques and materials remains poor and there is a great need for more high-level evidence-based research.

4.1 Limitations of this study

Apart from the poor response rate, another limitation of this study was that its design and construction of the questionnaire made it difficult to seek associations between questions.

4.2 Conclusion and Recommendations

4.2.1 Conclusion

The need for caution in drawing conclusions from this survey is noted in that this was a baseline survey with a limited response rate. Despite these limitations, this study shows

that SA dentists compare favourably in their practice of endodontic treatment to dentists in developed countries. The usage of rubber dam isolation compares favourably to the US, and is better than in many developing countries. The respondents in this study seem to be abreast with current developments regarding the techniques and materials used in endodontics. The high usage of phenol and aldehyde compounds, however, is of concern, as these are not recommended and should be avoided as part of endodontic treatment.

4.2.2 Recommendations

Within the limitations of this study, the following recommendations are made:

- Quality assurance and clinical practice guidelines for endodontic treatment should be developed in South Africa, and for other developing countries.
- Programmes for postgraduate training should be expanded by dental teaching institutions in South Africa.
- Further surveys/studies need to be carried out in order to assess the ongoing development of the practice of endodontic treatment. The results from these surveys would also be useful for the undergraduate teaching of endodontics at the various teaching institutions in South Africa.

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Division of Endodontics
Department of Restorative and Paediatric Dentistry
School of Oral Health Sciences
Faculty of Health Sciences

August 2005

Dear Doctor

Endodontic treatment forms part of the essential treatment repertoire of a dental practitioner. In South Africa, this is no exception. However, there is no information at present on the quality and quantity of endodontic treatment performed in the country. There is also no information regarding the need for continuing education programs in Endodontics.

We are conducting a research project in the field of Endodontics, involving a survey of dental practitioners in SA. It is hoped that this study will provide information on the practice of Endodontics in the country. The project is for fulfillment for an MSc degree at the University of the Witwatersrand.

You have been selected from a list of SADA members to participate in this study. Participation in his study is completely voluntary. Kindly assist by completing the attached questionnaire. It will take only about 5 minutes of your time, but it will be extremely valuable to us.

Every precaution will be taken to ensure full confidentiality and complete anonymity of the respondents. A dedicated e-mail address has been set up for all replies to the questionnaire. This e-mail address will independently be controlled by a third person in a secretarial capacity. Only the questionnaire will be forwarded to researchers as a separate attachment. The names and e-mails of the respondents will not be made available to the researchers.

Responses should be sent to endosurvey@dentistry.wits.ac.za. This is a secure e-mail address.

We thank you in advance for spending the few minutes for answering the questionnaire. The study will assist in understanding the practice of endodontics in SA, and will assist in the teaching of the subject at the University.

Yours sincerely

Dr L Naidoo
Dr I E Munshi

Appendix B

QUESTIONAIRE

Survey of attitudes, materials and techniques used in endodontic treatment by South African general dental practitioners.

Please mark with an "x" and/or elaborate in the space provided
Please ignore the rest of the questionnaire if the answer to Q1 is *NO*.

1. Do you perform endodontic treatment in your practice?

   Yes _____
   No _____

2. Is your practice restricted to endodontic treatment?

   Yes _____
   No _____

3. Have you ever had post-graduate training in endodontics?

   No _____
   Yes _____ Specify _____

4. Is your practice in an urban or rural setting?

   Urban ____|__
   Rural _____

5. How long are you in general dental practice?

   Less than 5yrs _____
   5 to 10 years _____
   10 to 20 years _____
   more than 20 years _____

6. At which university did you complete your dental degree?

   Witwatersrand _____
   Medunsa _____
   Pretoria _____
   Western Cape _____
   Stellenbosch _____
   Non South African _____ Specify _____

7. Relative to other fields of dental practice, do you enjoy performing endodontic treatment?

Yes _____
No _____

8. What method of field isolation do you use?

None _____
Cotton rolls _____
Rubber dam _____
Suction _____
Other _____ specify_____

9. Do you use endodontic access burs?

No _____
Yes _____ Specify: Endo-Z bur _____
Diamendo _____
Other _____

10. What type of Endodontic instruments do you use?

Hand instruments only? _____
Rotary (engine-driven) instruments? _____
Combination of the above _____

11. Which hand instrumentation technique do you use:

Crown-down _____
Step- down? _____
Step-back? _____
Other _____

12. If you use Rotary systems, which system do you prefer?

Profile _____
Protaper _____
Hero 642 _____
Hero Shaper _____
Lightspeed _____
Other _____ Specify _____

13. Do you use an endodontic microscope?

Yes _____
No _____

14. Please indicate which radiographs you take during routine treatment

Diagnostic _____
Working length _____
Master Apical File _____
Master apical cone _____
Post-op _____
None _____

15. Which technique do you use to determine working length?

Tactile sense only _____
Electronic apex locator only _____
Radiographic technique only _____
Electronic and radiographic _____

16. Which solution/s do you use for canal irrigation?

None _____
Sodium Hypochlorite _____
EDTA _____
Saline _____
Hydrogen Peroxide _____
Other _____ please specify _____

17. Do you perform endodontics on:

Incisors and canines only? _____
Incisors , canines, and premolars only? _____
All teeth (excluding third molars)? _____

18. In multi-visit cases, do you place an intracanal medicament between visits?

No _____
Yes _____ Specify_____

19. What percentage of your endodontic cases do you complete in a single visit?

None, all cases completed as multi-visit _____
Less than 25 _____
25 to 50 _____
Greater than 50 _____

20. How often do you detect the second mesiobuccal canal in the maxillary first molar?

Never _____
Seldom _____

21. What obturating material do you use?

Silver Points _____
Gutta Percha(GP) _____
GP and Sealer _____
Cement only _____
Other _____ Specify _____

22. If using Gutta Percha, which technique is used?

Single Cone _____
Lateral condensation _____
Heated _____ Specify _____
Other _____ Specify _____

23. Please name the root canal sealer that you use?

_____

24. When do you commence with final coronal restoration of the tooth?

Immediately after completion of the endodontic treatment? _____
After a waiting period _____ specify time? _____

25. What is your preferred method of coronal restoration of an endodontically treated tooth?

Anterior tooth _____
Posterior tooth _____

26. Do you refer endodontic cases to other colleagues?

Yes ____
No ____

27. Do you think your endodontic treatments could be improved?

Yes ____
No ____

28. Do you think there is a greater need for continuation education programmes in Endodontics

Yes ____
No ____

29. The use of antibiotics in endodontic cases, do you prescribe them:

Routinely ____
Only in severe infections ____
Name your usual first choice antibiotic _____

30. The use of analgesics in endodontic cases, do you prescribe them…

Routinely _____
When indicated _____
Name your usual first choice analgesic? _____