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Australian endodontists' perceptions of single and multiple visit root canal treatment

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Abstract

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Aim To ascertain endodontist's point of view (treatment philosophy, rationale and preference) regarding single- and multiple-visit root canal treatment. To identify the basis on which the choice is made and how the information necessary for the choice is acquired.

Methodology Endodontists registered with the dental practice board of every state in Australia were contacted, and if they agreed to participate, they were interviewed either face to face or by telephone. The following topics were addressed in an interview lasting 15 to 20 min: demographics, current clinical procedures, treatment rationales and preference. A hypothetical scenario was posed to investigate which treatment regimen they would prefer to deliver if biological concerns were eliminated from consideration.

Results Fifty-two endodontists (71% of all Australian endodontists) agreed to participate in the study. Almost all (51/52) participants had performed single-visit root canal treatment, but very few routinely performed it. A majority of participants were willing to provide single-visit treatment where patients had time constraints, and in vital cases (including elective endodontics). The most powerful factor of influencing practice change was interpersonal contact with colleagues. Publications in academic journals have a weak influence in practice change.

Conclusions Australian endodontists strongly prefer multiple-visit over single-visit root canal treatment even in cases where biological concerns are not an issue. Operator preference rather than biological or patient considerations appear to be the primary determinant of treatment choice.

Keywords: operator point of view, satisfaction, treatment modalities.

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Introduction

Single- and multiple-visit root canal treatment has been the subject of long-standing debate in the endodontic community (Bergenholtz & Spångberg 2004). In fact, the attempt to complete root canal treatment in one visit has been documented since before the beginning of the twentieth century (Dodge 1887), yet there has been no definitive conclusion to the debate. Some of the unresolved issues include possible differences in clinical outcomes, microbiological concerns and pain. This controversy can be investigated more systematically with the aid of an evidence-based approach. When clinicians are faced with choices of which treatment regimen should be offered to patients, the central issues that should be considered are not only effectiveness, complications and cost (Sackett 2000) but also patient/operator comfort, preference and satisfaction. In this study comfort is defined as the feeling of content from a physical point of view after the chosen treatment was performed (i.e. less muscular strain). Satisfaction, on the other hand, includes comfort but also encompasses the mental element. It occurs when there is no cognitive dissonance and operator logic in treatment choice can be fulfilled. It has been established that the current best available evidence has failed to demonstrate a difference in therapeutic efficacy (healing rates) between these two treatment regimens (Sathorn *et al.*

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2005, Figini *et al.* 2007, Ng *et al.* 2008). Also, compelling evidence is lacking of a significantly different prevalence of postoperative pain/flare-up of either single- or multiple-visit root canal treatment (Figini *et al.* 2007, Sathorn *et al.* 2008).

Another important consideration in treatment decision-making is the human factor. Clinicians have a strong influence on treatment decision-making; in many circumstances they are more influential than any other parties in the treatment decision. Anecdotally, endodontists are not likely to offer patients a choice between single- and multiple-visit treatments other than in exceptional circumstances, because of their clinical perceptions including treatment philosophy, rationale and preference for the different treatment options. Furthermore, root canal treatment is a skill-dependent procedure, therefore, operator skill, preference, comfort and convenience could also affect the choice of treatment.

The adoption of new treatments, techniques or concepts depends not only on their effectiveness or biological rationale but also on operator preference for and satisfaction in performing such procedures (Granados *et al.* 1997). Some clinical procedures are not widely implemented for the simple reason that they are too difficult or too inconvenient to perform, even though they have a strong biological rationale. Infrequent use of rubber dam is the classic example in endodontics. Undoubtedly, biological principles of endodontic treatment are violated when rubber dam is not used, yet a majority of practitioners continue to practice in such a manner (Whitworth *et al.* 2000, Slaus & Bottenberg 2002, Wilson *et al.* 2004, Björndal & Reit 2005). From a public health care point of view, the issue of treatment efficiency and cost is also important because resources in the society are limited. Hence they should be directed to the most effective and the most efficient treatment regimen.

Decision making by clinicians appears to be complex and multidimensional. Treatment effectiveness and complications are only two of several important factors in the decision making process, and social, psychological and even economic factors are also likely to play roles in the treatment decision (Greenhalgh *et al.* 2004). Also, clinical behavioural modification can only take place when there is a full understanding of what distracts clinicians from biologically sound treatment procedures. Merely providing scientifically valid information does not appear sufficient to lead to sustained behaviour change in practice (Davis *et al.* 1995, Stanton & Grant 1997).

This interview-based study aimed at identifying issues that influence treatment decisions from the operator point of view, by exploring endodontists' perspectives on single- and multiple-visit treatment approaches. Attempts were also made to identify the basis on which the choice is made and how the information necessary for the choice is acquired. By surveying a substantial majority of endodontists in Australia, a broadly national perspective on the issue was sought.

Materials and methods

The study received approval from the Health Sciences Human Research Ethics Committee of the University of Melbourne, Australia. All endodontists registered with the dental practice board of every state in Australia were contacted, and if they agreed to participate, they were interviewed by one of the authors (CS) either face-to-face (n = 41) or by telephone (n = 11) (see Appendix S1). The interview format was semi-structured with a pre-determined set of questions, which were similarly applied to all interviewees. The following topics were addressed in an interview lasting 15 to 20 min: demographics, current clinical procedures, treatment rationales and preference. Scripted questions were asked in a strictly nonleading manner. That is, the questions were open-ended and the interviewer did not offer possibilities for interviewees to choose from. All answers had to be volunteered by interviewees. A hypothetical scenario was posed to investigate which treatment regimen they would prefer to deliver if biological concerns were eliminated from consideration. The answers were recorded, transcribed and entered into spread sheet software for analysis. The data were qualitatively analysed using a taxonomy technique. Descriptive statistics was used on quantitative data. Potential confounding factors were investigated using Kruskall–Wallis and Fisher's exact test.

Results

Demographics and current clinical procedures

Fifty two endodontists agreed to participate in the study i.e. 71% of registered Australian endodontists. All participants were in private practice, with most having been in specialist practice for more than 10 years (Table 1). A large majority were Australian trained.

All but one endodontist used rotary NiTi instruments for canal preparation. For those who used rotary NiTi,

Table 1 Details of survey participants

Number of years in specialist practice	Number of participants
≤10	18
11 to 20	22
≥21	12
Specialist training in	**Number of participants**
Australia	39
Overseas	12
No formal training	1

Table 2 Estimates of single-visit treatment time and appointment time endodontists willing to offer patients

Time (min)	[a]Estimated treatment time (*n*)	[a]Appointment time offered (*n*)
≤60	6	37
61–90	14	15
91–120	20	0
121–150	2	0
151–180	8	0
≥181	1	0

[a]One endodontist did not provide estimated treatment time because he does not perform single-visit treatment.

a wide variety of NiTi systems were used, but all were used in a crown-down manner. Twenty eight endodontists used a matched-taper cone hybrid technique to obturate canals, ten used warm vertical condensation and nine traditional lateral condensation.

Sixty four percent of participants (33/52) had a separate consultation visit, 30 min or less, before beginning definitive treatment. Standard treatment visits were 90 min or less for all participants (Table 2). The majority of participants (31/52) estimated that they took or would take more than 90 min to complete a straightforward molar tooth in one visit (Table 2).

Single- versus multiple-visit treatment

All but one participant had performed single-visit root canal treatment, but very few routinely performed it. In fact, only one endodontist exclusively performed single-visit, one never did, and the remainder rarely did. A majority of participants were willing to provide single-visit treatment where patients had time constraints, and in vital cases (including elective endodontics). Other situations where single-visit treatment was considered appropriate were rarely mentioned (Table 3).

The most commonly volunteered reasons for not performing single-visit treatment were related to canal infection and microbial control [need for medication (36/52), teeth with apical periodontitis (16/52)], then pain and flare-up, then operator factors (Table 3). Most participants (41/52) did not offer patients a choice of treatment regimen. In technical terms, the majority of participants hold a paternalistic (authoritative) approach to treatment decision making (Hunink 2001).

Preference if biological concerns were resolved

A hypothetical situation was posed in which bacterial elimination could be reliably achieved in a single visit. With this scenario a majority of participants (37/52) indicated a preference for single-visit treatment, most of whom stated that 'patients prefer it'. There was a range of reasons for single-visit preference, which could be grouped into three categories i.e. patient factors (27/52), endodontist factors (20/52) and other reasons (1/52) (Table 4). Twenty five percent of participants would continue to prefer multiple-visit root canal treatment even if all biological constraints could be removed from the decision-making equation, of whom

Table 3 Various scenarios where participants indicated that single-visit treatment can and cannot be performed, and rationales for multiple-visit treatment

Possible	*n*	Not possible	*n*	Rationales for MV	*n*
Vital	34	Symptomatic	25	Bacterial control	36
Time constraints	30	Tooth with AP	16	Pain	20
Asymptomatic	4	Canal cannot be dried	16	Dentist feels more comfortable (no science)	18
Draining sinus	3	Necrotic	15	Want to see it settle or sign of healing	4
Single canal	3	Infected	13	Wet canal cannot seal	3
Every situation	2	Retreatment	13	More comfortable for patient	2
No circumstances	1	Draining sinus	12	Better technical quality in multiple	2
Non vital without AP	1	Large area	8	SV is less successful	2
Canal can be dried	1	Grossly infected	2	Multiple visit gives good result so why change	1
		Multi canal	1		

MV, multiple-visit treatment; SV, single-visit treatment; AP, apical periodontitis.

Table 4 Volunteered reasons for treatment preference

	Single visit	*n*	Multiple visit	*n*
Patient factors	Patient prefer it	14	Patient comfort	4
	Lower cost	10		
	Less time off work	1		
	Fewer injections (local anaesthetic)	1		
	More comfortable for patient	1		
Endodontist factors	More efficient	12	Operator comfort	7
	Operator prefers it	4	Peace of mind	1
	More profitable	3	Easier to collect fee	1
	Less writing (reports)	1	Get to know patient	2
Other (biological)	Less leakage (interim restoration)	1	Better technical quality	3

half regarded it as physically more comfortable for the endodontist. Two participants rejected the scenario as an impossible situation.

Potential confounding factors of treatment preference were also investigated. However, none could be statistically substantiated. Number of years in specialist practice and gender had no statistically significant impact on treatment preference ($P = 0.12$, Kruskall–Wallis test, $P = 0.6$ Fisher exact test, respectively). There were only four female endodontists in the sample, as gender disparity is very large within the Australian endodontic community (65 males vs. 8 females).

Openness to change/innovation

All participants offered reading journals as a way to keep pace with current developments in endodontics, followed by attending meetings (40/52) and discussion with colleagues (32/52) (Table 5). Forty three participants identified the operating microscope as a major change in endodontics since their graduation, and 41 nominated rotary NiTi files. No other innovation was mentioned by more than four respondents. The most powerful method of influence in practice change was interpersonal contact with colleagues: half of the participants adopted the use of the operating microscope because of informal discussion with colleagues (Table 5). The weakest influence in practice change was publications in academic journals; only one endodontist cited reading journals as a reason why he changed the way he practises.

Table 5 Methods by which endodontists update their knowledge, and methods of influence in practice change

Method of keeping up-to-date	*n*	Reasons for change	*n*
Journal	52	Colleagues	24
Meeting	40	Personal experience	19
Colleagues	32	Professional meeting	14
Teaching	5	Hands-on-training	10
Internet	1	Dental company recommendation	1
Being a reviewer	1	Journal	1

Discussion

Study method and limitations

A high response rate from any sample is essential for the data to be representative of the entire population (Fink 2003). Opinions differed as to a response rate high enough to eliminate nonresponse bias, but the range reported was commonly 70–80% (Gough & Hall 1977, Evans 1991, Christie *et al.* 1997). Our response rate (71%) was within this range. When participants agreed to participate in the interview, they had no knowledge of the questions. It was unlikely that their clinical predilection would systematically influence their decisions whether to participate in the study. However, to be certain, nonresponse bias was investigated based on nonresponder sociodemographics (Christie *et al.* 1997). There was no statistically significant difference between nonresponders and responders ($P = 0.95$, Kruskall–Wallis test) based on their sociodemographics.

An interview method was chosen over a written questionnaire because it was a two-way communication and reduced the likelihood of misinterpretation. An interview allows deeper exploration of issues as they come up in the process. Also the face-to-face and telephone interview methods are considered equivalent as a research methodology (Holstein & Gubrium 2002).

The data from the interview were analysed using technique called taxonomy (classification). It is a formal system for clarifying multifaceted, complex

phenomena according to a set of common conceptual domains and dimensions (Patton 1999). This analysis increased clarity in defining and comparing complex phenomena such as clinician treatment preference, satisfaction and behaviour change (Bradley *et al.* 2007).

Generalizability of this study may be limited, as it represents only Australian endodontists' views. Practitioners in other parts of the world will have different educational background, practice philosophy and belief systems. One survey demonstrated that in the US almost 70% of endodontists would treat teeth with a necrotic pulp and chronic apical abscess in one visit (Whitten *et al.* 1996), which was different from the finding (6%) in this study (Table 3). Nonetheless, the study provides insights into the way specialists acquire information and use it in treatment decision-making.

Range of treatment philosophy

The major concern of participants who preferred a multiple-visit approach was bacterial control and management of infected canals. Many interviewees felt strongly that bacterial control could be maximized only with calcium hydroxide medication, even though the current best available evidence does not support such a notion (Sathorn *et al.* 2007a).

In addition, participants tended to rely on bacterial culture studies as the biological rationale for their treatment decision-making process. The issue of treatment effectiveness (healing rate) of single- and multiple-visit root canal treatment was mentioned by only two participants. This finding suggests that participants considered the results of bacterial culture studies as the 'gold standard' by which any treatment regimen should be measured. Bacterial culturing is at best a surrogate end-point for clinical outcome (healing) (Prentice 1989, De Gruttola *et al.* 2001, Sathorn *et al.* 2007b), and numerous studies have shown that negative cultures are not reliably achieved following cleaning and shaping procedures. The same, however, is true following intracanal medication, and the frequency of positive cultures may be similar or even greater after the use of medicaments (Peters *et al.* 2002, Zerella *et al.* 2005, Manzur *et al.* 2007, Sathorn *et al.* 2007a, Siqueira *et al.* 2007). Consequently, studies of the true end-point (healing rates) should be more meaningful and more relevant to the treatment decision. Studies of healing rates have consistently documented the absence of any difference between single- and multiple-visit treatment (summarized in (Sathorn *et al.* 2005, Figini *et al.* 2007, Ng *et al.* 2008). It must be acknowledged, however, that the reliability of clinical data on healing has been questioned (Spångberg 2007), with strong advocacy of the continuing need for intracanal medicaments (Spångberg 2001, Nair *et al.* 2005).

The treatment decision depends not only on scientific principles but also on social and psychological dimensions. It was clearly shown that some operators preferred a multiple-visit approach even in cases where bacterial control is not an issue (specifically vital cases). Therefore, the actual reason for the preference for multiple-visit treatment must have been something other than bacterial control e.g. practise management, operator convenience, or simply habit. In fact, there were discrepancies between the time taken to complete endodontic treatment of a molar tooth in a single visit and the longest appointment time participants were willing to offer patients. Single-visit root canal treatment in a molar tooth generally was estimated to take longer than the majority of participants were willing to offer (Table 2).

When reasons such as 'peace of mind' or 'feeling uncomfortable' were given, participants were questioned further for the reasons behind it. The commonly mentioned fear of flare-up may reflect a risk-averse approach to practice, even though the concern may be misplaced (Figini *et al.* 2007, Sathorn *et al.* 2008).

A different outlook of operator's treatment preference in the US and Australia was evident. Whilst several American authors have listed purported advantages of single-visit treatment (Wahl 1996, Weine & Buchanan 1997), no formal investigation of endodontists' rationale for this preference has been published. National differences in treatment preference are not uncommon in health care. In the field of cancer therapy, there is considerable geographical variation in practice patterns (Edelman *et al.* 2006). These variations reflect a number of factors, including health care economics and the nature of health care provider and patient interaction.

Adoption of change

The three main methods that the respondents identified for keeping up-to-date with developments in endodontics were through reading journals (52/52), attendance at meetings (40/52) and through interaction with colleagues (32/52). Other means were rarely mentioned (Table 5). In a different part of the interview, respondents were also asked what they saw as the

major developments in endodontics during their own careers and how they had acquired their knowledge of these developments. A very different picture emerged. No single source was nominated by a majority of respondents, and the three main sources of information were through colleagues (24/52), from personal evaluation of the new procedure (19/52) and via attendance at professional meetings (14/52). This pattern is in accordance with previous medical and dental literature (Coleman *et al.* 1957, Parashos & Messer 2006) that subjective personal experiences of professional peers with a new technology or procedure were more important than scientific data in convincing practitioners to change. Only one person nominated journals as the source of information influencing the decision to adopt a new procedure. In this context, journals may represent the primary source of scientific data in relation to new developments, but are insufficient to promote actual change in clinical practice.

The role of opinion leaders in promoting change has received a great deal of attention in the medical literature and to a lesser extent in the dental literature. Specialists are often seen by general practitioners to be opinion leaders (Blumberg 1999, David 2000, Robertson *et al.* 2001). Amongst specialists, however, peer influence is more likely to occur. One of the recently developed learning theories is community of practice (Hughes *et al.* 2007). Rather than defining learning as the acquisition and internalization of knowledge, in this theory, learning is considered as a process of becoming a member of a sustained community of practice. Communities of practice are groups of people who informally bind together, share a concern, set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis (Wenger *et al.* 2002). This learning theory seems to fit better than the opinion-leader concept and has more influence in practice change in a specialist setting than conventional forms of learning e.g. lectures, journal reading, etc. A community of practice may serve to restrain change as well as promote it. Almost all Australian endodontists (50/52) surveyed rarely practised single-visit treatment even in instances where they acknowledge its benefits.

Resistance to change

Despite a growing body of evidence on the issues of single- versus multiple-visit root canal treatment (Sathorn *et al.* 2005, 2007a, 2008, Figini *et al.* 2007, Ng *et al.* 2008), single-visit root canal treatment is not yet an accepted procedure by most Australian endodontists; waiting for more information before adopting the practice might be considered prudent until definitive evidence is available. On the other hand, it might simply be a form of resistance to change.

The resistance to change is well illustrated in this survey. Despite the evidence supporting the biological rationale for single-visit treatment in vital cases, and endodontists' recognition of lower costs and patient preference, a very large majority of participants (50/52) nevertheless rarely perform single-visit treatment. This resistance to change, however, is far from isolated. The adoption of new ideas, techniques or changes does not occur naturally. It is in fact more natural for human beings to resist change (Hultman 1998). The theory of adoption of innovation offers several explanations why participants seemed reluctant to change their practices to accommodate single-visit treatment (Rogers 2003). First, the current best available evidence on the issues of single- versus multiple-visit root canal treatment might not coincide with the participant's current values, beliefs and attitudes. Second, they may not perceive that the benefits and rewards for making the change outweigh the trouble involved (i.e. the change threatens to modify established working patterns). Third, a demonstrated need for the change does not appear to exist.

Conclusions

Australian endodontists prefer multiple-visit over single-visit root canal treatment even in cases where biological concerns are not an issue. Operator preference rather than biological or patient considerations appear to be the primary determinant of performing single- or multiple-visit root canal treatment.

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Supporting Information

Additional Supporting Information may be found in the online version of this article:

Appendix S1. Structured interview (Word document).

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