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Variables affecting endodontic recall

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Abstract

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Aim To determine the recall rate in an endodontic practice and to evaluate specified variables as to their effect on the rate of patients returning for recall.

Methodology The records of 7105 patients treated by one endodontist between 1975 and 1998 were reviewed. Recorded variables included chart number, patient gender and age, treated tooth number, pulp status, presence of spontaneous pain at initial visit, history of trauma to treated tooth, previous root canal treatment in the treated tooth, and presence of endodontic recall.

Results The recall rate was 49% for the 5641 patients who completed endodontic treatment. Odds ratio analysis showed that females returned for recall at a rate that was significantly higher than males (52% vs. 44%). Odds ratio and chi square analysis revealed that a diagnosis of pulp necrosis or previous root filling resulted in a higher than expected recall rate while a diagnosis of irreversible pulpitis resulted in a lower than expected recall rate ($p < 0.001$). Patients aged 6–40 years of age returned at a lower rate than expected and those aged 41–80 returned at a higher rate than expected ($p < 0.001$). There was no significant difference in recall rate for patients reporting spontaneous pain or history of trauma with the treated tooth. The type of treated tooth had no effect on patient recall rate.

Conclusions Forty-nine per cent of patients returned for recall after a minimum of 6 months with patient age, patient gender and pulp status affecting the rate of recall significantly.

Keywords: endodontic recall, follow-up, recall.

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Introduction

After root canal treatment has been completed, it is desirable to recall the patient 6 months to 1 year later for a clinical and radiographic examination of the treated tooth to determine the outcome. Little research has been undertaken on the variables that may affect the number of patients returning for such endodontic recalls.

In studies of endodontic outcome, a small proportion of patients returning for recall can bias the result toward the failing case, as the patient who is experiencing symptoms may be more likely to return than the patient who is symptom-free (Ingle *et al.* 1994). Rubinstein (2002) has said, 'Loss to recall is intrinsic to most long-term clinical studies and this loss diminishes scientific validity'. The unknown treatment outcome of patients who do not return for recall may affect the results of studies of endodontic outcome (Pekruhn 1986, Ingle *et al.* 1994, Friedman 2002). Friedman (1998) stated that 'recall of a high percentage of the treated population validates the results, as less subjects are missing in which the treatment outcome is unknown'.

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Rubinstein (2002) has commented on the difficulty in obtaining the recall numbers necessary for conducting clinical research. He noted that 'as the population ages, the researcher must take into account uncontrollable variables such as patient mobility, disability, and death' and also stated that 'endodontics is a referral-based practice, patients may live in geographic areas that are distant from the endodontist's office'. These factors can contribute to the difficulty in motivating patients to return for recall examinations.

Several authors have emphasized the importance of clinical and radiographic recall in determining the outcome of endodontic treatment (Seltzer *et al.* 1967, Barbakow *et al.* 1980, Benenati & Khajotia 2002). Certainly there can be no dispute that it is desirable to obtain the highest percentage of recall possible to reflect the true condition of the patient population being examined. It has also been said that 'Endodontists may be under the false assumption that if they do not hear from their patients, their cases are probably successful' (Rubinstein 2002). The criteria for endodontic success and the desirability for recall examination are presented in the Quality Guidelines of both the European Society of Endodontology (2006) and the American Association of Endodontists (1987).

Riley (1974) surveyed 159 diplomates of the American Board of Endodontics and reported that nearly half of the respondents had fewer than fifty per cent of their patients return for recall appointments, yet almost 80% of the diplomates reaffirmed the necessity of recall appointments. When asked to choose from a list of indicators, more than 75% of the endodontists indicated that the recall radiograph was the single most important indicator of success. Riley also reported that the recall rate percentages in the study were estimates of the treating clinician.

More recently, Molen *et al.* (1998) randomly surveyed 300 endodontists regarding their recall procedures. Two hundred and forty-three (78%) responded to the survey with 89% indicating an active recall system. The respondents reported tracking patients due for recall by a dated ledger or postcard (65%), computer program (29%), or some other method not specified (6%). They reported a recall rate of 34% and also indicated that many endodontists, who do not have an active recall system, 'rely on the general dentist or the patient to inform them if treatment failure occurs'. There have been a number of studies that describe the incidence and distribution of root canal treatments in dental schools (Serene & Spolsky 1981, Ingle *et al.* 1994), military clinics (Gordon *et al.* 1988, Wayman *et al.* 1994), general or specialty practice (Gurney *et al.* 1969, Barbakow *et al.* 1980), and the reasons for referral (Abbott 1994a), but no studies to date have been published regarding the characteristics and variables of the patients returning for recall appointments.

The purpose of this study was to investigate the rate of recall and the variables that affect the rate of recall in an endodontic practice.

Materials and methods

After obtaining Institutional Review Board approval from the University of Louisville Human Studies Protection Program, a portion of the records of patients treated from 1975 to 1998 by a board-certified endodontist were examined retrospectively. This single practitioner practice was located in a suburban area of a major metropolitan city in the south central portion of the United States and was located at the same address for 23 years.

The dependent variable was the presence of a recall appointment for the endodontically treated tooth. The independent variables were treated tooth number, patient age, patient gender, spontaneous pain at the time of treatment, history of trauma to the treated tooth, pulpal diagnosis, and previous root canal treatment on the treated tooth. The endodontist performing the treatment in this practice recorded the pulpal diagnosis in the patient record as (i) vital normal, (ii) irreversible pulpitis, (iii) degenerating pulp (partial pulp necrosis), or (iv) pulp necrosis (complete pulp necrosis). Partial pulp necrosis defined a pulp with a necrotic coronal pulp but still retaining some vitality in one or more canals of the radicular pulp. The determination of the pulpal diagnosis was based on preoperative cold and percussion tests, electric pulp testing if the cold test result was ambiguous, and direct visual inspection of the pulp chamber during endodontic access and canal cleaning and shaping. The date of initial treatment and the date of the recall appointment were also recorded. No identifying patient data (name, address, telephone number, zip code, etc.) was recorded.

The protocol for a recall appointment in this endodontic practice was as follows: At the canal filling appointment, the patient was notified verbally of the need for a follow-up evaluation in 6 months. Also at this appointment, a recall card was filled out and filed for mailing 6 months later. The patient was advised verbally that there was no fee or charge for the follow-up evaluation and this was also stated on the recall card itself. Cards that had been filed 6 months previ-

ously were mailed each month. A recall appointment was made if the patient called the office to make the recall. As there were some patients who were seen for 'observation' a few weeks or months after treatment, a recall appointment was only considered to have occurred if the patient returned after a minimum of 6 months post-treatment.

When the patient returned to the office for a follow-up evaluation, a dental auxiliary obtained a periapical radiograph of the treated tooth and completed a clinical exam. The recall radiograph was compared to the treatment radiograph and evaluated by the endodontist while the patient was still present. Only patients with a chief complaint of pain or some other concern with the treated tooth or another tooth were examined by the endodontist.

For the purpose of this study, the recorded data were entered into the statistical software, SPSS (SPSS, Chicago, IL, USA) version 11.0, for analysis. A standardized legend for each recorded variable was created to facilitate the entry of the data into SPSS as follows: treated tooth number, patient age, patient sex, history of spontaneous pain at initial appointment, history of dental trauma, pulpal diagnosis, previous root canal on the treated tooth, date of initial treatment, and date of recall.

Odds ratio and chi-square analysis were used for statistical analysis.

Results

The records of 7105 patients were reviewed with 5641 having completed endodontic therapy. The 1464 patients who were not treated were patients with teeth diagnosed as nonrestorable and referred for extraction, patients who declined treatment, or patients who were diagnosed as not needing endodontic therapy. There were 2749 patients (48.7% of those completing treatment) who returned for a recall appointment at a minimum of 6 months after root canal treatment was completed.

In this practice, women (n = 3273, 58%) composed a higher percentage of the patient population than men (n = 2368, 42%). Odds ratio analysis revealed that females returned for recall at a rate (n = 1716/3273, 52.4%) that was significantly higher than for males (n = 1033/2368, 43.6%), (OR = 1.422, CI: 1.277, 1.584) (Fig. 1).

Odds ratio and chi-square analysis revealed that a diagnosis of pulp necrosis or previous root canal resulted in a higher than expected recall rate while a diagnosis of irreversible pulpitis resulted in a lower than expected recall rate ($p < 0.001$). Teeth with an initial diagnosis of previous root canal therapy (retreatment cases) (n = 176) had the highest recall rate at 63%. Patients with a diagnosis of pulp necrosis (n = 1794) returned at a rate of 52%. Both groups returned for recall at a significantly higher rate than expected ($p < 0.001$). Teeth with a diagnosis of irreversible pulpitis (n = 2403) were the most frequently treated group and had a recall rate of 45%. This recall rate was significantly less than expected (Fig. 2).

The mandibular molar was the most frequently treated tooth type (n = 1707) followed by the maxillary molar (n = 1431). The mandibular canine was the least treated tooth type (n = 85). Comparing recall rates, the maxillary canine had the highest recall rate at 57% (112/197), followed by the maxillary incisors at 51% (411/808). The lowest rate of recall was found with the mandibular incisors at 44% (100/227).

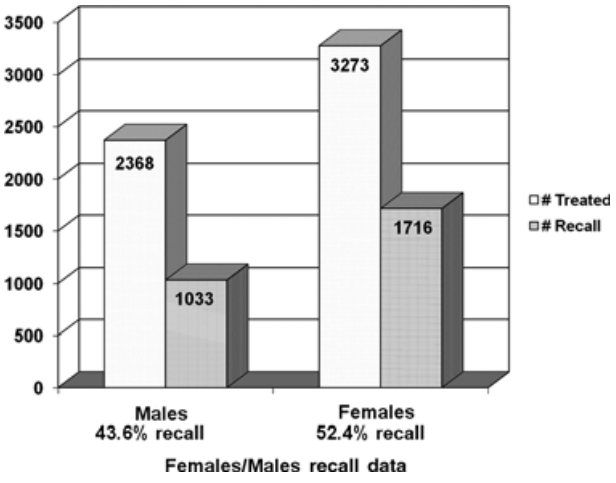

Figure 1 Females/males recall data.

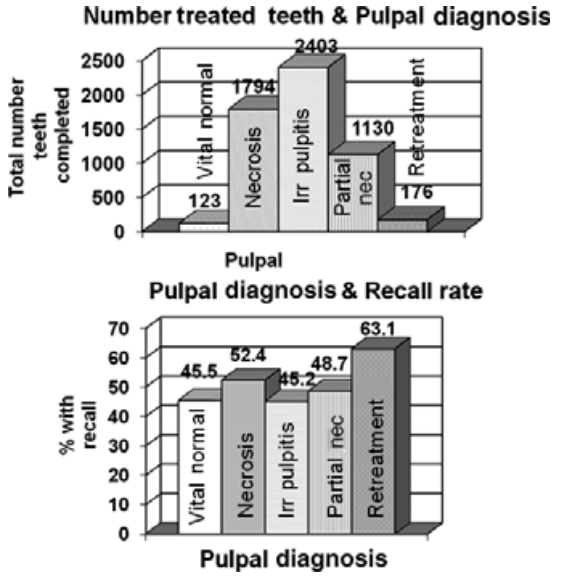

Figure 2 Number treated teeth & pulpal diagnosis. Pulpal diagnosis & recall rate.

Table 1 Rate of recall when comparing tooth types

Tooth type	Number treated	% Recall
Max. molars	1431	49.4
Mand. molars	1707	48.0
Max. premolars	752	46.5
Mand. premolars	433	47.6
Max. canines	197	56.9
Mand. canines	85	50.6
Max. incisors	808	50.9
Mand. incisors	227	44.1

Mand., Mandibular; Max., maxillary.

Treated tooth type did not have a statistically significant effect on the recall rate (Table 1).

Patients under the age of 40 returned at a lower rate than expected and those aged 41–80 returned at a higher rate than expected ($P < 0.001$). The age group with the highest percentage returning for recall (69%) occurred in the 61–70 age group ($n = 374$) (Fig. 3).

Of the 2749 patients who returned for recall, 544 (20%) had spontaneous pain at the initial appointment of their endodontic therapy. A total of 662 patients (23%) of the 2892 patients who did not return for recall had spontaneous pain at their initial endodontic appointment. There was no significant difference in the incidence of spontaneous pain at the initial appointment between those who returned for recall and those who did not return for recall.

A total of 202 patients (7%) of the group that returned for recall had a history of traumatic injury to the treated tooth while 192 patients (7%) of those patients who did not return for recall had a history of traumatic injury to the treated tooth. There was no significant difference in the incidence of a history of trauma to the treated tooth in those who returned for recall and those who did not return for recall.

Discussion

In this study, 5639 patients received endodontic treatment and 2748 (49%) returned for a recall appointment. This recall rate is similar to studies reported by Allen *et al.* (1989) (51.3%), Reid *et al.* (1992) (44.5%), and Abbott (1994b) (50.2%).

Female patients comprised 58% of the treated patient population and 62% of the recall population. The finding of a higher percentage of women in the treatment population has also been described in other studies (Wayman *et al.* 1994, Benenati & Khajotia 2002). A significantly higher percentage of women (52%) returned for recall when compared to men (44%). This is an interesting finding that deserves further investigation. In medicine, some studies have shown higher expenditures for physician services and hospital care for women than for men (Millar & Beaudet 1996, Arber 1997). However, Mustard *et al.* (1998) noted that studies of the use of healthcare services often reveal greater use by women during their reproductive years but greater use in later years by elderly men. They studied the use of healthcare services in the Canadian province of Manitoba during a 1-year period and found that the female/male ratio in healthcare expenditures was 1.3. After adjustment for healthcare due to gender-specific conditions and differences in mortality, the female/male ratio dropped to 1.0.

In dental care, it is also possible that female patients may be more concerned with their dental health and aesthetics than male patients. This may make them more likely to return for a recall examination.

An interesting finding was that patients presenting for endodontic retreatment returned for recall at a significantly higher rate than expected. This outcome could be due to the fact that for patients with a previous root canal treatment on the treated tooth, the motivation to retreat the tooth and the time and expense invested in treatment may influence the patient to attend recommended recall appointments. Certainly, the patient who agrees to undergo a second root canal

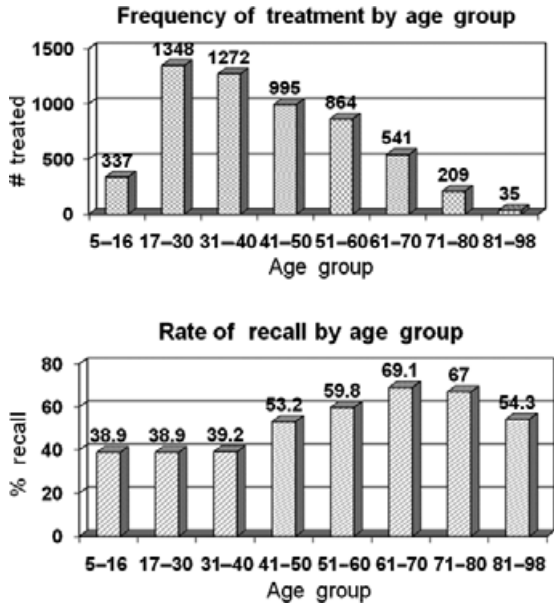

Figure 3 Frequency of treatment by age group. Rate of recall by age group.

treatment on the same tooth is a patient motivated to maintain their dentition. As this study did not involve the assessment of success or failure, it is not known if these patients were returning at a higher rate due to complaints regarding the treated tooth or over a general concern to verify the success of their treatment. It should be emphasized that the retreatment group in this study (n = 176) was much smaller than the groups with pulp necrosis (n = 1794), irreversible pulpitis (n = 2403), or partial necrosis (n = 1130).

This investigation found that patients with a diagnosis of pulp necrosis returned for recall at a significantly higher rate than expected while patients diagnosed with irreversible pulpitis returned at a significantly lower rate than expected. It is possible that if the patients diagnosed with partial pulp necrosis had been categorized into either the irreversible pulpitis or pulp necrosis groups that the results would have been different. The higher recall rate for patients diagnosed with pulp necrosis could be due to possible pre-treatment emphasis by the clinician on the presence of a periapical lesion which could have stimulated the patient to return and verify resolution of the lesion. However, a periapical lesion is not always present radiographically in cases of pulp necrosis.

The number of appointments to treatment completion was not a variable in this study. Almost all the cases in this study were completed in two appointments with treatment completion in a single appointment being extremely rare. Therefore, the number of appointments during treatment could not have been a variable affecting the recall rate in this study.

Older patients (41–80 age group) were found to return for recall at a statistically higher rate than expected. Patients aged 17–40 comprised a large portion of the patients treated and this group returned for recall at a rate that was less than expected. The finding of the majority of treated patients being in the 17–40 age group is similar to other studies (Abbott 1994b, Ingle *et al.* 1994, Wayman *et al.* 1994). Younger patients (under driving age) and some elderly patients are dependent on another person for transportation. However, retired patients could potentially have more time available to attend appointments and a patient who is employed full-time may have less time available and more difficulty in scheduling time away from work for a recall appointment. Rubinstein (2002) suggested that as the treatment population ages, 'it may become increasingly difficult for patients to arrange transportation for recall examinations'. As the occupational status of patients was not recorded, it cannot be determined from this study if the patient's occupation influenced their ability to return for recall appointments.

Neither a history of dental trauma, a history of spontaneous pain with the treated tooth, nor the type of tooth treated was found to affect the rate of recall after endodontic therapy. Dental trauma or a history of spontaneous pain with the treated tooth were thought by the authors to be worthy of investigation as to their effect on endodontic recall. It was considered that either could be remembered by the patient and that the memory of either incident could motivate the patient to return for recall evaluation to verify success of treatment. However, no significant effect on the recall rate was found.

Mandibular molars were the most frequently treated tooth type. Overall the frequency of treated tooth types was similar to that of other studies (Abbott 1994b, Wayman *et al.* 1994). The rate of recall for each tooth type was comparable to that of the total study population and there was no significant effect found on the recall rate when comparing treated tooth types. In other words, patients having incisors treated were not more likely to return for recall than patients having molar root canal treatment.

This study analysed data from one endodontist's private practice and the findings may be pertinent only to the patients that were referred to this practice or for this particular geographic region. Future projects that elaborate on this research could involve wider cross-

sectional studies that investigate whether the findings in this paper correlate with other endodontic patient populations. It would be helpful to know if the findings of this research are consistent in other regions and countries with similar practice characteristics, as well as regions with different demographics. A future study could also investigate the reasons that patients want to return for endodontic recall appointments. A significant omission in this study was the lack of knowledge as to why the patient returned for recall. Recording the presence of pain or any complaint at the recall appointment would have been helpful. A questionnaire at recall appointments designed to elicit the motivating factors for the visit could be beneficial. Other issues that could impact recall rate and should be evaluated include distance between the patient's home or workplace and the endodontic practice and patient relocation issues or changes of address.

With the rising importance of evidence-based dentistry, the endodontic recall remains a very significant part of root canal treatment. Factors that may lead to an increased patient response for recall should be investigated so that the specialty of endodontics may accurately inform the dental profession and the public of the outcome and benefits of endodontic therapy.

Conclusion

In this study, variables that affected the rate of endodontic recall were patient age, patient gender and preoperative pulp vitality status. Variables that did not affect the recall outcome were a history of dental trauma, a history of spontaneous pain with the treated tooth, and the treated tooth type.

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