

# Incidence of postoperative pain after one-appointment endodontic treatment of asymptomatic pulpal necrosis in single-rooted teeth

John Martin Mulhern, B Dent Sc, MSD; Samuel S Patterson, DDS, MSD;  
Carl W. Newton, DDS, MSD; and A. Michael Ringel, DDS, MSD

Sixty single-rooted teeth were endodontically treated by two postgraduate students for asymptomatic pulpal necrosis. Thirty were treated in a single visit each, and a control group of 30 were treated in three visits each. Clinical and radiographic evaluations were made. A subjective questionnaire was used to record pain experience. No significant difference in the incidence of pain existed between the single- and multi-visit groups.

A one-visit root canal treatment is attractive to a patient because it saves time and would probably reduce cost. In addition, one visit is less stressful to the anxious patient.

Several studies<sup>1-6</sup> have considered this mode of root canal treatment, and in 1980, Landers and Calhoun<sup>7</sup> reported that according to a survey of 50 postgraduate endodontic programs in the United States, a large percentage of these programs are teaching and practicing one-appointment therapy for some endodontic problems. Most program directors have said there has been little difference between single- and multi-appointment therapy with respect to postoperative flare-ups, successful healing, and patient acceptance.

Morse<sup>8</sup> has stated that, "in non-vital cases, once the canals are clean, smooth, tapered, and dry and the tooth is symptomless, then obturation can be done. This may be the first, second, third or fourth visit."

Taintor and Ross<sup>9</sup> attributed the relatively rare instances of postobturation pain either to periapical irritation by material extruded through the apex, poor coronal seal, high occlusion, or cracked tooth, or to such diverse causes as adjacent tooth involvement, or an interradicular periodontal abscess. Most pain according to their report occurs between appointments, after the tooth has been opened, but before it has been obturated. As causes of preobturation pain, they cited overlooked root canals, incompletely instrumented root canals, over-instrumentation, overmedication, root perforation, cracked teeth, and exudates to the apex.

In an investigation of the ability of trephination to prevent or relieve pain in endodontically treated teeth, Peters<sup>5</sup> concluded that whether the root canal is filled after one or after two appointments is not highly significant in relation to pain.

Flatley<sup>10</sup> investigated postoperative

pain after the one-appointment treatment of painful pulpitis without apical involvement seen radiographically. Although no significant difference occurred in the incidence of pain between the one-appointment and multiappointment treatments, the severity did seem to be greater in the one-appointment cases.

This study investigated the incidence of postoperative pain after one-appointment nonsurgical endodontic treatment of asymptomatic pulpal necrosis in single-rooted teeth that had no sinus tracts.

## METHODS AND MATERIALS

### Identification and selection of subjects

Patients studied were those requiring endodontic therapy in asymptomatic, mature single-rooted teeth with

necrotic pulps. Excluded from this study were patients with medically compromising conditions, or exposure to factors that might interfere with the normal inflammatory response, such as use of corticosteroid or other anti-inflammatory drugs. Individuals who had been on recent or active antibiotic therapy (other than as a direct result of the tooth being treated) were also excluded.

Sixty maxillary and mandibular single-rooted teeth were treated by two graduate endodontic students. The teeth were randomly assigned to group 1, the experimental group in which 30 teeth were treated in a single visit, or group 2, the control group in which 30 teeth were treated in three visits.

Patients in the experimental group received free treatment, whereas those in the control group were charged the usual clinic fee for treatment.

## Procedures

The endodontic treatment was performed in the following manner for group 2 (control):

No local anesthesia was administered. The tooth was isolated with rubber dam and swabbed with povidone-iodine, USP. All decay and carious debris were removed from the coronal aspects of the tooth; the occlusion was relieved; and access was obtained. A sample of the root canal contents was obtained on a paper point for aerobic culture (Brain Heart Infusion) with 0.1% agar. The root canal was irrigated with 2.5% sodium hypochlorite solution. The preoperative radiograph was measured for canal length determination. A fine barbed broach was used for thorough removal of pulpal debris from each root canal; and the apical portion of the root canal was cleaned with a size 10 file and frequent irrigation with sodium hypochlorite

solution. Root canal lengths were recorded, using either a size 10 or 15 file. Initial incremental preparation of the root canal was performed. After drying the canals with paper points, a dry pledget of cotton was inserted in the canals of those teeth treated in multiple appointments, and they were sealed with a double cement system of Cavit G and zinc oxyphosphate cement in the coronal access cavity.

At the second visit, root canal preparation was completed; then the sealing process was repeated. At the third appointment, the gutta-percha master points were fitted and verified radiographically. The root canal was thoroughly dried with paper points after irrigation with 95% alcohol. Gutta-percha was sealed with Kerr Tubli-seal, using a lateral condensation technique. A temporary double-seal was placed and a final radiograph was made. All patients were routinely advised to expect some tooth sensitivity for 24 to 48 hours after each appointment. Provision was made available for care of any exacerbations that might occur between appointments.

For teeth in group 1, repetition of sealing treatment on successive visits did not apply as all treatment was completed in a single visit.

## Methods for obtaining and recording observations

Each patient in the single-visit group (group 1) was given a questionnaire to complete 48 hours after treatment. A clinical examination was conducted one week postoperatively, and the patient was asked to complete a similar questionnaire designed to separate "a difference in feeling" from other gradients of pain.<sup>10</sup>

Patients with multivisit treatments (group 2) were asked to complete a

questionnaire for each visit, and a clinical examination was conducted one week after all treatment was complete. The postoperative clinical examination consisted of assessing the presence of either swelling or tenderness to percussion.

## Statistical analysis

The data were statistically analyzed by the Chi-square test to determine any significant differences between the single- and multiple-appointment procedures concerning incidence and severity of pain (Table 1). Other variables that were analyzed were:

medication; presence or absence of radiolucent area periapically; maxillary or mandibular tooth position; result of aerobic culture; maximum file size used at the first appointment; level of root canal filling with respect to radiographic apex; age; sex; race; and canal humidity.

## RESULTS

Patients' ages ranged from 13 to 75 years, with approximately equal distribution according to gender. Eight patients experienced pain in the single-visit treatment and 12 in the multivisit treatment. There was no significant difference in the occurrence of pain between the one-appointment and multi-appointment treatment groups (Table 2).

Medications taken for pain were aspirin (the most common), Tylenol, Tylenol 3, Synalgos-DC, and Darvocet. Neither of the clinicians prescribed these medications, and none of the patients indicated that they had sought analgesic prescriptions because of the treatment. The medications taken may have been simply those most readily available to the patients. Only one prescription was written and that was

Table 1 • Data regarding single- and multiple appointment endodontic treatment of patients reporting pain.

Factors	Single appointment				Multiple Appointment			
	With pain		Without pain		With pain		Without pain	
	no.	%	no.	%	no.	%	no.	%
<b>Number</b>	8	26.7	22	73.3	12	40	18	60
<b>Gender</b>								
Male	4	13.3	11	36.7	2	6.7	12	40
Female	4	13.3	11	36.7	10	33.3	6	20
<b>Race</b>								
White	7	23.3	14	46.7	6	20	15	50
Black	1	3.3	8	26.7	6	20	2	6.7
Asian	—	—	—	—	0	—	1	3.3
<b>Age</b>								
Younger than 21 yrs.	2	6.6	7	23.3	1	3.3	4	13.3
Older than 21 yrs.	6	20	15	50	11	36.7	14	46.7
<b>Teeth</b>								
Maxillary anterior teeth	6	20	19	63.3	7	23.3	12	40
Mandibular anterior teeth	2	6.6	3	10	5	16.7	6	20
<b>Periapical radiolucent areas</b>								
Absent	0	0	3	10	4	13.3	2	6.7
Present	8	26.7	19	63.3	8	26.7	16	53.3
<b>Condition of canal</b>								
Wet	2	6.6	6	20	1	3.3	0	0
Moist	4	13.3	13	43.3	2	6.0	9	30
Dry	2	6.6	3	10	9	30	9	30
<b>Preoperative culture</b>								
Positive	6	20	13	43.3	10	33.3	13	43.3
Negative	2	6.6	9	30	2	6.7	5	16.6
<b>Initial filing</b>								
Larger than size 30 file	7	23.3	20	66.7	4	13.3	7	23.3
Smaller than size 30 file	1	3.3	2	6.7	8	26.7	11	36.7
<b>Gutta-percha filling sealer</b>								
> Radiographic apex	3	10	8	26.7	6	20	6	20
At radiographic apex	2	6.6	5	16.7	1	3.3	5	16.7
< Radiographic apex	3	10	9	30	5	16.7	7	23.3
<b>Experiencing pain</b>								
Pain (48 hours)	7	23.3	23	76.7	8	26.7	22	73.3
Pain (one week)								
Post-obturation	3	10	27	90	2	6.7	28	93.3
Pain at nine days	—	—	—	—	3	10	27	90
Pain at 16 days	—	—	—	—	6	20	24	80
Swelling	2	6.6	—	—	—	—	—	—
<b>Medication</b>								
Medication taken	5	16.7	—	—	4	13.3	—	—
Strong analgesic	3	10	—	—	—	—	—	—
Mild analgesic	2	6.6	—	—	4	13.3	—	—
No medication	3	10	—	—	8	26.7	—	—

**Table 2 • Distribution of patients reporting pain according to treatment.\***

Treatment	With pain		Without pain		Total
	Observed	Expected	Observed	Expected	
One visit	8	(10)	22	(20)	30
Multi-visit	12	(10)	18	(20)	30
Total	20	20	40	40	60

\*For  $X^2 = 1$ ; DF = 1;  $P = .275$ .**Table 3 • Distribution of patient's pain experience according to gender\***

Gender	With pain		Without pain		Total
	Observed	Expected	Observed	Expected	
Male	6	(9.7)	23	(19.3)	29
Female	14	(10.3)	17	(20.7)	31
Total	20	20	40	40	60

\*For  $X^2 = 4.1$ ; DF = 1;  $P = .04$ .

for penicillin for a patient with an elevated temperature. This patient, along with those who took the stronger analgesics (Tylenol 3, Synalgos-DC, and Darvocet), and the two patients who had detectable swelling, were all from the experimental group. Although this group of patients may appear to be substantially different from the other patients who experienced pain, a Yates correction for small numbers in cells showed no significant differences. This was also true of the distribution of the patients' experience of pain according to swelling alone.

Clinically and radiographically, the apical terminus of the root canal filling seemed to have no effect on the incidence of pain. In recording level of filling, no distinction was made between sealer or gutta-percha. The range of fillings was  $2 \pm$  mm from the radiographic apex.

While a significant difference was noticed in the distribution of pain according to gender (Table 3), this difference was confined to the control group. Only two of the 14 males in that group reported pain compared with ten of the 16 females.

Age, race, tooth position, periapical radiolucent areas, results of bacterial culture, canal humidity, and amount of initial filing did not appear to influence the pain experience.

In the experimental group, the eight patients who reported pain described a total of ten incidents of pain. Seven of these patients reported pain on the 48-hour postobturation questionnaire. Two of them still reported pain at one-week postobturation, whereas only one patient who had reported no pain at 48 hours did report pain on the one-week postobturation questionnaire.

In the control group, 12 patients reported pain, for a total of 19 incidents. Eight incidents of pain were reported 48 hours after the first visit; three were reported 48 hours after the second visit (only one of these patients had previously reported pain); and six incidents of pain were reported 48 hours after the obturation appointment (of these, two patients had not previously reported pain). On the one-week postobturation questionnaire, only two incidents of pain were reported, both in patients who had reported five days before obturation but not immediately after the first visit.

In both groups, the incidence of pain at one-week postobturation was low, 3:30 (experimental) and 2:30 (control). At 48-hours postobturation, the incidence of pain was 7:30 (experimental) and 6:30 (control) (Table 1).

As Table 4 shows, there was no significant difference in the incidence

of pain per dental manipulation, regardless of group.

It was significant that two thirds of the patients treated had no pain.

## DISCUSSION

The results of this study show that there is no significant difference in the incidence of postoperative pain between one-visit and multi-visit endodontic treatment of asymptomatic pulpal necrosis. Although a third of all the treated patients experienced pain, no factor studied clearly indicated the cause. If we treat a tooth on three occasions rather than on one, we can expect the chances of at least one incident of pain to increase three times. The incidence of pain in females in this study was significantly higher than in males, though only in the control group (Table 3). It may be that females experience increased anxiety when treatment is prolonged as it was in the control group. The actual number of patients experiencing pain was also greater in the control group. The fact that these patients did pay a nominal fee for their treatment may have caused them to be more fastidious and to express discomfort more readily than those from the experimental group who paid no fee.

If the strength of analgesic taken by the patients directly reflected the

**Table 4 • Distribution of dental manipulations according to incidence of pain.\***

Incidence of pain	Control group		Experimental group		Total
	Observed	Expected	Observed	Expected	
Pain	17	(18)	7	(6)	24
No pain	73	(72)	23	(24)	96
Total	90	90	30	30	120

\*For  $X^2 = 0.28$ ;  $DF = 1$ ;  $.7 > P > .5$ .

severity of pain experienced, the postoperative pain in the experimental group could be considered more severe in nature. It could also reflect accessibility of controlled substances for self-medication. However, because these were, in fact, self-medications, no conclusions can be made. However, the fact that the patient who required the systemic antibiotic and the two patients with detectable swelling were also from the experimental group supports the hypothesis that postoperative inflammation after the single visit is more severe.

The finding that pain did not differ in patients younger or older than 21 years old agreed with those of Clem<sup>6</sup> and Maddox and others<sup>11</sup> but not with the results of Seltzer and others,<sup>12</sup> or O'Keefe.<sup>2</sup>

Race was not a factor in the pain experience in this study. The study population was taken from one geographic area. This lack of diversity might be explained by the findings of Milgram,<sup>13</sup> who showed a relationship between nationality and conformity in which culture may be more significant in experiencing pain than simple differences of race.

Maxillary or mandibular arch tooth position was not a factor. Pain caused by any technical difficulties experienced in mandibular incisors, which frequently have two canals, may have

been balanced by pain caused by technical difficulties in maxillary lateral teeth, which frequently have dilacerated roots.

The finding that a periapical radiolucent area did not have a significant relationship to pain was not unexpected, considering the difficulty in radiographic interpretation of a periapical radiolucent area.<sup>14</sup> Likewise, considering the recent literature on the culturing of root canal contents, it is not surprising that this study showed no correlation between pain experience and the results of bacteriologic cultures. What is not as easily explained is the finding that teeth that had obviously wet canals on opening showed not correlation with the pain experience. Because the accumulation of tissue fluid is inherent in inflammation, it was assumed that teeth with wet canals could not be considered quite as clinically asymptomatic as teeth having dry root canals as detected on opening.

The lack of correlation between pain and the amount of initial filing may indicate decreased importance of apically extruded debris as a cause of discomfort in these necrotic cases. Periapical resorption of hard tissues may permit a comfortable adaptation of any extruded material. This may also explain the lack of significance the level of filling material has in relation

to the pain experience as well as the high incidence of filling material extrusion (Table 1). Twenty-three of 60 cases treated showed periapical extrusion of sealer or gutta-percha, or both. The lack of resistance offered by a damaged periodontal ligament and lamina dura could account for the ease of overfilling. In teeth with necrotic pulps, it is not unusual to have some periapical resorption of the apex, which could result in a wider than normal apical constriction, also increasing the tendency on the operator's part to overfill. We thought these teeth had not been overinstrumented during preparation because a standardized technique had been maintained in each case.

Although past endodontic experience was not recorded, it may well have been a factor in pain experience. O'Keefe<sup>2</sup> showed the relationship of past endodontic experience with less severe pain before treatment. He said patient's previous experience might represent earlier detection of a problem by either the patient or the dentist, or it might indicate the patient's most positive attitude toward treatment. Being asked to report pain or being told to expect discomfort might predispose the patient to an expected symptom.

Initial file length was not evaluated in this study. It is quite possible that irritation of periapical tissue caused by an initially long file was related to the incidence of pain.

Of great concern to endodontic therapy is the overall high incidence (33.3%) of discomfort reported in this study. The figure is within the range of other studies<sup>2,3,5,6,11</sup> with reported incidences ranging from 16% to 54%. In the current study, when pain did occur it was within 48 hours of an operative procedure. Provided no further manipulation took place, the inci-

dence of pain dropped by more than 50% within one week. Although none of the patients found the pain to be severe, every effort should be made by clinicians to minimize any discomfort.

We thought that the multi-visit schedule provided some advantages in terms of assessing the health of the periapical tissues, becoming familiar with the canal morphology, and gaining easy access to treatment of the periapical tissues, if necessary, which might be significant in the eventual success of the root canal treatment. Multiple-appointment treatment may also be more effective in the control of clinically significant bacterial contamination with intracanal medications and irrigation solutions.<sup>15</sup> However, multiple-appointment therapy may actually increase chances of contamination during or between visits by the added risk of leakage around the rubber dam or through the sealing material.

## SUMMARY AND CONCLUSIONS

In this study, there was no difference in the incidence of pain whether treatment was performed on a single- or multi-visit basis. Pain did not appear to be influenced by any of the following: age, race, tooth position, presence of a periapical radiolucent

area, results of aerobic culture of canal contents on opening tooth, canal humidity, or amount of initial filing. Although a correlation was obtained between gender and pain experience in the control group (female patients reported more pain), this finding is viewed with some doubt.

The occurrence of pain proved to be unpredictable.

The eventual success or failure of the treatment is of greater concern to the patient and dentist than any transient discomfort associated with treatment. Therefore, before advocating the routine use of single-visit treatment of asymptomatic pulpal necrosis, long-term studies of success or failure should be evaluated.

This research was aided by a Grant-in-Aid of Research from the Endowment and Memorial Foundation of the American Association of Endodontists.

The authors thank Professor Paul Barton, Indiana University School of Dentistry, for editorial assistance.

Dr. Mulhern is in private practice, Winnipeg, Manitoba, Canada; Dr. Patterson is chairman, department of endodontics, Indiana University School of Dentistry, Indianapolis; Dr. Newton is associate professor, department of endodontics, Indiana University School of Dentistry, Indianapolis; and Dr. Ringel is in private practice, Mississauga, Ontario, Canada. Request for reprints may be directed to Dr. Samuel S. Patterson, Indiana University School of Dentistry, 1121 W Michigan St, Indianapolis, 46202.

## References

1. Fox, J. and others. Incidence of pain following one-visit endodontic treatment. *Oral Surg* 30:123-130, 1970.
2. O'Keefe, E.M. Pain in endodontic therapy: preliminary report. *J Endod* 2:315-319, 1976.
3. Soltanoff, W. A comparative study of the single visit and multiple visit endodontic procedure. *J Endod* 4:278-281, 1978.
4. Ashkenaz, P.J. One-visit endodontics: a preliminary report. *Dept Surv* 55:62-67, 1979.
5. Peters, D.D. Evaluation of prophylactic alveolar trephination to avoid pain. *J Endod* 6:518-526, 1980.
6. Clem, W.H. Posttreatment endodontic pain. *JADA* 81:1166-1170, 1970.
7. Landers, R.R., and Calhoun, R.L. One appointment endodontic therapy. An opinion survey. *J Endod* 6:799-801, 1980.
8. Morse, D.R. Clinical endodontology. Springfield, Ill, Charles C Thomas, 1974, p 466.
9. Taintor, J.F., and Ross, P.N. Endodontic posttreatment pain. *Dent Surv* 54:52-55, 1978.
10. Flatley, C.J. Incidence of postoperative pain following one-appointment treatment of painful pulpitis without apical radiographic involvement. Thesis. Indianapolis Indiana University School of Dentistry, 1975.
11. Maddox, D.L.; Walton, R.E.; and Davis, C.O. Incidence of post treatment pain related to medicaments and other factors. *J Endod* 3:447-452, 1977.
12. Seltzer, S.; Bender, I.B.; Ehrenreich, J. Incidence and duration of pain following endodontic therapy. *Oral Surg* 14:74-82, 1961.
13. Milgram, S. Nationality and conformity. *Sci Am* 205:45-51, 1961.
14. Goldman, M.; Pearson, A.; and Darzeneta, N. Endodontic success. Who's reading the radiograph? *Oral Surg* 33:432-437, 1972.
15. Ringel, A.M. and others. A clinical study to determine the antimicrobial effects of chlorhexidine gluconate when used as irrigant in the endodontic treatment of teeth with necrotic pulps. *J Endod* 8:200-204, 1982.