
Incidence of postoperative pain after single- and multiple-visit endodontic procedures

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A series of 359 endodontic cases were followed and evaluated by the frequency of reported postoperative pain. A statistical analysis of the data obtained attempted to identify a relationship between pain experienced and the anatomic location, the pulpal vitality as determined by hemorrhage, or the number of treatment visits used in completing the case. Data obtained indicated no relationship between pain experience and pulpal vitality, no statistically significant relationship to the anatomic location, and a significant relationship to the number of visits used. The data indicate a 2 to 1 higher frequency of pain reported following treatment completed in multiple visits as compared to that reported for those completed in one visit.

Landers and Calhoun¹ have recently focused attention on the tendency to develop and teach single-visit techniques in endodontic graduate programs. Their survey indicated at least limited acceptance of the concept and the prevalence of opinion that single-visit procedures can be expected to perform as well as multiple-visit procedures in many situations. This opinion survey points out the need for clinical studies comparing various aspects of treatment sequelae between the two approaches.

Previous clinical studies relating to single-visit therapy have helped stimulate the present interest in such procedures. In the earliest study published in the English language, Ferranti² reported a relatively low rate of severe pain following single-visit procedures. The next study to appear was that of Julius Fox and associates³ which reported that 90 percent of single-visit treatments produced little or no spontaneous pain while 1 percent of the patients thus treated experienced slight pain enduring as long as 1 week.

O'Keefe⁴ found no significant differences in the

postoperative pain experienced by his patients following single- or multiple-visit treatment procedures. He did, however, propose a correlation between pretreatment pain and postoperative discomfort and a lower incidence of postoperative pain associated with treatments of anterior teeth. This correlation of pain and anatomic groups is also reported by Clem.⁵

Soltanoff⁶ used a random selection of cases treated during a 20-year period to compare single- and multiple-visit treatments by the degree of postoperative pain experienced. Eighty-eight single-visit cases were compared with 193 multiple-visit cases. Following single-visit treatments, more than 50 percent of his patients experienced pain; 3.4 percent claimed to have a severely painful aftermath.

Ashkenaz⁷ reported 195 cases completed in a single visit and found that eight patients experienced pain after the first day, three had pain lasting 2 days, and two reported pain lasting for 1 week.

The literature to date has failed to establish a consensus concerning the relationship between postoperative pain and the number of treatment appointments. Some authors^{2-4,7} support single-visit treatments, while others^{5,6} indicate that the use of such procedures produces more discomfort for the patient and would therefore be less desirable under most circumstances. Seeing these contradictory findings in the literature and having gained through the use of both procedures, a clinical impression that there is no real difference in postoperative complaints following the two approaches, we developed a clinical model with which to test that impression.

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Table I. Incidence of pain by anatomic groups

Group	None and slight	Moderate and severe	No. in study	Percentage having pain
Maxillary anterior teeth	63	6	69	8.7
Mandibular anterior teeth	14	7	21	33.3
Maxillary premolars	34	10	44	22.7
Mandibular premolars	22	6	28	21.4
Maxillary molars	72	17	89	19.1
Mandibular molars	82	26	108	24.1
Totals	287	72	359	20.1 (Average)

Chi square = 9.2298; 5 degrees of freedom; $p \geq 0.10$.

Table II. Incidence of pain: Vital and nonvital

Group	None and slight	Moderate and severe	No. in study	Percentage moderate and severe
Vital	125	28	153	18.3
Nonvital	162	44	206	21.3

Chi square = 0.5122; 1 degree of freedom; not significant ($p \geq 0.1$).

Table III. Incidence of pain: Single and multiple visit

Group	None and slight	Moderate and severe	No. in study	Percentage Moderate and severe
Single visit	212	38	250	15.2
Multiple visit	75	34	109	31.2

Chi square = 12.1084; 1 degree of freedom; $p \leq 0.001$.

MATERIALS AND METHODS

Three geographically separate offices participated in the study in order to obtain a larger data pool and to eliminate bias which might result from an undetected operator idiosyncrasy. We employed preparation and obturation techniques which were apparently identical. Each used the preparation and obturation concepts advocated by Dr. Schilder⁸ as they have been adapted for a single-visit treatment approach at the University of Oklahoma.⁹ The preparations were completed with 5.25 percent sodium hypochlorite irrigation while obturations were completed with vertically condensed warmed gutta-percha and Kerr pulp canal sealer.*

Patients were treated and evaluated until results were available on at least 100 cases from each office. The decision to use single- or multiple-visit treatment was based solely on the time available for treatment and never on the pulpal vitality, clinical symptoms, presence or absence of swelling, sinus tract, or apical pathosis. This disregard for initial status eliminated the grouping of painful, nonvital, or other specific

clinical conditions into a particular treatment group, as such a selection process could have biased the results by falsely indicating a relationship to the treatment method employed.

Each patient was given a self-addressed stamped card and asked to report any pain experienced following each treatment session. When these cards were returned to the practitioner, the data were combined with the clinical data on each case and the compiled data were analyzed by the chi-square method to determine if there were any significant relationships between the incidence of pain, the method of treatment, the anatomic type of tooth treated, or the pulpal vitality as determined by the presence of hemorrhage.

RESULTS

Of the patients treated during the study 359 returned the evaluation cards, thereby forming a data pool of 250 treatments completed in a single visit and 109 completed in multiple visits. These treatments were performed on teeth of which 153 had vital pulps (as determined by the presence of pulpal hemorrhage) and 206 had nonvital canal

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Table IV

Tooth type	Single-visit treatments			Multiple-visit treatments		
	No. of teeth	No. reporting pain	Percent with pain	Percent with pain	No. reporting pain	No. of teeth
Maxillary arch						
Anterior	63	5	7.9	16.7	1	6
Premolar	35	8	22.9	22.0	2	9
Molar	50	8	7.6	23.1	9	39
Mandibular arch						
Anterior	20	6	30	100	1	1
Premolar	26	5	19.2	50	1	2
Molar	56	6	10.7	38.5	20	52

contents. Anatomically, there were 69 maxillary and 21 mandibular anterior teeth, 44 maxillary and 28 mandibular premolars, and 89 maxillary and 108 mandibular molars. These groups are reported in Tables I, II, and III.

Postoperative pain was indicated by the patients on the returned cards as none, slight, moderate, or severe. These categories were reclassified into two categories by combining "none" with "slight," forming what was considered a report of insignificant pain, and "moderate" with "severe," which was considered a report of significant pain. The resulting data were used to evaluate relationships between pain reported and the anatomic group to which the treated tooth belonged, presence or absence of vitality within the pulp, and the number of visits used to complete the treatment.

Comparison of the reported pain experience to tooth groups indicated percentages as follows: Maxillary anterior teeth were the least frequently painful (8.7 percent) and mandibular anterior teeth were the most frequently painful (33.3 percent). There was little difference between upper and lower premolars and molars or between premolars and molar groups. The incidences of pain observed were as follows: maxillary premolars, 22.7 percent; mandibular premolars, 21.4 percent; maxillary molars, 19.1 percent; and mandibular molars, 24 percent (Table I). A statistical analysis of painful experience associated with anatomic groupings revealed no significant correlation ($p \geq 0.10$).

Analysis pain reported as related to the vitality of canal contents at the start of treatment produced only a slight difference between groups. Teeth with vital pulps were observed to have the lowest frequency of pain (18.3 percent), while those with nonvital pulps were found to have the highest frequency of pain (21.4 percent) (Table II). This correlation was also found to be statistically insignificant ($p \geq 0.10$).

Comparison of pain experience to number of treatment visits indicated that the frequency of pain was lower in the single-visit group (15.2 percent of treatments) and higher in the multiple-visit group (31.2 percent of treatments). This correlation was found to be significant at $p = 0.001$ (Table III). Since the difference could be due, in part, to the anatomically related pain frequencies that were observed (Table I), the multiple and single-visit groups were subdivided and analyzed by anatomic categories. This analysis demonstrated that, among the multiple-visit cases, molars were most likely to be associated with postoperative pain while, among the single-visit cases, mandibular anterior teeth were most likely to be associated with a posttreatment pain experience. In every anatomic category except the maxillary premolars, multiple-visit procedures were associated with postoperative pain more frequently than were single-visit procedures (Table IV).

DISCUSSION

The greatest difficulty in a study of pain related to procedures, anatomic structures, or pathologic conditions is the reliability of values placed on the entity *pain*. Because of the subjective nature of the pain experience,¹² the interpretation and evaluation of patients will show wide variations. Such factors as positive pre- and postoperative suggestions concerning a procedure may influence patients to report a lower incidence of pain than if there had been no such suggestion. Stressful situations unrelated to treatment may reduce the patient's tolerance for discomfort and result in an increase in the reported incidence of significant pain. Anxiety and ignorance of the procedure and its sequelae can alter the incidence of reported pain experience. Because of the variables introduced as a result of the psychological interactions in the pain experience, it was decided to allow the patients to discriminate between four levels

of intensity of pain. These four categories were then reclassified as significant and nonsignificant painful experience. The patients were therefore allowed to express their subjective impressions in a manner which would minimally alter the reliability of the data obtained.

When the incidence of significant pain was correlated with the anatomic location of the treated teeth, no significant relationship was found ($p \geq 0.10$). These findings are not consistent with those of Clem⁵ or with those of O'Keefe.⁴ This lack of significant correlation could be due to the relatively small sample size of some groups. A relationship between pain experience and anatomic location may exist, but such a relationship was not revealed by the present study.

No significant correlation could be found between pulpal vitality and the reported incidence of postoperative pain ($p \geq 1.0$). This finding is in direct conflict with the traditional attitude that only vital cases or cases with a sinus tract should be considered as candidates for single-visit endodontics. It is supported, however, by Fox and associates³ and is in agreement with our own clinical impressions.

A significant difference was disclosed when the relationship between single and multiple visits and the reported incidence of postoperative pain was examined statistically: 15.2 percent of the cases treated in a single visit were associated with significant postoperative pain, as compared with 31.2 percent of the multiple-visit cases. This difference is significant when examined in a two by two chi-square test: chi square = 12.1084, $p = 0.001$.

Extreme care was exercised to ensure that the number of visits was the primary factor associated with postoperative pain experience. The differences in the frequency of painful episodes were unrelated to the pulpal vitality as determined upon initiation of treatment (Table II). This, of course, can be interpreted as true only when therapy is given by the standardized methods employed in this study, as the influence of technique has not been fully explored. The possibility that anatomic groupings could have influenced the results must be examined further, as a numerical, although insignificant, difference was observed between some groups. In an effort to evaluate whether the anatomic groupings had collectively influenced the interpretation of data, we assembled a table which compared anatomic groupings to pain experience and treatment method simultaneously. Table IV lists the results and eliminated to our satisfaction the possibility that anatomic distribution within the groups was responsible for the observed differences in pain reported. In fact, this table supports our observation as the frequency of

patients reporting pain consistently is higher for multiple visits except in the case of the maxillary premolars, where the observed frequency was essentially equal between methods. It should be noted that the maxillary premolar group is small and therefore does not lend itself to reliable interpretation as an entity.

The frequency of reported pain for the respective groups supports the concept that pain can result from each clinical entry into the root canal space. Each visit represents an entry, regardless of whether obturation or instrumentation is accomplished, and may produce an incidence of pain; therefore multiple-entry procedures introduce more opportunity for the patient to experience pain than single-entry procedures. The treatment used in both methods consisted of the same steps except that single visits did not involve intracanal medicaments or temporary seals; hence some postoperative pain might be attributed to the intracanal medicaments. Kleier and Mullaney,¹⁰ however, were unable to show a relationship between medicaments and pain. Therefore, we believe a more likely factor altering the experience of pain is that immediate obturation prevents further communication to the apex via the canal. That, in turn, prevents the occurrence of painful episodes resulting from reinfection of the canals as a consequence of leakage past the temporary obturation.¹¹

SUMMARY AND CONCLUSION

Preparation and obturation methods advocated by Schilder and adapted for single-visit use were employed during a series of endodontic treatments. Each case was evaluated in order to identify possible relationships between the incidence of pain and anatomic groups of teeth, pulpal vitality at the commencement of treatment, and the number of visits used to complete the treatment. Data were obtained and evaluated for 359 patients.

The following conclusions can be drawn from this study:

1. Under the conditions observed, there is no significant difference in postoperative pain experience for teeth in different anatomic groupings.
2. Pulp status at the time of treatment is unrelated to postoperative pain experience.
3. Single-entry endodontic treatments using the methods employed in this study result in a postoperative pain experience approximately one half as often as when multiple-entry treatments are used.

Further research is needed to determine whether the number of canals may influence the frequency of postoperative pain associated with endodontic treatment. A relationship between painful postoperative episodes and the number of apical foramina or the

size of apical foramina may exist, and if such a relationship does exist it should be expressed in the anatomic groupings.

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