

CLINICAL ARTICLES

Single-visit Endodontics: A Clinical Study

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The concept of doing total endodontic treatment of a tooth in a single visit is not new. However, most accepted techniques in current use stress multi-visit procedures. As a result, schools concentrate upon teaching a multi-visit concept, leaving most dental students with an impression that is carried over into practice; namely, that this is the only acceptable treatment modality.

Many clinicians have predetermined ideas concerning single-visit endodontics (1). These range from anticipation of more "flareups" postoperatively to the practice of limiting treatment to single-rooted teeth with mechanically exposed vital pulps. Other variations in treatment include artificial fistulation, immediate apicoectomy, and the filling of root canals with special filling materials claimed to contain unusual physical or chemical properties. Unfortunately, most of the current "dogma" originated from clinical impressions rather than clinical documentation and therefore is suspect.

The objectives of this clinical research project were: (a) to investigate and compare postoperative sequelae (i.e. pain/swelling) following single-visit endodontics and multi-visit endodontic procedures and (b) to compare the healing response following single-visit versus multi-visit procedures.

LITERATURE REVIEW

There have been many publications concerning single-visit endodontics. Most of these are opinions based upon limited clinical observation and inadequate documentation. Nonetheless, the techniques used and the recorded comments are interesting and provocative.

At the turn of this century, "Immediate Root-Filling" was the title of three papers by Dodge (2) (1887), Kells (3) (1887), and Hofheinz (4) (1892). Trallero (5) (1901) described his one-visit technique using a bi-chloride wash, hot platinum wire sterilization, and a canal filling consisting of zinc oxide, eugenol, and

xeroform paste. Inglis (6) (1904) used cocaine as a pulpal anaesthetic, applied the rubber dam, "sterilized" the root canal with potassium permanganate, and filled the canals with chloropercha, sectional gutta-percha, or formapercha. His comments seem current in that he excluded "all acute cases," that a prime advantage was "saving time," and that one could expect "absolute success when directions are followed"!

Philips (7) (1904) reported that the teeth he treated were "in perfect condition after three years," "color as when alive," and "no abscess in a thousand." His technique was removing the coronal portion of the pulp, covering it with a pulp preservative seal and amalgam. Barnes (8) (1908) used sulfuric acid to irrigate canals which he filled with chloropercha. He excluded "abscessed roots" from treatment. Zsigmondy (9) (1912) irrigated canals with sodium dioxide, sterilized them with a hot wire, and alcohol-dried the canals before filling.

Years later, the single-visit procedure was modified by the immediate root resection; i.e. the resection of the root apex immediately after filling the canals. Artificial fistulation, a form of soft-hard tissue perforation, was also introduced as an optional procedure in single-visit endodontics to prevent or alleviate post-operative pain or swelling. Okun (10) (1953), Camara (11) (1954), and Kaplan et al. (12) (1960) described various endodontic-surgical techniques for completion of treatment in one visit which they claimed resulted in excellent healing afterward.

In 1955, Lorinczy-Landgraf and Polocz (13) reported that 10% of 1,200 gangrenous single-rooted teeth had moderate to severe pain following single-visit endodontics; 3% of which required postoperative trephination. Two years later they reported that 82% had healed with bone regeneration (14). Ferranti (15) (1959) compared single-visit and two-visit procedures and reported little difference in postoperative sequelae. Sargenti and Richter (16) (1959) advocated the use of single-visit endodontics as an alternative to

multi-visit procedures, relying primarily on the root-filling material containing paraformaldehyde, with or without artificial fistulation, to prevent flareups and failure.

Kittawaga (17) (1969) treated 80 teeth, all vital pulps with no acute symptoms, and reported that only 2 teeth had prolonged pain, but 89% had some postoperative discomfort following single-visit treatment. Fox et al. (18) (1970) reported approximately 7% severe pain within 24 h after treating 291 teeth in one visit. They indicated that more pain occurred postoperatively in teeth that had no radiographical areas, in female patients, and in teeth that were instrumented or filled beyond the radiographical apex.

Ether et al. (19) (1978) compared single-visit and two-visit endodontic procedures on 564 vital teeth. The three operators reported moderate to severe pain in 9% of teeth treated in one visit compared with 5% in two visits. Soltanoff (20) (1978) treated 80 teeth in one visit and reported slightly more postoperative pain compared with multi-visit procedures and little difference in healing upon recall.

MATERIALS AND METHODS

The test group of patients was not randomly selected since this study was conducted by me in my private practice on referred patients. Selection was based upon the following factors: (a) positive patient acceptance of the proposed single-visit procedure (informed consent); (b) sufficient treatment time available to properly complete procedure; (c) exclusion of any tooth with acute symptoms where drainage via the root canal was established, as well as those teeth with a persistent, continuous flow of exudate; and (d) exclusion of any tooth which could not be completed within available time because of anatomical difficulties (calcified canals, fine tortuous canals, bifurcated canals) or procedural difficulties (ledge formation, blockage, perforation, inadequate fill).

In order to achieve a test sample (single visit) and comparative control sample (two visits) with the least variable factors in a clinical study, all procedures were done by me. All treatment was completed in either one or two visits; no cultures were utilized; and canals were irrigated with 5% sodium hypochlorite, dried, and filled with laterally condensed gutta-percha cones and a zinc oxide-eugenol type of canal sealer (22).

No surgical procedure, such as apicoectomy or fistulation, was performed in this study. Antibiotics were not prescribed unless the patients were medically compromised and required premedication for dental procedures (e.g. medical history of subacute bacterial endocarditis). Analgesics were dispensed as needed for pain consisting of aspirin alone or aspirin plus one-half grain of codeine, or its equivalent.

RESULTS

Postoperative Sequelae

A total of 264 teeth were examined for postoperative pain following single-visit endodontics after 24 h, 48 h, and 1 wk. The results were compared with those of 123 teeth treated in two visits. While the percentages of "single-visit" patients who exhibited moderate to severe pain (10.6%) differed from those treated in two visits (6.4%), the χ^2 Test indicated that no statistically significant difference existed.

No statistical evaluations were made on the data at 48 h or 1 wk. When postoperative pain occurred, it occurred within the first 24 h and receded over the next few days. No postoperative pain persisted as long as 1 wk (Table 1).

Similarly, when the test sample of single-visit endodontics was compared with the control sample, two-visit endodontics, no differences existed between the anterior teeth, between the premolars, or between the molars after 24 h (Table 2).

When comparing the test sample (OV) and control sample (TV) for 24-h postoperative pain when treating teeth diagnosed as pulpitis (vital pulp), no signifi-

TABLE 1. Pain: following endodontic treatment*

	OV (264 Teeth)			TV (123 Teeth)		
	24 h	48 h	1 wk	24 h	48 h	1 wk
None to slight	236	250	264	115	122	123
Moderate	20 (7.6)†	12	0	5 (4)†	1	0
Severe	8 (3)	2	0	3 (2.4)	0	0
	$p = 0.32\ddagger$					

* Four teeth (1.5%) had swelling which disappeared after 48 h.

† Numbers in parentheses, percentage.

‡ Data analyzed by χ^2 test. If $p = 0.05$ or less, a significantly high probability exists that results were not due to chance. Only results after 24 h were analyzed in all tables on postoperative sequelae. In all pain analyses, none to slight results were compared with the totals of moderate and severe pain.

TABLE 2. Pain: anatomy

	OV		χ^2 ($p = 0.22$)	TV	
	Anterior (119)			Anterior (42)	
	24 h	48 h		24 h	48 h
N-S*	102	109		39	41
M	9 (7.6)†	8		1 (2.4)	1
S	8 (6.7)	2		2 (4.8)	0
	Premolars (71)		$p = 0.23$	Premolars (25)	
N-S	62	69		24	25
M	8 (11.3)	2		0	0
S	1 (1.4)	0		1 (4)	0
	Molars (74)		$p = 0.70$	Molars (56)	
N-S	70	72		52	56
M	3 (4.1)	2		4 (7.1)	0
S	1 (1.4)	0		0	0

* N-S, none to slight; M, moderate; S, severe.

† Numbers in parentheses, percentage.

cant difference existed. No significant difference in postoperative pain existed between teeth treated either way whose pulps were nonvital and had a periapical radiolucency. Comparing the "vital versus the nonvital" data on postoperative pain for teeth completed in a single visit, no statistically significant difference existed; a similar result occurred when comparing 24-h postoperative pain in the two-visit group (Table 3).

No difference in 24-h postoperative pain existed between test and control samples when root canals were filled short or to the radiographic apex. However, overfilling of the root canals resulted in a statistically significant increase in postoperative pain (25%) within the test sample (Table 4).

Comparing 24-h postoperative pain in both samples according to sex revealed no statistically significant differences (Table 5).

However, a statistically significant increase in pain

TABLE 3. Pain: pulp vital (V) versus nonvital (NV) pulp with apical rarefaction

	OV				TV			
	V (145)		NV (119)		V (37)		NV (86)	
	24 h		48 h		24 h		48 h	
	V	NV	V	NV	V	NV	V	NV
N-S*	127	107	139	111	34	81	37	85
M	14 (9.7)	6 (5)	6	6	2 (5.4)	3 (3.5)	0	1
S	4 (2.8)	6 (5)	0	2	1 (2.7)	2 (2.3)	0	0
	V (OV) versus V (TV), p = 0.15 NV (OV) versus NV (TV), p = 0.28 V (OV) versus NV (OV), p = 0.06 V (TV) versus NV (TV), p = 0.66							

* N-S, none to slight; M, moderate; S, severe.

TABLE 4. Pain: root canal filling

	OV					
	24 h			48 h		
	A*	L	S	A	L	S
N-S†	176	39	19	185	46	19
M	9 (4.7)	10 (19.2)	1	6	5	1
S	7 (3.6)	3 (5.8)	0	1	1	0
	TV					
	24 h			48 h		
	A	L	S	A	L	S
N-S	107	3	5	114	3	5
M	5 (4.3)	0	0	1	0	0
S	3 (2.6)	0	0	0	0	0

* A, filling at apical terminus; L, filling beyond apical terminus; S, filling more than 1/2 mm short of apical terminus. A (OV) versus A (TV), p = 0.69; A (OV) versus L (OV), p < 0.01; A (OV) versus S (OV), p = sample insufficient.

† N-S, none to slight; M, moderate; S, severe.

TABLE 5. Pain: sex

	OV				TV			
	24 h		48 h		24 h		48 h	
	M	F	M	F	M	F	M	F
N-S*	103	131	111	139	55	60	58	64
M	9 (7.8)	11 (7.4)	4	8	2 (3.4)	3 (5)	1	0
S	4 (3.4)	6 (4.1)	1	1	2 (3.4)	1 (1.7)	0	0
	M (OV) versus M (TV), p = 0.38 F (OV) versus F (TV), p = 0.25 M (OV) versus F (OV), p = 0.95 M (TV) versus F (TV), p = 0.97							

* N-S, none to slight; M, moderate; S, severe.

occurred in the younger age group, 10 to 39 yr, when compared with patients aged 40 to 59 yr and those patients 60 yr and older in the test sample (OV). Two-visit results were too small in number to analyze (Table 6).

Healing

Healing was determined after a minimum of 18 months postoperatively in the single-visit and two-visit samples. The data present the results of those observations on 153 teeth treated in a single visit and 185 teeth treated in two visits. No statistically significant difference in healing existed between teeth treated by either method (Table 7).

The following tables report no statistically significant difference in healing between the test sample and control sample when the teeth treated were classified according to anatomy (anterior, premolars, molars; Table 8), and pulp status (vital versus nonvital with periapical rarefaction; Table 9). No statistically significant difference existed in the test sample (OV) between sexes (Table 10) and age (Table 11).

However, Table 12 reveals that a statistically significant number of teeth fail to heal in the single-visit procedure when their canals are overfilled (18%) when compared with canals filled short or to the radiographical apex (Table 12).

DISCUSSION

Healing following endodontic therapy will usually occur following an accurate diagnosis, proper case selection, and the use of skilled techniques of treatment. These procedures are based upon known biological principles incorporated into the technique triad, specifically: biomechanical preparation of the canal system, debridement and disinfection, and complete obturation of the prepared canals. Each of these objectives must be achieved in order to ensure a successful result.

The single-visit procedure does not deviate from achieving these objectives. The major difference dis-

The disadvantages are also obvious. The single-visit procedure eliminates some of the controls available in multi-visit treatment, such as culturing to check the effectiveness of the biomechanical preparation and the ability to apply "tincture of time" to reevaluate tissue responses following treatment procedures. In the event of a flareup, the emergency procedures for drainage are complicated, since artificial fistulation or the removal of the root canal fillings is needed.

In this study no tooth was fistulated and no root canal filling was removed because of flareup. Greater care in diagnosis and case selection must be part of the treatment since single-visit procedures are not considered appropriate for every endodontically involved tooth.

The analyzed data indicate that postoperative sequelae occur in an equivalent number of instances regardless of the technique used. Postoperative pain of greater magnitude and frequency does occur when the periapical tissues are insulted through overinstrumentation and overfilling. There do not appear to be any differences in single-visit procedures related to age or sex. No statistically significant differences occurred between either procedure when treating teeth with periapical rarefactions. Teeth with sinus tracts had no postoperative pain or swelling, but documentation of this observation was not included in this study. Teeth exhibiting copious amounts of exudate were not completed in one visit and were not included in this study.

The classification of postoperative pain used in this study was an arbitrary one. Documentation was done in the following way: After completion of treatment, each patient was called the next day (24 h) and the following day (48 h) and at the end of the week. The patient was requested to report all postoperative sequelae. If the patient did not require an analgesic and reported none to minimal discomfort, the tooth was classified as none to slight postoperative pain. If the patient reported tolerable discomfort but more intense, usually requiring medication such as aspirin for relief, the pain response was classified as moderate. However, if the report was severe discomfort, requiring a stronger analgesic (i.e. aspirin with codeine), the patient was requested to return to the office for evaluation and/or treatment. At no time was fistulation needed or was the root canal filling removed. Swelling occurred in only four patients, was small in extent, and it disappeared within 48 to 72 h. Antibiotics were used only in those patients who exhibited elevated temperatures, swelling, or were medically compromised and required premedication. Since this occurred in so few instances, their documentation was omitted from this study.

The data concerning healing suggest that single-visit and two-visit endodontic procedures result in similar healing potential. This fact is not surprising

since one would expect healing to occur when the triad of treatment was performed successfully. However, the results could have been biased in favor of single-visit treatment because of the case selection. Conversely, the single-visit procedures could have been negatively affected if the quality of the treatment was reduced considering the stress experienced by the clinician to properly complete all treatment procedures within a limited time period.

This study was continued long enough to verify the healing response for at least 18 months. Patients were recalled over an extended time period in order to document changes to the periapical areas of rarefaction that were originally present in the nonvital series. If an area persisted, became enlarged, or was reduced slightly, the tooth was recorded as a failure to heal, even though the tooth was asymptomatic. If a tooth in the vital pulp series demonstrated an area of rarefaction anytime after 6 months, it was recorded as a failure. The subsequent formation of a sinus tract, pain, or swelling of endodontic origin in either series was also considered a failure.

Some observations can be made from the accumulated data. The magnitude and frequency of pain did not differ significantly regardless of single- or two-visit procedures under the conditions described in this study. The healing potential is within anticipated and acceptable levels when single-visit is compared with multi-visit cases, and when compared with the percentages of healing reported in other studies (21, 23). I believe that single-visit endodontics is a viable and preferable treatment modality under carefully selected circumstances.

SUMMARY

A clinical study was conducted to compare single-visit and two-visit endodontic procedures. Under controlled circumstances including accurate diagnosis, proper case selection, and skilled treatment technique, single-visit treatment postoperative sequelae and healing did not differ significantly when compared with two-visit procedures.

I am indebted to Mr. Solomon M. Sorin for statistically analyzing the reported data and Mrs. Hazel Dean and Dr. Louis I. Grossman for preparation of the manuscript.

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