Incidence and severity of post-operative pain following root canal treatment of teeth with non-vital pulps using hand and rotary instrumentation techniques

Jorge Paredes Vieyra and Julieta Acosta Guardado investigate the incidence and severity of post-operative pain following one-appointment root canal treatment of 180 maxillary and mandibular non-vital teeth with necrotic pulps

The goal of root canal therapy is to shape, clean, disinfect and obturate canals without additional injury to the periradicular tissues. Since the vast majority of endodontic problems are microbial in origin, their removal is considered the most important step in root canal therapy (Senia, 2000; Hulsmann, Rummelin, Schafers, 1997; Siqueira et al, 1997).

Reducing the incidence and severity of post-operative pain following one-appointment treatment is based on thorough cleaning and disinfection on the first visit. It is understood that additional treatments would not improve the quality of care (Fava, 1991). A single visit avoids wasting time for the patient as well as the dentist. Fairbourn et al (1987) reported that hand instrumentation resulted in apical extrusion of canal contents, which in necrotic cases may cause flare-ups with post-operative discomfort and swelling. Others have demonstrated that the healing process may be impaired when infected dentin chips are carried to the apical area (Walton, Fouad, 1992; Houck et al, 2000).

Most instrumentation techniques now advocate early coronal flaring. Instrumentation techniques that prepare canals in a cervical to apical direction are recommended to minimize the incidence of apical extrusion (Marshall, Pappin, 1980; Morgan, Montgomery, 1984).

According to Stabholtz at el (1995), the benefits of early coronal flaring include:

- Establishment of an adequate coronal escape route for irrigants and debris
- Removal of dentin interferences at the canal orifice and cervical third
- Neutralization and removal of pulp contents from the cervical third before preparing the middle and apical thirds
- Deeper penetration of the irrigating needle.

The purpose of this study was to evaluate the incidence and severity of post-operative pain following instrumentation and obturation of 180 maxillary and mandibular non-vital teeth in one appointment. All teeth had non-vital pulps and radiographically visible apical lesions of 1-3mm of diameter.

Materials and methods

One hundred and eighty teeth with necrotic pulp from patients aged 18 to 60 years were treated. A medical history, including any use of analgesics or antibiotics, was obtained and clinical examination was performed.

Patient selection was based on the following criteria:

1) The aims and requirements of the study were freely accepted
2) Treatment was limited to patients in good health
3) All teeth, either maxillary or mandibular had non-vital pulps and 1-3mm periapical radiolucencies, with or without sinus tract
4) No analgesics or antibiotics before clinical procedures were used.

All the subjects were treated in accordance with the Helsinki Declaration (www.cirp.org/library/ethics/helsinki). Informed consent of each patient was obtained after explaining the clinical procedures and risks involved and clarifying all questions raised by the patients.

The non-vital status of pulps was determined each by hot and cold thermal tests, palpation, percussion and radiographic examination. In every tooth a negative response to hot and cold were recorded.

All teeth were asymptomatic with diagnosis of necrosis. Periodontal probing revealed no pocketing around any of the teeth. Radiographic examination demonstrated small and irregular periapical radiolucency. Treatment took place in the author's dental office.

After administering a local anaesthesia using 2% lidocaine 1:100,000 epinephrine and applying rubber dam, access was made with a number 331 carbide bur. Disinfection of the tooth and the rubber dam was done by scrubbing a cotton roll moistened with 5.25% of NaOCl using a circular movement, starting on the tooth and

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Table 1: The 180 teeth were divided into three groups

Group 1 Balanced force			Group 2 Lightspeed LSX			Group 3 Hand instrumentation		
Tooth (Number)	Initial instr. (root)	Final instr.	Tooth (Number)	Initial instr. (root)	Final instr.	Tooth (Number)	Initial instr. (root)	Final instr.
Upper central incisor (4)	# 25	# 80	Upper central incisor (3)	#30	# 80	Upper central incisor (5)	# 25	# 60
Upper second premolar (8)	(B) # 15 (P) # 20	# 60	Upper second premolar (9)	(B) # 25 (P) # 25	# 80 # 70	Upper second premolar (9)	(B) # 15 (P) # 20	# 60 step back to # 80
Lower second premolar (12)	# 25	# 80	Lower second premolar (18)	# 25	# 80	Lower second premolar (6)	# 25	# 60
Upper first molar (20)	(MB) # 25 (MB2) # 15 (DB) # 15 (P) # 25	# 55 # 45 # 55 # 70	Upper first molar (20)	(MB) # 20 (MB2) # 20 (DB) # 22.5 (P) # 30	#55 #55 #55 #80	Upper first molar (15)	(MB) # 15 (MB2) # 10 (DB) # 15 (P) # 15	#50 #45 #50 #60
Lower first molar (16)	(MB) # 15 (ML) # 10 (D) # 20	# 55 # 55 # 60	Lower molar (20)	(MB) # 20 (ML) #20 (D) # 25	# 55 # 50 # 70	Lower molar (25)	(MB) # 15 (ML) # 10 (D) # 20	# 55 # 55 # 60

going outwards to the rubber dam.

In all teeth, the pulp chamber was rinsed with 5.25% sodium hypochlorite irrigant solution (Ultra bleach, Bentonville, AR 72716 USA).

Working length was determined radiographically and with the Root ZX (J Morita & Co, Tustin CA). Working length was established 1mm short of the radiographic apex in all teeth. During instrumentation the canals were flushed with Milton's solution (1% sodium hypochlorite). In every case, a 17% solution of REDTA was used (REDTA, Roth International, Chicago IL 60610).

Crown down technique was used in all 180 teeth for coronal flaring (Fava, 1991; Saunders, Saunders, 1992), which involved:

a) Using the Milton's solution to clean the pulp chamber
b) Cervical-apical flaring with Gates Glidden drills (Dentsply Maillefer, Ballaigues, Switzerland)
c) Completing the flared preparation in an apical-cervical direction in all 180 teeth (Saunders, Saunders, 1992).

After access was obtained, the 180 teeth were divided into three groups (Table 1) as follows:

- Group 1 (60 teeth). The instrumentation was performed using the Balanced Force technique with Flex-R files (Moyco–Union Broach Co. York, PA 17402).
- Group 2 (60 teeth). The instrumentation was performed using the LightSpeed LSX technique (Discus Dental, Culver City, CA, USA).
- Group 3 (control group of 60 teeth). The instrumentation was performed using the step-back technique. With K type files (Moyco–Union Broach Co. York, PA 17402).

During instrumentation, all canals were flushed with Milton's solution (1.8 cc) after each file, alternating with a 17% solution of REDTA.

All 180 teeth were subsequently dried with sterilized paper cones (Diadent Group Internacional Inc., North Fraser Way, B.B.C., Canada) and obturated by lateral condensation of gutta percha and AH26 (Dentsply, Rio de Janeiro, Brazil). Thereafter, the access cavities were sealed with Cavit (3M ESPE, AG Seefeld, Germany) and post-treatment control radiographs were taken.

After treatment, patients recorded the incidence and severity of pain experienced during the seven day period. Post-operative pain was categorized as follows: if a patient reported no or minimum pain and no analgesics were required, the pain was classified as none to slight (N/S). If the pain required a mild analgesic or pain was experienced on biting, the pain was classified as moderate. If the pain required a strong analgesic or severe pain was experienced on biting, the pain was classified as severe.

Patients were called at 24, 48 and 72 hours to obtain their reports for the first three days. Seven days after treatment their records were reviewed and percussion and palpation tests performed.

Results

Telephone report (Table 2): In group 1, 51 of 60 patients reported no to slight pain (N/S) at 24 hours, 47 reported N/S pain at 48 hours and 31 reported N/S pain at 72 hours (pain disappeared shortly thereafter). Nine patients reported moderate pain at 24 hours, 13 reported moderate pain at 48 hours and 29 reported moderate pain at 72 hours (pain disappeared shortly thereafter). A mild analgesic controlled the moderate pain in all cases. No patients reported severe pain.

In group 2, 56 of the 60 patients reported no to slight pain (N/S). When pain was present it lasted only 24 hours. Four patients reported moderate pain lasted 24 hours and was controlled with a mild analgesic. No patients reported severe pain.

In control group (group 3) 43 of 60 patients reported no to slight pain (N/S) at 24 hours, and 17 with moderate pain.

Clinical evaluation (Table 3): Seven days after

Table 2: Incidence and severity of post-operative pain 24-, 48- and 72-hours after root canal treatment (N/S = no or slight pain)

Group	N/S			Moderate			Severe			Total
	24	48	72hr	24	48	72hr	24	48	72hr	
1	51	47	31	9	13	29	0	0	0	60
2	56	58	60	4	2	0	0	0	0	60
3	43	42	28	17	18	32	0	0	0	60

Table 3: Incidence of pain to percussion and palpation seven days after root canal treatment

Treatment group	No pain to percussion and palpation	Pain to percussion and palpation	Total
1	58	2	60
2	59	1	60
3	57	3	60

$X^2 = 0.351$, $\alpha = 0.05$, $p = 0.44$

Table 4: Incidence of post-operative pain by groups

	Group 1		Group 2		Group 3	
	Yes – No	Mean	Yes – No	Mean	Yes – No	Mean
Pain before	7 – 53	0.88	6 – 54	0.90	12 – 48	0.80
Pain after	9 – 51	0.85	4 – 56	0.93	17 – 43	0.72
Vitality	Necrotic	Mean	Necrotic	Mean	Necrotic	Mean
	26 (38.2%)	2.57	19 (27.9%)	2.68	21 (30.9%)	2.65
Sinus tract	Yes – No	Mean	Yes – No	Mean	Yes – No	Mean
	3 – 57	0.028	4 – 56	0.93	0 – 60	1
Tooth	11- 4 teeth	(5.9%)	11- 3 teeth	(4.4%)	11- 4 teeth	(5.9%)
	15-8 teeth	(11.8%)	15-9 teeth	(13.2%)	15-9 teeth	(13.2%)
	16-20 teeth	(29.4%)	16-20 teeth	(29.4%)	16-15 teeth	(22.1%)
	45-12 teeth	(17.6%)	45-8 teeth	(11.8%)	45-12 teeth	(17.6%)
	46-16teeth	(23.5%)	46-20 teeth	(29.4%)	46-25teeth	(36.8%)

completion of treatment two patients in group 1 and one patient in group 2 reported tenderness to percussion and palpation

When the patients were asked to record reactions between the second and seventh day period, four patients reported continuous tenderness on biting, and the need to use analgesics.

Discussion

The success and failure of endodontic treatment is determined by long-term results and not the presence or absence of short-term post-operative pain. A root canal treatment with post-operative pain can result in long-term success, whereas treatment without post-operative pain may result in failure (Mattscheck, Law, Noblett, 2001). However, post-operative pain is an important issue for both dentists and patients when considering one-appointment treatment.

The purpose of this study was to determine the post-operative incidence and severity of pain after a one-appointment treatment.

Different criteria have been used in previous studies for the assessment of pain after endodontic therapy (Mattscheck, Law, Noblett, 2001; Trope, 1991; Roana, Dryden, Grimes, 1983). Most studies have only addressed the incidence of interappointment emergencies or levels of post-operative pain. For example, the incidence of pain for retreatment cases is significantly higher than for initial root canal treatment (Eleazer, Eleazer, 1998).

The effect of the number of treatment visits on post-operative pain has not been well studied. One-appointment endodontic treatment of vital cases has been accepted by most of the endodontic community and is widely practiced (DiRenzo et al, 2003). One-appointment treatment of non-vital cases is quite often practiced but not universally accepted.

One reason for this is the fear by some dentists that a single visit produces a higher incidence and severity of post-operative pain (Genet, Hart, Wesselink, 1987). However, this fear is not supported by previous research or this study.

The popularity of single-visit treatment can be credited to favorable reports, which showed no difference in treatment complications or success rates when compared with teeth treated in multiple visits (Genet, Hart, Wesselink, 1987; Ruiz-Hubard, Gutman, Wagner, 1987).

Intracanal microbiota, the major source of endodontic problems, are eliminated or controlled by mechanical instrumentation, antimicrobial irrigants and isolation of any remaining microorganisms with an effective obturation.

Historically, several appointments to complete treatment was the norm, emphasising the advantage of interappointment dressings. In recent years however, the number of sessions have been reduced (Genet, Hart, Wesselink, 1987). A two-visit model using an interappointment dressing with calcium hydroxide was proposed as standard (Ruiz-Hubard, Gutman, Wagner, 1987). Genet et al (1987) found a positive correlation of operative factors associated with pain after the first endodontic visit. Our study agrees with their findings when debris is removed from the canals without extruding it in beyond the apical foramen.

Our results agree with the studies of Roane et al (1983) and Fava (1991) that included non-vital teeth regardless of the presence or absence of symptoms.

Disinfection of root canals is important in order to prevent recontamination between appointments.

This study showed a low incidence and low severity of post-operative pain following a single visit treatment with hand or rotary instrumentation. The LightSpeed LSX group had a smaller incidence (and severity) of pain during the 72-hour post-operative period compared to the balanced force group (one versus four). At the seven-day evaluation both groups were very similar in the number of patients sensitive to percussion and palpation testing (Group1=2; Group 2=1 and Group 3=3) (Table 4).

Based on the results of this study both groups experienced a low incidence and low severity of pain. Severe pain was not reported and any pain that did occur was controlled with a mild analgesic. Concern about a higher incidence and severity of post-operative pain resulting from one-appointment treatment in non-vital cases appears to be not well-founded.

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