Partial pulpotomy as a treatment alternative for exposed pulps in crown-fractured permanent incisors

Fuks AB, Chosack A, Klein H, Eidelman E. Partial pulpotomy as a treatment alternative for exposed pulps in crown-fractured permanent incisors. Endod Dent Traumatol 1987; 3: 100–2.

Abstract – Sixty-three vital permanent incisors with complicated crown fractures were treated by partial pulpotomy and assessed clinically and radiographically for healing. Healing of the pulp was considered to have taken place when the following criteria were fulfilled: absence of clinical symptoms, radiographic evidence of dentin bridge formation, no intrapulpal or periapical pathosis, continued root development in immature teeth, and a positive response to electrical pulp testing. The treatment was successful in 59 teeth (94%). In the remaining 4 teeth, necrosis of the pulp was diagnosed clinically and radiographically 3 weeks to 6 months after treatment. The high frequency of healing in both the present and previous studies seems to justify recommending partial pulpotomy as the treatment of choice in crownfractured teeth with pulp exposure.

Traumatic injuries resulting in pulp exposure present a challenge in treatment, particularly in young patients. Since healing does not occur spontaneously and untreated exposures ultimately lead to pulpal necrosis, the immediate objective would be to select a procedure designed to maintain pulp vitality (1). A vital pulp accidentally exposed by trauma can be treated by capping, pulpotomy or pulpectomy, depending on several factors such as degree of exposure, the time elapsed between the accident and the emergency treatment, and the stage of root development (2). Pulpotomy is regarded as a temporary treatment that should be followed by pulpectomy when the root development is completed. An alternative technique for treating vital exposures is known as partial pulpotomy. In contrast to the conventional pulpotomy technique, where all the coronal pulp is removed, partial pulpotomy implies the removal of the pulp tissue only to a depth of 1 to 2 mm, and covering the pulpal wound with a calcium hydroxide dressing. Cvek (3) has demonstrated a high success rate when pulp exposures in crown-fractured teeth were treated by partial pulpotomy. He also stated that the size of the exposure and the time between the accident and the treatment are not critical for the recovery of a priAnna B. Fuks, Aubrey Chosack, Hortense Klein and Eliecer Eidelman

Hadassah Faculty of Dental Medicine, Dept. of Pedodontics, The Hebrew University, Jerusalem, Israel

Key words: partial pulpotomy, crown fracture, permanent incisor.

Dr. A. Fuks, The Hebrew University, Hadassah Faculty of Dental Medicine, Dept. of Pedodontics, POB 1172, Jerusalem, Israel

Accepted for publication 20 October 1986.

marily healthy pulp. However, no other comprehensive study has so far been reported, so that these results have neither been confirmed nor questioned. The purpose of the present study was therefore to assess, clinically and radiographically, the results of partial pulpotomy as a treatment form in young permanent incisors with traumatic pulp exposures.

Material and methods

The study sample consisted of 63 vital permanent incisors with a complicated crown fracture. The patients, 35 boys and 27 girls, received emergency treatment at the Department of Pedodontics of the Hadassah Faculty of Dental Medicine in Jerusalem. Their ages ranged from 7 to 22 years, with only 1 patient older than 16 years. Of the 63 teeth, 10 were immature and 53 mature. Preoperative examination revealed that in addition to the crown fracture and pulp exposure, 23 were concussed, indicated by sensitivity to percussion, 7 were subluxated, showing slight increase in mobility, 1 was mildly extruded and 1 had an apical third root fracture. The time elapsed from the injury until the emergency treatment varied from less than 2 h to 3 weeks. All the teeth were vital, and no signs of pulpal necrosis were detected from direct observation of the exposed pulp at the time of the initial examination.

Partial pulpotomies were performed utilizing the technique recommended by Cvek (3). Briefly, after local anesthesia and isolation of the tooth with a rubber dam, the pulp was amputated with surrounding dentin to a depth of 2 mm using a diamond or carbide bur on a high speed turbine with water cooling (4). Bleeding was controlled with a sterile saline solution, and the pulpal wound was dried with a sterile cotton pellet and covered with Calxyl[®]*, a calcium hydroxide product. The cavity was sealed with a zinc-oxide eugenol cement. The teeth were restored with composite material in most instances. In cases where the proximity of the fracture line to the gingival tissue could cause moisture contamination and failure of the restoration, the teeth were covered by a stainless steel basket crown. These were fabricated with orthodontic band material and were cemented with a zinc oxide eugenol paste. The teeth were checked clinically and radiog-



Fig. 1. Maxillary central incisor 18 months after partial pulpotomy treatment. Dentin bridge formation is evident (arrow). No pulpal or periapical pathosis can be seen radiographically.

* Calxyl – Dental preparation, Otto & Co. Frankfurt/Main, FRG.

raphically 6 weeks after the treatment and thereafter at 3-month intervals up to 1 year, and then at longer intervals until the end of the study. The observation period ranged from 6 to 50 months.

Healing of the pulp was considered to have taken place when the following criteria were fulfilled:

- 1) Absence of clinical symptoms;
- 2) Radiographic evidence of dentin bridge formation (Fig. 1);
- 3) No intra-pulpal or periapical pathosis could be detected radiographically;
- 4) Continued root development in immature teeth and
- 5) Positive response to electrical pulp testing.

Results

The results are presented in Table 1, from which it is evident that healing occurred in 59 of 63 teeth (94%) (Fig. 1). Pulpal necrosis was diagnosed in the remaining 4 teeth, in 1 after 3 weeks, in 2 after 3 months, and in the fourth 6 months following treatment. Concussion was diagnosed at the time of pulpotomy treatment in 2 of these teeth and 1 was subluxated. Two of the teeth with pulpal necrosis were treated within 1 day, 1 within 2 days and the fourth was treated 1 week after the accident (Table

Table 1. Distribution of 63 crown-fractured incisors treated with partial pulpotomy, according to the time interval between pulp exposure and treatment (days), results of treatment and extent of follow-up period (months)

Interval exposure- treatment (days)	He	aling of the			
	Follow-up (months)			- No	
	6–12	13–24	25–50	<1-6	Total
<1	19	17	6	2	44
1-4	2	2	5	1	10
>4	2	4	1	1	8
not known	1			an còrait An Taich	1
Total	24	23	12	4	63

Table 2. Distribution of 63 crown-fractured incisors with exposed pulp and treated with partial pulpotomy, according to the type of injury, time interval between accident and treatment (days) and outcome of treatment (*).

	Interval accident-treatment (days)				
	<1	1—4	>4	not known	Total
Exposure only	19		4	1	31
Exposure and concussion	17*	2	4*		23
Exposure and subluxation	6*	1	-		7
Exposure and extrusion	1	18: <u>-</u> 464	122	(1990) <u>-</u> (19-19	1
Exposure and root fracture	1	- 1	0-1	are L ist	1
Total	44	10	8	1	63

Each * denotes 1 separate tooth with pulpal necrosis.

2). The 2 teeth treated within 1 day had immature roots.

Discussion

The result of this investigation, in which pulp healing was observed in treatment up to 3 weeks following pulp exposure, corroborated Cvek's findings that the time between injury and treatment has little or no bearing on the outcome (3, 5). Treatment was successful even in instances that, in addition to the exposure, presented with subluxation, concussion, or horizontal root fracture. Treatment was unsuccessful in only 3 out of 32 teeth with these types of injuries.

These results are supported by histologic findings observed experimentally in monkey teeth (6, 7). In one of these studies, where pulps were exposed by grinding or fracture, the depth of inflammation did not exceed 2 mm from the exposure site (6). It has also been demonstrated that calcium hydroxide, the most commonly used pulp dressing, has no beneficial effect on inflamed pulps (8). Therefore, the surgical removal of the lacerated and/or inflamed tissue will probably enhance healing. Furthermore, pulpal healing after partial pulpotomy has been observed even when treatment was delayed (9–11).

Direct pulp capping has been demonstrated to be an acceptable treatment when utilized in immature teeth, and a success rate of 100% has been reported (12). Despite the high success rate reported for direct pulp capping when utilized in immature teeth, partial pulpotomy might still be preferable for several reasons. In addition to allowing better wound control, as previously mentioned, a more effective protection of the operational area by the zinc-oxide eugenol seal is obtained. The deleterious effect of bacteria in connection with inadequate seal has been amply demonstrated (10, 11).

The advantages of partial pulpotomy when compared with cervical pulpotomy lie in: the preservation of cell-rich coronal pulp tissue, providing a better healing potential; physiologic apposition of dentin in the cervical area is maintained (which is lost and dentinal walls weakened by cervical pulpotomy); a subsequent root canal treatment is not necessary; the natural color and translucency of the tooth is preserved, and it is possible to perform sensitivity testing.

The high frequency of healing in the present as well as in previous studies seems to justify recommending partial pulpotomy as the treatment of choice in every instance of crown fracture with pulp exposure. This is irrespective of the size of the exposure, the time interval until the emergency treatment, or the degree of root development, as long as the pulp is vital, and no signs of necrosis are observed.

References

- 1. McDONALD RE. Management of traumatic injuries to the teeth and supporting tissues. In: McDONALD RE, ed. *Dentistry for the child and adolescent*. St Louis: Mosby, 1974; 287–323.
- CVEK M. Endodontic treatment of traumatized teeth. In: ANDREASEN JO, ed. *Traumatic injuries of the teeth*. 2nd ed. Copenhagen: Munksgaard, 1981; 321–83.
- CVEK M. A clinical report on partial pulpotomy and capping with calcium hydroxide in permanent incisors with complicated crown fracture. *J Endod* 1978; 4: 232-7.
- GRANATH LE, HAGMAN C. Experimental pulpotomy in human bicuspids with reference to cutting technique. Acta Odontol Scand 1971; 29: 155-63.
- KLEIN H, FUKS A, EIDELMAN E, CHOSACK A. Partial pulpotomy following complicated crown fracture in permanent incisors: a clinical and radiographical study. *J Pedod* 1985; 9: 142–7.
- CVEK M, CLEATON-JONES PE, AUSTIN JC, ANDREASEN JO. Pulp reactions to exposure after experimental crown fractures or grinding in adult monkeys. *J Endod* 1982; 8: 391–7.
- HEIDE S, MJOR IA. Pulp reactions to experimental exposures in young permanent monkey teeth. Int Endod J 1983; 16: 11-9.
- TRONSTAD L, MJOR IA. Capping of the inflammed pulp. Oral Surg Oral Med Oral Pathol 1972; 34: 477-85.
- 9. CVEK M, LUNDBERG M. Histological appearance of pulps after exposure by a crown fracture, partial pulpotomy, and clinical diagnosis of healing. *J Endod* 1983: 9: 8-11.
- COX CF, BERGENHOLTZ G, HEYS DR, SYED SA, FITZGERALD M, HEYS RJ. Pulp capping of dental pulp mechanically exposed to oral microflora: a 1-2 year observation of wound healing in the monkey. *J Oral Pathol* 1985; 14: 156-68.
- 11. HEIDE S, KEREKES K. Delayed partial pulpotomy in permanent incisors. Int Endod J 1986; 19: 78-89.
- 12. RAVN JJ. Follow-up study of permanent incisors with complicated crown fractures after acute trauma. Scand J Dent Res 1982; 90: 363-72.

102

This document is a scanned copy of a printed document. No warranty is given about the accuracy of the copy. Users should refer to the original published version of the material.