

# Effect of Application of One-Time Method and Multiple Root Canals on Cryptic Fracture with Endodontic Lesions and VAS Score

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**Abstract:** *Objective:* To evaluate the therapeutic efficacy of primary method root canal treatment (ORCT) and multiple root canal treatment (MRCT) for dental cryptocleidosis with endodontic lesions. *Methods:* 88 patients with fissured teeth with endodontic lesions who were admitted to the hospital between November 2021 and November 2023 were selected, and after randomized numerical table grouping, 44 cases in the experimental group were included in the ORCT treatment, and 44 cases in the reference group were included in the MRCT treatment, and the total effective rate, root canal filling rate, visual analog scale (VAS) score, periodontal indexes, and the complication rate were compared. *Results:* The total effective rate and root canal filling rate of the experimental group were higher than that of the reference group; after treatment, the VAS score of the experimental group was lower than that of the reference group, and the periodontal indexes were lower than that of the reference group; and the complication rate of the experimental group was lower than that of the reference group ( $P < 0.05$ ). *Conclusion:* ORCT can improve the overall efficacy of patients with fissured teeth with endodontic lesions, ensure the filling rate of root canals, significantly reduce pain symptoms, improve a number of periodontal indicators, have high endodontic safety, and have more therapeutic advantages than MRCT.

**Keywords:** Primary endodontic treatment; Multiple endodontic treatment; Fissured teeth with pulpal lesions; VAS score

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## 1. Introduction

Cryptocleidosis refers to the occurrence of small cracks on the tooth surface due to long-term exposure to various factors, and its etiology includes enamel plate hypoplasia, defective development of tooth sockets, and the presence of cuspal bevels. In addition, traumatic jaw forces, as well as fossa floor splitting forces over time, can also lead to cryptocleidosis<sup>[1]</sup>. In the early stage of the disease, there are no typical symptoms, but with the prolongation of the course of the disease, the fine cracks will gradually deepen, which will lead to endodontics and even lead to tooth fracture and other adverse events. Cryptic fracture with endodontic lesions is a complex condition with significant destruction of dentin structure and thus requires early treatment. MRCT is a routine treatment for this comorbidity, which is less expensive and widely applicable. However, MRCT

requires patients to make multiple visits to the clinic, which results in poor treatment convenience and average patient compliance<sup>[2]</sup>. For this reason, ORCT is mostly practiced in the clinic, which can complete root canal treatment in a single visit and has excellent overall efficacy. Based on this, this study selected 88 patients with cryptogenic fracture with endodontic lesions with the aim of evaluating the therapeutic differences between ORCT and MRCT and reported as follows.

## 2. Data and methods

### 2.1. General information

88 cases of patients with dental occult fracture with pulpal lesions who were admitted to the hospital for treatment between November 2021 and November 2023 were selected and grouped by randomized numerical table, 44 cases in the experimental group, 27 male patients and 17 female patients; their ages ranged from 31 to 74 years old, with a mean number of ( $49.35 \pm 4.18$ ) years old and the duration of the disease ranged from 5 months to 6 years, with a mean number of ( $1.95 \pm 0.57$ ) years. In the reference group, there were 44 cases, 28 males and 16 females; the age ranged from 32 to 75 years old, with a mean of ( $49.47 \pm 4.27$ ) years old; the disease duration ranged from 6 months to 6 years, with a mean of ( $0.04 \pm 0.61$ ) years. The general information between the groups was comparable with  $P > 0.05$ .

Inclusion criteria: (1) The affected teeth were positive after the bite swab test; (2) The presence of cryptic cracks on the surface of the crowns; (3) Accompanied by endodontic lesions; (4) Adult patients; (5) More detailed and complete clinical data; (6) The patients were informed and agreed to the study.

Exclusion criteria: (1) Other periodontal diseases; (2) Verbal or written communication disorders; (3) Serious organic diseases; (4) Mental disorders.

The study was reviewed and approved by the Ethics Committee.

### 2.2. Methods

The experimental group was treated with ORCT: Patients were treated with local anesthesia, grooves (0.25 mm) were prepared at about 1/3 and 2/3 of the buccal side of the crown of the affected tooth and ligature wires (diameter: 0.25 mm) were fixed at the grooves. Pulp opening and extraction were performed, and the length of the root canals was measured, after which the root canals were prepared, and the canals were rinsed several times with sodium hypochlorite solution and an appropriate amount of the lubricant: ethylenediaminetetraacetic acid was taken. Root canals were prepared with Protaper nickel-titanium root canal files, and then root canals were filled. The base material was zinc phosphate, and a resin material was taken to fill the cavity, which was then cured. The tooth was prepared, modeled and then treated with a self-consolidating plastic full crown restoration.

In the reference group, MRCT was performed: Root canal treatment was carried out in stages; after preparing the root canal, the canal was repeatedly wiped with moisture-absorbent paper and temporarily sealed with calcium hydroxide paste and was reviewed after 1 week. In the absence of discomfort, the canals were filled with cementum tips. Inflammatory reaction exists, it is necessary to change the medicine at regular intervals, and it is necessary to treat 2 paper 4 times.

### 2.3. Observation indexes

- (1) Root canal filling rate: Overfilling, the filling exceeds the apical range; filling, the root canal is in a sealed state, the filling is less than 2 mm from the root tip; underfilling, the root canal is not completely sealed, the filling is not less than 2 mm from the root tip.

- (2) VAS score: Before and after 1 week of treatment, the VAS score was evaluated, with a range of 0–10 points and positive pain scoring.
- (3) Periodontal indicators: The same evaluation time as above, the specific indicators are:
- (a) Plaque Index (PLI): Measure the plaque content and plaque thickness of the gingival margin. The score value is 0–3 points, no plaque is 0 points; the number of plaques is small is 1 point; the number of plaques is medium is 2 points; the number of plaques is large is 3 points.
- (b) Attachment Loss (AL): Immediately following the root surface of the tooth to pierce the probe, the depth of periodontal pockets-enamel bone boundary and the gingival margin distance, that is, the value of AL.
- (c) Gingival Sulcus Bleeding Index (SBI): Choose a blunt-ended periodontal probe, probe the bottom of the gingival sulcus and the bottom of the periodontal pocket, assess the degree of bleeding within 20 s of removing the probe, with scores ranging from 0 to 5 points, no inflammation, no bleeding is 0 points; slight inflammation but no bleeding is 1 point; slight inflammation and a small amount of bleeding is 2 points; gingival bleeding spreads to the edge of the tooth is 3 points; blood spills out of the gingival sulcus is 4 points; gingival automatic bleeding is 5 points.
- (4) Periodontal Probing Depth (PD): A probe is inserted along the long axis of the tooth and the periodontal depth of insertion is counted.
- (5) Complication rate: Gingival inflammation, chewing difficulty, apical inflammation, gingival redness and swelling.

## 2.4. Efficacy evaluation criteria

Cure: the disappearance of the pain sensation and local percussion; Obvious effect: significant improvement of the pain sensation and local percussion; Effective: improvement of the pain sensation and local percussion; Ineffective: no change of the pain sensation and local percussion.

## 2.5. Statistical analysis

The data processing software is SPSS 28.0, the expression of measurement data is mean  $\pm$  standard deviation (SD), using the *t* value comparison and test, the expression of count data is [*n*/%], using the  $\chi^2$  value comparison and test, *P* < 0.05 for the difference is statistically significant.

## 3. Results

### 3.1. Comparison of total effective rate

The total effective rate of the experimental group was higher than that of the reference group and the difference was statistically significant (*P* < 0.05). See **Table 1**.

**Table 1.** Comparison of the total effective rate of the two groups [*n*/%]

Subgroup	Cure	Obvious effect	Effective	Ineffective	Total Effective
Experimental group ( <i>n</i> = 44)	21 (47.73)	12 (27.27)	9 (20.45)	2 (4.55)	95.45 (42/44)
Reference group ( <i>n</i> = 44)	20 (45.45)	10 (22.73)	5 (11.36)	9 (20.45)	79.55 (35/44)
$\chi^2$					5.091
<i>P</i>					0.024

### 3.2. Comparison of root canal filling rate

The root canal filling rate of the experimental group was higher than that of the reference group and the difference was statistically significant ( $P < 0.05$ ). See **Table 2**.

**Table 2.** Comparison of root canal filling rate between the two groups [n/%]

Subgroup	Overfilled	Fill in	Underfill
Experimental group (n = 44)	2 (4.55)	39 (88.64)	3 (6.82)
Reference group (n = 44)	6 (13.64)	31 (70.45)	7 (15.91)
$\chi^2$	2.200	4.470	1.805
<i>P</i>	0.138	0.035	0.179

### 3.3. Comparison of VAS scores

After treatment, the VAS score of the experimental group was lower than that of the reference group and the difference was statistically significant ( $P < 0.05$ ). See **Table 3**.

**Table 3.** Comparison of VAS scores between the two groups (mean  $\pm$  SD/points)

Subgroup	Before treatment	After treatment
Experimental group (n = 44)	4.95 $\pm$ 0.75	3.21 $\pm$ 0.46
Reference group (n = 44)	4.98 $\pm$ 0.71	4.18 $\pm$ 0.57
<i>t</i>	0.193	8.784
<i>P</i>	0.848	0.000

### 3.4. Comparison of periodontal indicators

After treatment, the periodontal indicators of the experimental group were lower than those of the reference group and the difference was statistically significant ( $P < 0.05$ ). See **Table 4**.

**Table 4.** Comparison of periodontal indicators between the two groups before and after treatment (mean  $\pm$  SD)

Subgroup	PLI		AL (mm)		SBI		PD (mm)	
	Before	After	Before	After	Before	After	Before	After
Experimental group (n = 44)	2.15 $\pm$ 0.41	0.74 $\pm$ 0.18	4.08 $\pm$ 0.57	2.34 $\pm$ 0.57	4.33 $\pm$ 0.51	1.77 $\pm$ 0.31	5.24 $\pm$ 0.61	3.01 $\pm$ 0.42
Reference group (n = 44)	2.17 $\pm$ 0.44	1.09 $\pm$ 0.35	4.10 $\pm$ 0.55	3.20 $\pm$ 0.61	4.37 $\pm$ 0.42	2.86 $\pm$ 0.57	5.26 $\pm$ 0.57	4.18 $\pm$ 0.49
<i>t</i>	0.221	5.899	0.167	6.833	0.402	11.143	0.159	12.026
<i>P</i>	0.826	0.000	0.867	0.000	0.689	0.000	0.874	0.000

### 3.5. Comparison of complication rate

The complication rate of the experimental group was lower than that of the reference group and the difference was statistically significant ( $P < 0.05$ ). See **Table 5**.



**Table 5.** Comparison of complication rates between the two groups [n/%]

Subgroup	Gum Inflammation	Difficulty chewing	Inflammation of the root apex	Red and swollen gums	Incidence
Experimental group (n = 44)	1 (2.27)	0	0	1 (2.27)	4.55 (2/44)
Reference group (n = 44)	2 (4.55)	1 (2.27)	2 (4.55)	3 (6.82)	18.18 (8/44)
$\chi^2$					4.062
<i>P</i>					0.044

## 4. Discussion

Cryptocleidosis is a non-physiologic and subtle crack that occurs on the surface of the crown of the tooth and its direct etiology includes structural abnormalities of the dental tissues, anatomical factors and insufficient occlusal force; its indirect etiology includes aging, pathologic abrasion and poor lifestyle habits [3]. The early stages of the disease are nonspecific, and prolongation of the disease can lead to a variety of pathologies, such as pulp necrosis or pulpitis, which can reduce the patient's oral health. The basic treatment for this comorbidity is root canal therapy, which improves tooth function and prevents tooth splitting [4,5].

MRCT is a commonly used root canal treatment for cryptogenic fracture with endodontic lesions, which can remove internal inflammation and effectively fill the root canal, thus resulting in a high treatment success rate. However, the treatment steps of MRCT are cumbersome, and patients need to be admitted to the hospital several times, which will significantly increase their psychological burden [6]. In addition, the treatment cycle of MRCT is long, and errors in any part of the root canal preparation or filling will increase the risk of treatment failure, which is an obvious treatment defect. In contrast, ORCT can complete all operations of root canal treatment in one go without the need for multiple hospital admissions of the patient, so the treatment convenience is higher [7,8]. In addition, ORCT does not require temporary sealing, thus avoiding root canal infections due to poor sealing or loss of sealing material. It has a lower rate of root canal blockage, thus making it more feasible to use ORCT in treating root canals.

ORCT uses Protaper nickel-titanium files for root canal preparation and sodium hypochlorite to rinse the root canals several times to reach the deep dentin tissue, which can remove necrotic tissues and inhibit bacterial growth, as well as sterilize and lubricate the walls of the root canals, resulting in a high degree of thoroughness of the treatment [9]. In addition, ORCT can complete the full crown restoration treatment in a shorter period to protect the crown's strength and prevent the cryptic crack from continuing to deepen, reducing the risk of crown fracture. This study showed that the total effective rate of the experimental group was higher than that of the reference group, and the root canal cha-cha filling rate was higher than that of the reference group ( $P < 0.05$ ). The results were basically consistent with the findings of Liu X *et al.* (2023) [10].

Toothache is common in patients with cryptogenic fractures with endodontic lesions, and there is a correlation between the degree of pain and the degree of endodontic lesion. In the case of mild lesions, where the bacterial content inside the root canal is low, there is no infection in the dentin, and the root canal is not resorbed. The pain level is normally mild but can be intense in severe lesions. After ORCT treatment, the infected material inside the root canal can be thoroughly cleaned and the apical segment can be sufficiently rinsed to avoid the entry of root canal debris and contents inside the apical foramen, so the establishment of apical stops is good, which can improve the success rate of the treatment and alleviate the pain symptoms as soon as possible [11]. In addition, the medical device of ORCT is used less frequently, and the damage to the

affected tooth is slight, so the pain score after treatment is lower. In this study, after treatment, the VAS score of the experimental group was lower than that of the reference group ( $P < 0.05$ ).

The root canal preparation effect of ORCT is good, which can sufficiently clean the root canal, improve the filling rationality, and then maintain the good polymerization coefficient and thermal expansion index of the filling material, enhance the external force tolerance of the dental tissues, and improve the occlusal relationship and dental morphology, and then improve the periodontal index. In this study, all periodontal indicators in the experimental group after treatment were lower than those in the reference group ( $P < 0.05$ ). In addition, ORCT has a shorter treatment time, is less likely to cause medical infection, and protects the root apex and gingiva of the affected teeth, so there are fewer complications, such as apical inflammation. In this study, the complication rate of the experimental group was lower than that of the reference group ( $P < 0.05$ ).

## 5. Conclusion

In conclusion, ORCT is more effective than MRCT for treating fissured teeth with endodontic lesions. It can improve the root canal filling rate, reduce pain symptoms, and improve periodontal indexes, and it has a high therapeutic safety.

## Disclosure statement

The author declares no conflict of interest.

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