

Reconstruction of Endodontically Treated Teeth using Post and Composite Resin in Three Cats

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Abstract : This clinical report describes the dental treatment of canine teeth fractures in three cats. These animals were diagnosed by oral examination and dental radiography as having fractured teeth with pulpal exposure. After endodontic treatment was completed, root canal filling material was removed from the coronal access and a trial post placement was performed. The post was permanently cemented after shortening. Teeth were etched and a bonded composite resin core formed and then shaped using rotary instruments. Fractured canine teeth were treated without any complications observed during a six-month follow-up period, proving that fractured cat canine teeth can be treated successfully with root canal therapy followed by restorative treatment with posts and composite resin.

Key words : endodontically treated teeth, post, composite resin, cat.

Introduction

Trauma is the most common cause of tooth fracture encountered in small animal practices. Fractured teeth have been reported in 10% to 29% of dog and cat patients (5). In a previous report of dental pathology in feral cats, the highest incidence of trauma appeared in the upper canine teeth and carnassial fractures (10). High-rise syndrome was diagnosed in 132 cats, and in addition to thoracic trauma, 17% of these animals had dental fractures (11).

Treatment options for fractured teeth include vital pulp therapy, root canal treatment, bonded composite restoration, crown restoration, and extraction. Fractured teeth with pulp exposure may be treated by extraction or endodontically. The choice of treatment is based on various determinants such as assessment of dental radiographs, amount of tooth structure fractured, and the size of pulp exposure (1,9).

The aim of this report was to present cases of complicated crown fractures of cat canine teeth successfully treated endodontically using posts and composite resin.

Case

Three cats with fractured teeth and pulp exposure were brought to Chonbuk Animal Medical Center of Chonbuk National University. Table 1 provides the breed, weight, age, sex, and location of fractured teeth in each patient. All cases of fractured teeth were found upon clinical examination of

the cats at the local animal hospital but the cause was not determined. All cats were in good physical condition, with no evidence of head and neck trauma. Extraoral examination revealed no significant abnormalities. Intraoral examinations and dental radiographs showed complicated crown fractures of canine teeth and indicated complete root formation and a closed apex with no evidence of any other fractures on adjacent teeth (Fig 1A and 1B).

Prior to surgery, the cats received intramuscular cephalixin (Methilexin Inj®; Union Korea Pharm. Co. Ltd., Seoul, Korea) 20 mg/kg for prophylaxis. The cats were premedicated with a subcutaneous injection of atropine sulfate (Daewon Pharmaceutical Co., Seoul, Korea) 0.01 mg/kg and intravenous propofol (Anepol IN®; Ha Na Pharm, Seoul, Korea) 6 mg/kg. After intubation, general anesthesia was maintained with isoflurane and oxygen. All teeth were first disinfected with 0.2% chlorhexidine, and gingivae were also disinfected before each procedure with povidone-iodine.

On the basis of clinical and radiographic findings a treatment plan was proposed comprised of immediate endodontic treatment and reconstruction of fractured teeth using posts and composite resin. Under local anesthesia, the pulp was removed and the length of the root canal determined by files. Root canals were chemically and mechanically cleaned and shaped using the step-back technique and then filled using the cold lateral condensation technique (Fig 2). At the beginning of reconstruction of the fractured teeth, gutta-percha was removed from the root canal with a reamer (Largo Peeso Reamer; Dentsply Maillefer, USA), and the post (EG Post Complete Kit, Mani, Japan) was placed in the canal. The post was cemented into the root canal using self-etch adhesive

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Table 1. Demographics of cats with complicated crown fractures of canine teeth

Cat (#)	Breed	Weight	Age(y)	sex	Location of fractured teeth
1	Russian blue	3.1 kg	3	M	Right maxillary canine
2	Siamese	2.8 kg	5	F	Left maxillary canine
3	DSH	3.9 kg	2	F	Right/Left maxillary canines

DSH-domestic short haired

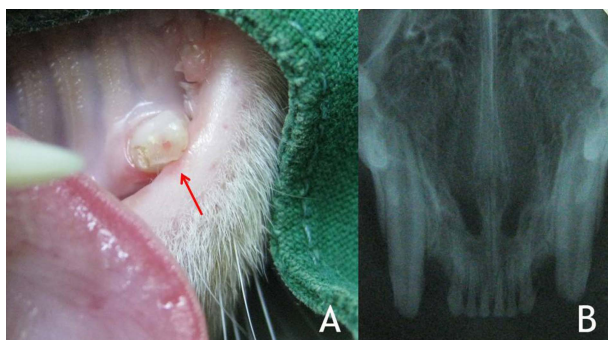


Fig 1. Complicated crown fracture of left maxillary canine tooth (cat #3). A: Clinical appearance where approximately 2/3 of the crown is absent and pulp tissue is exposed (arrow) B: Radiograph of fractured canine tooth.



Fig 2. Fractured canine tooth after endodontic treatment (cat #1).

resin cement (Maxcem Elite; Kerr Mfg Co., USA) (Fig 3). After post fixation, crown reconstruction was performed with etched and bonded composite resin core formed by using composite resin materials (Quadrant Universal LC Refill; Cavex, Haarlem, Netherlands) and shaped using diamond burs (Fig 4A and 4B).

All final results after dental treatment were satisfactory. The patients were inspected at two-month intervals. Cat #3 showed signs of slight gingival inflammation in the labial surface of the mandible at two months which was reduced



Fig 3. Post cemented in the root canal with resin cement (cat #1).

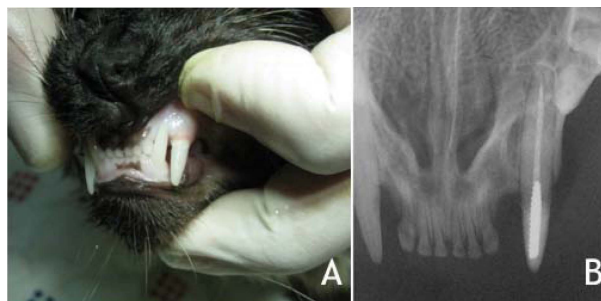


Fig 4. Post-operative appearance of treated tooth (cat #2). A: Intraoral view of the cat after the restoration. B: Radiographic view of final restoration.

after polishing the lingual surface of the treated tooth. At six months post-treatment, clinical and radiographic examination revealed no evidence of disease associated with reconstructed teeth or any other complications.

Discussion

Tooth fractures are painful, and a number of options have been proposed for fracture treatment, including vital pulp therapy, root canal treatment, bonded composite restoration, crown restoration, and extraction (1,4,9). The choice of treatment depends on the extent of fracture, the pulp exposed, and the radiographic evidence of pathology. Enamel thickness in

dogs and cats varies from 0.1 mm up to only 1.0 mm (3). Particularly in cats, the pulp chamber extends to just under the crown tip compared to mature dogs (1). When trauma causes pulp exposure, migration of oral bacteria into the pulp chamber occurs and can lead to pulp infection, pulpal necrosis, tooth root resorption, draining sinus tracts, facial swelling, and tooth loss (6).

When a fractured tooth leads to pulp exposure, the treatment of choice is endodontic therapy and extraction. In the past, veterinary clinicians routinely performed extraction of fractured teeth because of the inexpensive cost and simplicity of the procedure (9). Tooth extraction however is a final surgical intervention. Endodontic treatment involves vital pulp therapy and root canal therapy (1,9). The objective of endodontic treatment is to maintain tooth vitality by treating the pulp of the tooth. Vital pulp therapy involves removing most of the coronal portion of the pulp, placing a pulp-capping agent to stimulate formation of tertiary dentin over the pulp, and then applying a bonded composite restoration. Vital pulp therapy is a treatment option for acutely fractured teeth in immature patients (1,9).

Harran-Ponce et al. reported that marked bacterial contamination and histological signs of inflammation in the coronal pulp occur just 48-72 hours after experimentally induced crown fractures (6). If pulp exposure has occurred over 72 hours or more, the preferred treatment option is root canal therapy, with complete pulp removal. A previous study evaluated the results of root canal treatment in 127 dog teeth. This study reported the failure rate for root canal therapy in dogs as only 6% (7). Root canal therapy is a much less invasive treatment than tooth extraction, and the patient retains its teeth. After root canal treatment, the tooth has to be restored with either a composite or metal crown. Crown therapy is a common treatment in human dentistry; however, it is not nearly as common in animal dentistry due to several reasons: besides financial, shaping the tooth to accept a crown can actually weaken the tooth, and an additional anesthetic is required (1,9). In human dentistry, after endodontic therapy of fractured teeth a commonly used treatment involves metal posts and composite resin (2). In an in vitro study, comparing resin-based composite, amalgam, and cast gold as core materials under a crown in endodontically treated teeth, no significant difference in fracture and failure characteristics were found among these materials (8). Compared with alternative techniques, crown therapy has the advantages of quickly restoring function, low-cost materials, and aesthetic enhancement of the fractured teeth.

In the cases presented here, the cats were mature and all patients had a history of pulp exposure over 72 hours. Dental radiographs showed an apical closure and no other abnormalities in the root canal. In all cases a decision was made to perform root canal therapy and reconstruction with posts and composite resin. No complications were observed during post-treatment follow-up examinations. This treatment proved beneficial to quickly restore the function and the aesthetics of the fractured teeth.

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치아골절이 있는 고양이에서 근관치료 후 복합 레진과 포스트를 이용한 치아 재건술

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요 약 : 치아 골절을 가진 고양이에서 근관 치료 이후 복합레진과 포스트를 이용한 재건술의 증례이다. 내원한 고양이 3례 모두 구강검사와 치과 방사선 검사를 통해 치수가 노출된 치아 골절로 진단 되었다. 근관치료가 완료된 후, 일부 충전 물질을 제거하고 포스트를 설치하고 에칭과 본딩 전처치 후 복합 레진으로 광중합을 시행하였다. 치료된 치아들은 치과용 바와 디스크를 이용하여 성형하였으며, 6개월 동안 추시한 결과 치료된 치아들은 특별한 부작용을 발견할 수 없었다. 따라서 고양이에서 치수가 노출된 치아골절의 경우, 먼저 근관치료를 시행한 다음, 결과를 확인하고 복합 레진과 포스트를 이용한 재건술은 실시한다면 임상에 있어서 매우 좋은 효과를 거둘 수 있을 것으로 생각된다.

주요어 : 근관치료, 포스트, 복합 레진, 고양이