

原文題目(出處)：	Diagnosis and treatment of endodontically treated teeth with vertical root fracture: Three case reports with two-year follow-up. J Endod 2011;37:97-102.
原文作者姓名：	Senem Yi_git € Ozer, G € ulten € Unl € u, Yalc,ın De_ger
通訊作者學校：	Department of Operative Dentistry and Endodontics, Department of Oral Surgery, and Department of Prosthodontics, Faculty of Dentistry, Dicle University, Diyarbakir, Turkey
報告者姓名(組別)：	Int G 組黃渝聖
報告日期：	100/2/8

內文：

### Introduction

- a complete or incomplete fracture line extending obliquely or longitudinally through the enamel and dentin of teeth
- VRFs usually result in extraction

### Major iatrogenic and pathologic risk factors for VRFs

- excessive root canal preparation,
- overzealous lateral and vertical compaction forces during root canal filling,
- moisture loss in pulpless teeth
- overpreparation of post space
- excessive pressure during post placement
- compromised tooth integrity as a result of large carious lesions or trauma

A multi-rooted tooth with VRF can be conserved by resecting the involved root

No specific treatment modality has been established

The extraoral bonding of fractured segments with an adhesive resin cement and intentional replantation of teeth after reconstruction

The diagnosis of VRF:often requires prediction rather than definitive identification

Conventional periapical (PA) radiographs

VRF might lead to bone loss, pain, and malfunction of the involved area

cone-beam computed tomography (CBCT)

### Procedures

CBCT scans were taken of each patient by using 0.2-mm voxel size, 6-cm field of view (FoV), 120 kV, and 5 mA.

Classified into 2 groups according to type (hairline versus separated) and location  
preoperative oral hygiene instruction

**TABLE 1.** Treatment Modalities of Intentionally Replanted Teeth

Case no.	Tooth no.	VRF type	Reconstruction method	Time (min)
1	10	Complete VRF	Total adhesion	12
	11	Hairline-like VRF	Shallow sealing	16
2	22	Hairline-like VRF	Shallow sealing	18
3	6	Complete VRF	Total adhesion	24

**steps**

- Local anesthesia by using a solution of 2% articaine with 1:1000 epinephrine
- A full-thickness mucoperiosteal flap
- supra-alveolar fibers were circumferentially dissected
- The tooth was gently extracted to protect the periodontium
- Each extracted tooth was immediately immersed in saline solution (0.9% isotonic NaCl)
- The socket walls adjacent to the fracture region were curetted and irrigated
- extraction of affected teeth while avoiding periodontal damage
- bonding of the separated segments with a self-etching dual-cure adhesive resin cement(Panavia F 2.0)
- Intentional replantation of the reconstructed teeth
- 2 hairline-like VRFs were prepared as a shallow preparation
- VRFs through the entire root were treated by removing the root-filling material
- Use tetracycline 30 sec for enhancing PDL attachment
- Extroral procedure:16~28 min
- Keep moistened during curing
- Rx:chlorhexidine mouth rinse  
3x500 mg amoxicillin daily for 1week  
2x550 mg naproxen daily for 1week
- All affected teeth were restored with full-cast crowns 2–6 months after reconstruction and intentional replantation

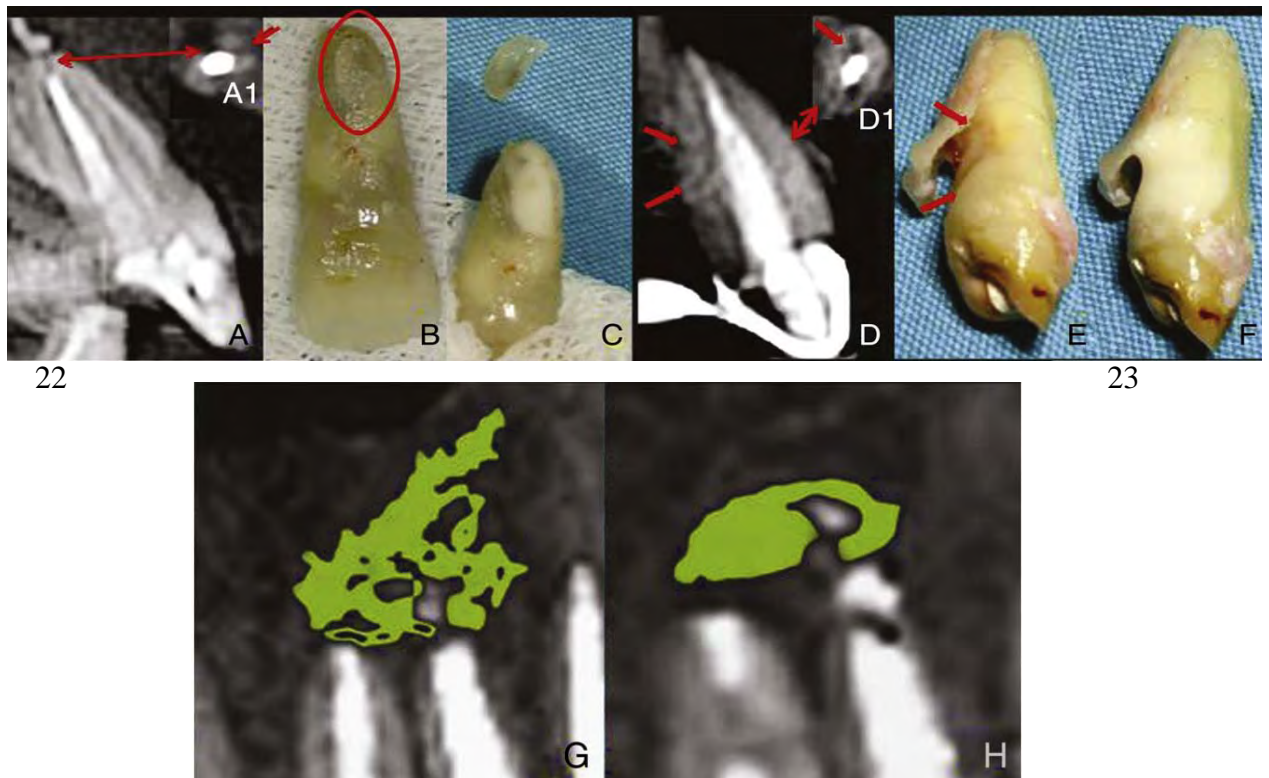
**Clinical success**

- lack of sensitivity to percussion
- percussion tone that did not differ from the healthy adjacent teeth
- mobility within normal limits at 6 months
- reduction in periapical radiolucency

**Case 1**

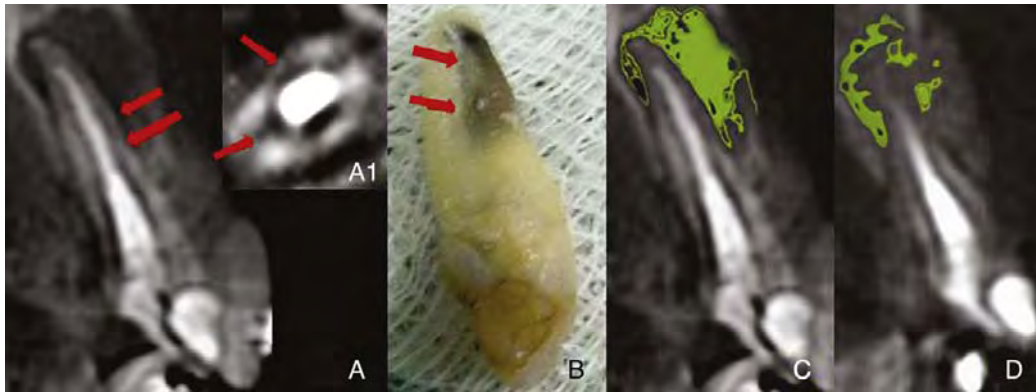
- complained of chronic dull pain in the left anterior maxilla.
- large composite resin restorations in the maxillary incisors and canines

- Periodontal pocketing:3 mm
- no mobility
- 21 22 23 root canal treatment 3 years ago
- Because of failed healing, the root canals had been retreated 2 years later
- Axial and sagittal CBCT scans showed VRFs on the left maxillary lateral incisor 22
- an incomplete hairline-like on the left maxillary canine23
- Six months later, teeth were asymptomatic clinically



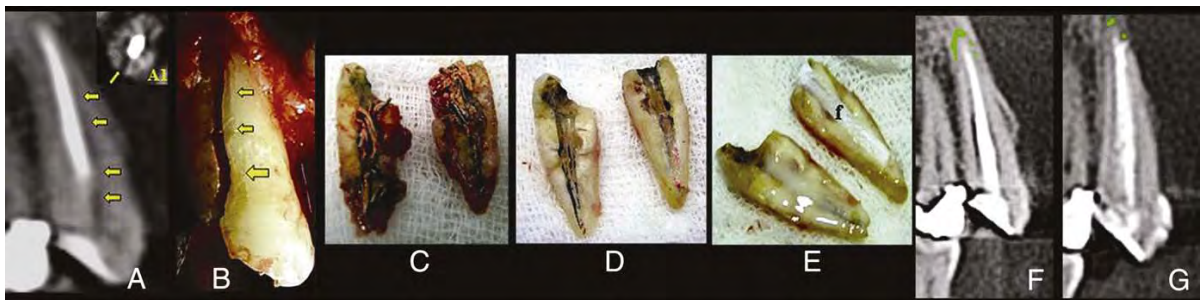
### Case 2

- A 25-year-old woman complained of mild pain in her maxillary left lateral incisor during chewing
- Endodontic treatment 2 years ago
- buccal and palatal periodontal pockets averaged 5 mm in depth
- CBCT scans revealed a hairline-like VRF on the apical and middle thirds of the root
- After 8 months, The tooth was asymptomatic
- PA radiolucency was reduced at the end of 2 years



Case 3

- A 32-year-old man complaining of draining pus and chronic dull pain in the right anterior region of the maxilla.
- Clinical examination revealed a separable distal fracture on the maxillary right canine 13
- A polyethylene fiber (Ribbon; Ribbon Inc, Seattle, WA) was adhered on the root dentin to form a post for retention
- The tooth was asymptomatic, with physiologic mobility 2 years later



**Discussion**

The way to detect VRFs

1illumination

2x-rays

3periodontal probing

4staining

5surgical exploration

6bite tests

7direct visualization of the fracture

8operative-microscope examination

9CBCT scanning

- Rapid diagnosis of a VRF is required to prevent additional bone loss that will furtherimpede reconstruction.
- VRF treatment that included resin cement bonding and intentional replantation

was then performed

- appropriate for anterior teeth
- Hayashi et al reported no failure in vertically fractured incisors treated with this method
- the posterior teeth were negatively affected by strong occlusal forces
- The morphology and location of anterior teeth also facilitate the maintenance of gingival health
- use of a dual-curing material shortened extraoral working time and preserved the vitality of the periodontal ligament
- Hayashi et al addressed the imperfect curing of the light-cured adhesives at the apical portions
- Recent studies have reported that the use of 4-META/MMA-TBB resin, a self-cure adhesive resin cement, leads to successful VRF reconstruction outcomes
- dual-cure adhesive resin cements are preferable
- These cements achieve controlled polymerization , are easy to apply, have short curing times
- Andreasen et al treated the roots of 2 incisors with apicoectomy and retrograde dentin-bonded composite filling, concluding that the tissue accepted the composite as a base for cementogenesis
- Healthy cementum on the root surface and periodontal membrane vitality are important factors in preventing ankylosis
- Solutions such as citric acid, tetracycline, and ethylenediaminetetraacetic acid have been advocated for root surface modification
- A 30-second application of tetracycline has been reported to successfully remove the smear layer, leaving clean and open tubules

### **Ankylosis**

- Ankylosis can be demonstrated 2 weeks after replantation
- The percussion test can often reveal replacement resorption in its initial phases before it can be diagnosed radiographically
- Radiographic examination is considered to be of limited value in the early detection of ankylosis
- Usually on buccal and lingual side
- ankylosis might occur after 5–10 years
- the CBCT imaging system used does not exceed 0.020 mm, which is the average width of the periodontal ligament space

CBCTs are categorized as the following:

- (1) small volume used to scan a few teeth or one jaw

(2) medium volume, involving both jaws, the maxillary sinus, and part of the nose

(3) large volume, covering the entire maxillofacial region

- The smaller the scan volume, the higher is the spatial resolution of the image
- In our cases, Next-Generation i-CAT (medium FoV) was used with a 0.2-mm voxel size
- The images were unable to clearly demonstrate cracks as a result of the decreased resolution
- As previously reported by Hassan et al , **axial slices** were more accurate than coronal and sagittal slices in detecting VRF.
- Sagittal-plane images were useful for determining the extent and direction of each fracture line



- clinical signs and symptoms are fundamental and very important for the diagnosis of fractures, and one must consider the signs and symptoms too
- CBCT provides enhanced and accurate information

### Conclusions

- Scanners with smaller FoVs with higher resolutions would be advisable for use in detecting VRFs and in the follow-up period
- Bonding the separated fragments of VRFs extraorally and intentional replantation of the reconstructed tooth are an innovative method
- Further long-term studies of treatment outcomes are necessary

題號	題目
1	Which one is not the way to detect vertical root fracture (A) illumination (B) operative-microscope examination (C) periodontal probing (D) EPT
答案(D)	出處：Diagnosis and Treatment of Endodontically Treated Teeth with Vertical Root Fracture: Three Case Reports with Two-year Follow-up <i>J Endod 2011;37:97-102</i>
題號	題目
2	Ankylosis 通常發生在牙齒的哪個面 (A) Buccal (B) Lingual (C) Proximal (D) A+B
答案(D)	出處：Diagnosis and Treatment of Endodontically Treated Teeth with Vertical Root Fracture: Three Case Reports with Two-year Follow-up <i>J Endod 2011;37:97-102</i>