

Aviad Tamse

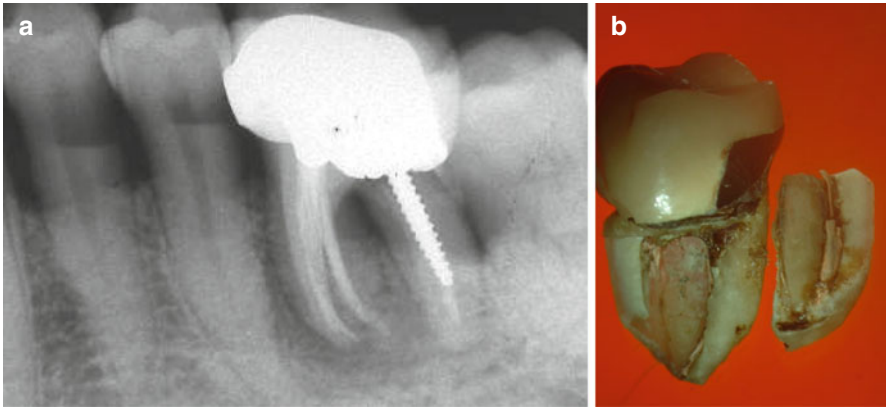
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### Abstract

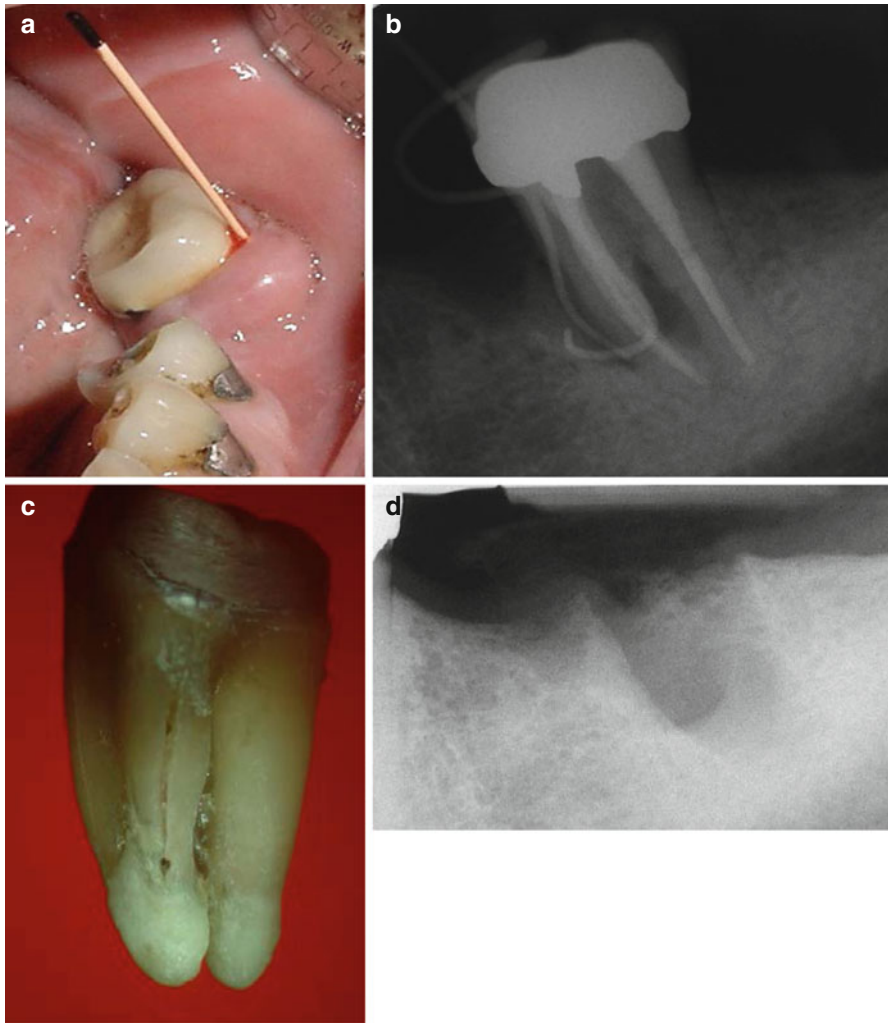
A variety of clinical cases of vertical root fractures (VRFs) in endodontically treated teeth will be presented in this chapter. The importance in achieving accurate VRF diagnosis will be emphasized with figures and legends, and the clinical difficulties will be highlighted. The more typical cases will be presented, together with those in which the accurate VRF diagnosis was difficult to achieve. The importance of accumulating the most relevant information from the history of the involved tooth with meticulous clinical examination is shown in these clinical VRF cases.

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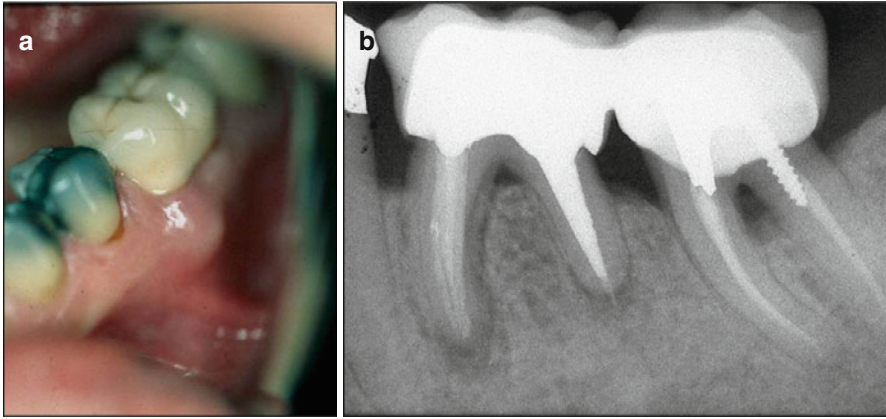
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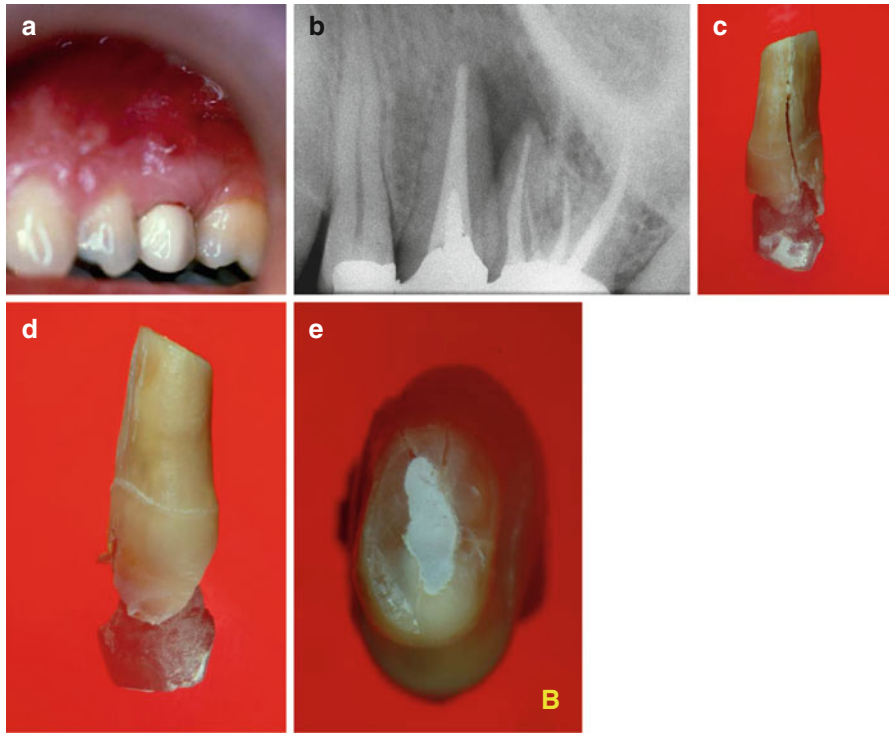
**Fig. 5.1** (a, b) The patient arrived at the dental office with a chief complaint of recurrent abscesses in the past year. The left mandibular molar was tender to percussion and palpation, and cl II mobility was also noted. An 8 mm probing defect was recorded in the mesiobuccal area and 5 mm in the midbuccal. The periapical radiograph (a) showed a previously treated mandibular molar, gutta-percha-filled root canals, a Dentatus dowel in the distal root, an amalgam dowel in the mesial, and full coverage with a crown. There was bone loss in the bifurcation and at the coronal half of the distal root. The mesial root was surrounded by a radiolucent lesion. A VRF was suspected and the tooth extracted. The typical buccolingual fracture can be seen in Fig. 5.1b



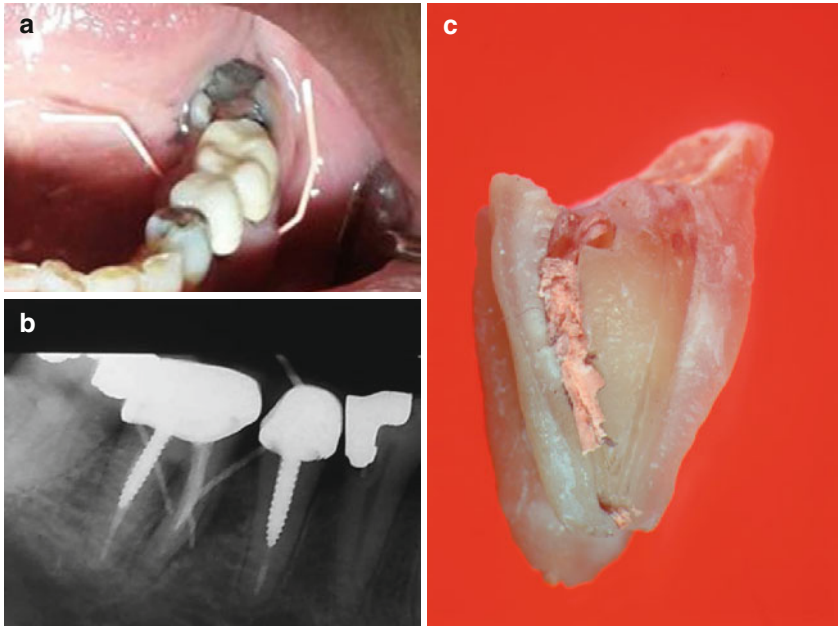
**Fig. 5.2** (a–d) The patient arrived at the dental office with “soreness on biting for the last couple of months and a swelling in the area about a year ago.” The first mandibular molar was extracted 5 years earlier but only the second molar endodontically treated, restored with amalgam dowels in the coronal 3 mm of the two roots and a crown (a). Clinical examination revealed sensitivity to percussion and two 8 mm probing defects both in the buccal and lingual aspects. The periapical radiograph (b) shows two gutta-percha tracing cones at the bone resorption area in the coronal two-thirds of the mesial root. A VRF diagnosis was made and the tooth extracted. In the extracted tooth (c), the fracture in the coronal two-thirds of the mesial root can be seen. A periapical radiograph of the extracted site (d) shows the amount of bone loss in the bone as a result of the continuous inflammatory process in the area (Courtesy Prof. J. Nissan)



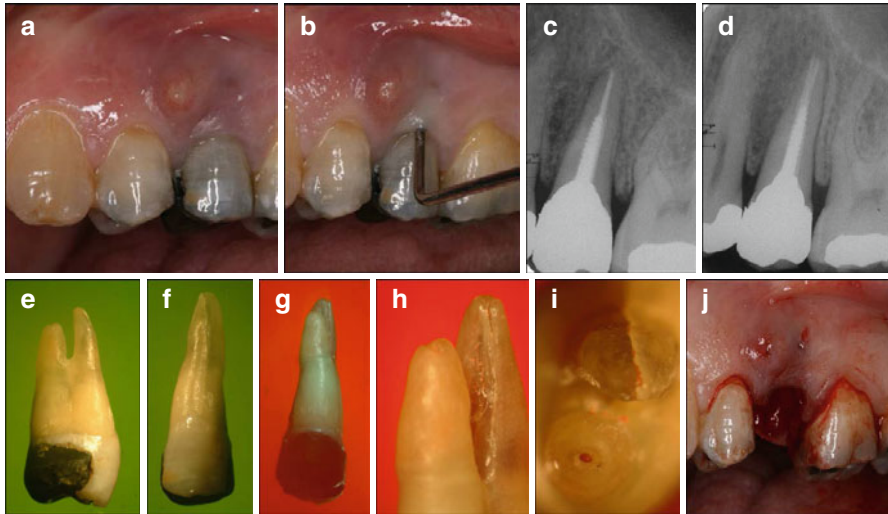
**Fig. 5.3** (a, b) A patient with severe periodontal problems who was evaluated for periodontal surgery arrived at the office with a small swelling adjacent to the mesial root area (a). The mandibular left first molar was endodontically treated 7 years previously and restored afterward. Probing depth around the tooth was 5 mm in the midbuccal and 4 mm in the mesiobuccal area. The radiographic appearance of the radiolucency around the mesial root which most likely was of an endodontic origin (b) and swelling in the gingivae adjacent to the mesial root pointed to a VRF. However, in this periodontally involved patient, the final diagnosis was an acute apical abscess (Courtesy Dr. J Halpern)



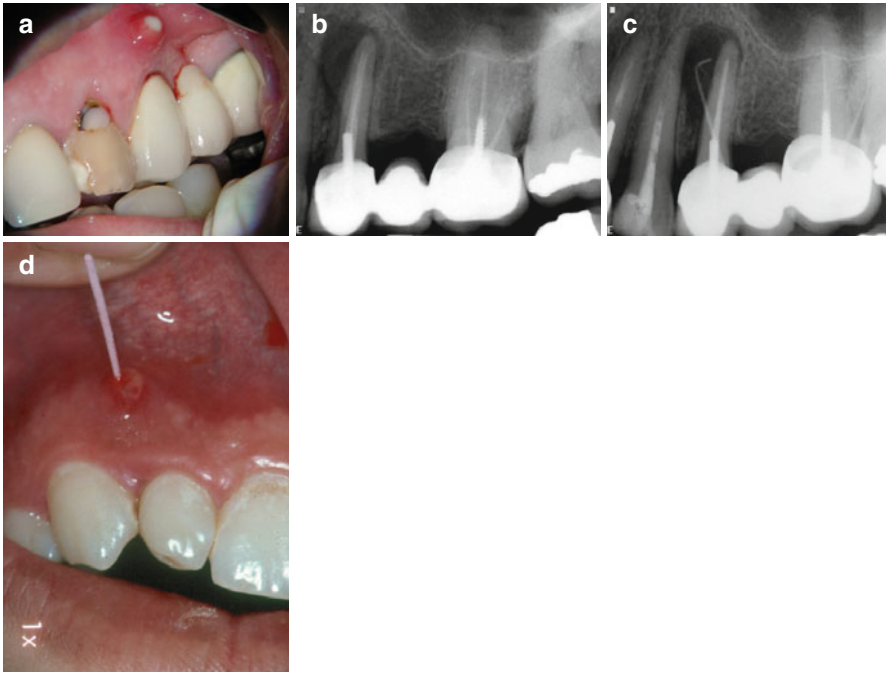
**Fig. 5.4** (a–e) A patient arrived at the dental office with a complaint of “draining pus from the gum” in the upper jaw. Clinical examination revealed a veneer crown in the second premolar that was endodontically treated and restored at the same time with the maxillary molar adjacent to it (a). A highly located sinus tract was noted, but the probing numbers were between normal limits. Endodontic treatment appeared adequate in the radiograph (b), but a large radiolucent area can be seen laterally in the distal aspect of the premolar tooth involving the mesiobuccal root of the maxillary molar. Poor outcome of the endodontic treatment either in the maxillary premolar (chronic apical abscess) or the mesiobuccal root of the molar led to the treatment plan of endodontic surgery either in the premolar or the mesiobuccal root or both. Endodontic surgery was performed in the maxillary premolar with IRM as a retrograde filling material. At 12 months post-op, the patient returned with an acute abscess, and the premolar was extracted. A VRF was noted in the buccal aspect (c), but it was of the incomplete type since it was not seen in the buccal aspect (d). In the apical view (e), the incomplete VRF can be seen in the palatal aspect but not in the buccal one. Most likely, the incomplete VRF on the palatal aspect was not noticed during surgery



**Fig. 5.5** (a–c) The mesial root of the mandibular molar showing two gutta-percha tracings from the buccal and lingual sinus tracts (a). Radiograph (b) shows the wide lateral radiolucency on the mesial root aspect. Also, there is radiolucency in the bifurcation. After VRF diagnosis and extraction, the crown was removed, and one part of the mesial root can be seen with some of the gutta-percha filling (c) (Courtesy Dr. A. Aronovich)

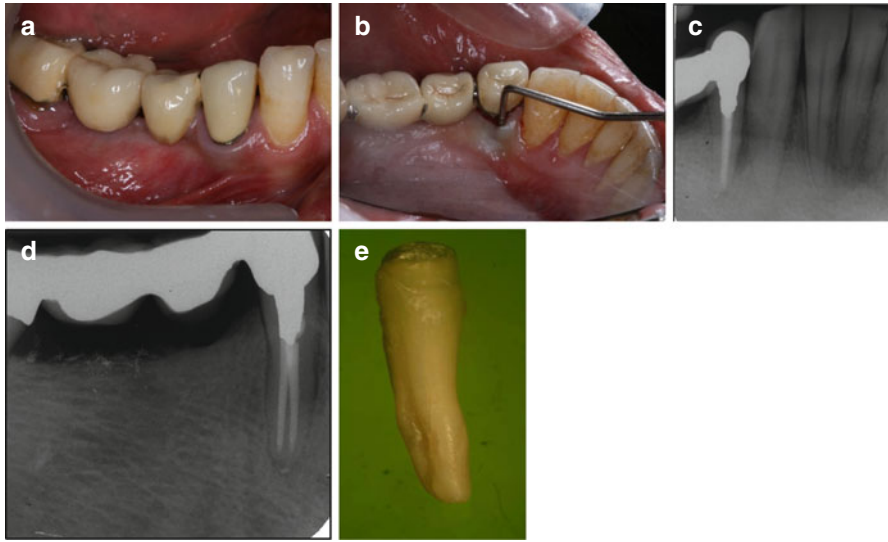


**Fig. 5.6** (a–j) A patient arrived at the dental office with a complaint of a “lump in the gum” for several months (a). From the case history, it was revealed that the maxillary second premolar was endodontically treated 3 years earlier and Dentatus and a large amalgam restoration followed thereafter. Clinical evaluation revealed a highly located sinus tract (a, b), and a narrow midbuccal 7 mm probing defect was noted (b). A small isolated lateral radiolucency on the mesial aspect was noted along the root (c, d). A VRF diagnosis was made and the tooth extracted. It was a bifurcated maxillary premolar (e) of which only the buccal root was fractured (f) but not the lingual one (g). A closer examination of the two roots shows the typical depression on the bifurcation aspect of the buccal root (R) along with the apicocoronal VRF. A closer look at the two apices (i) the complete buccolingual VRF on the buccal root. After tooth extraction, the typical bony dehiscence, which faced the fracture in the buccal root, is reflected as triangular flabby attached gingivae (j) (Courtesy Dr. E. Venezia)

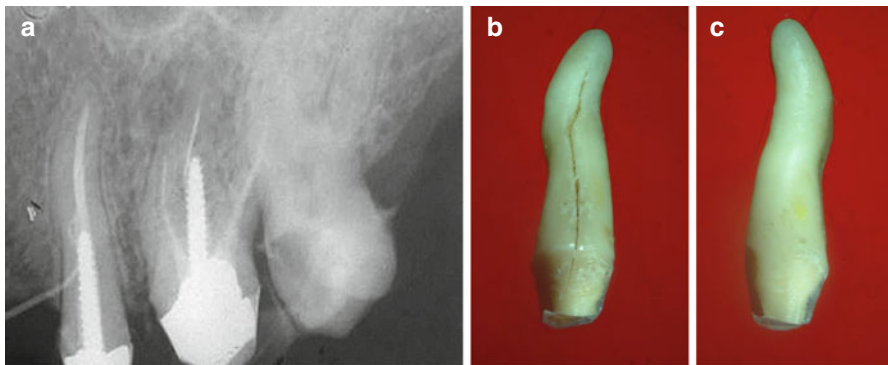


**Fig. 5.7 (a–d)** The patient arrived at the dental office with a chief complaint of “a lump in the gum that comes and goes.” Upon examination, a highly located sinus tract was noticed in the second premolar attached gingivae (a) with some pus extruding on slight pressure. A narrow 9 mm probing defect was noted in the buccal aspect and no probing noted in the palatal side. The periapical radiograph revealed that the tooth was used as a mesial abutment for a three-unit bridge and that both the second premolar and first molar were endodontically treated (b). A large “halo”-type radiolucency can be seen in the mesial root aspect extending from the root tip of the root laterally to the coronal part. A gutta-percha tracing through the sinus tract extends to this area (c). In patients with chronic apical abscess in non-VRF cases, the sinus tract is located in the gingivae much closer to the apical area (d). The patient had clinical signs and symptoms that are pathognomonic for the diagnosis of VRF (a–c) (Courtesy Dr. R. Paul)

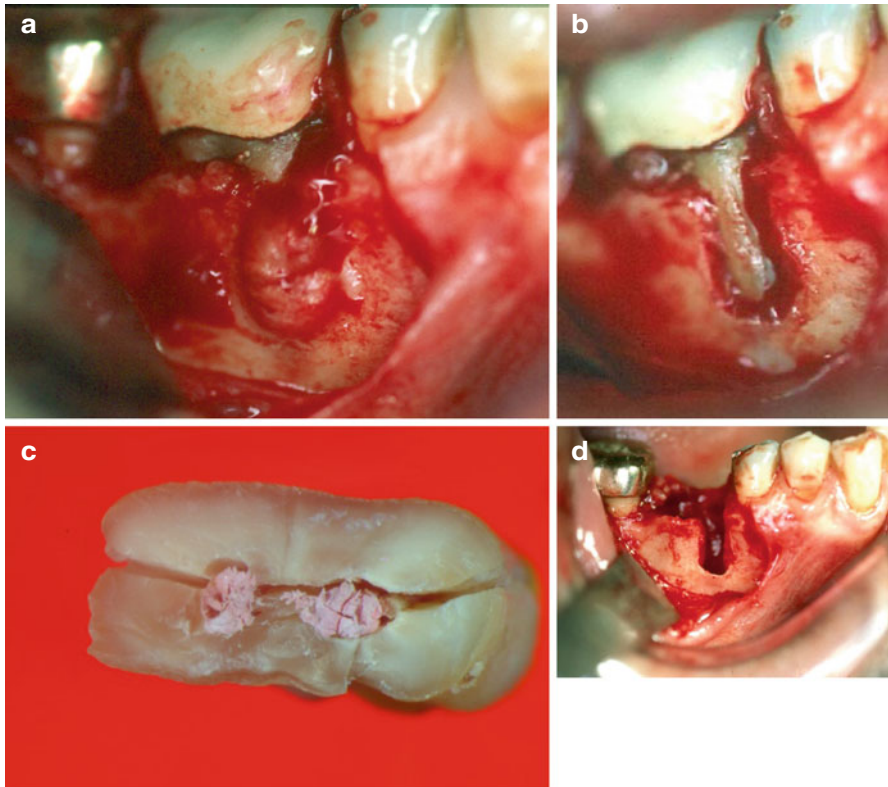




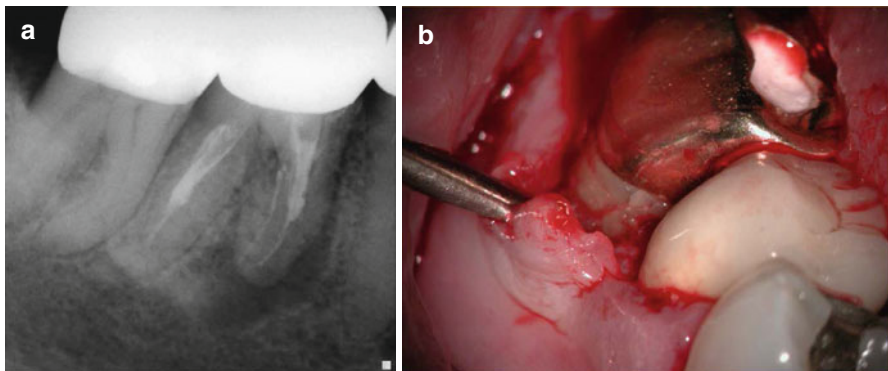
**Fig. 5.8** (a–e) The mandibular first premolar was used as a mesial abutment for a four-unit bridge (a). The patient presented for a routine examination with no symptoms. Upon examination, a 7 mm probing defect was found on the lingual gingivae (b). There was no probing on the buccal aspect. The radiographs (c, d) revealed two well-condensed canals with gutta-percha and a wide metal post in the coronal part of the root. A lateral radiolucent area can be seen next to the middle third of the root in the mesial aspect. Since these signs were not present when the endodontic and restorative procedures were performed 6 years earlier, a diagnosis of asymptomatic apical periodontitis was made and the tooth extracted (e). A hairline fracture can be seen on the lingual aspect. As demonstrated in this case, the use of a mandibular or a maxillary sole abutment for a bridge is highly inadvisable due to the large horizontal and torquing forces during function (Courtesy Dr. E. Venezia)



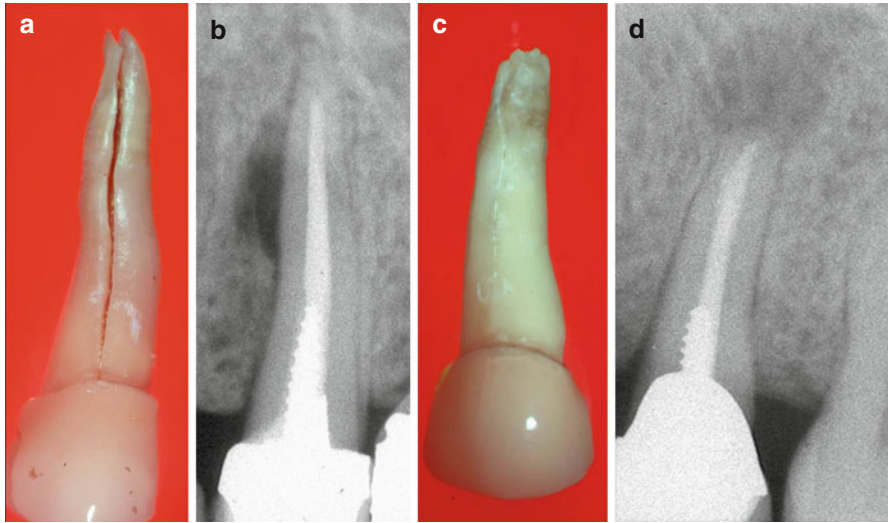
**Fig. 5.9** (a–c) The patient arrived at the dental office for a re-examination to replace two temporary crowns with permanent ones. Root canal treatment was performed 16 months earlier in a maxillary premolar, restored with a dowel and a temporary crown as well as in the maxillary molar. No radiolucencies in the bone surrounding the tooth could be detected in the radiograph (a). The patient initially declined to return to continue the restorative procedures. However, when he did return, there was a 9 mm probing defect in the midbuccal root and a highly located sinus tract. The gutta-percha tracing cone can be seen in the radiograph. The tooth was extracted. The incomplete VRF was found in the buccal side (b) but not in the lingual side (c)



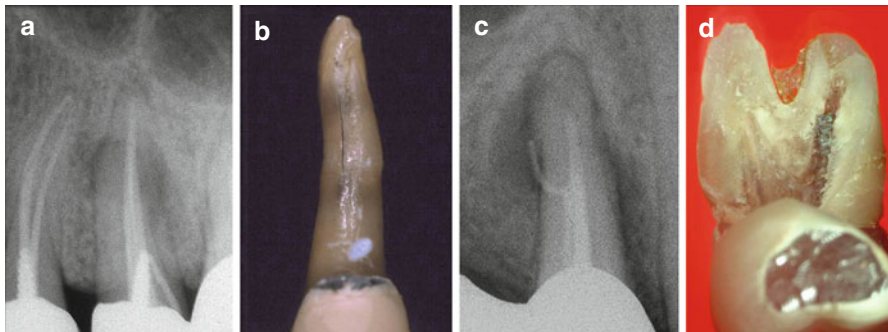
**Fig. 5.10 (a–d)** A large granulation tissue was seen when an exploratory flap procedure was performed to confirm a tentative diagnosis of a VRF in a mandibular first molar (a). After the granulation tissue was removed, a large dehiscence was seen in the buccal plate (b). Although the VRF was complete (all the way from buccal to lingual) (c), the large dehiscence was in the buccal plate as it was originally thinner than the lingual one (d)



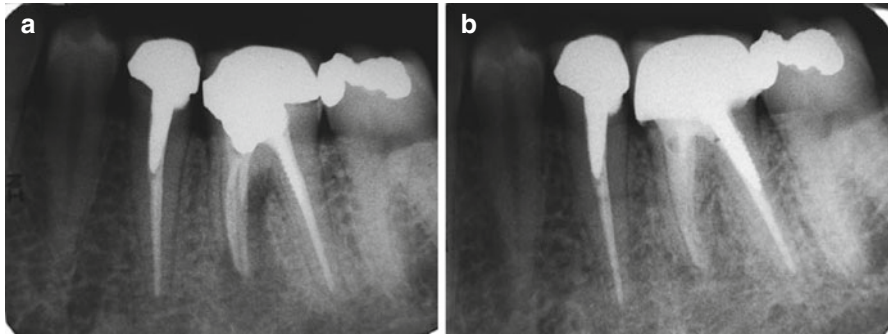
**Fig. 5.11 (a, b)** Mandibular first molar during retreatment. Following removal of the gutta-percha, calcium hydroxide was placed in the root canal. There was no probing; however, the “halo” radiolucency around the mesial root was suggestive for VRF (a). Upon probable flap reflection (b), the fracture can be seen in the mesial root (Courtesy Dr. R. Paul)



**Fig. 5.12** (a–d) Two longitudinal VRFs are presented. The segments are separated as in Fig. 5.12a, and the parts are still attached to each other in the other extracted tooth as in Fig. 5.12c. Although both VRFs are to the full length of the root, the radiolucency in the bone in case (a) is limited to the lateral part of the middle third of the root (b), and in the tooth (c), the radiolucency is limited to the periapical area (d), which is not typical to a vertically fractured tooth but rather to the failure of root canal treatment



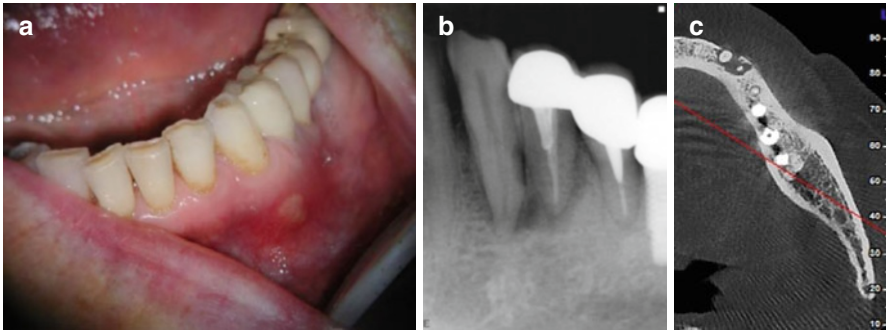
**Fig. 5.13** (a–d) Bony radiolucencies are seen in the mesial and distal lateral aspects of the middle third of the roots in two maxillary premolars (a, c). However, the types of fractures are different. In Fig. 5.13b, the fracture is limited to the middle third of the root, whereas in (d), the fracture is completely buccolingual



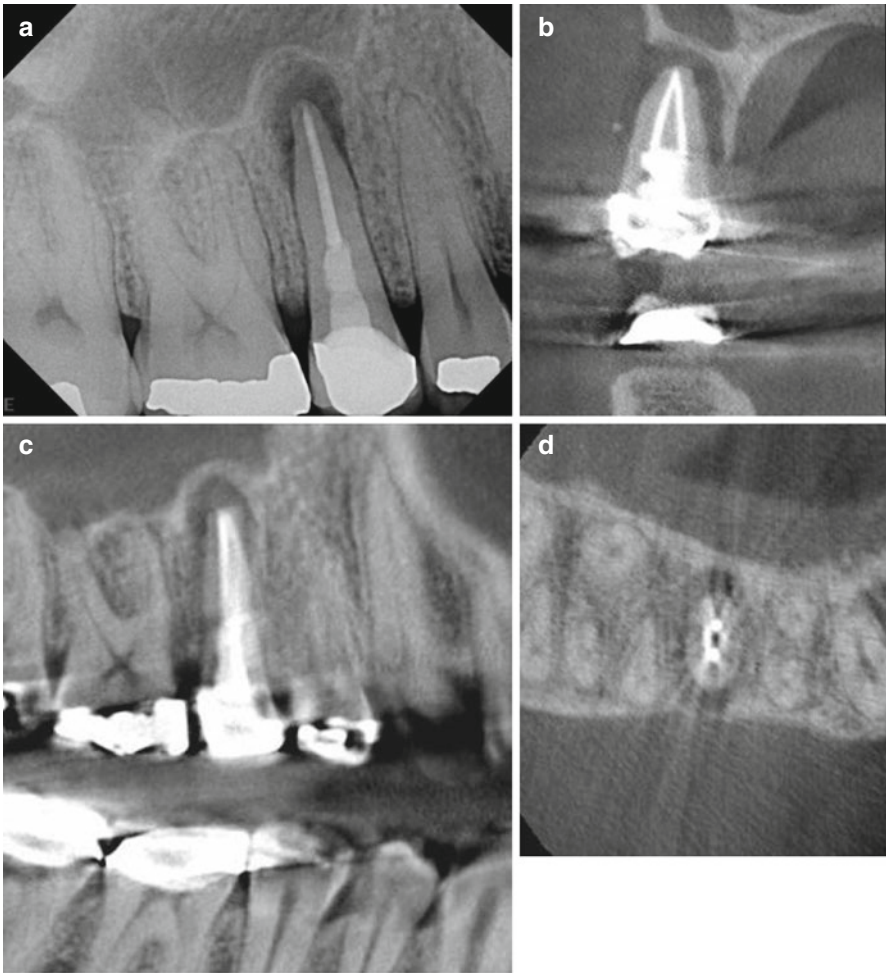
**Fig. 5.14** (a, b) The need for meticulous clinical examination to achieve accurate VRF diagnosis is emphasized in Figs. 5.14, 5.15, and 5.16. A periapical radiograph shows well-condensed gutta-percha filling in the mesial root of a mandibular molar, an amalgam dowel, and typical “halo” radiolucency around the mesial root combined with radiolucency in the bifurcation. Since there were no other signs or symptoms to make a VRF diagnosis, a diagnosis of asymptomatic apical periodontitis was made and the patient scheduled for retreatment (a). Complete healing of the radiolucency can be seen 1 year after retreatment (b) and a new restoration (Courtesy Dr. Z. Elkes)

**Fig. 5.15** Typical bony appearance of a “halo” radiolucency in a poorly filled mandibular molar, combined with radiolucency in the bifurcation. Other signs and symptoms typical to a VRF tooth led to the accurate diagnosis of VRF (Courtesy Dr. T. Blazer)

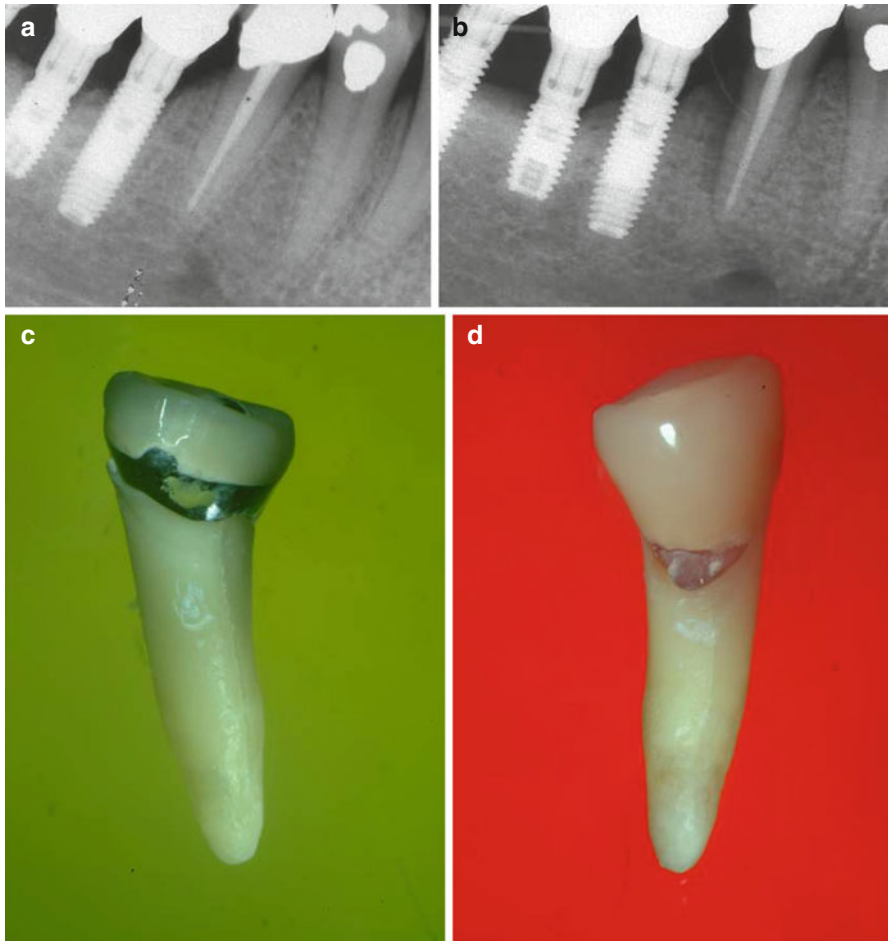




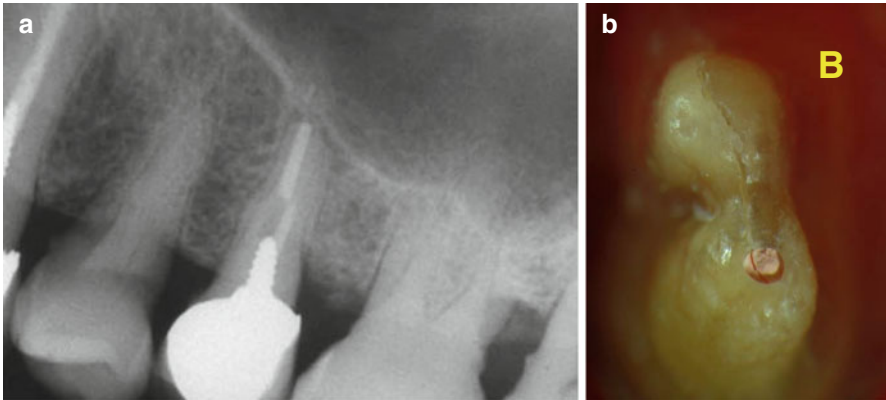
**Fig. 5.16 (a–c)** The patient arrived at the dental office for evaluation regarding tenderness on “touching the gum in the lower jaw.” Clinical examination (a) revealed two connected crowns in the first and second premolars next to implants in the posterior region. A highly located sinus tract was seen in the attached gingivae adjacent to the first premolar. The area was sensitive to palpation but no probing defect noted. The periapical radiograph (b) revealed a diffuse radiolucent bony lesion on the mesial and distal aspect of the root that was suspicious to be more typical to a VRF than of failure of root canal treatment. The canine tested vital. The large bony defect seen in the axial slices of the CBCT Scan (c) (this slice in the apical 2 mm) resulted in a diagnosis of chronic apical abscess, and the tooth was extracted. The extracted tooth did not reveal any fracture (Courtesy Dr. R. Paul)



**Fig. 5.17** (a–d) A periapical radiograph of a VRF tooth in a maxillary second premolar (a). Note the typical “halo” radiolucency around the root. With CBCT imaging, the radiolucency around the root can be seen in the coronal (b), sagittal (c), and axial (d) images. What can be observed is the bone loss around the root but not the fracture itself (Courtesy Dr. R. Ganik)

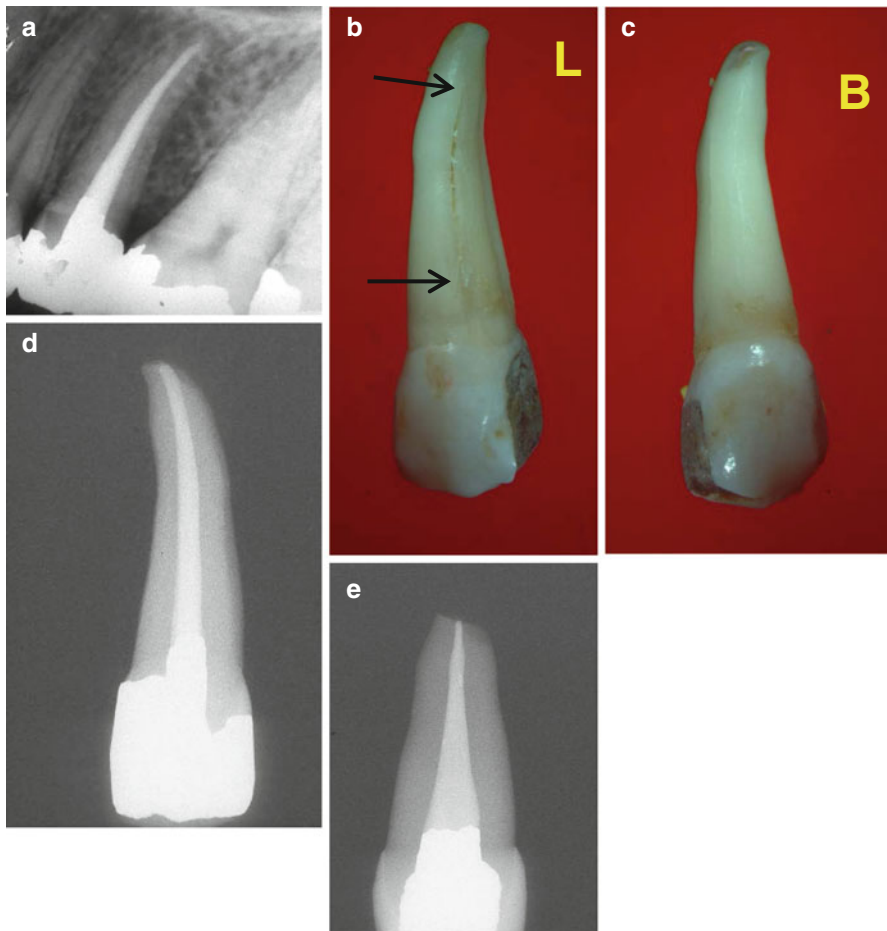


**Fig. 5.18** (a–d) Five years following root canal treatment as a result of symptomatic irreversible pulpitis in a mandibular premolar (a), signs and symptoms of a VRF in this tooth were diagnosed (b). A lateral radiolucency along the distal aspect of the root can be seen, together with a No. 20 gutta-percha tracer via a highly located sinus tract. The utmost importance of urgent tooth extraction was explained to the patient to prevent bone loss adjacent to the tooth, especially in such proximity to the implants (b). The extracted tooth shows a complete narrow fracture both at the lingual (c) and buccal (d) aspects of the tooth

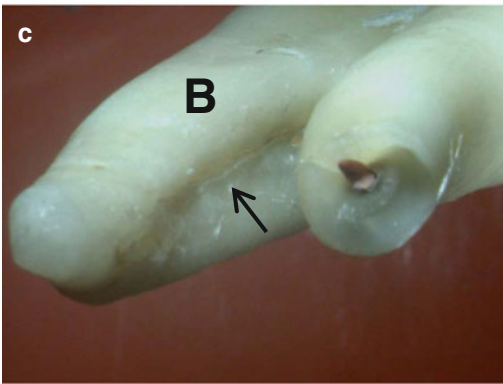
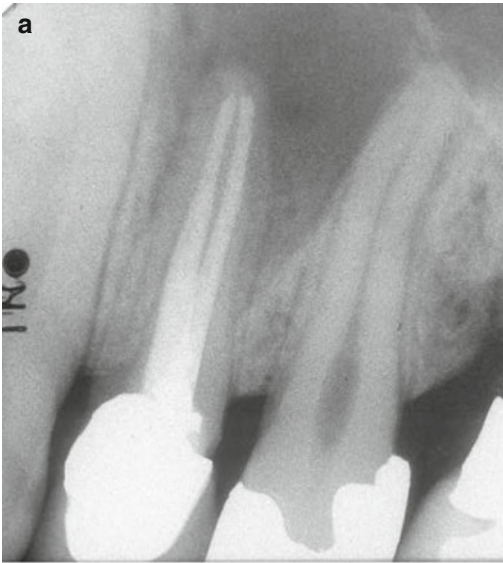


**Fig. 5.19** (a, b) The patient arrived at the dental office with a complaint about discomfort in “touching the tooth and when biting” and pointed to the maxillary second premolar. The tooth had been endodontically treated 4 years previously with gutta-percha, passive cementing of a serrated dowel in the palatal canal, and full coverage to the crown. Examination of the tooth revealed sensitivity to percussion and a 6 mm probing depth in the midbuccal area. The radiograph revealed two obturated canals and the dowel most likely placed in the palatal canal (a). A diagnosis of acute apical periodontitis was made. Since the endodontic prognosis for retreatment was poor, endodontic surgery procedure was suggested. The patient declined any surgery, and the tooth was extracted. Examination of the extracted tooth from the apices (b) shows the deep mesial concavity in the root trunk and the incomplete VRF from the buccal aspect toward the palatal area of the root





**Fig. 5.20** (a–e) Root canal therapy was performed on a maxillary second premolar as a result of chronic irreversible pulpitis. The root canal was obturated with laterally condensed gutta-percha (a). Shortly afterward and for several months, the patient complained of tenderness on biting. On clinical examination, the only sign noted was sensitivity to percussion. No probing, mobility, or bony radiolucency was noted even when the patient was examined 4 months post-op. The patient declined any further treatment, such as endodontic surgery. The tooth was extracted and cleaned. A VRF was found in the middle third of the palatal aspect of the root (*Arrows*) (b) but not in the buccal aspect (c). The well-obtained premolar can be seen in the bench periapical radiographs (d, e). This partial midroot palatal VRF could not be clinically diagnosed. This expresses the difficulties clinicians encounter in making accurate and timely VRF diagnosis (Courtesy Dr. Z. Elkes)



**Fig. 5.21 (a–d)** Patient history revealed that 5 years prior to arriving at the dental office, root canal therapy was performed on the maxillary first premolar with an amalgam dowel and PFM crown. The patient’s chief complaint was tenderness on biting and a “loose tooth.” The patient also experienced two episodes of swelling in the area over the past 3 years. Clinical examination revealed slight mobility, sensitivity to percussion, and a 7 mm probing defect on the midbuccal area. The first periapical radiograph revealed a well-obturator root canal and large “halo” radiolucency (**a**). An additional radiograph with a slight change in angulation showed (**b**) this tooth to be a bifurcated maxillary premolar. When a VRF is suspected it is highly recommended to take two periapical radiographs from different angulations. There was no sinus tract in the attached gingivae, and a definitive diagnosis of a VRF tooth could not be done. The patient declined a surgical flap procedure for final diagnosis and treatment. The tooth was extracted (**c**). The typical depression on the bifurcation aspect of the buccal root with the longitudinal fracture along the depression can be seen in this image following some shaving of the palatal root (*black arrow*). In one of the cross sections done (**d**), complete VRF from one side of the root to the other can be seen in both roots. The typical depression in the buccal root can also be seen



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