Duration from Initial Symptoms to Diagnosis of Vertical Root Fracture in Dental Offices

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Abstract

Diagnosing vertical root fracture (VRF) is difficult. Here, we retrospectively investigated the duration from initial symptoms to a definite diagnosis of VRF in dental offices. Data were collected on patients with VRF between July 2013 and June 2015. Initial symptoms were ascertained from clinical records. The focus was on the maxillary second premolars and mesial roots of the mandibular first molars, where VRF is most frequent. All VRF in the bilateral dentition was analyzed. Only cases in which the buccal-lingual plane of the root was fractured were included. Data from 31 dental offices revealed a total of 39 VRFs in the maxillary second premolars and 43 in the mandibular mesial roots of the first molars. The patients comprised 42 males and 40 females, and the average age was 59.7 ± 11.6 years at initial onset of symptoms. The mean duration from initial symptoms to a definite diagnosis in the maxillary second premolars was 18.3 ± 22.5 months, while that in the mandibular first molars was 16.1 ± 17.8 months. The cumulative diagnostic rate was 48.7% at 12 months and 79.5% at 24 months in the maxillary second premolars, and 38.1% at 12 months and 86.0% at 24 months in the mandibular first molars. No significant difference was observed between tooth type. If VRF is suspected, doctors should explain the risks of tooth extraction and begin considering treatment options. The present results revealed that 80% of VRFs were diagnosed within 2 years of initial onset of symptoms.

Key words: Vertical root fracture — Initial symptoms — Diagnosis — Duration — Dental offices

Introduction

Diagnosing vertical root fracture (VRF) is difficult for the dental practitioner because early signs and symptoms are minimal and similar to those of other conditions, such as periodontal disease and apical periodontitis1,5. Recently, one study found that tooth loss due to VRF was increasing and that the percentage of extractions due to VRF was 31.7%
in dental offices in Tokyo\textsuperscript{6}. This suggests that VRF will become a major problem for patients and dental practitioners in the near future, since extraction cannot be avoided when teeth are diagnosed with VRF\textsuperscript{1}. This means additional treatment will be required for the patient with a concomitant increase in cost. If the symptoms of VRF could be detected earlier, however, it might be possible to explain the problem to the patient and commence treatment planning at an earlier stage than usual. The purpose of this study was to investigate the duration from onset of initial symptoms to a definite diagnosis of VRF in dental offices.

**Methods**

This was a retrospective cohort study. The data were provided by 31 general practitioner dentists, all of whom are members of a clinical research organization. Their dental offices are located in the Kanto (28) and Tokai (3) regions of Japan. The mean period the dentists had been practicing since graduation from dental school was 26.7 $\pm$ 7.5 years (range: 15–49 years) as of April 2016.

1. **Data collected**

Data were collected on patients who had received a definite diagnosis of VRF between July 2013 and June 2015. All were undergoing regular maintenance, attending at least once every 6 months. Only endodontically treated teeth were targeted. Previous reports showed that the maxillary 2nd premolars and mesial roots of the mandibular 1st molars are the most frequent locations for VRF\textsuperscript{2,3,6,7}. Therefore, the focus here was on the maxillary second premolar and the mesial root of the mandibular first molar. Only buccolingual fractures were included. The VRF-diagnosed teeth analyzed included 39 maxillary second premolars and 43 mesial roots of the mandibular first molar from 42 males and 40 females with a mean age of 59.7 $\pm$ 11.6 years at the time of initial onset of symptoms.

The initial symptoms of VRF were determined from clinical records and dental X-rays. These symptoms were ascertained based on visible intraoral findings, patient description, or radiographic evidence of change in comparison with images obtained at an earlier date. Visible intraoral findings comprised tooth mobility, sinus tract, abscess, and pocket depth ($\geq$ 4 mm). Subjective symptoms comprised spontaneous pain, pain when masticating, swelling, and other vague complaints. Radiographic signs comprised widening of the periodontal ligament space, destruction of the lamina dura, increased radio-opacity, halo-like radiolucency\textsuperscript{3}, J-shape radiolucency\textsuperscript{3}, periodontal disease-like radiolucency, apical periodontitis-like radiolucency, abnormality in the vicinity of the apical root, and an abnormally shaped apical root. Dental X-rays were rechecked by one dentist.

Vertical root fracture was defined as cases in which separate pieces were observed on an X-ray image, a fracture line was visible in the extracted tooth, or where there was visual confirmation during surgical assessment.

The protocol of this study was approved by the Ethical Committee of Tokyo Dental College (Approval No.633).

2. **Statistical analysis**

The Mann-Whitney $U$ test was used when comparing two groups. The data were analyzed using IBM SPSS Statistics software, Version 23.0 (IBM Corp., Armonk, NY, USA).

**Results**

The mean duration from initial onset of symptoms to a definite diagnosis of VRF in the maxillary second premolars was 18.3 $\pm$ 22.5 months, and that in the mandibular first molar was 16.1 $\pm$ 17.8 months. No differences were observed between tooth type. The cumulative diagnostic rate was 48.7% at 12 months and 79.5% at 24 months for the maxillary second premolars, and 38.1% at 12 months and 86.0% at 24 months for the mandibular first molars (Fig. 1).
Discussion

Patients are usually reluctant to undergo tooth extraction based on a diagnosis of VRF. Takeuchi et al.\(^4\) reported that the median duration from diagnosis of VRF to obtaining patient agreement to extract was 27.0 months. Adding that figure to the results of the present study revealed that the duration from onset of initial symptoms to extraction was more than 40 months. After this long, bone resorption may be advanced, and burdensome additional treatment may be required.

Our previous report\(^7\) showed that almost all teeth with a diagnosis of VRF occurred in patients of over 50 years in age, irrespective of the duration from pulpectomy to a definite diagnosis (141.1 ± 88.9 months). That study suggested that age might be a stronger indicator of VRF than duration from pulpectomy to a definite diagnosis.

In conclusion, the present results revealed that 80% of VRFs were diagnosed within approximately 2 years from the onset of initial symptoms. If a tooth in an older patient with a history of canal treatment is showing initial symptoms of VRF, the dentist should explain to the patient the possibility of VRF and how it might be treated, in addition to the presumptive diagnosis of periodontal disease or apical periodontitis.

References


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