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CASE REPORT/CASO CLINICO

# Vertical root fracture: A case report and review of the literature

*Frattura verticale della radice: un caso clinico e revisione della letteratura*

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## KEYWORDS

Vertical root fracture;  
Fracture line;  
Extraction;  
Diagnosis;  
Treatment.

## Abstract

**Aim:** Vertical root fracture is one of the most complicated conditions in dental practice as the diagnosis of such cases is challenging. Many etiological factors contribute to vertical root fracture including excessive masticatory force and iatrogenic dental procedures. The treatment options can vary from whole tooth extraction to saving the tooth with certain conservative approaches. The evaluation of the surrounding periodontal tissue and the supporting alveolar bone is essential to determine the prognosis of the tooth. The aim of this article is to report an interesting case of vertical root fracture and review how to diagnose and treat vertical root fracture.

**Methodology:** The Patient was diagnosed with vertical root fracture related to lower right second molar. The fracture line extended from the top of the clinical crown to the apex of the root making the prognosis very poor.

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## PAROLE CHIAVE

Frattura verticale della radice;  
linea di frattura;  
Estrazione;  
Diagnosi;  
Trattamento.

**Results:** The treatment involved the extraction of the tooth and scheduling of the patient for prosthetic rehabilitation. As a result, tooth extraction can be considered as the treatment of choice for vertical root fracture especially in posterior teeth.

**Conclusion:** The combination of comprehensive clinical and radiographic examination is essential to diagnose vertical root fracture. The effectiveness of different treatment options should be evaluated with long-term follow up. Treatment plan need to be discussed with the patient as part of evidence base practice.

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## Riassunto

**Scopo:** La frattura verticale di radice è una delle condizioni più complicate da affrontare nella pratica odontoiatrica poichè la diagnosi di tali casi è difficile. Molti fattori eziologici contribuiscono alla frattura verticale, tra cui un'eccessiva forza masticatoria e procedure dentali iatrogene. Le opzioni di trattamento possono variare dall'estrazione al tentativo di salvare il dente con alcuni approcci conservativi. La valutazione del tessuto parodontale circostante ed il supporto dell'osso alveolare è essenziale per determinare la prognosi del dente. Lo scopo di questo articolo è quello di descrivere un interessante caso di frattura verticale ed effettuare una revisione della letteratura su come diagnosticare e trattare la frattura verticale di radice.

**Metodologia:** Al paziente è stata diagnosticata una frattura verticale relativa al secondo molare inferiori di destra. La linea di frattura si estendeva dalla parte superiore della corona clinica all'apice della radice rendendo la prognosi molto infausta.

**Risultati:** il trattamento ha coinvolto l'estrazione del dente e la programmazione del paziente per la susseguente riabilitazione protesica. L'estrazione del dente può essere considerata come il trattamento di scelta per la frattura verticale soprattutto nei denti posteriori. In conclusione, la combinazione fra l'esame clinico e radiografico è fondamentale per una diagnosi di frattura verticale. L'efficacia di diverse opzioni di trattamento deve essere valutata con un lungo periodo di follow up ed il piano di trattamento deve essere discusso con il paziente sulla base di una pratica basate sull'evidenza scientifica.

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## Introduction

According to the American Association of Endodontics, vertical root fracture (VRF) is "A longitudinally oriented fracture of the root that originates from the apex and propagates to the coronal part".<sup>1</sup> Also, it can be defined as "longitudinally oriented fractures of the root, extending from the root canal to the periodontium".<sup>2</sup> In general, tooth fracture is considered the third most common cause of tooth loss.<sup>3</sup> In addition, VRF composes 2–5% of whole tooth fracture cases.<sup>4</sup> The incidence of VRF is more commonly associated with endodontically than non-endodontically treated teeth.<sup>5</sup> It occurs mainly in patients above forty years of age, and twice higher in males than females.<sup>6,7</sup> The most susceptible teeth in order are premolars, molars, incisors then canines.<sup>8</sup> The incidence of VRF in mandibular molars are two times higher than maxillary molars, some studies claim that the root depressions in the mesial root of mandibular molars and the buccal root of bicuspid premolars lead to more susceptibility for VRF.<sup>5,8</sup>

Literature points out that VRF can be classified by two methods.<sup>9,10</sup> First method is based on the relation of the fracture to the alveolar bone crest either the fracture terminates superior to the alveolar bone crest (supra-osseous), which does not cause any periodontal effect, or terminates inferior to the alveolar bone crest (infra-osseous) compromising the periodontium and the supporting bone.<sup>9</sup> The second method for VRF classification is based on the

visibility of the separated fragments either there is a visible separation, which is referred to as complete VRF, or invisible separation called incomplete VRF.<sup>10</sup>

## Diagnosis

The difficulty of dealing with VRF is based on fact that the diagnosis is complicated as misdiagnosis of such cases occurs frequently.<sup>11</sup> Multiple radiographic signs can be related to VRF including fracture appearance to the root structure or the surrounding structure.<sup>12,13</sup> Dislodgment of the root fragments, post, canal filling and appearance of double images all are indication for VRF.<sup>12</sup> Also, finding a radiolucent line or space around the root canal filling or the post can be related to VRF.<sup>13</sup> On the other hand, evaluation of the surrounding structure could lead to diagnosis of such cases as different bone defects such as horizontal, vertical, bifurcation and step-like bone loss are associated with VRF.<sup>13</sup> Other findings as widening of periodontal ligaments or resorption around the suspected fracture area can be linked to the presence of VRF.<sup>12,13</sup> Because conventional radiograph has the limitation of being two-dimensional x-ray, the use of advanced radiographic system has been suggested.<sup>14</sup> It has been found that using three-dimensional radiograph system as Cone Beam Computed Tomography (CBCT) shows more information regarding the presence, location and extension of VRF. Even

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