Giornale Italiano di Endodonzia (2014) **28**, 91—96

Available online at www.sciencedirect.com

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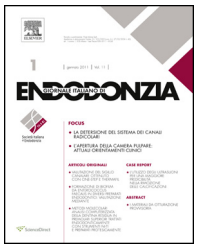

LITERATURE REVIEW/REVISIONE DELLA LETTERATURA

Diagnostic issues dealing with the management of teeth with vertical root fractures: a narrative review

Diagnosi della frattura verticale della radice in previsione di una sua corretta gestione clinica: revisione della letteratura

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Received 29 September 2014; accepted 14 November 2014
Available online 11 November 2014

KEYWORDS
Vertical root fracture;
CBCT;
Diagnosis;
Postextraction implant.

Abstract
Aim: The objectives of this study were to review the existing literature of vertical root fractures (VRFs) dealing with its management and to describe a classification for the bone defects resulting after extraction.
Methodology: An electronic search was performed on biomedical databases using a combination of appropriated search terms combined through the use of Boolean operators. A classification of the bone defects associated with vertical root fracture (VRF) was also proposed.
Results: Outcomes data extracted from the selected articles were summarized. Conventional radiography could fail in directly detecting the presence of VRF but can allow finding bone resorption areas which are related to the fracture itself. Tridimensional radiography (CBCT) may allow a better visualization of such bone defects. The bone defects associated to VRF could be

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Peer review under responsibility of Società Italiana di Endodonzia

Production and hosting by Elsevier

http://dx.doi.org/10.1016/j.gien.2014.10.002

classified on the basis of the number of walls affected and of the depth (in apico-coronal direction).
Conclusions: The diagnosis of VRF is a challenging process that includes both clinical and radiographic examination. In most cases, when postextraction implant was placed, guided bone regeneration is required to compensate the bone defect caused by VRF. A deep knowledge of the characteristics of the associated bone defect may allow an immediate and predictable substitution with dental implants, when tooth extraction is the only option.

PAROLE CHIAVE
Frattura verticale;
CBCT;
Diagnosi;
Impianti post-estrattivi.

Riassunto
Obiettivi: Lo scopo dello studio è stato valutare la letteratura riguardante le fratture verticali della radice (VRF) e la loro gestione clinica, illustrando una classificazione dei difetti ossei ad esse associate.
Materiali e metodi: È stata condotta una ricerca della letteratura utilizzando motori di ricerca elettronici, interrogati utilizzando una stringa preparata ad hoc.
Risultati: I risultati estratti dagli articoli selezionati sono stati riassunti. La radiografia convenzionale periapicale può non essere sufficiente per individuare con certezza la presenza di VRF ma può permettere di individuare aree di riassorbimento osseo, correlate alla frattura stessa. I difetti ossei associati alle VRF possono essere classificati sulla base del numero di pareti coinvolte e sulla sua dimensione apico-coronale.
Conclusioni: La diagnosi di VRF è un processo spesso complesso che deve includere una valutazione sia clinica sia radiografica. Inoltre, nel caso di estrazione, quando vengono posizionati impianti postestrattivi, la rigenerazione ossea è spesso fondamendale per compensar eil difetto osseo creato dalla VRF. Una conoscenza profonda delle caratteristiche del difetto osseo associate può consentire una sostituzione immediata e predicibile con impianti dentali, quando l'estrazione dell'elemento fratturato è l'unica opzione.

Introduction

The term vertical root fracture (VRF) refers to a fracture developing from apical or coronal portion of the root of a tooth and developing vertically along the root axis. These kinds of fractures can be complete or incomplete, and are usually directed facio-lingually[1].

VRF are more frequent in endodontically treated teeth[2,3] and it was hypothesized that it was because of an oversized root canal therapy that weakened canal dentin walls or of the presence of endodontic posts.[4] The continuous chewing forces lead to a higher prevalence of longitudinal fractures in treated teeth as compared to untreated.[5,6]

Chewing forces direction and entity seem to have an important role in determining the formation of a vertical fracture of root, also in non-treated teeth.[7]

The diagnosis of VRF may not be always easy due to lack of specific signs, symptoms and/or radiographic features, and due to many precipitating causes.[8] These limitations may lead to invasive diagnostic and exploratory surgical approaches to determine the presence of a VRF.[9,10]

Although, conservative approaches may be used to obviate extraction of the fractured tooth the prognosis of teeth with VRF is often poor.[9,11–13]

Under the circumstances a dental implant is considered the treatment of choice. But the success of the latter depends upon the timing and surgical approach which should be considered carefully based on the residual bone volume and the presence of any residual infection.[14] Even though the presence of a chronic infection in the site of implant placement could not be already considered as an absolute contraindication to implant placement, as it was shown in several systematic reviews of the literature,[15,16] this could have created bone resorptions and also complete disruptions of bony wall, limiting the possibilities of implant placement.

Literature has validated the use of guided bone regeneration to treat peri-implant bone defects at the time of implant placement.[17,18]

A recent systematic review of the literature proposed a classification of bone defects that can be associated to vertically fractured teeth.[19] In that paper, authors presented different clinical situations that can occur due to the infection spreading from the vertically fractured tooth. In all these cases, in order to obtain an adequate stability of the immediately placed implant, the application of guided bone regeneration procedures could be considered mandatory.

The aim of this narrative review of the literature was to revise the existing literature about the radiological and clinical diagnosis of vertical root fractures and to integrate the outcomes with the clinical classification of bone defects.

Materials and methods

An electronic search was performed on biomedical databases MEDLINE through Pubmed interface (http://www.pubmed.com), EMBASE (http://www.embase.com), and Cochrane Central Register of Clinical Trials (http://www.cochrane.org) using the following

search terms combined with the use of Boolean operators ("AND" and "OR"): "post extraction implants," "dental implant," "extraction socket," "bone defect," "bone dehiscence," "immediate implant," "immediate placement." No time nor language