



CODEN [USA]: IAJPBB

ISSN: 2349-7750

INDO AMERICAN JOURNAL OF PHARMACEUTICAL SCIENCES

<http://doi.org/10.5281/zenodo.2634129>

Available online at: <http://www.iajps.com>

Research Article

X-RAYS DIAGNOSTICS OF THE TOOTH ROOTS RESORPTION

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Article Received: February 2019

Accepted: March 2019

Published: April 2019

Abstract

Purpose of research. Assessment of informational content of x-ray method of research of root canal resorption, allowing an accurate evaluation of the localization, the size of the process and to plan the treatment CBCT.

Materials and methods. The present study was approved by local ethic committee Sechenov University 19.04.2017 N 03-17. The patient signed a form of informed consent and gave written permission for the processing of personal information and publication of pictures. The material for the study was the literature publications mainly in the last ten years: x-ray signs that are observed in various types of resorption, as well as their own x-ray materials in the examination of patients with the diagnosis: external cervical resorption of the tooth 13 (K 03.3). To confirm the diagnosis, CBCT was performed, with the help of which it was possible to make accurate diagnoses, estimate the volume of the resorbed area and plan the treatment of root resorption.

Results. Treatment of root resorption after CBCT was performed in the following sequence:

1. Endodontic treatment with subsequent filling resorption section and the outer access.
2. Pulp extirpation, mechanical and medical treatment of the canal.
3. The crown part is restored with Enamel filling material.
4. Treatment was complicated by the position of the focus on the border of the Palatine and distal surface of the root. The surgeon-dentist was thrown Muco-periosteal flap. With the help of an operating microscope, the resorption site was visualized and cleaned with carbide spherical boron No. 3, then the resorbed cavity was further treated with a solution of trichloroacetic acid 40%. The defect is closed, the MTA and the Wound sutured.

Summary:

1. Tooth root resorption is a poorly understood pathological process, which not sufficiently described in the literature; the timely diagnosis of it may be a problem in practical dentistry.
2. Different types of resorption may look different on x-rays. It is necessary to carefully examine the patient before making a diagnosis and planning the treatment of a tooth with internal root resorption.
3. At present, CBCT is the most objective diagnostic method within root resorption, allowing to accurately assess the location, size of the process and plan the treatment.
4. Despite the large amount of root defect, timely treatment provides a good long-term prognosis for teeth affected by cervical resorption.

Key words: resorption of tooth tissues; etiological factors; radiological methods of diagnostics of resorption of tooth tissues; cone - beam computed tomography in the diagnosis of resorption of tooth tissues; treatment of resorption.

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Please cite this article in press Loos Yu.G and I.M.Makeeva., *X-Rays Diagnostics of The Tooth Roots Resorbtion.*, *Indo Am. J. P. Sci.*, 2019; 06(04).

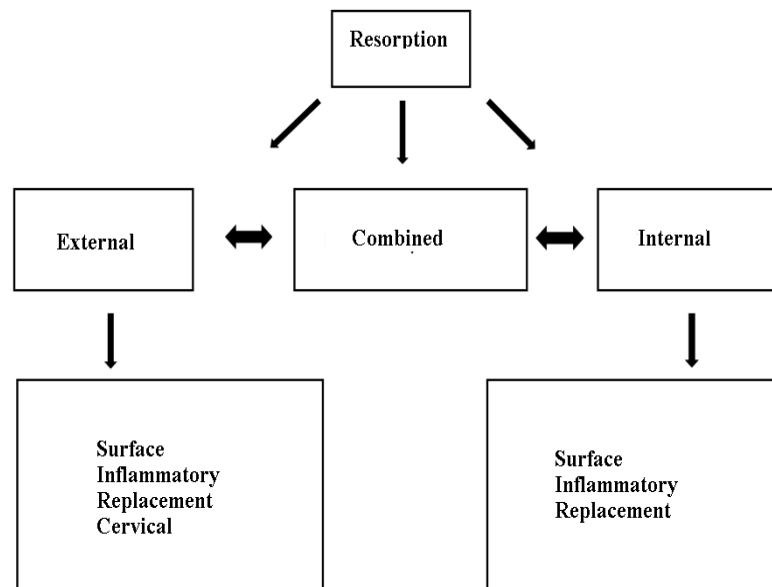
INTRODUCTION:

Tooth root resorption is a pathological and physiological process that leads to loss of dentine or cement. Mineralized tissues of permanent teeth are not normally resorbed [1, 2]. The published studies indicate that the resorption process occurs when the structure of the outer or inner surface of the root is disturbed in the presence of two factors: damage to the protective layer of cement (the cement and the layer of cement-blasts) or dentin to the inner surface of the root (pre-dentine and dentinoblasts) resulting in the formation of exposed areas of dentin and also in the presence of incentives for the activation and transport of clastic cells.

Currently, there are a large number of classifications of tooth resorption based on localization, the mechanism of formation and the type of process. According to the International Classification of Diseases (ICD-10), there are several types of pathological resorption: internal, external, and pathological (K03.3).

External resorption is the process of destruction of cement and dentin on the outer surface of the root. Lejf Tronstad distinguishes transient, infectious and replacement resorption of the tooth roots. In addition, the classification of Andreassen J.O. is of interest to practitioners (Scheme 1).

Scheme 1. Classification of Andreassen J.O.



Internal root resorption is a progressive process of dentin destruction that occurs within the root canal system and is associated with an inflammatory process in the pulp.

An internal replacement resorption is also distinguished, in which replacement dentin is irregularly deposited on the surface of resorbed sites, as a result of a reparative response to inflammation in the pulp.

Resorption of the outer surface of the root can be caused by the inflammatory process in the periodontal disease, trauma (acute or chronic), excessive pressure of adjacent tumors.

Internal resorption can be caused by a carious process, trauma (mechanical, thermal, chemical), leading to damage and subsequent inflammation of the pulp.

Some researchers associate the onset of the resorption process with a number of diseases, for example, hyperparathyroidism, Paget's disease, Gancher's disease, shingles and the degeneration of odontoblasts due to systemic viral infection [3].

Accurate data on the frequency of resorption are currently not available, because the use of different research methods gives different results. It is assumed that the probability of occurrence varies from 0.01% to 55% of teeth exposed to etiological factors, histological studies confirm a higher incidence of the process [4].

Sections, the degree of demineralization of which is more than 75%, are determined radiographically. In fact, the resorptive focus may be larger; this fact must be taken into account when planning treatment.

X-ray inflammatory resorption looks like radioluminescence patches on the outer surface of a root, a rounded, wavy, cup-shaped form that breaks the smooth contour of the root surface.

External cervical resorption is manifested in the form of radio luminescent centers eaten by moths, irregular, localized in the cervical third of the root and propagating along the root canal. With an approximate localization of the lesion, a radiopaque line bounding the pulp chamber from the resorption site is visualized on the X-ray image.

Replacement resorption is characterized by shortening of the apical part of the root with its replacement by

trabecular bone; the root becomes dull, but maintains a relatively smooth contour.

Depending on the type of internal resorption appears on the X-ray in different ways. The internal resorption of the root appears on the X-ray picture as a radiolucency of a rounded shape with even clear contours. Replacement root resorption is manifested on X-rays by an uneven, patchy, cloudy expansion or intermittent course of the root canal. When conducting a two-dimensional X-ray examination, it is necessary to differentiate the internal root resorption from the external cervical resorption, since both lesions may have a similar X-ray picture. It is necessary to perform a series of images in different projections for differential diagnosis. The image of the focus of external resorption will move beyond the direction of the X-ray tube, while the internal will not change its position relative to the root and root canal [5].

It is necessary to pay attention to the limitations of two-dimensional X-ray picture, which provide a two-dimensional picture of three-dimensional objects. The displayed anatomical structures may be distorted, which can lead to incorrect diagnosis and incorrect treatment. Such inaccuracies in the process of image acquisition as incorrect angulation and incorrect position of the tooth with respect to the sensor will lead to errors in the interpretation of images. Pictures of poor quality may have artifacts and contribute to misdiagnosis [6,7].

Purpose of the study:

Assessment of informational content of x-ray method of research of root canal resorption - CBCT, allowing an accurate evaluation of the localization, the size of the process and plan the treatment.

MATERIALS AND METHODS:

The present study was approved by local ethic committee Sechenov University 19.04.2017 N 03-17. The patient signed a form of informed consent and gave written permission for the processing of personal information and publication of pictures.

The material for the study was the literature publications mainly in the last ten years: x-ray signs that are observed in various types of resorption, as well as their own x-ray materials in the examination of patients with the diagnosis: external cervical resorption of the tooth 13 (K 03.3). To confirm the diagnosis, CBCT was performed, with the help of which it was possible to make accurate diagnoses, estimate the volume of the resorbed area and plan the treatment of root resorption.

Cone-beam computed tomography:

Today, it is preferable to use CBCT (cone-beam computed tomography) to diagnose internal resorption. CBCT has been used in dentistry since 1981. Conventional computed tomography creates an image on different layers, CBCT creates an image in 3D pixels (voxels). The voxels are isotropic, and therefore it is possible to accurately measure an object in different directions. Thanks to these facts, it is possible to visualize a geometrically undistorted image of the maxillofacial region, which can be evaluated in various projections. In addition, in order to provide high resolution images, CBCT is available for field-of-view (FOV) for use in different situations [7]. A device with limited FOV in endodontics is usually sufficient.

The discontinuity of the cortical plate, as well as the expansion of the periodontal gap, are an early symptom of periapical pathology. Therefore, the optimal resolution for obtaining images with CBCT used in endodontics should not exceed 200 nm (the average width of the periodontal space), which is quite enough to detect internal root resorption at an early stage.

When performing CBCT, the patient receives a lower radiation load than with conventional computed

tomography. It should also be noted that the image of a single tooth, obtained using high-resolution CBCT, replaces three targeted intraoral X-rays [8,9]. A study published in the Iranian X-ray Journal showed that CBCT with different voxel sizes has relatively equal diagnostic efficacy in terms of sensitivity and specificity for detecting defects of varying size in different areas and root surfaces, and this method has sufficient diagnostic value to detect external roots resorption. Although small differences in sensitivity and specificity were found in voxel sizes of 150, 200, 250, and 300 μm , they were not significant [10].

RESULTS:

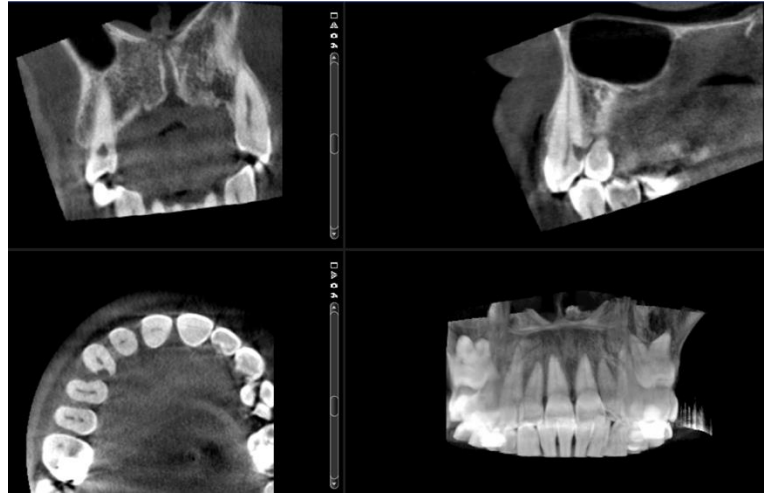
Below, we present a clinical case as an example of the diagnosis of root resorption. In February 2016, patient K., born in 1957, applied to the UNIT dental clinic in Perm with complaints of discoloration of the tooth 13, which appeared a few months ago, gradually increasing. When collecting the history, the patient pointed to injury, which was received when falling on the rink about a year ago. When analyzing the targeted intraoral X-ray diffraction, a radiolumination center of a rounded shape in the upper third of the root was found. To differentiate the type of resorption, a series of sighting shots were taken at different angles (in different projections) (Figure 1).

Figure 1: X-rays made in various projections for differential diagnosis between internal and external resorption.



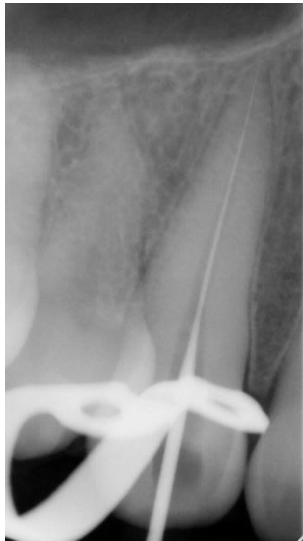
On examination, tooth 13 is intact, percussion is painless, and the temperature test is negative. EDI > 100 μA . The mucous membrane of the alveolar process in the area of 13 physiological staining, without visible pathological changes, is painless on palpation.

To confirm the diagnosis, CBCT was performed, with which it was possible to make an accurate diagnosis of external cervical resorption of tooth 13 (K 03.3), estimate the volume of the resorbed area and plan the treatment (Figure 2).

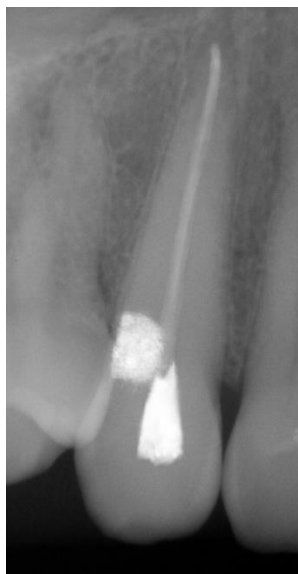
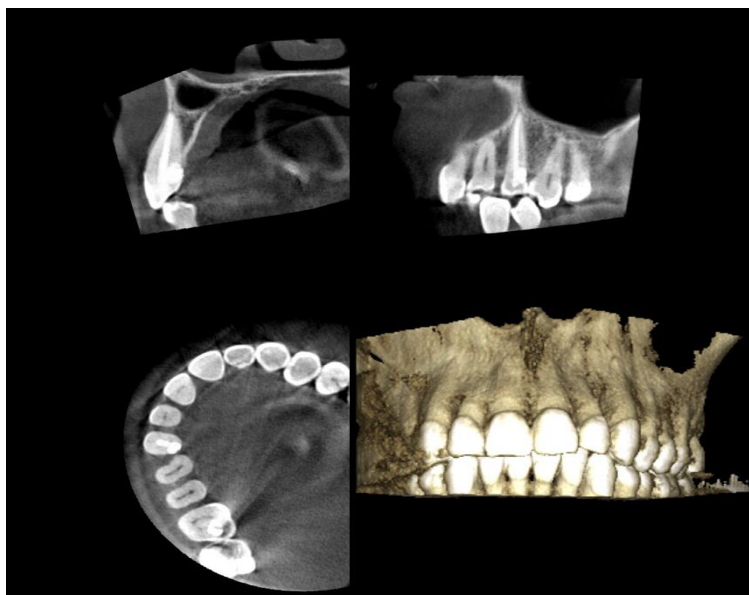
Figure 2: Diagnostic CBCT

CBCT revealed a message of resorption with the tooth cavity, it was decided to carry out endodontic treatment with subsequent sealing of the resorbed area through external access. The pulp extirpation, mechanical and drug treatment of the canal were carried out. The crown part was restored with Enamel filling material. The treatment was complicated by the position of the lesion on the border of the palatine and distal root surfaces.

The dental surgeon pushed back the periosteal graft. With the help of an operating microscope, the resorption site was visualized and cleaned with carbide nodular boron No. 3, then the resorbed cavity was additionally treated with a solution of trichloroacetic acid 80%. The defect was closed by MTA, the wound was sutured. During the machining process, a message of the resorbed area with the tooth cavity was detected. (Figures 3, 4).

Figure 3 : X-ray during treatment**Figure 4: X-ray during treatment**

The patient had no complaints in the spring of 2018. Percussion of tooth 13 is painless. Periodontal tissue is normal. X-ray destruction of hard tissues of the tooth and bone tissue surrounding the tooth is not observed. (Figures 5, 6).

Figure 5: X-ray after 2 years after treatment**Figure 6 CBCT after 2 years after treatment**

Heithersay described in detail the external cervical resorption, its signs, possible predisposing factors, the clinical picture. Proper diagnosis of the type of resorption, its location and volume is important for choosing a specific treatment and, therefore, improving the prognosis for the affected tooth [11]. Literary sources indicate possible difficulties in conducting a differential diagnosis between intra-root resorption and external cervical resorption [12,13, 14].

In cases where clinical pathognomonic signs of external cervical resorption are absent, X-ray examination is indispensable. The diagnostic ability of two-dimensional radiographs is limited because they provide a two-dimensional image of a three-dimensional object. Two-dimensional images reveal changes in the root canal, but the actual length and location of the focus are not clear [15].

The appearance of cone-beam tomography in dentistry and its availability at an outpatient dental appointment opened up new possibilities for visualization in the maxillofacial region. CBCT creates an image in 3D pixels (voxels), voxels are isotropic, this ensures that the resulting images are geometrically accurate, and the measurements have no distortion [16]. One study reported that CBCT is 100% accurate in diagnosing the presence and determining the type of root resorption, in contrast to intraoral radiographs, which resources for timely diagnosis were lower [17]. A study comparing CBCT and 2D X-ray, showed that CBCT is much more effective in detecting external

resorption, and CBCT, as a rule, more effectively identified root perforations [18].

The literature describes a variety of approaches to the treatment of external cervical resorption, such as subgingival curettage, orthodontic extrusion to provide access to the defect, deliberate re-plantation, surgical access. In addition to machining the cavity, it is recommended to use 80-90% aqueous solution of trichloroacetic acid, because it causes necrosis and coagulation of granulation tissue, causes inactivation of any potentially resorptive cells, reducing the likelihood of recurrence. It also helps control hemorrhage [19]. Various methods and materials processed the lesion areas in the root, caused by external cervical resorption. Smidt and coauthors have demonstrated successful treatment using an interdisciplinary approach with orthodontic root extrusion, endodontic treatment and resorbed cavity filling [20]. Hiremath and colleagues used glass ionomer cement to seal the resorption site [21]. It is also recommended to use MTA as a material for filling the resorbed defect, which inhibits the activity of bacteria, it is not affected by the presence of moisture and blood (the moisture in the surrounding tissue acts as a catalyst for a chemical reaction in this material), and it can also harden and form an airtight restoration due to its hydrophilic characteristics [22]. In the clinical case described by Eftekhar and coauthors, the selected material was biodentin, as it had the best consistency after mixing, was easy to use and did not change the color of the teeth as compared to MTA. It

is biologically active, biocompatible, non-absorbable, has sufficient adhesion to the walls of the dentin, which makes it an excellent material for sealing resorbed defects [23]. However, information on its use specifically in the resorptive defect is limited; the long-term color stability of biodentin in such a case remains unproven [24].

The main purpose of the treatment of external cervical resorption is the complete removal of resorbed and granulation tissue, the restoration of the damaged area of the root.

CONCLUSION:

Tooth root resorption is a poorly understood pathological process, which not sufficiently described in the literature, the timely diagnosis of which may be a problem in practical dentistry.

Different types of resorption may look different on x-rays. It is necessary to carefully examine the patient before making a diagnosis and planning the treatment of a tooth with internal root resorption.

At present, CBCT is the most objective diagnostic method within root resorption, allowing to accurately assess the location, size of the process and plan the treatment.

Despite the large amount of root defect, timely treatment provides a good long-term prognosis for teeth affected by cervical resorption.

Source of funding and conflict of interest. The authors of this article confirmed the lack of financial support for the study and a conflict of interest that must be reported.

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