VANDA HELENA DE FARIA QUEIROZ

TOMOGRAFIA COMPUTADORIZADA DE FEIXE CÔNICO NO DIAGNÓSTICO DE REABSORÇÃO RADICULAR EXTERNA EM DENTES PERMANENTES REIMPLANDOS: *UMA INVESTIGAÇÃO EM VIVO*

Vanda Helena de Faria Queiroz

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Monografia apresentada ao Curso de Pós-Graduação Lato Sensu em Radiologia e Imaginologia Odontológica da Faculdade de Odontologia da UFMG, como requisito parcial para obtenção do título de Especialista em Radiologia.

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Ata da Comissão Examinadora para julgamento de Monografia da aluna **VANDA HELENA DE FARIA QUEIROZ**, do Curso de Especialização em Radiologia Odontológica e Imaginologia, realizado no período de 13/02/2017 a 20/12/2018.

Aos 18 dias do mês de dezembro de 2018, às 15:00 horas, na sala de Pós-Graduação (3403) da Faculdade de Odontologia, reuniu-se a Comissão Examinadora, composta pelos professores Tania Mara Pimenta Amaral (orientador), Claudia Borges Brasileiro e Daniela Augusta Barbato. Em sessão pública foram iniciados os trabalhos relativos à Apresentação da Monografia intitulada **"Reabsorção externa radicular associada ao traumatismo dentário: comparação entre radiografia periapical e tomografia computadorizada Cone Beam - uma investigação in vivo"**. Terminadas as arguições, passou-se à apuração final. A nota obtida pela aluna foi _100_ (____Cem____) pontes, e a Comissão Examinadora decidiu pela sua ____Aprovação____. Para constar, eu, Tania Mara Pimenta Amaral, Presidente da Comissão lavrei a presente ata que assino, juntamente com os outros membros da Comissão Examinadora. Belo Horizonte, 18 de dezembro de 2018.

Prof. Tania Mara Pimenta Amaral

Orientador

Prof. Claudia Borges Brasileiro

Prof. Daniela Augusta Barbato

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RESUMO

As reabsorções radiculares externas progressivas inflamatórias (RREI) e por substituição (RRES) representam a sequela mais frequente em dentes permanentes reimplantados ou que sofreram luxações intrusivas. O exame clínico, incluindo os sinais e sintomas e ainda os exames complementares, em destaque os exames radiográficos são fatores determinantes para o diagnóstico. A radiografia periapical (RP) é o exame complementar de escolha para o acompanhamento em casos de RRE, no entanto, as imagens bidimensionais apresentam sobreposições de estruturas anatômicas. Para suprir as limitações apresentadas pelas radiografias convencionais as imagens multiplanares vêm sendo amplamente utilizadas, destacando-se a tomografia computadorizada de feixe cônico. O objetivo do presente estudo foi fazer uma avaliação do desempenho de exames de imagem da TCFC e de radiografias periapicais para diagnóstico dos diferentes tipos de RRE pós-traumáticas, em diferentes estágios. A amostra foi composta por 29 pacientes, com 39 incisivos superiores reimplantados após avulsão. Radiografias periapicais e TCFC realizadas no mesmo dia foram examinadas de forma independente por 2 avaliadores, a fim de identificar a presença, o tipo e a extensão da reabsorção radicular nos dois exames. As reabsorções leves e as inflamatórias foram mais frequentemente identificadas pela TCFC enquanto as reabsorções moderadas a severas e por substituição nas radiografias periapicais. Pode-se concluir que apenas uma técnica radiográfica não é suficiente para o diagnóstico de todos os tipos e gravidade de RRE, sendo assim a TCFC é importante para complementar o exame periapical, principalmente em estágios iniciais.

Palavras-chave: Reabsorção da raiz. Tomografia computadorizada de feixe cônico. Diagnóstico por imagem. Reabsorção radicular externa de substituição. Reimplante dental.

ABSTRACT

Cone Beam Computed Tomography in the diagnosis of external root resorption in replanted permanent teeth: - an *in vivo* investigation

The progressive external inflammatory root resorptions (IERR) and substitution (RERR) represent the most frequent sequelae in permanent teeth replanted or that suffered intrusive dislocations. The clinical examination, including the signs and symptoms and the complementary exams, highlighting the radiographic examinations are determining factors for the diagnosis. Periapical radiography (PR) is the complementary exam of choice for follow-up in RRE cases, however, two-dimensional images show overlaps of anatomical structures. In order to overcome the limitations presented by conventional radiographs, multiplanar images have been widely used, particularly concomitant computed tomography. The objective of the present study was to make a evaluation of the performance of CBCT and periapical radiographs for the diagnosis of different types of posttraumatic RRE at different stages. The sample consisted of 29 patients, with 39 superior incisors reimplanted after avulsion. Periapical radiographs and CBCT performed on the same day were independently examined by 2 evaluators in order to identify the presence, type and extent of root resorption in both examinations. Mild and inflammatory resorptions were more frequently identified by CBCT while moderate to severe resorptions and by replacement in periapical radiographs. It can be concluded that only one radiographic technique is not sufficient for the diagnosis of all types and severity of RER, so CBCT is important to complement periapical examination, especially in the early stages.

Key words: Root resorption. Computed tomography. Cone-beam computed tomography. Diagnosis imaging. Tooth replantation.

SUMÁRIO

1 CONSIDERAÇÕES INICIAIS

A reabsorção radicular externa inflamatória (RREI) e a por substituição (RRES) representam a sequência mais frequente em dentes permanentes que foram reimplantados e foram relatados com frequência variando de 6,8 a 64,3% e 18,1 a 94,1%, respectivamente. Ambas as formas resultam em danos irreversíveis à estrutura da raiz que podem levar à perda do dente ou a consequências funcionais, estéticas, psicossociais e econômicas relevantes (Nguyen *et al.*, 2004).

O diagnóstico precoce e diferencial dos diferentes tipos, localização e estágios da reabsorção radicular é fundamental para um correto plano de tratamento e, consequentemente, melhorar o prognóstico do dente. Considerando que os sintomas clínicos aparecem apenas nos estágios finais de ambos os tipos, o diagnóstico dessas entidades tem sido rotineiramente feito com a ajuda de radiografias. No entanto, imagens bidimensionais mostram sobreposições de estruturas anatômicas, o que é um fator limitante para o diagnóstico de RRE (Cavalcanti, 2010; Aziz *et al.*, 2014).

Nas últimas décadas, para superar as limitações apresentadas pelas radiografias convencionais, imagens multiplanares têm sido amplamente utilizadas, como a tomografia computadorizada de feixe cônico (TCFC) (Safi *et al.*, 2017).

A tomografia computadorizada pode fornecer maior precisão quanto ao grau de envolvimento dentário e localização da reabsorção, bem como a identificação precoce do processo devido aos vários planos de cortes e reconstrução em 3D. Portanto, o presente estudo teve como objetivo avaliar clinicamente o desempenho de CBCT e radiografias periapicais (RP) digitais no diagnóstico de diferentes tipos de RRE, em diferentes estágios, em dentes permanentes replantados após a avulsão.

2 OBJETIVOS

2.1 Objetivo geral

Comparar as imagens de reabsorção radicular em radiografias periapicais e imagens de tomografia computadorizada tipo feixe cônico.

2.2 Objetivo específico

Avaliar clinicamente o desempenho de TCFC e radiografias digitais no diagnóstico de diferentes tipos de RRE, em diferentes estágios, em dentes permanentes replantados após a avulsão.

3 METODOLOGIA

3.1 Pacientes e dentes

Este estudo foi aprovado pelo Comitê de Ética da Universidade Federal de Minas Gerais (66813417.7.0000.51494). Um termo de consentimento livre e esclarecido foi obtido de todos os pacientes.

A amostra foi composta por 29 pacientes, 21 do sexo masculino (72,5%) e 08 do sexo feminino (27,5%), com 39 incisivos superiores reimplantados após a avulsão (6 incisivos laterais e 33 incisivos centrais). A idade do paciente no momento da lesão variou de 8,0 a 41 anos (média de 14,4).

O tempo decorrido entre o trauma e o exame foi de 23 dias a 14 anos. Os pacientes foram acompanhados na Clínica Odontológica de Trauma da Faculdade de Odontologia da Universidade Federal de Minas Gerais, em Belo Horizonte, Brasil.

3.2 Técnicas radiográficas

Radiografias periapicais foram realizadas utilizando um sistema digital com técnica de paralelismo. O aparelho de raios X Gendex (765DC, Paris), operando a 65 KV e 7mA 0,2 segundos. Sistemas de placa de armazenamento de fósforo VistaScan® (Durr Dental, Bietigheim-Bissingen, Alemanha). As radiografias digitais foram analisadas no software DBSWin (Durr Dental AG, Bietigheim-Bissingen, Alemanha).

A TCFC foi realizada com o aparelho KODAK 9000C 3D® (Kodak Dental Systems, Carestream Health, EUA) com um tamanho de voxel de 0,076 mm, FOV de 50 mm de diâmetro x 37 mm de altura, voltagem de tubo de 70 kVp, corrente de tubo de 10 mA e um tempo de varredura de 32,40s. Os arquivos de imagem e comunicações Digitais em medicina (DICOM) foram avaliados usando o software Implant Viewer® (Anne Solutions, Brasil).

Os examinadores foram instruídos a manipular as imagens conforme necessário, usando as ferramentas de aprimoramento do software de acordo com sua própria preferência para fazer sua avaliação. Examinador também revisou um

conjunto de imagens de padronização para ambos os sistemas de classificação usando o mesmo software e condições de estudo.

3.3 Avaliação de imagem de reabsorção radicular

Radiografias periapicais e TCFC realizadas na mesma visita foram examinadas independentemente por 2 investigadores devidamente treinados e calibrados (JVB e TMPA). Um radiologista experiente (TMPA) avaliou a TCFC e outro especialista experiente em endodontia (JVB) avaliou a RP, a fim de avaliar a presença, tipo e extensão da RRE. Os dados referentes à presença e extensão da RRE foram avaliados pelo índice de reabsorção radicular desenvolvido por Anderson *et al.* (1989).

Os contornos da raiz mesial e distal foram divididos em 3 seções igualmente longas, desde o nível ósseo marginal até o ápice. A medida original do tamanho inicial da raiz foi realizada a partir do dente homólogo traçando no plano da seção transversal. Cada terço das superfícies das raízes mesial e distal recebeu uma pontuação (0, 1 ou 2), dependendo da profundidade das lacunas de reabsorção medidas a partir da superfície da raiz em direção à polpa. O escore final foi a soma de todos os terços e pode variar de 0 a 12 em RP e de 0 a 24 em TCFC, considerando que as faces vestíbulo-lingual (VL) também foram avaliadas nessa modalidade de exame.

Índices de RRE foram agrupados em 3 categorias da seguinte forma: ausente ou leve (≤4), moderada (≥5 e ≤8) e grave (≥9) para RP e ausente ou leve (≤8), moderada (≥9 e ≤ 16) e grave (≥17) para exames de CBCT. A RRE também foi classificada de acordo com os critérios descritos por Andreasen et al.28 como RREI, quando as cavidades de reabsorção mostraram radiolucência em forma de tigela, ou RRES, quando o espaço periodontal não era visto e as cavidades de reabsorção eram preenchidas com estruturas ósseas.

4 ARTIGO

Introduction

External root resorption inflammatory (IERR) and replacement (RERR) represent the most frequent sequel in permanent teeth that replanted and were reported as having been reported as varying between 6.8 to 64.3% and 18.1 to 94, 1%, respectively.[1, 2] Both forms results in irreversible damage to the root structure not rare leading to the tooth loss or with relevant functional, aesthetic, psychosocial and economic consequences.[2] The early and differential diagnosis of the different types, location and stages of root resorption is fundamental for a correct treatment plan and, consequently, to improve the prognosis of the tooth. Considering that clinical symptoms appear only in final stages of both types, the diagnosis of such entities has been routinely done with the help of radiographs. However, two-dimensional images show overlaps of anatomical structures, which is a limiting factor for the diagnosis of ERR.[3, 4]

During the last decades, to overcome the limitations presented by conventional radiographs, multiplanar images have been widely used, such as cone beam computed tomography (CBCT).[5] Computed tomography can provide greater precision regarding the degree of tooth involvement and localization of the resorption, as well as earlier identification of the process due to the various planes of cuts and reconstruction in 3D.

Evidence obtained from *ex vivo* studies, have widely demonstrated the superiority of CBCT in the diagnosis of experimental deep-space cavities performed in the apical, middle and cervical thirds of human teeth to simulate ERR.[6-12] However, there are few studies that evaluated clinically the performance of CBCT for the diagnosis of ERR. Estrela *et al* [13] concluded that CBCT was more effective in the diagnosis of IERR. Patel *et al* [14] concluded that while intraoral radiography was reasonably accurate in the diagnosis of root resorption (RR), scanning with CBCT resulted in a perfect diagnosis of the presence, type and severity of RR. In addition, there are no experimental or clinical studies that have assessed the accuracy of CBCT by considering IERR and RERR separately. Lima *et al* [15] conducted a retrospective study to compare digital periapical radiographs (PR) and CBCT images of 40 teeth

with root resorption from patients with root resorption and a history of dental trauma referred to a radiological center.

The authors concluded that CBCT was superior to digital PR in diagnosing external and internal inflammatory root resorption after dental trauma. Therefore, the present study aimed to evaluate clinically   the performance of CBCT and digital radiographs in the diagnosis of different types of ERR, at different stages, in permanent teeth replanted after avulsion.

MATERIAL AND METHODS

Patients and teeth

This study was approved by the Ethics Committee of Federal University of Minas Gerais (66813417.7.0000.51494). Written informed consent was obtained from all patients. The sample consisted of 29 patients, 21 males (72,5%) and 08 females (27,5%), with 39 maxillary incisors replanted after avulsion (6 lateral incisors and 33 central incisors). Patient's age at the time of injury ranged from 8.0 to 41 years (mean 14.4). The time elapsed between the trauma and the examination was from 23 days to 14 years. The patients were followed up at the Dental Trauma Clinic of the School of Dentistry, from the Federal University of Minas Gerais in Belo Horizonte, Brazil.

Radiographic techniques

Periapical radiographys were taken using a digital system with a paralleling technique. The X-ray unit Gendex (765DC, Paris), operating at 65 KV and 7mA 0,2 seconds, and storage phosphor plate systems VistaScan® (Durr Dental, Bietigheim-Bissingen, Germany). Digital radiographs were analyzed in the software DBSWin (Durr Dental AG, Bietigheim-Bissingen, German). CBCT scans were taken using a small volume CBCT scanner KODAK. CBCT of all patients was performed using the KODAK 9000C 3D® (Kodak Dental Systems, Carestream Health, USA) with a voxel size of 0.076 mm, field of view of 50 mm diameter × 37 mm height, tube voltage of 70 kVp, tube current of 10 mA, and a scan time of 32.40s.

Digital Imaging and Communications in Medicine (DICOM) files were evaluated using the Implant Viewer software® (Anne Solutions, Brazil). Examiners were instructed to manipulate the images as necessary, using the software enhancement tools according to their own preference to make their assessment. Examiner also reviewed a set of standardization images for both classifications systems using the same software and study conditions.

Image assessment of root resorption

Periapical radiographs and CBCT taken at the same visit were independently examined by 2 investigators properly trained and calibrated (JVB and TMPA). One

experienced radiologist (TMPA) evaluated CBCT and another experienced specialist endodontist (JVB) evaluated the PR, in order to evaluate the presence, type and extension of ERR. Data regarding the presence and extension of ERR were assessed using the root resorption index developed by Anderson *et al.* [16]

The mesial and distal root contours were each divided into 3 equally long sections from the marginal bone level to the apex. The original measurement of initial root size was performed from the homologous tooth by tracing at the cross-section plane. Each third of the mesial and distal root surfaces was given a score (0, 1 or 2), depending on the depth of resorption lacunae measured from the surface of the root towards the pulp. The final score was the sum of all thirds and can range from 0 to 12 in PA and 0 to 24 in CBCT, considering that the buccal-lingual (BL) faces were also evaluated in this modality of examination. Indexes of ERR were grouped into 3 categories as follows: absent or mild (≤4), moderate (≥5 and ≤8) and severe (≥9) for PR and absent or mild (≤8), moderate (≥9 and ≤16) and severe (≥17) for CBCT exams. ERR was also classified according to the criteria described by Andreasen *et al.*[28] as IERR, when resorption cavities showed bowl-shaped radiolucency in the (Fig.1a and 2a), or RERR, when periodontal space was not seen and resorption cavities were filled with bone structures (Fig1.b and 2b).

(a)   (b)
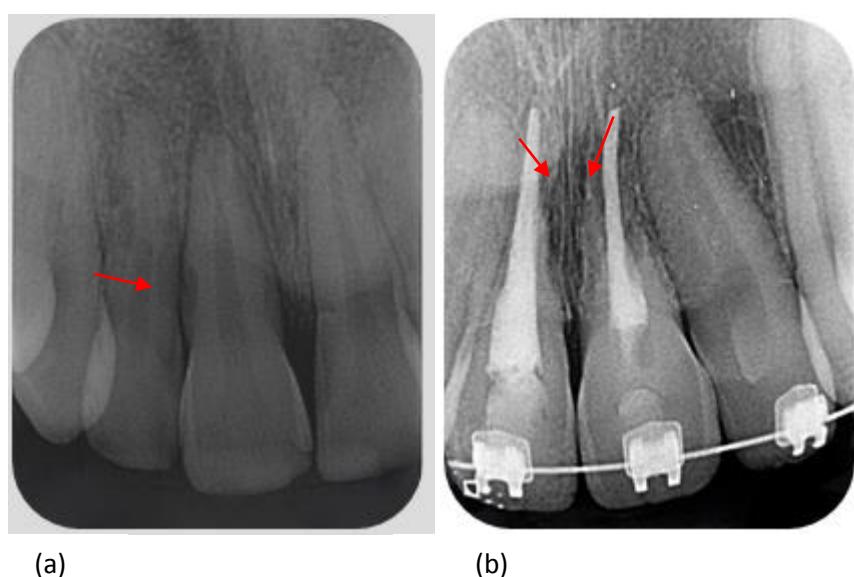
**Figure 1**: Radiographic feature of IERR (a) characterized by radiolucency in the resorption area and of RERR (b) bone structures imbricated with root structure and loss of PL.

(a)   (b)
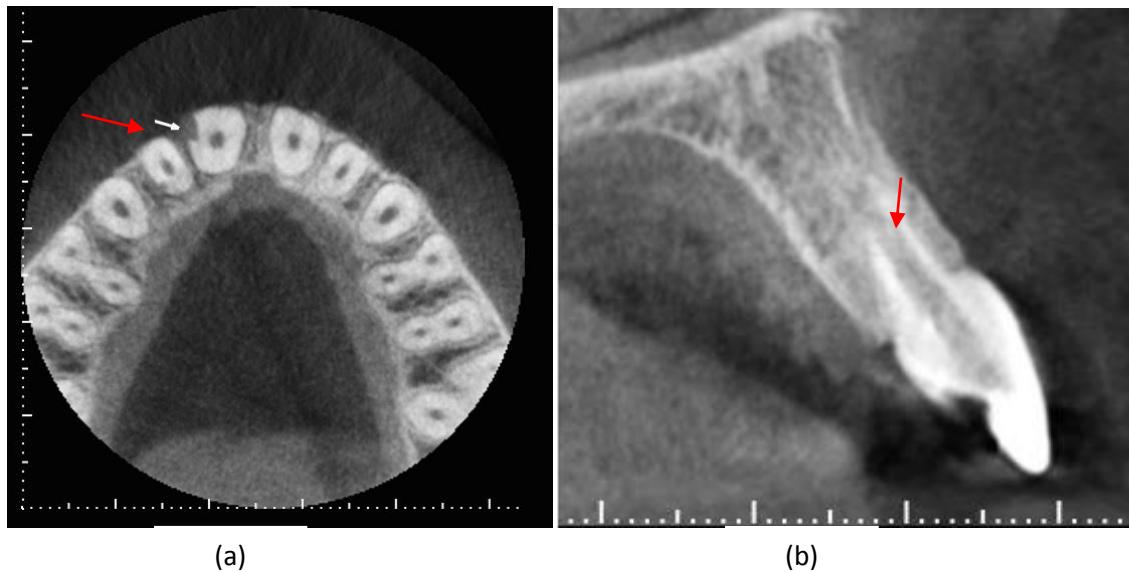
Figure 2: (a) Characteristic features of IERR in CBCT exams: radiolucency in the resorption area. (b) Characteristic features of RERR in CBCT exams: bone like structures in the resorption area.

Statistical analysis

The reliability and degrees of agreement between CBCT versus PR in assessing the presence/absence, type and extent of ERR were determined by the mean of Cohen's Kappa analysis using the software.

All the results were considered significant for a probability of significance of less than 5% ($p < 0.05$) with a 95% confidence interval of 95%.

RESULTS

Root resorption activity

CBCT identified ERR in 31 from 39 cases when considered only mesio-distal (MD) surfaces while PR identified ERR in all but one case. Agreement between the two methods regarding the presence/absence of ERR occurred in 30 of 39 cases (77%) (Table1). The results showed that the CBCT identified two cases without resorption while the PR identified only one case (Table 2). Agreement between both methods when we compared the ERR on the all surfaces (mesial, distal, buccal and lingual) of the teeth by CBCT to PR was 92% (Table 2).

Table 1: Agreement between CBCT – MD and PR regarding the presence of ERR

CBCT - MD	PR		Total
	Present	**Absent**	
Present	30	1	**31**
Absent	8	0	**8**
Total	**38**	**1**	**39**

Table 2: Agreement between CBCT – MD/BL and PR regarding the presence of ERR

CBCT – MD/BL	PR		
	Present	**Absent**	**Total**
Present	36	1	**37**
Absent	2	0	**2**
Total	**38**	**1**	**39**

Sample distribution according to type of ERR (IERR or RERR) for PR and CBCT exams considering the MD and BL surfaces separately or mesial-distal-buccal and lingual surfaces together is presented in graphic 1.
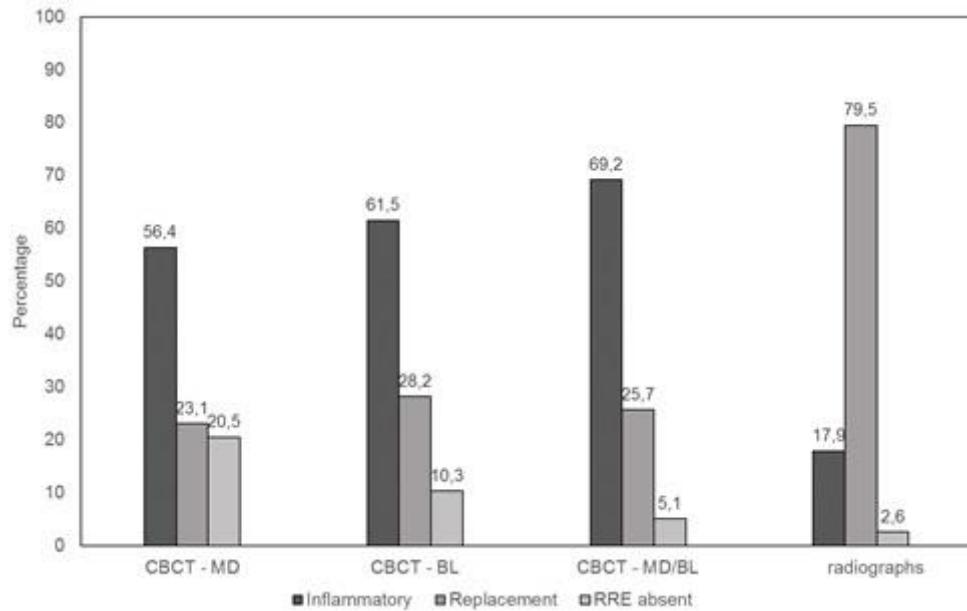
Graphic 1 – Sample distribution according the type of ERR in CBCT and PA images

IERR predominated in CBCT exams when considered mesial-distal or buccal-lingual faces separately (56,4% and 61,5% respectively). On the other hand, RERR was more frequent (79, 5%) on PR. A concordance level of 30.8% was observed between the two methods in the diagnosis of the type of resorption when considered only the mesial-distal surfaces (Table 03).

Table 3: Agreement between CBCT – MD and PR regarding the type of ERR

CBCT - MD	PR			
	Inflammatory	**Replacement**	**RRE absent**	**Total**
Inflammatory	4	17	1	**22**
Replacement	1	8	0	**9**
ERR absent	2	6	0	**8**
Total	**7**	**31**	**1**	**39**

When all the surfaces were analyzed on the CBCT exams, IERR was diagnosed in 69,2% and RERR 25,7% of the cases against 17.9% of IERR and 79.5% of RERR in PR. The agreement rate between total CBCT and PR was of 38.5% (Table 4).

Table 4: Agreement between CBCT - MD / BL and PR regarding the type of RRE

CBCT – MD / BL	PR			
	Inflammatory	**Replacement**	**RRE absent**	**Total**
Inflammatory	6	20	1	**27**
Replacement	1	9	0	**10**
ERR absent	0	2	0	**2**
Total	**7**	**31**	**1**	**39**

Sample distribution according to the extension (severity degree) of ERR for PR and CBCT exams considering the mesial-distal and buccal-lingual surfaces separately, or mesial-distal-buccal-lingual surfaces together is shown in graphic 2.

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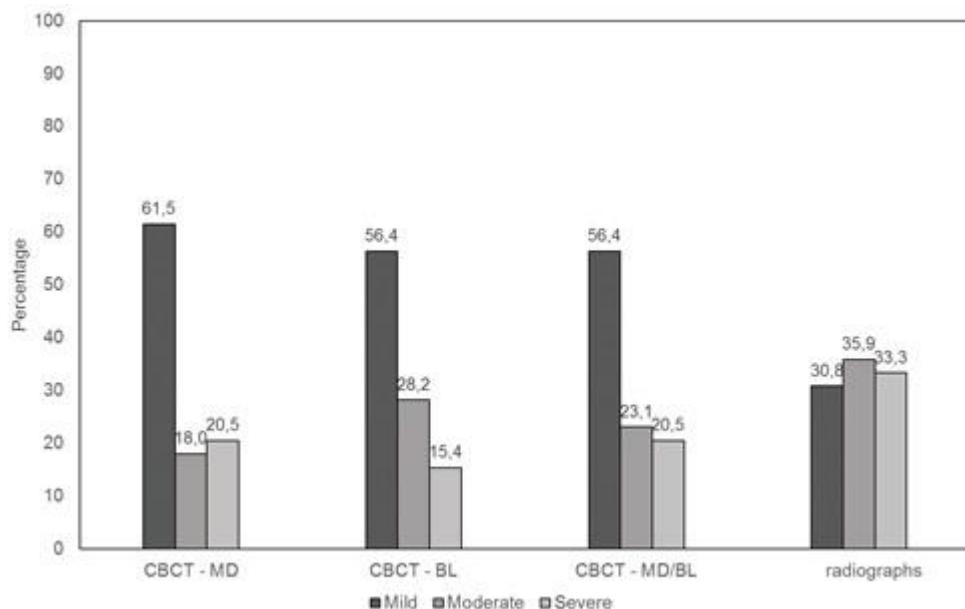
Graphic 2: Sample distribution according the severity of ERR in CBCT and PR.

CBCT exams identified more cases as absent or mild (61,5%), when only the mesial - distal surfaces were analyzed. PR disclosed more cases moderate or severe cases were more frequent in (69.2%). The agreement rate was of 61.5% (Table 5).

Table 5: Agreement between CBCT – MD and PR regarding ERR severity

Severity degree in CBCT - MD	Severity degree in PR			
	Mild	**Moderate**	**Severe**	**Total**
Mild	11	7	6	**24**
Moderate	1	6	0	**7**
Severe	0	1	7	**8**
Total	**12**	**14**	**13**	**39**

When all the surfaces were analyzed on the CBCT exams, 56.4% of the cases presented with absent to mild ERR, 23% with moderate ERR and 20.5% with severe ERR performing an agreement rate between total CBCT and PR of 59% (Table 6).

Table 6: Agreement between CBCT – MD/BL and PR regarding ERR severity

Severity degree in CBCT – MD/BL	Severity degree in PR			
	Mild	**Moderate**	**Severe**	**Total**
Mild	10	7	5	**22**
Moderate	2	6	1	**9**
Severe	0	1	7	**8**
Total	**12**	**14**	**13**	**39**

DISCUSSION

Progressive forms of ERR are common findings after permanent tooth replanted and the main cause of permanent anterior tooth loss. The diagnosis of such entities has been routinely done with the help of radiographs. However, two-dimensional images show overlaps of anatomical structures, which is a limiting factor for the diagnosis of ERR. Cone beam computed tomography was introduced in dentistry as an alternative to intraoral radiography in order to overcome the well known limitations of two-dimensional (2D) imaging of a three-dimensional (3D) object, with overlapping of anatomical structures and geometric distortions. Although CBCT requires higher doses of radiation than intraoral radiographs,[17] it can offer greater precision regarding the position and extension of ERR, and permit earlier identification of the process due to multiplanar cuts and reconstruction in 3D.

Studies evaluating the diagnostic efficiency of CBCT for ERR detection are predominantly *ex vivo* studies in which simulated cavities, of different measures and positions, were created in extracted teeth that were then repositioned in the alveolar cavity of mandibles before being radiographically examined with PR and CBCT.[6-12, 18-25] Such methodology, however, fails to replicate the true resorption pattern of the IERR lesion and does not represent RERR. In addition, a silicone, acrylic or wax material is used to reproduce the absorption and dispersion of the X-ray beam caused by the soft tissues. However, structures in the maxillofacial region have different radio densities that cannot be accurately represented by a material of uniform thickness, and cannot reproduce the small movements that may occur during an PR or CBCT.[14]

The present study evaluated, *in vivo*, the difference between PR and CBCT images in diagnosing the presence/abscene, type and severity of ERR in replanted permanent avulsed teeth. There are few *in vivo* studies which have tested the ability of CBCT to improve the diagnosis of ERR.[13, 14] RERR was more frequent in the PR and IERR was more common in the CBCT exams. That can be explained by the overlaping of buccal and lingual root surfaces in PR generating a false image of replacement and an underestimation of IERR frequency resorption. In addition, the similarity between dentin and bone can make diagnosis difficult. As the CBCT images are performed by slices, there is no overlap of structures, making easier to visualize of dental abnormalities such as ERR.[26] On the other hand, 82% (32 teeth) of the present sample had intra canal plug material (gutta percha) artifacts may have

significantly impaired the examination, causing in the images an undesirable effect, disfiguring the field of vision and representing a challenge of interpretation of CBCT interfering with the quality of the diagnosis.[27, 28] These artifacts reduce the contrast between adjacent objects and limit the clarity of areas of interest. Many studies have shown that artifacts and low contrast cause errors in the diagnosis of root fractures, especially in the presence of gutta-percha and endodontic cements.[11, 28]

Mild resorptions were more frequently identified by CBCT, while moderate and severe resorptions were more frequently observed in PR. The diagnosis of early-stage cavities is fundamental for a more favorable prognosis of resorptions. The earlier treatment is initiated, the less severe the long-term consequences of resorption will be. Therefore, an early diagnosis is a critical factor in the success of treatment.[29]

The limitation of the present study was that ERR was diagnosed only by radiography and CBCT and had no gold standard for ethical reasons since the histopathological analysis of resorbed defects was not indicated. To provide better scientific evidence for the findings of our study, further investigations addressing this issue are needed.

Under the conditions tested and within the limitations of this study, it can be concluded that only one radiographic technique is not sufficient for the diagnosis of all types and severity of ERR, so CBCT is important to complement periapical examination, especially in the early stages.

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5 CONSIDERAÇÕES FINAIS

O presente estudo foi limitado pois a reabsorção radicular externa foi diagnosticada apenas por radiografia ou tomografia computadoriza de feixe o cônico e não teve padrão ouro por razões éticas, uma vez que a análise histopatológica dos defeitos reabsorvidos não foi indicada.

Para fornecer melhores evidências científicas para as descobertas do nosso estudo, são necessárias investigações adicionais que abordem esse assunto.

Nas condições testadas e dentro das limitações deste estudo, pode-se concluir que apenas uma técnica radiográfica não é suficiente para o diagnóstico de todos os tipos e gravidade de reabsorção radicular externa, portanto a TCFC é importante para complementar o exame periapical, principalmente nos estágios iniciais.

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