LUMEN ET VIRTUS

Quality of root canal fillings on periapical radiographs

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ABSTRACT

The objective of the present study was to radiographically evaluate the presence or absence of failures in endodontic fillings performed at the Faculty of Dentistry of Pernambuco FOP/UPE. A total of 1091 periapical radiographs of teeth treated endodontically in the last two years were selected. The radiographs were observed by three professors who are specialists in endodontics. Radiographs with teeth submitted to apicoectomy surgery, radiographs of the posterior teeth

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(premolars and molars), teeth with incomplete rhizogenesis, presence of impacted teeth, and total edentulous teeth in the anterior region were considered inappropriate, and treated canals were considered those containing radiopaque material in the pulp cavity or inside the root canal. The collected data were quantified and submitted to statistical analysis. A large percentage of radiographs with teeth treated endodontically and the presence of periapical lesions (51.6%) and slightly fewer teeth treated without lesions (48.4) were observed. When comparing the presence of periapical lesion with the longitudinal limit of filling and the homogeneity of the material, they present better results. At the end of this study, it was possible to observe a statistically significant relationship between unsatisfactory endodontic treatments and periapical lesions.

Keywords: Endodontic Treatment, Periapical Radiography, Filling, Periapical Lesion.

INTRODUCTION

Endodontic treatment aims to maintain and recover the function of the tooth element, allowing it to perform its functions in the stomatognathic system. To result in success in endodontic therapy, it is necessary to obey several factors, among them, the most hermetic root canal filling possible and the minimum aggression to adjacent tissues (ESPÍNDOLA et al., 2002; CANTO et al., 2013).

Although the success of endodontic treatment is related to the attention given to each of the phases that compose it, from anamnesis to longitudinal clinical control, the three-dimensional hermetic filling of the root canal system is undoubtedly fundamental. This filling prevents percolation and infiltration of the periapical exudate into the canal, blocking reinfection, and creates a favorable environment for the healing of the periapical tissues (BILGINER et al., 1997; YOSHIKAWA et al., 1997; PERTOT et al., 1997; GIUSTI et al., 2007).

The filling of the root canal consists of filling it completely in order to prevent the entry of bacteria. It is the consecration of the treatment, as it perpetuates the state of disinfection achieved during the chemical-mechanical preparation (FREITAS et al., 2008).

Obtaining adequate apical sealing of the root canal is still considered a primary factor in the treatment, despite recent studies of bacterial infiltration via coronary sealing (SIQUEIRA et al., 2000; FREITAS et al., 2008). The success of endodontic treatment is evaluated based on radiographic analysis and the absence of clinical signs or symptoms during tooth preservation (BENENATI; KHAJOTIA, 2002; FREITAS et al., 2008).

Pine; Fernandes; Herrera (1998) discussed the validity of radiography as the only instrument to evaluate the success or failure of endodontic treatment, since radiography is only a two-dimensional image of an object at a given moment, but they stated that important data can be obtained, such as: the quality of the filling and instrumentation, accidents that occurred such as perforations, step formation and instrument fractures (GASPAR JÚNIOR et al., 2009).

Currently, more advanced radiographic methods are used to improve conventional radiographs in terms of the quality of the image obtained, the radiation dose, the time it takes to produce the image and its storage (DUMMER et al, 1984., OLIVEIRA et al, 2000., ROSA et al, 2011).

Digital technology is the newest milestone reached by dental radiology, both in quality and practicality.

Intraoral digital radiography is the safest method because of the significant reduction in patient exposure to radiation (ANANTHRAJ et al., 2011; MENEZES, 2013), immediate image generation, ease of manipulation and elimination of chemical processing of radiographs (HUUMONEN, ØRSTAVIK, 2002; MENEZES, 2013).

OBJECTIVE

He had evaluated the quality of the root fillings by means of periapical radiographs.

METHODOLOGY

TYPE OF STUDY

This is a retrospective, observational, cross-sectional study with a quantitative approach.

LOCATION OF THE STUDY

This research was developed at the Faculty of Dentistry of Pernambuco, located in the city of Camaragibe – PE.

DATA ANALYSIS

All collected material was quantified and treated using statistical techniques through absolute and percentage distributions.

SAMPLE SIZE

A total of 1091 periapical radiographic films were selected, which corresponded to 1091 upper and lower anterior permanent teeth, from the archives of the school's clinics, following specific criteria for sample selection.

SAMPLE SELECTION

A total of 1091 periapical radiographs belonging to patients of both sexes, performed in the clinics in the last 2 years, were selected.

The data obtained during the clinical examination and anamnesis were not known, as well as gender, age, name, and indication for the examination. This sample was obtained through the selection of radiographs, following inclusion and exclusion criteria.

Inclusion Criteria

Periapical radiographs of maxillary and mandibular permanent anterior teeth, with complete rhizogenesis, obtained in the orthoradial position, were selected. The dental arches could not be completely edentulous, that is, the patient must have at least one tooth in the upper or lower anterior region.

Exclusion Criteria

Radiographs suggesting teeth submitted to apicoectomy surgery, radiographs of the posterior teeth (premolars and molars), teeth with incomplete rhizogenesis, presence of impacted teeth, and total edentulous teeth in the anterior region were excluded.

RADIOGRAPHIC ANALYSIS

The images were viewed using a 1-body negatoscope, height 500mm x width 105mm x length 360mm. Three evaluators, specialists in Endodontics, will carry out the observation. After the analysis of the first two evaluators, the conflicting results were confirmed by the third evaluator. To prevent possible impairment of the analyses due to eye strain, the ambient light and the brightness of the monitor will be reduced and the number of images limited to 90 scans in sequence. Interpretation will be conducted at different times of the day. The notes were made in a Microsoft Excel spreadsheet.

Figure 1 - 1-body negatoscope.



CRITERIA FOR RADIOGRAPHIC EVALUATION

Table 1 shows the criteria that were used to fill out the research data sheet.

Treated root canals will be considered those that contain radiopaque material in the pulp cavity or inside the root canal, disregarding those that suggested being part of the intraradicular retainer.

As for the longitudinal limit of the filling, it will be considered underfilled when the end of the filled material was more than 2mm away from the radiographic apex. Filling with adequate limit when this distance is between 2 and 0.5mm. Exactly, when this limit coincided with the apex. Overfilling will occur when the filling material exceeds the limit of the root vertex.

Table 1 – Criteria for radiographic evaluation	
PERIAPICAL INJURY	1 – Absent 2 – Present

SHUTTER LIMIT	8 – Underfilled 9 – Satisfactory 10 – Exactly. 11 – Overfilled
HOMOGENEITY OF THE FILLING MATERIAL	1 - Failed 2 - No failure

DATA TABULATION AND DATA ANALYSIS

Data were tabulated in a table of the SPSS (Statistical Package for the Social Sciences) to quantify the root fillings distributed by the number of the dental element.

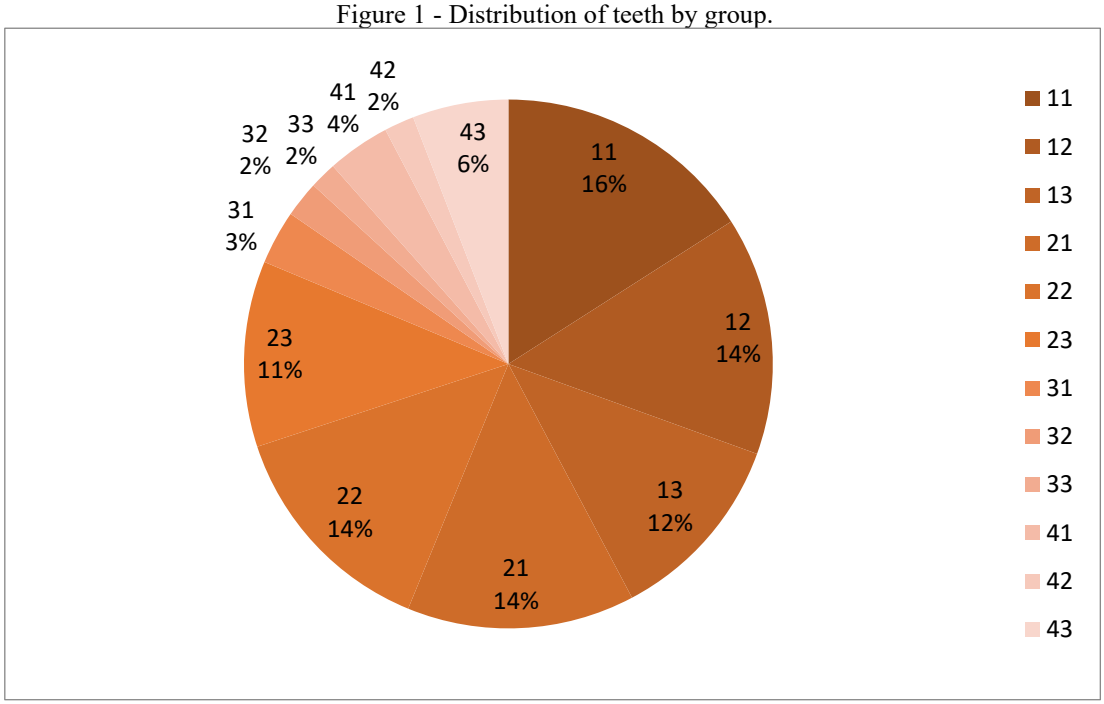
Absolute and percentage distributions and statistical measures were obtained: mean, median, standard deviation (descriptive statistical techniques) using Pearson's Chi-square statistical test (inferential statistics technique).

Statistical tests were performed with a margin of error of 5.0% using the SPSS software in version 15 for Windows.

RESULTS

After completion of the analysis of the 1091 periapical radiographs. Figure 1 shows the distribution, in absolute numbers and percentages, of the teeth in the corresponding groups.

Figure 1 - Distribution of teeth by group.



The distribution and presence of each tooth with periapical lesion, as well as the result of the entire sample, are shown in Table 1.

Regarding endodontic treatment, 100% of the teeth had an obfilled canal. The right maxillary central incisor, with 16% of the cases filled, was the one with the highest prevalence. Element 33 had the lowest prevalence, with only 1.6% of them treated, as can be seen in Table 2. Still in this table,

The results of endodontically treated teeth were correlated with the presence of periapical pathology, and we could observe that in 51.6% of the cases the lesion was associated with filled teeth, as shown in Table 2.

Table 2 – Relationship between endodontically treated teeth and periapical lesion

			Treated Channel	
				Yes
Injury	Absent	Quantity Percentage per Injury		528 48,4%
	Present	Quantity Percentage per Injury		563 51,6%
Total		Quantity Percentage per Injury		1.091 100%

Regarding the homogeneity of the filling material, 55.1% of the cases presented radiographically adequate characteristics. The highest percentage of teeth with homogeneous filling was found in the right mandibular lateral incisors, while the one that presented the greatest complication to obtain a homogeneous obturator mass was element 43, with 56.3% of the cases classified as non-homogeneous filling.

The relationship between apical periodontitis and the quality of endodontic treatment. This relationship is shown in Tables 3 and 4, which relate the presence of periapical lesion to the longitudinal limit of the filling and to the homogeneity of the filling material, respectively. Underfilled teeth accounted for 42% of all root canal teeth. Of these, 44.8% had periapical lesions, while teeth with adequate filling (44.5% of the sample of teeth with endodontic treatment) were associated with periapical pathology in 36.1% of the cases. Of the teeth treated without the presence of lesions, the satisfactory canals showed 53.4% of treatment success.

Table 3 – Relationship of the longitudinal limit of the filling vs. periapical lesion

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			Longitudinal limit of the blank				Total
			Sub-filled	Satisfactory	Exact	Overfilled	
Injury	Absent	Amount Percentage	206 39,0%	282 53,4%	4,5%	16 3,0%	528 100,0%
	Present	Amount Percentage	252 44,8%	203 36,1%	4,9%	24 4,3%	563 100,0%
Total		Amount Percentage	458 42,0%	485 44,5%	108 9,9%	40 3,7%	1.091 100,0%

Table 4 - Relationship between the homogeneity of the filled material vs. the periapical lesion.

			Homogeneity		Total
			Flawed	Homogeneous	
Injury	Absent	Quantity Percentage	174 33,0%	354 67,0%	528 100,0%
	Present	Quantity Percentage	316 56,1%	247 43,9%	563 100,0%
Total		Quantity Percentage	490 44,9%	601 55,1%	1.091 100,0%

Of the 1091 cases with endodontically treated teeth, only 335 cases (30.7%) had a totally satisfactory endodontic treatment, i.e., with a longitudinal limit of the filling as measured by the CRT and with a radiographically homogeneous obturator mass.

DISCOURSE

Endodontic treatment aims at the sanification of root canals and their hermetic sealing through obturation, which corresponds to the correct filling along the entire length of the root canal, by materials that are biologically compatible, through a filling technique (TARTAROTTI, 2005). To this end, the radiographic evaluation of the quality of the root filling is an important means of diagnosis that the dentist has to determine the prognosis of endodontic therapy (TARTAROTTI, 2005).

Radiographic examination in endodontics is useful for diagnosis; useful in the intraoperative period; in addition to allowing an immediate and long-term postoperative analysis (BIANCHI and LOJACONO, 1996; TARTAROTTI, 2005). However, Goldman, (1972); Tartarotti (2005) et al. state that radiographic evaluation has a questionable significance in determining success and failure in endodontics. X-rays need to be interpreted, and this interpretation may vary from observer to observer. Thus, the present study used three observers to evaluate the quality of endodontic fillings and in questionable cases the third evaluator will be responsible for the result.

The present study shows the radiographic analysis of 1,091 radiographs, in which the right maxillary central incisor, with 16% of the cases filled, was the one with the highest prevalence. On the other hand, element 33 had the lowest prevalence, with only 1.6% of them treated. In other studies, such as Pereira's (2008), maxillary incisors, maxillary molars and mandibular molars were the most common.

Pereira, (2008) says that the prevalence of incisors may be associated with the traumas that occur, which usually affect the teeth that occupy an anterior position, and more prominent in the dental arch. We observe this statement in the work of Traebert, (2004). In the study by Cartelli and Rodrigues (2012), the teeth most affected by apical periodontitis were the maxillary anterior ones.

Apical periodontitis is undoubtedly one of the most common biofilm-induced diseases that affect humans, being a group of inflammatory diseases caused by microorganisms (mainly bacteria),

infecting the root canal system with necrotic pulp (ROCAS; SIQUEIRA, 2008; JESUS; NETO, 2013). Diagnosed by clinical and radiographic criteria, and radiography is the resource of choice for its diagnosis (LOFTUS; KEATING; MCCARTAN, 2005; FREITAS, 2008).

Endodontic procedures, such as root canal instrumentation, intracanal medication, irrigation, and filling, are intended to eradicate infection from the root canal system and prevent reinfection. However, these processes are not efficient for the complete elimination of endodontic infections in the vast majority of cases. What can be achieved with these procedures is a reduction of the bacterial population inside the root canal, to a level lower than that necessary to maintain the disease process (ZOLETTI, 2010; JESUS; NETO, 2013). This is because the immune system is unable to eradicate the bacteria entrenched in the necrotic root canal, which lacks an active microcirculation and is consequently beyond the reach of the body's defenses (ROCAS; SIQUEIRA, 2008; JESUS; NETO, 2013). Due to these findings, similar results are found in this study: when 51.6% of the teeth treated endodontically have periapical lesions, this may occur due to the permanence of microorganisms inside the root canals.

The critical factor for endodontic success is the elimination of microorganisms from the root canal system through the association of procedures, i.e., cleaning, enlargement, modeling, use of intracanal antimicrobial medications, and quality of canal filling and coronary restoration (ESTRELA, 2008b; MENESES, 2013). However, root canal cleaning and modeling cannot be evaluated by radiography (DE MOOR, 2000; MENESES, 2013). It should be noted that a two-dimensional image does not provide complete information about the quality of the treatment performed (ECKERBOM and MAGNUSSON 1997; MENESES, 2013). For this reason, this study evaluated only the longitudinal limit and the homogeneity of the filling.

Evaluating the longitudinal limit of the filling, we observed that 44.5% of the cases were considered satisfactory and 55.1% had the filling material homogeneously. Works such as Lupi-pegurier's, (2002); Dugas, (2003) and Freitas, (2008), have a rate of channels considered satisfactory ranging from 38.7 to 61.5%. The ideal apical limit of filling should be as close as possible to the CDC limit, being restricted to the dentin canal (FREITAS, 2008)

Poorly filled root canals do not necessarily indicate failure, but they can facilitate bacterial invasion and its by-products into the root canals, which in turn can lead to diseases causing treatment failure (LOFTUS; KEATING; MCCARTAN, 2005; MENESES, 2013).

Apical periodontitis is found less frequently when the quality of endodontic treatment is good (ECKERBOM, FLAYGARE, MAGNUSSON, 2007; MENESES, 2013). In this study, we found that 43.9% of the teeth in which the filling was radiographically homogeneous and 36.1% of the cases of teeth treated at the CRT limit had apical periodontitis. The values increased when the tooth was underfilled or the obturator mass was not homogeneous. Other studies have shown a very large

variation in the association of BP with root canal treatment (from 18.2% to 64.5%). This variation is mainly due to the quality of the root canal filling.

CONCLUSION

Based on the methodology used and the results obtained, it is legitimate to conclude that:

Of the 1,091 teeth analyzed with endodontic treatment, the highest percentage of treatments was performed on the right upper central incisor, and the left lower canine had the lowest prevalence.

Of the teeth treated endodonally, the vast majority had periapical lesions

Regarding the analysis of the quality of the filling, when evaluating the longitudinal limit and homogeneity of the material, we can find satisfactory success in relation to the longitudinal limit and higher prevalence of filling material in a homogeneous way.

Underfilled teeth represented a lower percentage in relation to teeth with satisfactory filling. Of these, almost half had periapical lesions, whereas teeth with adequate filling were associated with periapical pathology in less than half of the cases. Of the teeth treated without the presence of lesion, the satisfactory root canals showed a high incidence of treatment success

Comparing the quality of the homogeneity of the material, it can be seen that more than half had periapical lesions, with regard to failures in homogeneity, with a decrease in the prevalence of lesions when the material is well homogenized.

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