

RADIOGRAPHIC EVALUATION OF FACTORS INFLUENCING THE OUTCOME OF PRIMARY ENDODONTIC TREATMENT

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Abstract

Aim of our study. The aim of our study is to evaluate the root fillings quality and the periapical status after primary endodontic treatments, based on radiographic examination, in order to identify factors that could be correlated to successful therapy. **Material and methods.** The sample was represented by a consecutive series of 53 patients with 71 teeth scheduled for treatment due to endodontic problems. All patients were treated under the same conditions, regarding examination protocol, materials, techniques and instrumentation. **Results.** From the 71 teeth, in 31(43.7%) inadequate endodontic treatments were recorded. The persistence of apical periodontitis in cases with adequate versus incorrect root fillings was 17.5% (7 teeth) and 45.16% (14 teeth) respectively ($p < 0.05$). **Conclusions.** Adequate root fillings significantly reduced the prevalence of apical periodontitis. The presence of preoperative symptoms did not influence the outcome of endodontic treatment.

Keywords: endodontic treatment, root filling quality, apical periodontitis

Introduction

The most frequent causes of primary endodontic treatment failures include incomplete filling, root perforations, missed or unfilled root canals and broken instruments. If there is no microbial infection present in the root canal, these conditions usually do not determine treatment failure.

Numerous clinical studies had shown a strong negative correlation between apical periodontitis and inadequate quality of the root filling on the outcome of primary endodontic treatment (Chueh et al 2003, Ng YL et al

2008, Khabazz et al 2010, Chugal 2003). The success rate of these treatments are a public health problem and the improvement of techniques and treatment objectives could lead to a higher success rate (Cabral dos Santos et al 2013).

It is still imperative for dentists to have a thorough knowledge upon the anatomy of the pulp chamber and root canal system in order to increase the efficiency and the success rate of endodontic treatment, but it is strongly believed that the dental operating microscope will increasingly influence all treatments procedures in the years to come (Mamoun 2009, Kersten et al 2008).

The aim of our study is to evaluate the quality of root fillings and periapical status after non-surgical endodontic treatments, based on clinical and radiographic examination. We wanted to identify factors that could be correlated to successful therapy. The null hypotheses to be tested was that the treatment outcome is not influenced by technical parameters of the root fillings or the preoperative periapical status of the treated teeth.

Material and Methods

The sample was represented by a consecutive series of 53 patients (71 teeth) with a mean age of 47.2 \pm 16.1 years old, referred to our department for endodontic treatment due to necrotic teeth or the presence of clinical symptoms such as pain or tenderness to percussion. We used the following inclusion criteria: teeth without previous endodontic treatments, presence of apical periodontitis or combined endo-periodontal lesions, possibility to use the same treatment protocol for all the cases, a control period of more than 6 months, no furcation involvement and absence of periodontal pockets of 6 mm or more. The exclusion criteria were: root canal perforations during endodontic treatment, presence of separated instruments, vertical root fractures, signs of root resorption before or during the control period, presence of deep periodontal pockets (over 6 mm). The presence of clinical symptoms was noted and radiographs were used to record the periapical status of the evaluated teeth, based on the Periapical index (PAI) criteria (Orstavik et al 1986): 1- normal bone, 2- small bone changes, 3- visible bone resorption, 4- radiolucent zone, 5- severe apical lesion. Postoperatively, the presence of lateral gaps between the dentin walls and endodontic materials and the apical limit of the root filling (0.5-1mm short of the apex) were investigated and recorded as acceptable or unacceptable. The treatments were performed by postgraduate students supervised by qualified endodontists. The teeth were reevaluated at the completion of the treatment and after 6 and 12 months, based on the same criteria. The periapical radiographs were obtained by long-cone paralleling technique on double Kodak Ektaspeed films (Kodak, Rochester, NY, USA). Statistical analysis was made using the Statistical Package for the Social Sciences for Windows

(SPSS vV8.0) and for each variable the mean and standard deviation was calculated. We used a tooth as statistical unit. The values were compared using chi-squared test for statistical significance and the level of confidence was established at $p < 0.05$.

Results

The distribution of tooth type was 37 anterior teeth (52.12%) and 34 lateral teeth (47.88 %) a difference that was not statistically significant ($p > 0.05$). The distributions of teeth regarding type and location correlated to the treatment outcome are presented in tables 1 and 2.

Table 1. Tooth type correlated to and treatment quality

Tooth type	Adequate treatment	Inadequate treatment	Total
Anterior	21	16	37
Lateral	19	15	34
Total	40	31	71

Tooth type: chi square=2.54, $p=0.11$ ($p > 0.05$) not statistically significant.

Table 2. Tooth location correlated to the treatment quality

Tooth location	Adequate treatment	Inadequate treatment	Total
Upper jaw	16	23	39
Lower jaw	24	8	32
Total	40	31	71

Tooth position; chi-square= 5.26, $p=0.03$ ($p < 0.05$) statistically significant difference.

Statistically significant differences were found between length of the root filling correlated to tooth location in mandibular or maxilla. More frequently the fillings were short or long in maxillary molars compared to the lower jaw. From the 71 teeth, 31 cases (43.7%) presented inadequate endodontic treatments, with only inadequate root filling length in 7 cases (20.2%) and only poor lateral condensation in 5cases (16.12%). The rest of the 19 cases (63.70%) both parameters were recorded as unacceptable.

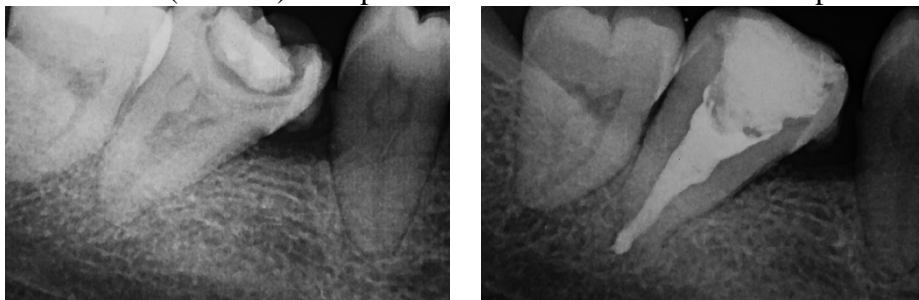


Fig 1. Tooth 47 with necrotic pulp. Control radiograph shows minimal over-filling and inadequate lateral condensation.

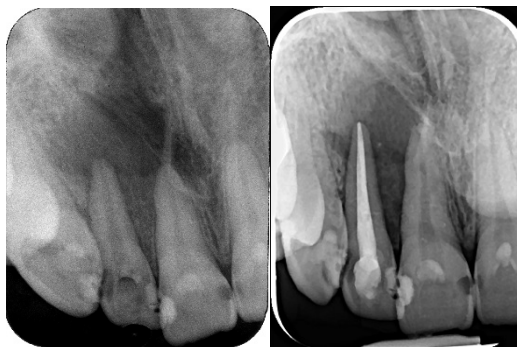


Fig. 2 Tooth 22 with large radiolucent area which was reduced after adequate endodontic treatment (proper length and homogeneity of the root filling).

The comparison between PAI scores recorded at baseline and after 6 and 12 months showed important differences, confirming the good results of the treatment in the group of teeth with adequate root canal treatments. The persistence of apical periodontitis in cases with adequate versus incorrect root fillings was 17.5% (7 cases) and 45.6% (14 cases) respectively ($p < 0.05$). The results obtained after evaluation with PAI are presented in Table 3.

Table 3. Mean values (M) and standard deviation (SD) of PAI score in adequate root filled teeth

Radiographic evaluation	Preoperatively	At 6 months	At 12 months
PAI score M / SD	3,58 +/-0.64	2,67 +/-0.82	1,85 +/-0.73

These differences are statistically significant with $p = 0.04$ ($p < 0.05$)

Discussion

The evaluation of endodontic treatments are done mostly on periapical radiographs and recently, on cone beam computed tomography images, using different criteria, among which the length and homogeneity of the root fillings were more frequent. In a study from 2003 Chueh et al found that root canals with adequate length represented 61,7% while unacceptable treatments due to inadequate length were 25.0%, overfilling 12,6% and in 0.6% there was no material in the root canal, only in the pulp chamber. Only 38.0% of the root fillings were considered homogenous. Our results showed acceptable root fillings that included proper length and apical limit in 40 cases (66.3%). Adequate root fillings significantly reduced the presence of apical periodontitis, based on the evaluation made by PAI scores which showed a statistically significant differences between the scores recorded before and at 6 and 12 months control ($p < 0.05$). In a meta-analysis study, Kojima et al (2004) concluded that the root filling should be within 2 mm of the radiographic apex in order to have favorable long term results of endodontic treatment.

There are rare reports on the difference between technical outcomes of endodontic treatment of maxillary or mandibular teeth. Kamberi et al (2011) consider that the quality of endodontic treatment is directly associated with the likelihood of development of periodontitis. In our study, the small size of our sample is a limitation in assessing the clinical significance and therefore larger surveys are needed to have conclusive statements on this matter.

We used the paralleling technique for preoperative and control radiographs as we wanted to maintain the same incidence angle, meaning that the x-ray tube was placed exact over the film holder, with no mesial or distal angulation. This is a bi-dimensional evaluation of a tri-dimensional lesion and therefore the results are not always exact, but for the purpose of our research we considered it acceptable, as a Cone Beam Computed Tomography was not available. The technical quality of the root canal treatment and the coronal seal play an important role in the periapical healing in root filled teeth with apical lesions (Ng et al 2008, Kabbaz et al 2010, Touboul et al 2014). During this investigation we recorded an overall success rate of 66.3% regarding technical standards which is lower than expected. In 14.8% of the inadequate root fillings group but we recorded patients without clinical symptoms and favorable radiographic results, which was explained by a good control of marginal leakage and endodontic infection. The long-term success of primary but especially retreatment cases in endodontics rely on the accuracy of technique used during cleaning, shaping and filling of the root canals, which are enhanced especially by improved lightning and magnification

Conclusion

High-quality endodontic therapy is the basis for long-term clinical and radiological success in endodontic treatment of necrotic teeth. State of the art equipment and thorough knowledge are very important in reaching this goal.

The lateral condensation technique of cold gutta-percha in a non-flared root canal may create voids and have a negative impact on the outcome of primary endodontic treatment. The absence of lateral voids and a correct apical limit of the root filling are very important in clinical long-term success of primary endodontic treatments.

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