

Influence of Apical Foramen Cleaning on Periapical Lesion Repair

Influência da Limpeza do Forame Apical no Reparo de Lesões Periapicais

Carolina dos Santos Guimarães¹, Gerhilde Callou Sampaio², Élvia Barros de Almeida³, Luciano Barreto Silva⁴, Ana Paula Mourato⁵, Diógenes Ferreira Alves⁶

Resumo

Objetivo: O presente estudo procurou acessar o efeito da limpeza do forame apical no reparo de lesões periapicais detectadas radiograficamente.

Materiais e métodos: A amostra constituiu-se de 980 dentes selecionados de 25 de fevereiro de 1997 a 15 de março de 2005 que foram submetidos a tratamento endodôntico e exibiram lesões periapicais radiograficamente visíveis. A amostra foi então dividida em dois grupos: Grupo I, 402 tratamentos de canal em que a limpeza do forame apical não foi realizada, e Grupo II, composto pelos 578 dentes restantes onde o procedimento foi realizado. Após um ano, os dentes foram clinicamente e radiograficamente avaliados.

Resultados: No Grupo I, 360 canais (89,55%) não tiveram evidência de lesões periapicais, versus 521 (90,13%) no Grupo II. Presença parcial dessas lesões foi observada em 23 canais (5,72%) no Grupo I versus 27 (4,67%) no Grupo II. O teste qui-quadrado de Pearson não demonstrou significância estatística entre os Grupos I e II ($p=0,732$).

Conclusões: Estes achados sugerem que a limpeza do forame apical não é um determinante para o reparo de lesão periapical.

Palavras chave: Limpeza do forame; Tratamento endodôntico; Reparo periapical

Abstract

Aim: The present study sought to assess the effect of apical foramen cleaning in the repair of periapical lesions detected by radiography.

Methods: The sample comprised 980 teeth collected from 25 February 1997 to 15 March 2005, which had been subjected to endodontic treatment and exhibited radiographically visible periapical lesions. The sample was then divided into two groups: Group I, 402 root canal treatments in which cleaning of the apical foramen had not been performed, and Group II, composed of the remaining 578 root canal treatments where the procedure had been performed. After one year, the teeth were clinically and radiographically evaluated.

Results: In Group I, 360 canals (89.55%) had no evidence of periapical lesions, versus 521 (90.13%) in Group II. Partial presence of these lesions was observed in 23 canals (5.72%) in Group I versus 27 (4.67%) in Group II. No changes in images were observed in 19 (4.72%) canals in Group I and 30 in Group II. Pearson's chi-square test showed no statistically significant difference between the Groups I and II ($p = 0.732$).

Conclusions: These findings suggest that foramen cleaning is not a determinant of periapical lesion repair.

Keywords: Foramen cleaning; Endodontic treatment; Periapical repair

¹DDS, MSc, Graduate Student (Doctorate Degree), Department of Oral Diagnosis, University of Pernambuco, Recife, PE, Brazil

²DDS, MSc, PhD, Chairman and Professor of Oral Pathology, University of Pernambuco, Recife, PE, Brazil

³DDS, MSc, Graduate Student (Doctorate Degree), Department of Oral Diagnosis, Federal University of Pernambuco, Recife, PE, Brazil

⁴DDS, MSc, Graduate Student (Doctorate Degree), Department of Oral Diagnosis, Federal University of Pernambuco, Recife, PE, Brazil

⁵DDS, Specialization in Endodontics, University of Pernambuco, Recife, PE, Brazil

⁶DDS, MSc, PhD, Chairman and Professor of Endodontics, University of Pernambuco, Recife, PE, Brazil

Correspondência: Carolina dos Santos Guimarães

Endereço: Rua Gervásio Fioravante, 87, apto 402 – Graças – CEP 52011-030, Recife – PE, Brazil

Fone: (81) 92323932

E-mail: carolina.odontologia@gmail.com

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Introduction

Despite recent advances in endodontics, many aspects and procedures are still widely debated among professionals in this field (GUIMARÃES; SILVA; SANTOS, 2009). The apical limit of root canal instrumentation is a very controversial topic (NEGISHI; KAWANAMI; OGAMI, 2005), and the influence of apical foramen cleaning on the resolution of periapical changes is an excellent example of a controversial theme in endodontics³.

Given the risk of undesirable and unnecessary injury of the periapical tissues, some studies advocate that endodontic instrumentation should only be performed in the dentinal canal, to a working length located 1 mm short of the radiographic root apex (SOUZA, 2006). According to this concept, the cemental portion of the root canal should not be instrumented (LEONARDI; ATLAS; RAINDEN, 2007; SCHAEFFER; WHITE; WALTON, 2005).

In teeth with periapical lesions, the cemental canal has enough physical space to shelter nearly 80,000 microorganisms (SOUZA, 2006), with an absolute prevalence of anaerobic bacteria (LEONARDI; ATLAS; RAINDEN, 2007). The presence of microorganisms in the cemental canal (VANNI, 2005), and even in the lesion itself (FLANDERS, 2002), has contributed to the widespread acceptance of the need for cleaning and debridement of the apical foramen during root canal instrumentation.

This study set out to analyze the influence of foramen cleaning on the repair of radiographically visible periapical lesions *in vivo*.

Materials and Methods

A total of 980 endodontic treatments of teeth with periapical lesions of various sizes, radiographically consistent with chronic apical periodontitis, were selected. The included patients were of both genders and between the ages of 20 and 60 years. All treatments were performed in a private office setting, by the same practitioner, between February 25, 1997 and March 15, 2005. This study was approved by the Research Ethics Committee of the University of Pernambuco and all patients provided written informed consent for participation in the study.

The sample was divided into two groups: Group I and Group II. Group I consisted of 402 treatments in which the root canal preparation had not included foramen cleaning, whereas Group II consisted of the remaining 578 treatments in which foramen cleaning had been performed (Table 1).

Table 1: Group allocation

Group	Number of treatments
Group I (foramen cleaning not performed)	402
Group II (foramen cleaning performed)	578

After initial radiographs, coronal access, and rubber dam isolation, biomechanical preparation of all teeth was performed in a crown-down direction with the aid of K-Flexfiles (Dentsply Indústria e Comércio LTDA – Maillefer, Ballaigues, Switzerland) and Gates-Glidden drills (Maillefer, Ballaigues, Switzerland) of proper diameter. Subsequently, working length (WL) was measured and established 1 mm short of the radiographic apex, an apical stop was created and the master apical file was recorded. A step-back preparation was performed, alternating instruments of increasing size with the master apical file so as to join the apical third to the coronal and middle third preparations.

In Group II, during instrumentation, the apical foramen was cleaned using K-Flexfiles compatible with the anatomical diameter of the foramen, over the total length of the root canal (WL +1 mm), rotated one-fifth of a turn forward and one-fifth of a turn backward, always under copious irrigation and aspiration.

All root canals were irrigated with sodium hypochlorite 4-6% (Roval Pharmacy, Recife, Pernambuco, Brazil) during instrumentation. *Calcium hydroxide* (Calen/ SSWhite Artigos Dentários SA, Rio de Janeiro, RJ, Brazil) was used as *intracanal* medication for 15 days. For the filling procedure, canals were dried with paper points (Dentsply Indústria e Comércio LTDA, Petrópolis, RJ, Brazil), filled with *gutta-percha cones* (Dentsply Indústria e Comercio LTDA, Petrópolis, RJ, Brazil) and *Sealer 26* (Dentsply Indústria e Comércio LTDA, Petrópolis, RJ, Brazil) (Tagger's hybrid technique) and restored with composite resin.

One year after restoration, two endodontists evaluated treatment success (classified simply as successful or unsuccessful) by clinical and radiographic evaluation of the treated teeth. On clinical examination, particular attention was given to reported pain. When there was no spontaneous pain and no pain on vertical and horizontal percussion, treatment was considered clinically successful. On radiographic evaluation, cases were considered successful when there was partial or complete resolution of periapical lesions. Complete repair was defined as complete disappearance of the lesion from radiographs, and partial repair, as a decrease in lesion size. When lesions remained the same or increased in size, treatment was considered unsuccessful, that is, there was no repair. Radiographic evaluation was standardized, using the same X-ray device, current, kilovoltage, exposure time, and radiographic film. Vertical and horizontal angles were standardized with the use of an X-ray

positioner. Radiolucent areas were measured in AutoCad 2007 (Autodesk, San Rafael, CA, USA). Intra and inter-examiner calibration were performed, and the kappa coefficient was 0.83. Statistical analyses were then carried out using Pearson's chi-square test with a 95% confidence interval.

Results

Radiographic findings showed that, in Group I, 360 (89.55%) periapical lesions achieved complete repair, 23 (5.72%) achieved partial repair and 19 (4.72%) failed to repair. In Group II, 521 (90.13%) periapical lesions achieved complete repair, 27 (4.67%), achieved partial repair and 30 (5.2%) did not repair at all. Absence of pain and complete or partial disappearance of the periapical reaction, as shown by radiographic examination, were the criteria for treatment success.

Pearson's chi-square test showed no statistically significant differences between Group I and II ($\chi^2=0.624$, $p=0.732$).

Discussion

Foramen cleaning is a controversial issue in endodontics, particularly regarding its status as a mandatory procedure for the repair process of periapical lesions (BERGENHOLTZ; SPANGBERG, 2004).

The present study found no statistically significant difference between the percentage of repair of periapical lesions in Group I and II. These results suggest that foramen cleaning does not play a decisive role in the healing of periapical lesions. A previous study showed that two experimental groups, group A with foramen cleaning and group B without this technical maneuver, remained free of bacteria in 94% and 81% of cases respectively. All specimens in the control group, where irrigation alone was done, without biomechanical preparation, contained bacteria. The authors concluded that there is no need to clean the foramen when the canal is shaped adequately, allowing satisfactory irrigation of the canal system with antimicrobial agents (COLDERO, 2002). Foramen cleaning is just another step toward proper cleansing and preparation of the root canal, and, therefore, is not solely responsible for the success or failure of endodontic treatment (SOUZA, 2000).

However, authors claim that foramen cleaning is essential to create better conditions for tissue repair, as in cases of pulp necrosis where bacteria are found beyond the dentinal canal. On the basis of the results of this study, it can be speculated that the minimum amount of remaining bacteria located beyond the cementodentinal junction is not enough to keep the periapical reaction (YU; SCHILDER, 2001).

Some investigators report that foramen cleaning can lead to postoperative pain because the periapical tissue is richly innervated. Moreover, the compression of root canal fluids and of the irrigant itself by the endodontic instrument during manipulation of the foramen may be responsible for pain (BAUMGARTNER; CUENIN, 1992). However, a previous study showed no perception of pain in 93.1% of canals treated with foramen cleaning. When well done, this procedure results in apical patency and the root canal becomes a drainage area for periapical edema, which can actually relieve pain by means of tissue decompression (SOUZA, 2000).

Extrusion of contaminated material into the periapex due to foramen cleaning can also trigger pain (GOLDBERG; MASSONE, 2002; BEESON, 1998; TINAZ, 2005). However, all techniques cause periapical extrusion; therefore, it is up to the dental practitioner to choose the method associated with the least extrusion, proving that mere apical patency will not extrude more debris than instrumentation of the root canals itself (RIBEIRO; MALNATI; COSTA JÚNIOR, 2010; SOUZA, 2006).

In the present study, treatments that resulted in no pain and partial reduction of periapical lesions on radiography were considered successful. In cases of partial resolution of lesions, even though the tissue repair process has not been completed, there is a trend toward complete resolution, as the long repair process has begun and such cases are within the estimated timeframe for tissue repair (PEREIRA; CARVALHO, 2008)

Various authors have stressed on the importance of prolonged observation of teeth with periapical lesions after treatment. In a clinical review, the length of follow-up ranged from 2 to 10 years (LEE, 2009). One study has suggested that patients should be recalled at 3 months, 6 months, 1 year, and 2 years to assess the healing of periapical lesions (ÇALISKAN, 2004). However, in this investigation, 1-year follow-up was sufficient to demonstrate that foramen cleaning was not a major factor in the repair of periapical lesions.

Because of the complexity of this work, we were unable to control for variables such as the virulence of microorganisms and the immune status of patients. On the other hand, the large sample size and the fact that all treatments were performed by the same operator and using the same technique and material support the conclusions of this study, which suggest that, regardless of foramen cleaning, periapical lesions may regress at similar rates and that uncontrolled variables such as the immune status of the patient, skill of the operator, and technical and scientific resources are more relevant than the use of this maneuver.

Conclusion

Our findings suggest that foramen cleaning is not a determinant of periapical lesion repair.

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