

POSSIBILITIES TO ASSESS THE BONE PERIAPICAL REMINERALISATION USING RADIODENSITOMETRIC MEASUREMENTS

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ABSTRACT

Aim of the study This study aimed to explore the possibility that digitized conventional periapical radiographs to be used for an accurate assessment and measurement of the results of the endodontic treatment for patients with chronic apical periodontitis (CAP). **Material and methods** The study included 20 patients (12 males, 8 females) with ages between 18-38 years, presenting severe CAP with non-surgical endodontic treatment recommendation. For each patient, conventional intraalveolar periapical radiographs were taken initially (before and after treatment completion) and at interval of 24 months. The endodontic therapy used intracanal medications (calcium hydroxide paste for 14 days) and endodontic sealer (Endoflas, Sanlor) with high antibacterial and remineralisation properties. The group of digitized radiographs was submitted to the radiodensitometric measurement. **Results** The results regarding the success rate of CAP healing were as follows: 1 case had no periapical healing (5%), 11 cases presented (55%) partial bone periapical healing and 8 cases (40%) presented complete periapical healing with total absence of periapical radiotransparence. The degree of bone remineralisation for the cases with partial bone healing varied between 52% and 80%, with a mean value of 66%. **Conclusions** The radiodensitometric measurements of periapical and CAP area provides a tool of quantitative assessment of the healing of CAP after completion of endodontic treatment.

Keywords: chronic apical periodontitis, digitized conventional periapical radiograph, radiodensitometric assessment

INTRODUCTION

In last decade was observed an increasing tendency to use digital radiography and digitally processing of conventional intraoral periapical radiographs for the diagnostic and the assessment of the post-treatment evolution of the chronic apical periodontitis (CAP). The indirect digital radiography has some advantages like convenience, the integration of image into dental practice

software, real time imaging and communication, possibility to use tools for imaging improvement [1,2]. More, the resolution of the digitized images is comparable or even better comparing with the conventional film [3]. Also the indirect digital radiography is a tool for patient instruction and motivation as well as acceptance of treatment [4]. The digitization of conventional radiograph gives the advantage

of image enhancement using filters like image enhancement, density and contrast changes, gray scale inversion, magnification, and pseudo 3-D [5]. The use of radiographic image processing transforms the original image in an improved counterpart that allows better detection and interpretation [6]. The radiodensitometric measurements also represent a valuable alternative that allows accurate analysis and measurement of the CAP evolution and rate of success after endodontic treatment completion.

AIM OF STUDY

This study aimed to explore the possibility that digitized conventional periapical radiographs to be used for an accurate assessment and measurement of the results of the endodontic treatment for patients with chronic apical periodontitis.

MATERIAL AND METHODS

The study included 20 patients (12 males, 8 females) with ages between 18-38 years, presenting severe CAP with non-surgical endodontic treatment recommendation. An informed consent from each patient was obtained. For each patient, conventional intraalveolar periapical radiographs were taken initially (before and after treatment completion) and at interval of 24 months. The conventional radiographs were scanned at 600 dpi resolution with an automated level of bright and contrast. The radiographs were taken in the same laboratory through modified bisectory technic (cylindric long cone) at a Siemens radiographic device. The endodontic therapy used intracanal medications (calcium hydroxide paste for 14 days) and endodontic sealer (Endoflas, Sanlor) with high antibacterial and remineralisation properties. The group of digitized radiographs was submitted to the radiodensitometric measurement. The software analyzed all periapical images

regarding the boundaries of the chronic apical periodontitis, and provided numeric values and quantitative assessment for the progression of the remineralisation processes in the periapical region. In order to objectively interpret the bone remineralisation processes, it is defined a global index of renewal (GI), that represents an objective evaluation of the bone tissue's renewal, being defined as the ratio between the global luminous intensity of a geometric area of affected tissue and the luminous intensity of the same geometric area of healthy tissue. The radiodensitometric measurements performed an accurate comparison of the CAP extension between periapical status immediate after root treatment completion and periapical status at an interval of 18-24 months.

RESULTS

Radiographic aspect and radio densitometric examen of digitized conventional radiograph are presented in figures 1a-1c.

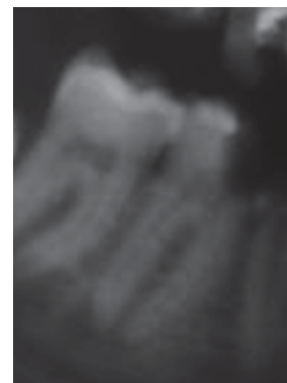


Figure 1a. Digitized intraalveolar periapical radiograph (3.6.)

The results regarding the rate of endodontic treatment success for periapical lesions, at an interval time of 18-24 months, are presented in figure 2. The results regarding the success rate of CAP healing were as follows: 1 case had no periapical healing (5%), 11 cases presented partial bone

periapical healing (55%) and 8 cases (40%) presented complete periapical healing with total absence of periapical radiotransparence.

The results regarding the rate of periapical bone remineralisation for all researched

clinical cases are presented in fig.3. The mean value of GI was 78% with minimal value 0% (failure) and peak value 100% (complete periapical healing).

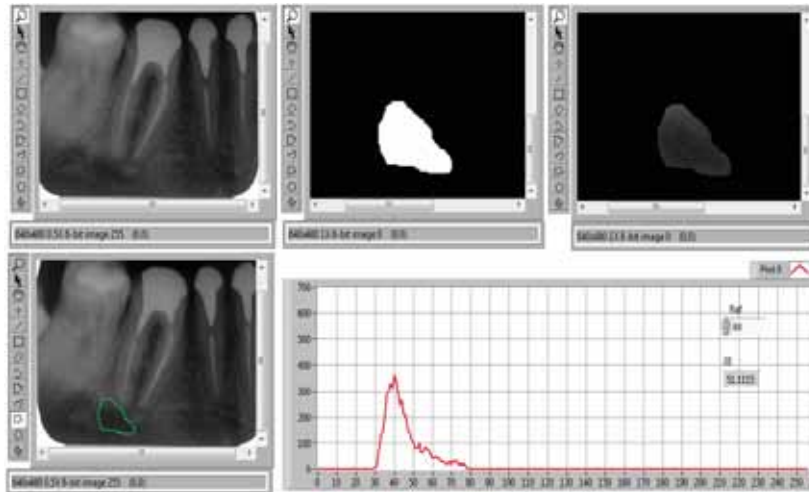


Figure 1b. Aspect with root canals treatment completed (3.6.). Radiodensitometric examen

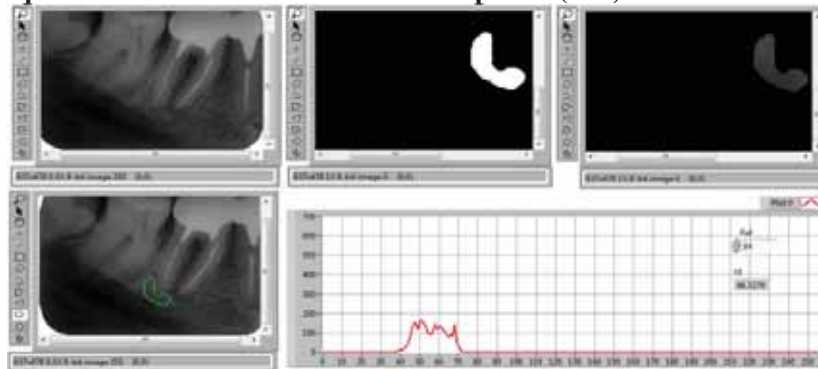


Figure 1c. Aspect at 24 months after root canals treatment completed (3.6.). Radiodensitometric examen

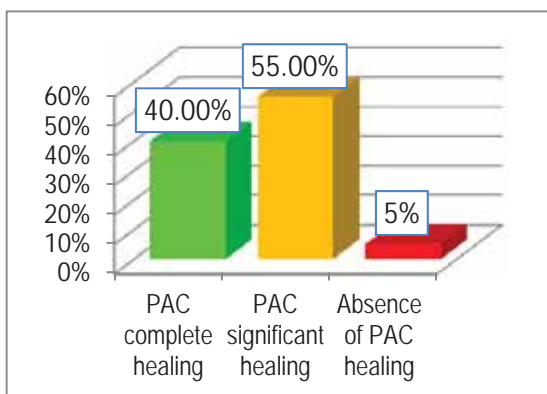


Figure 2. Success rate of CAP endodontic treatment after 24 months

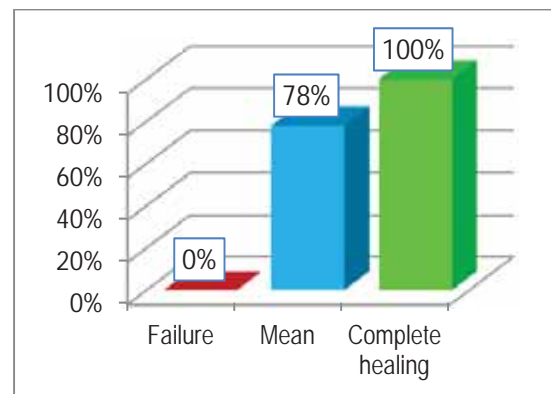


Figure 3. Mean GI (rate of bone remineralisation) at 18-24 months

The results regarding minimal, mean and peak values regarding the rate of endodontic treatment success for periapical lesions, at an

interval time of 24 months, are presented in figure 4. The radiodensitometric measurements recorded the degree of bone

remineralisation for cases with partial bone healing. For this category of clinical cases, the rate of bone remineralisation varied between 52% and 80%, with a mean value of 66%.

DISCUSSIONS

Contradictory opinions regarding the diagnostic accuracy, based on visual perception, are expressed by the researchers focused on the role of digital radiography and the role of processed digitized radiographs in the improvement of endodontic diagnostic. Most of the studies have supported the use of digital tools for dental images enhancement (7-9). There are also other factors like image compression, monitor luminance, room luminance, that can influence the visual perception and interpretation of digital radiographic imaged [11, 12, 13].

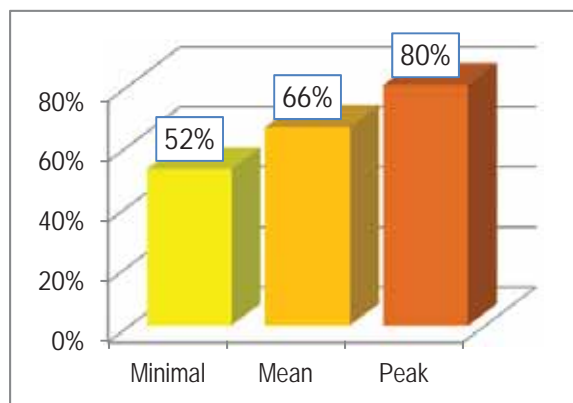


Figure 4. Minimal, mean and peak GI (rate of bone remineralisation) at 18-24 months (partial periapical healing)

Our study used radiodensitometric measurements, a method that allowed the recording of the individual data for each case of CAP monitored for 24 months. The

recorded parameters represent objective indicators of periapical healing processes, quantifying the periapical bone changes both at dimensional level and by measuring optical density of radiographic images at diverse time intervals, in relation to initial original image. The progressive reduction of pixels number indicates the initiation of the remineralisation processes. The progressive reduction of spectrum of nuances indicated the increase of periapical bone density and presence of reparatory processes. In similar study, mineral gain was detected at 90 days after root canal filling and major bone repair was diagnosed after 180 days (14). Our results demonstrate the utility of radiodensitometry demonstrating, as other similar studies, that the determination of pixels number and the assessment of grey levels distribution changes are objective indicators for periapical remineralisation processes [15-16].

CONCLUSIONS

The ease of use, accuracy and the speed in the measurement of the changes of chronic periapical lesions before and after treatment, the possibility to explain and to justify the diagnostic and treatment planning, are some of the reasons for the introduction of this method in dental practice. This method provides a tool of quantitative assessment of remineralisation periapical tissues after completion of endodontic treatment. However more researches are required, with increased size of the study groups, to validate this method and to encourage their use in dentistry.

REFERENCES

- 1 Christensen GJ. Why switch to digital radiography? *J Am Dent Assoc.* 2004 Oct;135(10):1437-9.
- 2 Parissis N, Kondylidou-Sidira A, Tsirlis A, Patias P. Conventional radiographs vs digitized radiographs: image quality assessment. *Dentomaxillofac Radiol.* 2005 Nov;34(6):353-6
- 3 Whaites E. *Essentials of Dental Radiography and Radiology.* 3rd ed. Churchill Livingstone; 2002. Alternative and specialized imaging modalities. In: Whaites E.
- 4 Goga R, Chandler NP, Love RM. Clarity and diagnostic quality of digitized conventional intraoral

- radiographs. *Dentomaxillofac Radiol.* 2004 Mar;33(2):103–7.
- 5 Hellen-Halme K, Nilsson M, Petersson A. Digital radiography in general dental practice: a field study. *Dentomaxillofac Radiol.* 2007 Jul;36(5):249–55.
 - 6 Ludlow JB, Andre Mol. Principles and interpretation. 6th ed. India: Elsevier; 2009. Digital Imaging. In: White SC, Pharoah MJ. Oral radiology.
 - 7 Wenzel A, Hintze H. Perception of image quality in direct digital radiography after application of various image treatment filters for detectability of dental disease. *Dentomaxillofac Radiol.* 1993 Aug; 22(3):131–4
 - 8 Kullendorff B, Petersson K, Rohlin M. Direct digital radiography for the detection of periapical bone lesions: a clinical study. *Endod Dent Traumatol.* 1997, Aug;13(4):183–9.
 - 9 Malleshi SN, V G M, Raina A, Patil K.A Subjective Assessment of Perceived Clarity of Indirect Digital Images and Processed Digital Images with Conventional Intra-oral Periapical Radiographs. *J Clin Diagn Res.* 2013 Aug; 7(8):1793-6.
 - 10 Raghav N, Reddy SS, Giridhar AG, Murthy S, Yashodha Devi BK, Santana N, Rakesh N, Kaushik A. Comparison of the efficacy of conventional radiography, digital radiography, and ultrasound in diagnosing periapical lesions. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2010 Sep;110(3):379-85
 - 11 Cederberg RA, Frederiksen NL, Benson BW, Shulman JD. Effect of different background lighting conditions on diagnostic performance of digital and film images. *Dentomaxillofac Radiol.* 1998 Sep;27(5):293–7.
 - 12 Haak R, Wicht MJ, Hellmich M, Nowak G, Noack MJ. Influence of room lighting on grey-scale perception with a CRT-and a TFT monitor display. *Dentomaxillofac Radiol.* 2002 May;31(3):193–7.
 - 13 Friedlander LT, Love RM, Chandler NP. A comparison of phosphor-plate digital images with conventional radiographs for the perceived clarity of fine endodontic files and periapical lesions. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2002 Mar;93(3):321–326.
 - 14 Orstavik D. Radiographic evaluation of apical periodontitis and endodontic treatment results: a computer approach. *Int Dent J.* 1991 Apr;41(2):89-98.
 - 15 Delano EO, Ludlow JB, Ørstavik D, Tyndall D, Trope M. Comparison between PAI and quantitative digital radiographic assessment of apical healing after endodontic treatment. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2001 Jul;92(1):108-15
 - 16 Rozylo-Kalinowska I., Czelej-Gorski J., Rozylo T.K. Radiodensitometric measurement in cases of chronic periapical changes of endodontically treated teeth. *Ann Univ Mariae Curie Sklodowska* 2002; 57 (1): 98-105