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RADIODENSITOMETRIC STUDY REGARDING CONSERVATIVE ENDODONTIC THERAPY IN PERIAPICAL LESIONS

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Abstract:

Introduction. Our study aimed to assess periapical healing processes using a quantitative method based on radiodensitometry.

Material and methods. The evolution of periapical lesions in a study group of 10 patients taken in conservative endodontical therapy was monitorised through radiographs taken at baseline, after 12 months and after 24 months. The radiographs were scanned at 300 dpi resolution with an automated level of bright and contrast. Modification of bone density and periapical lesion size were assessed using radiodensitometry.

Results and discussions. Radiodensitometry indicated objectively the increase of bone density and decrease of periapical radiotransparencies size that were correlated with time interval and preoperator diagnostic.

Conclusions. Radiodensitometry can be useful for an objective cuantification of endododontic therapy success in chronic periapical periodontitis..

Keywords: periapical lesions, endodontic therapy, bone density, size, radiodensitometry

INTRODUCTION

The conventional radiographic examen is an important tool in contemporary dentistry related to diagnostic and monitoring of healing processes of periapical lesions post-nonsurgical treatment. Post-treatment monitoring of healing processess is based on radiographic criteria of success or failure. The absence of changes in periapical radiotransparency diameter or increase of periapical lesion diameter represent signs of failure treatment. However conventional radiographs taken at different time intervals can present different contrasts, bright levels and scales because of the different angles of incidence and different properties of the films./1/ To reduce the error possibilities, dentists use a category of indices, named PAI (Periapical Index), on a scale that includes clinical situations from healthy periapical bone to severe chronic apical periodontitis. That is why, in some cases that present discrete healing processes, conventional radiography can lead to diagnostic errors. Digital radiovisiography allows an objective assessment of stages of periapical healing because of the reproductibility and possibilities of objective measurement but this method is not a routine practice for most dentists because of the high costs. As alternative technique to improve diagnostic performances were proposed optical densitometry or processing of digitized serial radiographs /2/ Also images processing can offer objective indicators for a number of medical applications/3/

AIM

Our study aimed to present possibilities of radiodensitometry in monitorising the evolution of periapical

status at patients with periapical lesions treated through conservative endodontic therapy.

MATERIAL AND METHODS

Study group included 12 patients with age ranging between 19 and 34 years, with bicusps and molars with severe periapical lesions (PAI 4-5) treated endodontically and monitorised for 24 months. Working protocol followed conventional stages used in periapical lesions treatment. NaOCl 2,5% and EDTA 17% were solutions used as root canals irrigants, Rockle's solutions was used as antiseptic, and calcium hydroxide was used as intracanalar medication for 14-30 days. Radicular obturations were processed using lateral condensing technique and Endoflas sealer (Sanlor), a sealer with powerful antibacterial and remineralising properties (calcium hydroxide, eugenol, iodoform). Following endodontic treatment, periapical lesions presented visible positive evolution for all teeth taken in study. Conventional periapical radiographs were taken baseline, at 12 months and 24 months. The radiographs were scanned at 300 dpi resolution with an automated level of bright and contrast. To avoid subjective analyzing of healing processes, conventional radiographs were processed through radiodensitometric method. The implemented processing algorithm uses as source the digitized image of the classic radiographies or the image obtained in digital format. The main instrument, in realizing the interpreting analysis for the bone tissue's renewal, is the histogram function. Only those pixels having a value that falls in this range are taken into account by the histogram calculation. In order to objectively interpret the process of bone tissue's renewal, it is defined a *global index of renewal*. The *global index of renewal* (GI) represents an objective evaluation of the bone tissue's renewal, being defined as the ratio between the global luminous intensity of a geometric area (ROI –Region of interest) of affected tissue and the luminous intensity of the same geometric area of healthy tissue. The software instrument is represented by LabView 8.2. Imaging processing was realized through virtual instrumentation techniques in order to calculates and displays the value of the *global index of renewal* and the average value of the gray level, specific to the healthy bone tissue. Taking into consideration that the determination of the ROI area is realized with certain subjectivism, to calculate the final evaluation value (GI) it was introduced the reporting of the ROI to the same area with the reference gray hue of the healthy tissue. So, the total number of pixels, as ROI area, is not a parameter that will interfere in the calculation of the *global index of renewal.* To interpret the evolution of the bone tissue's renewal of a patient it were taken into consideration three radiographies taken during 24 months interval of monitoring.

RESULTS AND DISCUSSIONS

We selected three representative cases of chronic periapical lesions with visible gradual evolution that was quantified through radiodensitometric methods.

Case 1. Patient B.A, age 31. Patient presented at 3.5. a periapical granuloma with PAI 5. Periapical lesion was treated following conservative endodontic treatment as described below. Control radiographs were taken at 12 months and 24 months. Figure 1 presents periapical status of 3.5. periapical area at baseline. Figures 2-3 present processed conventional radiographs and values for Global index of bone renewal. We see an increase of GIR from 77% at 12 months post-treatment to 81% at 24 months post-treatment.

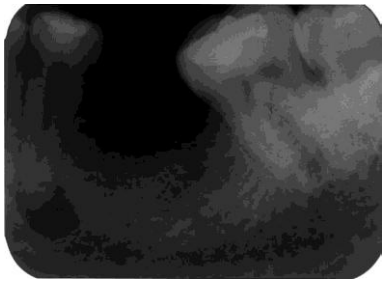

Fig.1. Radiographic aspect at baseline (3.5.)

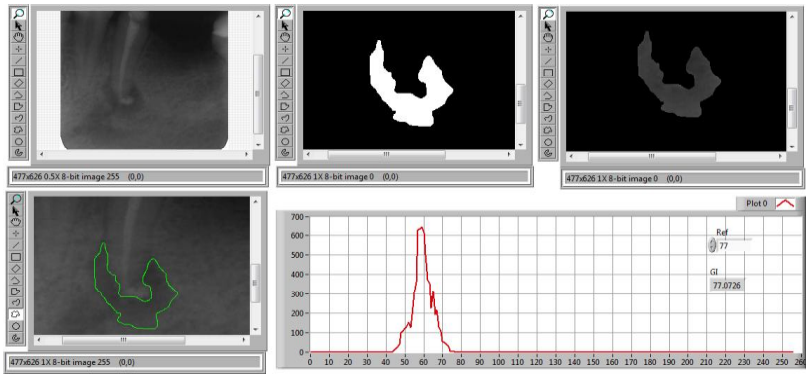

Fig. 2. Stage 2 of investigation

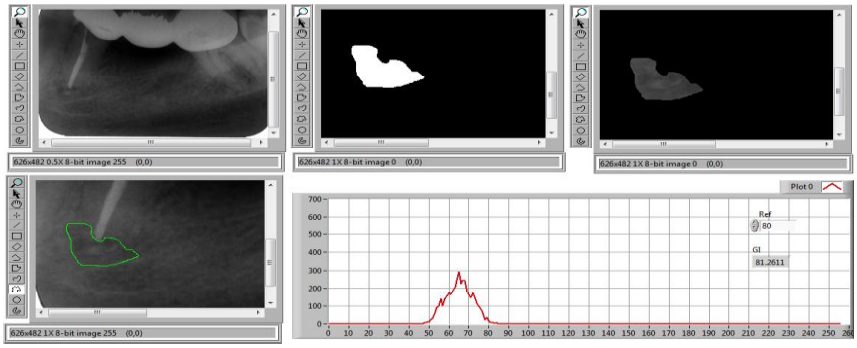

Fig. 3. Stage 3 of investigation

Case 2. Patient C.A, age 28. Patient presented at 3.6. difuse periapical osteitis with PAI 5. Periapical lesion was treated following conservative endodontic treatment as described below. Control radiographs were taken at 12 months and 24 months. Figure 4 presents radiographic aspect of 3.6. periapical area at baseline. Figures 5-6 present processed conventional radiographs and values for Global index of bone renewal. We see an increase of GIR from 64% (12 months post-treatment) to 80% at 24 months post-treatment.

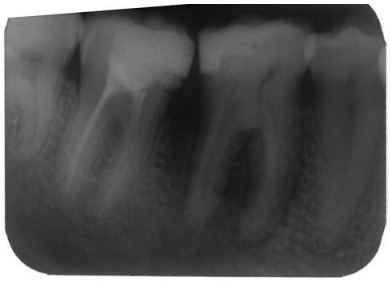

Fig.4. Radiographic aspect at baseline (3.6.)

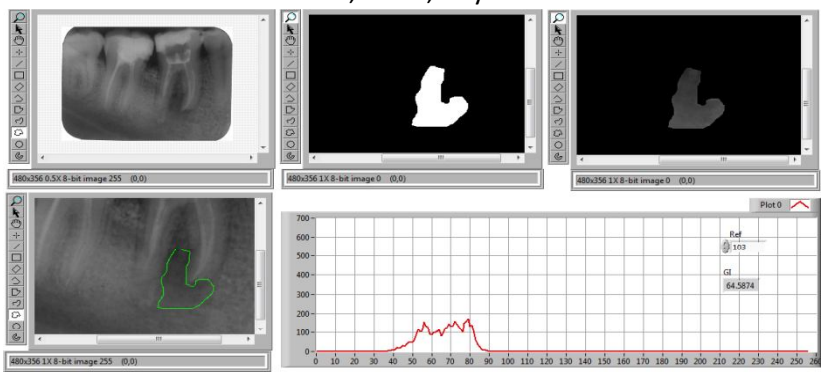

Fig.5. Stage 2 of investigation (12 months post-treatment)

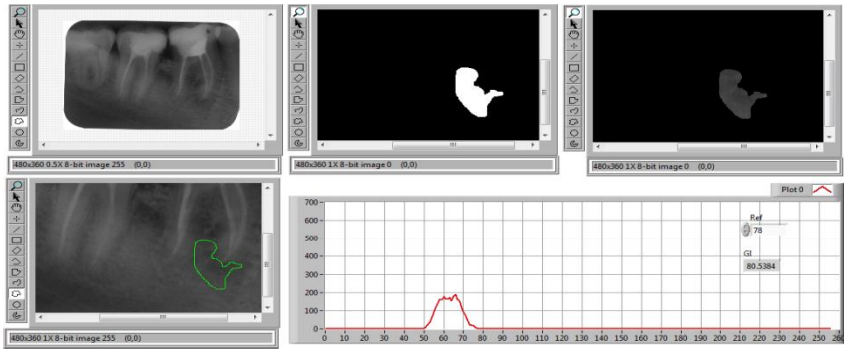

Fig.6. Stage 3 of investigation (24 months post-treatment)

Case 3. Patient D.D., age 26. Patient presented at 3.5. periapical granuloma with PAI 5. Periapical lesion was treated following conservative endodontic treatment as described below. Control radiographs were taken at 12 months and 24 months. Figure 1 presents processed conventional radiographs 3.5 and values for Global index of bone renewal. We see an increase of GIR from 51% at 12 months post-treatment to 66% to 24 months post-treatment.

Fig.7. Radiographic aspect at baseline (3.6.)

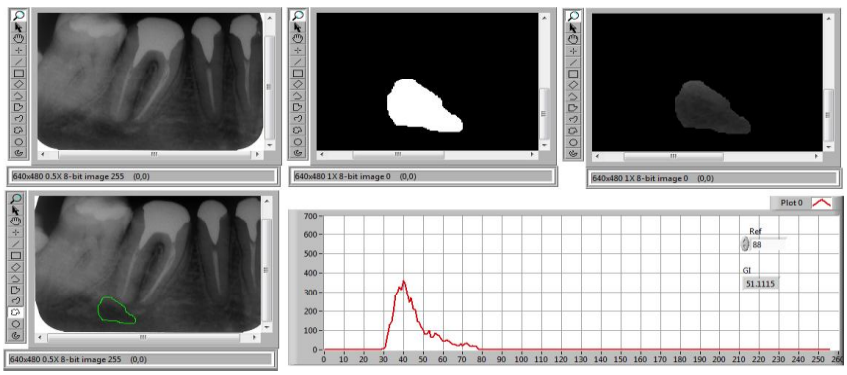

Fig. 8 Stage 2 of investigation (12 months post-treatment)

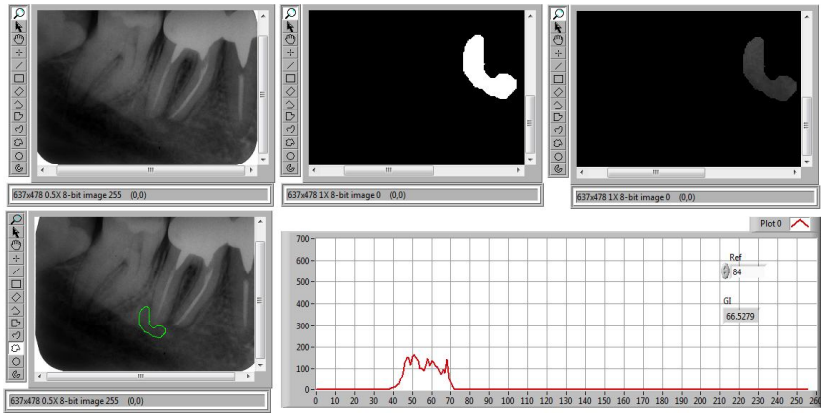

Fig. 9 Stage 3 of investigation (24 months post-treatment)

For all radiographs sets taken in study index GIR presented a gradual increase value indicating the existence of remineralisation processes of bone tissues. GIR changes express the periapical healing processes observed on conventional radiographs. Our results sustain favourable conclusions of similar studies focused on possibilities of improving diagnostic and monitoring of periapical lesions evolution through methods of imaging processing and radiodensitometry /4-8/.

CONCLUSIONS

The evolution of the periapical healing processes can be objectively quantified through radiodensitometry. The various values of bone remineralisation degree, detected in the selected cases, indicate the different individual reactions influenced by systemic status, reactivity of immune system, phosphate and calcium metabolism and type and extension of chronic periapical lesions.

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