

## **AN OVERVIEW OF DENTAL RADIOLOGY IN CITIES OF BRAZIL**

**MENEZES, F.L.<sup>1</sup>, FERREIRA, F.C.L.<sup>2</sup>, BELINATO, W.<sup>3,4</sup> and PASCHOAL, C.M.M.<sup>1</sup>**

<sup>1</sup> Universidade Estadual Vale do Acaraú (UVA), Sobral, Ceará, Brazil

<sup>2</sup> Universidade Federal do Sul e Sudeste do Pará (UNIFESSPA), Marabá, Pará, Brazil

<sup>3</sup> Universidade Federal de Sergipe (UFS), São Cristóvão, Sergipe, Brazil

<sup>4</sup> Instituto Federal da Bahia (IFBA)/*Campus* Vitória da Conquista, Vitória de Conquista, Bahia, Brazil

### **ABSTRACT**

In Brazil, the National Ordinance No. 453/1998 of the Ministry of Health regulates the operation of medical and odontological diagnostic radiology services. However, the inspection of periapical dental X-ray equipment is not carried out by some Sanitary Surveillances. This study intended to determine the suitability to the ordinance of the dental offices of Sobral-CE, Northeast of Brazil, and to compare the results with literature data for other cities of Brazil, giving a view of dental radiology of this country. It was performed tests of radiation field and image quality, and it was applied questionnaires to the professionals of Sobral-CE. For the image quality test, it was used a dental phantom and the processing of the films was performed in the clinics and at the laboratory (standard). The questionnaire assessed physical parameters that interfere on the radiation protection and on the quality of images. The results show that the ordinance is not being properly followed and that it is necessary to inspect the periapical X-ray equipments. Moreover, in general, it is observed that dental professionals should have better training on ionizing radiation and on radiation protection.

### **1. INTRODUCTION**

X-ray are electromagnetic waves of high frequency that have high penetrating power and are able to ionize atoms and molecules. To penetrate the body part, of the X-radiation can be absorbed and part can be transmitted. The contrast observed on radiographs, for example, between bone and muscle, is due to difference in absorption of X-ray by different body tissues [1]. Among the several applications of X-ray, it may be mentioned their use in dental diagnosis.

Despite the benefits obtained by the use of X-ray, it was noticed, over time, the existence of a deleterious effect when used improperly [2]. The use of ionizing radiation in radiological examinations requires special attention with regard to radiation protection of the patient and the professional who performs the tests, since the main source of exposure of radiation to the population comes from its use in hospitals, medical clinics and dental offices [3-4]. Given the potential of ionizing radiation to cause somatic and/or genetic changes and important applications in medicine and dentistry, several countries began to establish standards of conduct and clinical procedures, seeking to ensure that the equivalent dose received by a person is as low as reasonably achievable (ALARA).

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<sup>1</sup> E-mail of the Autor. cinthiam.paschoal@gmail.com

In Brazil, National Ordinance No. 453/98 of the Ministry of Health regulates the operation of diagnostic services medical and dental [5]. Parameters and criteria for the implementation of equipment for quality control tests were published by the National Health Surveillance Agency (ANVISA) in 2005. In Ceará, supervising the quality control of X-ray equipment is carried out by the Health Surveillance state, but this control is not required for periapical dental equipment.

Notwithstanding the implications resulting from intraoral exposures are minimal, the radiation effects can be cumulative. Many studies are unanimous in reporting the poor fit of dental offices to the standards set by the Decree No. 453/98.

Given the importance of evaluation of physical parameters in periapical dental equipment, this study intended to determine the suitability to the ordinance of the dental offices of Sobral-CE, Northeast of Brazil, and to compare the results with literature data for other cities of Brazil.

## 2. METHODOLOGY AND RESULTS

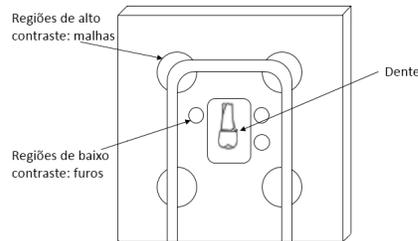
### 2.1. Methodology

It was visited 18 clinics in the city of Sobral, publics and privates, and it was identified 20 equipments. It was guaranteed to the establishments the confidentiality of provided informations. The X-ray equipment was not working in one of the clinics and, in another, the equipment did not show any identification technique, as the kVp and mA. It was applied questionnaires to dental professionals and carried out quality control tests on X-ray equipment, they were: radiation field and image quality. The questionnaire had objective questions about: the users and professionals' radiation protection, the characteristics of the offices and equipments, the used techniques, and the processing of periapical films. The radiation field size was obtained by exposing four periapical films directly on the collimator exit, as shown in Figure 1. After an X-ray exposition, the films were processed and the the diameter of the radiation field was measured. Thus it was possible to verify if the equipment was in accordance with the limits set by the Decree No. 453/98.



**Figure 1. Radiation field test**

For image quality control test, it was used a dental phantom developed by [3]. Inside the simulator, it was arranged four different types of metal mesh, 100, 80, 60 and 40 lines per inch, and three holes with 10 mm, 20 mm and 30 mm deep [3]. The meshes allow the analysis of high-contrast regions, while the holes enable the evaluation of the low contrast regions. The phantom used is illustrated in Figure 2.



**Figure 2. Representation of used dental phantom.**

It was selected three exposure times: the most used by the clinic and two taking into account the nominal voltage specified on the equipment: 0.4 and 0.5 seconds for equipment of 70 kVp; and 0.7 and 0.8 seconds for equipments of 50 to 60 kVp. Six films were exposed in each X-ray equipment, two expositions for each time. The processing of the films was performed in the clinics and at the laboratory (standard).

## 2.2. Results

83% of the evaluated offices possessed thyroid protectors and 89% had lead aprons. However, only 33% of offices reported that they use one of the protectors frequently; 50% said they use them only in some patients and 17% reported that they do not use the protector justifying that the radiation dose was very low. Better results for the use of the shields were registered in the city of Olinda-PE (85.7%) [6], Pouso Alegre-MG (72%) [4] and in Recife (90%) [7].

Proper packaging of the shields is fundamental for the preservation of their structures. The Decree 453/98 establishes that there must be appropriate supports in order to preserve the integrity the shields. It was found that 61% of the offices possesses appropriate supports, 17% folded up them, 11% had no criteria for accommodate them and 11% did not have any shields. In the city of Olinda-PE [6] only 28.6% possesses appropriate supports and in the city of Recife-PE this percentage is 70% [7].

Ordinance MS 453/98 recommends that professionals are positioned at least two meters of X-ray equipment during the radiographs. In this study, 61% of dentists reported that locate themselves behind walls with baryta, 28% said stay more than two meters, and 11% less than two meters of the X-ray equipment. In the cases where there were not adequate protection barriers, the dentists stay behind common walls. In Pouso Alegre-MG, 15.7% of dentists reported that position themselves behind walls with baryta [4].

The Decree No. 453/98 establishes that the X-ray tube tension must be greater than or equal to 50 kVp, preferably greater than 60 kVp, for intraoral radiography [5]. In the present study

it was found that 72% of the equipments had voltage of 70 kVp. This result was 81.8% in the city of Aracaju-SE [3], 40% in the city of Recife-PE [7], and 57.1% in Teresina-PI.

The diameter of the radiation field was higher than 6 cm in 50% of the evaluated equipments, as established by the Decree No. 453/98. This result was most satisfactory among those found in the literature: 21.4% in Teresina - PI [8], 45.5% in Aracaju-SE [3], 47.9% in Itajaí-SC and Camboriu-SC [2] and 39.5% in Rio de Janeiro-RJ [9].

Every analyzed equipment possessed cylindrical collimators, as required by the Decree No. 453/98. This result was 58.6% in the city of Teresina, PI [8], 60% in Recife-PE [7], 69.7% in Pouso Alegre-MG [4] and 83.5% in Aracaju-SE [10].

The Decree recommends electronic timer for selection of exposure times, instead of the the mechanical systems [5]. It was observed that 61% of the offices were in accordance with the rule, while 39% were still using mechanical timer. In Recife-PE, 30% of the equipments possessed mechanical timer [7].

The visual method of film processing is not allowed, but 83% of the visited offices still use visual technique. It is recommended opaque material for revelation chamber, 83% of the visited offices use acrylic chamber of revelation being that 67% of them are located in places of great clarity. Only 11% performed the film processing in a totally opaque rooms and 6% had only digital processing. 28% of interviewees reported that the revelations were made through timing, but not using revelation table. At no one of the evaluated offices were found classification tables relating time-temperature, in disagreement with the Decree 453/98. In Aracaju-SE, 67% of dental professionals confirmed the use of visual processing method [3]. This percentage was 50% in Recife-PE [7] and 62.92 in São Paulo-SP (62.9%) [11].

For the image quality test, the films processed at laboratory showed higher contrast variations than those processed in the offices.

### 3. CONCLUSIONS

The results show that the ordinance is not being properly followed in many cities in Brazil and that it is necessary to inspect the periapical X-ray equipments. Moreover, in general, it is observed that dental professionals should have better training on ionizing radiation and on radiation protection.

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