

## A Study of Dentists' Knowledge about Dental Radiology Principles

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### ABSTRACT

**BACKGROUND AND OBJECTIVE:** The use of dental radiography is inevitable in order for disease diagnosis, assessment and monitoring. Radiography is potentially harmful due to the use of ionizing radiation. This study was conducted to evaluate dentists' knowledge about the principles of dental radiology.

**METHODS:** This cross-sectional study was performed on 600 general dentists willing to cooperate with this study in Amol, Noor, Mahmoodabad and Sari cities located in Mazandaran province, Iran, in 2014. All the data were obtained by means of a questionnaire. The questionnaire included two parts; the first part surveyed demographic information, and the second part included 11 items about radiographic technique and equipments.

**FINDINGS:** 500 questionnaires were completed. Among the surveyed population, 335 (67%) and 165 (33%) dentists were male and female, respectively. The mean of practical experiences was  $12.35 \pm 6.68$  years. 469 dentists (93.8%) used the dental X-ray machine with digital timer and 404 dentists (80.8%) used the dental X-ray machine with long cone tube. Additionally, 470 (94%) X-ray machine had round. Generally, 367 (73.4%) and 374 (74.8%) dentists used bisecting technique and E-speed films, respectively. Also, annual calibration of X-ray devices was suggested by 416 (83.2%) dentists.

**CONCLUSION:** According to our study, dentists' knowledge about the dental radiography principles was fair.

**KEY WORDS:** Dentist, Dental Radiography, Radiology.

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### Introduction

Radiography is a valuable modality in medical imaging and approximately 30-50% of medical decisions, especially in critical cases, are made

using radiological findings (1). The use of dental radiographs is inevitable in order for disease diagnosis, assessment and monitoring. There is no

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doubt about efficiency of radiographs in dental care. Almost half of dental caries are found only by means of X-rays. Despite these benefits, radiography is potentially harmful due to the use of ionizing radiation. Inappropriate use of X-rays can increase its inherent risks (2). The annual rate of radiation dose received from various sources by the general population is 2.5 mSv, 15% of which belongs to medicine. Although, the radiation doses received from individual dental radiographs are generally low, it can have critical effects due to large number of patients receiving radiation for dental problems (3-5).

Some of recent advances in radiology technology, equipment and techniques are used to reduce the radiation dose received by patients and to improve the image quality (6). In the recent decades, numerous findings have been obtained to reduce the radiation dose received by patients and staff radiologist.

The findings and recommendations for radiation protection have been listed in the guidelines provided by international radiation protection association (IRPA) (7). These recommendations include: using E-speed and higher-speed films, collimation of square radiation field, employing tall head tubes, quality control (QC) equipment tests, lead aprons thyroid shields and skirts, intraoral cones radiation therapies, high speed videos combined with cavity resonators and resonators (consisting of rare earth elements) in extra-oral radiography (1, 8).

Keeping patients from unnecessary radiation, even from the smallest doses, is one of the main concerns of dentists. Dose radiation can be significantly reduced if dentists follow the IRPA guidelines and be aware of the new guidelines or standards of practice on radiation protection such as new techniques and selection criteria and having motivation to use specific methods (9). Results of a study conducted by GhazikhanlouSani et al., demonstrated that the dentists did not have sufficient information about QC equipment, regular

monitoring of plants and equipment and the use of digital imaging equipment (1). Therefore, it is necessary for dentists to consider changing old and inefficient methods in favor of modern radiation fractionation, updated techniques and equipment. This study aimed to evaluate dentists' knowledge about the dental radiography principles in Mazandaran province

## Methods

This cross-sectional study was performed on 600 general dentists in Mazandaran Province, Iran, 2014. All the dentists worked in clinics equipped with X-ray devices based on the medical council instructions. Amol, Noor, Mahmoodabad and Sari cities, located in Mazandaran province, were included in the study through cluster sampling method.

A questionnaire was sent to all the dentists. The completed questionnaires were considered eligible as long as half of the items were answered. To determine the validity of the questionnaire, all the items were evaluated by three faculty members at oral and maxillofacial radiology department. Subsequently, the test-retest (25 dentists completed the questionnaire twice with a time interval of two weeks) and Cronbach's alpha (0.90) for assessing reliability of the questionnaire were used. The questionnaire included two parts, i.e., demographic information part (e.g., age, gender and years of practice) and a part including 11 items regarding knowledge of radiography equipment (e.g., timer, speed and type of film, digital sensor and tall head tube) and radiation techniques (e.g., parallel-bisector). The questionnaires were completed by the dentists during a specified time. Then, the obtained data were analyzed.

## Results

In general, 500 questionnaires were completed in this study. Among the population of the study,

335 (67%) and 165 (33%) dentists were male and were female, respectively. The mean of practice experience was  $12.35 \pm 6.68$  years. Approximately, 447 (95.4%) of X-ray devices were made after 2000 and about 22 (4.4%) devices were made between 1991 and 2000. One (0.2%) X-ray device was made between 1980 and 1990.

The evaluation of Kilovoltage peak (kVp) in different devices demonstrated 65, 70, 60, 60-70, and 50 kVp in 348 (69.6%), 131 (26.2%), 13 (2.6%), 5 (1%) and 1 (0.2%) of devices, respectively. Also, the used kVp was not specified in two (0.4%) devices.

Moreover, the used milliamperes (mA) were 8, 10, and 4 in 305 (61%), 186 (37.2%) and 4 (0.8%) devices, respectively. Milliampere was variable in five (1%) devices.

**Table 1. The frequency of radiology equipment in Mazandaran province**

| Variables                        |                              | N(%)      |
|----------------------------------|------------------------------|-----------|
| Timer                            | Manual/automatic             | 30(6)     |
|                                  | Digital                      | 469(93.8) |
|                                  | Unknown                      | 1(0.2)    |
| Head tube size                   | Tall Cone                    | 404(80.8) |
|                                  | Short Cone                   | 71(14.2)  |
|                                  | Unknown                      | 25(5)     |
| Type of localization             | Cone                         | 25(8)     |
|                                  | Rectangular                  | 5(1)      |
|                                  | Circular                     | 470(94)   |
| intraoral radiography techniques | Bisecting technique          | 367(73.4) |
|                                  | Radiology-parallel-technique | 133(26.2) |
|                                  | Unknown                      | 0(0)      |
| image sensor types               | Film                         | 479(96.4) |
|                                  | CCD                          | 16(3.6)   |
|                                  | PSP                          | 0(0)      |
| Speed films                      | E                            | 374(78.8) |
|                                  | EF                           | 106(20.8) |
|                                  | F                            | 4(0.8)    |

## Discussion

In this study, the majority of the dentists used E-speed films, this finding was in agreement with the obtained results of GhazikhanlouSani et al. and Shahab et al. studies (1, 10).

Using E-speed films leads to decreased radiation dose without reducing the quality of radiographic imaging. According to the obtained data, approximately 8% of the dentists used E-speed films that was less than the amounts reported in other studies (11, 12). According to a study conducted by Shahab et al., one of the reasons for the more frequent use of E-speed films rather than F, is the higher accessibility of E-speed films which can affect dentists' choice (10).

Based on our study, the majority of the dentists use a tall head tube, this finding was in agreement with the Tugnait et al. study and was inconsistent with the study of Aps et al. (6, 13). The use of short rather than tall head tube in Aps et al. study may be due to the lack of subject's awareness about the difference between short and tall head tubes (13). Using tall head tube leads to increasing the distance between the X-ray source and the patients' skin. Therefore, tall head tubes is efficient in reducing radiation exposure. In our study, the rate of using tall head tube was 80%.

Considering our results, application of circular, cone and rectangular collimators had the highest frequencies, respectively. This was consistent with the obtained results of Salti and Gijbels et al. studies (14, 15). Use of circular collimator instead of rectangular can lower the rate of effective dose by 60% (9).

The other results of our study suggest that the bisecting technique in radiography was more frequently used as compared to the radiology-parallel-technique in intraoral radiography. This result was in line with Shahab et al. and Mutyabule et al. results (10, 16). According to the obtained results, the dentists' knowledge about the principles of dental radiography was satisfactory as compared to other studies on the subject. In a nutshell,

training dentists regarding principles of dental radiology is required for both graduates and practicing dentists.

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