

Study of the Observing the Principles of Radiation Protection and the Factors Related to it in Dentistry Centers

¹Mohammad Javad Keikhai Farzaneh, ¹Nader Miri,
²Mojtaba Vardian and ³Reza Afzalipour
¹Zahedan Health Promotion Research Center,
Zahedan University of Medical Sciences, Zahedan, Iran
²Fasa University of Medical Sciences, Fasa, Iran
³Department of Medical Physics,
Tehran University of Medical Sciences, Tehran, Iran

Abstract: The risk of death rate resulted from imaging with X-rays has been assessed as 2.5 cases of all one million radiographies so that 170 cases of death rate are annually occurred owing to using X-rays to perform a thorough intra-oral radiography. For this reason, various guidelines are taken in recent years regarding the protection against ionizing radiations in dental radiography from the International Organization for Radiation Protection. This study aims to determine observing the protection principles against radiation in dentistry centers. In this descriptive study, a number of dentistry centers in Sistan and Baluchestan Province were evaluated to determine observing the radiation protection principles so that having been presented in dentistry centers, some information was achieved the patients and personnel's observing the protection principles through observation and filling out the questionnaire and the relative and absolute frequency of each indicators were then analyzed in the next stage through SPSS Software. An undesirable condition can be seen in most dentistry center due to existing the equipment of radiation protection such as lead pinny, thyroid protection and compressed lead walls in these centers such that 100% of dentistry radiography rooms had lead partitions, 31% of radiography rooms had thyroid protection and 26% were deprived of lead immunized walls. Using high-speed films and automatic fixation and emergence equipments in regarded centers is a very positive point and on the other hand, one of the main problems in these centers is lack of periodically performing quality control tests. Observing the protection principles against radiation in dentistry centers had a desirable condition however, this condition was not the same as those in quality control program.

Key words: Radiation protection, X-ray, dental radiography, dentistry, Iran

INTRODUCTION

Using radiography in dentistry is unavoidable so that according to the evaluations performed in this regard, >25% of radiography was performed in the field of dentistry in 1993 in United States (NRPB, 2001). The risk which is resulted to death rate is 2.5 cases per one million full intra oral radiography which can be reduced to one case per two million radiography by decreasing the number of radiography (4 films). On the other hand, many findings have been achieved in recent decades in order to decrease the obtained dose of patients and personnel of radiography center in which these findings have been mentioned as the advices for radiation protection in the gushiness of the organizations for radiation protection (Mupparapu, 2005; Geist and Katz, 2002). Using films with

E-speed and higher than it, square collimation of radiation field using a high distance between the member and the source being radiated the tests of quality control for the equipments using the lead coverage and thyroid protection using high radiation cones in intra-oral radiographies and using the combination of film and an high speed intensifying screen in extra-oral radiographies can be mentioned amongst these advices (Mupparapu, 2005; Geist and Katz, 2002; European Commission, 2004). Finally, using these criteria in dentistry sectors not only reduce the patient's dose but it is a good policy to train these methods to trainees and optimizing the society's obtained dose (Geist and Katz, 2002). The aim of designing this study is to determine observing the guidelines of international organizations for radiation protection in dentistry centers of Sistan and Baluchestan.

MATERIALS AND METHODS

In this study, 21 dentistry centers in Sistan and Baluchestan Province have been studied such that a questionnaire was provided based on the legislations of International Commission on Radiological Protection (ICRP) and the European Commission on Radiation Protection in the field of protection principles required in center for dental radiography to study about observing the protection principles in dentistry centers. The questionnaire is comprised of the questions related to the kind and model of radiography equipments, films speed used here the filtration of the equipment for producing X-ray the type of limiters used here the protection environment of radiography equipment, performing quality control tests of the equipments, controlling the dose achieved to personnel and the kind of fixation and emergence system. Having been gathered

the questionnaires and entering the data to computer the obtained data were analyzed and the mentioned cases were adopted with the standards through SPSS Software.

RESULTS AND DISCUSSION

The general condition for observing the protection principles against intra and extra oral radiographies of the centers under study have been shown in Table 1 and 2. On the other hand, the general conditions for periods of quality control of the equipments and the compatibility of the present conditions with global standards have been shown in Table 3 and 4, respectively. The results achieved from this study indicate that the regular quality control programs and measuring the output of radiography equipments are not performed in any of the centers under study and only in 14 centers (66.7%) the quality control of the equipments was performed in an

Table 1: The condition of observing protection issues in intra oral radiography centers in the centers under study

Parameters	-----Intra oral radiography [No. (percentage)]-----			
Type of film	D-speed 0 (0)	D and E-speed 5 (23.8)	E-speed 16 (76.2)	E-speed 0 (0)
Type of collimator	Cylindrical 14 (66.7)	Square 0 (0)	Cylindrical and square 7 (33.3)	Conical 0 (0)
Collimator length	<8 inches 4 (19)	8 inches 5 (23.8)	12 inches 7 (33.3)	>16 inches 5 (23.8)
Existing equipment tools	Lead coverage only 15 (71.4)	Iodine thyroid only 0 (0)	Both 6 (28.6)	None 0 (0)
Uses of lead coverage	Pregnant women 18 (85.7)	Children and pregnant women 0 (0)	Children, pregnant women and full dental series 3 (14.3)	All patients 0 (0)
Patient's radiography authority	Students only 0 (0)	Radiology technician only 3 (14.3)	Students or radiology technician 14 (66.7)	Therapist dentist 4 (19)
The authority for caring children and disabled people	Patient accompanier 21 (100)	Therapist doctor 0 (0)	Radiology technician 0 (0)	Nurses in the center 0 (0)
Used kVp	Below 60 kVp 0 (0)	60 kVp 3 (14.3)	60-70 kVp 16 (76.2)	Over 70 kVp 2 (9.5)
The amount of equipment's filtration (mmAl)	1 and below 1 0 (0)	1.5 3 (14.3)	2 16 (76.2)	2.5 2 (9.5)
Type of environment of radiography room's protection	Lead wall 10 (47.6)	Apron 4 (19)	Thickness of ordinary wall 7 (33.3)	Observing th distance 0 (0)

Table 2: The condition of observing protection issues in extra oral radiography centers in the centers under study

Parameters	-----Extra oral radiography [No. (percentage)]-----			
Screen film speed	100 and below 0 (0)	200 (0) 0	300 (0) 0	400 and upper 21 (100)
Existing protection tools	Lead coverage only 14 (66.7)	Iodine thyroid only 0 (0)	Both 7 (33.3)	None 0 (0)
Uses of coverage	Pregnant women 17 (81)	Children and pregnant women 11 (4.7)	All patients 2 (9.5)	None 1 (4.7)
Radiography authority of patients	Students only 3 (14.3)	Radiology technician only 16 (76.2)	Students or radiology technician 2 (9.5)	Therapist dentist 0 (0)
The authority for caring the children and disabled people	Patient accompanier 21 (100)	Therapist doctor 0 (0)	Radiology technician 0 (0)	The nurses of center 0 (0)
Used Kvp	Below 60 0 (0)	60 (0) 0	60-70 13 (14.3)	Over 70 8 (38.1)
Amount of equipment's filtration (mmAl)	1 and below 0 (0)	1.5 0 (0)	2 9 (42.8)	2.5 12 (57.1)
Type of protection environment in radiography rooms	Lead wall 12 (100)	Apron 0 (0)	Thick of ordinary wall 0 (0)	Observing the distance 0 (0)

Table 3: The adoptability of observed protection issues against intra and extra oral radiography with global standards of radiation protection

Protection cases of intra oral dental radiography	Amount of compatibility with standards [No. (percentage)]	
	Extra oral radiography	Intra oral radiography
Using square collimator	-	7 (33.3)
The length of used collimator	-	17 (80.1)
Existing protection tools for patients	21 (100)	21 (100)
Uses of lead coverage and ironed thyroid	2 (9.5)	3 (14.3)
The authority of radiography of patients	18 (100)	21 (100)
Existing film badge and the particular tools to record the radiation	21 (100)	21 (100)
The authority for caring children and disabled people	21 (100)	21 (100)
Measuring the base density and films fogging	3 (14.3)	3 (14.3)
Measuring the safe light and evaluating the light leakage in darkroom	3 (14.3)	5 (23.8)
Controlling the received dose to personnel and radiographers	21 (100)	21 (100)
Quality control and measuring the equipment's output	4 (19)	0 (0)
The authority for equipment's quality control	6 (28.6)	5 (23.8)

Table 4: Condition of dentistry radiology centers in terms of periods of equipment's quality control

Conditions	Periods of quality control [No. (percentage)]			
	Monthly and below	Annually	Regularly	Not performed
Base density and fogging the extra oral films	3 (14.3)	0 (0)	8 (38.1)	10 (47.6)
Base density and fogging the intra oral films	3 (14.3)	0 (0)	8 (38.1)	10 (47.6)
Assessing the safe light and measuring the light leakage in darkroom	4 (19)	1	13 (61.9)	3 (14.3)
Quality control of the equipments and measuring the output	0 (0)	4 (19)	14 (66.7)	3 (14.3)
Controlling the dose received to personnel and radiographers	2 (9.5)	18 (85.7)	1 (4.8)	0 (0)

irregular way. On the other hand the film badge was used in all centers under study to monitor the personnel's dose and the patients and personnel's protection tools are available in all centers.

Regarding the fixation and emergence system of films, all the extra oral radiography centers are equipped with automatic fixation and emergence system and five centers (23.8%) are deprived of automatic fixation and emergence system for intra oral films. According to the rule enacted by ADA using high-sensitive films to reduce patient's dose is necessary in dentistry radiography. On the other hand, maximum level of coetaneous radiation should be 38.5 cm² however, the square collimator should be 4×5 dimensions and the cross section 20 cm². The minimum height of PID should be 8 and 16 inches in maximum and the plastic cones with the end points are not recommended (White, 1992; Goren, 1998; Herschmann, 1995; Fredridsen, 1999; NRPB, 2001). On the other hand using the thyroid protection and lead apron reduces the thyroid dose up to 50% and gonad dose up to 95% (Fredridsen, 1999).

Moreover, using the beige film to monitor the personnel's dose in dentistry is necessary and according to the NCRP rules the effective dose of the entire body for dentists, assistants and hygienists is annually 50 mSv which this amount can be reduced by observing the standards of radiation protection (White, 1992; Fredridsen, 1999). In addition, regarding using the lead coverage, Herchman put it in 1995 that due to the fact that lead coverage is cumbersome and the received dose of sexual glands is low, there is no need to use them

routinely in dental radiography (Herschmann, 1995) however, according to the NCRP and ADA reports using the lead apron to reduce patient's unnecessary radiation is necessary (Fredridsen, 1999; NRPB, 2001). According to the performed studies in all centers under study pregnant women used lead apron in the time of radiography however, using these equipments for all patients in intra oral radiography was 14.3 and 9.5% for extra oral radiography. On the other hand, using the thyroid protection in dentistry centers was not prevalent and very few centers are inclined to use these equipments.

In addition, the conducted study indicate that using the rectangular collimator (33.7%) was lower than that of other global studies (Kaugars *et al.*, 1985; Nakfoor and Brooks, 1992). On the other hand, all the centers were provided with automatic fixation and emergence equipments and high-speed films (E-speed in intra oral radiography and speed 400 and more than it in extra oral radiography) were used for the fixation and emergence processes.

CONCLUSION

According to the findings obtained in this study and its comparison with the similar studies, it can be concluded that observing the protection principles against radiation in this dentistry center under study are in a relatively desirable condition and the ideal condition can also be achieved with a little attention to regular quality control of the equipments.

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