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## Evaluation of X-ray protective shielding used in dental offices in Kerman, Iran, in 2014

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### Original Article

#### Abstract

**BACKGROUND AND AIM:** Protective equipment, such as lead aprons and thyroid shields, is effective in reducing patient radiation. This study was conducted for evaluation the use of thyroid shields and lead aprons in dental offices, in Kerman, Iran, in June 2014.

**METHODS:** In this descriptive-analytical study, 106 dental offices with active X-ray machines were evaluated in Kerman. The information was recorded on a data sheet consisting of eight questions in three fields of the rate of the use of lead aprons, thyroid shields and taking part in radiation protection courses. Data were evaluated using frequency distribution and chi-squared test.

**RESULTS:** In this study, 12.3% of clinics were equipped with lead aprons but only 5.7% used them for all the patients. Only 10.4% of Kerman Dental Clinics had thyroid shields. Approximately, 9.7% of Kerman dentists had participated in continuous retraining courses on radiation protection. There was a significant relationship between clinics equipped with lead aprons with more job experience.

**CONCLUSION:** The results showed that the rate of the use of lead aprons and thyroid shields in dental clinics equipped with X-ray machines in Kerman is not sufficient and is far from the international standards. Therefore, it is suggested that radiation protection equipment be promoted and oral and dental radiologists be responsible for the use of such equipment in their clinics.

**KEYWORDS:** Patient Protection; Radiation; Dentists

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Dental X-rays are valuable tools in diagnosing oral and dental diseases, and the proper use of these radiographs is beneficial for patients. However, the use of dental radiology procedures requires caution because the X-rays cause potential damage to cells and tissues.<sup>1</sup>

Manifestations of damage caused by radiation may appear after 10-20 years.<sup>2</sup> Although the risk associated with dental

radiography is certainly minor, it cannot be considered completely free of risk.<sup>3</sup> Therefore, specific attention should be paid to radiation safety and dentists need to be updated with changes in techniques and equipment and change their practice.<sup>4,5</sup>

Technical developments in equipment and systems significantly reduce X-ray doses to patients with the use of protective equipment, such as lead aprons and thyroid shields that are effective in reducing

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radiation.<sup>6</sup> The use of E-speed films and direct digital radiography, compared with D-speed films, can reduce exposure time, leading to a decrease in radiation dose.<sup>7,8</sup> In addition, thyroid collar is a lead shield used to protect the thyroid gland from scattered radiation and is recommended for all the intraoral exposures, especially in small children and adults with thyroid disorders. A lead apron is a flexible shield placed over the chest to protect reproductive organs from scattered radiation and recommended for intraoral and extraoral exposures. Therefore, there are many reasons to use a lead apron and thyroid sheath to protect patients from the harmful effects of radiation.<sup>9</sup>

However, many studies have shown that dentists do not follow the precautions and safety factors, especially in their private practice. The results of a study in North-East England showed that a significant proportion of dentists were not making full use of opportunities to reduce dose to their patients.<sup>10</sup> The results a study in Turkey showed that lead aprons and thyroid collars were used by a small number of dentists.<sup>6</sup> Furthermore, the previous studies in Iran showed that rate of the use of lead aprons and thyroid shields in dental clinics is not sufficient.<sup>11,12</sup> Nisha et al.,<sup>13</sup> in India, Zangoie Booshehri et al.<sup>14</sup> in Yazd, Iran, and Tavakkoli et al.<sup>15</sup> in Tehran, Iran, have focused on increasing knowledge of dentists about the hazards of radiation. Furthermore, these studies showed that the dentists should implement recent and appropriate radiation protection techniques and guidelines in their offices.

There is no data available on the practice of dentists about protection during dental radiology procedures in Kerman, Iran. The aim of this study was to determine the use of thyroid shields and lead aprons in dental clinics equipped with X-ray machines in Kerman.

## Methods

This research was a cross-sectional study of

dental clinics that had active X-ray machines in Kerman, Iran, in June 2014. A total of 139 dentists had active X-ray machines in their clinics, of which 106 dentists (76.2%) were enrolled in the study after obtaining informed consent. The rest either were not available or did not consent to research.

The survey tool was a checklist consisting of questions about (1) demographic characteristics of dentists, (2) use of lead aprons, (3) use of thyroid shields, and (4) passing the radiation protection courses.

The statistical analysis was performed by SPSS software (version 21, IBM Corporation, Armonk, NY). Data were analyzed in terms of frequency distribution, and chi-squared test was used to distinguish the difference the significance of differences between the variables. The level of significance was considered at 5%.

## Results

In this study, 106 dental offices equipped with X-ray machines were evaluated. The time passed of graduation and clinic establishment were  $8.7 \pm 4.2$  and  $7.2 \pm 4.1$ , respectively. The most dentists had graduated from Kerman (29.2%) and Tehran (22.6%) universities.

The results of questions about radiation protection are presented in table 1. According to these results, 12.3% [confidence interval (CI) 95%: 6.0-18.6%] and 10.4% (CI 95%: 4.1-16.7%) of dental offices in Kerman were equipped with lead aprons and thyroid shields, respectively. Only 9.7% of dentists evaluated had participated in radiation protection courses (Table 1).

To investigate the association between years in practice with questions about radiation protection, these variables were divided into two groups: less or equal to 10 years and more than 10 years. The results are shown in table 2. Based on the table, there was a significant relationship between clinics equipped with lead aprons with time passed the establishment of the office ( $P = 0.001$ ). This relationship was marginally significant for the time after graduation ( $P = 0.060$ ).

**Table 1.** The results of answers to questions about radiation protection

Questions	n (%)
Do you have a lead apron in your clinic?	
Yes	13 (12.3)
Do all your patients wear a lead apron while being exposed to X-ray?	
Yes	6 (5.7)
The millimeter of your lead apron	
0.2	0 (0)
0.3	2 (1.9)
0.4	0 (0.0)
0.5	3 (2.8)
Do you have a thyroid shield in your clinic?	
Yes	11 (10.4)
Which type of thyroid shield do you use?	
Small	1 (0.9)
Medium	8 (7.6)
Large	0 (0)
Do you use a thyroid shield for children?	
Yes	11 (10.4)
Do you use a thyroid shield for adults?	
Yes	8 (7.6)
Have you participated in continuous learning courses about radiation protection at a university?	
Yes	10 (9.7)

### Discussion

Based on guidelines for protecting the patients during radiographic examinations, they must be provided with a shielded apron for gonad protection and a thyroid shield. Thyroid skin exposure can be reduced by 33-84% in adults and 63-92% in children by using a thyroid shield.<sup>3</sup> The findings of this study showed that radioprotection for the

patient was not favorable and far from international standards.

In this study, 12.3% of clinics were equipped with lead aprons but only 5.7% of clinics used it for all the patients, consistent with a study carried out in Turkey, in which, 8.7% of dentists used lead aprons.<sup>6</sup> In a study in Tabriz, Iran,<sup>9</sup> lead aprons were used by 16.2% of dentists, which is little more than that in this study.

**Table 2.** Relationship between rate of the use of lead apron and thyroid shield with job time passed after graduation and clinic establishment

Questions	Time passed after graduation		P	Time passed of clinic establishment		P
	> 10	≤ 10		> 10	≤ 10	
	n (%)	n (%)		n (%)	n (%)	
Have a lead apron in clinic						
Yes	9 (20.5)	4 (6.5)	0.060	9 (32.1)	4 (5.1)	0.001
No	35 (79.5)	58 (93.5)		19 (67.9)	74 (94.9)	
Use a lead apron for all patients						
Yes	4 (8.8)	2 (3.3)	0.390	4 (13.3)	2 (2.6)	0.098
No	41 (91.2)	59 (96.7)		26 (86.7)	74 (97.4)	
Have a thyroid shield in clinic						
Yes	6 (13.6)	5 (8.1)	0.500	6 (20.0)	5 (6.6)	0.110
No	38 (86.4)	57 (91.9)		24 (80.0)	71 (93.4)	
Pass the course about radiation protection						
Yes	5 (11.9)	5 (7.8)	0.400	5 (17.8)	5 (6.4)	0.200
No	37 (88.1)	59 (92.2)		23 (82.2)	73 (93.6)	

The previous studies in Iran showed that radioprotection for patients using lead apron was not suitable. The results a study in Yazd showed that none of the dental offices lacked lead aprons.<sup>11</sup> In Isfahan,<sup>12</sup> only 10% of dentists used lead apron.<sup>12</sup>

Although, our results indicated that there was a significant correlation between more job experience and clinics equipped with lead aprons, there was no significant relationship between the use of lead apron and more job experience. In Isfahan, there was a reverse relationship between job experiences with dentist's awareness about the potential dangers of radiation and radiation dose reduction.<sup>12</sup> These findings show the importance of continuing education in radiation protection. However, dentists with more job experience should also continually update their knowledge based on standard protocols.

In our study, only 10.4% of dental clinics had thyroid shields and 7.5% of clinics used it for adults, and all of them used it for children and 2.9% used it only for children. In Tabriz, thyroid shields were used in 8.5% of the cases,<sup>9</sup> consistent with our results. The results of our study and research in Tabriz are higher than studies in Isfahan,<sup>12</sup> and Turkey,<sup>6</sup> in which 4.5% and 3.7% used lead collars, respectively.

It seems that dentists have not necessary knowledge about the efficacy of these shielding (lead apron and thyroid collar) on reducing the dose to patients, and prefer to increase the speed of treatment. Although in these studies a small number of dentists used lead aprons and thyroid shields, a study conducted in universities of the United States and Canada showed that 95% of dental practitioners used lead aprons for extraoral radiography and 85% of subjects used lead collars for intraoral radiography.<sup>16</sup> In addition, the results of a study in Iranian dental schools showed that in relation to the availability of radiation protection facilities (such as lead aprons, thyroid shields, and lead-impacted walls) in dental schools, there was a favorable situation.<sup>17</sup> The main differences between our results and other

studies might be due to the samples evaluated, showing that radioprotection methods are more common in universities than offices.

In addition, our results showed that 8 out of 13 dentists did not know how much the thickness of lead was in their lead apron in their offices. Studies have indicated that the shielded apron and thyroid shield must have a lead equivalence of at least 0.25 mm of lead.<sup>1</sup> In this study, 8 and 1 out of 11 dentists reported average and small size of thyroid shields, respectively. Two dentists did not have any information about their thyroid shield size. Based on previous studies, thyroid shields are available in the market based on size, location of the thyroid gland in the neck, and compatibility. These protective shields are in three sizes: small, medium, and large. The small one is used more often in children, the medium one in adolescents, and the large one in adults.<sup>18</sup>

The results of this study and other studies indicate that the dentists' knowledge about radiation dose reduction techniques was not adequate. Zangoie Booshehri et al.<sup>14</sup> in Yazd showed that the knowledge of dentists about radiation protection techniques was very poor and attempts should be made to improve dentists' knowledge about radioprotection techniques. Other studies in England,<sup>10</sup> Isfahan,<sup>12</sup> Tehran,<sup>14</sup> also emphasize the need for continuing education after graduation. This may be because of the large number of dentists have not received the necessary training in the field of radiation protection either in the university or after training, and had not been updated in radiation protection practices, and consequently, lead to the failure to implement the best radiographic practice.

It seems that after graduation dentists must update their knowledge by attending meetings, reading dental journals, and participating in continuous education courses in universities or the atomic energy organization. Alcaraz et al.<sup>5</sup> assessed the influence of European Union legislation and

recommendations on radiation doses in intraoral dental radiography in Spain. The results point to a dose reduction of 19% in 7 years. In our study, only 9.7% of Kerman dentists participated in continuing education courses and most dentists who were relatively new graduates should be required to take such courses to optimize protection against radiation exposure of their patients.

The limitations of this study were that some dentists did not cooperate and all of the protection techniques such as the kind of radiographic films, and X-ray barriers in the office were not assessed. However, in this study, we assessed protective shielding (lead apron and thyroid shields) that is very effective for gonad and thyroid protection. It is recommended that more studies be done with consideration of all factors and radiation protection equipment.

## Conclusion

The findings of this study showed that methods of radioprotection for the patients were not favorable and were far from international standards. In general, dose reduction techniques are considered less important in offices compared to educational centers. Therefore, dentists must update their safety awareness and the availability of new equipment, and techniques that could further improve the diagnostic capacity of radiographs and decrease exposure, which necessitates more continued education in this field.

## Conflict of Interests

Authors have no conflict of interest.

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