Original Article

The Consistency of Panoramic Radiography Selection Criteria by Dentists in Tehran with the FDA Guidelines

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Abstract

Background and Aim: Use of panoramic radiography in some cases is easier and more cost-effective than other radiographies. However, it has some limitations as well. Considering the importance of radiography in dentistry, the present study sought to assess the consistency of selection of panoramic radiography by general dentists in Tehranwith FDA guidelines during 2010-2011.

Materials and Methods: In this descriptive cross-sectional study, 500 general dentists were selected using randomized cluster sampling and evaluated by a questionnaire. The questionnaire asked for demographic data and had 27 questions regarding the selection criteria for panoramic radiography. Dentists had the following answer choices for each criterion: "Strongly leads to prescription", "probably leads to prescription", "has no effect on prescription", "probably prevents prescription" and "strongly prevents prescription". The answers were collected and descriptively analyzed. To evaluate the effect of different factors on dentists' answers, binary logistic regression with enter method was used.

Results: Of the understudy dentists, 44% were females and 56% were males with a mean age of 36.84 yrs. Based on the results of regression analysis, panoramic radiography was prescribed by dentists in case of concerns regarding the carcinogenicity of radiation, good oral hygiene and for evaluation of growth and development before the age of 6 which are not in accord with the FDA guidelines. Also, for primary assessment of periodontal status, poor oral hygiene, disseminated pain, determination of alveolar crest height in the anterior region and pregnancy, panoramic radiography was prescribed by dentists which is completely in agreement with the FDA guidelines ($p<0.05$).

Conclusion: Easy application of panoramic radiography and its accessibility were the reasons for its prescription in 55.5% and 47.6% of cases, respectively. Some reasons of prescription were in accord with the FDA guidelines while some others were in contrast to them.

Key Words: Panoramic radiography, General dentists, FDA guidelines

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Introduction

Panoramic radiography is an easier, quicker and less expensive imaging technique than the full mouth periapical radiography [1]. Its wide coverage, accessibility and the ability to use it for patients with mouth opening limitations are among other advantages of this technique. Its indications for use include evaluation of trauma, extensive

lesions, dental anomalies, teeth or residual roots and developmental anomalies; which do not require high clarity of details like in intraoral radiography. Unequal magnification of objects and distortion are among the disadvantages of this technique. Furthermore, superimposition of teeth by objects like the cervical vertebra can hide the odontogenic lesions especially at the location of incisor teeth [2]. Panoramic radiography has less accuracy in detection of caries and bone loss due to periodontal disease compared to intraoral techniques. However, some dentists prescribe panoramic radiography for caries detection [3]. FDA has prepared a guideline for selection of dental radiographs and elimination of unnecessary radiographs in order to decrease the absorbed dose of patients [1]. However, these guidelines have yet to be widely introduced [3]. Furthermore, no reliable information is available on the type of prescribed radiographs and dentists' perspectives about the diagnostic accuracy of panoramic radiography in comparison with intraoral techniques or its accordance with the FDA guidelines. The present study aimed at determining the consistency of panoramic radiography selection criteria by general dentists in Tehran with the FDA guidelinesduring 2010-2011.

Materials and Methods

In this descriptive cross-sectional study data were obtained by using a questionnaire. Using randomized cluster sampling, 10% (about 500 subjects) of general dentists in Tehran (out of about 5000 subjects) were selected and questionnaires were administered among them. Sample loss was 16%. Districts 2, 5, 6, 9, 11, 12, 15, 16, 18 and 20 were randomly selected among a total of 22 districts in Tehran. Of the mentioned districts, 50 dentists were randomly chosen. The questionnaire asked for demographic characteristics of patients and had 27 questions about the selection criteria and indications of using panoramic radiography including patient's firstattendance, evaluation of primary caries, primary evaluation of periodontal disease, pre-and post-surgical treatments, pre- and post-orthodontic treatments, before removable partial denture (RPD) treatments, evaluation of growth pattern and development before the age of 6, evaluation of growth pattern and development after the age of 6, primary evaluation of maxillary sinuses, determination of alveolar crest height especially at the anterior region, determination of alveolar crest height in the posterior region, disseminated pain, paresthesia, edema, trauma, jaw movement limitation, jaw movement anomalies, easy application of panoramic radiography, accessibility of panoramic radiography, legal concerns about not having x rays in patient's file, legal concerns about obtaining radiographs of patients, concerns about the carcinogenic effects of radiation, patient's request, radiation fear in patient, pregnant patient, poor and good oral hygiene. The validity of the questionnaire had been previously evaluated and confirmed by 3 radiologists in Shahid Beheshti School of Dentistry using the available reliable resources. To assess its reliability, 50 dentists (5 from each district) were randomly selected and asked to fill out the questionnaire for the second time one week after filling it out for the first time and their responses to the two questionnaires were compared. The Kappa value obtained for twice responding to the questionnaires was 0.89; which is statistically acceptable. SPSS version 16 software was used for data analysis. To assess the effect of variables on dentists' responses in each domain of the test, Binary logistic regression was used. SPSS version 16 software was used for statistical analysis with type I error as 0.05.

Results

Of a total of 420 general dentists in Tehran enrolled in this study, 185 (44.0%) were females and 235 (56.0%) were males. The mean age of dentists was 36.84±8.09 yrs. Based on the results of regression analysis, panoramic radiography was selected by dentists for the following reasons "carcinogenicity of intra-oral radiography", "patient's fear of radiation", "legal concerns about obtaining radiographs of patients", "good oral hygiene" and "evaluation of growth pattern and development before the age of 6"; which are not in accordance with the FDA guidelines. Furthermore, for primary evaluation of periodontal status, poor oral hygiene, paresthesia, swelling, disseminated pains, determination of alveolar crest height at the anterior region and pregnancy panoramic radiography was the preferred technique of imaging by dentists which are in accord with the FDA guidelines. The most significant differences in prescription of panoramic

radiography between the two genders were for "primary evaluation of periodontal status", "determination of alveolar crest height at the anterior region" and "pregnancy". In the mentioned cases, female dentists prescribed panoramic radiography significantly more than male dentists. Male dentists more commonly prescribed panoramic radiography in cases of "patient's fear of radiation" and "poor oral hygiene" (Table 1).

Table 1. Regression analysis results regarding the effect of different factors on selection of panoramic radiography

Index	Gender (male to female)		Graduation year (later to sooner)		Participation in continuing education programs (no, yes)	
	OR	P	OR	P	OR	P
Patient's first attendance	1/30	0/024	1/23	0/053	1/58	0/0008
Evaluation of primary caries	1/03	0/798	0/49	0/0001	2/05	0/0003
Primary evaluation of periodontal diseases	0/78	0/03	0/67	0/0004	2/53	0/0001
Before and after surgical treatments	1/05	0/174	0/93	0/038	1/07	0/074
Before and after orthodontic treatments	0/98	0/613	1/02	0/647	1/01	0/961
Before RPD treatments	1/06	0/088	1/06	0/174	1/02	0/615
Evaluation of growth and development pattern before the age of 6	0/88	0/011	1/79	0/0003	0/68	0/001
Evaluation of growth and development pattern after the age of 6	0/87	0/009	1/04	0/363	0/84	0/008
Primary evaluation of maxillary sinuses	0/94	0/096	1/54	0/001	1/16	0/004
Determination of alveolar crest height at the anterior region	0/79	0/018	0/71	0/008	3/79	0/001
Determination of alveolar crest height at the posterior region	0/89	0/027	0/98	0/428	2/55	0/001
Disseminated pains	1/18	0/041	0/98	0/491	1/69	0/001
Paresthesia	1/30	0/016	1/37	0/006	0/93	0/314
Edema	1/12	0/058	1/44	0/003	0/94	0/276
Trauma	1/11	0/059	1/25	0/024	0/89	0/012
Jaw movement limitation	0/93	0/047	0/99	0/847	0/88	0/008
Developmental anomalies	1/08	0/068	1/07	0/269	0/92	0/058
Easy application of panoramic radiography	1/21	0/036	0/59	0/001	1/15	0/046
Accessibility of panoramic radiography	1/16	0/048	0/47	0/0001	0/70	0/0006
Legal concerns about not having radiography in patient's file	1/30	0/021	0/66	0/0007	1/42	0/0004
Legal concerns about obtaining radiography of patients	1/09	0/274	1/29	0/031	2/00	0/0001
Concerns about the carcinogenicity of radiation	1/19	0/047	2/38	0/0006	1/51	0/005
Patient's request	0/76	0/001	0/86	0/046	1/08	0/064
Patient's fear of radiation	2/17	0/001	2/65	0/0001	1/19	0/016
Pregnant patient	0/25	0/0001	1/17	0/068	0/57	0/0003
Poor oral hygiene	1/72	0/001	0/29	0/0001	1/30	0/009
Good oral hygiene	1/13	0/032	2/52	0/0001	0/62	0/0007

OR (Odds Ratio): shows the odds of selecting to not selecting panoramic radiography under the mentioned conditions

For gender variable, ratio of prescription by male dentists to female dentists, for the graduation year variable, ratio of dentists graduated after 1994 to those graduated before that date and for the variable of participation in continuing education courses the ratio of dentists that had not participated in such programs to the number of those who had participated were calculated.

Discussion

In this study, 27 panoramic radiography selection criteria were evaluated. The results showed that panoramic radiography had the greatest frequency of prescription "before RPD treatments", "before and after orthodontic treatments", "before and after surgical treatments" and "trauma". "Pregnancy", "evaluation of primary dental caries", "legal concerns about obtaining panoramic radiography of patients and "fear of radiation" were associated with the least number of panoramic radiography prescriptions.

Jnwoo in 2011 and Rushton et al, in 2008 demonstrated that panoramic radiography had high diagnostic value for treatment of patients with swelling [1, 4]. Swelling in 79.1% of dentists was the reason for prescription of panoramic radiography. Since panoramic radiograph has the ability to show extensive lesions [1, 2], it is also among the suggested indications for prescription of panoramic radiography [2].

Disseminated pains and paresthesia were the reason for prescription of panoramic radiography by 54.1% and 60% of dentists, respectively. Since the mentioned two factors are among the occult diseases and panoramic radiography is indicated in such cases, further education in this respect seems necessary.

For primary evaluation of periodontal disease according to the FDA guidelines, proper bitewing and periapical radiographs are still the imaging techniques of choice [2]; while in our study, 47.6% of dentists recommended panoramic radiography for this purpose.

Rushton et al, in their study in 2002 evaluated the factors affecting dentists' decisions to obtain panoramic radiographs and found that "planning oral surgery" was most likely to influence dentists taking a panoramic radiograph [5]. In our study, 90% of the respondents stated that trauma had the highest likelihood to influence them for obtaining a panoramic radiograph.

In another study by Rushton et al, in 1999 the most common factors influencing dentists' decision to obtain panoramic radiographs were planning oral surgery (95%), facial trauma (90%), periodontal disease (87.8%), heavily restored dentition (84.2%) and 'patient's first attendance (79%) (3).

In our study, 37.9% and 41.4% of dentists stated that "evaluation of the growth and development pattern before and after the age of 6", respectively was a factor that strongly influenced their decision to take a panoramic radiograph. However, according to the FDA selection criteria, assessment of growth pattern with panoramic radiography before the age of 6 is not necessary.

In the study by Rushton et al, in 1999, fear of radiation and good oral hygiene in 69.8% and 36.0% of dentists, respectively were the reasons for not prescribing panoramic radiographs [3]. Our study showed that 38% of dentists were not aware of the fact that panoramic radiography is not suitable for assessment of primary caries. Furthermore, "concerns about the carcinogenicity of radiation", "patient request" and "fear of radiation" were the reasons for selection of panoramic radiography in 3.6%, 53.4% and 0.9% of dentists.

According to the FDA selection criteria, the abovementioned factors do not justify the prescription of panoramic radiography revealing the knowledge of dentists in this respect [2-6].

In the study by Rushton et al, in 1999, 54% of dentists had participated in continuing education courses; which is smaller than our obtained rate [3]. Higher number of dentists participating in such courses in our study may be explained by the location of our study evaluating dentists in only one city (Tehran) with 4 dental schools; whereas, Rushton et al, in their study evaluated dentists randomly selected from Family Health Service Authorities in England and Wales. In their study, participation in continuing education courses had no effect on dentists' answers [3]. In contrast, Svenson et al, in 1996 found a correlation between the mentioned two factors [6]. As explained by Rushton et al, lack of a significant correlation between these two factors in their study may be attributed to the ineffectiveness of these courses or insufficient discussion about the subject of "proper selection of type of radiography". The attended dental school and participation in different congresses and seminars on radiation health had also influenced dentists' responses in their study and in 17 cases, had a significant effect on dentists' responses.

Rushton and Horner in 1996 and Kaugars et al, in 1985 in separate studies reported that "pregnancy" was the most important factor for not prescribing panoramic radiography [5]. In Rushton et al, study

in 1999, 91.1% of dentists reported that "pregnancy" was the reason for not prescribing panoramic radiographs [3]. In our study, 38% of dentists strongly stated that pregnancy was the reason for not choosing panoramic radiographs.In guidelines on radiology standards for primary dental care provided by the Royal College of Radiologists and the National Radiological Protection Board in 1994, it was stated that due to the low level of radiation in oral and maxillofacial radiographies, there is no need to change the natural trend of selection of type of radiography [7]. Due to the advancements made in panoramic radiography technology, panoramic radiography decreases the patient's absorbed dose by one/tenth of full mouth periapical radiographs [8, 11]. Thus, it seems that dentists in Tehran have low level of knowledge in this respect.

Easy application of panoramic radiography was the reason for its prescription by 55.5% of dentists. However, its easy application is important in cases that are not capable of opening their mouth due to trauma, infection or etc. [2]. Also, 47.6% prescribed this radiography due to its accessibility; which is not in agreement with scientific reasons and FDA recommendations. In 63.8%, poor oral hygiene had no influence on prescription of panoramic radiography; whereas, use of panoramic radiographs in such patients is considered a strength point because when patient's oral condition necessitates obtaining more than 4 bitewing radiographs, panoramic radiography is the imaging technique of choice for an overall evaluation [2].

In general, 2.6% of general dentists recommended panoramic radiography for patients with good oral hygiene. According to FDA guidelines, in patients with good oral hygiene depending on their age range, the only required radiography is periodical bitewing radiographs [2, 12].

According to 81.7% of dentists, limitation of jaw movement was the reason for prescription of panoramic radiographs; which is in accord with the FDA guidelines considering the fact that evaluation of TMJ and limitation of jaw movement are among the indications of panoramic radiography [2].

Developmental anomalies were the reason for prescription of panoramic radiography by 85.2% of dentists; which is also in agreement with the FDA guidelines [2].

Furthermore, 53.4% of dentists had reported that they would prescribe panoramic radiograph upon patient's request; which has no scientific justification and should not be the reason for prescribing this radiography [2, 12].

For primary evaluation of maxillary sinuses, 67.8% of dentists recommended obtaining a panoramic radiograph. Panoramic radiography is useful for primary assessment of maxillary sinuses and it should be noted that for evaluation of lateral walls of the sinus and extension of lesions, complementary radiographs must be prescribed as well [2].

A total of 34.3% and 40.5% of dentists selected panoramic radiograph for evaluation of alveolar crest height at the anterior and posterior regions, respectively; whereas, periapical radiography is more accurate for this purpose [2]. Panoramic radiography does not have a precision as high as that of intraoral radiographs for revealing alveolar crest level especially at the anterior region [5].

For dental caries and periodontal diseases intraoral radiographs are the preferred imaging technique due to their higher translucency compared to panoramic radiographs. It seems that educating and encouraging dentists for successful implementation of FDA guidelines in this respectcan greatly help reduce the number of panoramic radiographs taken by dentists and improve the health care system.

Conclusion

Easy application of panoramic radiography and its accessibility were the reasons for its prescription in 55.5% and 47.6% of cases, respectively.Some reasons of prescription were in accord with the FDA guidelines while some others were in contrast to them.

References

1- Jnwoo, Choi, Rushton VE. Assessment of panoramic radiography as national tool. Imaging Sci Dent. 2011, Mar; 41(1):1-6.

2- White & Pharaoh. Oral radiology principles an dinterpretation. 6th ed. China: Mosby; 2009, Chap 10, 14.

3- Rushton VE, Horner K, Worthington HV: Factors influencing the selection of panoramic radiol-

ogy in general dental practice. J Dent. 1999 Nov; 27(8):565-571.
4- Rushton VE, Horner K: Clinical justification of dental radiography in adult patients. Radiol. 2008 Mar; 246(3):845-53.
5- Rushton VE, Horner K: The use of panoramic radiology in dental practice. J Dent. 1996 May; 24 (3):185-201.
6- Svenson B, Soderfeldt B, Grondahl H-G: Analysis of dentists' attitudes towards risks in oral radiology. Dentomaxillof Radiol. 1996Jun;25(3):151-156.
7- Hirschmann PN. Royal college of radiologists and national radiological protection board. Guidelines on radiological standards for primary dental care. National radiological protection board. Br Dent J. 1995 Mar 11; 178(5):165-7.
8- Ludlow JB, Ludlow LE, White SC. Patient risks related to common dental radiographic examinations: the impact of 2007 International Commission on Radiological Protection recommendations regarding dose calculations. J Am Dent Ass. 2008 Sept; 139(9):1237-1243.
9- Rushton VE, Horner K, Worthington HV. Routine panoramic radiography of new adult patients in general dental practice: Relevance of diagnostic yield to treatment and identificantion of radiographic selection criteria. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2002 Apr; 93(4):488-95.
10- Langland OE, Langlais RP, Preece JW: Principles of dental imaging. 2nd ed. [S.L]: Lippincott Williams & Wilkins; 2002, Chap9:201-218.
11- Center for devices and radiological health. The selection of patients for x-ray examinations: Dental radiographic examinations. HHS Publications 88-8273. Rockville: Federal Drug Adiminstration, 1987.
12-Gail F, Williamson. RDH: Patient dose reduction in dental imaging. Dentistry IQ, 2011 Nov; 30 (4):57-68.