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Population Knowledge and Awareness Concerning Dental Radiography. A Cross-Sectional Study

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Abstract

Introduction: Oral radiology plays indispensable role in every discipline in dentistry. Assessing public knowledge and concern may aid in increasing the compliance and help in overcoming be misleading, confusing, or incorrect information circulating among public.

Aim: Aim of this survey was to assess the knowledge and awareness of general population concerning dental radiograph used in dentistry.

Study Design: Cross-sectional study.

Materials and Methods: This survey is based on 7 question to assess the level of knowledge and 8 questions to assess the awareness, sliding scales were used to assess knowledge whereas awareness was assisted using yes or no questions.

Results: A total of 437 participant included in this survey, 62% of participant depend on multiple sources of information to gain their knowledge about hazard of radiation, 64.3% strongly believed that oral radiography may carry risk to them. 85.8% knew it is not suitable for pregnant women as well as it is harmful for growing children (63,1%). 49% of the participant unable to decide whether x-ray harmful to pregnant women with use of lead apron after forth months, as well as if the digital panoramic has less radiation than conventional one. Most participant displayed good level of awareness regarding the sensitivity of the thyroid gland, the majority of the sample not aware about the type of imaging they had received and have no idea if the digital imaging or the guideline for descripting radiograph to children. The knowledge. Affected significantly by Gender, marital status and previous radiographs.

Conclusion: It is critical issue in dentistry to identify the knowledge and awareness of population concerning the safe uses and follow the recommend guidelines of prescribing dental radiograph because this will determine the response and acceptance of individuals to dental radiographs. Surveying patients is recommended method to obtain and document their knowledge and awareness about dental radiograph they encounter in daily basis when visiting dentist.

Keywords: *Dental Radiograph; Knowledge; Awareness; Panoramic Image; Protective Procedures*

Introduction

Oral radiology plays indispensable role in every discipline in dentistry, various imaging modalities available for dentist to improve the diagnosis and treatment outcome.

In the past conventional radiography either intraoral or panoramic radiography frequently requested by dentist in daily basis. Recently, digital radiography gain popularity and become widely accepted by many dental institutions. Each imaging technique have variable radiation dose as described by many researchers [1,2].

The amount of radiation delivered to patients is low but never reach zero, it is depending on several factors, among them weather analogue or digital sensor are used, exposure parameter employed, type of collimators, technology employed and how frequently are used by the dentist. Dentist expected to follow the ALARA principle (As Low As Reasonably Achievable) to reduce the amount of radiation delivered to their patients [3,4]. There is tremendous increase of use of ionizing radiation by various specialty to improve the quality of treatment. Unfortunately, there is no currently available data or studies document the frequency of each imaging modalities used to estimate the risk associated with each imaging modalities. In united states, there were dramatic increase in the use of oral radiography since 1970 from 54 million to 500 million in 2007 [5]. Oral health improved intensely, the dental service became widely available throughout the world as well as increase of the number of practicing dentists who have access to various kinds of imaging modality available all over, this led to increase in the number of requested radiograph by the dentist.

Radiosensitivity [6] is term used to describe the sensitivity of the tissue of an organ to different kind of ionizing radiation. The cells in the body have different sensitivity to ionizing radiation, cell with high mitotic rate and undifferentiated are more radiosensitive to ionizing radiation than specialized cell. X-ray photon may interact directly with the cell causing destruction of vital structure like DNA, this interaction may lead to alteration of the cell function, mutation or death of the cell, another type of interaction is indirectly, through interact with water molecule leading to formation of free radicles which is toxic substance to the living cell. either direct or indirect interaction of ionization radiation could be damaging to the biologic system of the living cell. Not all ionizing radiation lead to permanent damage of the cell, sometime the cell able to repair themselves without observable biological effects [6].

Patients at high risk of continuous exposure to dental radiography are pregnant women and children. The risk of exposure to radiation is not negligible. In the first trimester, the tissue of developing fetus and children have cell with high rate of mitotic activity make their cell more sensitive to ionizing radiation [7]. Therefore, x-ray to this group must be requested with appropriate justification based on application of selection criteria and guideline of prescribing dental radiographs [8].

Diagnostic doses in dentistry are less than 10 rads, congenital abnormalities will occur if the developing fetus exposed to radiation doses above 10 rads (150 mGy to 200 mGy) which cannot be attributed to dental diagnostic doses. The Use of lead aprons during pregnancy can reduce radiation doses to gonads up to 98% [10].

Despite the low doses and various protection procedures implemented by the dentist as well as the use of digital technologies, still there are public apprehensions of increased health risks associated with exposure to dental X-rays for public, children and pregnant women, therefore this study sought out to identify the knowledge and awareness and general public towered health hazard associated with oral radiography received by general population with emphasis on children and pregnant women.

Materials and Methods

A cross-sectional study was conducted to assess knowledge, awareness and attitude of population regarding hazard associated with prescribed dental radiographs. Data was collected using a predesigned self-administered structured and pretested questionnaire. The questionnaire's items were generated by carefully reviewing relevant literature. The content of the questionnaire was validated by oral radiologist before distribution to the population. Approval of the questionnaire was obtained from the institutional ethical committee.

The questionnaire was anonymous and included cover page with a consent, request for cooperation and instructions, questions socio-demographic characteristics including age, marital status, educational level and previous exposure to dental radiography, last dental visit and if the clinic was private practice, governmental or academic institutions. Last sections included questions was designed for assessment of the level of knowledge, awareness toward the dental radiography and x-ray using 5 points rating scale. On the other hand, awareness was assisted using yes or no questions. A pilot study was carried out on 40 participants with different characteristics to assess its clarity and feasibility. The questionnaire was then distributed through social media.

Statistical analysis

The data were compiled and analysed, summarized and presented in tables, all statistical analyses were performed with the Statistical Package for Social Sciences (SPSS) program (version 22). The following descriptive statistics were performed: frequency distribution tables, T-test of analysis was used to study the association between previous radiographs and knowledge, awareness and attitude of population. One-way ANOVA and post hoc analysis were used to measure the relationship between the variables and sociodemographic data with P value ≤ 0.05 was considered statistically significant.

Results

A total of 437 completed questionnaires were received. More than half (58.1%) of the respondents were at the age of 40 or below. Almost two-third (75.1%) of the sample have a college level of education. More than half of the study participants (56.52%) were either unemployed or students, the working individual was the smallest group which represent 36.4% of the sample who are working in non-health related sectors. The distribution of the socio-demographic characteristics of the participants is shown in figure 1.

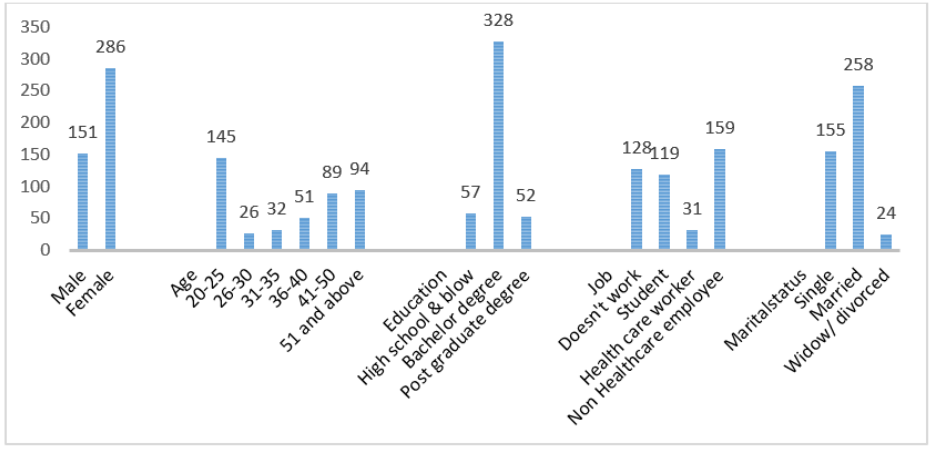

Figure 1: *Socio-demographic characteristics of the sample.*

Sample characteristics is presented in figure 2. Most of the participants had their dental visits in private clinics. More than eighty-eight percent of the sample had previous radiographs and the majority get their information about radiographs from multiple sources.

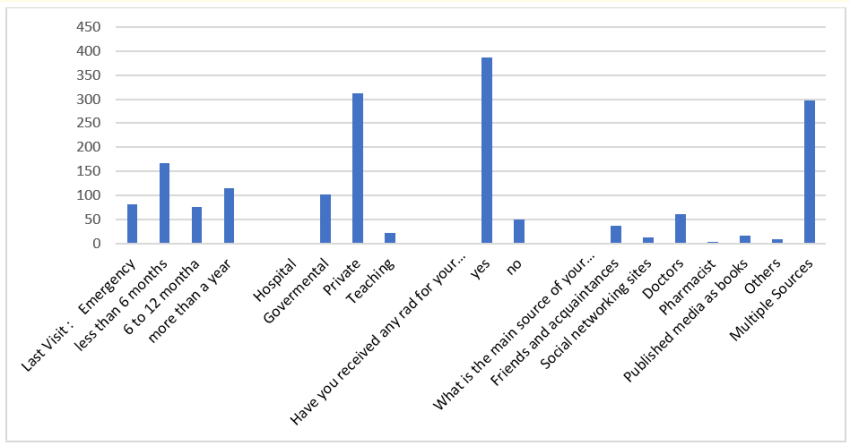

Figure 2: *Sample characteristics regarding hospital, visits and received radiographs.*

More than half of the sample (64.3%) agree that X-ray carries a risk in general. As regard to pregnant women and children 85.8% and 63.2% respectively agreed that x-ray is hazardous for both. Approximately half of the sample did not whether digital radiography and radiographs after the 4th month of pregnancy was dangerous or not. Two thirds of the sample were positive that panoramas during pregnancy (71.9%), exposure of doctors and X-ray personals (73.2%) and repeated radiographs (74.4%) carries a risk. One hundred eighty-five participant (42%) disagreed that radiographs are important for oral diseases. The results are represented in table 1 and figure 3.

Variable	Strongly agree n (%)	Agree n (%)	Neutral n (%)	Disagree n (%)	Strongly disagree n (%)	Average	Std.	Order
X-rays carry risks in general?	101 (23.1)	180 (41.2)	134 (30.7)	17 (3.9)	5 (1.1%)	3.81	0.872	6
X-ray is not suitable for pregnant women	281 (64.3)	94 (21.5)	50 (11.4)	10 (2.3)	2 (0.5)	4.47	0.819	1
X-rays are harmful to children	129 (29.5)	147 (33.6)	128 (29.3)	30 (6.9)	3 (0.7)	3.84	0.949	5
The modern digital devices used in taking the panorama of the teeth with a weak and not dangerous exposure	62 (14.2)	109 (24.9)	216 (49.4)	34 (7.8)	16 (3.7)	3.38	0.946	7
Dental radiation is safe after the end of the fourth month with the use of a protective apron	49 (11.2)	69 (15.8)	214 (49.0)	64 (14.6)	41 (9.4)	3.05	1.061	8
Panorama rays should be avoided during pregnancy, unless necessary	220 (50.3)	94 (21.5)	93 (21.3)	14 (3.2)	16 (3.7)	4.12	1.077	2
Exposure to the doctor and x-ray personnel may present a danger	182 (41.6)	138 (31.6)	84 (19.2)	25 (5.7)	8 (1.8)	4.05	1.000	4
Periodic or repeated x-rays may be dangerous	188 (43)	137 (31.4)	86 (19.7)	18 (4.1)	8 (1.8)	4.10	0.973	3
Many mouth diseases cannot be diagnosed without radiation, so X-rays are important	0 (0)	158 (36.2)	94 (21.5)	18 (4.1)	167 (38.2)	2.56	1.317	9
Average						3.71	0.483	

Table 1: *Knowledge of the participants about X-ray safety and importance for oral diseases.*

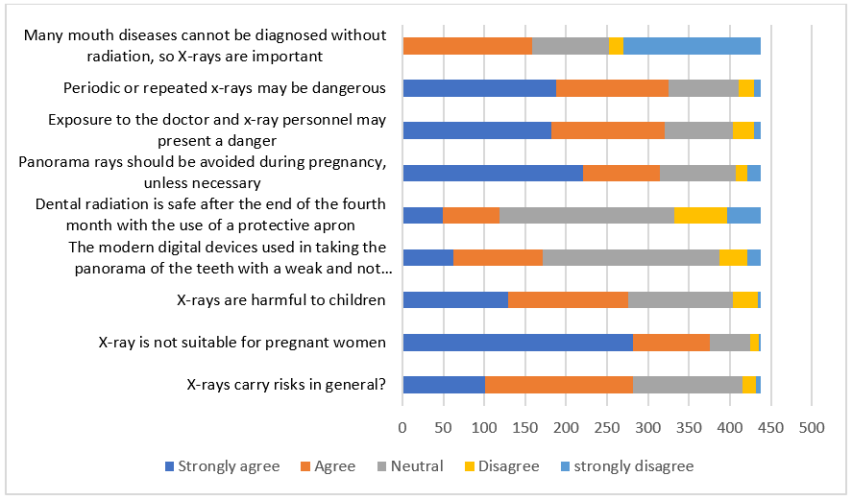

Figure 3: *Knowledge of the participants about X-ray safety and importance for oral diseases.*

Variable	Yes	No	Average	Std.	Order
I was aware of the risks of radiation before performing an x-ray?	241 (55.1)	196 (44.9)	1.55	0.497	6
Are you aware of the guidelines for describing radiation for children?	85 (19.5)	352 (80.5)	1.19	0.396	1
Do you know what dental x-rays are?	229 (52.4)	208 (47.6)	1.52	0.499	5
The thyroid gland is more sensitive than radiation	310 (70.9)	127 (29.1)	1.71	0.454	7
I think the children's bones are the most affected by the rays	241 (55.1)	196 (44.9)	1.55	0.497	6
The eye is one of the organs most affected by the radiation	221 (50.6)	216 (49.4)	1.51	0.500	4
The salivary gland is one of the organs most affected by X-rays	200 (45.8)	237 (54.2)	1.46	0.498	3
Are you aware of the x-ray quality of your dentist whether it is normal or digital?	90 (20.6)	347 (79.4)	1.21	0.404	2
Average			1.46	0.245	

Table 2: *Awareness of sample about X-ray.*

Gender, marital status and previous radiographs significantly affected knowledge (Table 3). Females were more to believe that X-ray is not suitable for pregnant women (p = .039). Likewise, they were more inclined to avoid panoramas during pregnancy at p = .003. On the other hand, males were more to agree that X-ray is safe after the 4th month for pregnant lady at p = .008. Significantly, women were more to know that repeated radiography carries a risk at p = .015. Married were more to recognize the risk of panoramas and X-ray exposure to pregnant women at p = .014 and p = .000 respectively. Singles were more to recognize that radiographs are safe after the 4th month at p=.001. Those who had previous radiography were to more to agree that X-ray were not suitable for pregnant women at p=.008 and that it is not safe after the 4th month at p = .011. In general, previous radiograph was significantly associated with awareness at p = 0.035 (Table 4).

Statement		N	Mean	Std. Deviation	T	Sig. (2-tailed)
Gender						
X-ray is not suitable for pregnant women	Male	151	4.36	.819	-2.074	.039
	Female	286	4.53	.815		
Dental radiation is safe after the end of the fourth month with the use of a protective apron	Male	151	3.22	.879	2.652	.008
	Female	286	2.96	1.139		
Panorama rays should be avoided during pregnancy, unless necessary	Male	151	3.91	1.022	-2.976	.003
	Female	286	4.23	1.093		
Periodic or repeated x-rays may be dangerous	Male	151	3.94	1.008	-2.441	.015
	Female	286	4.18	.948		
Marital status						
X-ray is not suitable for pregnant women	Single	155	4.27	.892	-3.804	.000
	Married	282	4.58	.756		
Dental radiation is safe after the end of the fourth month with the use of a protective apron	Single	155	3.25	.887	3.214	.001
	Married	282	2.94	1.133		
Panorama rays should be avoided during pregnancy, unless necessary	Single	155	3.95	.949	-2.462	.014
	Married	282	4.21	1.135		
Have you received any rad for your teeth before?						
X-ray is not suitable for pregnant women	Yes	387	4.51	.809	2.669	.008
	No	50	4.18	.850		
Dental radiation is safe after the end of the fourth month with the use of a protective apron	Yes	387	3.00	1.062	2.602	.011
	No	50	3.40	1.010		

Table 3: *Independent T test analysis of the association between gender, marital status and previous radiographs and knowledge among participants.*

Have you received any radiographs for your teeth before?		N	Mean	Std. Deviation	t	df	Sig. (2-tailed)	Significantly different (P < 0.05)?
Knowledge	Yes	50	3.6644	0.55510	-.611	58.581	0.544	No
	No	387	3.7146	0.47353				
Awareness	Yes	50	1.3825	0.28393	-2.155	58.256	0.035	Yes
	No	387	1.4729	0.23821				

Table 4: *Independent T test analysis of the association between previous radiographs and knowledge and awareness.*

Discussion

Dentist usually providing treatment for adult patients, children and pregnant women, they have the required knowledge and understand the amount of radiation doses delivered by various imaging modalities employed. Based on the fundamental knowledge of the hazards associated with oral radiation, dental practitioners strictly adhere to the guideline for protection as recommended by the American

dental association. Thus, are well prepared to effectively advise their patients when to use the X-ray properly and they have justification for requested radiograph to avoid exposing the patients to unnecessary radiation [11].

Despite all of the precaution and strict adherence by dentist there are some of public's concerns regarding radiation risks that sometime could be misconducted and circulated widely by means of social media which need to be clarifies to public in simple and understandable way based on evidence. The estimated risk from dental radiography is challenging topic because no epidemiological studies document the number of visits to dentist and the type of dental equipment used or the procedures implemented. Also, the population may visit different dentist if they have bad experience or the quality of provided treatment not optimal for them, which may require repeating the exposure for them despite they already have previous x-ray record based on self-reporting of the patients.

In this study the majority of participant gained the required information about risk of radiation in dentistry from multiple resources, and majority of them relied on their dentist for information which is the same finding reported by Purmal., *et al*. [12] it was found that the population never relay on the media alone for important information which is the same finding reported by Ashok [13] this high percentage of multiple sources make the role of dentist and the oral and maxillofacial radiologist to disseminate the information through different channel to become more accessible to population when they need it.

In this Study 52% of the respondents have knowledge about X-ray in comparison to Sharma., *et al*. [14] study where low level of knowledge was achieved by only 14% of their study groups. In their sample there was poor level of knowledge about the item radiation could be hazardous during pregnancy which contradict our finding where high level of knowledge was obtained for this item.

In this study 79.2% of the participant have no idea of the x-ray equipment used whether conventional or digital which is the same result obtained by Sharma., *et al*. [14] therefor the responsibility of the dentist to explain to their patients that the x-ray that will be carried out with digital technology require less amount of radiation than conventional one [15].

Our investigation demonstrated possible inadequate information provided by dentist regarding the guideline of prescribing radiograph to children [16-18]. This may has an affect knowledge but not awareness, since our results demonstrated that awareness is affected by previous radiographs but not knowledge. Despite that a considerable percentage of them were aware that x- ray is not good for children, the majority of our sample did not know about those guidelines. This is similar to the results reported by Ashok., *et al*. [13] and Chris., *et al*. [19] where they found that patients do not have a definite knowledge about X-ray.

The parents have the legitimate right to refuse exposure for their children to radiation if the reasons for taking radiograph not justified based on clinical evidence. In panoramic radiography the machine will scan the head of the child, the location of thyroid gland as well as the major salivary gland and eyes will be in the field of view, in panoramic radiography thyroid shield is not recommend because it will obscure the middle part of the image, patients must be educated about this issue to avoid repeating the panoramic radiograph and exposing child to extra dose of radiation, the effective doses arising from dental panoramic imaging are larger than those associated with intra oral radiographic procedures [8]. Therefore, selected periapical and bitewings radiographs is preferable in young age group when needed, also if this radiograph will not contribute to diagnosis and treatment it is better to be avoided. exposing sensitive organs not recommended by requesting panoramic radiography and avoid as much as possible repeating radiograph because of the cumulative effects caused by radiation exposure should not be neglected.

There are controversies between researcher whether to expose pregnant women with radiographs within first trimester [20,21]. The risk to the fetus from stochastic effect has to be cautiously evaluated against the benefits of obtaining a radiograph. It is preferable to postpone taking radiograph unless it is highly indicated to rule out serious pathology. Thyroid collars and protective lead aprons should be used to reduce exposure of radiosensitive organs and the developing fetus. The dentist could educate the patient regarding protective measure used and the direction of central beam will not be directed toward the developing fetus. In line with Ashok., *et al*. our research, showed that the 85,8% of the participant considered x-ray not suitable for pregnant woman [13]. In addition, their study revealed that 11% of their sample don't have any idea if x-ray suitable for pregnant ladies or not which is the same result obtained in this study. The present results disclosed that the majority of the respondents believe that panoramic is not good during pregnancy but have poor knowledge if it can be done in the second trimester with protective lead apron when necessary.

Analyzing the association between knowledge, marital status and gender, indicated that there were great significant differences between male and female as well as between single and married, where being married and female have more knowledge than males and singles.

In contrast to Ashok., *et al*. [13] who found that 99% of his sample have knowledge about x-ray, our investigation showed that only 52% have knowledge about x-ray, surprisingly 48 % did not know what is x-ray. Thus, one may consider marginal knowledge level among the population of this study when compared to high level of knowledge obtained by Ashok., *et al* [13].

Sensitivity to ionizing radiation not similar by all of the cells, as a result living cells can be either radiosensitive or radioresistant cell. The thyroid gland, growing bones and eyes are highly sensitive to ionizing radiation during childhood and adolescence. Therefore, before prescribing radiograph, dentist must consider the benefit obtained from taking radiograph [22]. In this survey, 70% of the participant aware that thyroid gland is sensitive to ionizing radiation and marginal awareness regarding eye, salivary gland and growing bone, to the best of our knowledge this is the first study investigate the awareness of public for sensitivity to critical organs. Also, the participant knew that repeated exposure to radiation may carry risk to them.

Despite the of variable level of knowledge, attitude and awareness of population reported by various studies [13,23-25] concerning of hazard that could be associated with taking dental radiograph, but it is not common practice to obtain informed consent from patients before requesting or taking dental radiographs. Because The level of radiation dose used in dentistry consider low with low chance of stochastic effect and the benefit is outweighed the risk. Moreover, studies have demonstrated inadequate knowledge and awareness [26-28].

Conclusion

Our investigation demonstrated knowledge deficiency among population but reasonable awareness. Marital status and gender were significant factors affecting knowledge. While awareness was affected by previous exposure to X-ray. Surveying patients visualize the state of knowledge, awareness and gaps in views. Thus, assist in identifying their response encounter on daily basis by the dentist when prescribing. Further education and knowledge reinforcement is recommended by dentists and through several social media outlets.

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Conflict of Interest

The author reports no conflicts of interest in this work.

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