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Dentistry Section

Imaging More Imagining less: An Insight into Knowledge, Attitude and Practice Regarding Radiation Risk on Pregnant Women among Dentists of Ghaziabad – A Cross-Sectional Study

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ABSTRACT

Introduction: The safety of diagnostic imaging during pregnancy is an important aspect for all clinicians. Pregnant women often do not receive proper dental care as the dentists are not aware of low diagnostic radiation doses involved in dental radiation.

Aim: To assess awareness of radiation risks on pregnant women among dentists of Ghaziabad city.

Materials and Methods: A total of 268 practicing dentists in Ghaziabad were selected for a questionnaire based cross-sectional study. Data consisted of 18 questions which assessed the knowledge, attitude and practice of dental professionals regarding radiation risks on pregnant women. The questionnaire was distributed and collected personally by the principal investigator. Data was analyzed by Mann Whitney U test and chi-square test. The level of significance was set at $p \leq 0.05$.

Results: The results showed that the dentists who had attended continuing dental education program had increased level of knowledge regarding radiation effects among pregnant women as compared to the dentists who had not attended continuing dental education programs ($p<0.05$). Among them who had attended continuing dental education programs 93.3% were aware of the safe dose of radiation and 62% were aware of threshold radiation doses of pregnancy termination. On the contrary there was no significant difference in the knowledge, attitude and practice scores regarding radiation risks on pregnant women based on their academic qualification ($p\geq0.05$).

Conclusion: The level of knowledge among dentists was found to be satisfactory, this outcome shows that continuing dental education regarding radiation protection principles and its risks on pregnant women is required to ensure maximum safety both for clinician as well as pregnant women.

Keywords: Continuing dental education, Pregnancy, Radiation effects

INTRODUCTION

Pregnancy is one of the life's enthusiastic and exhilarating experiences. The target of each pregnancy is that a mom and a baby must be in good health. During recent years there has been increasing interest in the oral health of the pregnant women and as such diagnostic imaging during pregnancy has been of utmost importance for all clinicians [1]. The principles, diagnostic value and safety of imaging to the fetus and the mother should be known to select the most appropriate imaging modality. It has been known that ionizing radiation has biological damaging effects which affects the cell directly or indirectly and produces free radicals which cause DNA damage [2].

Biological hazards are categorized into: Non-stochastic and Stochastic effect. Non-stochastic or deterministic effects are those effect in which above threshold dose cell injury starts to appear [3]. In stochastic effect there is no determined dose that could lead to biological damage and damage to cells occurs at any level of doses. High dose ionizing radiation is having both deterministic and stochastic effects but low doses radiations have predominantly stochastic effects [4].

International Commission on Radiological Protection (ICRP) in 1977 proposed that patients must undergo exposures of low dose and accounted for their exposures [5]. Therefore, ALARA principle "As Low as Reasonably Achievable" was made mandatory during dentist routine work [6]. Despite that, dentists do not completely implement ALARA principles in their routine work [7,8]. Therefore, stochastic effect has more impact on dentist as well as patients due to not having threshold dose. Though X-rays helps in disease diagnosis but dentists should also be cautious of the probability of its biological hazards [9].

Pregnant women often go to dental offices for their oral health problems and in most cases a radiograph of the involved tooth is required. It is noted that dentists postpone dental treatments to the period after delivery because they do not have sufficient knowledge of the low doses involved in diagnostic dental radiation and this delay in treatment may have detrimental effects on the mother and the fetus [10].

The first two weeks of pregnancy is more sensitive to the biologic responses which is a period when mother is not aware of her pregnancy which leads to spontaneous abortion of fetus [10]. Kusama et al., in 2002 reported that the radiation dose less than 100 mGy (10 radons) is safe for the fetus and pregnancy termination is not required. He also revealed that radiation doses during head and chest diagnostic exposures does not affect fetus directly and the absorbed dose was less than 0.01mGy [11].

Hence, radiographic procedure should not be carried out on any pregnant women unless there is requirement for the same. All techniques which lessen the absorbed dose should be undertaken when such radiographs are made obligatory. Radiographs should be provided with well-collimated beams in precisely-protected shields. A high kVp technique is appropriate in such cases [12].

AIM

The present study was conducted to evaluate awareness of radiation risks on pregnant women among registered dentists practicing in Ghaziabad city.

MATERIALS AND METHODS

The study was conducted in Ghaziabad city located in Western part of Uttar Pradesh, India.

It is a questionnaire based cross-sectional study. The subjects in this cross-sectional study consisted of all the registered dentists practicing in Ghaziabad city. All eligible subjects were included in the study without discrimination. The study was conducted from June 2015 to August 2015. Ethical approval was received from the Institutional Review Board, Divya Jyoti College of Dental Sciences and Research, Modinagar, Uttar Pradesh, India. The purpose of the study was explained and informed and a written consent was obtained from all the study participants. Participation in the study was voluntary and confidentiality of data was maintained. Data was collected by principal investigator by distributing questionnaires among the subjects and then collected personally by hand after one week of distribution. The first reminder was given to the study subjects after three days and second reminder was given after five days and finally the questionnaire was collected after seven days. The questionnaire consisted of 18 questions about the awareness of the risk of dental radiation on pregnant women. The questionnaire consisted of two parts:-

1. General information regarding age, educational qualification, practice module, years of experience and taking part in continuing education course.

2. Data regarding the safe dose for fetus, radiation protection principles, radiation dose for pregnancy termination as well as radiographic techniques which result in reduced radiation dose to pregnant women.

The questionnaire related to knowledge and practice was closed ended and the response was recorded only in yes/no. Questionnaire based on attitude was based on five point Likert scale ranging from strongly disagrees to strongly agree. Anonymity and confidentiality of the answers were emphasized at the time of handing out the questionnaires.

Reliability and Validity of the Questionnaire

The pilot study which served as a preliminary study was conducted on 52 study participants who comprised of 20% of the study sample to assess the feasibility and relevance of the study. The questionnaire was assessed for its reliability by using Test-Retest and the values of measured Kappa (k) and Weighted Kappa (k) was 0.86 and 0.92 respectively. The questionnaire was assessed for its internal consistency by using Cronbach's alpha coefficient (0.92).

STATISTICAL ANALYSIS

The returned questionnaires were coded and entered on computer, using SPSS (Statistical Package for Social Sciences) software, version 16.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistical method (mean ± standard deviation), frequency were applied to data. Mann Whitney U test and chi square test was applied to compare the knowledge among the dentists. The level of significance was set at $p<0.05$.

RESULTS

Among 268 dentists, 250 dentists responded to the questionnaire thus the response rate was 93.28%. Only complete questionnaire filled was considered for this study. The mean age of the subjects was 31.82 ± 5.78 years (range: 25–66 years). The mean job experience was 6.55 ± 5.90 years (range: 1–45 years). Among 250 dentists 159 (63.6%) were males and 91 (36.4%) were females. Overall, 141 (56.4%) respondents were university graduates (Bachelor of Dental Surgery; BDS), whereas 109 (43.6%) of the remaining subjects had completed post-graduation (Master of Dental Surgery; MDS) in various specialties of dentistry [Table/Fig-1].

The mean knowledge, attitude, practice scores of the dentist towards the radiation effects on pregnant women was 0.66 ± 0.15 (Min-0; Max-1); 4.67 ± 0.34 (Min-1; Max-5) and 0.66 ± 0.30 (Min-0; Max-1) respectively. [Table/Fig-2] shows the distribution of study subjects according to the mean knowledge, attitude and practice regarding radiation effects on pregnant women.

In [Table/Fig-3] the comparison of knowledge, attitude and practice scores regarding radiation effects on pregnant women was done between the dentists who had attended continuing dental education programs and those dentists who had not attended. In the present study the results showed that the dentists who had attended continuing dental education program had significant level of awareness regarding radiation effects on pregnant women in all the three groups knowledge, attitude and practice ($p<0.05$) as compared to the dentists who had not attended continuing dental education programs.

[Table/Fig-4] shows the comparison of the levels of knowledge, attitude and practice regarding radiation effects on pregnant women between graduates and postgraduate which revealed that there was no significant difference of knowledge between them. In addition, there was no significant difference of knowledge regarding radiation risks on pregnant women based on their job experience (knowledge score $p=0.15$, attitude and practice score $p=0.60$ and $p=0.22$ respectively).

DISCUSSION

In the present study, the knowledge, attitude and practice of the dentist towards the harmful effects of the radiation on pregnant females was assessed. The mean knowledge score of the dentists towards the radiation effects was 0.66 ± 0.15 (Min-0, Max-1). In a similar study conducted by Razi T et al., the mean of the correct answers was 6.47 (±1.66) on a scale of 15 items [10]. The mean attitude score assessed on five point Likert scale was 4.67 ± 0.34 (Min-1, Max-5). The present study showed a favorable attitude of dentists which indicated a possibility to improve on radiation risks on pregnant women and further studies are needed to elaborate on various issues related to the attitude of dental practitioners toward radiation protection measures taken for pregnant woman. The mean practice score was 0.66 ± 0.30 (Min-0, Max-1). The study subjects who had attended CDE program regarding radiation hazards in the pregnant females had better mean knowledge (0.80 ± 0.12) (Min-0, Max-1) and attitude scores (4.79 ± 0.25) (Min-1, Max-5) and practice scores (0.77 ± 0.22) (Min-0, Max-1) than those who do not attended, which is in agreement with the results of Razi T et al., [10]. These may be due to more exposure to the relevant scientific literature and academic activities like continuing dental education and continuing professional development programs.

Gender Distribution	Number (%)
Male	159 (63.6)
Female	91 (36.4)
Education Qualification	
BDS	141 (56.4)
MDS	109 (43.6)
Participation in CDE	
CDE Attended	60 (24)
CDE Not Attended	190(76)

[Table/Fig-1]: Distribution of study subjects according to gender, educational qualification and participation in CDE.

KNOWLEDGE		Number of Dentists N(%)	Mean Value
Dental X-rays are harmful for pregnant ladies.	YES	240(96%)	0.96
	NO	10(4%)	
Dental radiographs can have deterministic and stochastic effects on the pregnant females.	YES	190(76%)	0.76
	NO	60(24%)	
Dental radiographs can lead to preterm birth and low birth weight in foetus.	YES	121(48.4%)	0.48
	NO	129(51.6%)	
Are you aware of the safe dose of radiation for the foetus?	YES	90(36%)	0.36
	NO	160(64%)	
Are you aware of the protection principles of ALARA?	YES	132 (52.8%)	0.53
	NO	118 (47.2%)	
Are you aware of the usefulness of collimation and filters for the reduction of the biological effects of the radiation in the pregnancy?	YES	216 (86.4%)	0.86
	NO	34 (13.6%)	
Are you aware of other protection methods like high speed films, lead aprons, digital radiography for reduction in radiation exposure?	YES	239(95.6%)	0.96
	NO	11(4.4%)	
Are you aware of the period in which the fetus is most sensitive to radiation?	YES	216(86.4%)	0.86
	NO	34(13.6%)	
Are you aware of the threshold radiation doses for the pregnancy termination?(25 radons)	YES	42(16.8%)	0.17
	NO	208(83.2%)	

ATTITUDE		Strongly Agree (5) N (%)	Agree (4) N (%)	Neither Agree nor Disagree (3) N (%)	Disagree (2) N (%)	Strongly Disagree (1) N (%)	Mean Value
Dental radiographs should be avoided in the pregnancy unless necessary.	No. of Dentists	176(70.4%)	72(28.8%)	2(0.8%)	0	0	4.70
The radiographs in the pregnant females (when necessary) should only be taken with proper protection techniques.	No. of Dentists	176(70.4%)	70 (28.0%)	04(1.6%)	0(0%)	0(0%)	4.69
There should be increased awareness in health professionals regarding the radiation effects in pregnant females by the education and training programs.	No. of Dentists	178(71.2%)	70(28.0%)	1(0.4%)	1 (0.4%	0	4.70
There should be compulsory accreditation and monitoring by regulatory bodies of the dental and medical clinics using radiography.	No. of Dentists	157(62.8%)	90(36%)	3(1.2%)	0	0	4.62

PRACTICE		No of Dentists N(%)	Mean Value
Have you ever attended the CDE /CME programme regarding radiation hazards in pregnant females?	YES	60(24%)	0.24
	NO	190(76%)	
Do you use protection techniques like lead aprons, high speed films, collimation for the pregnant females?	YES	173(69.2%)	0.69
	NO	77(30.8%)	
Is your clinic equipped with digital radiography techniques?	YES	154(61.6%)	0.62
	NO	96(38.4%)	
Do you question the subject about pregnancy before doing any radiographic procedures?	YES	190(76%)	0.76
	NO	60(24%)	
Is your auxiliary staff, well equipped to deal with radiographic procedures in pregnant female?	YES	149(59.6%)	0.60
	NO	101(40.4%)	

[Table/Fig-2]: Distribution of study subjects according to knowledge, attitude and practice regarding radiation effects on pregnant women.

The present study revealed that 51.6% of dentists were aware that dental radiographs do not lead to preterm birth and low birth weight in fetus whereas 70% of dentists who attended CDE programme and 45% of dentist who did not attend knew that dental radiographs do not lead to preterm birth and low birth weight. The percentage was considerably higher in the subjects who had attended the CDE programme. The study conducted by Mortazavi SMJ et al., reported that there were no statistically significant differences between the mean weights of newborns whose mothers had been exposed to dental radiations [13].

The present study shows that 86.4% of dentists were aware of the period in which the foetus is the most sensitive to radiation. Around 93% of dentists who attended CDE program were aware of the period in which the foetus is the most sensitive to radiation. However according to the study conducted by Razi T et al., in Tabriz, 56.8% of the dentists were aware of the period (first trimester) in which the foetus is most sensitive to the radiation [10].

In the present study 16.8% of dentists were aware of the threshold radiation doses for the pregnancy termination (25 radons). A total of 62% of the dentists who had attended CDE program and 2.63% of dentist who did not attend were aware of the threshold radiation doses (25 rads) for pregnancy termination. These finding are similar to the study conducted by Razi T et al., Tabriz, where only 58% of the dentists were aware of the threshold radiation doses for pregnancy termination [10]. This may be attributed to undergoing continual dental education programs which enhances the knowledge about radiation risks in pregnant women of the dentists. Threshold radiation dose for the development of congenital defects during the most sensitive period is 0.2 Gy. No response will be elicited at doses less than 25 rads (250 mGy) [10].

The present study also compared knowledge, attitude and practice regarding radiation risks between dentist based on their qualification i.e., undergraduates and postgraduates. While comparing between

KNOWLEDGE		CDE N (%)	Non–CDE N(%)	p-value
Dental X-rays are harmful for pregnant ladies.	YES	60 (100%)	180 (94.73%)	NS
	NO	0 (0%)	10 (5.26%)	
Dental radiographs can have deterministic and stochastic effects on the pregnant females.	YES	50(83.3%)	140 (73.68%)	NS
	NO	10 (16,6%)	50 (26.31%)	
Dental radiographs can lead to preterm birth and low birth weight in foetus.	YES	18 (30%)	103(54.21%)	S
	NO	42 (70%)	87(45.78%)	
Are you aware of the safe dose of radiation for the foetus?	YES	56 (93.3%)	34(17.9%)	S
	NO	4 (6.67%)	156(82.1%)	
Are you aware of the protection principles of ALARA?	YES	47 (78.3%	85(44.73%)	S
	NO	13 (21.6%)	105(55.26%)	
Are you aware of the usefulness of collimation and filters for the reduction of the biological effects of the radiation in the pregnancy?	YES	55 (91.6%)	161(84.73%)	NS
	NO	5 (8.33%)	29(15.26%)	
Are you aware of other protection methods like high speed films, lead aprons, digital radiography for reduction in radiation exposure?	YES	54 (90%)	185(97.36%)	S
	NO	6 (10%)	5(2.63%)	
Are you aware of the period in which the fetus is most sensitive to radiation?	YES	56 (93.3%)	160(84.21%)	NS
	NO	04 (6.67%)	30 (15.79%)	
Are you aware of the threshold radiation doses for the pregnancy termination?(25 radons)	YES	37(62%)	5(2.63%)	S
	NO	23(38%)	185(97.37%)	

ATTITUDE		Strongly Agree (5) N (%)	Agree (4) N (%)	Neither Agree nor Disagree (3) N (%)	Disagree (2) N (%)	Strongly Disagree (1) N (%)	p- value
Dental radiographs should be avoided in the pregnancy unless necessary.	CDE	53(88.3%)	7(11%)	0	0	0	S
	Non –CDE	123 (64.73%)	65 (34.21%)	2 (1.05%)	0	0	
The radiographs in the pregnant females (when necessary) should only be taken with proper protection techniques.	CDE	54(90%)	04 (6.67%)	02(3.33%)	0	0	S
	Non –CDE	122(64.21%)	66(34.74%)	02(1.05%)	0	0	
There should be increased awareness in health professionals regarding the radiation effects in pregnant females by the education and training programs.	CDE	45(75%)	15(25%)	0	0	0	NS
	Non –CDE	133(70%)	55(28.94%)	1(0.5%)	1(0.5%)	0	
There should be compulsory accreditation and monitoring by regulatory bodies of the dental and medical clinics using radiography.	CDE	40(66.67%)	20(33.33%)	0	0	0	NS
	Non –CDE	117(61.57%)	70(36.84%)	03(1.57%)	0	0	

PRACTICE		CDE	Non –CDE	p value
Have you ever attended the CDE /CME programme regarding radiation hazards in pregnant females?	YES	60(100.0%)	0	S
	NO	0	190 (100%)	
Do you use protection techniques like lead aprons, high speed films, collimation for the pregnant females?	YES	43(71.67%)	130(68.42%)	NS
	NO	17(28.33%)	60(31.58%)	
Is your clinic equipped with digital radiography techniques?	YES	54(90%)	100(52.63%)	S
	NO	06(10%)	90(47.36%)	
Do you question the subject about pregnancy before doing any radiographic procedures?	YES	51(85%)	139(73.15%)	NS
	NO	9(15%)	51(26.84%)	
Is your auxiliary staff well equipped to deal with radiographic procedures in pregnant female?	YES	39(65%)	110(57.90%)	NS
	NO	21(35%)	80(42.10%)	

[Table/Fig-3]: Knowledge, attitude and practice of study subjects according to participation in CDE.
(S-Significant;p<0.05); (NS- Non-significant;p≥0.05)

the undergraduates and postgraduates, there was no significant association between the knowledge, attitude and practices scores of the undergraduates and postgraduates regarding the radiation risks among pregnant women, like 96.45% of undergraduates and 95.41% of postgraduates think that dental X-rays are harmful. The findings are in contrast with study findings of Arnout E et al., who reported that 92% of postgraduates dentists considered dental x-rays to be harmful as compared to 81.8% of the undergraduates and 79.5% of interns [14]. In contrast, Svenson et al., reported an association of knowledge with educational status, and duration and type of practice [15,16]. Only 37.58% of undergraduates and 33.94% of postgraduates were aware of the safe dose of radiation for the foetus. The findings are in contrast to the study conducted by Ardakani EF et al., in 2008 who deduced that postgraduates are more knowledgeable than undergraduates [17].

There was no significant difference in the awareness and knowledge regarding radiation risks in pregnant women based on their job experience.

RECOMMENDATIONS

1. There should be continuing dental education programs at regular interval regarding radiation effects and protection measures to be taken to have maximum safety for both the dental practitioners and the patients.
2. There is a definite need to reinforce the importance of radiation risks and protection measures among pregnant women in the dental curriculum in India.
3. The training of dental practitioners must be mandated prior to the use of ionizing radiation in dental practice in India.
4. Protective measures like use of lead aprons, thyroid collar should be made mandatory and its implementation in clinical practice should be reinforced.

KNOWLEDGE		BDS N (%)	MDS N (%)	p-value
Dental X-rays are harmful for pregnant ladies.	YES	136(96.45%)	104(95.41%)	NS
	NO	5(3.55%)	5(4.58%)	
Dental radiographs can have deterministic and stochastic effects on the pregnant females.	YES	108(76.6%)	82(75.22%)	NS
	NO	33(23.40%)	27(24.77%)	
Dental radiographs can lead to preterm birth and low birth weight in foetus.	YES	72(51.06%)	49(44.95%)	NS
	NO	69(48.94%)	60(55.05%)	
Are you aware of the safe dose of radiation for the foetus?	YES	53(37.58%)	37(33.94%)	NS
	NO	88(62.41%)	72(66.06%)	
Are you aware of the protection principles of ALARA?	YES	73(51.77%)	59(54.12%)	NS
	NO	68(48.23%)	50(45.88%)	
Are you aware of the usefulness of collimation and filters for the reduction of the biological effects of the radiation in the pregnancy?	YES	118(83.68%)	98(89.9%)	NS
	NO	23(16.32%)	11(10.10%)	
Are you aware of other protection methods like high speed films, lead aprons, digital radiography for reduction in radiation exposure?	YES	133(94.32%)	106(97.24%)	NS
	NO	08(5.67%)	03(2.75%)	
Are you aware of the period in which the fetus is most sensitive to radiation?	YES	120(85.10%)	96(88.07%)	NS
	NO	21(14.90%)	13(11.92%)	
Are you aware of the threshold radiation doses for the pregnancy termination?(25 radons)	YES	22(15.60%)	20(18.34%)	NS
	NO	119(84.40%)	89(81.66%)	

ATTITUDE		Strongly Agree (5) N (%)	Agree (4) N (%)	Neither Agree nor Disagree (3) N (%)	Disagree (2) N (%)	Strongly Disagree (1) N (%)	p- value
Dental radiographs should be avoided in the pregnancy unless necessary.	BDS	107(75.89%)	34(24.11%)	0	0	0	S
	MDS	69(63.33%)	38(34.86%)	02(1.83%)	0	0	
The radiographs in the pregnant females (when necessary) should only be taken with proper protection techniques.	BDS	101(71.63%)	37(26.24%)	03(2.12%)	0	0	NS
	MDS	75(68.80%)	33(30.27%)	01(0.92%)	0	0	
There should be increased awareness in health professionals regarding the radiation effects in pregnant females by the education and training programs.	BDS	96(68.08%)	44(31.20%)	0	01(0.70%)	0	NS
	MDS	82 (75.22%)	26(23.85%)	01(0.92%)	0	0	
There should be compulsory accreditation and monitoring by regulatory bodies of the dental and medical clinics using radiography.	BDS	81(57.44%)	59(41.84%)	01(0.70%)	0	0	NS
	MDS	76(69.72%)	31(28.45%)	02(1.83%)	0	0	

PRACTICE		BDS N(%)	MDS N(%)	p value
Have you ever attended the CDE /CME programme regarding radiation hazards in pregnant females?	YES	38(26.95%)	22(20.18%)	NS
	NO	103(73.05%)	87(79.81%)	
Do you use protection techniques like lead aprons, high speed films, collimation for the pregnant females?	YES	92(65.24%)	81(74.31%)	NS
	NO	49(34.75%)	28(25.69%)	
Is your clinic equipped with digital radiography techniques?	YES	83(58.87%)	71(65.14%)	NS
	NO	58(41.13%)	38(34.86%)	
Do you question the subject about pregnancy before doing any radiographic procedures?	YES	110(78.01%)	80(73.40%)	NS
	NO	31(21.99%)	29(26.60%)	
Is your auxiliary staff well equipped to deal with radiographic procedures in pregnant female?	YES	82(58.15%)	67(61.46%)	NS
	NO	59(41.84%)	42(38.53%)	

[Table/Fig-4]: Knowledge, attitude and practice of study subjects according to educational qualification.
(S- Significant;p<0.05); (NS- Non-significant;p≥0.05)

The investigation included dental practitioners of Ghaziabad city and the results of the present study have to be confirmed among a larger sample to generalize the results.

Studies involving the use of questionnaires are susceptible to acquiescence (yes-saying) bias and social desirability (faking good) bias [18].

In order to treat pregnant women using protective technique, there is a need to broaden our knowledge and awareness by means of training and continuing dental education programs on radiation risks and protection.

CONCLUSION

From the response obtained through our present study, it is seen that dentists have satisfactory level of knowledge regarding radiation effect on pregnant women. The ALARA principle should be followed in the dental field to have minimum exposure to both dentists as well as patients. The continuing dental education program should be conducted repeatedly regarding radiation effects to ensure utmost protection for clinician as well as pregnant women. So, at regular intervals continuing dental education program should be conducted for strict adherence of different radiographic protection regulation protocols for pregnant women.

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