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ORIGINAL ARTICLE

'DENTIST'S PERSPECTIVE ABOUT RADIOLOGICAL WASTE MANAGEMENT'- A QUESTIONNAIRE STUDY IN TAMIL NADU

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ABSTRACT

BACKGROUND: Radiographs are diagnostic aids commonly used by dentists and physicians for accurate diagnosis and proper treatment. Traditional method of radiography is still being practiced despite the invention and evolution of digitalization. Dental workplaces that practice conventional radiographic techniques must use numerous chemical solutions for X-ray film processing. All these chemical solutions necessitate specific handling and disposal techniques.

OBJECTIVES: To evaluate the knowledge on dental radiological waste management among dentists in Tamil Nadu.

METHODOLOGY: A survey was performed for a sample size of 379 dental clinicians. A multiple-choice response type of questionnaire was designed with close-ended questions with a maximum choice of four responses. Responses were evaluated to extract the results.

RESULTS: The result of this present study showed that total correct answers have been reported to be <50%. This showed lack in knowledge among the dentists.

CONCLUSIONS: Harmful dental radiographic wastes should be carefully disposed to minimize hazards to the environment. Although there is small amount of contribution of waste generated by individual, it's eventual accumulation plays a pivotal role in affecting the environment and human health in various ways. Thus, it becomes exceedingly significant for proper disposal of waste products from conventional radiographs in lowering its impact on the surrounding environment.

KEYWORDS: Radiographic waste, lead foil waste, silver waste.

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INTRODUCTION

Environmental pollution has become a persistent concern gaining global attention even with the adoption of government policies. One of the most important causative factor for contamination results from the disposal of medical waste. It has the capacity to create health risks to the environment indirectly by liberating toxic pollutants. In medicine as well as in dentistry, radiographs act as the primary modality which aid in diagnosis, assessing the disease status and formulating appropriate treatment. Conventional oral radiography is still being practiced and plays a pivotal role in dentistry in the era of digitalization.

The criteria to get radiographic images includes X-ray exposure of radiographic films; subsequently processing the film with various chemical solutions. During processing, the residues generated should be properly handled and discarded, aiming to minimize the environmental impact[1]. Silver will pollute the soil and groundwater if it is thrown to a landfill without recycling. Although there are basic biomedical waste management protocols, its practice is very much limited among dentists[2].

Even while using digital radiography, one should always keep the conventional radiographs to encounter an emergency situation[3]. Digital radiography lowers the patient exposure and does not require the usage of processing chemicals or darkroom; inspite of these advantages, dental practitioners in most developing countries and teaching institutes continue to use conventional radiography for either educational purposes or due to financial constraints[4]. Dentists are usually oblivious to detrimental effects of radiologic wastes, and perhaps feel that discarding them improperly would cause only negligible effect to the surrounding. The aim of the current study is to assess the knowledge on dental radiological waste management among dentists in Tamil Nadu.

MATERIALS AND METHODS

A survey was performed for a sample size of 379 dental clinicians in Tamil Nadu. A multiple-choice response type of questionnaire was designed with 18 close-ended questions with a maximum choice of four responses. Responses were evaluated to extract the results.

INCLUSION CRITERIA

1. All the dentists owning a dental clinic in Tamil Nadu
2. All the dentists practicing in a dental clinic in Tamil Nadu
3. Dental Students who have entered clinical posting
4. Dentists with work experience but not practicing presently
5. Interns presently working at a dental set-up

EXCLUSION CRITERIA

1. Dentists who are not practising
2. Dental students who haven't entered clinical postings
3. Dentists who are not practising in Tamil Nadu.

RESULTS

This study aimed towards assessing the knowledge about dental radiological waste management among the dentists in Tamil Nadu and also discusses about the biological effect of conventional radiographic wastes produced by dental specialists and their group to bring awareness about the conceivable dangers they bring to the environment.

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1. **Total number of years of practising Dentistry?**

a) Less than 1 year b) 1-3 years c) 3-5 years d) More than 5 years

2. **Type of X-Ray you practise in your clinic?**

a) Conventional b) Digital c) Both

3. **How do you discard lead foil in the X-Ray film?**

a) Discard along with regular clinic waste

b) Give it along with patients X-Ray film packet

c) Return to the manufacturer for recycling

4. **How do you discard used/exposed X-Ray film?**

a) Discard along with regular clinic waste

b) Give it along with patient c) Give for silver recycling

5. **How do you discard unused/expired X-Ray film?**

a) Discard along with regular clinic waste

b) Return to the manufacturer c) Give for silver recycling

6. **Do you think that the developer and fixer solutions you use is harmful to the environment?**

a) Yes b) No c) No idea

7. **Do you think that the rinse water following fixer wash you use is harmful to the environment?**

a) Yes b) No c) No idea

8. **How do you discard the used developer solution in your clinic?**

a) Throw in the sink b) In the soil c) Discard after specialized treatment

9. **How do you discard the used fixer solution in your clinic?**

a) Throw in the sink b) In the soil c) Give for silver recycling

10. **How do you discard the rinse water following fixer solution in your clinic?**

a) Throw in the sink b) In the soil c) Give for silver recycling

11. **Do you have automatic film processor in your clinic?**

a) Yes b) No

12. **What type of cleaner you are using for automatic film processor?**

a) Chromium based cleaner b) Environmentally friendly cleaner

c) Not using in clinic

13. **Do you think Digital Dental Radiography creates waste?**

a) Yes b) No c) No idea

14. **Type of waste created by Digital Dental Radiography armamentarium?**

a) Bio degradable waste b) Hazardous waste

c) Recyclable waste d) No idea

15. **How to you discard electronic waste?**

a) Discard along with regular clinic waste

b) Return to the manufacturer c) Give for recycling

16. **Do you use lead aprons, collars or shield in your clinic?**

a) Yes b) No

17. **Do you think there is a need for an inclusion of a chapter on radiological waste management in the BDS curriculum?**

a) Yes b) No c) No idea

18. **Do you think there is a need for an organizing authority to provide guidelines on management and control of dental radiographic waste?**

a) Yes b) No c) No idea

Fig 1: Depicts Structured Questionnaire used for the study.

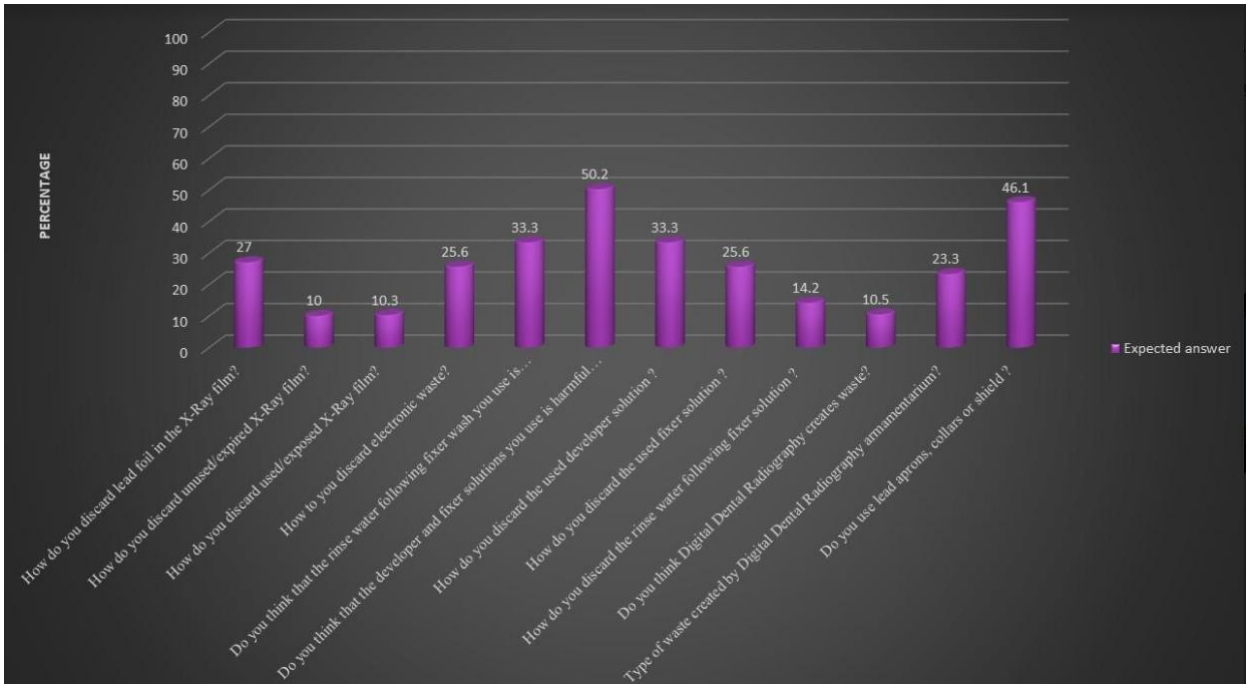

Fig 2: Depicts the percentage of expected response received from the responders for each question. Only one question received more than 50% of the replies as expected out of 12 main questions from the 18.

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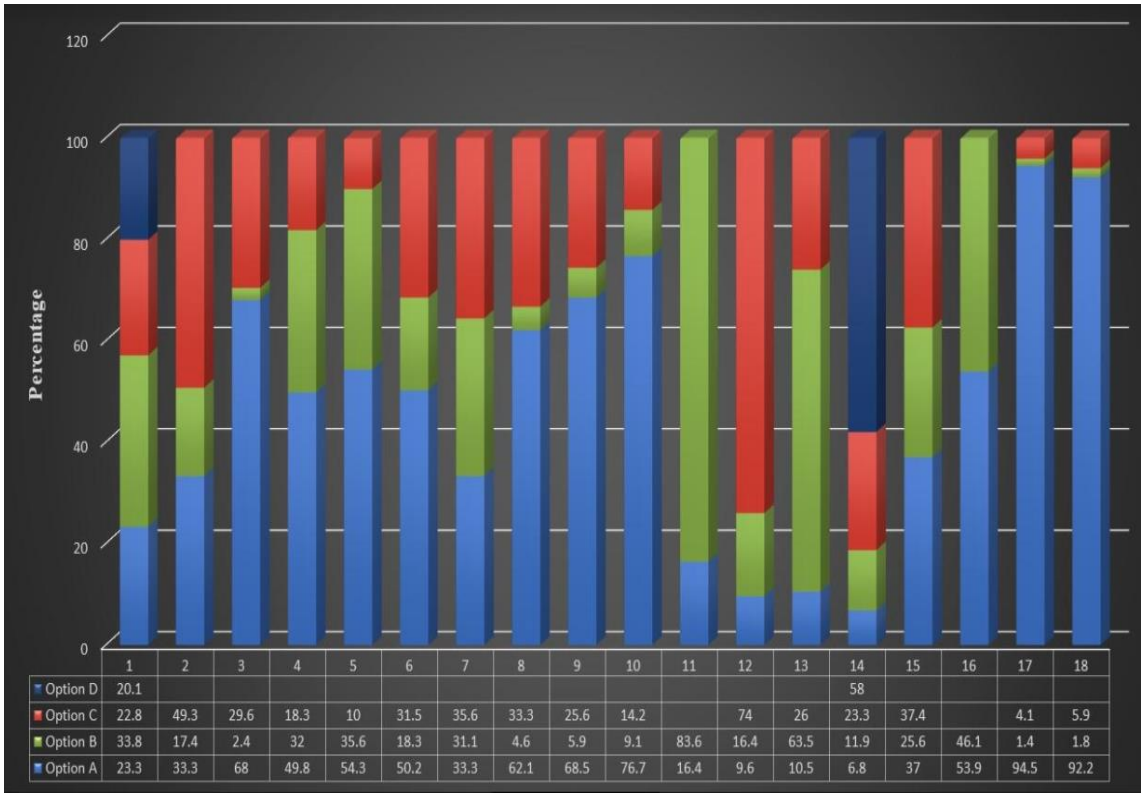

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Option D	20.1													58				
Option C	22.8	49.3	29.6	18.3	10	31.5	35.6	33.3	25.6	14.2		74	26	23.3	37.4		4.1	5.9
Option B	33.8	17.4	2.4	32	35.6	18.3	31.1	4.6	5.9	9.1	83.6	16.4	63.5	11.9	25.6	46.1	1.4	1.8
Option A	23.3	33.3	68	49.8	54.3	50.2	33.3	62.1	68.5	76.7	16.4	9.6	10.5	6.8	37	53.9	94.5	92.2

Fig 3: The total responses received from the participants on percentage basis.

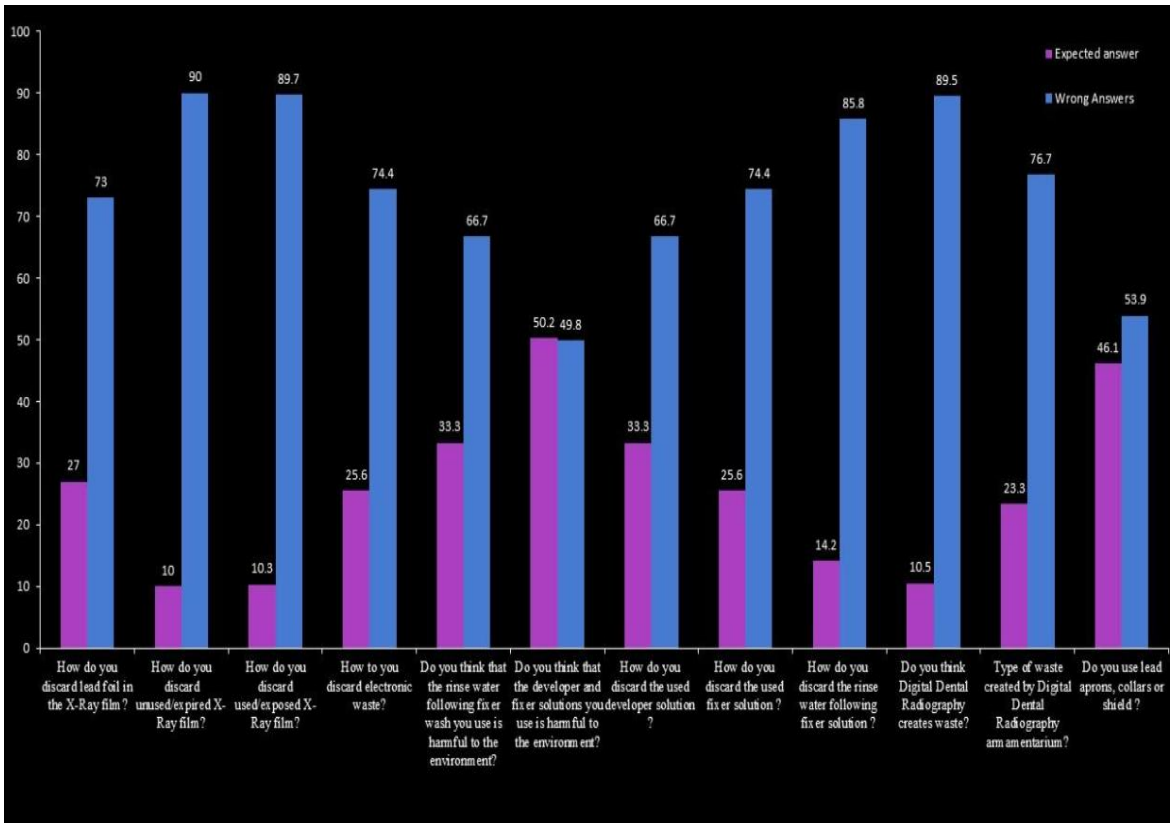

Fig 4: Comparative bar chart

values for expected correct response against the other responses.

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Fig 5: Depicts various response received from each question in pie chart.

Fig 1 shows the questionnaire format used in this study. Fig 2 shows the overall correct results have been reported to be <50% in almost all the questions. Total responses were evaluated for all the participants on the percentage basis which is depicted in the bar chart in Fig 3. Comparative bar chart showing the values for expected correct response against the other responses in Fig 4. Individual questions were also evaluated for results. Almost 33.3% of clinicians practice only conventional radiology, 17.4% practice digital radiography whereas 49.3% practice both. Regardless of the method of practice the respondents answered all the questions in the questionnaire for evaluating their outlook. Figure 5 shows 68% dentists discard the lead foils along with regular clinical wastes, 5% give away the foils with patient's X-ray packets and the remaining 27% believe in recycling. Around 50% of the dentists dispose the used X-ray films along with regular waste, 32% give them to the patients and 18% send for recycling. Once again 54% of the dentists discard the unused expired X-ray films along with regular waste, 36% of them return it to the manufacturer and only 10% send for recycling. Only 50% responders firmly believed that the used developer and fixer solutions are harmful to the environment whereas 18% don't and 32% have no idea about it. 33% of the dentists believe that the water used for rinsing X-ray during processing is harmful to the environment whereas 31% of them don't and 36% have no idea. The results for method of disposal of used developer suggested that 62% clinicians dispose the solution in their sink, 5% in the soil and 33% discard after special treatment. Similarly, the results of disposal of used fixer solution shows 69% dispose it in the sink, 5% into the soil and 29% give it for recycling considering it as a hazardous waste.77% of the dentists throw away the water used for rinsing purpose during film processing into the sink, 9% into the soil and roughly about 14% give it for recycling. Out of the 84% of the dentists using automatic film processor in their clinic, 10% use Chromium based cleaner and 16% use environmentally friendly cleaner whereas the remaining don't use a cleaner. 64% of the dentists believe that digital dental radiography does not create waste, 11% believe it does and 26% of them have no idea. 7% of the dentists think they are bio degradable waste, 12% think it to be hazardous waste, 23% recyclable waste whereas the majority 58% of them had no idea. Regarding electronic waste, 37% of the practitioners discard it along with the regular clinic waste, 26% return to the manufacturer and 37% give for recycling. 54% of the dentists use lead aprons. 95% of the responders think there is a need for an inclusion of a chapter on radiological waste management in the BDS curriculum and 92% think there is a need for an organizing authority to provide guidelines on management and control of dental radiographic waste. The percentage analysis thus proved that the results were establishing evidence for knowledge gap in dental clinicians regarding radiological waste management.

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DISCUSSION

Radiographic assessments being the major instrument in dentistry, a few headways like innovative technologies, gadgets and procedures have teamed up in the decrease of presentation of their unsafe impacts. Sudhakar V et al in their study had reported that in India, dentists pay no attention to waste management. [5] Dental radiographic systems produce squander substances with possible test to nature. Instances of such waste materials incorporate spent X-ray processing solutions, lead aprons, lead foil, processor system cleaners, utilized and unused X-ray films[6]. The amount of lead present in lead foil is between 69 to 85%. No safe degree of presentation to lead was discovered; lead was harmful even in low dosages. The lead foil present inside X-ray film packet is a leachable toxin which can contaminate the soil and groundwater in landfill destinations7. In Tsuji et al's study, it was reported that approximately 11 grams of lead waste could be created during full mouth radiographic assessment8. The lead foil from the films should be collected to return them to the manufacturer for recycling. Apparently, there is absence of awareness among the dental specialists on this administration offered by makers as the organizations report that just about 5% of the sold items are returned[9].

Silver from the developer and fixer solutions ought to be considered as a significant asset and ought to be reused[10]. Dental hospitals working with individual septic removal frameworks should make sure they dispense the developer solution safely as they contain aromatic phenols and amino acid. These chemicals require enormous amount of oxygen and result in harmful septic framework. However, used developer solutions are not that dangerous enough because of its lower content of silver9. But still, the they should be neutralized preceding its disposal in light of the fact that it has a pH around 11 to 12, (i.e.) it is a profoundly basic solution[1]. Even the water utilized in the washing of the radiographs displays levels of silver, well over the permitted esteem.

Silver from the fixer solution can be discarded in two different ways specifically (1) Onsite treatment and (2) Offsite treatment. Onsite recovery of silver from the fixer solution includes either electroplating techniques or metallic replacements. Through off-site removal of fixer,100% recovery of silver in fixer is ensured by sending them to the producers or distributors of the solutions[11]. The clinic should make sure to enclose the solutions in tightly closed plastic containers during storage or disposal of these solutions. The containers could be named as "Used fixer" with labels denoting the date it was first added to the containers8. The sad news about dental specialists is that they disregard and are unaware of the harmful effects of these radiographic wastes as they believe these wastes created by them could be insignificant. Indeed, even lead aprons and lead shields ought not be tossed into the normal trash, yet got back to the producer6,11. Automatic processor's cleaners usually contain chromium, which again is one of the dangerous waste products. System cleaners without chromium could be preferred with an added benefit of cost effectiveness10. Additionally, certified waste carriers can be used to discard radiologic wastes[12]. Dentistry being a health care service, the dental radiographic waste management should be sorted out[13]. Educational instructive pictures and posters in the dental office might be helpful and will act as a guidance for the dental staff[9]. Considering the aforementioned discussion, there is a need of more prominent consideration regarding the disposal of radiographic waste. The lack of care in handling the dental radiographic residues might cause serious damage to the people working to execute the garbage collection, the public and the environment which could be avoided by a system of previous separation of these materials[14]. Intending to diminish the harmful impact on the public health and environment, the clinicians need to take initiative to enquire and acquaint themselves with correct knowledge and change the perspective.

CONCLUSION

Considering the approach utilized and the outcomes acquired, it is clear that a large portion of the dental specialists didn't dispose of the radiographic waste appropriately. The solution is to practice digital radiography with computer-based devices. This would eliminate the wastes associated with conventional method of film processing. Dentists have moral and professional responsibility towards the dental as well as the general health of the patients they care. So, it is the responsibility of the dentists to save the environment by proper waste disposal while using conventional imaging.

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Nil

CONFLICT OF INTEREST:

There are no conflicts of interest.

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