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Research Article

# ASSESSMENT OF KNOWLEDGE, ATTITUDE AND PRACTICES OF DENTAL WASTE MANAGEMENT AMONG UNDERGRADUATE DENTAL STUDENTS OF BAPUJI DENTAL COLLEGE AND HOSPITAL IN DAVANGERE CITY- A CROSS SECTIONAL SURVEY

Usha GV<sup>1\*</sup>, Divyapriya GK<sup>2</sup>, Madhurima Basu<sup>3</sup>

<sup>1</sup>Reader, Dept. of Public Health Dentistry, Bapuji Dental College and Hospital, Davangere, India

<sup>2</sup>Post graduate, Dept. of Public Health Dentistry, Bapuji Dental College and Hospital, Davangere, India

<sup>3</sup>Intern, Bapuji Dental College and Hospital, Davangere, India

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\*Corresponding Author: **Usha G.V**

Reader, Dept. of Public Health Dentistry, Bapuji Dental College and Hospital, Davangere-577004; Mob: +917829794198

## ABSTRACT

**Aim:** To assess the level of knowledge, attitude and practice towards dental waste management among undergraduate dental students of Bapuji Dental College and hospital in Davangere city.

**Methodology:** A descriptive cross-sectional survey was conducted among the dental students (140 students) in Davangere city. Knowledge, attitude and practice towards dental waste management was assessed using a structured questionnaire containing 29 items. Descriptive statistics was applied to check the knowledge, attitude and practice of dental students.

**Results:** Out of 140 participants 41(29.3%) were males and 99 (70.6%) were females. Majority (97.9 %) of dental students were aware of the term biomedical waste and almost 72.8 % agreed to the need for disinfection of biomedical waste before disposal. Only 48.6% agreed that infectious waste to be put in yellow plastic bag with bio-hazard symbol. Only few (13.6%) of them use needle burner to destroy it which is the ideal method.

**Conclusion:** Though dental students have good knowledge but they were not aware of color coding in disposing the infectious waste and not practicing appropriate method of handling the dental waste.

**Keywords:** Bio-medical Waste, Dental waste, Dental Waste Management, Dental students.

## INTRODUCTION

**“Let the wastes of the sick not contaminated the lives of the healthy”**

Hospital is a place of almighty, a place to serve the patient. The health care sector includes a diverse range of health care facilities which have a size assortment from large general and specialist hospitals to small municipal dispensaries and D-type centres. All these facilities are an integral part of our society with an endeavour to reduce health problems and to eliminate imminent jeopardy to people's health. In the course of curing health problems the health care sector produce huge amount of bio-medical waste which may be hazardous to all those who come in contact with this waste<sup>1</sup>.

The term *biomedical waste* has been defined as "any waste that is generated during the diagnosis, treatment, or immunization of human beings or animals, or in the research activities pertaining to or in the production or testing of biological and includes categories mentioned in schedule I of

the Biomedical Waste (Management and Handling) rules 1998<sup>2</sup>.

Dental setup is a multidisciplinary system which consumes lot of items for delivery of dental care. Dental waste is a subset of biomedical (BM) waste. This includes sharps, used disposable items, infectious waste (blood-soaked cotton, gauze, etc.). All these waste contains a great variety of pathogenic microorganisms. Hazardous waste contains metals that are toxic and never degrade once they reach the environment. It consists of mercury containing waste (mercury, amalgam scrap), lead containing waste (lead foil packets, lead aprons) and chemical waste (such as spent film developers, fixers, and disinfectants)<sup>3</sup>. Amalgam is an acute neurotoxin; it's the most toxic non-radioactive element and also the most volatile heavy metal. Mercury can pose a threat due to release of mercury into the environment from dental practices and industries due to poor disposal. Other materials may contain potential hazards such as polystyrenes, barium, strontium, which may cause harm if correct use and disposal is not instilled.

With the increase in demand for dental care, there has been a rapid growth of dental clinics in the recent years and this led to the increase in the amount of biomedical waste generated by them<sup>4</sup>. Improper Bio-Medical waste management thus will cause environmental pollution, unpleasant smell, growth and multiplication of vectors like insects, rodents and worms and may lead to the transmission of diseases like typhoid, cholera, hepatitis and AIDS through injuries from syringes and needles contaminated with human blood. It is a potential health hazard to health workers, public, flora and fauna of the area<sup>5</sup>. However, lack of awareness has led to the hospitals becoming a hub of spreading disease rather than working toward eradicating them<sup>6</sup>. Hence appropriate management of health care waste is a crucial component of environmental health protection and it should become an integral feature of health care services<sup>7</sup>. For this, a conscious, coordinated and cooperative effort has to be made from doctors to health care waste handlers.

The doctors, dentists and other healthcare workers spend maximum time with patients in their working institutions or clinics. Improper disposal of dental waste can cause harm to the Dentist, to the people in the immediate vicinity of the Dentist who handle the materials, to the waste handlers or the general public at large through production of toxins through incineration<sup>8</sup>. They need to be well equipped with latest information, skills and practices in managing this wastes besides reducing hospital acquired infections to protect their own health, other member of health team and community<sup>9</sup>.

Literature search revealed there is scarcity of information related to dental waste management among undergraduate dental students at various teaching institutions in India. Hence the attempt is made to assess the knowledge, attitude and practices towards dental waste management among undergraduate dental students in Davangere city.

## MATERIALS AND METHODS

**Study design:** The study was a descriptive cross sectional survey across a sample of dental students in Bapuji Dental College and Hospital located in Davangere city, India

### Source of data

All the final year undergraduate students and Interns of Bapuji Dental College and Hospital dental in Davangere city constituted the study sample

### Questionnaire design:

Ethical approval was obtained from Institutional Review Board of Bapuji Dental College and Hospital, Davangere. Permission to collect the relevant data from the undergraduate dental students was obtained from the respective college authorities. Informed consent was taken from the dental students after explaining the purpose and the procedures involved in the study.

### Questionnaire

A self-designed structured questionnaire was used in the current study to collect the knowledge, attitude and practice of study sample. It comprised of 29 items which was given under two sections

- Section I: To collect the demographic details of the participants' like name, age, gender, addresses and education.

- Section II: Contained three parts.
  - Part A contain 12 questions regarding knowledge towards dental waste management
  - Part B contains 9 questions regarding attitude towards dental waste management
  - Part C contains 8 questions regarding practices towards dental waste management.

### Pilot study

The questionnaire was pretested in a group of 10 dental students and modifications were made accordingly. Cronbach's alpha was 0.70 and test-retest analysis showed a good reliability of 0.7 of the questionnaire. Those dental students who were involved in the pilot study were excluded from the final study. The knowledge questions were assigned one point each for the correct answer and zero points for the wrong answer.

### Informed consent

All the potential participants were detailed about the purpose of the study. The subjects were appraised that if they participate in the study, they need to answer a questionnaire containing 29 questions. The proforma used to collect data had the provision to record informed consent. A voluntary written informed consent was then obtained from the study participants.

### Administration of the questionnaire

The subjects were administered the questionnaire and instructions were given to the study participants to fill the questionnaire. A validated questionnaire comprised of 29 items about Knowledge, Attitude and Practice (KAP) of dental waste management was used. On an average it took 20 minutes to complete the questionnaire. The filled questionnaires were collected on the same day. The subjects who did not give the consent and incomplete forms were not included in the study.

### Statistical analyses

All the obtained data was compiled and tabulated systematically in Microsoft Excel Spread sheet and subjected to statistical analysis (SPSS version 17). Descriptive statistics were employed in terms of percentages.

## RESULTS

The current study was conducted to assess the knowledge, attitude and practice of undergraduate dental students of Bapuji Dental College and Hospital, Davangere. Totally, 140 dental students provided required data for analysis and there was no missing data with respect to those participants (100% response rate).

Out of the 140 dental students, 41 (29.4%) were males and 99 (70.6%) were females. Table 1 shows that almost 97.9 % of dental students were aware of the term biomedical waste management applicable to the dentists and few (3.6%) of the dental students were not aware that biomedical waste transmit infectious diseases. Most (92.9%) of the subjects were aware that needle should be recapped after use and also they knew that needle should be discarded immediately after use. Many (94.3%) were concerned about needle stick injury. Only 9.3 % of subjects were not aware of the color coding used to dispose the waste. When asked about the storage of waste, only 62.9% were answered that waste should not be stored more than 48

hours. Almost 72.8 % agreed to the need for disinfection of biomedical waste before disposal.54.3% of them had the knowledge of Pollution control board of India regulates for safe transport of health care.

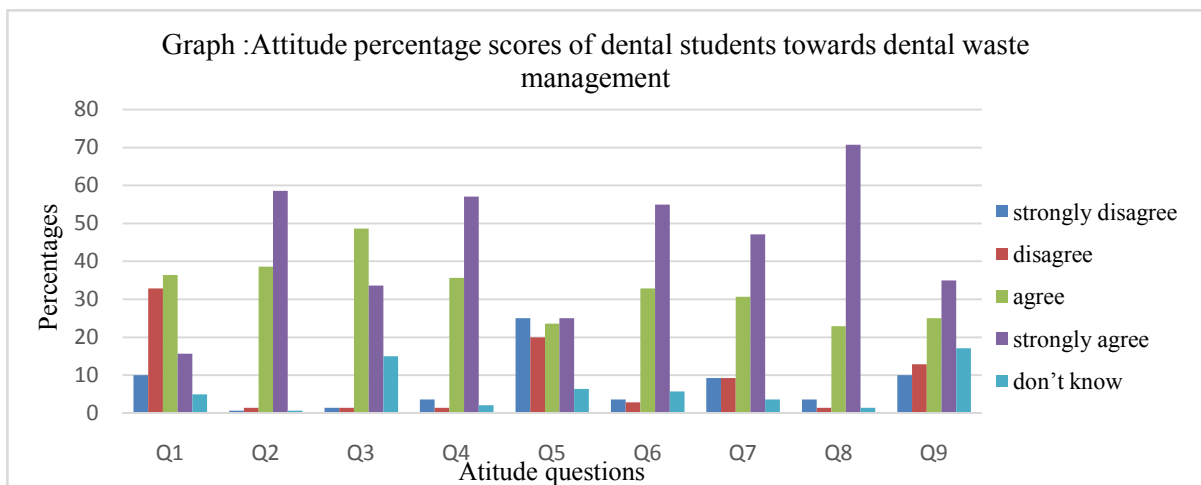
Bar graph shows the attitude of dental students towards dental waste management segregation of waste at sources increases the risk of injury to waste. Out of 140 students (58.6%) had positive attitude that decontamination or disinfectant reducing chances of infection. 48.6% of study subjects had positive attitude that infectious waste to be put in yellow plastic bag with bio hazard symbol. 94.6% had good attitude that occupational safety of waste handlers is must. 45% had negative attitude that reporting of needle stick injury is an extra burden on work.87.9 % had positive attitude about the use of colour coding for segregation of waste.77.9% of them agreed that immunization against hepatitis B prevents transmission of hospital acquired infection. 93.6 % subjects had favourable attitude towards post exposure prophylaxis (HIV/Hepatitis B) to be initiated as soon as possible. Only 37.9% of students showed positive attitude that excess mercury should be stored in water.

Table 2 describes the practices of the dental students regarding dental care waste management.

Only 32.4% of students store excess amount of silver amalgam in fixer solution.36.4% and 26.4% of them practice storage in airtight container and with water respectively. To the question regarding the disposal of sharp wastes like needle, only 48.6% students practice needle breaking before disposing it into disposal and only 13.6% use needle burner to destroy it which is the ideal method. 7 % of dental students dispose the developer solution by letting into sewer, 46% of them dilute and led into sewer and 47% return it to the supplier. 0.7 % of dental students dispose the fixer solution by letting into sewer, 7.9% of them dilute and led into sewer and 59.3% return it to the supplier. When the question was posed regarding the disposal of lead film foil nearly one third (36.4%) of dental students practice to store it separately and dispose in a separate container and 31.4% of them sell it to certified buyers. Exposed X ray films are disposed in secured land fill by 31.4% of dental students.53.6% of the subjects dispose used orthodontic wires and brackets by deforming it. Outdated and contaminated medicine are disposed in common bin by 16.4% of dental students, 34.3 % deformed and disposed it and only 31.4 % dispose it in secure land fill which is considered to be ideal method.80.4 % of dental students used certified collectors for final disposal of dental waste.

**Table 1: Level of knowledge among dental students towards dental waste management in percentages**

Sr. No	Knowledge Questions	Yes %	No %	Don't know %
1	Are you aware of the term 'biomedical waste'?	97.9	1.4	0.7
2	Are you aware that biomedical waste management rules are applicable to dentists?	89.3	8.6	2.1
3	Is Bio-medical waste (BMW) transmits infectious diseases like HIV/Hepatitis?	92.1	3.6	4.3
4	Do you re-cap the used needle?	92.9	7.1	0
5	Do you discard the used needle immediately?	93.6	6.4	0
6	Is needle-stick injury a concern?	94.3	2.1	3.6
7	Are you aware of colour coding of waste containers?	87.9	9.3	2.1
8	Do you think that labelling the container before filling it with waste is of any clinical significance?	95.7	2.9	1.4
9	Do you know that waste should not be stored > 48hrs?	62.9	17.1	20
10	Do you know the need for disinfection of BMW before disposal?	72.9	17.9	9.3
11	Does improperly managed Health care waste (HCW) may contaminate soil?	80.7	5	14.3
12	Are you aware that Pollution Control Board of India regulates for safe transport of healthcare waste?	54.3	20	25.7



Sr. No	Attitude Questions
1	Segregation of waste at sources increases the risk of injury to waste handlers
2	Decontamination/disinfection reduce chances of infection
3	Infectious waste should be put in yellow plastic bag with biohazard symbol
4	Occupational safety of waste handlers is a must
5	Reporting of needle stick injury is an extra burden on work
6	Use of color coding for segregation of waste is must
7	Hepatitis B immunization prevents transmission of hospital acquired infection
8	Post exposure prophylaxis (HIV/Hepatitis B) should be initiated as soon as possible
9	Excess mercury amalgam should be stored in water

**Table 2: Dental students practice towards dental waste management in percentages**

Q	Practice towards dental waste management	Percentage scores
1.	Storage of excess silver amalgam	
	a. Dispose to common bin	3.6%
	b. Store in an air tight container	36.4%
	c. Store in an air tight container with water	26.4%
2.	d. Store in a fixer	32.4%
	Disposal of infectious sharp waste like needle or files	
	a. dispose to common bin	2.9%
	b. break the needle and then dispose	48.6%
3.	c. destroy the needle with needle burner	13.5%
	d. dispose in a puncture proof plastic container	35%
	Disposal of developer solution	
	a. led into sewer	7%
4.	b. diluted and led into sewer	46%
	c. return it into supplier	47%
	Disposal of X-ray film lead foils	
	a. common bin	13.6%
5.	b. stored and disposed in separate container	55%
	c. sell to certified buyers	31.4%
	Disposal of exposed X-ray film	
	a. common bin	20%
6.	b. stored separately	36.4%
	c. buried in soil	12.1%
	d. disposed in secured landfill	31.4%
	Disposal of orthodontic wires and brackets	
7.	a. common bin	17.1%
	b. deform and disposed	53.6%
	c. sell to certified buyers	31.4%
	Disposal of outdated and contaminated medicines	
8.	a. common bin	16.4%
	b. deform and disposed	34.3%
	c. buried in soil	17.9%
	d. disposed in secured landfill	31.4%
9.	Final disposal of dental care waste	
	a. corporation bin	19.3%
	b. certified collectors	80.7%

## DISCUSSION

Hospitals and other health-care establishments have a “duty of care” for the environment and for public health, and have particular responsibilities in relation to the waste they produce<sup>6</sup>. Today, hospitals/clinics use a wide variety of drugs including antibiotics, cytotoxic, corrosive chemicals, radioactive substances, which ultimately become part of

hospital waste. The introduction of disposables in hospitals has brought in its wake many ills such as inappropriate recycling, unauthorized and illegal re-use, and an increase in the quantity of waste. Appropriate methods of dental waste disposal are the call of the hour. Even though the policy is given, there is for this continuing updating of knowledge with respect to dental waste management and also monitoring of the practices has to be practiced<sup>10,11</sup>.

Knowledge, attitude and practice act as three pillars, which make up the dynamic system of life itself. Knowledge, being the basic criterion that allows one to earmark between the right and the wrong, is a mixture of comprehension, experience, discernment and skill. Attitude accredits to thinking towards a proper situation. Practice means contemplation of rules and knowledge that lead to action thus, a right knowledge, a positive attitude and a good practice are imperative to guide and serve the patients<sup>3,12</sup>. Hence, the present study was conducted to determine the knowledge, attitude and practices regarding management of biomedical waste among dental students of Bapuji Dental College and Hospital.

In the present study, 98% of the undergraduate were aware of the term BMW management. This is in agreement with the study of Charania et al<sup>13</sup>. 89% of the study participants believed that, BMW rules should be applicable to dentistry. 92% of the study participants have knowledge regarding transmission of infectious disease through biomedical waste. This shows that they have relatively good level of knowledge about BMW and transmission of infections. 93% of the study participants were aware about recapping of the needle and had knowledge regarding needle discard. This is in contrast with the study conducted by Pandit et al<sup>14</sup>. This shows that our study participants have very good knowledge regarding recapping and discarding of needles. 88% of the study participants were aware of the disposal of waste into different color coding bags. Our results are similar to the study conducted by Narang et al<sup>15</sup>. Almost 96% of the study participants labelled the container before filling the waste.

Regarding the minimum time limit for the storage of BMW according to natural guidelines, about 63% were aware of the time limit. This is in contrast to the study conducted by Sanjeev et al<sup>3</sup>. 35% of the study participants were aware of the color coding for segregation of waste. This is in conformity with the study conducted by Sood et al in Delhi. 70% of the study participants have knowledge on post exposure prophylaxis and 33% of the study participants choose to store excess amalgam in fixer solution. 3.6% of study participants store it in common bin, which is in line with the study conducted by V. Sudhakar et al, in which 47.6% participants agreed that they will hand over health care waste to street garbage collectors. According to American Dental Association, fixer solution is the recommended method for storage of excess silver amalgam<sup>17</sup>. Empty amalgam capsules are to be disposed of in the garbage. Since amalgam decomposes on heating, it should not be incinerated

48% of the participants break the needle before disposing it to common bin. This is similar to results of the study conducted by Treasure et al, in which 35% of the study participants dispose the needle in a puncture proof plastic container<sup>18</sup>. Only 13% of the participants dispose the used needles and files by using needle destroyer which is the ideal method. It is of note that in India there is need of legislation to ensure the proper disposal of sharp waste.

In the present study, 46% of participant dispose the developer solution by diluting it and led into sewer. As developer solution does not contain silver, so it can be diluted and put into sewer; on the other hand fixer solution contains silver and

if put into sewer it will increase the metal load in the sewer which is not allowed as per environmental protection rules. About 68.1% dispose of the X-ray film foils into common bin which is not permitted because lead is a heavy metal that affects neurological development and functions. It should not be incinerated or treated as general waste. It potentially leaches from landfills and can contaminate soil and ground water. Some of the factories may use lead as a raw material for manufacture of batteries, but the quantity required is high<sup>19</sup>. 36.4% of study participants stored exposed X-ray films separately which is comparatively lesser than the study conducted by Sudhakar et al in which half (52.9%) of the study participants store it separately<sup>20</sup>. Exposed X-ray films are harmless and can be considered as general wastes. 17% of study subjects dispose of orthodontic wires and brackets into common bin. 53% of the study participants deformed and disposed the orthodontic wires. According to OSHA (Occupational Safety and Health Administration) regulations, orthodontic wires are considered as sharp wastes because the ends of orthodontic wires can penetrate the skin and their contamination with blood can reasonably be anticipated. So they should be disposed as sharp wastes and it should be categorized as recyclable waste.

In the present study, 34% of the study participants deform and dispose the outdated and contaminated medicine. 31% dispose it in a secure landfill which is the ideal method. This clearly shows that the participants have inadequate knowledge regarding disposal of outdated and contaminated medicine. We recommend there should be proper and intensive training programs regarding awareness and practices of waste disposal for all health-care staff, students with continuous monitoring at regular intervals. Further research must be undertaken to seal existing gaps in the knowledge about hospital waste management. The findings of this study will help to address the issue more appropriately, and inform plans for better training programs and monitoring of biomedical waste management systems in hospitals.

## CONCLUSION

This study was done to assess the knowledge, attitude and practices towards dental waste management among undergraduate dental students studying in Bapuji Dental College and Hospital, Davangere. Some of the conclusions that could be drawn from the study are participants had very good knowledge regarding transmission of infection through hospital waste, post prophylaxis measures, needle recapping, color coding system and labelling of the container. However practice of segregation of waste was very much lacking in our participants and also students were less aware of mercury management

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