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KNOWLEDGE ABOUT REUSE AND RECYCLING OF DENTAL WASTES MANAGEMENT: AN INSTITUTIONAL SURVEY STUDY

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A. Somalee Mahapatra prepared the Conceptual or Design of the study along with the data collection.
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D. Aurolipi achieved in the Critical revision of the article.
E. Saswati coined the data interpretation.
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Tables:

Table1Demonstrating:Do you know about dental management waste by reuse

Category	Yes(In %)	No(In%)	Donot Know (In %)	P
BDS	**59**	**22**	**19**	**0.00017**
Interns	**62**	**20**	**18**	
MDS	**79**	**19**	**2**	
PG	**41**	**59**	**0**	

UG	**61**	**21**	**18**	

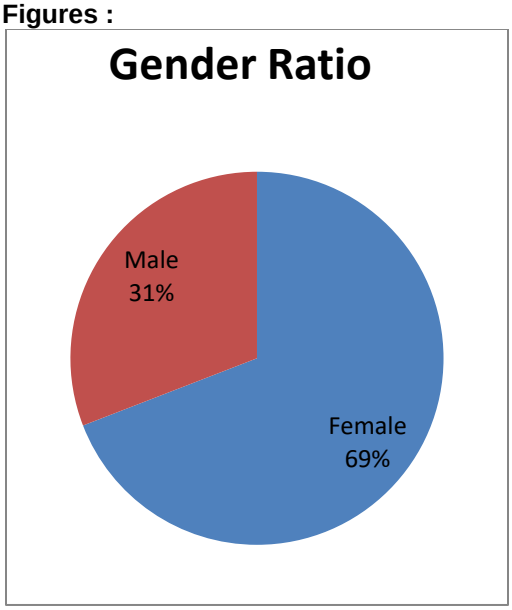
Table2 Demonstrating : Are you aware that silver can be collected from Dental amalgam for Reuse

Category	Yes(In %)	No(In%)	Donot Know (In %)	P
BDS	**48**	**31**	**21**	**0.03**
Interns	**40**	**37**	**22**	
MDS	**50**	**38**	**13**	
PG	**58**	**8**	**32**	
UG	**40**	**23**	**33**	

Table3Demonstrating: Are you aware that the lead aprons should be handed over to licensed recyclers

Category	Yes(In %)	No(In%)	Donot Know (In %)	P
BDS	**53**	**22**	**22**	**0.00008**
Interns	**42**	**26**	**24**	
MDS	**81**	**10**	**10**	
PG	**59**	**18**	**22**	
UG	**59**	**16**	**24**	

Figures :



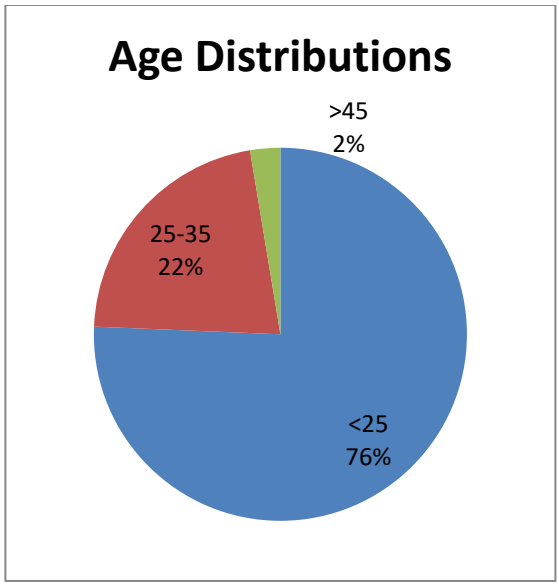


Figure:1 Demonstrating the gender ratio Figure:2Showing the age distribution

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Abstract:
Background:
The healthcare facilitators should have the perception and be knowledgeable with having an insight to holistically practicing in relation to dental waste management. Although all around the world many studies conducted which suggested that there is still lot of gap in the perception about DWM and the actual practice followed regarding reuse and recycling. So an assessment is needed to discover this degree and the breach between the perception, insight and the practices among the dental faculties & students in a dental college at Bhubaneswar, Odisha which will help in initiating reuse and recycling of the dental wastes.
Material & Methods :
This is a cross sectional study which demonstrated the bridge between the perception and insight about dental biomedical waste management.
Results: About 79%of MDS & 59% of BDS respondents were aware about the reuse section and 83%MDS and 81%BDS respondents aware about the recycling section for the dental waste in their Institution.
Conclusions: The results indicates that strategy can be formulated by the authorities of the hospital from the data collected for the improvement of dental waste for reuse and recycling of the dental wastes in order to achieve environmental sustainability. In relation to the BMW management as per this study the dental students are less knowledgeable about the reusing and recycling of the dental wastes. As the dental waste has an influence on the environment so immediate academicals evaluation is needed for the management of these dental wastes along with training section about the awareness is essential by which the dental students will become knowledgeable about reuse and recycling of dental waste to reduce the burden on earth.
Keywords: Reuse, dentistry, knowledge, recycling, students.

Introduction

Dental wastes are the waste materials that are generated during the provision of the oral healthcare by the dentists. The diagnosis, investigations and treatment altogether generate wastes in the solid form in the sequence of investigations ,treatment and the diagnosis of the human beings & or the trials done in the animals.(Michael,2013;Blackman,1996;Oke,2008)The two categories namely; infectious and non-infectious wastes are the solid waste being generated from the dental hospital. These wastes should be treated wisely in order to minimize the hazard caused due to it to the mankind. As they have the potential to produce many infectious diseases These various types of microbes causes condition's relating to the health.(EPA,1986)Face masks, gloves, rubber dams, protective cellophane and other chlorine containing items are the consumables used which are disposed of by incineration which are used in dental treatment. Reproductive defects, neurological problems, cancer formation, hormonal and immune disorders could arise due to Incineration as it releases dioxin, Hydrogen Chloride (HCl) and Chlorofluorocarbon (CFC).(Michael,2013; Floret N,2003) A direct impact on environment can be seen due to increase in waste production, mismanagement of recycling is emerging as a threat to public health. Therefore, management of biomedical waste should be implemented by the universities and institutions which will produce professionals in future who can continue the trend. (Diaz-Soriano A,2020; . Mousavi SA,2015;Drost EA,2011; Almasi A,2017)The dental wastes are inevitable as dental practice is necessity of the increasing modernized society of today. So it's the responsibility of all the oral health care facilitators to take utmost care about the dental waste management. The procedure of reduction and recycling of the dental waste before disposal will help in achieving environmental sustainability. Recycling programs are being given outmost importance now especially in the developed countries in which health clinicians are trained to isolate the biomedical waste.(Schwarz-HerionO,2008) Biomedical waste practices in India, was started by the WHO in the year 2002. Most of the biomedical waste products like needles and syringes which are used only once were seen to be reused 50% of the times as per WHO.(Ranjan R,2016; Mattoo K,2014) Biomedical waste rules were first proposed on 20thJuly 1998 by WHO. Then by the draft of 2011 the biomedical wastes were marked off into eight categories which was ten in numbers which was put forward by the notification in the year1998.(SharmaA,2013) Environmental protection also involves sound management which is now an important part of biomedical waste management.(Thota MM,2014) Hospitals and clinics are now bound to employ proper disposal technologies and affective treatment of

biomedical wastes. At a conceptual level, it's generally looked upon and it may represent a new value to human society. Since the impact on the environment is minimized, some people consider it as part of the sustainable development concept. (Cristina Ghinea, 2014).These biomedical waste comprises of infectious agents/ diseases which can be dangerous if not handled and managed properly can lead to water, air and soil pollution. The BMW are usually present in clinics, hospitals or research of healthcare involving procedures or tests applied to human/ animals. For this reason proper management of the BMW 's handling is mandatory along with efficacious transport with elimination of the waste will help in avoiding the damage obtained, furthermore the materials that are reusable must be recycled.(Mayta-TovalinoF,2022;KumarPVS,2017;SinghBP,2012;RudraswamyS,2012).So this present study aimed to access the level of knowledge about the reusing and recycling of the dental wastes among the dental students, interns and the faculties.

Materials & Methods:

The study involved a questionnaire based on the cross-sectional study was conducted during the month of March 2022. The reference population comprised of randomly selected dental students, interns and faculties from a dental teaching Institution at Bhubaneswar. The participants were given the survey questionnaire and then the data was collected through their mail.

Data collection and study instrument:

A validated questionnaire regarding knowledge about reuse and recycle was used in order to collect data of UG, PG, interns, MDS and BDS. The first 10 questions of the first section and second section comprising of 10 questions in the questionnaire were related to the knowledge about reuse and recycling of the dental materials.The answer of each question was divided into yes, no and do not know. The information collected was analyzed and statistics was used to evaluate the knowledge regarding the reuse and recycle of the dental waste.

The analyses carried out had *P* value <0.05 as significant.

Results

In total 230 participants, males and females, belonging to dental college of Bhubaneswar city were included in the study. Among the participating dentists in the present study, the female respondents were about 69% and the male respondents were about 31% as in figure1 with maximum of the dentists having maximum of the dentists having age distribution of <25years was 76% for 25-35years was 22% and for >45years was 2% as seen in figure1&2,probably because more dental students responded and young practitioners were in the dental teaching Institution. While comparing the BDS and MDS dental faculties, a significant increase in knowledge regarding Dental waste management was found among the MDS dental faculties and the difference was statistically significant ($p \leq 0.05$).

.The knowledge aboutr euse and recycling of dental materials is demonstrated in table's1,2,3.About79%of MDS & 59% of BDS respondents were aware about the reuse section for the dental waste in their Institution as shown in table1 Among the respondents MDS were 81% and BDS were 53% respectively being aware that the lead aprons used to take X-rays should be handed over to licensed recyclers in table3. All the BDS and MDS faculties in our study considered reuse and recycling of the biomedical dental waste is an important issue for environmental sustainability. While analyzing the knowledge of dental practitioners, the MDS faculties were observed to have a more positive attitude towards dental waste management and the difference was statistically significant ($p \leq 0.05$) in table2.

DISCUSSION

During the dental treatment a huge quantities of wastes from the hospitals is normally created that leads to injurious effects to the ecosystem if we don't take care of the proper disposal.(Baghele ON,2013) WHO has given a statistics of 20% which is generated in the health care sector.(Pandit NB,2005) As the population is growing faster and so is the latest technologies the amount of treatment increases thus leading to accumulation of huge biomedical waste.As these wastes cannot be disposed in the grounds due to the amount of toxicity being released from the them, making hazardous situation for the future.(VilasMA,2015)The countries which are developing like India, (SharmaS.2010;SushmaMK,2010) Brazil,(DaSilvaCE,2005) Dhaka,(HassanMM,2008)and Turkey,(Alagöz AZ, Kocasoy G.2008) which shows the knowledge that is not adequate and the workers belonging to healthcare having attitude especially which is indigent in regards to the biomedical wastes. The reuse and recycling of dental wastes is not discussed much in previous studies but mainly concentrated for BMW management. The past studies showcased that the population accounting to 61% were ignorant about the awareness of(reuse & recycling) for the materials used in dentistry. Most of these respondents did not know about the disposal of amalgam which could be harmful and also regarding the gypsum products that can be recycled which is frequently being utilized in the dental

field.(Singh RD,2014)As was the result by Tippatetal (Tippat SK,2015) so was similar to this study .In the dental practice the recycling of mercury and their products should be done .In the dental office to prevent mercury toxicity, use of vaccum pump filter ,amalgam capture devices and chair side trap should be executed which will help in recovering the amalgam.(Adams E,2007)According to American Dental Association(ADA)the amalgam which is excess must be stored in closed container in order to reduce hazard caused due to it, and then sent for recycling.(http://www.epa.gov/hg/ dental amalgam. html#bmps.,2008)The hazards related to disposal of Gypsum and byproducts are numerous because it releases hydrogen sulfide gases, deteriorates soil functions as soil crusting is reduced and increases infiltration of water and aeration of the soil.(Mattoo K,2014). The various materials in dentistry which could be reused are investments of phosphate bonded ,dental gold ,alginate, the orthodontics brackets of ceramic & metallic and dental alloys being unused(merged with Pd ,Ag ,or Au).(Mattoo K,2014) If disposed in the basin directly, the silver present in the fixer solution increases the metal content in the sewer. Basically, the fixer solutions must be handed over to certified buyers for profitable extraction of silver from it.(Government of India, Ministry of Environment, Forest and Climate Change,2016)In our study, about 50% of MDS and49% of BDS knew the correct disposal of fixer solution to the certified buyer. The study conducted by Singh et al. (5.6%)(Singh RD,2014) this was practiced even lesser. The heavy metal lead present in the X-ray film foils, which should be disposed carefully as it has the risk of contaminating soil and ground water is there which can lead to various neurological problems and other disorders. Therefore, ideally, it should be definitely handed over for offsite disposal or to certified buyers, and the extracted materials such as lead, may be used as a raw material in other industries.(SinghRD,2014;HegdeV,2007)In this study from the X-ray film foils containing lead should be handed to the certified buyers as responded by 54% of MDS and 47% of BDS. There are some reports which says gypsum has been recycled and being used in mixed Landfills.(Arora S,2017) The gypsum being disposed,leads to liberation of hydrogen sulphide gas that is highly dangerous for the nervous & respiratory system.

The short term and long term toxicity caused various problems like irritation to eyes, respiratory tract and memory loss, difficulty in breathing.(Environment and sustainability health technical memorandum 07-01: Safe management of health care waste,2019) Due to this reason the disposal of gypsum was banned in 2009. Specially prepared landfills are therefore advised for the disposal of gypsum.The present curriculum in BMW is regarding disposal of waste but the concepts of recycle and reuse are not well established.The lack of knowledge in relation to biomedical waste management is indirectly related to the curriculum of dental surgery as the present students become the future practitioners and hence it is important incorporate this subject as an independent chapter in the dental curriculum so that the present students and future practitioners shall be more aware and knowledgeable regarding the biomedical waste management and the significance of recycle as well as reuse of byproducts.

CONCLUSION

As India being densely populated, large number of hospitals and colleges are coming up regularly but they lack proper disposal of medical waste leading to risk of health hazards and to the environment. Hence with proper knowledge and awareness regarding reuse and recycle of dental wastes will help in decreasing the burden on the environment. Safe and effective management of waste is not only legal necessity but also a social responsibility. It is imperative that waste should be segregated and disposed in a safe manner to protect the environment as well as human health and for this an optimistic attitude and collective accountability of all health care workers are required. Periodic and orientation based training programmes should be provided to all health care workers, so that both the knowledge as well as practice of bio-medical waste management can be upgraded along with reuse and recycling of the dental waste will maintain the ecosystem. Even though the topic of biomedical waste management is included in the curriculum, there should be an essential need for better education with practical demonstration classes to further improve the knowledge about biomedical waste management by well-designed seminars, programs, workshops, assessments etc.

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