

# Knowledge And Awareness On Needle Stick Injury, Personal Protective Equipment, Bio -Medicalwaste Disposal Managemant Among Dental Interns-A Questionnaire Study.

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## **Abstract:**

**Background:** Dental interns, due to their limited clinical experience, are particularly vulnerable to these risks. This study aims to assess the knowledge and awareness among dental internship students regarding needle stick injury (NSIs), personal protective equipment (PPE) and waste disposal management. The study underscores the urgent need for comprehensive, hands-on training programs in dental education, emphasizing the importance of adherence to safety protocols to reduce the risk of NSIs and ensure proper waste disposal. By addressing these knowledge gaps, the study aims to contribute to fostering a safer clinical environment for both healthcare providers and patients

**Methods:** A questionnaire evaluated the intern's knowledge and awareness towards Needle stick injury (NSIs) as well as their compliance with personal protective equipment (PPE) regulations and waste disposal management. Responses were analyzed using frequency distribution and chi-square test.

**Result:** The study shows that dental interns have a high level of awareness regarding biomedical waste regulations (100%) and the risks associated with needle stick injuries. However, some misconceptions remain, with misinterpreting the function of PPE and making errors in sharp waste disposal. Although some recognized the terms "Donning" and "Doffing," only few followed the correct donning sequence, and somw knew the proper doffing order. When managing needle stick injuries, some correctly chose to wash the wound with soap and water, while others mistakenly opted for alcohol. The primary obstacles to following protocols were inadequate training (53.8%) and stress (30.3%) ( $p=0.05$ ).

**Conclusion:** In conclusion the study finds a knowledge gap in awareness of needle stick injury, biomedical waste management and personal protective equipment, where the dental interns can be better equipped thus reducing the risk.

**Keywords:** dental interns, clinical safety, dental education, training programs.

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## **I. Introduction**

Needlestick injuries (NSIs), personal protective equipment (PPE), and biomedical waste disposal are critical aspects of infection control in dental practices. NSIs are among the most common occupational hazards for healthcare professionals, particularly in dental settings where the use of sharp instruments is prevalent. These injuries pose a risk of transmission of bloodborne pathogens such as HIV, Hepatitis B, and Hepatitis C, making effective preventive strategies vital in dental practice [1,2].

Dental interns in the early stage of dental practice, often face increased exposure to these risks due to their learning environments and their handling of sharp instruments during procedures [2]. However a lack of awareness and proper training can significantly contribute to the prevalence of NSIs in dental settings[3,5].Hence the understanding the level of awareness regarding NSIs in dental setting and associated safety protocols are significantly important for minimizing risks in dental practice [4,6].

Personal protective equipment plays a vital role safeguarding dental professionals from exposure to potentially infectious materials. Correct use of PPE, including gloves, masks, face shields, and gowns, is essential to reduce the likelihood of direct contact with blood or body fluids during dental procedures[7,8,9]. However, inconsistent or improper use of PPE has been reported among dental interns, raising concerns about their preparedness to protect themselves and their patients effectively[9,10].

Furthermore, the proper management of biomedical waste is a critical component of maintaining a safe and hygienic dental environment. Improper disposal of contaminated materials, such as needles, gloves, and cotton swabs, can lead to the spread of infectious diseases and pose environmental hazards[11,12,13]. Understanding the correct waste disposal methods and the importance of segregation and safe disposal techniques is a crucial area of training for dental interns[14,15].

The aim of the questionnaire is to assess the level of awareness and knowledge regarding NSIs, PPE use and biomedical waste disposal among the dental interns. The conclusions of this study will provide valuable insights into the gaps in knowledge and will help in formulating needed intervention to enhance the awareness of safety protocols and minimize the risk in dental setting.

## **II. Materials And Methods**

### **Study Design**

A cross-sectional questionnaire-based study was conducted to assess the attitude and perception of undergraduate dental students towards prosthodontics as a specialty in Adhiparasakthi Dental College and hospital,Melmaruvathur, Chengalpattu district, Tamil Nadu.

### **Study Population**

The study included undergraduate dental students from Adhiparasakthi Dental College and Hospital, Melmaruvathur. Students who were under their internship were invited to participate. The sample size is estimated as 120 undergraduate dental students .Method of sample collection was a convenience sampling method.

### **Inclusion Criteria:**

- Currently enrolled undergraduate dental students of Adhiparasakthi Dental College and Hospital
- Students willing to participate voluntarily in the study.

### **Exclusion Criteria:**

- Students with incomplete responses.

### **Methodology: Questionnaire Development:**

Included questions in questionnaires was 15, all questions were framed in English .The question were designed to assess the knowledge, attitude and awareness towards needle stick injury, PPE and biomedical waste disposal among dental interns

### **Questionnaire**

1. Are you aware of the Biomedical Waste (Management and Handling) Rules?

Yes

No

2. What do you understand by the term "biomedical waste"?

General household waste

Waste generated during the diagnosis, treatment, or immunization of humans or animals

Recyclable material

3. Which color-coded bag is used for the disposal of infectious waste?

Yellow

Red

Blue

Black

4. Which type of waste is disposed of in a puncture-proof container?

Non infectious waste

Sharps

Expired medicine

5. What are the major challenges you face in adhering to waste disposal protocols?

Lack of resources (bins, bags, etc.)

Lack of training

Inadequate supervision

Time constraints

6. Are you aware of PPE

Yes

No

7. What is the primary purpose of PPE in a clinical setting?

To protect healthcare workers from exposure to infectious agents

To improve patient comfort

To meet legal requirements

All of the above

8. What does the term “donning” and “doffing” refer to in PPE usage?

Wearing PPE and Removing PPE

Removing PPE and Wearing PPE

9. What is the correct sequence for donning PPE?

Hand hygiene, gown, mask, eye protection, gloves

Gloves, gown, mask, eye protection, hand hygiene

Eye protection, gloves, mask, gown, hand hygiene

10. What is the correct sequence for removing (doffing) PPE?

Gloves, gown, eye protection, mask, hand hygiene

Gown, mask, gloves, eye protection, hand hygiene

Mask, eye protection, gloves, gown, hand hygiene

11. Are you aware of the risks associated with needle stick injuries?

Yes

No

12. What infections are commonly transmitted through needle stick injuries?

Hepatitis B (HBV)

Hepatitis C (HCV)

Human Immunodeficiency Virus (HIV)

All of the above

13. What is the first step after sustaining a needle stick injury?

Wash the wound with soap and water

Apply alcohol directly to the wound

Ignore if the wound is minor

14. How soon should you initiate PEP after exposure?

Within 1 hour

Within 72 hours

Within 7 days

15. What are the main barriers to adhering to NSI prevention guidelines?

Lack of training

High workload/stress

Unavailability of safety equipment

### III. Data Collection

The questionnaire was distributed in online format (using platforms like google forms ) over a period of two months. Participation was anonymous and voluntary.

### IV. Statistical Analysis

The survey's findings were examined to assess the correlation between the attitude, knowledge and awareness towards the NSIs, Biomedical waste disposal and Personal protective equipment among the dental interns. Chi square tests were used to determine statistical significance; p-value of less than 0.05 was deemed significant

### V. Results

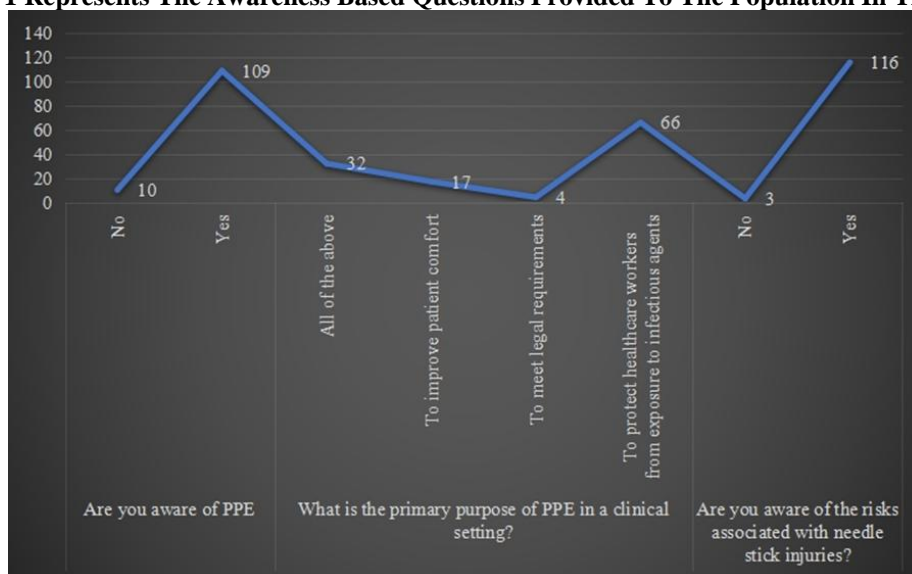
**Table 1 Represents The Awareness Based Questions Provided To The Population In The Study**

Questions	Responses	Frequency	Percentage	Sig
Are You Aware Of The Biomedical Waste (Management And Handling) Rules?	Yes	119	100.0	1.000
	No	-	-	
Are You Aware Of Ppe	No	10	8.4	0.000
	Yes	109	91.6	
What Is The Primary Purpose Of Ppe In A Clinical Setting?	All Of The Above	32	26.9	0.045
	To Improve Patient Comfort	17	14.3	
	To Meet Legal Requirements	4	3.4	
	To Protect Healthcare Workers From Exposure To Infectious Agents	66	55.5	
Are You Aware Of The Risks Associated With Needle Stick Injuries?	No	3	2.5	0.000
	Yes	116	97.5	

*\*P value less than or equal to 0.05 is considered statistically significant different*

Table 1 & Graph 1 represents awareness-based questions in the study. Awareness of Biomedical Waste Rules was 100%, with a p-value of 1.000, indicating no variability. PPE awareness was high (91.6%), but the p-value of 0.000 suggests a significant difference in awareness levels. Regarding the primary purpose of PPE, 55.5% correctly identified it as protecting healthcare workers, while 26.9% chose "All of the above," indicating a broader understanding. However, 14.3% selected "To improve patient comfort," and 3.4% chose "To meet legal requirements," with a p-value of 0.045, reflecting significant variation in responses. Awareness of needle stick injury risks was 97.5%, with a p-value of 0.000, showing a statistically significant difference. Overall, there is strong awareness of biomedical waste rules and needle stick injuries, while PPE awareness is high but varies, and understanding of its primary purpose shows some misconceptions.

**Graph 1 Represents The Awareness Based Questions Provided To The Population In The Study**



**Table 2 Represents The Knowledge Based On Biomedical Waste Management Questions Provided To The Population In The Study**

Questions	Responses	Frequency	Percentage	Sig
What Do You Understand By The Term "Biomedical Waste"? * General Household Waste	General Household Waste	9	7.6	<b>0.000</b>
	Waste Generated During The Diagnosis, Treatment, Or Immunization Of Humans Or Animals	110	92.4	
Which Color-Coded Bag Is Used For The Disposal Of Infectious Waste?	Black	1	.8	<b>0.000</b>
	Red	5	4.2	
	Yellow	113	95.0	
Which Type Of Waste Is Disposed Of In A Puncture-Proof Container?	Expired Medicine	3	2.5	<b>0.045</b>
	Non Infectious Waste	4	3.4	
	Red	3	2.5	
	Sharps	63	52.9	
	Yellow	46	38.7	
What Are The Major Challenges You Face In Adhering To Waste Disposal Protocols?	Inadequate Supervision	42	35.3	<b>0.065</b>
	Lack Of Resources (Bins, Bags, Etc.)	33	27.7	
	Lack Of Training	37	31.1	
	Time Constraints	7	5.9	

\*P Value Less Than Or Equal To 0.05 Is Considered Statistically Significant Different

Table 2 represents knowledge-based questions on biomedical waste management. A majority (92.4%) correctly identified biomedical waste, while 7.6% mistakenly associated it with household waste (p = 0.000, significant difference). Most respondents (95.0%) correctly identified Yellow as the bag for infectious waste, with minor errors (p = 0.000, significant). For puncture-proof container disposal, 52.9% correctly chose Sharps, but 38.7% incorrectly selected Yellow, showing some misconceptions (p = 0.045, significant variation). Challenges in waste disposal were distributed among inadequate supervision (35.3%), lack of training (31.1%), and lack of resources (27.7%), with time constraints being the least reported (5.9%). The p-value (0.065) indicates no dominant challenge. Overall, knowledge of biomedical waste and color-coded disposal is strong, though slight confusion exists regarding sharp waste disposal, and challenges in adherence are multifaceted.

**Table 3 Represents The Knowledge Based On Ppe Questions Provided To The Population In The Study**

Questions	Responses	Frequency	Percentage	Sig
What Does The Term "Donning "And Doffing Refer To In Ppe Usage?	Removing Ppe And Wearing Ppe	14	11.8	<b>0.742</b>
	Wearing Ppe And Removing Ppe	105	88.2	
What Is The Correct Sequence For Donning Ppe?	Eye Protection, Gloves, Mask, Gown, Hand Hygiene	8	6.7	<b>0.023</b>
	Gloves, Gown, Mask, Eye Protection, Hand Hygiene	13	10.9	
	Hand Hygiene, Gown, Mask, Eye Protection, Gloves	98	82.4	
What Is The Correct Sequence For Removing (Doffing) Ppe?	Gloves, Gown, Eye Protection, Mask, Hand Hygiene	73	61.3	<b>0.067</b>
	Gown, Mask, Gloves, Eye Protection, Hand Hygiene	39	32.8	
	Mask, Eye Protection, Gloves, Gown, Hand Hygiene	7	5.9	

\*P Value Less Than Or Equal To 0.05 Is Considered Statistically Significant Different

Table 3 represents knowledge-based questions on PPE. Most respondents (88.2%) correctly identified "Donning" and "Doffing," with no significant difference in response distribution (p = 0.742). The majority (82.4%) correctly identified the proper donning sequence, while 17.6% had misconceptions, making the variation statistically significant (p = 0.023). Doffing knowledge was weaker, with only 61.3% selecting the

correct sequence, while 38.7% made errors, though the distribution was not statistically significant ( $p = 0.067$ ). Overall, there is strong knowledge of donning PPE but some misconceptions about its definition. The understanding of PPE removal is less established, highlighting the need for additional training to reduce contamination risks.

**Table 4 Represents The Knowledge Based On Needle Stick Injury Questions Provided To The Population In The Study**

Questions	Responses	Frequency	Percentage	Sig
What Infections Are Commonly Transmitted Through Needle Stick Injuries?	All Of The Above	51	42.9	0.898
	Hepatitis B (Hbv)	51	42.9	
	Hepatitis C (Hcv)	6	5.0	
	Human Immunodeficiency Virus (Hiv)	11	9.2	
What Is The First Step After Sustaining A Needle Stick Injury?	Apply Alcohol Directly To The Wound	40	33.6	0.078
	Ignore If The Wound Is Minor	9	7.6	
	Wash The Wound With Soap And Water	70	58.8	
How Soon Should You Initiate Pep After Exposure?	Within 1 Hour	52	43.7	0.067
	Within 7 Days	7	5.9	
	Within 72 Hours	60	50.4	
What Are The Main Barriers To Adhering To Nsi Prevention Guidelines?	High Workload/Stress	36	30.3	0.066
	Lack Of Training	64	53.8	
	Unavailability Of Safety Equipment	19	16.0	

*\*P Value Less Than Or Equal To 0.05 Is Considered Statistically Significant Different*

Table 4 represents knowledge-based questions on needle stick injuries. Awareness of NSI-related infections was moderate, with 42.9% correctly selecting “All of the above” (HIV, HBV, HCV), but many focused only on HBV ( $p = 0.898$ , no significant difference). Only 58.8% correctly identified washing the wound with soap and water as the first step, while 33.6% incorrectly chose alcohol application, highlighting a training gap ( $p = 0.078$ , not significant). Awareness of PEP timing was fair, with 50.4% correctly selecting “Within 72 hours,” though 43.7% chose “Within 1 hour” ( $p = 0.067$ , not significant). The primary barrier to NSI prevention was a lack of training (53.8%), followed by stress (30.3%) and equipment shortages (16.0%) ( $p = 0.066$ , not significant). Overall, there are misconceptions about NSI infections and response protocols, emphasizing the need for improved training on proper wound care and PEP initiation.

The study assessed awareness and knowledge of biomedical waste management, PPE, and needle stick injury (NSI) risks. Awareness of Biomedical Waste Rules was universal (100%,  $p = 1.000$ ), while PPE awareness was high (91.6%) but significantly varied ( $p = 0.000$ ). Understanding PPE’s purpose varied, with 55.5% correctly identifying its role in protecting healthcare workers, though misconceptions persisted ( $p = 0.045$ ). Awareness of NSI risks was strong (97.5%,  $p = 0.000$ ). In biomedical waste management, 92.4% correctly defined biomedical waste ( $p = 0.000$ ), and 95.0% identified the Yellow bag for infectious waste ( $p = 0.000$ ). However, 38.7% mistakenly selected Yellow for sharp waste instead of a puncture-proof container ( $p = 0.045$ ). Challenges in waste disposal were distributed across supervision, training, and resources, with no single dominant factor ( $p = 0.065$ ). Regarding PPE, 88.2% understood “Donning” and “Doffing” ( $p = 0.742$ ), and 82.4% correctly identified the donning sequence ( $p = 0.023$ ), while doffing knowledge was weaker (61.3% correct,  $p = 0.067$ ). NSI-related infection awareness was moderate, with 42.9% choosing “All of the above,” but many focused only on HBV ( $p = 0.898$ ). Only 58.8% correctly identified washing the wound as the first step ( $p = 0.078$ ), and PEP timing knowledge was mixed (50.4% correct,  $p = 0.067$ ). Lack of training (53.8%) was the primary barrier to NSI prevention ( $p = 0.066$ ). Overall, while awareness was high, misconceptions in PPE usage, NSI response, and sharp waste disposal highlight the need for targeted training programs.

## VI. Discussions

Needlestick injuries (NSIs) are a significant occupational hazard for dental professionals, posing a risk of HIV, hepatitis B (HBV), and hepatitis C (HCV) transmission [17,18]. These injuries frequently result from improper handling of needles, lack of training, and failure to follow infection control protocols [18]. Proper NSI prevention, biomedical waste disposal, and the use of personal protective equipment (PPE) are essential for ensuring the safety of dental students and professionals. Dental students and interns are particularly vulnerable to NSIs due to frequent exposure to sharp instruments and limited experience [19,20]. Common causes includes, manual recapping of needles, which increases the risk of accidental pricks, improper disposal of sharps in

appropriate containers, lack of training in safe handling practices, absence of chair side assistance [21]. The preventive strategies that can be implemented includes non- recapping policy and using safety – engineered syringes. Providing infection control training for students and professionals. Offering infection control training for both students and professionals, organizing frequent workshops and safety drills[22].

Proper biomedical waste management (BWM) is essential in reducing NSI risks and maintaining a safe dental environment [23,24]. Poor waste disposal practices contribute to accidental injuries. The main key aspects in biomedical waste management includes disposal of sharps i.e. needles, burs, scalpels in puncture proof containers. Disposal of biohazard waste contaminated waste such as blood soaked materials, gloves in biohazard bags. Handling of chemical wastes such as expired anesthetics, disinfectants as hazardous waste. Proper disposal should be practiced such as disposal of sharps in puncture resistant bags and should be properly labeled[25]. Autoclaving or incineration for high risk waste. Dental institutions should implement strict waste management protocols and conduct regular training sessions to ensure adherence. Routine inspections must be carried out to monitor compliance and maintain high safety standards[26].

Personal protective equipment is the first line defense in reducing the infection risk in dental practice . However, research indicates that many students misinterpret its purpose, with some assuming that wearing gloves alone is sufficient to prevent NSIs. Role of personal protective equipment(PPE) is vitally important for safe dental practice. Gloves help reduce contamination but do not provide complete protection against needlestick injuries (NSIs)[27,19]. Face masks and shields serve as barriers against blood and fluid splashes, while protective eyewear safeguards against aerosol and debris exposure. Additionally, gowns and aprons minimize direct contact with infectious materials, enhancing overall safety in clinical settings[28]. Adhering to best practices for personal protective equipment (PPE) is essential in maintaining infection control. Proper donning and removal techniques help prevent contamination, while regularly replacing gloves and masks ensures continued protection. In high-risk procedures, using double gloves adds an extra layer of safety. Additionally, strict compliance with OSHA and CDC guidelines is crucial for maintaining a safe clinical environment[29,30].

The study indicates strong awareness of biomedical waste rules (100%) and needle stick injury risks (97.5%) among dental interns. However, misconceptions persist, such as 14.3% incorrectly identifying the purpose of PPE and 38.7% making errors in sharp waste disposal. While most respondents (88.2%) recognized the terms "Donning" and "Doffing," knowledge of the correct donning (82.4%) and doffing (61.3%) sequences was lower, highlighting a need for better training. Additionally, 58.8% knew to wash wounds with soap and water after a needle stick injury, but 33.6% chose alcohol, indicating a training gap. Barriers to proper protocol adherence included a lack of training (53.8%) and stress (30.3%).

Overall, while the awareness of key safety protocols is high, significant gaps in knowledge and misconceptions remain, emphasizing the need for targeted educational efforts to improve adherence and minimize risks.

## **VII. Conclusion**

In conclusion, the findings from the study highlight a generally strong level of awareness and knowledge in key areas related to healthcare safety, but also reveal several gaps that require further attention. Participants demonstrated high awareness of biomedical waste management and needle stick injury risks, with 100% awareness of biomedical waste rules and 97.5% understanding of needle stick injuries. However, misconceptions were noted in areas such as the primary purposes of PPE, the proper disposal of sharp waste, and the correct first aid steps for needle stick injuries, suggesting that while foundational knowledge is strong, there is a need for more specific training and clarification.

The study also revealed significant variation in knowledge, particularly regarding the correct sequence for donning and doffing PPE, as well as understanding the proper response to needle stick injuries, such as wound care and the timing for post-exposure prophylaxis (PEP). The barriers to effective implementation of safety protocols were multifaceted, with inadequate training being the most frequently cited issue, followed by stress and equipment shortages.

Overall, the results emphasize the need for targeted educational interventions to address misconceptions and reinforce proper practices in biomedical waste management, PPE usage, and needle stick injury response. By improving training and resources, healthcare workers can be better equipped to adhere to safety protocols, reducing risks and enhancing overall workplace safety.

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