

Knowledge, Awareness and Compliance of Personal Protective Equipment and Measures among Undergraduate Dental Students of South India

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Abstract

Dental health care workers as well as patients need to be protected from cross contamination during routine dental procedures by means of infection control measures. As dental students are at an increased risk of exposure to microorganisms it is important to assess the knowledge and awareness of personal protective measures and reinforce the practices of various personal protective measures among them. The objective of the study was to determine the level of knowledge, awareness, and compliance of undergraduate dental students towards personal protective equipment/measures, undergoing the clinical phase of training in South India's dental colleges. A cross-sectional study was conducted to obtain information regarding knowledge, awareness, and compliance with personal protective equipment's and measures. The sample (n = 210) consisted of undergraduate dental students (3rd, 4th and 5th year) of various colleges of South India. The data was collected after validation of the survey and analysed using One-way ANOVA followed by post hoc Tukey test. Knowledge about personal protective equipment and measures was significantly higher among the 5th year (p=0.003) dental undergraduate students compared to the 3rd year students. Awareness about post exposure prophylaxis was higher among the 5th (p<0.001) and 4th (p<0.001) year students compared to the 3rd year students. Compliance of personal protective equipment and measures was higher among the 5th year students ; however, willingness to treat HIV infected patients was higher among 3rd (p<0.001) and 4th year students (p<0.001) than 5th year students. The 5th year undergraduate dental students demonstrated good adherence to personal protective equipment and measures compared to the 3rd and 4th year students ; however the 5th year students were less willing to treat HIV infected patients. New protocols to be framed to tackle novel infections and with adequate training of the same to be incorporated to the dental undergraduate students.

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Introduction

Infection control and prevention of cross-contamination are crucial to protect

both patients and health-care workers and more so in dental practice due to the nature of routine procedures. New infections emerge and spread before the medical fraternity can even understand the modes of transmission, clinical course, and precautions that are to be taken while treating patients. On January 8, 2020, a novel coronavirus was officially announced

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as the causative pathogen of COVID-19 by the Chinese Centre for Disease Control and Prevention. Within weeks, it turned into a pandemic that forced the world into a lockdown. Due to the characteristics of dental settings, the risk of cross-infection is high between dental practitioners and patients^{1,2}.

In a dental set-up, cross-contamination and infection transmission may occur through direct salivary contact, or blood, airborne droplets containing infective agents generated from air router, or indirect contact via contaminated objects during procedures such as cavity preparation, root canal treatment etc^{3,4}. With the upsurge of COVID-19 dental bio-aerosols have posed a unique challenge. Bio-aerosols are aerosols consisting of particles of any kind of organism. Aerosols can be inhaled into the lungs reaching the alveoli or contact the skin or mucous membranes. Most dental aerosols have a diameter of 5 μ or less⁵ and are a significant threat in the transmission of coronavirus while performing a dental procedure on an infected patient.

The Centre for Disease Control and Prevention, USA, had introduced strategies to be used for the prevention of cross-contamination and infection control. 'Standard Precautions' have now been adopted worldwide and are updated time-to-time.^{6,7} Even though Standard Precautions have been adopted extensively, the gaps in the implementation still exist⁸.

Once introduced to the clinical phase, dental students are at risk of exposure to pathogens, and also probable source of infection spread among them. It is, therefore, essential to instil a proper knowledge and attitude towards standard precautions. It is also pertinent to check for compliance with the guidelines to any passivity towards the same⁹. Moreover, this should begin right from the pre-clinical phase¹⁰ with a need by dental schools to work towards providing an excellent patient centric environment¹¹.

At this critical juncture, it becomes pertinent to question how prepared our future dental health task force is to carry out safe dentistry in the wake of novel infectious diseases, taking us back to our basics of personal protective measures or equipment, knowledge, awareness and compliance. Even though there are several studies conducted to assess the knowledge, attitude, and compliance of dental students towards personal protective measures^{9,10,12}, there is a need to conduct a survey repeatedly to gauge where we stand as any such survey would become obsolete in a very short period. Such surveys would also keep a check on our readiness to face any pandemic emergency that may require additional measures such as recent COVID 19.

The objective of the study was to determine the level of knowledge, awareness, and compliance of undergraduate dental students towards personal protective equipment/measures(PPE/M), undergoing the clinical phase of training in South India's dental colleges.

Materials and methods

A cross-sectional study was conducted among undergraduate dental students(years 3, 4, and 5)(n=210) of various South Indian colleges. Simple random sampling using the lottery method was done to select the dental colleges from the southern part of India. The dental undergraduate students of the clinical phase were included in the study. A questionnaire was constructed to acquire data related to the students' knowledge, attitude, and compliance towards personal protective measures. This questionnaire was validated by two experts after minor corrections, using a pilot study performed on a random sample of students(n=20). The validated questionnaire consisted of closed and open-ended questions. The responses(Table 1) were kept anonymous, and the identity of

either participant or institute was not collected.

		N	%
What year are you currently studying in?	3	71	33.8%
	4	70	33.3%
	5	70	32.9%
18. Do you know what is Personal Protective Equipment/Measures (PPE/PPM)?	Yes	195	92.9%
	No	15	7.1%
19. Where did you hear/learn about PPM/PPE from?	Formal education	210	100.0%
	Reading material	0	0.0%
	Friends	0	0.0%
	Family	0	0.0%
	Social Media	0	0.0%
20. Do you think PPM/PPE is important?	Yes	195	92.9%
	No	15	7.1%
	May be	0	0.0%
21. Do you know there are regulations associated with PPE/PPM?	Yes	195	92.9%
	No	15	7.1%
22. Do you/Does your institution implement PPM/PPE during dental clinics?	Yes	195	92.9%
	No	0	0.0%
	Not aware	15	7.1%
23. Personal Protective Equipments used in dentistry is required to be CE marked	Yes	31	14.8%
	No	179	85.2%
	Not sure	0	0.0%
24.1. How often do you[wear a headcap when in dental clinics]	Always	196	93.3%
	Sometimes	0	0.0%
	Never	14	6.7%
24.2. How often do you[use protective eyewear during dental procedures]	Always	191	91.0%
	Sometimes	0	0.0%
	Never	19	9.0%
24.3.How often do you[wear a face mask when treating patients]	Always	210	100.0%
	Sometimes	0	0.0%
	Never	0	0.0%
24.4.How often do you[change your mask between patients]	Always	158	75.2%
	Sometimes	45	21.4%
	Never	7	3.3%
25. which protective eyewear do you prefer to use?	Visor	0	0.0%
	Goggles	187	89.0%
	None	23	11.0%
26.1. Choose true/false(protective eyewear can be worn over spectacles)	True	210	100.0%
	False	0	0.0%
26.2.Choose true/false(a used face mask can be touched using bare hands)	True	181	86.2%
	False	29	13.8%
27.1 HIV can be transmitted from patient to dentist through a single needle stick injury	True	210	100.0%
	False	0	0.0%
27.2. all dental instruments need to be sterilized after each patient	True	210	100.0%
	False	0	0.0%
27.3. dental chair needs to be regularly disinfected	True	210	100.0%
28. Are you aware of post exposure prophylaxis	False	0	0.0%
	Yes	178	84.8%
	No	32	15.2%
29. are you comfortable with treating infectious patients such as those with HIV with PPE?	Least willing	9	4.3%
	2	40	19.0%
	3	78	37.1%
	4	44	21.0%
	Willing	39	18.6%
30. Do you wear your lab coat when in clinics	Always	210	100.0%
	Sometimes	0	0.0%
	Never	0	0.0%
31.1.Please answer the following [Do you wear gloves when treating patients]	Always	210	100.0%
	Sometimes	0	0.0%
	Never	0	0.0%
31.2.Please answer the following [The nurses/dental assistants wear gloves when handling patients]	Always	145	69.0%
	Sometimes	63	30.0%
	Never	2	1.0%

32. Rate the importance of a proper fitting sized glove	Least important	1	0.5%
	3	2	1.0%
	4	14	6.7%
	Highly important	193	91.9%
33.1. Choose true/false for the following statements on gloves [Medical gloves consists of 2 types; examination gloves and surgical gloves]	True	205	97.6%
	False	5	2.4%
33.2. Choose true/false for the following statements on gloves [Powdered latex gloves are associated with causing allergic reactions]	True	209	99.5%
	False	1	0.5%
33.3. Choose true/false for the following statements on gloves [Nitril/Neoprene (non-latex) made gloves are preferred over latex gloves]	True	182	86.7%
	False	28	13.3%
33.4. Choose true/false for the following statements on gloves [Double gloving can reduce the danger of infection from glove failure or penetration of the gloves by sharp objects during medical procedures.]	True	194	92.4%
	False	16	7.6%
34. How often do you [Change gloves between patients]	Always	206	98.1%
	Sometimes	4	1.9%
	Never	0	0.0%
35.1. Do you [Generally wash your hands using the proper technique]	Always	121	57.6%
	Sometimes	83	39.5%
	Never	6	2.9%
35.2. Do you [Wash your hands using the proper technique after every glove change]	Always	125	59.5%
	Sometimes	73	34.8%
	Never	12	5.7%
35.3. Do you [Remove your watch, bracelets, rings and other hand accessories before treating patients]	Always	179	85.2%
	Sometimes	30	14.3%
	Never	1	0.5%

Table 1. Knowledge, awareness and compliance about PPE/M among undergraduate dental students of south India.

All the analysis was performed using SPSS version 20. A p-value of <0.05 was considered statistically significant. The data was expressed in terms of mean ± SD. The means values of knowledge, awareness, and compliance of years three, four, and five were analyzed using One-way ANOVA followed by post hoc Tukey test.

Results

Knowledge about PPE/M (Fig 1)

The knowledge about PPE/M in terms of its understanding (p=0.003), importance (p=0.003) and regulations (p=0.003) associated with it was significantly higher among the 5th year dental undergraduate students compared to the 3rd year students (Fig 1).

Knowledge about touching a used face mask with bare hands was significantly higher among the 5th year dental undergraduate students in comparison with the 3rd (p<0.001) and 4th year students (p<0.007). The acceptance of the fact that an ill-fitting glove influence dental procedures

was significantly higher ($p=0.003$) among year 5 students compared to year 3 students. The fact about double gloving decreasing the danger of infection from glove failure/penetration of the gloves by sharp objects during medical procedures was significantly higher ($p=0.011$) among the 4th year students compared to the 3rd year students.

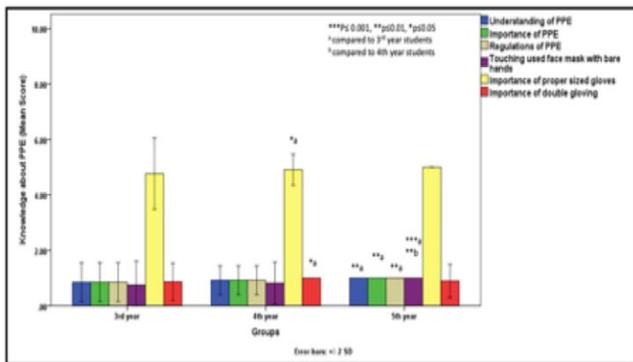


Figure 1. Knowledge about PPE/M among undergraduate dental students of South India.

Awareness about PPE/M(Fig 2)

The awareness on post exposure prophylaxis was significantly higher among the 4th($p<0.001$) and 5th ($p<0.001$) year students in comparison with the 3rd year students (Fig 2).

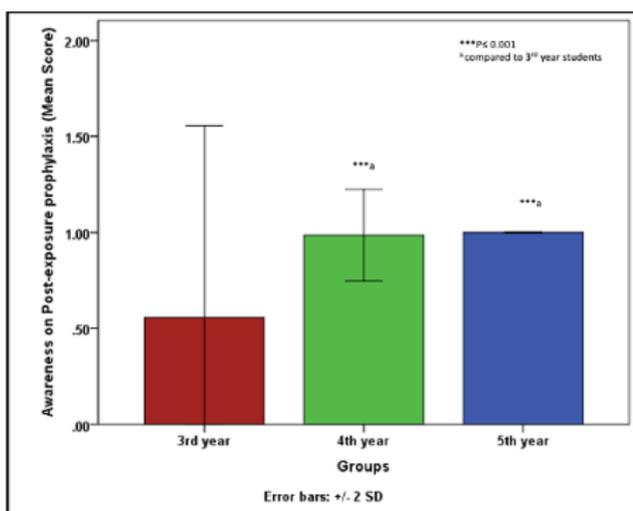


Figure 2. Awareness about PPE/M among undergraduate dental students of South India.

Compliance of PPE/M(Fig 3)

There was significantly higher compliance in terms of wearing the head cap while working in the clinic among the 5th year students($p=0.002$) compared to the 3rd year students. In addition, significantly higher compliance with regards to wearing protective eyewear during dental procedures was observed among 5th year students compared to the 3rd ($p=0.003$)and 4th year($p=0.045$) students (Fig 3). The 5th year students were significantly more compliant in terms of change of masks between patients compared to the 3rd($p=<0.001$) and 4th year ($p=<0.001$)students. Willingness in treating HIV infected patients and washing hands using the proper technique was significantly higher among the 3rd ($p<0.001$)and 4th ($p<0.001$) year students compared to the 5th year students.

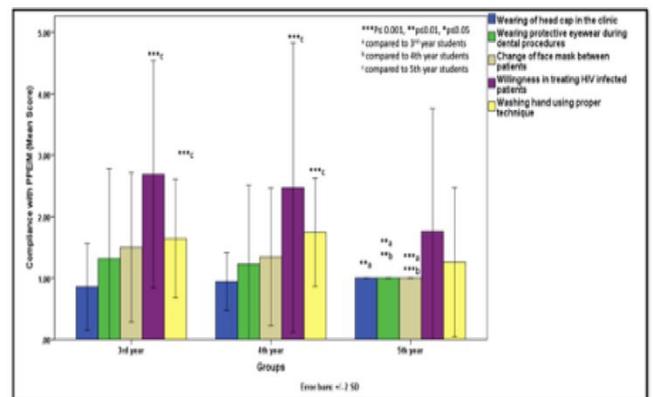


Figure 3. Compliance of PPE/M among undergraduate dental students of South India.

Discussion

Occupational safety and health administration mandates that dental health care workers wear gloves, surgical masks, protective eyewear, and protective clothing in specified circumstances to reduce the risk of exposures to blood-borne pathogens¹³. In the present study, we found that knowledge about PPE/M in terms of its understanding ($p=0.003$), importance ($p=0.003$), and regulations ($p=0.003$) associated with it was significantly higher among the 5th year

dental undergraduate students compared to the 3rd students (Figure 1). Our findings are different from the findings of both Alharbi et al. and Singh et al., where both studies reported that 3rd year students have better knowledge when compared to 4th and 5th year^{10,14}. Another study, however, had results similar to the present study with 5th year students having better knowledge compared to the 4th year students¹⁵. The differences in the relative knowledge between different years could be due to differential emphasis on the knowledge and application of infection control procedures in a particular academic year in any dental college. Another reason could be that once students are given theoretical knowledge about PPE in 3rd, and if not reinforced, they may tend to forget by the time they are in the 5th¹⁴.

Face masks are single-use items that are worn to protect the operator from aerosol inhalation and splash and should be worn for all procedures¹⁶. The mask must be worn correctly at all times following the manufacturer's instructions. The mask becomes ineffective after a short while due to the water vapor in the breath, and the outside surface of the mask should never be touched during operative procedures¹⁷. In our study, we found that knowledge about touching a used face mask with bare hands was significantly higher among the 5th year dental undergraduate students in comparison with the 3rd ($p < 0.001$) and 4th year students ($p < 0.007$) (Figure 1). Even though many studies have reported survey results about using masks regularly during treatment and removing masks when not with a patient^{9,10,14,15,18}, we could not find any study specifically exploring the knowledge about touching the used face mask with bare hands. The reason for this could be because this aspect is not stressed upon much theoretically in the 3rd and 4th year however, as the students spend more and more time in the clinic, they acquire this knowledge through practice and observation.

Wearing the right-sized glove is essential not just for the delivery of proper treatment but also for infection control. The rate of perforation could increase up to 100% with the use of ill-fitting gloves¹⁹. In the present study, we found that the acknowledgment of problems posed by ill-fitting gloves during dental procedures was significantly higher ($p = 0.003$) among year five students compared to year three students (Figure 1). This could again be due to more clinical experience among 5th year students than in the 4th and 3rd years. Previous studies have explored various aspects of gloves and hand hygiene^{9,10,14,15,18}, but we could not find any study discussing infection control in dentistry in the context of glove size.

The knowledge that double gloving decreases the danger of infection from glove failure/penetration of inner gloves²⁰ by sharp objects during medical procedures was significantly higher ($p = 0.011$) among the 4th year students compared to the 3rd students. The difference was not statistically significant between the 4th and 5th years (Figure 1). This could again be because even though double gloving is spoken about theoretically, it is rarely practiced during routine dental procedures, which is more during the fifth year.

Post-exposure prophylaxis plays a vital role in the prevention of blood-borne diseases after occupational exposures. The awareness of post-exposure prophylaxis was significantly higher among the 4th ($p < 0.001$) and 5th ($p < 0.001$) year students in comparison with the 3rd year students (Figure 2). Garcia et al²¹ and Okoh et al²² found that the majority of their study participants lacked awareness of post-exposure prophylaxis. This could be because the focus during training is more on prevention, and any student may rarely encounter a situation where they need post-exposure. A 5th year student is more likely to have come across this situation than a third-year student.

Gammon et al., in their review on compliance of health-care practitioners to infection control precautions, found suboptimal compliance. They observed that compliance improves after the intervention. However, they did not find enough evidence on how long any intervention keeps the health-care practitioners compliant⁸. Head cap is an essential component of PPE in especially in dentistry owing to airborne infection through aerosol. There was significantly higher compliance in terms of wearing the head cap while working in the clinic among the 5th year students ($p=0.002$) compared to the 3rd year students (Figure 3). This could be due to repeated reinforcement of infection control protocol among fifth-year students. Kanaparthi et al. found very little compliance to use of head cap among dental students more so among females²³.

It has been reported in some studies that eye infections were common among dentists^{24,25}. However, these studies suggested low compliance with wearing protective glasses. We found significantly higher compliance with regards to wearing protective eyewear during dental procedures among 5th year students compared to the 3rd ($p=0.003$) and 4th year ($p=0.045$) students (Figure 3). With an increase in the exposure to the clinical setting, one experiences a cumulative number of minor ocular accidents resulting in reinforcement through experience and hence higher compliance. Final year students are generally more aware of the clinical correlations and aspects compared to the third and fourth year students.

The 5th year students were significantly more compliant in terms of change of masks between patients compared to the 3rd ($p<0.001$) and 4th year ($p<0.001$) students (Figure 3). In developing countries, affordability, unavailability, limited resources, and a shortage of equipment could be a reason for low compliance with PPE guideline²⁶. However, Porter et al. from their study concluded that compliance with cross-infection control measures are poor in

dentistry, even when clinicians are provided with appropriate facilities²⁷. In any case, the present study suggests that reinforcement can improve the compliance to change of mask as it is more among the 5th year than the 3rd and 4th years.

The risk of occupational transmission of the virus from a patient to a health-care provider has been estimated at 0.3% after a single percutaneous exposure to HIV-infected blood²⁸. Dentists have an ethical responsibility to provide treatment to HIV-infected patients, mainly because oral lesions are common among them. In the present study, we found that willingness in treating HIV infected patients and washing hands using the proper technique was significantly higher among the 3rd ($p<0.001$) and 4th ($p<0.001$) year students compared to the 5th year students (Figure 3). As the students enter the final year of their undergraduate course, they acquire more practical knowledge with the existing theoretical background about the precautions to be taken while treating HIV infected patients; hence their willingness to treat HIV patients may reduce. However, theoretical knowledge is predominating year three and four students²⁹.

The majority of the students (92.9%) knew about PPE/PPM and that it is essential in dentistry. Most students (85.2%) did not know that PPE used in dentistry is required to be CE (or EC) marked. This could be since most students use the PPE supplied to them by their institution and are not involved in the purchase process. Hence they are unaware of the standardization aspect of the PPE used in dentistry. All students (100%) reported using a face mask during dental treatment (Table 1).

Most students (86.2%) were unaware that used face mask cannot be removed with bare hands (Table 1). This indicates that the fundamentals of donning and doffing may be neglected during PPE/PEM education in dentistry. Since dentists are at a high occupational risk for acquiring respiratory

and other healthcare-associated infections, particularly self-contamination when removing (“doffing”) contaminated PPE^{30,31} it is extremely important and the students be trained to execute a safe donning and doffing protocol of PPE in a dental set-up.

Additionally, we observed that the awareness and compliance of those PPMs were better which could be easily observed and monitored. For instance, it is easy to see whether a student is wearing a face mask or lab coat or protective eye wear or not, but it is difficult to observe and monitor whether a student is changing mask after every patient or whether a student is following a proper hand wash protocol or not. Repetition and reinforcement can help the students inculcate stringent infection control knowledge, awareness and compliance which is a prerequisite for their own safety and the safety of their patients. Thus, adopting health promoting behaviour is essential in maintaining and achieving good health and achieving good attitude towards patient care at the time of completing studies at the dental school^{32,33}.

Conclusions

The covid-19 pandemic pushed elective dental treatment to a standstill in many countries and posed new threats to cross-contamination and spread of health-care related infections. At this point is necessary to reflect upon the status of knowledge, awareness and compliance of the future task force of dentistry and accordingly set new training standards for PPE/PPM dental students preparing them for future. The present study revealed that the knowledge, awareness and compliance of dental students for PPE/PPM can be improved to meet the novel demands.

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Declaration of Interest

The authors report no conflict of interest.

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