

Knowledge, Attitude and Practice regarding Infection Control Measures Among Dental Students in South India: A Cross-Sectional Study

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How to cite this article: Ashfaq Ahmed M, Sumalatha S, Narendran N et. al. Knowledge, Attitude and Practice regarding Infection Control Measures Among Dental Students in South India: A Cross-Sectional Study. Indian Journal of Public Health Research and Development / Vol. 16 No. 4, October-December 2025.

Abstract

Background: Dental professionals are at high risk of exposure to infectious pathogens, primarily due to close contact with patients' oral cavities and contaminated instruments. Infection control protocols, including sterilization, are crucial in dental settings. However, previous studies have shown poor compliance among dental students regarding infection control measures. The aim of the study was to evaluate the knowledge, attitude, and practice (KAP) of dental students in South India regarding infection control measures.

Methodology: A cross-sectional study was conducted from May 2024 to October 2024 among final-year Bachelor of Dental Surgery (BDS) students, interns, and postgraduate (PG) dental residents in South India. A total of 346 students participated. A structured questionnaire with 21 questions was distributed via Google Forms, covering knowledge (10 questions) and attitude and practice (11 questions) on infection control. Data were analyzed using SPSS software, with Chi-square tests and ANOVA used to assess group differences. Pearson's correlation analyzed the relationship between KAP scores, with a significance level of $p < 0.05$.

Conclusion: Moderate knowledge levels but inconsistent attitudes and practices highlight the need for improved infection control training in dental education, focusing on both knowledge and practical application to enhance patient safety.

Keywords: Dentistry, Infection, Knowledge, Students, Sterilization.

Introduction

Dentistry is one of the professions where dental health care professionals are at increased risk of exposure to various infectious blood-borne and air-borne pathogens because of their direct contact with the patient's oral cavity and the clinical environment.

This risk is enhanced by dental injuries due to accidents caused by mishandling an instrument [1]. The patient's physical appearance does not apply to the health status as the patient might appear healthy according to clinical examination. Still, he/she might be a carrier to an infectious pathogen unknown.

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Submission date: December 3, 2024

Revision date: Jan 24, 2025

Published date: September 24, 2025

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Among the serious and commonly transmitted oral infections, Microorganisms such as Mycobacterium Tuberculosis, Influenza virus, COVID 19 and Streptococcus mutans colonize the oral cavity in the majority. A dental environment is more susceptible to cross-infection through several routes such as blood, oral fluids, indirect contact with the contaminated instrument, etc^[2]. An infection requires a chain of a host, a pathogen and a portal of entry, therefore to control the spread of disease, sufficient measures are to be taken to break this chain ^[3].

In the late 20th century, it was found that dentists were 3x more likely to be affected with hepatitis B than the general population. The Center for Disease Control (CDC) and the World Health Organization (WHO) have set a series of guidelines to be followed in a dental setup^[3]. Dental schools are responsible for adequate training of their dental students as soon as they start with their cases to ensure the safety of the patients and establish a safe environment.

Several studies are conducted across various regions of the world to assess the knowledge, attitude, and practice of dental students and have implied poor compliance with infection control practices ^[1,4]. Considering the critical importance of infection control in a dental setting, it is necessary to assess and remind dental students about infection control protocols so that they may pave the way for a healthier practice.

Therefore, the aim of the present study is to assess the knowledge, attitude, and practice of dental students towards the infection control measures.

Materials and Methodology

The cross-sectional study was conducted among the dental students of various dental colleges in the south Indian population from May 2024 to October 2024. The study was approved by the institutional ethical committee (BDSC-IEC/2024/MAY/P-28) to proceed with the study. A questionnaire was prepared and validated to gain information about the knowledge, attitude and practice towards infection

control measures. The questionnaire was uploaded in Google Forms and distributed across various dental colleges in South India. Participants were asked to click on an option of Yes/No for informed consent which was displayed on the first page before answering the questions.

The study population included BDS IV year, Interns and Postgraduate students who have varying levels of exposure to clinical practice, which allows for a more comprehensive assessment of Knowledge, attitude, and practice. The students of the first, second, and third-year undergraduates were excluded since the training about infection control is provided extensively from the final year of the dental curriculum. The participants who did not wish to participate were also excluded from the study.

The sample size was calculated using G power software V2 with a 95% confidence interval and a total of 346 dental students participated and completed the questionnaire comprising 21 questions of which the initial few questions were demographic details with no name to maintain the anonymity intact and 10 questions were knowledge-based and 11 questions were related to the attitude and practice of dental students towards infection control. The data obtained was entered into Microsoft Excel and statistically analyzed.

Statistical analysis

The data was analyzed and tabulated using the SPSS Software version 23. The consistency of the questionnaire was assessed using the Cronbach's alpha. Descriptive statistics was done to analyze the mean and standard deviation. Percentage and frequency were calculated for a quantitative variable. Pearson Chi-square test and ANOVA test were done to compare the mean score of the questions answered by the participants and analyze the difference between the groups respectively. The p-value <0.05 was considered statistically significant.

Results and Discussion

Table 1: Students' knowledge, attitudes and Practice regarding infection control measures, by number and percentage of total respondents to each item.

S.No.	Questions	Options	Response			Total	P value
			Interns	PG Residents	BDS IV Year		
1	What is the most reliable method of sterilization for dental instruments?	Autoclave	143	118	80	341 (98.5%)	0.644
		Disinfectants	2	1	2	5 (1.4%)	
2	What is the biological indicator in sterilization?	Bacillus Steothermophilus	109	102	60	271 (78.3%)	0.332
		Bacillus Subtilis	4	3	3	10 (2.8%)	
		Staphylococcus Aureus	13	4	8	25 (7.2%)	
		Streptococcus Mutans	19	10	11	40 (11.5 %)	
3	What is the chemical indicator in sterilization?	Change in color of the instrument label/ Strip.	115	104	62	281 (81.2%)	0.281
		Change in color of the instrument.	9	5	6	20 (5.7 %)	
		Corrosion of the Instrument.	21	10	14	45 (13.0%)	
4	What are autoclave strips made of?	Copper oxide	28	34	14	76 (21.9%)	0.247
		Lead carbonate	59	39	32	130 (37.5%)	
		Phenolphthalein	51	41	28	120 (34.6%)	
		Zinc	7	5	8	20 (5.7%)	
5	Which is the best chemical used to disinfect alginate impression?	0.5% of NaOcl.	47	22	21	90 (26.0%)	0.122
		5% Glutaraldehyde.	92	88	56	236 (68.2%)	
		Iodophor	6	9	5	20 (5.7%)	
6	What is the ideal temperature and time required for sterilization using autoclave?	121 C for 15 min	133	110	78	301 (86.9%)	0.092
		130 C for 3 min	5	0	0	5 (1.4%)	
		160 C for 1 hr	7	9	4	20 (5.7%)	
7	What is the acceptable number of bacteria in the water used in dental units?	500-1000 CFU per mL of heterotrophic water bacteria	28	26	16	70 (20.2%)	0.778
		less than 200 CFU per ml of heterotrophic water bacteria	24	22	9	55 (15.8%)	
		less than or equal to 250 CFU per mL of heterotrophic wate	29	25	17	71 (20.5%)	
		less than or equal to 500 CFU per mL of heterotrophic wate	64	46	40	150 (43.3%)	

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8	Which is the common micro-organism present in Dental water pipelines?	Actinomyces	28	10	7	45 (13.0%)	0.021*
		Legionella Pneumoniae	65	59	31	155 (44.7%)	
		Staphylococcus	18	22	21	61 (17.6%)	
		Streptococcus	34	28	23	85 (24.5%)	
9	Highest rate of transmission via needle stick injury?	Hepatitis B	105	83	58	246 (71.0%)	0.102
		Hepatitis C	5	2	3	10 (2.8%)	
		HIV	35	29	21	85 (24.5%)	
		Tetanus	0	5	0	5 (1.4%)	
10	How much dosage do you think is required for a hepatitis B vaccination?	1 Dose every year	2	6	2	10 (2.8%)	0.058
		2 Dose (0,6 month)	21	6	8	35 (10.1%)	
		3 Dose (0,1,6 month)	122	107	72	301 (86.9%)	
11	What type of mask do you prefer to prevent microbial transmission?	3 ply mask	26	41	19	86 (24.8%)	0.013*
		Cloth mask	5	0	0	5 (1.4%)	
		Face shield	18	11	11	40 (11.5%)	
		N95 mask	96	67	52	190 (54.9%)	
12	How often do you think eye wear is necessary for a dental practice?	Always	76	55	39	170 (49.1%)	0.574
		Sometimes	69	64	43	176 (50.8%)	
13	How often do you wash your hands during patient care?	Before and after treating the patient.	90	83	47	220 (63.5%)	0.303
		Every time you remove your gloves.	43	28	24	95 (27.4%)	
		Only after treating the patient.	12	8	11	31 (8.9%)	
14	Do you wear gloves while arranging your instruments in the tray?	No, I don't wear.	31	48	27	106 (30.6%)	0.004*
		Not necessary	12	7	1	20 (5.7%)	
		Yes, I wear gloves every time I arrange my instruments.	102	64	54	220 (63.5%)	
15	How often do you disinfect dental water pipelines?	After every patient treatment for 20-30 sec	25	17	13	55 (15.8%)	0.103
		At the beginning of the day for 1 min	48	30	28	106 (30.6%)	
		At the end of the day for 10-20 sec	55	41	29	125 (36.1%)	
		Never	17	31	12	60(17.3%)	
16	What type of water do you use for patient care?	Drinking water	38	29	18	88 (25.4%)	0.153
		Distilled water	31	29	21	81(23.4%)	
		Saline	40	17	18	75 (21.6%)	
		Tap Water	36	44	25	105 (30.3%)	

Continue.....

17	What will you do if u drop an instrument?	Pick up immediately with gloves and use it.	5	0	0	5 (1.4%)	0.057
		Pick up with Gloves, disinfect it and use it.	6	3	6	15 (4.3%)	
		Pick up without Gloves, disinfect it and use it.	21	11	8	40 (11.5%)	
		Use an alternate instrument.	113	105	68	286 (82.6%)	
18	What method of sterilization do you use in your clinic?	Chemical method	17	8	5	30(8.6%)	0.396
		Dry Heat	24	24	12	60 (17.3%)	
		Moist Heat	104	87	65	256 (73.9%)	
19	Are you vaccinated for hepatitis B?	No	34	33	28	95 (27.4%)	0.221
		Yes	111	86	54	251 (72.5%)	
20	If yes, how many doses have you taken?	Zero dose	34	33	28	95 (27.4%)	0.001**
		One dose	41	28	26	95 (27.4%)	
		Three doses	16	28	2	46 (13.2%)	
		Two doses	54	30	26	110 (31.7%)	
21	What will you do immediately after a needle stick injury?	Apply a bandage directly.	5	0	0	5 (1.4%)	0.012*
		Apply a disinfectant immediately.	17	16	12	45(13.0%)	
		Squeeze the blood out and then apply pressure.	51	29	35	115(33.2%)	
		Wash with soap water first.	72	74	35	181(52.3%)	

Table 2: Descriptive mean scores of knowledge, Attitude and practice about Infection control measure among the students.

		N	Mean	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum	F	P-Value
					Lower Bound	Upper Bound				
Knowledge	Intern	145	6.94 ± 1.5	.131	6.69	7.20	3	9	1.129	0.325
	PG Resident	119	7.19 ± 1.4	.129	6.94	7.45	3	10		
	UG Final Year	82	6.94 ± 1.3	.152	6.64	7.24	3	9		
	Total	346	7.03 ± 1.4	.079	6.87	7.18	3	10		
Attitude	Intern	145	1.90 ± 0.8	.071	1.76	2.04	0	3	6.909	0.001**
	PG Resident	119	2.20 ± 0.7	.066	2.07	2.33	0	3		
	UG Final Year	82	1.83 ± 0.7	.086	1.66	2.00	0	3		
	Total	346	1.99 ± 0.8	.043	1.90	2.07	0	3		
Practice	Intern	145	3.59 ± 1.1	.097	3.40	3.78	0	7	0.563	0.563
	PG Resident	119	3.71 ± 1.4	.137	3.44	3.99	0	7		
	UG Final Year	82	3.52 ± 1.2	.138	3.25	3.80	0	7		
	Total	346	3.62 ± 1.3	.070	3.48	3.75	0	7		

Table 3: Correlation between Knowledge, Attitude and Practice scores

Correlation		Knowledge	Attitude	Practice
Knowledge	Pearson Correlation	1	.122*	.185**
	Sig. (2-tailed)		.023	.001
	N	346	346	346
Attitude	Pearson Correlation	.122*	1	.118*
	Sig. (2-tailed)	.023		.028
	N	346	346	346
Practice	Pearson Correlation	.185**	.118*	1
	Sig. (2-tailed)	.001	.028	
	N	346	346	346
*. Correlation is significant at the 0.05 level (2-tailed).				
**. Correlation is significant at the 0.01 level (2-tailed).				

The study assessed the knowledge, attitude, and practice (KAP) related to sterilization and infection control measures among dental students, including interns, postgraduate (PG) residents, and final-year undergraduate (UG) students. The findings provide critical insights into their KAP levels.

Knowledge

The overall knowledge score among participants was moderate, with a mean score of 7.03 out of 10. PG residents had a slightly higher mean score (7.19) compared to interns (6.94) and BDS IV Year students (6.94), likely due to advanced training (Table 2). Specific knowledge gaps were identified, such as the biological indicator for sterilization, where only 78.3% correctly identified *Bacillus steothermophilus*, and the acceptable number of bacteria in dental unit water, where responses varied. Additionally, 44.7% identified the predominant organism in dental water pipelines, and 71% correctly stated Hepatitis B as transmissible via needle stick injuries (Table 1).

Most students demonstrated familiarity with basic sterilization methods, but gaps remained in specific areas. Studies by Moradi et al. (2013) [5] and Singh et al. (2011) [6] reported similar findings, highlighting deficiencies in understanding indicators. In contrast, Shamiri et al. (2019) [7] found higher knowledge scores in Saudi Arabia, likely due to differences in curricula. Addressing these gaps through targeted educational programs with practical demonstrations could improve knowledge.

Attitude:

Attitude scores were low across groups, with a mean of 1.99 out of 3. PG residents scored higher (2.20) compared to interns (1.90) and BDS IV Year students (1.83) (Table 2). Low scores regarding eyewear use (49.1%) and hand hygiene practices (63.5%) (Table 1) suggest underestimation of infection control's importance.

Higher attitude scores were observed in El-Houfey et al.'s (2016) study in Egypt, especially for PPE use and hand hygiene [8]. Similar to this study, Alshiddi (2015) in Riyadh highlighted a lack of consistent use of PPE and hand hygiene, suggesting that despite adequate knowledge, attitudes towards these practices may be influenced by factors such as perceived risk, peer behavior, and the availability of resources [9]. Enhancing attitudes requires fostering a safety culture, integrating infection control practices in training, and faculty role modeling.

Practice:

Practice scores were moderate, with a mean of 3.62 out of 7. PG residents scored highest (3.71), followed by interns (3.59) and BDS IV Year students (3.52) (Table 2). Variability was observed in wearing gloves during instrument arrangement and disinfecting dental water pipelines. Notably, 27.4% were unvaccinated for Hepatitis B, and only 13.2% had completed all three doses ($p=0.001$). Washing with soap after needle stick injuries was reported by 52.3% ($p<0.05$) (Table 1).

A positive correlation was found between knowledge and practice ($r = 0.185$, $p = 0.001$), knowledge and attitude ($r = 0.122$, $p = 0.023$), and attitude and practice ($r = 0.118$, $p = 0.028$). These findings align with Otieno et al. (2020) in Nairobi, where practice inconsistencies stemmed from inadequate monitoring^[10]. Similarly, Ghimire et al. (2018) in Nepal highlighted lapses in consistent hand hygiene and glove use^[11].

Knowledge positively influences practice, but a supportive attitude is necessary for effective implementation. El-Saaidi et al. (2021) in Egypt reported strong knowledge-practice correlations, underscoring the importance of attitude in translating knowledge into action^[12]. Ehsani et al. (2014) in Iran observed weaker correlations due to limited training^[13]. Studies by Cheng et al. (2012)^[14] and De Souza et al. (2006)^[15] found that majority of dental students followed basic infection control measures, including wearing gloves, masks, and eye protection during dental procedures. While some infection control protocols, such as the proper handling of contaminated instruments and surfaces, were not uniformly understood or practiced by students.

The positive correlations between knowledge, attitude, and practice highlight the importance of a comprehensive approach to infection control education. Enhancing knowledge, fostering positive attitudes, and ensuring consistent practices through audits and feedback can help standardize infection control measures. The study also highlights the need for continuous professional development, even beyond formal education, to ensure that dental professionals maintain high standards of infection control throughout their careers.

Limitations

The limitations of the study must be acknowledged. The sample size did not represent the entire student population limiting the generalizability of the study. Reliance on the data obtained from surveys might restrict the in-depth understanding of the students' clinical practices.

Implications for Future Research:

Future research could focus on identifying the barriers to the consistent application of infection

control practices and exploring the role of continuous professional development and peer influence in shaping attitudes and behaviors. Additionally, longitudinal studies could provide insights into how KAP evolves with experience and how targeted interventions during dental education could lead to sustained improvements in practice.

Conclusion

The comparisons with other studies suggest that while the findings of this study are in line with global trends, there are specific areas where improvement is needed, particularly in fostering a more positive attitude towards infection control and ensuring consistent practice. The moderate correlations between KAP components underline the importance of a comprehensive approach that not only educates but also motivates and supports dental students in adhering to high standards of infection control.

These findings highlight the critical need for educational institutions to not only impart knowledge but also to cultivate a culture of safety and responsibility among dental students. By doing so, we can ensure that future dental professionals are well-equipped to protect themselves and their patients from infection risks, ultimately leading to better clinical outcomes and enhanced public health.

Conflict of interest: Nil

Source of Funding: The Authors received no source of funding.

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