ORIGINAL ARTICLE

Knowledge and practices of cross-infection control among clinical undergraduate students and house officers - A cross sectional survey at prosthodontic departments of dental institutes in Lahore.

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ABSTRACT

Background and Objective: Effective infection prevention is an essential component of safe dental practice, particularly in prosthodontics, where instruments, impressions, and laboratory materials may serve as potential sources of cross-contamination. This study assessed the knowledge and practices related to cross-infection control among undergraduate dental students and house officers working in Prosthodontics Departments of dental institutions in Lahore.

Methods: A questionnaire-based cross-sectional survey was conducted among 384 participants comprising third- and fourth-year BDS students and recent dental graduates from public and private dental institutions in Lahore. Data were collected through a 14-item, closed-ended questionnaire developed by the investigators and administered electronically using Google Forms. Data analysis was performed using SPSS version 24.

Results: Nearly half of the participants (49.8%) reported receiving no formal workshop on cross-infection control, while 51.4% indicated the availability of infection-control protocols in their clinics. Knowledge and implementation of infection-control measures differed significantly between public and private institutions. Autoclaving was the most frequently reported method for decontaminating metal trays (81.6%), Fox's plane (45.0%), facebows (44.7%), stone burs (58.9%), acrylic trimmers (57.9%), and wax knives/spatulas (40.9%). Chemical disinfection was preferred for plastic trays (57.7%) and shade guides (54.1%), whereas 51.7% of respondents reported cleaning rubber bowls by rinsing with water. Regular disinfection of dental impressions was reported by 82% of participants, with glutaraldehyde being the most commonly used disinfectant. Lack of awareness (26.0%), insufficient time (24.0%), and limited resources (18.1%) were the leading barriers to appropriate infection-control practices.

Conclusion: Knowledge and application of cross-infection control measures varied among participants and between public and private dental institutions. Gaps in formal training and adherence to recommended decontamination practices indicate a need for structured infection-control education, regular practical workshops, and refresher training, particularly within public-sector dental institutions.

Keywords: Cross-infection, disinfection, patient safety, prosthodontics, house officers, undergraduates.

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Introduction

Cross-infection control is an indispensable aspect of modern prosthodontics, as it plays a pivotal role in safeguarding the health and well-being of both patients and healthcare professionals.[1] Prosthodontics, a specialized field of dentistry focused on the restoration and replacement of missing teeth, involves a variety of invasive procedures, making it essential to implement rigorous infection control measures.[2,3]

Prosthodontic practice involves the frequent use of a wide range of instruments and accessories, including rubber bowls, shade guides, facebows, Fox planes, acrylic trimming burs, wax knives, spatulas, and metal and plastic impression trays.

Some of the armamentaria are not autoclavable and can only be disinfected. There is active involvement of the dental laboratory and its staff as well. Prosthodontic clinics require

a high degree of concern regarding cross-contamination between the clinic and the laboratory.[3]

In the developed world, many countries maintain acceptable dental infection control and safety standards, which are imposed by higher levels of practice standards formulated by regulatory bodies to enhance the level of safety. In the 1970s and 1980s, particularly in the United States, representatives of the developed world confronted difficulties in implementing these protocols.[4]

Dental colleges/universities are responsible for training their students on infection control protocols. Aristotle said, "Good habits formed in youth make all the difference." In shaping the correct practice of cross-infection control protocols, thorough knowledge and the implementation of these protocols in the early years of clinical training are required. A study in the UK states that more knowledgeable dentists not only tend to hold favorable opinions about the guidelines but also practice them. Moreover, younger dentists were more aware of the cross-infection control measures.[5]

The consequences of inadequate cross-infection control in prosthodontics can be far-reaching, leading to patient-to-patient transmission, occupational health hazards, and the potential spread of drug-resistant pathogens. Patients with compromised immune systems, the elderly, and individuals with systemic health conditions are particularly susceptible to the adverse effects of cross infections. [1,3,5,6]

Previous studies from Pakistan have largely focused on infection-control practices in general dentistry or have been limited to individual dental institutions. Consequently, multi-institutional evidence regarding cross-infection control practices specific to prosthodontic clinics remains scarce. Considering the frequent handling of reusable instruments, impressions, and prosthodontic materials, assessment of current practices is important to identify potential gaps in infection control. Therefore, this study aimed to evaluate the knowledge and practices related to cross-infection control among clinical undergraduate students and recent dental graduates working in Prosthodontics Departments across different dental institutions in Lahore.

Methods

This cross-sectional study was conducted from January 1, 2022, to March 13, 2023, among third- and final-year BDS students and house officers working in the Prosthodontics Departments of one public and two private dental colleges in Lahore. Participants were recruited through convenience sampling. The calculated sample size was 384, based on an expected prevalence of 47%, 95% confidence level and 5% margin of error.[7,8]

A pilot survey was undertaken to assess the reliability of the questionnaire. Internal consistency, determined using Cronbach's alpha, was 0.76, indicating acceptable reliability. The final questionnaire consisted of 14 closed-ended items organized into four sections covering participants' demographic characteristics, baseline knowledge of cross-infection control, infection-control practices, and self-evaluation of adherence to infection-control measures.

The questionnaire was uploaded to Google Forms. Class Representatives of clinical undergraduate years and House Officers were approached, and the Google link for the forms was shared with them via WhatsApp, which they later shared with the Principal Author under al applicable confidentiality procedures.

Statistical analysis

SPSS version 24.0 for Windows was used to analyze the data statistically (SPSS Inc, Chicago, USA). The quantitative and categorical variables were presented using descriptive statistics (mean, standard deviation, and percentages). The categorical variables were compared using the Chi-square test. A p-value of less than or equal to 0.05 was considered significant.

Results

In the present study, a total of 418 participants responded. The response rate was 94%. The demographics are presented in Table 1. The majority of the respondents were females and belonged to private dental institutes.

Information about the lectures and workshops on cross-infection control and the presence of cross-infection control in the clinics has been illustrated in Figure 1. The majority of the respondents (70.8%) received lectures on cross-infection. Almost one-half of the respondents (49.8%) did not receive demonstrations or workshops on cross-infection control. Furthermore, 51.4% respondents reported the application of partial or complete cross-infection control protocols in clinics (Figure 1).

The preferred methods for cleaning and maintaining cross-infection control for different instruments and equipment used in prosthodontic departments have been presented in Table-2. Autoclave was the most preferred method for

Table 1. *Demographic information of the respondents*

Demographics		n	%
Gender	Male	96	23.0
	Female	322	77.0
Year of study	Third year	191	45.7
	Final year	191	45.7
	House officers	36	8.6
Institute	Private	321	76.8
	Public	97	23.2

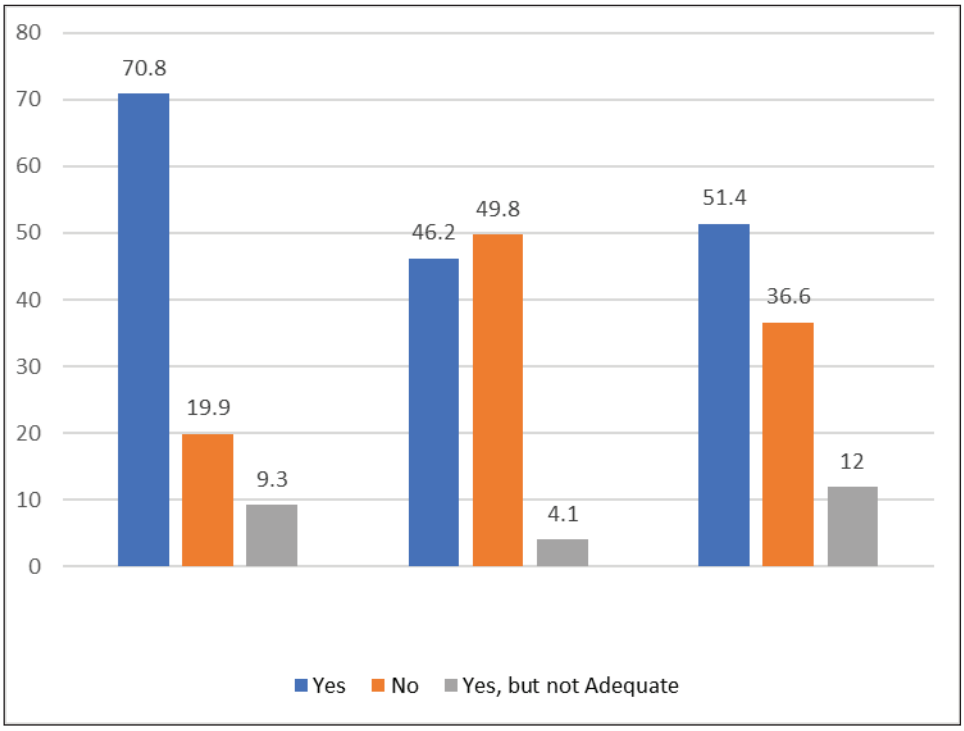


Figure 1. *Cross-infection control lectures, demonstrations/workshops, and presence of cross-infection protocols in the clinics of the prosthodontic department*

Table 2. *Preferred methods for cleaning different equipment and instruments used in the prosthodontic departments*

Equipment	Preferred method for cleaning n(%)			
	Autoclave	Chemical disinfection	Rinse with water	After every patient
Metal trays	341(81.6)	55(13.1)	0(0)	22(5.3)
Plastic trays	48(11.5)	241(57.7)	0(0)	129(30.8)
Rubber bowl	25(6)	172(41.1)	216(51.7)	5(1.2)
Shade guide	51(12.2)	226(54.1)	85(20.3)	56(13.4)
Face bow	187(44.7)	148(35.4)	52(12.4)	31(7.5)
Fox's plane	188(45)	152(36.4)	47(11.2)	31(7.4)
Stone burs	246(58.9)	119(28.5)	35(8.4)	18(4.2)
Acrylic trimmers	242(57.9)	114(27.2)	50(12)	12(2.9)
Wax knife/Spatula	171(40.9)	138(33)	99(23.7)	10(2.4)

cleaning metal trays (*n* = 341, 81.6%), Fox's plane (*n* = 188, 45%), face-bow (*n* = 187, 44.7%), stone burs (*n* = 246, 58.9%), acrylic trimmers (*n* = 242, 57.9%), and wax knife/spatula (*n* = 171, 40.9%). For plastic trays (*n* = 241, 57.7%) and shade guides (*n* = 226, 54.1%), chemical disinfection was found to be the most preferred method; however, around one-third (*n* = 129, 30.9%) chose to use a new plastic tray after every patient. In case of rubber bowls (*n* = 216, 51.7%), rinsing with water was the most preferred method for cleaning (Table 2).

Most respondents (*n* = 343, 82%) regularly disinfected the dental impression of patients before sending it to the laboratory. However, 12% (*n* = 50) never disinfected (Figure 2).

The preferred methods for disinfection of different impression materials have been expressed in Table 3. Glutaraldehyde was the most favored method of disinfection for all impression materials, followed by chlorine compounds and iodophors. The least preferred method was rinsing with water.

As shown in Table 4, there was a significant difference between private and public dental institutes in terms of self-reported knowledge and implementation of cross-infection

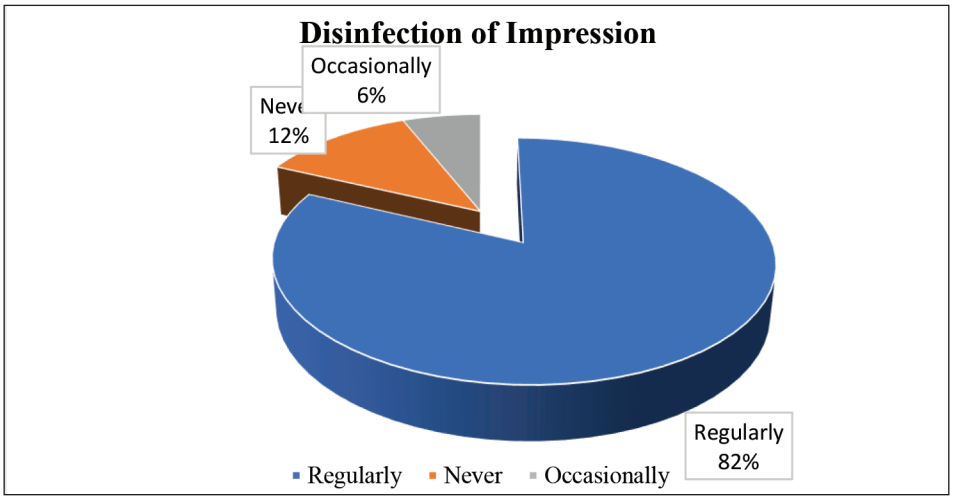


Figure 2. *Frequency of disinfection of impressions*

Table 3. *Frequency and preference of disinfection methods for different impression materials*

Impression material	Disinfection Method n(%)			
	Glutaraldehyde	Chlorine compound	Iodophors	Rinse with water
Alginate	283(67.7)	73(17.4)	38(9.2)	24(5.7)
Impression compound	203(48.6)	135(32.3)	46(11.1)	33(7.9)
Addition silicone	199(47.6)	124(29.6)	71(17.1)	24(5.7)
Zinc oxide eaugenol	219(52.4)	112(26.9)	50(12)	36(8.7)

Table 4. *Comparison of knowledge and satisfaction between private and public dental institutes*

	n(%)	Private n(%)	Public n(%)	X^2	p
Knowledge					
Very poor	38(9.1)	19(5.9)	19(19.6)	20.65	<0.001*
Poor	60(14.4)	42(13.1)	18(18.6)		
Fair	210(50.2)	170(53.0)	40(41.2)		
Good	97(23.2)	80(24.9)	17(17.5)		
Very good	13(3.1)	10(3.1)	3(3.1)		
Implementation					
Very poor	28(6.7)	13(4.0)	15(15.5)	27.12	<0.001*
Poor	54(12.9)	33(10.3)	21(21.6)		
Fair	203(48.6)	164(51.1)	39(40.2)		
Good	117(28.0)	98(30.5)	19(19.6)		
Very good	16(3.8)	13(4.0)	3(3.1)		

control and cleansing methods for various equipment and materials. The respondents from private dental institutes reported a more positive perception, and their self-reported knowledge and implementation were significantly better than those from public dental institute (Table 4).

Most respondents showed a positive perception and were "satisfied" with their knowledge and performance regarding cross-infection and cleaning different equipment and materials used in prosthetics. However, at the same time, a significant proportion showed dissatisfaction with their knowledge and performance (Figure 3).

When asked about different constraints faced during cross-infection and cleaning of dental equipment and materials, lack of awareness (n=109, 26%), time constraints due to

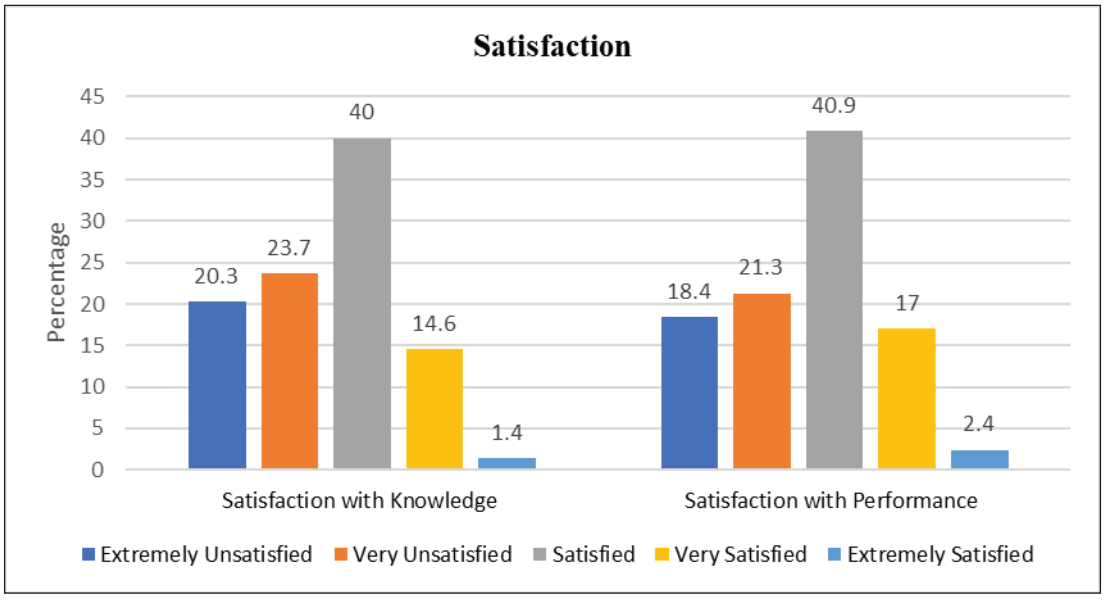


Figure 3. *Self-reported satisfaction with knowledge and performance*

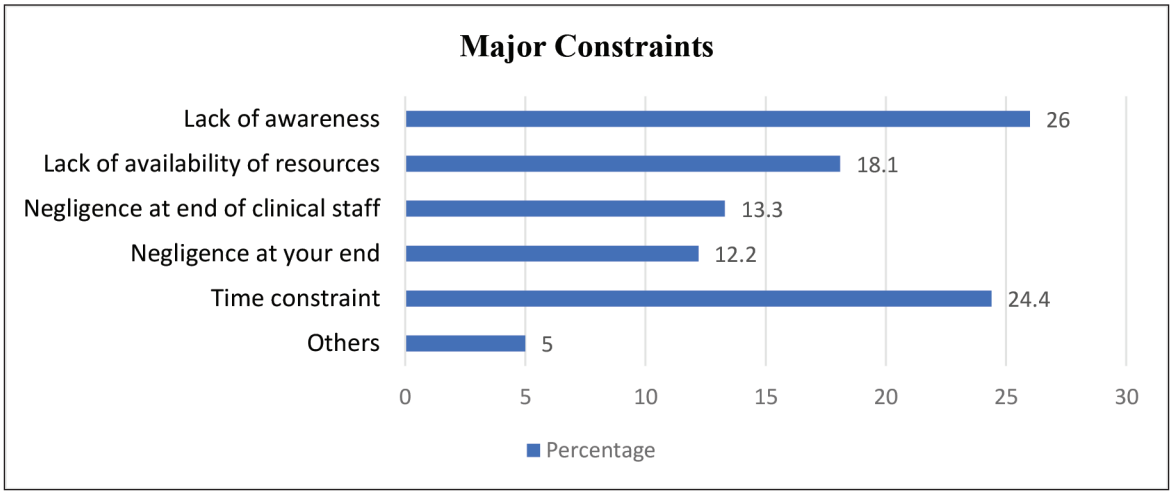


Figure 4. *Major constraints faced by the respondents regarding cross-infection control*

higher patient turnover (n=100, 24%), and lack of availability of resources (n=76, 18.1%) were the most reported factors. The other constraints are shown in Figure 4.

Discussion

Cross-infection control holds paramount importance, especially when it comes to the prosthodontic department. The use of complex instruments, repeated impressions, multiple visits, and longer appointments put patients, as well as the operator, at risk of cross-infection.[2]

Previous literature has shown a considerable improvement in compliance with cross-infection control among healthcare personnel who frequently attended workshops or refresher courses on cross-infection control. The significance of these refresher courses has been supported by studies done by Hassan et al. and Sana et al., which reported a drop in cross-infection control practices among healthcare providers who did not attend cross-infection control workshops regularly.[9,10,11] In this study, most participants got lectures on cross-infection control as part of their course. However, only one-half of the participants received demonstrations and workshops on cross-infection control. Practical demonstrations and regular workshops play a key role in integrating cross-infection control knowledge in clinics.

The Centers for Disease Control categorized reusable dental equipment as critical, semi-critical, or non-critical. Critical instruments pierce bone or soft tissue (*i.e.*, scalpels, scalers, and burs). Non-critical make contact with but do not

penetrate oral tissue (*i.e.*, dental mouth mirrors and dental impression trays). Non-critical instruments make contact with skin only. Instruments that are critical or semi-critical must be sterilized using an autoclave or chemicals that have been approved by the US Food and Drug Administration. Non-critical instruments are not mandatory to be sterilized and can instead be cleaned using a surface disinfectant.[12,13] In the present study, the majority of the respondents had adequate knowledge about cleaning various instruments; however, when it came to plastic trays, rubber bowls, and acrylic trimmers, the knowledge was not sufficient. The results of the present study were in congruence with the studies done by Otieno et al. in Nairobi and Eusner in the United States.[12,13] The operators must be taught about the categorization and the appropriate cleaning method for every instrument.

Dental impressions are cleaned and disinfected using methods including soaking in chemical cleaners, autoclaving, and radiation. The disinfectant must be highly effective at reducing hazardous bacteria without impairing the material's dimensional stability or ability to replicate delicate features. The impression should be regularly disinfected before delivering to the laboratory.[14] Literature has shown that 2% glutaraldehyde effectively disinfected dental impressions and lowered bacterial count but reported a disadvantage of affecting the dimensional stability of the impression. Recently, techniques such as UV radiations, ethylene oxide, microwaves, and radiofrequency flow discharge have been introduced to disinfect impressions.[15] In the present study, the majority regularly disinfect dental impressions and preferred glutaraldehyde to disinfect various impression materials. These results were consistent with the studies conducted by Kotwal et al. and Mushtaq et al.,[14,15]

Dental schools are responsible for teaching their students about infection management. This type of training is critical for protecting patients by providing therapy in a safe working environment. Previous research has found that different categories of medical workers have various levels of knowledge and awareness about cross-infection control policies and procedures. It has also been noted that the examples set by senior staff members have a significant impact on these practices.[10,11] Researchers have already portrayed a bleak image of cross-infection control measures in public hospitals.[11] Previous researchers in Pakistan have found that most dentists in public hospitals do not follow cross-infection control due to fewer resources, overcapacity, and poor policies.[10,16,17] A previous study conducted by Bokhari et al. in dental institutes of Punjab reported that the knowledge and practice of dental practitioners about cross-infection control measures were not very good but were within acceptable standards.[18] Similar results have been reported in another study conducted by Sufia S on dental institutions of Punjab, which reported adequate knowledge and positive attitude but unsatisfactory practice about infection control.[16] In the present study, most respondents had a fair knowledge of cross-infection control. However, private institute respondents were significantly more aware and had a better implementation of those cross-infection control protocols. However, interestingly, respondents from both sectors were satisfied with their knowledge and performance of cross-infection control in their respective clinics. This might be because respondents in the public sector are used to working in clinics with subpar facilities and a high patient load and doing their best. The public sector should be better funded and better equipped.[11]

It has been determined that hurdles to cross infection in hospitals include poor hospital infrastructure, a lack of resources and manpower, staff education, insufficient training and supervision, and high visitor numbers. Moreover, high patient numbers, supply chain disruptions, high infection rates, and time limitations were all directly related to the conflict.[19] In the present study, the major constraints faced by the respondents were lack of awareness, time constraints, lack of resources, and poor clinical staff training.

Limitations of the Study

Differences in practice settings may influence the implementation of infection control measures and could affect the general applicability of the study's findings. Moreover, the present research relies on self-reporting by dental professionals and may be subject to social desirability bias, where respondents may overstate their adherence to infection control protocols. Another limitation of this study is the convenience sampling technique and unequal representation from private and public sector institutes.

Conclusion

The core knowledge and practice of cross-infection control is one of the most important aspects of the clinical practice of dentists. A multi-institutional approach toward disinfection of specific equipment used for patients within prosthodontics clinics is essential. Most respondents, with a significant proportion from private institutes, had adequate knowledge about cross-infection control. The majority were satisfied with their knowledge and its implementation. Regular workshops and refresher courses regarding cross-infection control should be conducted, especially in public-sector dental institutes.

List of Abbreviations

IRB	Institutional Review Board
SPSS	Statistical Package for Social Sciences

UK United Kingdom
UV Ultraviolet

Conflict of interest
None to declare.

Grant support and financial disclosure
None to disclose.

Ethical approval
This cross-sectional survey was conducted with the approval of the Institutional Review Board (IRB) of CMH Lahore Medical College, Lahore vide Letter no: 672 ERC/CMH/LMC _01-02-2022.

Authors' contributions
HAS, AMZ: Conception and design of study, acquisition and analysis of data, drafting of manuscript, critical intellectual input.
DND, HT, KY,UI: Acquisition of data, analysis of data, drafting of manuscript, critical intellectual input.
ALL AUTHORS: Approval and full responsibility of the final version of the manuscript to be published._

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