

Dental Infection Control Practices and Public Perception: A Cross-sectional Study

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Abstract:

Background: The aims of this study was to determine the practice of infection control among the dental professionals practicing in private dental clinics in Ernakulam city, and public's perception of infection control measures.

Materials and Methods: This was a cross-sectional study conducted with a sample of 84 private dental clinics and 152 respondents from the general public in Ernakulam city. A 24 item self-administered close-ended questionnaire was used for the dentists and a 13 item semi-structured questionnaire with both open and closed ended questions administered to the general public. Data obtained from both populations were tabulated and analyzed using descriptive statistics and bivariate analyses using Chi-square test ($\alpha = 0.05$).

Results: The final sample consisted of 66 dental clinics. Most of the dentists complied with the use of barrier techniques (gloves and mouth mask) during patient care. Almost half of the dentists had no knowledge of their auxiliaries being vaccinated against hepatitis B. With regard to the general public, 58% of the people had concerns regarding the methods used by the dentists to sterilize dental instruments, yet most of them (77%) did not avoid the dental treatment due to perceived cross infection risk.

Conclusion: Results of this study revealed that the level of infection control practices adopted by the private dental clinics in the city was inadequate in a few areas. It was found necessary to educate, raise awareness, and promote continuing dental education aimed at improving dental safety.

Key Words: Dental practice, Ernakulam city, infection control, infectious diseases, private dental clinics, public opinion, public perception

Introduction

In dentistry there is constant exposure to various blood borne and upper respiratory tract pathogens or infectious

agents through blood, saliva, and various other body fluids.¹⁻⁴ Infections can spread in a dental setting either through touch, spatter, or flying debris from the oral cavity.^{1-3,5-7} Occupational exposure to blood borne pathogens can be from the human immunodeficiency virus, hepatitis B virus (HBV), hepatitis C virus, *Mycobacterium tuberculosis*, herpes simplex virus Type I and Type II, Staphylococci, and other potentially infectious agents.⁴ The primary route of occupational exposure to "blood borne pathogens," being mostly unintentional percutaneous injuries. These types of injuries are more prevalent in dental settings than other healthcare fields, mainly because of the small operating field, frequent patient movements, and the variety of sharp instruments being used in dentistry.⁸ Literature has also shown that the dental team is significantly at higher risk of contracting infections when compared to the general public, where the source could be a patient or a member of the dental team.^{4,9-11} The ongoing surveillance by the United States Centers for Disease Control and Prevention (CDC) states that the occupational blood borne pathogen exposure remains an important public health concern.¹² Infectious diseases and its likely spread through the dental hospitals or clinics is a mammoth predicament where only the tip of the iceberg is visible to the naked eye. AIDS epidemic in the past three decades has been the greatest public health issue having reached unforeseen levels and has prompted the health communities to re-evaluate many routines and norms in provision of health care services.¹³ A 2004 study has also shown that dentists working in private dental clinics are less likely to adhere to infection control protocols than dentists working in hospitals and dental schools because institutions usually have stricter occupational health policies related to infection control.¹⁴ Further in a similar analysis of infection control data from Indian dentists from two independent surveys (1999 and 2010) by Shetty *et al.*, when the dentists were stratified by occupation, the private practitioners compared to faculty were more likely to be immunized and used heat sterilisable instruments. Overall, the private practitioners were less likely to adhere to the infection control practices than the faculty because they did not require any institutional oversight and updates on their infection control practice measures.¹⁵ Infection control practice in the 2010 survey was less stringent than in the 1999 sample and could be attributed to the surveys being conducted in different parts of India on mutually independent samples.¹⁵ The use of heat sterilisable instruments and regular use of surface barriers, autoclave and rubber dam were a more common in the 1999 cohort that was predominantly in South India.¹⁵ The results broadly

demonstrated inadequacies in dental safety in both surveys and further prompted authors of this manuscript to conduct a study in India to discern the present situation with regard to dental infection control. Although some overseas studies^{7,14} have given insight into the infection control measures taken by private dental clinics, there is still a lacuna of information where the infection control measures by the private dental clinics have been assessed in detail.

The general public or patients who avail the dental treatment should also be made aware of this situation so that they can be alert and take the necessary precautions. On assessing the public perception on dental infection control in other parts of the world, a great deal of confusion and anxiety was revealed about dental cross-infection and many patients were ignorant about dental sterilization methods.¹⁶ Studies have also shown that people preferred their dentists adhere to strict infection control protocols and use barrier techniques.¹⁶ Studies from many countries have focused on the perceptions of patients availing dental treatment and have provided valuable information, but without data from the broader Indian population. Until now, there have been no population-based reports of public perceptions of dental infection control in the Indian settings. Thus, gauging the public knowledge and perceptions would only help in implementing a better infection control protocol. The objective of this study was to assess the infection control practices of private dental clinics in Ernakulam city, a bustling metropolis in the Southern Indian state of Kerala and also to assess the public perception of infection control practices in dental clinics.

Materials and Methods

This cross-sectional study was conducted in Ernakulam city, Kerala, India. The study population consisted of all private dental clinics within Ernakulam city limits and a sample of at least two respondents from the general public within half a kilometer radius of the dental clinic. The exact borders of Ernakulam city and a list of the registered private dental practitioners in the city were obtained from the city corporation office. All the private dental clinics within the city were included in the study. There were 84 private dental clinics from which, a total of ten private dental clinics were included in the pilot study. Four clinics were reluctant to participate in the study. Two clinics did not have any available dentist to answer the questionnaire. Three of the dental clinics had closed down and two were under renovation. This left a remaining total of 66 dental clinics, which was the final population for the study.

Two separate questionnaires (data collection instruments) were developed. A self-administered, structured closed-ended questionnaire in English for the dentists, and a structured self-administered questionnaire with both open and closed ended questions in both Malayalam (local language) and English were developed for the general public. Each questionnaire

was personally administered by the investigator. Both the questionnaires consisted of two parts. The first part consisted of demographic information and the second consisted of questions on the knowledge and practice of infection control measures, in par with the guidelines suggested by the CDC. Most questions included in both the questionnaires were dichotomous. The questionnaires were pre-tested on a random sample of ten dentists and ten respondents within the stipulated area to ensure practicability, validity, cogency, and interpretation of responses. The questions were modified based on the feedback obtained from the pilot study.

The research proposal was submitted and approved by the ethical review committee at the Amrita Vishwa Vidyapeetham (Dental Educational Institution in Ernakulam City). The questionnaire was completed by the respondent in the presence of the investigator. Anonymity was guaranteed and after signing an informed consent, a copy was returned to the investigator. The responses were coded as (Yes, No or Do not Know), (Always, Sometimes or Never) and separate coding in case of the open ended questions, to ensure confidentiality.

Data collection

Data were collected by one of the investigators. Every single clinic in this study was personally visited by the investigator and the questionnaire was provided to the clinician present in the clinic. The investigator was only present to help the dentist in understanding the questionnaire but did not interfere with the response or completion of instrument by the respondents. Meanwhile, the questionnaires were also administered to two of the general public, in and in near vicinity to the dental clinic.

The data obtained from both the populations were entered, edited for accuracy of data entry, tabulated and analyzed using IBM Statistical Package for Social Sciences for Windows version 17. Descriptive statistics were generated, and Bivariate analyses using Chi-Square conducted ($\alpha = 0.05$).

Results

The demographic details of the study population, infection control protocols adopted in the dental clinics, the status of hepatitis B vaccination among dentists and dental auxiliaries are shown in Table 1. Most of the dentists were male. General dental practitioners were the majority in Ernakulam city (71.2% compared to 28.8% of specialists). Autoclave was the most common method for the sterilization of instruments, but the high speed hand pieces were only disinfected and not heat sterilized. Most of the dentists were vaccinated against hepatitis B barring two. Only 50% of the auxiliary staff was vaccinated against hepatitis B.

The distribution of occupational exposures, the disposal of needles and other sharps in the clinic are listed in Table 2. All the dentists in the study used special containers for the disposal of sharps and 89% had needle shredders in their clinic. It was

also seen that only 36.4% of dentists routinely disinfected the impressions before sending it to the laboratory.

Table 3 shows that, all the dentists used gloves and 90% of them used facemasks while treating a patient, but a majority rarely used protective eyewear, face shield and protective gowns. The frequency of recirculating dental instruments such as extraction forceps and elevators, hand pieces, saliva ejectors, burs and flushing of water lines is provided in Table 4.

Table 5 enumerates the public's perspective on the dental infection control practices. While the norm is to wear full personal protective equipment comprising gloves, mask, eyewear and gown together while anticipating splash/spatter, public opined that majority of the dentists used gloves and mouth mask. But many of them did not use protective eyewear while treating patients and 87.8% of them did not provide any eyewear or goggles to the patients. Although 58% of the people had concerns regarding the measures used by the

dentists to reprocess dental instruments, most of them (77%) did not avoid dental treatment due to fear of infection from contaminated dental equipment and instruments.

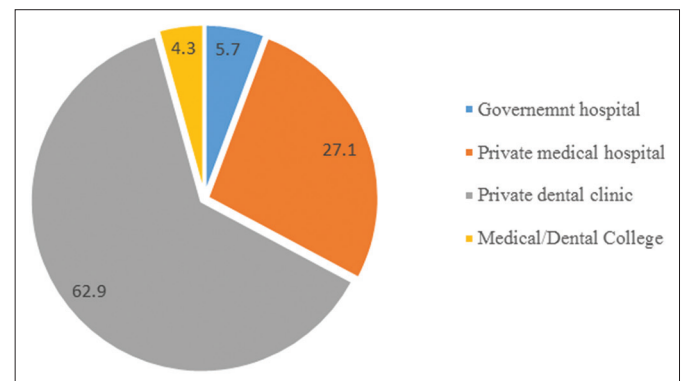
Graph 1, illustrates the public's opinion on where the most aseptic precautions are taken, and a majority opined that, it was the private dental clinics where better safety measures were followed. The public also opined that it was the medical and dental teaching institutions where the least aseptic precautions were taken.

In Table 6, a comparison was made based on the gender and professional status of the dentist. Although not statistically significant, female dentists were relatively less aware of their auxiliary staff being vaccinated against hepatitis B in comparison with their male counterparts ($P = 0.063$). Male general dentists and specialists always disinfected/changed their dental hand pieces in between patients compared to female dentists and general dentists ($P \leq 0.05$). It was seen that 89.5% of the specialists did not reuse the contaminated dental hand pieces between patients as to only 63.8% of general dentists who always disinfected their hand pieces between patients.

Table 1: Demographic details of the study population, methods of sterilization and the status of hepatitis B vaccination among dentists and dental auxiliaries.

Characteristics	n (%)
Gender	
Male	34 (51.5)
Female	32 (48.5)
Total	66 (100)
Age in years	
20-40	38 (57.6)
41-60	23 (34.8)
61-80	04 (6.1)
Total	65* (98.5)
Professional status	
General dentist	47 (71.2)
Specialist	19 (28.8)
Total	66 (100)
Years of practice	
1-10	24 (36.4)
>11	31 (47.0)
Total	55 (83.4)
Most common system for routine sterilization of instruments	
Autoclave	57 (86.4)
Boiling water	09 (13.6)
Total	66 (100)
Treatment of hand pieces in between patients	
Thorough cleaning by wiping	08 (12.1)
Thorough cleaning by wiping and disinfectant	41 (62.1)
Autoclave and dry heat	15 (22.7)
Total	64* (96.9)
Have you been vaccinated against hepatitis B?	
Yes	64 (97)
No	02 (3.0)
Total	66 (100)
Auxiliary staff vaccinated against hepatitis B?	
Yes	33 (50)
No	16 (24.2)
Do not know	16 (24.2)
Total	65* (98.5)

*Dentists did not answer the question



Graph 1: The public opinion on where the most aseptic precautions are taken.

Table 2: Distribution of the exposure and disposal of needles and other sharps in the dental clinics.

Related questions	Variables	n (%)
Approximate number of needle stick injuries in a year?	None	37 (56.1)
	Once or more	29 (43.9)
	Total	66 (98.5)
After completion of local anesthesia, how do you recap the needle?	Using needle capping device	27 (40.9)
	Using gloved fingers	34 (51.5)
	Do not recap the needle	05 (7.6)
Total	66 (100)	
Do you use special containers for the disposal of sharps?	Yes	66 (100)
Do you use a needle shredder in your clinic?	Yes	59 (89.4)
	No	04 (6.1)
	Sometimes	02 (3.0)
Total	65* (98.5)	

*One dentist did not answer the questions

Table 3: Distribution of the use of basic barrier techniques of infection control by dentists.

Responses	n (%)				
	Gloves	Mouth mask	Eye protection	Face shield	Protective uniform
Always	66 (100)	60 (90.9)	31 (47.0)	8 (12.1)	40 (60.6)
Sometimes	0 (0)	6 (9.1)	27 (40.9)	21 (31.8)	23 (34.8)
Never	0 (0)	0 (0)	8 (12.1)	30 (45.5)	1 (1.50)
Total	66 (100)	66 (100)	66 (100)	59* (89.4)	64* (97.0)

*Dentists did not answer the questions

Table 4: Frequency of changing/reprocessing basic dental instruments between patients.

Variables	n (%)			
	Always	Sometimes	Never	Total
Extraction instruments	64 (97.0)	2 (3.0)	0 (0)	66 (100)
Hand pieces	47 (71.2)	16 (24.2)	3 (4.5)	66 (100)
Saliva ejectors	66 (100)	0 (0)	0 (0)	66 (100)
Burs	58 (87.9)	8 (12.1)	0 (0)	66 (100)
Flushing of water lines	36 (54.5)	25 (37.9)	2 (3.0)	63* (95.5)

*Dentists did not answer the question

Table 5: Distribution of responses of the public towards dental infection control.

Questions related to attitudes and awareness towards dental infection control	n (%)		
	Yes	No	Total
Does your dentist wear mask while treating patients?	139 (93.9)	08 (5.4)	147 (99.3)
Does your dentist wear rubber gloves on his hands when treating patients?	145 (98.0)	02 (1.4)	147 (99.3)
Does your dentist wear eye wear when treating patients?	69 (46.6)	74 (50.0)	143 (96.6)
Does your dentist give you eye wear/goggles when he treats you?	16 (10.8)	130 (87.8)	146 (98.6)
Does your dentist use sterilized instruments?	126 (85.1)	06 (4.1)	132 (89.2)
Have you ever delayed/avoided your dental treatment because of risk of infection from dental equipment?	30 (20.3)	114 (77.0)	144 (97.3)
Do you have concerns about the procedures used by your dentist to sterilize dental instruments?	86 (58.1)	58 (39.2)	144 (97.3)

Discussion

Dental clinics are believed to be reservoirs of infectious pathogens where disease transmission can readily occur.¹⁷ These pathogens may be transmitted through direct contact with blood or other oral fluids, contact with contaminated instruments, equipment or environmental surfaces, and mucosal contact with droplets generated by coughing, sneezing or inhalation of airborne microorganisms.^{6,18} In light of these facts, it is important that all health care professionals adhere to strict infection control measures. The results presented in this study throw light on the infection control practices of private dental clinics in Ernakulam city. Whether such practices would be widely held on a nationwide basis remains to be determined by conducting similar studies in government and other private clinics using a stratified sample within India. It was seen that majority of the dentists practicing in private dental clinics in Ernakulam city were of the younger age groups. This study

demonstrated that most practitioners were in the initial years of practice. Of the 66 dentists included in the study, only three dentists had more than 45 years of clinical experience as they were reaching towards retirement. These older practitioners may not have wanted to be involved in the practical difficulties of managing a dental clinic and possibly not very keen on continuing to practice. The latter was also in concurrence with previous studies where most dentists in active practice were in the younger age groups.^{10,19}

Autoclave was the most common method of sterilization (86.4%), barring nine dentists who used "boiling water" that were inappropriate for routine decontamination of instruments. This is in par with the other studies, where majority of the dentists used autoclave for sterilization of instruments.^{10,19} The study in Sao Paulo by Matsuda *et al.* in 2011 had autoclave, dry heat sterilization, chemical solutions and alcohol as methods of decontamination but most dentists used autoclaves as the preferred sterilization method.¹⁹ Boiling, intermediate level disinfection and cold sterilization are not acceptable methods of sterilization of critical instruments and needs to be discouraged as their effectiveness cannot be verified. While the standards published by the Dental Council of India required dentists to heat sterilize hand pieces, only wiping down with an intermediate-level disinfectant was the norm in this sample as well as being a common practice in most dental practices in India.²⁰ Nevertheless, the results of the present study was noteworthy in comparison to a study by Puttaiah *et al* 2010. in the Tamil Nadu and Karnataka states of India, where, although autoclave was identified as the most common method of sterilization by most respondents, it was seen that many of the 'autoclaves' were modified pressure cookers.²¹

Exposure to HBV is a serious concern in health care settings and more so in dentistry because the dental profession is 5-10 times more at risk of exposure to the virus than the normal adult population.²² In the 1999 and 2010 study by Shetty *et al.*, it was seen that in the 2010 cohort, <50% of the respondents reported being immunized against infectious diseases although, in the same study the 1999 cohort showed better adherence to the infection control protocols with regard to immunization against infectious diseases.¹⁵ While surveys in 2010 showed vaccination against hepatitis B as 50%, the present study showed that most of the dentists in Ernakulam city (97%) were vaccinated against hepatitis B demonstrating

Table 6: Distribution of awareness of the dentists about the auxiliary staff being vaccinated against hepatitis B, based on gender of the dentist; and the frequency of changing the dental hand pieces in between patients based on the gender and professional status of the dentist.

Variables	n (%)	P value
Are your auxiliary staff vaccinated against hepatitis B		
Male dentists		
Yes	22 (64.7)	P=0.063
No	06 (17.6)	
Do not know	06 (17.6)	
Female dentists		
Yes	11 (35.5)	
No	10 (32.3)	
Do not know	10 (32.3)	
Do you change the hand pieces in between patients?		
Male dentists		
Always	28 (82.4)	P=0.036
Sometimes	06 (17.6)	
Female dentists		
Always	19 (59.4)	
Sometimes	13 (40.6)	
Specialist dentists		
Always	30 (63.8)	P=0.033
Sometimes	17 (36.2)	
General dentists		
Always	17 (89.5)	
Sometimes	02 (10.5)	

better adherence to immunization protocols among dentists. The latter was similar to the results of the study by Matsuda *et al.* where 92.62% of dental surgeons had completed the vaccination series.¹⁹ It was also in par with a study done by Puttaiah *et al* 2010. between 1998 and 2004, to explore and compare the infection control knowledge, attitude and practice of dentists across eight countries. In that study, over 86% of the dentists in India were immunized against diphtheria, polio, and tetanus, which was the highest among all the other countries included in the study.²³ However, in this study only 50% of the dentists in the present study, were aware of their auxiliaries being vaccinated against hepatitis B. Of the 50% who were aware of the auxiliaries being vaccinated against hepatitis B, majority of them were male dentists.

Every single dentist included in this study, had a needle shredder in their clinic and most of the dentists had special containers for the disposal of sharps. This is similar to the study by McCarthy *et al.* where, almost all the dentists used puncture proof containers for the disposal of sharps.²⁴ Compared to a study by Budnyak *et al.* where only 10% had more than 10 exposures within the past 6 months,²⁵ in this study 43.9% of the dentists experienced more than one needle stick injury in the past 1 year. However, a study by Matsuda *et al.* shows otherwise, where occupational accidents by sharp instruments or needles were a common occurrence among the dentists.¹⁹ Also a study by Leggat and Smith, found that more than three-quarters (78.5%) damaged their gloves at least once during a clinical procedure in the past 12 months.²⁶ In the present study only 36.4% of the dentists disinfected

impressions before sending it to the laboratory compared to 61% and 53.7% who disinfected the impressions in the studies by Budnyak *et al.*²⁵ and Yengopal *et al.*,⁷ respectively. However, the figures were slightly better than that of by Al-Omari and Al-Dwairi, where only 18% of the private dental practitioners in Jordan disinfected the impressions before sending it to the laboratory.¹⁴

McCarthy *et al.* provided evidence on the protective effect of barriers. Eye protection and masks reduce the mucous membrane exposures and wearing gloves reduced the percutaneous exposures.²⁴ Nevertheless, in the present study, all the dentists used gloves and mouth masks while treating patients and majority of them used eyewear and protective uniform. This could be because of increased awareness and better sensitization of the private dental practitioners in Kerala. It is very similar to the previous studies where the dentists used appropriate barrier techniques during patient care.^{4,10} The study by Shetty *et al.* conducted in India, showed 83% of the dentists in 2010 and only 75% dentists in 1999 reported using sterile surgical gloves.¹⁵ Alarmingly, a unique finding from a study by Budnyak *et al.*, which is usually not seen in similar studies done elsewhere is that, 100% of the respondents used protective eye wear while attending to a patient.²⁵ Our study showed that 47% always used protective eye wear, 41% rarely used and 12% never used protective eyewear. It was similar to the results of the study by Puttaiah *et al.* where only 34% dentists in India, regularly used protective eye wear.²³ In the present study, only 4.7% of dentists regularly used rubber dam which was very alarming and distressing, 50% of the dentists never used a rubber dam and almost 45% of them, used a rubber dam on rare occasions. This was very dissimilar to other studies done in India and elsewhere. Puttaiah *et al.* showed that 16% dentists regularly used rubber dam and in 1999 and 2010, Shetty *et al.* illustrated that 26% of dentists used rubber dam.^{15,23} Study done in Jordan by Al-Omari and Al-Dwairi., showed that 13.63% of the dentists and in Durban (Yengopal *et al.*), reported that 30% of the dentists regularly used rubber dam.^{7,14} Although the statistics from other studies were not very reassuring, our sample showed that compliance was slightly better.

All the dentists sterilized extraction instruments in between patients, except for two. Information that two dentists rarely reprocessed the surgical instruments in-between patients was very disquieting and it only reinforced the belief that continuous training in infection control rules and practice guidelines including post-exposure protocols are necessary. This could have been a negligence either developed during the course of a dentist's professional life. Similarly, Al-Omari and Al-Dwairi, presented that only 95% of the dentists reprocessed their surgical instruments in-between patients. The remaining 5% was disquieting. The authors did not come across a similar variable in other studies. The saliva ejectors and burs were

sterilized in between patients most of the time. However, only 54.5% of the time the water line was flushed in between patients and only 71.2% stated the hand pieces were cleaned in between patients. This was similar to a Canadian study by McCarthy *et al.* Where the compliance among the Canadian dentists for flushing the water lines in between each patient was only 20-68%.²⁴

Results in this study showed that the influence of the dentist's gender or professional status on the frequency of changing the dental instruments in between patients, it was seen that the male dentists and specialists were more cautious and regularly changed the dental instruments in between patients. This was contrary to a similar study done in India during 1999 and 2010 by Shetty *et al.*, where the general dentists were more compliant, better immunized and were more alert than specialist dentists.¹⁵ Also another study by Al-Omari and Al-Dwairi, where the female dentists were more compliant compared to the male dentists.¹⁴ In one study, a higher prevalence of accidents (unintentional injuries/exposures) among women were observed.⁸ In contrast, Canadian male dentists showed a higher risk of percutaneous exposure.²⁷ The association between the occurrence of accidents and the gender of the dentist is not very clear and further studies are required.

Kerala being the most literate states in India,²⁸ the public opinion was paramount since they would be more vigilant of the infection control measures taken in the dental clinics and this in turn would make the dentists more cautious. Furthermore, previous studies done overseas by Baseer *et al.*, revealed that the public generally had adequate knowledge about the barrier techniques used by dentists.²⁹ According to the present study, the public was of the opinion that the dentists complied with infection control measures in terms of using gloves, mouth mask and eye wear. Although 58% of the people had some concerns regarding the procedures used by the dentists to sterilize the dental instruments, it did not deter them from seeking dental care. This information was contradictory to the previous studies where the public delayed or avoided the dental treatments when there was a perceived cross infection risk.^{16,29} The foregoing salient list is just illustrative in nature and not exhaustive. Inadequate infection control measures being followed in the Asian countries as availed from literature²³ and also as demonstrated in the present study could be due to inadequate training in infection control and also more hectic work schedules. A similar study by Puttaiah *et al.*, done in India, showed that each dentist in their sample treated approximately 25% more patients on an average compared to the practitioners in the United States.²¹ Increase in the workload can also lead to compromise on effective infection control measures.

Conclusion

This study is expected to pave way for more surveys of similar kind by other researchers in different parts of India. The results of this study showed that while the level of knowledge

of the dentists were generally acceptable, the infection control measures implemented by them were far from ideal. The critical points observed were: Poor knowledge of the dentists on their auxiliaries being vaccinated against HBV, use of ineffective methods of decontamination by some dentists, not heat sterilizing the hand pieces, not disinfecting impressions before sending it to the laboratory, and negligent behavior by not reprocessing the surgical instruments in-between patients by some dentists. The public were aware of the dental infection control measures being taken at the dental clinics they frequented and expressed some distress at the shortfalls. Thus, the onus is on the health professionals to provide adequate information on the measures taken to minimize cross infection in dentistry in order to avoid any undue public concern or avoidance of dental care. Likewise, it is necessary to educate and raise awareness among the dentists by all methods possible to improve safety in the dental practice since it was established in a study by McCarthy *et al.* that, more than 6 hours of continuing education in infection control in the past 2 years were important predictors of excellent compliance. The results of this study lends support to the concept of mandatory continuing education on infection control.²⁴

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