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Awareness of cross-infection control among dentists in their workplace in Bhopal city: A questionnaire-based study

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A B S T R A C T

Background: Infection control in dentistry is a critical aspect of clinical practice due to the continuous emergence of transmissible infectious agents. Cross-infection remains a significant concern, particularly through aerosols, bloodborne pathogens, and contaminated dental unit waterlines (DUWLs). Compliance with infection control protocols is essential to minimize occupational risks. This study assesses the awareness and adherence to cross-infection control measures among dentists in their workplace in Bhopal City.

Materials and Methods: A descriptive cross-sectional study was conducted among 312 dentists practicing in solo, group, and hospital-based settings in Bhopal City. A structured, pre-validated questionnaire was distributed online, covering aspects such as demographic characteristics, awareness of cross-infection control, preferred preventive measures, sterilization practices, and concerns regarding infection risks. The data were analyzed using SPSS Version 29, with statistical significance set at $p \leq 0.05$.

Results: Out of 312 participants, 175 (56.1%) were female and 137 (43.9%) were male. The majority (51.6%) were clinical specialists, while 48.4% were general practitioners. Among the respondents, 51.0% practiced solo, 14.1% worked in group clinics, and 34.9% were in hospital-based settings. The study found no significant difference in infection control awareness across gender, professional status, or practice type. A high proportion of dentists (88.8%) consistently followed universal precautions, while 93.3% reported strict adherence to avoiding exposure to sharp devices. Notably, 92.3% of respondents expressed concern about cross-infection risks, and 85.9% recognized the role of high aerosol suction in minimizing contamination. However, 31.4% lacked awareness of cross-infection protocols, and 11.2% had not been vaccinated against hepatitis B.

Conclusion: The study indicates a high level of awareness and compliance with infection control measures among dentists in Bhopal. However, gaps exist in practices like high-volume suction use, handpiece sterilization, and waste disposal. Regular training and audits are crucial for improved adherence.

Keywords: Cross-infection, infection control practices, occupational hazards, sterilization, universal precautions, biomedical waste management.

INTRODUCTION

Infection control in dentistry is a perennial subject requiring constant review because of the relentless emergence of novel transmissible infectious agents[1].

It is prudent to reassess and review key areas of infection control protocols in dentistry. Aerosols represent the primary pathway through which dental practitioners' contract respiratory infections in clinical settings. Regrettably, a significant number of dental professionals worldwide fell victim to COVID-19, acquired through this very route[1].

Consequently, the risk of exposure to bloodborne infections remains a constant concern in dentistry, particularly due to accidental needle stick and sharps injuries that can lead to blood contamination Fortunately, the availability of highly effective postexposure prophylaxis, to be administered within 72 hours of exposure, provides reassurance in preventing diseases such as HIV infection. Nevertheless, it is crucial to note that vaccines are currently unavailable for some bloodborne infections like hepatitis C, emphasizing the need for stringent infection control measures as the most prudent approach to prevent such infections[1].

Once in the environment, aerosols do not remain stable. The momentum with which they are emitted, either during breathing, coughing, or via an instrument such as a dental drill, affects how long they remain in the air and how far they travel[2]. The proper functionality of the dental chair and its components is essential for the safe and successful delivery of dental care[3].
Several reports indicate that dentists and their staff, because of their proximity to dental equipment, can inhale airborne droplets of contaminated water from DUWLs. This represents a prolonged, chronic occupational source of exposure to waterborne bacterial aerosols emanating from dental instruments connected to DUWLs[3].

Decontamination of the clinical working environment and reprocessing of reusable dental instruments and devices are key components of modern infection control[4]. One must also be aware that new and emerging infectious diseases could prompt reassessments of methods, materials, and devices used for decontamination of the clinical working environment and for instrument reprocessing, based on the challenges posed by new pathogens[4]. Attention to infection prevention and control (IPC) practices in dental units is critical to stop cross-infection[5]. Aseptic technique aims to prevent the introduction of micro-organisms from hands, surfaces and equipment to a susceptible sterile site[5].

The use of audit check list to conduct regular audits help identify discrepancies between standards and the actual practices among the team[5]. Most dental unit waterlines contain biofilm, which acts as a reservoir of microbial contamination. It is recommended that dental unit waterline systems must be regularly maintained, via water treatment and monitoring, and performed according to the manufacturer's instruction[5].

The correct application of infection control protocols and precautions can significantly reduce the risk of cross infection in dental settings. Compliance with infection control guidelines is paramount in breaking the chain of infection of communicable diseases and safe delivery of dental care. The Center for Disease Control and Prevention (CDC) published the guidelines for infection control in dental settings in 1993 and most of the international guidelines are based on these guidelines, but they have changed and evolved over time[6]. Dental assistants play a key role in the prevention of cross-infection and the majority of dental assistants responsible for carrying out such tasks are not certified in developing countries[6].

MATERIAL & METHODS

Ethics Committee Clearance and Permissions

Ethical clearance for the study was obtained from the Institutional Ethics Committee of Peoples Dental Academy, Bhopal with IEC No. IEC/2025/200/007. The study protocol, including the aim and objectives, was submitted for review and approved by the Research and Ethics Committee of the institution.

Informed Consent

Informed consent was obtained from all participants before data collection. Participants were informed about the nature and purpose of the study and assured that their responses would remain confidential. The online questionnaire included a consent form, and only those who agreed to participate could proceed with the survey.

Study Design

A descriptive cross-sectional study was conducted to assess awareness of cross-infection control among dentists in their workplace in Bhopal City. A cross-sectional, pre-validated questionnaire was prepared in English and distributed online. The study population included dentists practicing in solo, group, and hospital-based settings, selected through a convenience sampling approach.

Sampling and Sample Size

A convenience sampling approach was employed, and the study included 312 dentists practicing in Bhopal City. The sample comprised general dental practitioners as well as specialists. The participation was voluntary, and the questionnaire did not require any identification details to ensure anonymity and confidentiality.

Participants Selection

The study included dentists practicing in Bhopal City. Participants were approached online through professional

networks, dental associations, and personal contacts. They were informed about the study's objectives and significance in improving cross-infection control practices. Participation was voluntary, and the data collected remained anonymous to maintain confidentiality.
The participants were recruited based on preselected criteria relevant to the study objectives. The inclusion criteria were dentists practicing in Bhopal City who were willing to participate and completed the questionnaire. Exclusion criteria included unwilling participants, incomplete responses, and practicing students or interns.

Study Setting
The study was conducted among dentists working in solo practices, group clinics, and hospital-based settings in Bhopal City. The questionnaire was designed to capture a comprehensive assessment of cross-infection control awareness and practices.

Data Collection
A structured questionnaire consisting of ten sections was distributed online via Google Forms. The questionnaire included demographic characteristics (4 items), awareness and concern about cross-infection (3 items), preferred methods for prevention (7 items), time since last sterilization servicing (1 item), preferred barrier protection and biomedical waste disposal (4 items), awareness about microorganisms (5 items), preferred time of use of sterilized instruments (1 item), use of dental handpieces and devices attached to air and waterlines (2 items), use of autoclaves for handpiece sterilization (1 item), and the importance of high aerosol suction in minimizing contamination (1 item).
3. Statistical Analysis
The data was entered in excel sheet & data was statistically analysed using SPSS Version 29 (Chicago Inc. USA). The data was analysed using frequency distribution. The mean & standard deviation was obtained using students t- test & p value was ≤ 0.05 at 95% confidence level.

RESULTS
Questionnaire was distributed to participants to which response rate was 100%. Out of 312 dentists with whom questionnaire was distributed, 175 (56.1%) respondents were females and 137 (43.9%) were male. It was observed that 161 (51.6 %) were Clinical specialist & 151 (48.4 %) were general dentist. Among the respondents, 159 (51.0 %) were engaged in solo practice, 44 (14.1 %) were part of a group practice, and 109 (34.9 %) were involved in hospital-based practice. Regarding the duration of practice, 169 (54.2%) respondents had less than 5 years of experience, 79 (25.3%) had been practicing for 5–10 years, and 64 (20.5%) had more than 10 years of experience.
The majority of respondents reported ‘always’ using universal precautions (88.8%) and avoiding exposure to sharp devices and contaminated instruments (93.3%). Preoperative and operative mouth rinses were always used by 66% of participants. High-volume suction was consistently used by 59.3%, while 42.3% reported only sometimes using a rubber dam. Improving the quality of dental unit waterlines was always practiced by 73.7% of respondents. Notably, 100% of participants ensured that instruments remained sterile until usage. (Table 1)

About 92.3% respondents expressed concern about the risk of cross-infection to themselves and their dental assistants, while 2.9% were not concerned, and 4.8% were uncertain. Additionally, 85.9% of participants believed that high aerosol suction plays an important role in minimizing contamination in the treatment room, while 14.1% were uncertain. (Table 2)

A significant majority (87.5%) acknowledged HIV, HBV, HCV, and Mycobacterium tuberculosis collectively as important infectious agents.
However, only 3.8% considered HIV alone as a key concern**.** 96.2% of the respondents were aware that various microorganisms can be transmitted in a dental setting stating they always took special precautions when handling patients with HIV or tuberculosis. 88.8% responded reported being vaccinated against HBV & around 11.2% were not vaccinated against them. (Table 3)
When asked about precautionary measures for preventing cross-infection from HIV/Tuberculosis patients, 98.7% dentists reported adhering to strict protocols, including PPE use, instrument sterilization, disposable tools, sharp waste disposal, hand hygiene, and surface disinfection. Only 1.3% did not follow all measures.

Among the respondents 68.6% were aware of cross-infection, while 31.4% reported a lack of awareness. (Figure 1). In terms of perception, 80.4% of respondents correctly identified cross-infection and hospital-acquired infection as different terms, while 19.6% believed they were the same and interchangeable. (Figure 2)

Regarding the last servicing of sterilization devices, the highest proportion of respondents (37.8%) reported servicing within one week, followed by 29.8% within four weeks. A smaller percentage serviced their devices at six weeks (13.1%), twelve weeks (10.6%), and more than twelve weeks (8.7%) (Figure 3)
Around 89.1% of dentists preferred using sterilized, wrapped, or packed instruments within one week. Only 1% opted for

six weeks and more than twelve weeks. Regarding the sterilization of dental handpieces specifically, 50.6% of respondents reported always using an autoclave, while 37.5% used it sometimes. A smaller proportion (11.9%) admitted to never using an autoclave for sterilization.

A significant majority 77.9% reported cleaning and disinfecting all surfaces. As much as 82.4% dentist reported always using barrier protection and disinfecting environmental surfaces between appointments whereas about 1.3% admitted to never practicing barrier protection or surface disinfection. Information was requested about available methods of sterilization for dental handpieces and devices attached to air and waterlines.

The majority (59.3%) preferred cleaning with surface disinfectant solutions, while 30.1% opted for autoclaving & only 1% reported having no preferred procedure.

About 91% of respondents recognized improper disposal of biomedical waste as a contributing factor to cross-infection. However, (7.1%) acknowledged this risk only sometimes, and (1.9%) did not consider it a concern.

When we compared the mean knowledge among gender distribution, no significant difference was found. Similarly, no significant differences were observed when comparing mean knowledge across professional status (general dentists and clinical oral specialists), type of practice (solo practice, group practice, and hospital-based practice), and duration of practice (less than 5 years, 5–10 years, and more than 10 years). (Table 4)

Table 1 – Awareness and concern about cross – infection among dentist in Bhopal City

Question	Response	n (%)
Use of universal precautions (Gloves, Masks, Protective Eyewear or Face Shield, and Gowns)	Always Sometimes Total	277 (88.8 %) 35 (11.2 %) 312 (100 %)
Avoiding exposure to sharp devices and contaminated instruments	Always Sometimes Never Total	291 (93.3 %) 18 (5.8 %) 3 (1 %) 312 (100 %)
Use of preoperative and operative mouth rinses	Always Sometimes Never Total	206 (66 %) 106 (34 %) 312 (100 %)
Use of High-Volume Suction	Always Sometimes Total	185 (59.3 %) 127 (40.7 %) 312 (100 %)
Use of Rubber-Dam	Always Sometimes Never Total	127 (40.7 %) 132 (42.3 %) 53 (17 %) 312 (100 %)
Improving the quality of dental unit waterlines	Always Sometimes Never Total	230 (73.7 %) 79 (25.3 %) 3 (1 %) 312 (100 %)
Keeping the instruments sterile until usage	Always Total	312 (100 %) 312 (100 %)

Table 2 – Perceived risk about cross-infection and the role of high aerosol suction in dental workplace setting

Questions	Responses	n (%)

Concern about the risk of Cross-Infection to themselves and their Dental Assistants	**Yes** **No** **Maybe** **Total**	**288 (92.3 %)** **15 (2.9 %)** **15 (4.8 %)** **312 (100 %)**
Do you believe high aerosol suction plays an important role in minimizing contamination of the treatment room by micro particle aerosols that contain significant microbial load?	**Yes** **Maybe** **Total**	**268 (85.9 %)** **44 (14.1 %)** **312 (100 %)**

Table 3 – Awareness about Microorganisms among dentist in Bhopal City

Questions	Response	n (%)
Which infectious agents do you consider important?	**HIV** **HBV, HCV** **Mycobacterium tuberculosis** **HIV, HBC, HCV** **All of the above** **Total**	**12 (3.8 %)** **9 (2.9 %)** **3 (1 %)** **15 (4.8 %)** **273 (87.5 %)** **312 (100 %)**
Are You Aware of the Different Microorganisms That Can Be Transmitted in the Dental Setting?	**Yes** **No** **Total**	**300 (96.2 %)** **12 (3.8 %)** **312 (100 %)**
Have you been vaccinated against hepatitis (HBV) as a cross-infection control measure?	**Yes** **No** **Total**	**277 (88.8 %)** **35 (11.2 %)** **312 (100 %)**
Do you take special care while handling dental patients suffering from HIV or Tuberculosis in your clinic?	**Always** **Sometimes** **Never** **Total**	**300 (96.2 %)** **12 (3.8 %)** **312 (100 %)**

Table 4 - Comparison of mean knowledge about cross-infection among dentists of Bhopal City based on Gender, Professional Status, Type of Practice, Duration of Practice

Characteristics		Mean ± SD	t value or f value	p - value
Gender	**Male**	**19.07 ± 2.89**	**0.185**	**0.854**
	Female	**19.011 ± 2.94**		
	General Dentist	**18.92 ± 2.90**		

Professional Status	**(BDS)**		**0.652**	**0.515**
	Clinical Oral Specialist (MDS)	**19.14 ± 2.93**		
Type of Practice	**Solo Practice**	**19.05 ± 2.92**	**0.035**	**0.966**
	Group Practice	**18.93 ± 3.14**		
	Hospital Based Practice	**19.06 ± 2.83**		
Duration of Practice	**Less than 5 years**	**19.04 ± 2.99**	**0.584**	**0.558**
	5 – 10 Years	**18.79 ± 2.99**		
	More than 10 Years	**19.32 ± 2.60**		

Figure 1- Awareness of Cross-infection among dentist in Bhopal city

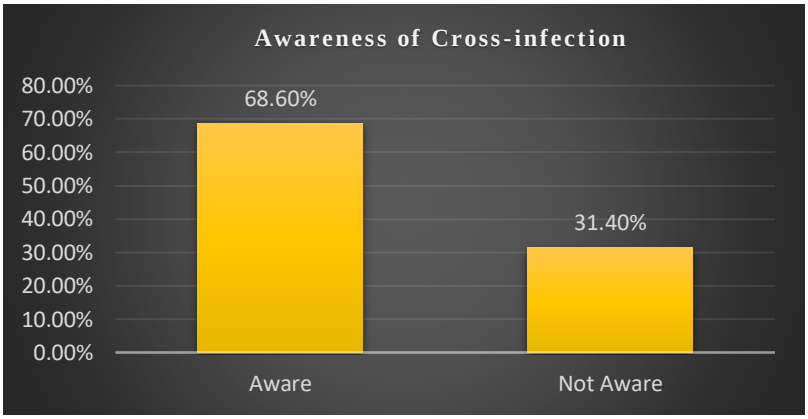


Figure 2 – Perception regarding cross-infection & HAI among dentist in Bhopal City

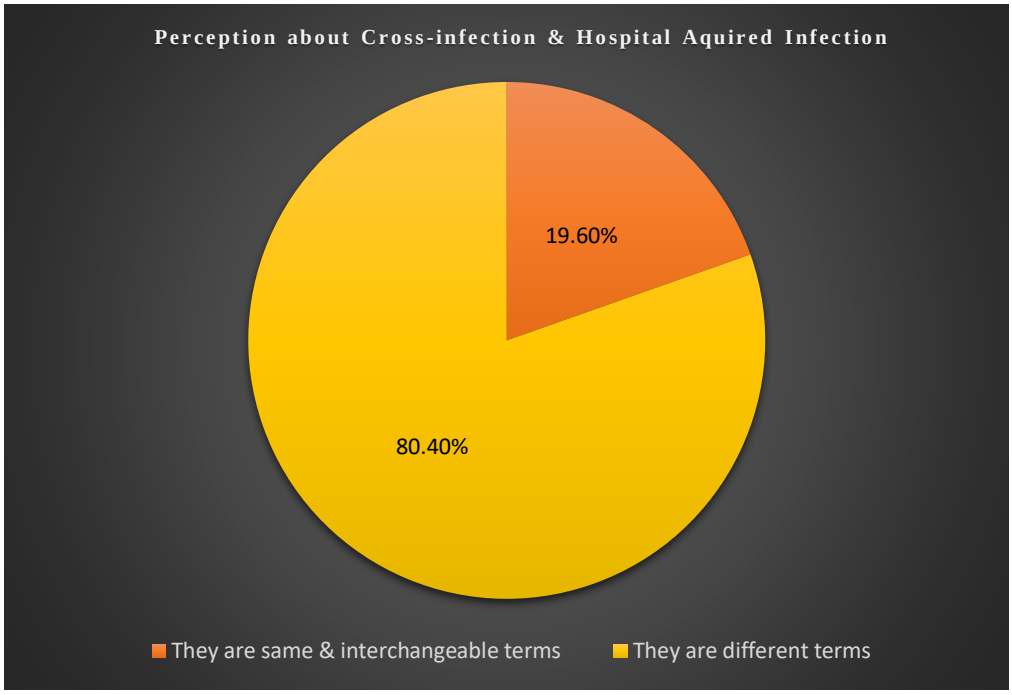
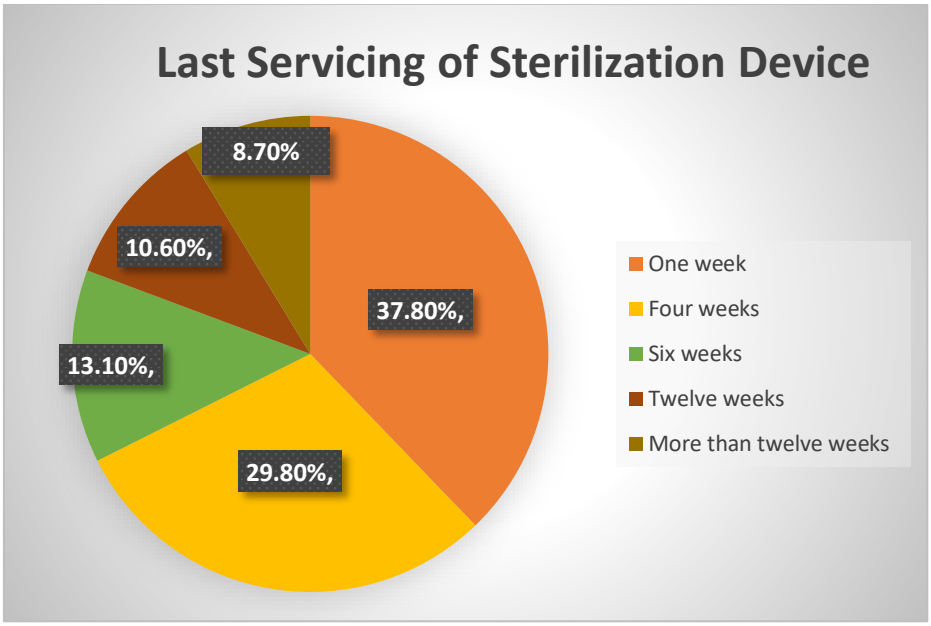


Figure 3 – Servicing of sterilization device in dental workplace setting



DISCUSSION

Effective biomedical waste management is essential in dental practice to prevent cross-infection and ensure environmental and occupational safety. Improper disposal of contaminated materials can lead to the spread of infectious diseases, posing risks to both healthcare workers and patients. This study assessed dentists' awareness and adherence to infection control measures, highlighting strengths in protective protocols while identifying gaps in sterilization practices and biomedical waste disposal.

In this study, the ratio of male and female participants was almost equal, suggesting balanced representation and minimizing the possibility of gender bias in the findings. There was no significant difference between the responses of male and female participants, so it did not affect the study design. The findings of the study indicate that most dentists demonstrated a strong understanding of various infection control practices, including the use of protective barriers, sterilization techniques, and biomedical waste disposal. Awareness of cross-infection and its risks was notably high, with

most respondents recognizing the importance of preventing contamination for both themselves and their assistants. Additionally, while most respondents could differentiate between cross-infection and hospital-acquired infections, some mistakenly viewed them as interchangeable, highlighting existing misconceptions. Forty-three percent of the participants were able to define "cross-infection" correctly in study done by Yüzbasioglu et al[7].

In previous study done by Al-Rabeah et al 100% of dentists use gloves and 90% of them use masks while treating their patients[8]. It was observed that a considerable proportion of dentists reported using a rubber dam only occasionally. Similar observations were made by Madarati and Gilbert et al, who noted that 62.7 and 53% of their respondents respectively did not utilize RD during endodontics procedures [9-10].

Nearly all participants recognized HIV, HBV, HCV, and Mycobacterium tuberculosis as key infectious agents, highlighting awareness of multiple transmission risks. While most adhered to strict cross-infection measures for HIV/TB patients, a few focused solely on HIV, and some reported occasional lapses in precautions, indicating gaps in infection control. Similarly in previous study by Qamar et al it was reported that in case of direct blood contact with a HIV patient, 62% would opt for anti-HIV immunoglobulins. During the work at a dental surgery, the use of face mask and gloves as an infection control measure was practiced by 38% while 32% would wear an eye protector, and only one-third of them (29%) would wear all of them[11].

The majority of dentists reported being vaccinated against HBV, while a subset remained unvaccinated, indicating a gap in preventive healthcare and increased occupational exposure risks. Similarly, most respondents were aware of microorganism transmission in dental settings, but a small fraction lacked awareness, highlighting the need for further training. Mahasneh AM et al. reported that 82.1% of participants were vaccinated against hepatitis B, with 34.4% of non-vaccinated individuals being dental support staff and 9.9% being dentists[12].

Most dentists used sterilized instruments within a week, while a few extended beyond six weeks. Sterilization devices were mostly serviced monthly, though some delayed beyond six weeks. Surface disinfectants were preferred for dental handpieces, while autoclaving was consistently used by about half. Mahasneh AM et al. reported 90.5% of respondents used autoclaves for instrument sterilization[12].

Most respondents recognized biomedical waste disposal as crucial for cross-infection prevention, though a few underestimated its importance. Osamong et al. found 52.4% of dentists incinerated pathological waste, while 28.6% disposed of it as general waste [13]
Overall, most respondents displayed commendable awareness and adherence to infection control practices, certain gaps in sterilization practices, protective measures, and cross-infection awareness underscore the need for further training and reinforcement of standardized protocols.

Limitations
The study's generalizability is limited due to convenience sampling and unequal sample distribution across dental practitioners. Additionally, reliance on self-reported data may introduce response bias, as participants might overestimate awareness or give socially desirable answers, making it difficult to assess actual adherence to cross-infection control protocols.

CONCLUSION
This study highlights a high level of awareness and adherence to cross-infection control among dentists in Bhopal, with most complying with universal precautions, sterilization practices, and biomedical waste management. However, variations were noted in sterilization maintenance, handpiece disinfection, and waste disposal, alongside gaps in vaccination and infection transmission knowledge among a small subset. Despite positive trends, occasional lapses underscore the need for continuous professional education, stricter adherence to protocols, and regular training to enhance compliance and ensure a safer clinical environment.

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