

Evaluation of Cross Infection Control in Dentistry; A Patients' Perception Study



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OBJECTIVE: To assess the perception of patients visiting a dental OPD in Karachi regarding cross infection control measures that should be taken in dental practice.

METHODOLOGY: A cross-sectional study was conducted at the OPD of Altamash Institute of Dental Medicine from January to August 2020. A total of 546 patients aged 20-75 years of either gender coming for routine dental check-ups were included in the study using non-probability convenience sampling. A well-structured and validated questionnaire was used to assess the knowledge, attitude and practices of patients regarding cross infection measures that should be present in dental practices. SPSS-25 was used to analyse the data. Descriptive statistics was used to calculate frequency and percentage of qualitative (gender, socioeconomic and education status, knowledge attitude and practice levels of patients) and quantitative variables (age groups). Chi-square test was used to detect the relation of patient's knowledge levels with potential factors like the age groups, gender, socioeconomic and education status. The p-value of (≤ 0.05) was considered as significant.

RESULTS: Out of the total participants, 79.1% had good knowledge about cross infection control measures in dental practice. Majority of the patients (84.6%) agreed that dentists should wear gloves during treatment, though majority were of the opinion that a dentist can treat several patients with the same set of gloves. About 4.9% of the patients said that they ask the dentist to wear face mask and gloves while treating them, and only 3.3% said that they ask the dentist about sterilization of instruments. The knowledge level of patients showed variation with their education status but not with respect to socioeconomic status, age and gender.

CONCLUSION: Although overall the patients visiting dental clinics had good perception and showed positive attitudes towards cross infection control, the dental health practitioners need to disseminate basic technical information about the infection-control practices required for safe dental practice to dental patients and the community at large.

KEYWORDS: cross infection, knowledge, dentist, dental patients, perception

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INTRODUCTION

Measures for cross infection control are an essential requirement for dental clinical practice. The dental clinic is considered a potential source of

spread of various infections due to the nature of the procedures undertaken.¹ It is crucial to provide patient safety in terms of cross infection by enhancing quality of care through recommended and universal steps of cross infection control.² Dental regulatory authorities globally emphasize on the importance of proper cross infection measures as the most basic and significant part of safe dental practice.^{1,3} Cross infection control was significantly highlighted in the field of dentistry post discovery of HIV in the year 1980 where six dentists were infected with HIV during dental practice.⁴ During dental treatment, the main reservoir for transmission of infection is blood and saliva, hence due to the nature of dental procedures, dental patients are highly prone to infectious disease transmitted through these routes.⁵ In addition, the transmission of infection during provision of dental care could also occur through aerosol and unsterilized

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instruments or needle stick injuries.⁶ Cross-infection in dental practise can occur with microbes including Hepatitis B Virus (HBV), Mycobacterium tuberculosis, herpes simplex virus (HSV 1 and 2), Hepatitis C Virus (HCV), mumps, rubella, influenza, cytomegalovirus (CMV), and HIV/AIDS.^{6,7} Additionally, many other communicable diseases have been part of global emergence and re-emergence.⁸ Respiratory Syndrome-Corona Virus, and Ebola are emerging agents and a reservoir of infection during practice.⁹⁻¹² Therefore, the exposure to saliva and blood are of great concerns for the patients and the dental practitioner.¹³ Since dental patients are highly vulnerable to get infectious diseases during their dental treatment if cross infection measures are not practiced by their health care provider, it is essential that their perception regarding what entails cross infection control and the standards that their dental practitioner should be following are assessed. Literature shows that patients have sufficient knowledge regarding usage of face mask, gloves, and goggles by dentist.^{14,15} Conversely, they have inadequate knowledge regarding the means of spread of HIV infection, Hepatitis-B, and use of autoclave.^{6,7} In addition, it was found that patients visiting dental clinic expect their dentist to adhere to cross infection protocols in the form of wearing gloves, masks and glasses.¹⁶ Although studies have been conducted on the knowledge, attitude and practice (KAP) of dentists regarding cross infection control, scant literature is available for these measures assessed in patients. It is imperative to identify patient's perceptions in this regard, which if found inaccurate could be modified with simple relevant awareness programs so they can become cognizant of the essential measure of cross infection control as well as identify and draw attention to any lapse in these when undergoing dental treatment by a dental care provider. The perception of patients regarding cross infection control will compel the health care providers to adopt the contemporary methods and acquire latest protective equipment and barriers in their clinical setup. This will further motivate the dentist to stay updated with recent infection control guidelines. Furthermore, the patient awareness will also aid in development of more enlightened dental practices where dentists and patients could strive together to curtail cross infection.

METHODOLOGY

This was a cross-sectional study conducted at the OPD of Altamash Institute of Dental Medicine from January, to August, 2020. The sample size was calculated using Open epi online sample size calculator by taking statistics for satisfactory knowledge as 32.5%¹⁷ margin of error as 5% and 95% confidence interval. The estimated sample size came

out as 546 participants. All the patients of age 20-75 years of either gender coming for routine dental check-ups and willing to be part of the study were included. The non-probability convenience sampling technique was used for recruiting participants. The study was approved by ethical and review board of Altamash Institute of Dental Medicine (AIDM/EC/06/2020/12).

The objective, consent statement for voluntary participations and declarations of anonymity and confidentiality was included in the questionnaire for all subjects to understand prior to their agreement. The Cronbach's alpha statistical analysis was used to assess the internal consistency (Reliability) of the questionnaire items and a strong correlation value of ($\alpha=0.76$) was recorded. Furthermore, face and content validity of items included were carried out by a group of researchers and dental specialists for accuracy and content relevance of the questionnaire. The study questionnaire was designed to evaluate the knowledge, attitude and practices of patient's regarding cross infection control. The questionnaire was translated in the local language. The first part of the questionnaire consisted of items related to socio-demographics, while the second part consisted of 14 questions to assess the knowledge of patients regarding cross-infection measures. Each correct response was scored as one. The score of 1-5 was labelled as poor knowledge, 6-10 as fair knowledge and 11-14 as good knowledge. The third and fourth part of questionnaire included questions regarding attitudes and practices.

The SPSS version 25 was used to analyse patient data. Descriptive statistics were performed to calculate frequency and percentage of qualitative variables (gender, socioeconomic and education status, knowledge, attitude and practice levels of patients) while mean and standard deviation was computed for quantitative variables (age groups). Chi-square test was used to detect any association of patient's knowledge levels with potential factors like the age groups, gender, socioeconomic and education status. The p-value of ≤ 0.05 was considered as significant.

RESULTS

The mean age of the participants was 37.29 ± 13.03 years ranging from 20-70 years. Majority of them were females ($n=312$, 57.1%) as compared to males ($n=234$, 42.9%). Of the total participants, 351 (64.3%) had middle income level (50,000-70,000 PKR monthly income), 159 (29.1%) had high income level ($>70,000$ PKR monthly income) and 36 (6.6%) had low income level ($<50,000$ PKR monthly income).¹⁸ Out of 546 participants, 471(86.3%) were highly educated (education of more than primary level) and 75(13.7%) were not educated (Illiterate; who could not read or write).

The questions to assess knowledge of cross infection and infection control are given in Table 1. About 79.1% of the participants had good knowledge, 16.5% had fair knowledge and 4.4% had poor knowledge respectively.

Table 1: Knowledge of cross infection and infection control (n=546)

Questions	Correct		Incorrect	
	N	%	n	%
An acceptable method of infection control used for washing instrument is using antiseptic.	444	81.3	102	18.7
One method of sterilization is boiling dental instruments for 15 to 20 minutes in water.	471	86.3	75	13.7
There are other methods of sterilization besides boiling, like Autoclave.	471	86.3	75	13.7
Operation knife blades and injection needles are reusable.	483	88.5	63	11.5
It is necessary to wear gloves during dental procedure	432	79.1	114	20.9
Dentists should wear gloves to prevent cross infection from other patients	471	86.3	75	13.7
It is necessary to wear facemasks during dental procedure	429	78.6	117	21.4
Dentists should wear facemasks to prevent cross-infection from patient to dentist	447	81.9	99	18.1
HIV/AIDS infection can be transmitted through dental treatment	450	82.4	96	17.6
HCV/HBV can be transmitted through dental treatment	471	86.3	75	13.7
HIV/AIDS can be transmitted from one patient's saliva to the other patient	390	71.4	156	28.6
HCV/HBV can be transmitted from one patient's blood to the other patient or dentist	444	81.3	102	18.7
TB infection can be transmitted from dentist to patient	465	85.2	81	14.8
TB infection can be transmitted through drinking water at dental clinics	411	75.3	135	24.7
OVERALL KNOWLEDGE				
Poor knowledge (1-5 Correct Responses)	24 (4.4%)			
Fair knowledge (6-10 Correct responses)	90 (16.5%)			
Good Knowledge (11-14 Correct responses)	432 (79.1%)			

Table 2: Comparison of knowledge with potential factors (n=546)

FACTORS	Knowledge			p-value
	Poor	Fair	Good	
Age groups				0.369
<30 years	6	42	150	
≥30 years	18	48	282	
Gender				0.166
Male	18	39	177	
Female	6	51	255	
Socio-economic status				0.584
Low	0	6	30	
Middle	21	63	276	
High	3	21	135	
Education status				0.001
Uneducated	24	33	18	
Educated	0	57	414	

No statistically significant difference ($p > 0.05$) was found between knowledge and age, gender and socio-economic level of the participants. However, majority of the educated participants had good level of knowledge as compared to the lesser educated patients and the relationship was statistically significant ($p > 0.05$) (Table 2).

Regarding the attitude of the participants towards infection control in dental clinics, about 89% of the patients agreed that dentists should wear goggles and 84.6% of the patients agreed that dentists should wear gloves during treatment, however 84.6% were of the opinion that a dentist can treat several patients with the same set of gloves. (Table 3).

Table 3: Attitudes of patients about the infection control measures (n=546)

Items	Agree	Disagree	Neutral
Dentists should be given HBV vaccines.	n 459	12	75
	% 84.1	2.2	13.7
Before some procedures, dentists must give certain patients prophylactic antibiotics.	n 453	21	72
	% 83.0	3.8	13.2
Dentists should always wear gloves while patients are being treated.	n 462	12	72
	% 84.6	2.2	13.2
Upon receiving calls on phone, dentists should change gloves.	n 453	21	72
	% 83.0	3.8	13.2
Dentists may use the same gloves on more than one patient.	n 462	18	66
	% 84.6	3.3	12.1
When treating patients' dentists should always wear face mask.	n 444	21	81
	% 81.3	3.8	14.8
When handling patients' dentists should wear eye goggles.	n 486	6	54
	% 89.0	1.1	9.9
Often, dentists should be using new set of gloves during long treatment.	n 423	48	75
	% 77.5	13.7	77.5

The self-reported practices of participants towards infection control measures in dental clinics are given in Table 4. About 4.9% of the patients said that they asked the dentist to wear face mask and gloves while treating them and only 3.3% said they asked the dentist about sterilization of instruments.

Table 4: Practices of patients towards infection control measures in dental clinics (n=546)

Items	No experience	No, I am shy	No, I am afraid	No, I do not mind	Yes
I should ask the dentist how the instruments are being sterilized	438 (80.2%)	33 (6%)	24 (4.4%)	33 (6%)	18 (3.3%)
I should point it out to the dentist if they don't wear a face mask	429 (78.6%)	18 (3.3%)	33 (6%)	39 (7.1%)	27 (4.9%)
I should point it out to the dentist if they don't wear gloves.	438 (80.2%)	15 (2.7%)	36 (6.6%)	30 (5.5%)	27 (4.9%)

DISCUSSION

This is the first study conducted in Karachi regarding cross-infection control perceived awareness of patients in dentistry and the results of the current study validate the findings of studies conducted in other countries. The study results affirm that majority of the dental patients had good knowledge regarding infection control, which is pivotal in the face of the current COVID-19 pandemic. The patients were also aware of the potential for transmission of TB, HCV/HBV infections during dental treatment. In a Sri Lankan study, dental patients showed same level of knowledge regarding infection control as seen in our study, and also explained their hesitation in taking dental treatment due to potential risk of transmission of diseases like HIV and HBV.¹⁸ In another research, dental patients who attended dental clinics in Saudi Arabia showed poor knowledge regarding dental infections in dentistry.¹⁷ Similarly, dental patients residing in Sudan also showed poor knowledge about HIV/AIDS.¹⁹ In a study conducted in Jordan,²⁰ 76.8% dental patients mentioned HIV transmission was through using needles that were previously used in patients infected with AIDS.

All dentists are expected to wear gloves as per the recommendations from the Centre for Disease Control and Prevention.²¹ In current study, the majority of dental patients believed that the dentist should wear gloves while treating patients. This result was lower as compared to an Indian study, in which 97.7%, 93.5%, and 43.6% of the patients believed that dentist should wear gloves, face masks, and eye goggles respectively, when treating patients.²² The present findings are also in agreement with a Nigerian study²³ wherein 88.8% dentists were expected to wear gloves while treating their patients and also other similar studies.^{24,25} However, studies conducted previously^{26,27} show low percentages of patients expecting dentist to wear gloves which could be because although donning gloves was recommended but was not considered necessary during dental procedures in the past, and hence dentistry was practiced without the use of gloves for every procedure. Due to current cross infection recommendations, wearing gloves for dental procedures is considered standard of care. As a result of advancement in general knowledge and global awareness programs making patients more aware of cross infection control protocols, we see the change in the perception of patients regarding the necessity of wearing gloves by dentists while performing dental procedures.

The results also showed high awareness and knowledge of patients in the local context with regards to sterilization of instruments and cross-infection control protocols cross-infection control protocols. They may be concerned

that these protocols are not being followed in dental practices and hence may be hesitant in undergoing dental treatment. The results are in agreement with other studies assessing patients' knowledge about instrument sterilization.²⁸ Conversely, another study demonstrated inadequate knowledge of patients regarding sterilization of dental instruments. Our study found that 85% of patients believed boiling water was a method of sterilization that can be used in dentistry, which is alarming since the recommended methods of sterilization for critical dental instruments include autoclaving, dry heat or heat/chemical vapour under monitored conditions, and boiling is no longer considered an appropriate sterilization method.¹⁸

According to the current study results, no statistically significant difference was found between knowledge and age, gender and socio-economic level of the participants. However, majority of the educated participants had good level of knowledge as compared to lesser educated participants and the relationship was statistically significant. The results of this study validate the findings of other similar studies.^{16,17} Overall, the present study demonstrates a good knowledge score and a positive attitude of patients towards cross infection procedures in dentistry, however their knowledge was inadequate regarding the actual practices in this regard. This is noteworthy that despite having satisfactory knowledge and positive attitude, the patients are still hesitant to ask their dentist regarding sterilization of instruments, or wearing masks or gloves. It is essential that the patients be made aware of their rights in inquiring from the dentist about the cross infection measures that they follow in their clinic, and if any deficiency in this regard is observed, be knowledgeable enough to draw the attention of their dental care provider to that aspect.

Some of the limitations of this study are that it only depicts the perceptions of patients presenting in one Dental OPD of Karachi. Therefore, the results from this study cannot be generalized to the whole city or country. Multicenter studies need to be conducted to include perceptions of the larger population. Also since patients living in a metropolis such as Karachi may be considered more aware of cross infection control measures and practices, the same cannot be said for the rural areas. Literature related to identifying the reasons due to which patients are hesitant or refrain from asking their dentist about their cross infection control measures is scarce. Therefore, within the limitation of this study, it is recommended to conduct in-depth studies in this context.

CONCLUSION AND RECOMMENDATIONS

Although overall the patients visiting dental clinics had good perception and showed positive attitudes towards cross

infection control, it was found that they still need to have better basic technical information about the infection-control practices needed for safe dental practice. In this regard, patient awareness programs and seminars could be arranged by the community of dental health professionals to raise awareness in patients regarding oral health care, attending dental practices and about the essential minimal cross infection measures that should be expected and followed in a dental clinic, so that apprehensions about cross infection and contracting any disease due to dental procedures can be alleviated in the community. The same could be conducted through various media campaigns. The patients should be encouraged to question the practices of their dentist related to cross infection control measures so the whole community can work together to prevent the spread of infection through dental practices.

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CONFLICT OF INTEREST

There was no conflict of interest.

REFERENCES

1. Taiwo J, Aderinokun G. Assessing cross infection prevention measures at the Dental Clinic, University College Hospital, Ibadan. *Afr J Med*. 2002;31:213-7.
2. Yamalik N, Van Dijk W. Analysis of the attitudes and needs/demands of dental practitioners in the field of patient safety and risk management. *Int Dent J*. 2013;63:291-7.
<https://doi.org/10.1111/idj.12081>
3. Nagraj SK, Eachempati P, Paisi M, Nasser M, Sivaramakrishnan G, Verbeek JH. Interventions to reduce contaminated aerosols produced during dental procedures for preventing infectious diseases. *Cochrane Database Syst Rev*. 2020;12:CD013686.
<https://doi.org/10.1002/14651858.CD013686.pub2>
4. Bray F, Chapman S. AIDS and dentistry in Australia: knowledge, infection control practices and attitudes to treatment in a random sample of Australian dentists. *J Commun Health Res*. 1990;14:384-93.
<https://doi.org/10.1111/j.1753-6405.1990.tb00049.x>
5. Rustage K, Rothwell P, Brook I. Evaluation of a dedicated dental procedure glove for clinical dentistry. *Br Dent J*. 1987;163:193-95.
<https://doi.org/10.1038/sj.bdj.4806240>
6. Baseer MA, Rahman G, Yassin MA. Infection control practices in dental school: A patient perspective from Saudi Arabia. *Dent Res J*. 2013;10:25-30.
7. Singh A, Purohit BM, Bhambal A, Saxena S, Singh A, Gupta A. Knowledge, attitudes, and practice regarding infection control measures among dental students in Central India. *J Dent Educ*. 2011;75:421-27.
<https://doi.org/10.1002/j.0022-0337.2011.75.3.tb05055.x>
8. Bueno-Marí R, Almeida A, Navarro JC. Emerging zoonoses: eco-epidemiology, involved mechanisms, and public health implications. *Front Public Health*. 2015;3:157.
<https://doi.org/10.3389/fpubh.2015.00157>
9. Abbasi MS, Ishfaq M, Ahmed N, Rahman MA, Kanwal Y, Ahmed N, Irfan AB. Awareness of Denture Cleansers and its Recognition among Dental Professionals. *J Bahria Uni Med Dental Coll*. 2020;10:211-4
10. Ahmed MA, Jouhar R, Ahmed N, Adnan S, Aftab M, Zafar MS, et al. Fear and practice modifications among dentists to combat Novel Coronavirus Disease (COVID-19) outbreak. *Int J Environ Res Public Health*. 2020;17:2821.
<https://doi.org/10.3390/ijerph17082821>
11. Ahmed N, Shakoor M, Vohra F, Abduljabbar T, Mariam Q, Rehman MA. Knowledge, Awareness and Practice of Health care Professionals amid SARS-CoV-2, Corona Virus Disease Outbreak. *Pak J Med Sci*. 2020; 36(COVID19-S4): S49-S56.
<https://doi.org/10.12669/pjms.36.COVID19-S4.2704>
12. Maqsood A, Shah R, Sarfaraz S, Irfan AB, Faisal A, Fatwani H. Healthcare workers knowledge, practices and stress level amid COVID-19 pandemic. *Pak Armed Forces Med J*. 2020;70:S244-50.
13. Tada A, Watanabe M, Senpuku H. Factors influencing compliance with infection control practice in Japanese dentists. *Int J Occup Environ Med*. 2014;5:24-31.
14. Arif Z, Butt SA, Pirvani M, Shaikh AA, Niaz AT, Khan S. Knowledge, attitude and practice regarding infection control procedures among dentists of Karachi. *J Adv Med*. 2019;30:1-7.
<https://doi.org/10.9734/jammr/2019/v30i830224>
15. Oberoi SS, Marya CM, Sharma N, Mohanty V, Marwah M, Oberoi A. Knowledge and attitude of Indian clinical dental students towards the dental treatment of patients with human immunodeficiency virus (HIV)/acquired immune-deficiency syndrome (AIDS). *Int Dent J*. 2014;64:324-32.
<https://doi.org/10.1111/idj.12122>
16. Barlean L, Saveanu I, Balcos C. Dental patients' attitudes towards infection control. *Rev Med Chir Soc Med Nat Iasi*. 2014;118:524-27.
17. Ibrahim NK, Alwafi HA, Sangoof SO, Turkistani AK, Alattas BM. Cross-infection and infection control in dentistry: Knowledge, attitude and practice of patients attended dental clinics in King Abdulaziz University Hospital, Jeddah, Saudi Arabia. *J Infect Public Health*. 2017;10:438-45.
<https://doi.org/10.1016/j.jiph.2016.06.002>
18. <https://www.pbs.gov.pk/content/pakistan-social-and-living-standards-measurement>.

18. Biradar SV, Narayan DP. Occupational Hazards in Dentistry - A Review. *Asian J Pharma Tech Innov (AJPTI)*. 2018;6:67-73.
19. Nasir EF, Astrom AN, David J, Ali RW. Utilization of dental health care services in context of the HIV epidemic-a cross-sectional study of dental patients in the Sudan. *BMC Oral Health*. 2009;9:30. <https://doi.org/10.1186/1472-6831-9-30>
20. Barghout N, Al Habashneh R, Ryalat ST, Asa'ad FA, Marshdeh M. Patients' perception of cross-infection prevention in dentistry in Jordan. *Oral Health Prev Dent*. 2012;10:9-16.
21. Deogade SC, Mantri SS, Sumathi K, Dube G, Rathod JR, Naitam D. Perceptions of dental outpatients toward cross-infection control measures in Jabalpur city. *J Indian Assoc Public Health Dent*. 2016;14:338-43. <https://doi.org/10.4103/2319-5932.189836>
22. Bebermeyer RD, Dickinson SK, Thomas LP. Personnel Health Elements of Infection Control in the Dental Health Care Setting-A Review. *Dent Assis*. 2006;75:37-8.
23. Otuyemi O, Oginni A, Ogunbodele E, Oginni F, Olusile A. Patients' attitudes to wearing of gloves by dentists in Nigeria. *East Afr Med J*. 2001;78:220-2. <https://doi.org/10.4314/eamj.v78i4.9068>
24. Yorden K. Patients' attitudes towards the routine use of rubber gloves in a dental office. *J Indiana Dent Assoc*. 1985;64:25-8.
25. Burke F, Baggett F, Wilson N. Patient attitudes to the wearing of gloves by dentists. *Dental Update*. 1991;18:261-4.
26. Grace E, Cohen L, Ward M. Patients' perceptions related to the use of infection control procedures. *Int J Clin Prev Dent*. 1991;13:30-3.
27. Peng X, Xu X, Li Y, Cheng L, Zhou X, Ren B. Transmission routes of 2019-nCoV and controls in dental practice. *Int J Oral Sci*. 2020;12:1-6. <https://doi.org/10.1038/s41368-020-0075-9>
28. Samaranyake L, McDonald K. Patient perception of cross-infection prevention in dentistry. *Oral Surg Oral Med Oral Pathol*. 1990;69:457-60. [https://doi.org/10.1016/0030-4220\(90\)90379-7](https://doi.org/10.1016/0030-4220(90)90379-7)
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