

Cross-Infection Control Practices among Dental Undergraduates and Graduates in Prosthodontics- A Survey in Dental Colleges of Karachi

Muneeb Ahmed Lone¹, Bharat Kumar², Samina Kanwal³, Farnaz Ilyas⁴,
Nadia Sultan⁵, ZilleHuma⁶, Maham Muneeb Lone⁷

Abstract

Objective: To assess cross-infection control practices among undergraduates and graduates working in the department of Prosthodontics in various dental colleges of Karachi.

Methods: This cross-sectional descriptive study was conducted after approval from IRB. The self-administered questionnaire was sent via emails or social media platforms to undergraduate final year students and graduates currently working in Prosthodontics department of dental colleges of Karachi. Along with demographics, the questionnaire included close ended multiple-choice questions related to participants' practice regarding cross infection control. A reminder was sent after 2 weeks to help improve response rate. Statistical analysis was performed using SPSS version 23.

Results: Out of total of 706 forms, 617 respondents submitted completely filled forms; a response rate of 87.4%. There were 410 (66.5%) final year students and 207 (33.5%) house officers. Majority of participants 502 (82.3%) had attended lecture regarding cross-infection control measures during their academic years, while only 178 (28.8%) had attended hands-on workshops on the same. Majority 530 (85.9%) recommended autoclave for sterilization for instruments but only around half the participants 311 (50.4%) were aware of the correct temperature and pressure recommended in autoclave for sterilization. Almost all participants 603 (97.7%) wear gloves and perform hand hygiene 527 (85.4%). More than two-thirds 416 (67.4%) respondents disinfect impressions, trial wax dentures, bite registrations and metal trials before sending to the dental laboratory. Around 50% of participants did not disinfect plastic impression trays, shade guide, rubber bowl, wax knife, carver and spatula in between patients.

Conclusion: A large majority of participants in our study adhered to universal precautions when dealing with patients i.e. use of gloves, mask and hand washing before and after wearing gloves. Comparatively, disinfection of instruments, materials and dentures before sending them to laboratory is neglected. There is a need to re-emphasize cross-infection control measures and practices in Prosthodontics OPD to minimize disease spread as much as possible.

Keywords: Infection control, Prosthodontics, Sterilization, Disinfection

IRB: Approved by the Institutional Review Board of Dow University of Health Sciences. Ref# IRB-2275/DUHS/Approval/2021/811. Dated: 12th April 2022.

Citation: Lone MA, Kumar B, Kanwal S, Ilyas F, Sultan N, ZilleHuma, Lone MM. Cross-Infection Control Practices among Dental Undergraduates and Graduates in Prosthodontics- A survey in Dental Colleges of Karachi [Online]. *Annals ASH & KMDC* 2022;27.

(ASH & KMDC 27(4):132;2022)

Introduction

Infection control is a key concept in contemporary era of dentistry. Cross infection is defined as “transfer of microorganisms like bacteria, viruses and other pathogens between patients, clinicians a-

^{1,3} Department of Prosthodontics, Dr. Ishrat-ul-Ibad Khan Institute of Oral Health Sciences, Dow University of Health Sciences

² Department of Prosthodontics, Dow International Dental College, Dow University of Health Sciences

⁴ Department of Prosthodontics, Bahria University Dental College

⁵ Department of Periodontics, Dr. Ishrat-ul-Ibad Khan Institute of Oral Health Sciences, Dow University of Health Sciences

⁶ Department of General Medicine, Dow University of Health Sciences

⁷ Department of Operative Dentistry, Sindh Institute of Oral Health Sciences, Jinnah Sindh Medical University

Correspondence: Dr. Muneeb Ahmed Lone
Department of Prosthodontics,
Dr. Ishrat-ul-Ibad Khan Institute
Email: muneeb.ahmed@duhs.edu.pk
Date of Submission: 3rd October 2022
Date of Acceptance: 29th November 2022

nd other healthcare workers in a clinical or laboratory setting”. Cross-infection control measures are designed to prevent transmission of microorganisms in dental clinics and laboratories¹. Dentists, dental staff and patients are at risk of acquiring Hepatitis B, C, Human Immune Deficiency Virus (HIV) and other communicable diseases through cross infection. These diseases may be transmitted from patient to dentist, or other personnel involved in dental care including dental surgery assistants and laboratory personnel².

In dental clinics infection can be transferred through blood, oral fluids, and nasal and oral mucosa droplets. Contaminated equipment and instruments can also be a source of cross infection. Cross infection control helps to prevent transmission of path-

ogenic micro-organisms from patient to patient, practitioner to patient and patient to practitioner³.

Prosthodontists and their patients are relatively at an added risk of infection transmission as infection can spread at clinic and also while working in the laboratory⁴. According to Centers for Disease Control and Prevention (CDC) guidelines, to minimize risk of cross infection, all instruments should be pre-cleaned and then sterilized in between patients. Some instruments used in the Prosthodontic clinic and laboratory may be damaged if sterilized and are therefore disinfected instead. These include shade guides, mixing spatulas, occlusal plane indicators, facebow, articulators, waxknives, polishing wheels etc. Similarly, casts, prostheses, record bases and occlusal rims are disinfected to reduce pathogenic micro-organisms on their surface⁵. This is essential as these can transmit bacteria from clinic to laboratory area and vice versa. According to a study, around 67% materials sent to Prosthodontics laboratory were contaminated with pathologic microorganisms⁶.

In the past two years the world became severely affected by Corona virus (COVID-19) pandemic, making patients even more anxious about getting dental treatment done without proper cross infection control measures⁷. In dentistry, specifically in Prosthodontics, dentists are exposed to infections through aerosol-generating dental equipment i.e. high-speed hand piece, air-water syringes, or via prosthodontic materials and instruments contaminated with an infected patients' saliva⁸.

Cross infection control measures are taught to students during undergraduate training, but it has been observed that they do not adhere to these protocols strictly⁹. Several studies done in international settings report that students have more theoretical knowledge on infection control as compared to its implementation in clinical practice¹⁰. Therefore, the importance of practicing cross infection control protocols should be reiterated to all personnel (dental undergraduate students, postgraduate students and auxiliary staff), so that they are followed meticulously by them when treating patients.

Prosthodontists are at a high risk of exposure to infection because of direct contact with patients during prosthetic treatment (aerosols generation from highspeed handpieces, salivary exposure during digital and conventional impressions, contaminated acrylic debris from dentures and temporary restorations). Indirect contact by impressions, fixed and removable prosthetic appliances and dental casts exposes the dental laboratories and dental technicians to infections^{4, 5}. To minimize crossinfection, preventive measures i.e. personal protective equipment, surface disinfection and hand washing should be practiced by dentists and their auxiliary staff at all times.

Even though studies have been done regarding infection control, to the best of our knowledge none of the studies have been conducted to assess the infection control practices in Prosthodontics department in various dental colleges of Karachi. The aim of the study was to assess the practice of cross infection control among undergraduates and graduates working in the department of Prosthodontics in various dental colleges of Karachi.

Subject and Method

A cross sectional study was conducted in department of Prosthodontics in dental colleges of Karachi over a period of one month after approval from Institutional Review Board (Ref #IRB-2275/DUHS/Approval/2021/811). Approval was taken from the head of all the dental colleges before their students and graduates were included in the study. The colleges of Karachi that were included for data collection were Dr. Ishrat-ul-Ebad Institute of Oral Health Sciences, Sindh Institute of Oral Health Sciences, Baqai Dental College, Fatima Jinnah Dental College and Hamdard Dental College. The participants included final year undergraduate students and dental graduates who were currently working in the Prosthodontics OPD of these dental colleges of Karachi. Participants who did not give consent to be included in the study were excluded from the study sample. The questionnaire was distributed by non-probability purposive sampling. The questionnaire was adapted from previous research conducted

on the relevant topic⁵. Few changes in the questionnaire were made by the help of subject specialists to ensure content validity. As the questionnaire had not been carried out in local settings, a pilot study was conducted on 30 participants who fulfilled the inclusion criteria. After they filled out the questionnaire, they were questioned directly by the principal investigator to gather their feedback. Ambiguous/ unclear questions were rephrased, the changes made and this was then incorporated into the final questionnaire before being disseminated to the study participants of various colleges.

The self-administered questionnaire consists of three parts. Part one recorded the informed consent of the participants. Once they consented to be a part of the study, part two inquired about demographic details of the participants. Part three included close ended multiple-choice questions related to the participants' practice regarding cross infection control in the Prosthodontic OPD.

The questionnaire link was sent to the final year coordinators of the public and private dental colleges. They were requested to disseminate the link among their students/ graduates who fulfilled the inclusion criteria either through emails or social media platforms such as WhatsApp®. A reminder was sent to the coordinators to remind their students after 2 weeks to help improve response rate. Email address of the primary investigator was provided to the study participants to clear any query they may have during filling out the form.

In a study conducted in Karachi, dental health care professionals reported that 40.8% of them use eye wear when working on patients¹¹. Using this percentage (40.8%) as the outcome variable, at 99% confidence interval, 80% power and 5% margin of error, the sample size came out be 588 participants via OpenEpi v.3.0 sample size calculator. Inflating this number by 20% to cater for nonresponders and incomplete forms, the sample size targeted was 706. For statistical analysis, SPSS version 23 (SPSS Inc., USA) was used. Mean \pm S-D of age of participants was computed. Frequencies and percentages of categorical variables i.e. baseline characteristics of our study population (age,

gender, type of dental college, undergraduate student or graduate) and the response of participants to the questions on practice of cross infection control in the Prosthodontics OPD were computed.

Results

Out of total of 706 forms, 617 respondents completely filled and submitted the forms, response rate was 87.4%. There were 115 (18.6%) males and 502 (81.4%) female participants with mean age of 22.3 ± 1.7 years. The participants included 410 (66.5%) final year dental students and 207 (33.5%) house officers. Three hundred and twenty-nine (53 %) participants were from private and 288 (47%) were from public dental institutes.

Majority of participants 502 (82.3%) had attended lecture regarding cross-infection control measures during their academic years, while only 178 (28.8%) had attended hands-on workshops about cross- infection control. Majority of the participants 530 (85.9%) recommended autoclave for sterilization for instruments, followed by chemical 46 (7.5%), dry heat 28 (4.5%) and boiling water 13 (2.1%). Only around half the participants 311 (50.4%) were aware of the correct temperature and pressure recommended in an autoclave for sterilization.

The response to questions on practice of cross-infection control are shown in Table 1. Table 2 shows the response of participants regarding their personal protection while treating patients. Majority 603 (97.7%) of the participants wear gloves and perform hand hygiene 527 (85.4%) wash hands before and after wearing gloves. Around 577 (93.5%) participants always use face masks. Majority of the respondents 494 (80.1%) were vaccinated for Hepatitis B.

More than two-thirds 416 (67.4%) participants responded that they disinfect the impressions, trial wax dentures, bite registrations and metal trials before sending to the dental laboratory for further processing. A large number 451 (73.1%) of participants disinfect dentures at time of insertion and post insertion for adjustment. Among all the participants almost 50% of them disinfect the plastic im-

pression trays while half of them did not disinfect shade guide, rubber bowl, wax knife, carver and spatula. A large majority 446 (72.28%) of participants always sterilized their hand pieces, burs 517 (83.79%) and metallic impression trays

566 (91.73%). The rest of the responses to disinfecting items before sending to dental laboratory, disinfection of items between patients and sterilization of items to be used for Prosthodontics OPD are shown in Table 3.

Table 1. Response to questions on Practice of cross-infection control in the Prosthodontics OPD.

	Yes n (%)	No n (%)	Sometimes n(%)
Take history of communicable diseases	552 (89.5)	32 (5.2)	33 (5.4)
Ask patients for screening of communicable diseases	459 (74.4)	78 (12.6)	80 (13.0)
Use of disposable instruments for patients with communicable diseases	406 (65.8)	145 (23.5)	66 (10.7)
Separate dental unit for known patients with communicable disease	337 (54.6)	267 (43.3)	13 (2.1)
Disinfection/use plastic wrap for isolation of dental unit surfaces	454 (73.6)	95 (15.4)	68 (11.0)
	Yes n (%)	No n (%)	Don't Know n(%)
Displayed Cross-Infection Control instructions in the Prosthodontics Department	405 (65.6)	149 (24.1)	63 (10.2)
Proper waste disposal system in the Prosthodontics Department	462 (74.8)	88 (14.2)	67 (10.8)

Table 2. Use of personal protective equipment when treating patients

	Yes n (%)	No n (%)	Sometimes n(%)
Wearing Gloves	603 (97.7)	05 (0.8)	09 (1.5)
Hand washing before & after wearing gloves	527 (85.4)	28 (4.5)	62 (10.0)
Wearing face mask	577 (93.5)	09 (1.5)	31 (5.0)
Wearing gown/ apron	423 (68.6)	113 (18.3)	81(13.1)
Using protective eye-glasses	269 (43.6)	252 (40.8)	96(15.6)

Table 3. Disinfection and sterilization of various items used in the Prosthodontics OPD

	Yes n (%)	No n (%)	Sometimes n(%)
Disinfection of items before sending to dental laboratory:			
Impressions	416 (67.4)	66 (10.7)	135 (21.9)
Cast	398 (64.5)	141 (22.9)	78 (12.6)
Trial dentures	436 (70.7)	130 (21.1)	51 (8.3)
Bite registrations	419 (67.9)	137 (22.2)	61 (9.9)
Metal trials	378 (61.3)	113 (18.3)	126 (20.4)
Dental prosthesis	451 (73.1)	112 (18.2)	54 (8.8)
Articulators	264 (42.8)	237 (38.4)	116 (18.8)
Disinfection of items between patients:			
Indelible pencil	258 (41.8)	271 (43.9)	88(14.3)
Shade guide	213 (34.5)	309 (50.1)	95(15.4)
Rubber bowl	198 (32.1)	329 (53.3)	90(14.6)
Spatula	244 (39.5)	311 (50.4)	62(10.0)
Wax knife	213 (34.5)	314 (50.9)	90(14.6)
Plastic impression trays	342 (55.4)	209 (33.9)	66(10.7)
Face bow	263 (42.6)	281 (45.5)	73(11.8)
Sterilization of items before being used on patients:			
High speed hand piece	446 (72.3)	106 (17.2)	65(10.5)
Burs	517 (83.8)	62 (10.0)	38 (6.2)
Metal impression trays	566 (91.8)	31 (5.0)	20 (3.2)
Facebow fork	405 (65.6)	133 (21.6)	79(12.8)
Fox occlusal plane	401 (65.0)	129 (20.1)	87(14.1)

Discussion

Measures for cross infection control are an essential requirement for dental clinical practice. This study was conducted to assess practice of cross-infection control among final year students and house surgeons. Emphasis on cross infection control procedures in the Prosthodontics OPD is essential as it prevents the spread of infection to all dental health care professionals including patients, staff as well as dental auxiliaries.

In the present study, about 90% of the participants took history of communicable diseases prior to commencing treatment, which is similar to results of other studies reporting 92% and 89% of subjects taking pre-treatment disease history^{12,13}. Around 75% subjects of this study asked patients for screening of communicable diseases which is far less as compared to a study by Hakam *et al.* where 98% participants carried out routine screening of their patients before Prosthodontic procedures⁵. In our study, only 65.8% participants used disposable instruments in patients with communicable diseases which is an alarming number and needs to improve for better cross infection control measures. A study in Karachi reported compliance by 97.3% of the subjects to isolate dental surfaces for preventing cross-infection. In contrast, only three-fourth of the participants of this study use plastic wrap for isolation of dental unit surfaces¹⁴. These results indicate that the measures taken to control cross-infection are below the level of standard care. Newer infection control practices and policies should be introduced like a cross-infection control administrator that will observe and keep an eye on infection control activities in health care centers.

Results of this study reported that 82.3% participants have attended lecture during their academic years and only 28% have attended hands-on workshop regarding cross-infection control measures. A study conducted in Jeddah, Saudi Arabia showed similar results of having 33.4% of participants who were professionally trained about waste disposal¹⁵.

Studies conducted in Jharkand and Faridabad regarding the knowledge of sterilization protocol in undergraduate dental students showed that 91% and 89% students knew the standard method and temperature required for sterilization of instruments^{16,17}. Even though majority of the participants in our study recommended autoclave for sterilization for instruments, only around half of them (50%) were aware of the correct temperature and pressure recommended in an autoclave. This highlights the importance of academic sessions about infection control with emphasis on sterilization during the educational years to ensure students carry out correct cross-infection control practices. Lectures, as well as hands-on workshops regarding cross-infection control, disinfection and sterilization should be included as a mandatory part of curriculum and be reiterated in continuing dental education seminars.

A large majority number of participants in our study wore gloves (97.7%), mask (93.5%) and practiced hand washing before and after wearing gloves (85.4%). In 2017, a cross-sectional survey conducted in Punjab, Pakistan showed comparatively similar results reporting 98.5%, 49.3% and 84.6% subjects wore gloves, mask and washed hands after each patient respectively¹⁸. This denotes adequate amount of knowledge and implementation of basic principles of infection control but still there is much room for improvement to prevent the risks of communicable diseases.

A study conducted among students of Al-Jouf University in Saudi Arabia showed that only 8% students change their mask after every patient and only 12% wear protective eye wear during treating a dental patient¹⁹. In comparison, practices in our study were comparatively better showing 68.5% subjects wear gowns and 43.5% use protective eye-wear. These numbers may be better than other studies but are far less than the ideal practice that should be followed by students as well as doctors working in the clinical departments. It is thus important that these protocols be re-emphasized and improved for better infection control measures. Another study conducted among dentists in Iran showed

that 55% dentists wear gown and change face masks after every patient but a large majority (80%) use protective eyewear when carrying out various Prosthodontic procedures²⁰.

Laboratory is a fundamental part of Prosthodontics OPD as many objects shift from the OPD to laboratory and then back to the OPD after the completion of laboratory work. These items include impression trays, articulators, trial dentures and bite registrations etc. This increases the risk of cross-infection manifolds and may also put laboratory workers at risk²¹. Our survey stated that only around two-thirds of the participants disinfect impressions, casts, trial dentures, bite registrations and articulators before sending them to the laboratory. A research conducted among dental practitioners in Qassim reported that 83% participants disinfect the impressions before pouring or sending it to the lab²². Another survey done by Jain *et al.*, reported that around half the dentists and students disinfect impressions before sending it for processing. Alarming, 55% of these participants used only tap water to 'disinfect' the impressions and only 30% used chemical agents²³. Results of our study and the mentioned studies exhibit the sheer negligence of dentists in adopting cross-infection control measures when moving items to and from the dental laboratory.

Another survey conducted among dentists, interns and students of prosthodontics department of Kathmandu Medical College, Nepal reported that around 50% - 65% participants disinfect rubber bowls, mixing spatulas, face bows and shade guides. The same research reported that around 60% participants autoclave, facebow fork, and fox occlusal plane²⁴. On the other hand, results of our study reported that only around 35-40% participants disinfect rubber bowls, mixing spatulas, face bows and shade guides. In comparison, adherence to sterilization of various instruments used during treatment was much better by our study participants.

As is the drawback and limitation of any questionnaire-based study, these are self-reported practices of the participants and therefore should be interpreted with caution.

A similar study can be conducted to report compliance to cross infection control practices of dental auxiliaries and technicians when sending and receiving items in the dental laboratory. An amalgamation of results of both would help us better understand the cross-infection control practices being carried out. If found deficient, strict administrative protocols can then be set to keep a check on the implementation of cross-infection control practices.

Conclusion

A large majority of the participants in our study adhered to the universal precautions when dealing with patients i.e. use of gloves, mask and hand washing before and after wearing gloves. Comparatively, disinfection of instruments, materials and dentures before sending them to the laboratory is neglected. There is a need to re-emphasize cross-infection control measures and practices in the Prosthodontics OPD to minimize disease spread as much as possible.

Conflict of Interest

Authors have no conflict of interest and no grant/funding from any organization

References

1. Rampal N, Pawah S, Kaushik P. Infection control in Prosthodontics [Online]. *J Oral Health Comm Dent.* 2010;4(1):7-11. Available from: <https://www.johcd.net/doi/JOHCD/pdf/10.5005/johcd-4-1-7>. Accessed on November 10, 2022.
2. Kohli A, Puttaiah R. Infection Control and Occupational Safety Recommendations for Oral Health Professionals. 2007. Infection Control in Dentistry. Available from: <https://www.healthmantra.com/blog/2008/08/Infectioncontrolbook.pdf>.
3. Gupta S, Rani S, Garg S. Infection control knowledge and practice: A cross-sectional survey on dental laboratories in dental institutes of North India. *J Indian Prosthodont Soc.* 2017;17(4):348-54. [DOI: 10.4103/jips.jips_5_17]. Available from: <https://pubmed.ncbi.nlm.nih.gov/29249878/>. Accessed on November 10, 2022.
4. Alex JA, Sudhir N, Taruna M, Reddy R. Infection control in Prosthodontics [Online]. *In dian J Dent Adv.* 2016;8(1):41-6. [DOI: 10.5866/2016.8.10041]. Available from: <http://nacd.in/ljda/08/01/10041>. Accessed on November 10, 2022.

5. Hakam FA, Khalil A, Khan SU, Shakir S. Cross-infection control practices in Prosthodontics among undergraduate students, graduates and post-graduate students: a cross-sectional study [Online]. *Pak Oral Dent J.* 2018;38(3):385-9. Available from: <http://www.podj.com.pk/index.php/podj/article/view/298>. Accessed on November 10, 2022.
6. Izadi A, Farnaz F, Soufiabadi S, Vafae F, Kasraei S. Antibacterial Effect of Sanosil 2% and 6% and Sodium Hypochlorite 0.5% on Impressions of Irreversible Hydrocolloid (Alginate) and Condensational Silicone (Speedex) [Online]. *Avicenna J Dent Res.* 2013;5(1). [DOI: 10.17795/ajdr-21107]. Available from: <https://avicennajdr.com/en/articles/21173.html>. Accessed on November 10, 2022.
7. Kumar S, Abidi SYA, Habib ME, Sajjad I, Adnan S, Lone MM, et al. Attitude and Mental Health Effects Related to COVID 19 in Dental Patients [Online]. *J Pharm Res Int.* 2022;34(26A):37-43. [DOI:10.9734/jpri/2022/v34i26A35970]. Available from: <https://journaljpri.com/index.php/JPRI/article/view/6144>. Accessed on November 10, 2022.
8. Izzetti R, Nisi M, Gabriele M, Graziani F. COVID-19 Transmission in Dental Practice: Brief Review of Preventive Measures in Italy. *J Dent Res.* 2020; 99(9):1030-8. [DOI:10.1177/0022034520920580]. Available from: <https://pubmed.ncbi.nlm.nih.gov/32302257/>. Accessed on November 10, 2022.
9. 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(4):438-45. [DOI:10.1016/j.jiph.2016.06.002]. Available from: <https://pubmed.ncbi.nlm.nih.gov/27422140/>. Accessed on November 10, 2022.
10. Galli MG, Tesauro M, Bianchi A, Consonni M. Evaluation of Milan University Dental Students' knowledge of health and hygiene risks related to clinical work. *Minerva Stomatol.* 2006;55(6):391-400. Available from: <https://pubmed.ncbi.nlm.nih.gov/16971884/>. Accessed on November 10, 2022.
11. Mohiuddin S, Dawani N. Knowledge, Attitude and Practice of Infection Control Measures among Dental Practitioners in Public Setup of Karachi, Pakistan: cross-sectional survey [Online]. *J Dow Uni Health Sci.* 2015; 9(1):89-93. Available from: <https://www.duhs.edu.pk/download/jduhs-vol.9-issue-1/2.pdf>. Accessed on November 10, 2022.
12. Al-Hassan M, AlQahtani S. Preparedness of dental clinics for medical emergencies in Riyadh, Saudi Arabia. *Saudi Dent J.* 2018;31:115-21. [DOI: 10.1016/j.sdentj.2018.11.006]. Available from: <https://pubmed.ncbi.nlm.nih.gov/30705575/>. Accessed on November 10, 2022.
13. Albelaihi HF, Alweneen AI, Ettish A, Alshahrai FA. Knowledge, Attitude, and Perceived Confidence in the Management of Medical Emergencies in the Dental Office: A Survey among the Dental Students and Interns. *J Int Soc Prev Community Dent.* 2017;7:364-9. [DOI:10.4103/jispcd.JISPCD_4_14_17]. Available from: <https://pubmed.ncbi.nlm.nih.gov/29387622/>. Accessed on November 10, 2022.
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 [Online]. *J Adv Med.* 2019;30(8):1-7. Available from: <https://journaljammr.com/index.php/JAMMR/article/view/3472>. Accessed on November 10, 2022. [DOI:10.9734/jammr/2019/v30i830224]
15. Sabbahi DA, El-Naggar HM, Zahran MH. Management of dental waste in dental offices and clinics in Jeddah, Saudi Arabia. *J Air Waste Manag Assoc.* 2020;70(10):1022-9. [DOI: 10.1080/10962247.2020.1802366]. Available from: <https://pubmed.ncbi.nlm.nih.gov/32720860/>. Accessed on November 10, 2022.
16. Razi MA, Debnath S, Qamar S, Kumari P, Singhal A, Minz RSM. Awareness, knowledge and practice towards sterilization protocol and infection control among clinical dental students in Hazaribag district, Jharkhand [Online]. *J Adv Med Dent Scie Res.* 2019;7(11):1-5. [DOI:10.21276/jamdsr]. Available from: <http://www.jamdsr.com/htmlissue.php?id=2768>. Accessed on November 10, 2022.
17. Sachdeva A, Sharma A, Bhateja S, Arora G. Knowledge, attitudes, and practices regarding sterilization protocol among undergraduate dental students in Faridabad city: a questionnaire-based study [Online]. *J Indian Acad Oral Med Radiol.* 2019;31:4-10. [DOI: 10.4103/jiaomr.jiaomr_186_18]. Available from: <https://www.jiaomr.in/article.asp?issn=09721363;year=2019;volume=31;issue=1;spage=4;epage=10;aulast=Sachdeva>. Accessed on November 10, 2022.
18. Tahir MW, Mahmood A, Abid A, Ullah MS, Sajid M. Knowledge, attitude, and practices of cross infection control among Dental Students of Punjab, Pakistan [Online]. *Pak J Med Health Sci.* 2018;12(1):238-43. Available from: <https://www.pakmedinet.com/40744>. Accessed on November 10, 2022.
19. Alanazi AO, Alrawili YK, Alanazi YM, Shah FA. Knowledge and Attitudes towards Infection Control Protocols among the Students of Al-Jouf University in Saudi Arabia [Online]. *Egypt J Hosp Med.* 2018;71(6):3328-31. [DOI: 0.12816/0047260]. Available from: https://ejhm.journals.ekb.eg/article_8558.html. Accessed on November 10, 2022.
20. Rostamzadeh M, Afkhamzadeh A, Afrooz S, Mohamadi K, Rasouli MA. Dentists' knowledge, attitudes and practices regarding Hepatitis B and C and HIV/AIDS in Sanandaj, Iran. *BMC Oral Health.* 2018;18(1):220. [DOI:10.1186/s12903-018-0685-1]. Available from: <https://pubmed.ncbi.nlm.nih.gov/30563497/>. Accessed on November 10, 2022.

21. Naz A, Hanif S, Kumar B, Musharraf H, Lone MA, Tariq A. Evaluation of Cross Infection Control Awareness and Practices in Dental Laboratories [Online]. *Pak Oral Dent J.* 2020;40(2):98-102. Available from: <https://www.podj.com.pk/index.php/podj/article/view/552>. Accessed on November 10, 2022.
22. Alhoumaidan A, Mohan MP, Doumani M. The knowledge, attitude and practice of fixed prosthodontics: a survey among Qassim dental practitioners. *J Family Med Prim Care.* 2019; 8:2882-7. [DOI:10.4103/jfmpc.jfmpc_683_19]. Available from: <https://pubmed.ncbi.nlm.nih.gov/31681660/>. Accessed on November 10, 2022.
23. Jain AR, Fauzi NQBA. Knowledge, attitude, and practice on various disinfectants used for impression materials among dental students and dental practitioners. *Drug Invent Today (discontinued).* 2018;10(1):23-8.
24. Dixit S, Dixit PB, Pradhan D, Gupta S. Infection Control Measures among Dental Professionals, Interns, and Students in Prosthodontic Department [Online]. *JNPS.* 2020;3(1):21-8. [DOI:10.3126/jnprossoc.v3i1.34758]. Available from: <https://www.nepjol.info/index.php/jnprossoc/article/view/34758>. Accessed on November 10, 2022.