Original article

Infection Control Practice: A cross-sectional Survey on Dental Laboratory Technicians in Benghazi, Libya

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ABSTRACT:

Objectives: Infection control represents the main concern in dental laboratories in recent years regarding the perceived risk of patients and professionals from getting infected. Even if the dental technicians do not come in direct contact with the patient's oral cavity, there is a risk of contamination from the prosthetic items coming from the dental office. The purpose of this study was to evaluate the knowledge, attitude, and practice of dental lab technicians toward infection control protocols at the dental laboratories of Benghazi, Libya.
Materials and Method: A descriptive cross-sectional study was conducted among prosthodontic dental technicians in the city of Benghazi, Libya. A self-administered questionnaire was distributed as a hard copy to the dental lab technicians working at both governmental and private dental laboratories (3 governmental and 7 private dental laboratories). The data was conducted using the SPSS program (SPSS 16 for windows, SPSS Inc., Chicago, USA); a P-value of 0.05 or less was considered significant.
Results: The response rate among dental technicians was 93%. The major age group of participants was (21-40 years) who work in a private dental laboratory with less than ten years of experience. 60.2% of the technicians had a valid hepatitis B vaccination, and 46.2% had received infection control training courses as part of their orientation, when respondents were asked about the most dangerous steps in the dental laboratory 60.1% of them answered dealing with impressions.
Conclusion: Within the limitations of the present study, the respondents demonstrated varying levels of knowledge, attitude and infection control practices. More efforts are needed to improve infection control practices and to apply appropriate policies in order to ensure the safety of the technicians and patients.

Keywords: *infection control, disinfection, cross-contamination, dental technicians, dental laboratories*

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INTRODUCTION

Infection control represents the main concern in dental laboratories in recent years regarding the perceived risk of patients and professionals from getting infected.[1] Before the 1970s, infection control was not performed in dental laboratories though there was a major concern about handling "high-risk patients" items.[2] As a result, diseases can be transmitted during treatment if preventive measures are not taken. The risk of cross-contamination has been documented in various studies in dental clinics as well as in laboratories.[3]

Infection control was first recommended by the American Dental Association (ADA) in laboratories through the Centers for Disease Control (CDC) guidelines and recommendations. It was published first in 1986 and revised in 1993.[4] The CDC defines standard precautions as "any standard of care designed to protect health care personnel and patients from pathogens that can be spread by blood or any other bodily fluid, excretion, or secretion".[5] Standard precautions include the use of personal protective equipment (PPE), cleaning and disinfecting environmental surfaces, sterile devices and instruments, safe injection practices, sharp safety, hand washing, and respiratory hygiene with cough etiquette.[6]

An infection can be transferred from the cast to the dental technologist/ technician in the dental laboratory by unwashed hands, aerosols, pumice, burs, and surface contact handpiece.[7] Various studies reported the contamination of prostheses and dental laboratory equipment from oral and non-oral pathogens.[8-10] Bacterial organisms, such as *Bacillus species*, *coagulase-negative Staphylococci, Micrococcus species,* and *Streptococcus species* were the most prevalent contaminants.[8] These organisms were found in the base of dentures sent to the laboratory. Moodley KL, *et al*., [11] reported that 11% of gypsum cast samples and 8% of the impressions were contaminated with *Candida species*. Furthermore, bacteria from the Enterobacteriaceae family (gut flora), including *Acinetobacter*, *Pseudomonas*, and *Klebsiella*, were also present on the denture base.[9, 10,12] However, some of these microorganisms can cause systemic diseases as they colonize on the denture surface, lead to colonization of the bacteria on the oropharynx, and eventually increase the patient risks for pneumonia, especially in immune-compromised patients.[11]

Thus, adequate infection control should be performed on the dental prostheses, impressions, and other prosthodontic materials, which are sent to the laboratory and upon return to the dental clinic. Utilizing pumice with disinfectants or sterile pumice and rag wheels will significantly reduce cross-contamination in the laboratory. Additionally, the use of protective barriers, such as protective glasses, gloves, and aprons, should be a routine procedure by the dentists, dental laboratory technicians, and all auxiliary personnel who are involved in these procedures.[13] A similar cross-sectional study[14] was conducted in Jeddah, Saudi Arabia recommended that infection control protocols are mandatory in dental laboratories and dental clinics. Another study conducted in some cities in Libya regarding awareness of dental technician's safety recommended that laboratory managers and technicians must take care of all personal protection tools and do training regularly.[15]

This study aimed to evaluate dental lab technicians' knowledge, attitude, and practice toward infection control protocols in the dental laboratories of Benghazi, Libya.

MATERIALS AND METHODS

The study was following the ethical standards of the institutional research committee of Benghazi University, Libya, with ethical approval number 110. A descriptive cross-sectional study was conducted in 2022 among 100 dental technicians who participated in the questionnaire to obtain information regarding infection control in the dental laboratories in the city of Benghazi, Libya. This study is targeted to investigate the knowledge and attitude of dental technicians working in the public and private sectors (including those working in dental Faculties). A pilot study was conducted on 17 technicians 9 males and 8 females then distribute 100 forms the response rate was 93%.

The validity of the questionnaires was tested by distributing the questionnaire and analyzing the results of the pilot study and the feedback of the primary study as well as using some critical questions regards of working experience and years of practice and knowledge. Inclusion criteria for all dental technicians who are working in a dental laboratory in Benghazi city exclusion criteria for dental technicians who are not Libyan citizens. The questionnaire was in English language and adopted from the previous studies[2,16] The nature and objectives of this study were explained to each participant and their inquiries were answered.

The questionnaire consisted of 14 close-ended questions that covered three major sections. The first section included demographic data (gender, age, work institution, and the number of years of experience). The second section was about the laboratory information. While the third section of the questionnaire covered the respondents' knowledge assessment, practice, and attitude toward infection control procedures. Data collection was extended over three months from January 2022 to April 2022. Response categories for each of the knowledge's questions were 'yes', 'sometimes', and 'no', and these answers were coded as 1, 2, and 3, respectively. Uncompleted questionnaires were excluded from the study. The data was conducted using the SPSS program (SPSS 16.0 for windows, SPSS Inc., Chicago, USA). The Chi-square test was used to analyze the association among variables at a 0.05 level of significance.

RESULTS

Out of 100 dental laboratory technicians to whom the questionnaire was sent, only 93 technicians responded. Participants' distribution and demographic data were summarized by their age, gender, work institution, and years of experience

(Table 1). The majority (69.9%, 65) were males and (30.1%, 28) were females. Just below half of the respondents (49.5%, 46) were of (31-40 years) age group, while (44.1%, 41) were of (21-30 years), and (4.3%, 4) were of (41-50 years) and only (2.2%, 2) were of (more than 50 years). Fifty-two respondents (55.9%) were private dental practitioners, while forty-one respondents (44.1%) were governmental dental practitioners. Regarding the years of work experience, (34.4%, 32) of the respondents had 6-10 years, and the majority (38.7%, 36) had 1-5 years of work experience in the practice of dental laboratory.
According to the laboratory information, the most critical step in terms of contagion exposure in the laboratory was all of the steps (68.8%), followed by dealing with the impression (66.1%), using sharp instruments (11.8%), repairing (2.2%) and then flame came afterword (1.1%) (Figure 1). Furthermore, only 60.2% (56) were vaccinated for the Hepatitis B virus (HBV). (Figure 2).

TABLE 1. Distribution of the study sample according to socio-demographic and occupation characteristics

Item	Group	No. (%)
Gender	Male	65 (69.9)
	Female	28 (30.1)
Age groups (Yrs.)	21-30	41(44.1)
	31-40	46 (49.5)
	41-50	4 (4.3)
	>50	2 (2.2)
Work institution	Governmental	41(44.1)
	Private	52 (55.9)
Years of work experience	1-5	36 (38.7)
	6-10	32 (34.4)
	> 10	25 (26.9)

FIG. 1. Bar graph showing frequency and percentage of the most critical steps in a dental lab.

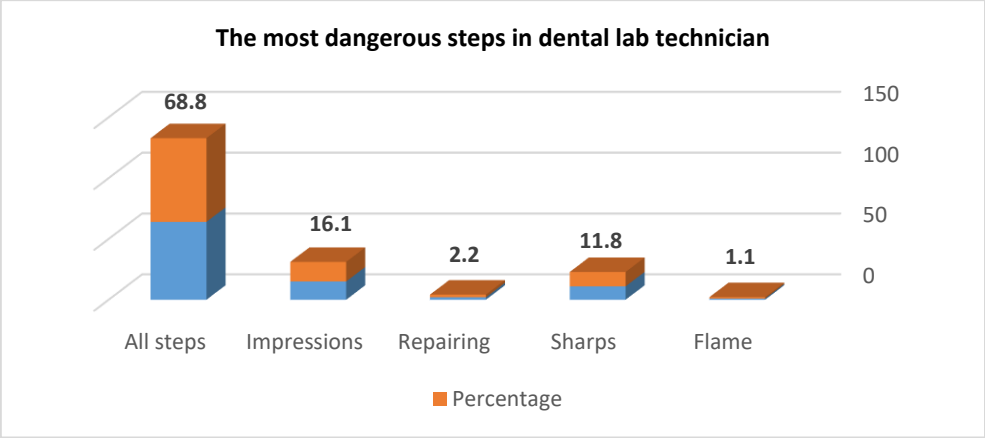

FIG. 2. A hepatitis B vaccination

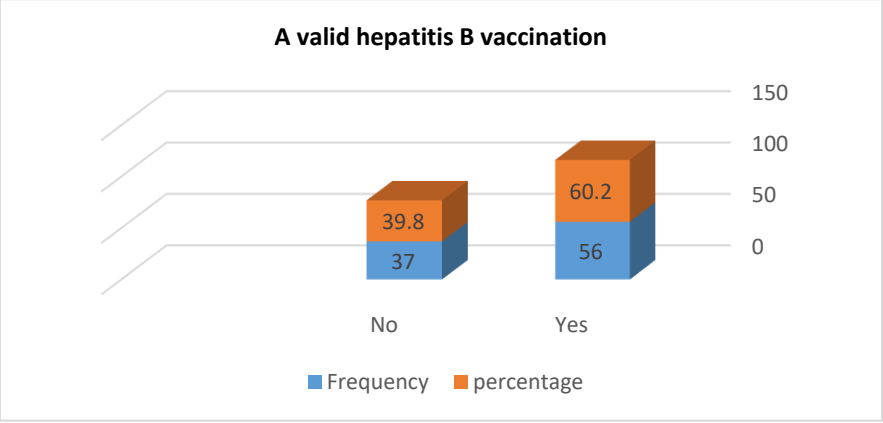

Table 2 shows the responses to questions related to the knowledge and attitude of dental technicians. The majority (60.2% and 62.4%) have written infection control protocol in their lab and have two polishing machines for repaired and new dentures. Just above a quarter of respondents consider infection control measures as an extra cost and less than half of them received training on disinfection. Table 3 shows the practices related to infection control among lab technicians. The majority wear PPE all the time (66.7%) and disinfect material on receiving and sending them. Above quarter (28%) always change the pumice powder in the polishing machine. Table 4 shows a comparison of these practices by characteristics of participants. Males and private-sector workers were more likely to wear PPE (p=0.044 and 0.000, respectively). On the other hand, females and private workers were more likely to disinfect materials at the end of work (p=0.028and 0.002, respectively). No significant differences were observed by years of experience.

TABLE 2. The Knowledge and Attitude of Dental Technicians Regarding Infection Control Guidelines

Questions	Yes (%)	No (%)
Received any training courses on disinfection	43 (46.2)	50 (53.8)
Have a written protocol for disinfection	56 (60.2)	37 (39.8)
Have two polishing machines one for new and another for repaired dentures	58 (62.4)	35 (37.6)
Cross-infection measures represent an added cost to be added on	24 (25.8)	69 (74.2)

TABLE 3. Dental Technicians' Practices Regarding Infection Control

Practices	Yes No (%)	Sometimes No (%)	No No (%)
Wear Personal protective equipment during the whole steps of the work?	62 (66.7)	18 (19.4)	13 (14)
Disinfect your materials including impressions when you received them from the clinic?	71 (76.3)	20 (21.5)	2 (2.2)
Disinfect your materials at the end of work?	71 (76.3)	12 (12.9)	10 (10.8)
Regularly change water pumice powder in the polishing machine?	26 (28)	61 (65.6)	6 (6.5)

TABLE 4. Comparisons of Infection Control Practices by Sociodemographic Characteristics of Participants

Variable		Wear PPE the whole steps of the work No. (%)	Disinfect materials when received from the clinic No. (%)	Disinfect your materials at the end of the work No. (%)	Regularly change water pumice powder in the polishing machine No. (%)
Gender	Male	59 (90.8)	63 (96.9)	55 (84.6)	62 (95.4)
	Female	21 (75)	28 (100)	28 (100)	25 (89.3)
	P-value	0.044	0.348	0.028	0.272
Work institution	Governmental	29 (70.7)	40 (97.6)	32 (78)	37 (90.2)
	Private	51 (98.1)	51 (98.1)	51 (98.1)	50 (96.2)
	P-value	0.000	0.865	0.002	0.249
Years of work experience	1-5Yrs.	32 (88.9)	34 (94.4)	33 (91.7)	34 (94.4)
	6-10 Yrs.	30 (90.9)	33 (100)	29 (87.9)	29 (87.9)
	> 10 Yrs.	18 (75)	24 (100)	21 (87.5)	24 (100)
	P-value	190	0.198	0.835	0.177

Chi-square test was used to compare subgroups, p set at 0.0

DISCUSSION

Infection control is very crucial in a dental laboratory therefore dental technologists/technicians can be prevented from getting infected.[1] Even if the dental technicians do not come in direct contact with the patient's oral cavity, there is a risk of contamination from the prosthetic items coming from the dental office. The study revealed that more than 60% of the dental offices' prostheses delivered to the dental laboratories were contaminated with pathogenic microorganisms originating from the patients' oral cavities.[17] Studies results revealed the presence of bacteria such as *Klebsiella oxytoca*, *Escherichia coli*, *Enterobacter cloacae,* and *Mycobacterium tuberculosis* on the dental impressions.[17, 18] Also, finishing and polishing prostheses have been described as the biggest sources of contamination in prosthetic laboratories.[17]

Despite the rigorous control of disinfection and sterilization of the equipment and instruments in dental offices, prosthetic devices do not always receive an adequate procedure for infection control.[1] Therefore, The use of effective infection control procedures in the dental laboratory and the dental office will prevent cross-contamination that may extend to dental technicians, dental office staff, patients, and dentists.[16,19,20] This survey was conducted to evaluate the level of knowledge, attitudes, and practices of dental laboratory technicians in Benghazi, Libya regarding infection control procedures.

Given the result of this study, 76.3% of the dental technicians carried out disinfection of all impressions brought to their dental laboratories. The remaining 21.9% of the dental laboratories sometimes disinfect the impression and only 14% of the dental laboratories relied on dental clinics to disinfect the impressions; thus, they did not disinfect them. These results confirm findings published in another study conducted by Sedky *et al.*[21] reported that more than 84.00% of the technicians carried out disinfection of all impressions in their dental laboratories. In contrast, a study by Sammy and Benjamin[2] recorded that only 33.33% of the technicians personally disinfected their impressions. This could be a result of a lack of proper communication between dental laboratories and dental clinics. Therefore, written communication should be tagged on every prosthesis or impression indicating that it has been disinfected with a specific disinfectant for a certain period to avoid confusion about whether an impression had been disinfected or not, as well as prevention of duplication of services.[2]

Concerning the use of personal protective equipment (PPE) only 66.7% of the dental laboratories wore (PPE) while working. Another study reported that 84% of dental technicians wore eyeglasses regularly and 59% occasionally use a facial shield while working or polishing dentures.[1]Wearing PPE such as eye protection, and a face mask/shield is mandatory to minimize the potential for cross-contamination, and disease transmission and avoid injury when operating rotatory equipment. For example, gloves and lab coats are equally important because they prevent cross-contamination, and face masks prevent aerosol inhalation with particle sizes as small as 50 microns.[2]

Regarding hepatitis B vaccination, 60.2% of the dental technicians who participated in this study had a valid hepatitis B vaccination, On the other hand, 39.8% of the dental laboratories required employees to submit valid hepatitis B vaccination records. This finding is almost similar to a study conducted in South Korea revealing that 63% of the dental laboratories had a valid hepatitis B vaccination.[22] More than half of the participants are hepatitis B vaccinated, dental technicians, and at increased risk of accidental puncture and other injuries. In other words, dental technicians contact with several harmful factors during their profession,[23] which will increase the risk of infection and cross-contamination.[18, 23, 24] According to the Guidelines for Developing a Dental Laboratory Infection-Control Protocol by the International Journal of Prosthodontics in 1992,[25] all laboratory personnel who have not had antibody testing revealing immunity or have not been previously vaccinated should receive hepatitis B virus immunization.

CONCLUSION

Within the limitations of the present study, the respondents demonstrated varying levels of knowledge, attitude and infection control practices. More efforts are needed to improve infection control practices and to apply appropriate policies in order to ensure the safety of the technicians and patients.

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Conflicts of interest

There are no conflicts of interest.

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