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Dental Staff Practices and Awareness of Microbiological Contamination of Water in Dental Units in Tripoli, Libya

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Abstract:
Objective: This study aimed to evaluate awareness of dentists of microbiological contamination in Dental Units (DUs). **Methods:** Cross-section survey was carrying out in nine government hospitals and three privates' dental clinics in a Tripoli city of Libya. Data was gathered over a 16-months period (from April 2021 to end of July 2022) using an especially designed survey. SPSS software was used for data analysis and the appropriate statistical tests were applied at (p value set at 0.05). **Results:** A total of the 204 surveyed dentists, 116 (56.7%) were females and 88 (43.3%) were males. They age between 26 - 57 years. It was pointed out that all of the enrolled dentists (100.0%) had knowledge about the causes of contamination of dental chair units (DCUs). Moreover, it was found that the majority of them did not perform the following practices: allowing water to flow out of the air/water syringes, allowing water to flow outside handpieces, covering light handles with disposable plastic sheets, covering head cushions with disposable plastic sheets, changing medical masks after each patient, wearing protective glasses, and disinfecting protective glasses after each patient, (90.2%, 88.2%, 89.7%, 90.2%, 88.2%, 89.2%, 88.7%, respectively).**Conclusions:** It can be concluded from this study that: dentists had adequate knowledge about the causes of contamination of dental chair units (DCUs) and mean to prevent them. Yet their practices were found to be suboptimal.

Keywords: Water contaminations, Dental chair units, Cross-infection.

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Introduction:

Cross-infection control that protects patients and medical staffs from infectious diseases that are related to medical devices and components have a major concern at healthcare administrators and many health care organizations [1]. Dental chair units (DCUs) are part of these medical devices that particular use in dentistry [2]. However, the dental chair units have been under developed process over decades of simple design that provides patient sitting while Dentist manage their mouths to more complicated intergrade system that provides all dental services [3]. A modern dental chair units (DCUs) have been designed with a wide range of equipment that helps a dentist to provide all dental treatment (e.g., air spray, suction, handpieces, ultrasonic scalers etc). This equipment that are connected to the dental chair units (DCUs) particularly the high-speed turbine handpieces are coolant with water through interconnect plastic dental unit waterlines(DUWLs) to irrigate the tooth surface and protect them from heat generated while cutting tooth surface [4].Those waterlines(DUWLs) with cup filler that use for patients rinsing their mouth are highly likely to be invaded by contaminated microbial organisms that can be delivery to patients mouth during dental treatment [5,6]. However, across-infection due to fouling of microorganism through

dental unit waterlines (DUWLs) during dental treatment have been documented [7-9]. For that reason, following a preventive measures and guidelines that protect patient and dental health care personnel (DHCP) from these containment water should be understand by dental practitioners. From an ethical aspect, the dental practitioners are responsible for ensuring that dental unit waterlines (DUWLs) output has a good quality water. The aim of our study was to evaluate the awareness of dentists related to microbiological contaminations through dental unit waterlines (DUWLs) output.

Material and methods

Cross-section survey was carrying out in nine government hospitals and three privates' dental clinics in a Tripoli city of Libya. Tripoli City is the biggest and capital city of the country of Libya. Data was gathered over a 16-months period (from April 2021 to end of July 2022) using an especially designed survey that was distributed to all dentist who willing to provide verbal consent to take a part in our study. This survey contains information on dentist's demographics variables such as gender; age; years of experience and includes questions on dentist's practices before, during and after patients care.

Ethical Approval:

All participants' dentists were informed about the aims of this study, and informed consent was obtained from all the participants of dentists. The study was conducted in accordance with the Declaration of Helsinki.

Sample size and sampling method: A total of **204** Dentists with **82** dental chair units (DCUs) were selected by the systematic random sampling method were invited to participate in the study.

Data analysis:

Data analyses were carried out using the Statistical Packages for the Social Sciences (SPSS Version 26.0) Data was described using frequency tables, mean, and standard deviation. Chi-square and fisher exact tests for category variables were used. The level of significance was adopted at $P < 0.05$.

Results and discussion

Socio-demographic information

Of the 204 surveyed dentists, 116 (56.7%) were females and 88 (43.3%) were males. They were aged between 26 - 57 years, where159 (78%) of them were vaccinated against HBV. Their years of experience ranged from 1- 18 years. It was noted that all of the enrolled dentists (100.0%) had knowledge about the causes of contamination of DUs and means to prevent them. Moreover, the study was strengthened by the observation of the dentists' practices in dental clinics.

Table (1) illustrates that by observing the practices performed by the 204 dentists included in the present study, it was found that the majority of them did not perform the following practices: allowing water to flow out of the air/water syringes, allowing water to flow outside handpieces, covering light handles with disposable plastic sheets, covering head cushions with disposable plastic sheets, changing medical masks after each patient, wearing protective glasses, and disinfecting protective glasses after each patient, (90.2%, 88.2%, 89.7%, 90.2%, 88.2%, 89.2%, 88.7%, respectively).

Table 1: Distribution of the 204 enrolled dentists according to their practices

Dental staff practices	percentages (n = 204)	
	No.	%
Part 2: Preparation phase before treating the patient		
Hand hygiene was done before wearing gloves		
No	91	44.6
Yes	113	55.4
Water was allowed to flow out of the air /water syringe		
No	184	90.2
Yes	20	9.8

Water was allowed to flow outside the handpieces		
No	180	88.2
Yes	24	11.8
The lighting handles were covered with disposable plastic sheets		
No	183	89.7
Yes	21	10.3
Patients used mouth wash before starting the treatment		
No	96	47.5
Yes	108	52.9
Head cushions were covered with disposable plastic sheets		
No	184	90.2
Yes	20	9.8
All water lines were flushed for 2 minutes at the beginning of the shift		
No	95	46.6
Yes	109	53.4
Part3: Stage of patient treatment		
Gloves were changed after each patient		
No	95	46.6
Yes	109	53.4
Medical masks were changed when exposed to any contamination		
No	96	47.1
Yes	108	52.9
Medical masks were changed after each patient		
No	180	88.2
Yes	24	11.8
Protective glasses were used		
No	182	89.2
Yes	22	10.8
Protective glasses were disinfected after each patient		
No	181	88.7
Yes	23	11.3

Table (2) displays that among the 82 examined DUs, the acceptability percentages regarding Fecal Coliform (FCs),were significantly higher than unacceptability percentages when the following practices were performed: medical masks were changed when exposed to any contamination, all water lines were flushed for 2 minutes at the beginning of the shift, patients used mouth wash before starting treatment, water was allowed to flow out of the air / water syringes, hand hygiene was done before wearing gloves, and protective glasses were disinfected after each patient (85.0%-15.0%, 79.6%-20.4%, 77.3%-22.7%, 100.0%- 0.0%, 73.5%-26.5%, 71.4%- 28.6%, respectively).In addition, acceptability

was 100% when water was allowed to flow outside the handpieces, and the head cushions were covered with disposable plastic sheets. These figures were found to be statistically significant. (p=<0.001)

Table 2: Relation between dental staff practices and FC acceptability in the 82 examined DCUs.

Dental staff practices	FC CFU/100ml				Total (n = 82)		χ^2	p
	0-100 (acceptable) (n=44)		> 100 (unacceptable) (n=38)					
	No.	%	No.	%	No.	%		
Part 2: Preparation phase before treating the patient								
Hand hygiene was done before wearing gloves								
No	8	24.2	25	75.8	33	100.0	40.857*	<0.001*
Yes	36	73.5	13	26.5	49	100.0		
Water was allowed to flow out of the air / water syringe								
No	3	10.7	25	89.3	28	100.0	31.534*	<0.001*
Yes	41	75.9	13	24.1	54	100.0		
Water was allowed to flow outside the handpiece								
No	14	26.9	38	73.1	52	100.0	40.857*	<0.001*
Yes	30	100.0	0	0.0	30	100.0		
Lighting handles were covered with disposable plastic sheets								
No	14	45.2	17	54.8	31	100.0	1.447	0.229
Yes	30	58.8	21	41.2	51	100.0		
Patients used mouth wash before starting the treatment								
No	10	26.3	28	73.7	38	100.0	21.292*	<0.001*
Yes	34	77.3	10	22.7	44	100.0		
Head cushions were covered with disposable plastic sheets								
No	10	20.8	38	79.2	48	100.0	50.163*	<0.001*
Yes	34	100.0	0	0.0	34	100.0		
All water lines were flushed for 2 minutes at the beginning of the shift								
No	5	15.2	28	84.8	33	5	32.931*	<0.001*
Yes	39	79.6	10	20.4	49	39		
Part3: Stage of patient treatment								
Gloves were changed after each patient								
No	15	38.5	10	100.0	25	51.0	12.062*	0.001*
Yes	24	61.5	0	0.0	24	49.0		

Dental staff practices	FC CFU/100ml				Total (n = 82)		χ^2	p
	0-100 (acceptable) (n=44)		> 100 (unacceptable) (n=38)					
	No.	%	No.	%	No.	%		
Medical masks were changed when exposed to any contamination								
No	10	23.8	32	76.2	42	100.0	30.850*	<0.001*
Yes	34	85.0	6	15.0	40	100.0		
Medical masks were changed after each patient								
No	24	44.4	30	55.6	54	100.0	3.711	0.054
Yes	20	71.4	8	28.6	28	100.0		
Protective glasses were used								
No	24	44.4	30	55.6	54	100.0	2.926	0.141
Yes	20	71.4	8	28.6	28	100.0		
Protective glasses were disinfected after each patient								
No	24	44.4	30	55.6	54	100.0	5.399*	0.020*
Yes	20	71.4	8	28.6	28	100.0		

Discussion

Several professional health care agencies such as the Center for Disease Control and Prevention (CDC), Occupational Safety and Health Administration (OSHA), American Dental Association (ADA) and National Institute of Health and Clinical Excellence (NICE), have issued specific recommendations attempting to minimize the risk of cross infection during dental practices. These guidelines suggest the routine use of gloves, masks, eye goggles, and sterilization of dental instruments, vaccination against HBV, and the universal (standard) precautions [10]. In the present study, of the 204 surveyed dentists, 116 (56.7%) were females and 88 (43.3%) were males. They were aged between 26 - 57 years, where 159 (78%) of them were vaccinated against HBV. Their years of experience ranged from 1- 18 years, shows all of the enrolled dentists (100.0%) had knowledge about the causes of contamination of dental chair units (DCUs) and they willing to prevent them. This finding was consistent with other studies [11]. On the other hand, in the questionnaire survey conducted in 2010 among 107 polish dentists, it was reported that dentists were not aware of microbiological contamination of DUWLs, where 80% of them believed that their knowledge about handling water and DUWLs was insufficient, also they noted that their dentists were unaware of the principles of dealing with dental water and water supply systems [12]. Moreover, our finding regarding dentist's knowledge of DUWLs microbiological contamination was in agreement with other previously studied in the group of dentists from other European Union countries, as they showed that 66% did not have such knowledge [13, 14]. In such way, other studies documented that the dentists were only partially aware of the need for maintaining DUWLs [15].

The awareness level is usually good but the compliance with universal precautions and safe dental practices is globally suboptimal. It has been noted that in their daily practice; dentists do not follow procedures leading to reduction or elimination of microbiological contamination of DUWLs.

By observing the practices performed by the 204 dentists included in the present study, it was found that the majority of them did not perform the following practices: allowing water to flow out of the air/water syringes, allowing water to flow outside handpieces, covering light handles with disposable plastic sheets, covering head cushions with disposable plastic sheets, changing medical masks after each patient, wearing protective glasses, and disinfecting protective glasses after each patient (90.2%, 88.2%, 89.7%, 90.2%, 88.2%, 89.2%, 88.7%, respectively). This is finding was in agreement with the studies did by Szymanska et al. 2013[12], which reported

that in daily dentists' practices, dentists did not follow standard procedures leading to increase of microbiological contamination of DUW. On the other hand, Fareed et al. 2008[16], reported that most of the dentists followed the standard precautions like: hand hygiene, wearing gloves and changing gloves after each patient, but there were other aspects that remained problematic such as: immunization against hepatitis B and post immunization tests. In addition, wearing masks and eyewear were found to be very weak among the dentists and dental hygienist.
the following practices were performed: medical masks were changed when exposed to any contamination, all water lines were flushed for 2 minutes at the beginning of the shift, patients used mouth wash before starting treatment, water was allowed to flow out of the air / water syringes, hand hygiene was done before wearing gloves, and protective glasses were disinfected after each patient (85.0%-15.0%, 79.6%-20.4%, 77.3%-22.7%, 100.0%-0.0%, 73.5%-26.5%, 71.4%- 28.6%, respectively).
Studies on microbiological quality of water in DUWLs indicate the necessity of educational campaigns among dentists in order to improve their knowledge and involvement in nonviolent dental practices and to change the way they deal with DUWLs systems [17].

Conclusion

It can be concluded from this study that: dentists had adequate knowledge about the causes of contamination of DCUs and mean to prevent them. Yet their practices were found to be suboptimal. It is recommended that dentists' awareness of the DUWLs microbiological contamination and their practices to prevent such contamination should be regularly monitored and evaluated, to ensure a safe operating environment for patients and dental healthcare personnel (DHCP).

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