Effectiveness of "SIAP" Infection Control Methods to Reduce Microorganism Contamination in Dental Practice at Primary Healthcare Center

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Abstract

Infection prevention and control is an important measure in the field of dentistry to prevent the contamination and spread of microorganisms in the dental practice.

Quasy Experimental research was conducted in 28 primary health care facilities in Semarang City. Interventions conducted from May to July 2023. Data collection is carried out by daily swabbing of the surface of the dental unit at lamp holders and dental seats. Swabbing will be performed using standard food and surface swabbing techniques. Bacteria counts were performed using a Colony Counter and results were reported in the form of colony forming units (CFU).

In both the control and experiment groups, the number of microorganisms on the surface of the dental unit decreased. However, in the experiment group, there was a significant decrease in the number of microorganisms on the dental seat (p=0.000) and dental lamp (p=0.000). The decrease in the number of microorganisms on the dental seat in the experiment group was 58571 CFU/10µl (pre), 18357 CFU/10µl (trial) and 11786 CFU/10µl (post). Meanwhile, the decrease in the number of microorganisms in the lamp handle in the experiment group was 62857 CFU/10µl (pre), 18571 CFU/10µl (trial), and 15857 CFU/10µl (post), respectively.

The infection control method is effective in reducing the number of microorganisms on the surface of dental seat and lamp handle in the dental unit. So it is important to implement comprehensive infection control measures to prevent contamination by microorganisms in dental and oral health facilities.

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Introduction

The provision of dental health care facilities in carrying out dental care cannot be separated from the risk of cross-infection[1,2]. In the dental health care facility environment, pathogens can be transmitted through direct contact with infected blood, saliva, or other body fluids or indirectly through instruments, materials, and contaminated surfaces[3,4]. Infection control in dentistry includes a series of procedures designed to prevent the transmission of potentially pathogenic microorganisms[5,6]. Currently, infection control methods need to be developed. These include screening measures, dental inspections, analysis of dental and oral problems, and important care measures performed when providing dental and oral health services in dental practices to prevent the transmission of infections[7,8].

Dental health workers are at risk for infection transmission. In dental practice, it is necessary to consider the risk of HIV transmission, especially due to accidental needle stick injuries[9]. Reportedly, 14.4% of dentists and dental nurses are infected with HBV and 1.4% with HCV[10]. Saliva is a source of infection transmission through aerosols generated during dental and oral health care, as well as through

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natural activities such as breathing, sneezing, and coughing, and therefore may pose a potential hazard to healthy, uninfected individuals and to health care workers in health care facilities[11].

Transmission of infections in healthcare facilities can be prevented by good infection control during dental and oral procedures. This includes the use of personal protective equipment (PPE), setting up practice rooms, administering vaccinations, hand washing, gargling before dental and oral procedures with a mouthwash containing antiseptic agents, sterilizing and disinfecting dental and oral treatment instruments, and waste disposal[11,12]. Implementing infection control measures, can reduce the potential for infection transmission during oral health care and protect dentists, dental caregivers, and patients from infection transmission during dental and oral care in the facility dental and oral health[13].

Dentists must take infection control measures to prevent the spread of infections in the practice area. However, this must also be supported by the implementation of sustainable infection control through training, monitoring, and evaluation in the implementation of infection control in the dentist's practice setting[14,15]. The purpose of this research is to determine the effectiveness of infection control methods to prevent the transmission of infections by reducing the number of microorganisms in dental and oral health primary care facilities.

Materials and methods

Study Area

This research was conducted after obtaining ethical approval from the Faculty of Public Health, Diponegoro University, Semarang, Indonesia, number 173/ EA /KEPK-FKM/2023. This Quasy Experimental research with a Non Equivalent Control Group Design research design was conducted in the dental and oral health services of primary health care facilities in Semarang City.

Study Population and Sample Size

A research sample was then selected from this population using simple random sampling techniques. The number of samples in this study was 28 samples. The experiment group consists of 14 primary health centers and the control group consists of 14 primary health centers randomly selected.

Study Intervention

The results of the research obtained were the number of microorganisms on the dental seat and lamp holder in the dental unit, and the predominant types of microorganisms on the dental seat and lamp holder in the dental unit. The swabbing is done after the dentist performed the dental and oral hygiene on the patient in the dental clinic of the health center. In the control group, the swabs were taken twice, before and after a treatment by the researcher. In the experiment group, on the other hand, swab samples were taken 3 times, namely before, after the intervention (trial), and after the intervention (field test). Interventions that were performed in relation to infection prevention and control included screening, dental inspections, analysis of dental and oral problems, and treatment procedures.

Data Collection

Samples are collected from the surface of the dental unit at the lamp holder and dental seat. Samples are collected with a swab (dipped in physiological serum) using an aseptic tip. Sterilized test tubes containing physiological serum and swabs were used for sampling. Insert a sterile cotton swab into a test tube containing the thyoglycolate solution and press it against the wall of the test tube until it stops dripping. Wipe the surface of the dental unit suspected of being contaminated with bacteria with a cotton swab. The surface of the dental unit is wiped horizontally three times, then the cotton swab is turned over to be wiped vertically three times.

Laboratory Tests

The cotton swab was placed back into the tyoglycolate transport medium, then the tube was tightly closed. The cotton swab was taken to the microbiology laboratory as soon as possible. The cotton swab was incubated for 1x24 hours at 37°C. Prior to clinical use (after disinfection and a waiting period of 10–15 minutes for the disinfectant to take effect), samples were collected with a sterilized swab by rubbing the swab in an area 10 cm long and 2 cm wide on the designated surface. The swab was placed in a closed tube. After the treatment session, sampling was performed as described above. The transport media containing the swab samples and the Mueller-Hinton plates were transferred to the Cito Semarang laboratory and placed in an incubator at 37°C for 24 hours. After

24 hours, the samples were diluted and transferred to blood agar and eosin methylene blue (EMB) media. Bacterial counts were performed using a Colony Counter and results were reported in the form of colony forming units (CFU).

Statistic Analysis

All the quantitative data were statistically analyzed with paired t-test and continued with the Independent Sampe T test using SPSS software.

Results

The intervention implemented is the application of infection control methods through patient screening, dental inspections, analysis of dental and oral problems, effective dental and oral care procedures to prevent infections in the dental and oral health facilities in the city of Semarang City Primary Health Facilities during May- July 2023. This intervention takes the form of implementing an infection control method consisting of screening efforts, dental inspections, analysis of dental and oral problems, and dental and oral care procedures. Based on this description, this method is referred to as the SIAP method of infection control. The SIAP method is the development of an infection control method that should be used in dental and oral health facilities(Table 1), including:

1. Screening is carried out with the aim of finding out the patient's medical history and general condition. It involves finding out each patient's condition through a screening form that includes signs and symptoms of infectious diseases and the patient's general condition.
2. Inspection at the dentist's office is carried out to detect the risk of hepatitis and Covid-19 infection in dentists. This inspection determines if the dentist is prepared to prevent the transmission of infection by administering the hepatitis B and Covid-19 vaccinations.
3. Analysis of dental and oral problems is carried out by explaining and identifying the dental procedures that fall into the categories of invasive and non-invasive. By knowing the classification based on the risk of infection transmission during dental procedures, it can be prevented by implementing more effective infection control.
4. Procedures to prevent infections
   a. Before treatment
      1) Wash hands before the procedure
      2) Use personal protective equipment (mask, handscoon, gown)
      3) Use PPE in the proper sequence (donning)
      4) Use an antimicrobial mouth rinse
   b. During treatment
      1) Implementation of four handed dentistry
      2) Use of transmission-based precautions (vacuum aerosol and saliva ejector)
   c. After treatment
      1) Perform sterilization of work equipment
      2) Carry out disinfection
      3) Manage infectious and non-infectious medical waste
      4) Proper and sequential removal of PPE (doffing)
      5) Wash hands upon completion of activity.

No	Stages	Implementation of SIAP Infection Control Methods			
		Before Intervention (Pre)	Percentage	After Intervention (Post)	Percentage
1	Carry out screening related to the general health and history of hepatitis	3	21%	9	64%
2	Carry out screening related to the general health and history of tuberculosis	3	21%	11	79%
3	Carry out screening related to the general health and history of HIV/AIDS	1	7%	10	71%
4	Carry out screening related to the general health and history of Covid-19	3	21%	13	93%
5	Dentists administered hepatitis B vaccine	13	93%	14	100%
6	Hepatitis B vaccination administered up to the third stage	13	93%	14	100%
7	Dentists administered COVID-19 vaccine	14	100%	14	100%
8	COVID-19 vaccination administered up to the third stage (booster)	14	100%	14	100%
9	Carrying out tooth extraction as an invasive procedure	8	57%	14	100%
10	Carrying out surgical extraction as an invasive procedure	1	7%	4	29%
11	Carrying out dental fillings as an invasive procedure	5	36%	14	100%
12	Carrying out scalling as an invasive procedure	7	50%	14	100%
13	Carrying out root canal treatment as an invasive procedure	3	21%	3	21%
14	Conducting dental health education at the individual or group level as a non-invasive intervention	14	100%	14	100%
15	Conducting consultations through online communication between the clinician and the patient/patient's family (teleservice) as a non-invasive procedure	2	14%	6	43%
16	Implementation of caries prevention measures, namely TAF and fissure sealing as a non-invasive measure	0	0%	0	0%

17	Use of medical masks when performing dental and oral care	14	100%	14	100%
18	Use of gloves when performing dental and oral care	13	93%	14	100%
19	Use of a face shield when performing dental and oral care	4	29%	11	79%
20	Use of a gown during dental and oral care	7	50%	13	93%
21	Changing masks at each patient change	2	14%	13	93%
22	Changing gloves at each patient change	11	79%	14	100%
23	Use of antimicrobial mouth rinse for patients	8	57%	14	100%
24	Patients gargle with antimicrobial mouth rinse before treatment	8	57%	14	100%
25	Handling used equipment after treatment	13	93%	14	100%
26	Disposing of used equipment such as syringes in safety boxes	10	71%	14	100%
27	Use of vacuum aerosol during treatment producing 7 50% aerosol	7	50%	14	100%
28	Removal of PPE after completion of dental and oral care	11	79%	14	100%
29	Discarding (take off) PPE in the correct order	6	43%	13	93%
30	Sterilization of used instruments	14	100%	14	100%
31	Sterilization of handpieces, scalers and drills at each patient change	14	100%	14	100%
32	Disinfection of the room after completion of treatment	12	86%	14	100%
33	Disinfection of the treatment unit and lamp handle after completion of treatment	12	86%	14	100%
34	The practice room is sprayed with a disinfectant solution after each treatment	11	79%	14	100%
35	Washing hands before and after treatment	12	86%	14	100%
Average		60%		87%	

Table 1. Implementation of Infection Control in the Experiment Group.

Most respondents implemented screening procedures, but they were still inadequate, including hepatitis screening in 9 respondents (64%), TB screening in 11 respondents (79%), and HIV/AIDS screening in 10 respondents (71%). Some respondents did not carry out several procedures at the Community Health Center, including surgical extractions in 4 respondents (29%), root canal treatment for 2 respondents (14%), teledentistry procedures in 6 respondents (43%) and TAF and Fissure Sealant procedures in 0 respondents (0%). Only 11 respondents (79%) used face shields when carrying out dental and oral care procedures, and 13 respondents (93%) had used PPE in the correct manner and sequence.

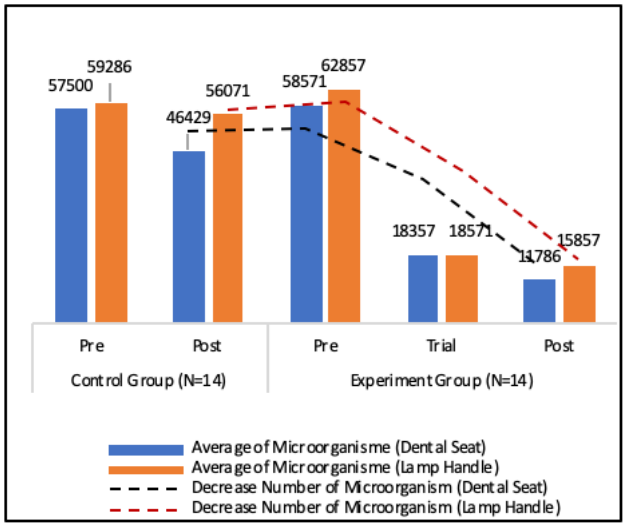
Based on the results in Table 2, it was found that the average number of microorganism colonies decreased in the control group in the dental seat decreased from 57,500 CFU/10µl to 46,429 CFU/10µl in the pre-and post-treatment data (percentage decrease of 19%). The average decrease in the number of microorganism colonies in the control group in the pre- and post-lamp intervention data before and after was 59286 CFU/10µl to 56071 CFU/10µl (percent decrease of 5%). In contrast, in the SIAP experiment group, the number of microorganisms in the dental seat decreased from 58,571 CFU/10µl to 18,357 CFU/10µl in the pre- and post-intervention data (percentage decrease of 69%).

Number Of Micro organism	Control Group (N=14)		Experiment Group (N=14)			Descrasing of Microorganism Number (%)		
	Pre	Post	Pre	Post of Trial Test	Post of Field Test	Before & After on Control Group	Before & After on Trial Test SIAP Intervenes	Before & After on Field Test SIAP Intervenes
Dental Seat	57500 CFU/10µl	46429 CFU/10µl	58571 CFU/10µl	18357 CFU/10µl	11786 CFU/10µl	19%	69%	80%
Lamp Handle	59286 CFU/10µl	56071 CFU/10µl	62857 CFU/10µl	18571 CFU/10µl	15857 CFU/10µl	5%	70%	75%

Table 2. Average Frequency of Number of Microorganism Colonies (CFU) in the Control Group and Experiment Group.

The decrease in the number of microorganisms in the dental seat in the data before and after the intervention field trial was 58571 CFU/10µl to 11786 CFU/10µl (80% reduction percentage). In the SIAP experiment group, the number of microorganisms in the lamp handle decreased from 62,857 CFU/10µl to 18,571 CFU/10µl in the data before and after the intervention field trial (70% reduction percentage). The decrease in the number of microorganisms in the lamp handle in the data before and after the intervention field trial was 62857 CFU/10µl to 15857 CFU/10µl (percentage reduction of 75%).

Based on graph 1 above, the average results show a decrease in the number of microorganisms in both groups. The largest reduction in the number of microorganisms in both the dental seat and lamp handle was found in the group that received the SIAP infection control method intervention compared to the control group that did not receive the SIAP infection control method intervention.



Graphic 1. Frequency of Number of Microorganism Colonies (CFU) on the Surface of Control Group and Experiment Group Samples.

Group	N	Dental Seat Mean±SD		P-Value	Lamp Handle Mean±SD		P-Value
		Pre	Post		Pre	Post	
Control Group	14	57500 ± 8026.4	46429 ± 10994.5	0.009	59286 ± 6157.28	56071 ± 13035.24	0.400
Experiment Group	14	58571 ± 7703.289	11786 ± 5279.548	0.000	62857 ± 7262.73	15857 ± 4588.57	0.000

Table 3. Average Number of Microorganism Colonies (CFU) on the Sample Surface Before and After SIAP Method Intervention

Control Goup		Experiment Group			Surface in Dental Unit		t-test for Equality of Means				
Pre	Post	Pre	Trial	Post	Dental Seat	Lamp Handle	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
√		√			√		-.360	26	.721	-1071.429	2973.259
√		√				√	-1.403	26	.172	-3571.429	2544.733
	√		√		√		8.770	26	.000	28071.429	3200.827
	√		√			√	9.682	26	.000	37500.000	3873.23667
	√			√	√		10.628	26	.000	34642.857	3259.631
	√			√		√	10.888	26	.000	40214.286	3693.358

Table 4. Independent sample t test to compare significant each group.

Based on table 3, it was found that there was a decrease in the number of microorganisms in the control group and experiment group. The results of the paired sample t test statistical test in the experiment group showed significant differences in the number of microorganisms before and after the SIAP infection control intervention in the dental seat (p-value = 0.000) and lamp handle (p-value = 0.000).

Based on table 4, there are no significant values in the pre-stage for both groups (p>0.05). while there was a significance value (p<0.05) in the post stages of both groups.

Discussion

Research related to the implementation of infection control methods in dental and oral health services in Community Health Centers was conducted in 28 Primary Health Centers as a control group and as an experiment group. The SIAP intervention was not implemented in the control group, but the control group still implemented infection control methods based on the Ministry of Health's PPI. The experiment group, on the other hand, used the SIAP infection control method, which consists of screening efforts, dental inspections, analysis of dental and oral problems, and treatment procedures before, during, and after dental and oral treatment.

The effectiveness of the SIAP Control Method is based on the number of microorganisms. Basically, this research aims to determine if the number of microorganisms decreases in the two groups with different treatments. Based on the data processed by SPSS program, it shows that the number of microorganisms decreased with the development of SIAP infection control method. The counting of the number of microorganisms in this study was done by swabbing the surface of the dental seat and lamp handle after treating patients in the dental and oral health services of Semarang City Health Center. Sample swabs were taken in the control group and the experiment group. The swabbing is carried out after the dentist performs dental and oral care on the patient at the dental clinic of the health center.

The results of the data analysis showed that the number of microorganisms decreased in the group that participated in the SIAP infection control method, both on the dental seat and on the lamp handle. In the control group, the average difference between the test results before and after the intervention on the dental seat showed a significance value or p-value of 0.009 < 0.05, i.e. a significant difference, while the lamp handle showed a significance value or

p-value of 0.400 > 0.05, i.e. no significant difference. In the experiment group, the test results showed that the average difference between the pre-intervention and post-intervention in the dental seat had a significance value or p-value of 0.000 < 0.05, that is, there was a significant difference. The results of the test of the average difference between the field tests of the experiment group before and after the dental seat showed a significance value or p-value of 0.000 < 0.05, so there was a significant difference. The results of the test of average difference between the pre and post intervention on the lamp holder showed a significance value or p-value of 0.000 < 0.05, so there was a significant difference. The results of the test of the average difference between the pre and post field test of the lamp holder experiment group showed a significance value or p-value of 0.000 < 0.05, so there was a significant difference.

The results of this study are consistent with research indicating that dentists who do not use PPE in dental and oral care have a 6.3% risk of infection transmission compared with dentists who use PPE in dental and oral care with a 2.83% risk of infection transmission[16]. The results of other research related to the use of gargling patients with an antiseptic solution before the procedure can reduce the number of bacteria or viruses in the oral cavity and aerosols in the dentist's practice[17]. The results of research at the Faculty of Dentistry, Mazandaran College, Sari, Iran, found that contamination with microorganisms in the air before treatment was 33.3% and after treatment was 80%, and contamination with microorganisms on the surface of the dental chair before treatment was 18.3% and after treatment was 70%[4].

Infection prevention and control are important measures that must be done to protect patients and health workers from the transmission of infections in healthcare facilities[6,18]. Dental health workers are at particular risk of infectious diseases such as Hepatitis B, Hepatitis C, HIV/AIDS (Acquired Immune Deficiency Syndrome) and COVID - 19[19,20]. Screening can be used to detect the presence or absence of disease in order to make the correct diagnosis and make appropriate referral[21,22]. The US Preventive Services Task Force (USPSTF) advocates for HIV screening in adolescents, adults, and pregnant women[23]. Several studies have highlighted the potential benefits of routine HIV screening in dental care, particularly with the availability of rapid HIV testing using oral fluids [24].

Currently, screening is recommended in dental practice as it may serve to limit the potential spread of pathogens in patients with unsuspected carriers from the start of treatment[25,26]. Vaccination may provide additional protection against certain pathogens from patient to dentist[27,28]. The prevalence of risk of hepatitis B infection among dentists in Yemen City was 17.9% in 2017[29]. Dental procedures are invasive because they are highly susceptible to transmission of infection when the treatment comes into contact with the patient's saliva and blood, in addition to the large number of aerosols and droplets generated during dental procedures that are mixed with the patient's saliva and breath, which may contain large numbers of pathogenic microorganisms[30].

Before carrying out dental procedures, you must use personal barrier protection[31]. The use of personal protective equipment (PPE) can protect dentists from infection transmission and can improve patient safety[5,32,33]. When carrying out dental and oral hygiene procedures, the use of an extraoral suction device is required because it can reduce the incidence of aerosol contamination during dental hygiene by 20%[34]. The use of extraoral suction devices is effective in reducing bioaerosols and splashes generated during ultrasonic scaling procedures[35]. Perioral suction devices have been shown to be effective in reducing biological aerosols that cause cross-contamination during dental treatment. However, to achieve maximum prevention, their use must be combined with standard personal protective equipment such as goggles, face shields, and surgical gloves[36,37]. After completion of dental treatment, it is imperative to implement disinfection and sterilization measures because, given the previous COVID -19 pandemic and the increase in the incidence and prevalence of infectious diseases such as HIV/AIDS and hepatitis B and C, this may be an attempt to protect clinic staff and patients from cross-contamination[38].

Conclusions

There is an effective of SIAP infection control method to reduce the number of microorganisms on the surface of the dental seat

and lamp handle in the dental unit. The implementation of infection control methods in the intervention group was carried out well, with an increase in infection control from before 60% to after the intervention to 87%. The infection control method applied in the 14 experiment groups was more effective in reducing the number of microorganisms than in the 14 control groups.

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Declaration of Interest

The authors declare that there are no conflicts of interest.

References

1. 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):438-445. doi:10.1016/j.jiph.2016.06.002
2. Mazzitelli C, Ionescu A, Josic U, Brambilla E, Breschi L, Mazzoni A. Microbial contamination of resin composites inside their dispensers: An increased risk of cross-infection? *J Dent*. 2022;116(1):1-8. doi:10.1016/j.jdent.2021.103893
3. Mahasneh AM, Alakhras M, Khabour OF, Al-Sa'adi A, Al-Mousa D. Practices of Infection Control Among Dental Care Providers : A Cross Sectional Study. *Clin Cosmet Investig Dent*. 2020;12(1):281-289.
4. Hoshyari N, Allahgholipour Z, Ahanjan M, Moosazadeh M. Evaluation of Bacterial Contamination in Clinical Environment of Sari Dental School in 2018. *Journal of Research in Dental and Maxillofacial Sciences*. 2018;4(2):19-25. doi:10.29252/jrdms.4.2.19
5. Menawi W, Sabbah A, Kharraz L. Cross-infection and infection control in dental clinics in Nablus and Tulkarm districts. *BMC Microbiol*. 2021;21(1):1-11. doi:10.1186/s12866-021-02382-0
6. Taheri S, Shahabinezhad G, Torabi M, Parizi ST. Investigation of Microbial Contamination in the Clinic and Laboratory of the Prosthodontics Department of Dental School. *Pesqui Bras Odontopediatria Clin Integr*. 2021;21(1):1-7.
7. Sholekhah NK, Suryawati C, Setyawan H, Rahfiludin MZ. Importance of Infection Control Through Screening, Inspection, Problem Analysis and Treatment Procedures in Dental Practice. *ODONTO : Dental Journal*. 2021;8(2):32. doi:10.30659/odj.8.2.32-42
8. Rachael E. Infection prevention and control in dental practice: Adopted by the General Assembly: September 2019, San Francisco, United States of America Original version adopted by the General Assembly: September 2009, Singapore, Singapore. *Int Dent J*. 2020;70(1):17-18. doi:10.1111/idj.12557
9. Bahl D, Shetty M, Shetty K. HIV and AIDS Related Knowledge and Awareness among Dental Students in Mangalore, India: A Cross Sectional Survey. *Journal of International Dental and Medical Research*. 2020;13(4):1355-1358. http://www.jidmr.com
10. 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):1-8. doi:10.1186/s12903-018-0685-1.
11. Patel M. Infection control in dentistry during COVID – 19 pandemic: what has changed? *Heliyon*. 2020;6(10):1-6. doi:10.1016/j.heliyon.2020.e05402
12. Keyhan SO, Fallahi HR, Motamedi A, et al. Reopening of dental clinics during SARS-CoV-2 pandemic: an evidence-based review of literature for clinical interventions. *Maxillofac Plast Reconstr Surg*. 2020;42(1):1-13. doi:10.1186/s40902-020-00268-1
13. Van der Weijden F. Aerosol in the oral health-care setting: a misty topic. *Clin Oral Investig*. 2023;27(1):23-32. doi:10.1007/s00784-023-05034-x
14. Wahdan Y, Habash G, Kateeb E, Junaidy R, Jayash SN. The Impact of COVID-19 on Infection Control Measures in Dental Settings: A Cross-Sectional Study. *Int J Environ Res Public Health*. 2023;20(15):1-12. doi:10.3390/ijerph20156517
15. Kajal K, Mohammadnezhad M. Organizational Preventative Strategies Undertaken by Dental Clinics in Fiji during COVID-19 Pandemic: A Qualitative Study. *Open Dent J*. 2022;17(1):1-12. doi:10.2174/18742106-v16-e221226-2022-36
16. Ren Y, Feng C, Rasubala L, Malmstrom H, Eliav E. Risk for dental healthcare professionals during the COVID-19 global pandemic: An evidence-based assessment. *J Dent*. 2020;101(1):1-8. doi:10.1016/j.jdent.2020.103434
17. Weber J, Bonn EL, Auer DL, et al. Preprocedural mouthwashes for infection control in dentistry—an update. *Clin Oral Investig*. 2023;27(1):33-44. doi:10.1007/s00784-023-04953-z
18. Farahat TM, Hegazy N, Mohammed MA. The Assessment of Infection Control Measures in Dental Clinics Primary Health Care , Bilqas , Dakahlia. *Egypt J Hosp Med*. 2020;81(3):1621-1627.
19. Al-Shamahy HA. Hepatitis B Virus among Dental Clinic Workers and the Risk Factors Contributing for its Infection. *Online Journal of Dentistry & Oral Health*. 2018;1(2):1-6. doi:10.33552/ojdoh.2018.01.000509
20. Nagpal B, Hegde U, Kulkarni M. Hepatitis B Seropositivity and Immune Status in Dental Students. *Journal of Advanced Medical and Dental Sciences Research* . 2019;7(2):9-12. doi:10.21276/jamdsr
21. Lambert JS, Murtagh R, Menezes D, et al. ' HepCheck Dublin ' : an intensified hepatitis C screening programme in a homeless population demonstrates the need for alternative models of care. *BMC Infect Dis*. 2019;19(1):1-9.
22. Qazi JA. Hepatitis Screening of Undiagnosed Dental Patients. *International Journal of Clinical Studies and Medical Case Reports*. 2021;8(3):10-13. doi:10.46998/ijcmcr.2021.08.000186
23. Owens DK, Davidson KW, Krist AH, et al. Screening for HIV Infection: US Preventive Services Task Force Recommendation Statement. *JAMA - Journal of the American Medical Association*. 2019;321(23):2326-2336. doi:10.1001/jama.2019.6587
24. Chung R, Leung S yin J, Abel SN, et al. HIV screening in the dental setting in New York State. *PLoS One*. 2020;15(4):1-16. doi:10.1371/journal.pone.0231638
25. Mascarenhas RE, Pralhad S, Manaktala N. Pan-dent-emic: safety considerations for dental surgery in the era of COVID-19. *Patient Saf Surg*. 2021;15(1):1-7. doi:10.1186/s13037-021-00289-3
26. Dacic SD, Miljkovic MN, Jovanovic MC. Dental care during the Covid-19 pandemic - To treat or not to treat? *J Infect Dev Ctries*. 2020;14(10):1111-1116. doi:10.3855/jidc.13147

27. Muljono DH, Wijayadi T, Sjahril R. Hepatitis B Virus Infection among Health Care Workers in Indonesia. *Euroasian J Hepatogastroenterol*. 2018;8(1):88-92. doi:10.5005/jp-journals-10018-1269
28. Dagher J, Sfeir C, Abdallah A, Majzoub Z. Infection Control Measures in Private Dental Clinics in Lebanon. *Int J Dent*. 2017;2017(1):1-11. doi:10.1155/2017/5057248
29. Abbas AK et al. Hepatitis B Virus among Dental Clinic Workers and the Risk Factors Contributing for its Infection. *Online Journal of Dentistry & Oral Health*. 2018;1(2):6-11. doi:10.33552/ojdoh.2018.01.000509.
30. Gandolfi MG, Zamparini F, Spinelli A, Sambri V, Prati C. Risks of aerosol contamination in dental procedures during the second wave of COVID-19—experience and proposals of innovative IPC in dental practice. *Int J Environ Res Public Health*. 2020;17(23):1-12. doi:10.3390/ijerph17238954
31. Amato A, Caggiano M, Amato M, Moccia G, Capunzo M, De Caro F. Infection control in dental practice during the covid-19 pandemic. *Int J Environ Res Public Health*. 2020;17(13):1-12. doi:10.3390/ijerph17134769
32. Hussein LM, Ali SD, Twair AMJ, Ali SD. Evaluation of Infection Control Measures of Iraqi Dentists in Dental Practices. *Medico-legal Update*. 2020;20(2):268-273.
33. Reske KA, Park D, Bach TH, et al. Assessment of dental health care personnel protocol deviations and self-contamination during personal protective equipment donning and doffing. *Journal of the American Dental Association*. 2022;153(11):1070-1077.e1. doi:10.1016/j.adaj.2022.08.004
34. Shahdad S, Patel T, Hindocha A, et al. The efficacy of an extraoral scavenging device on reduction of splatter contamination during dental aerosol generating procedures: an exploratory study. *Br Dent J*. 2020;229(5):1-10. doi:10.1038/s41415-020-2112-7
35. Horsophonphong S, Chestsuttayangkul Y, Surarit R, Lertsooksawat W. Efficacy of extraoral suction devices in aerosol and splatter reduction during ultrasonic scaling : A laboratory investigation. *Tabriz University of Medical Sciences*. 2021;15(3):197-202. doi:10.34172/joddd.2021.033
36. Lloro V, Giovannoni ML, Luaces VL de, Cristina M. Perioral Aerosol Sequestration Suction Device Effectively Reduces Biological Cross-Contamination in Dental Procedures. *Europian Journal of Dentistry*. 2021;15(1):340-346.
37. Goenharto S, Rusdiana E, Syafrudin CA. Personal Protective Equipment for Acrylic Workers at Dental Laboratories in Surabaya, Indonesia. *Journal of International Dental and Medical Research*. 2018;11(3):1061-1064. http://www.jidmr.com
38. Patil S, Kazi MMK, Shidhore A, More P, Mohite M. Compliance of Sterilization and Disinfection Protocols In Dental Practice-A Review To Reconsider Basics. *Int J Recent Sci Res*. 2020;11(4):38050-38054. doi:10.24327/ijrsr.2020.1104.5232.