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Evaluation of knowledge of risk of infection during dental treatment in Arkhangelsk region, The Russain Fedration

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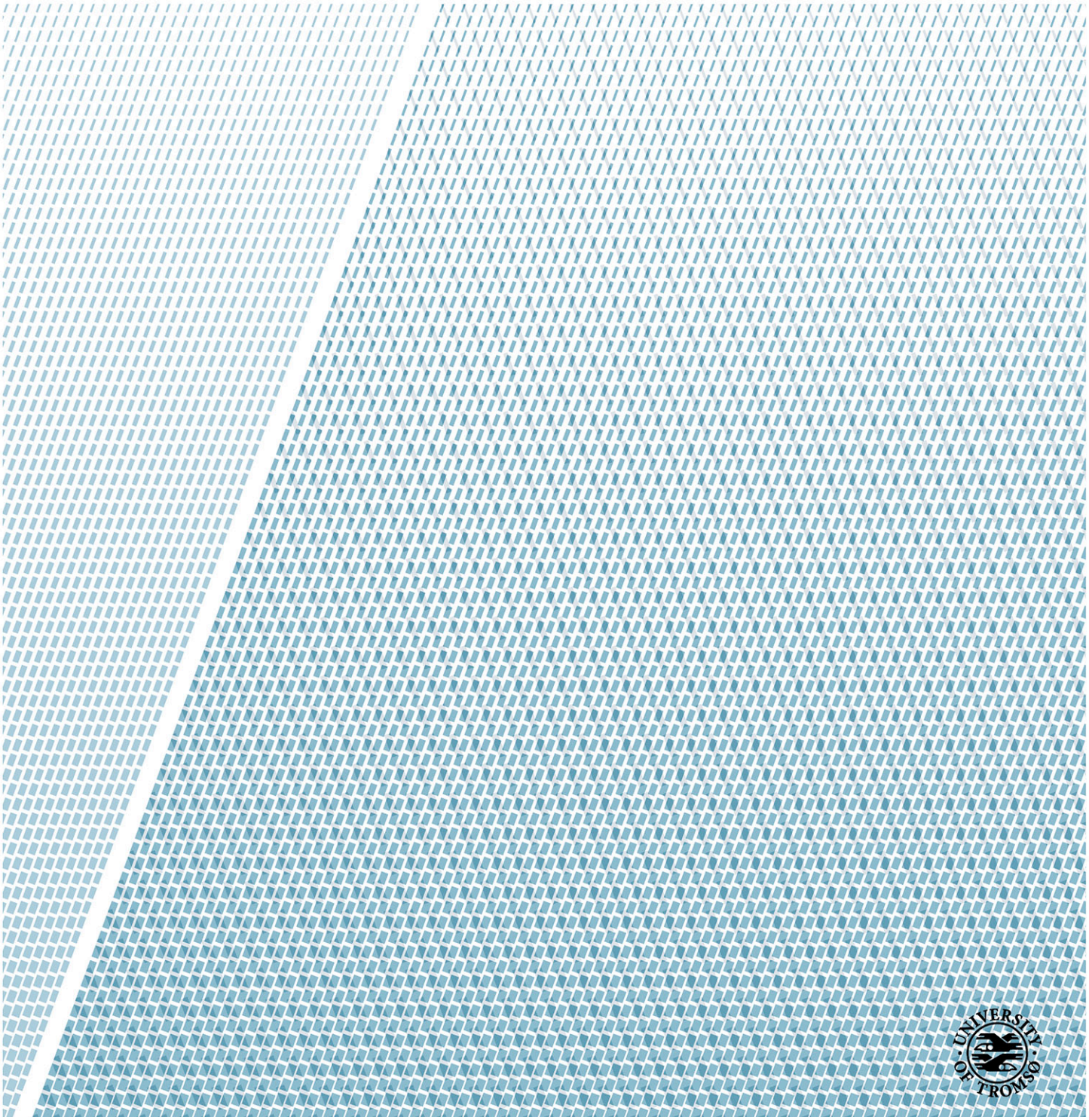

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Abstract

Aim:

Considering the increase in HIV and other blood-borne diseases in the Russian Federation, the lack of national guidelines and standard precautions in dental health care settings, as well as the antibiotic resistance rising to dangerously high levels in all parts of the world, the aim of this study was to evaluate the infection control practice to assess the knowledge of risk of infection in dental health care settings (DHCS) among last year dental students and practicing dentists in dental clinics in Arkhangelsk region in the Russian Federation.

Material and methods:

A questionnaire was distributed to practicing dentists and last year dental students in the Arkhangelsk region of the Russian Federation in the period of March to April 2018. It included 25 close-ended questions related to infection control routines in the dental clinics, relayed on the standards and recommendations published by the CDC. The questions were divided into five main clinical domains relevant to infection control in dental practice; protective wear, personal hygiene, routines regarding sterilization of the unit/working surface, sterile and autoclavation methods, and vaccination and managing of sharp instruments. The questions were given scorable values of 1 point for correct answer and 0 points for incorrect answer, with 0 points indicating suboptimal knowledge of risk of infection and 1 point indicating good knowledge of risk of infection.

Results:

87 respondents participated in this study, which gave a response rate of 14.5%. The obtained results were analyzed using SPSS. Most of the respondents were female (78.2%) dentists (60.9%), in the age of 23-32 (71.3%). The overall score was 72.5%, which is considered intermediate knowledge of risk of infection. The domain with the poorest result was protective wear (53.8%), while the domain with the best result was vaccination and management of sharp instruments (85.4%).

Discussion:

In this study, the participants showed an overall intermediate knowledge of risk of infection during dental treatments. The results from this study highlight the need for national guidelines in DHCS, and emphasizes the need of further instruction and implementation of infection control during the course of education, as well as continuous refreshing and training in the subject throughout the practice of dental health care personnel (DHCP).

1. Introduction

Background

Infection control practices are considered essential in clinical dentistry to protect dental health care personnel (DHCP) and patients from pathogens that can be transmitted by blood or any other body fluids, e.g., saliva. Exposure to pathogens can result in transmission from patient to DHCP, from DHCP to patient, and from one patient to another, where the opportunity for transmission is greatest from patient to DHCP (1). Transmission occur through percutaneous or per-mucosal routes, either by direct contact with blood, oral fluids, or other patient materials, or by indirect contact with contaminated instruments, surfaces, airborne droplets (e.g., spatter) or aerosols (2-5), where percutaneous injuries pose the greatest risk of transmission (1). Infectious diseases of main concern in dental practice are the different hepatitis-causing viruses, HIV, herpes simplex virus types 1 and 2, and tuberculosis (TB), including multidrug-resistant TB, and other viruses and bacteria that colonize or infect the oral cavity and respiratory tract (3, 5, 6).

Serologic surveys from the US demonstrate that DHCP, who have frequent contact with blood from infective patients, have an increased risk of HBV infection compared to the general population (7). Although transmission of blood-borne pathogens (BBPs) in dental health care settings (DHCS) have rarely been reported since routine hepatitis B virus (HBV) vaccination of DHCP in 1982 and universal precautions were recommended in 1987 (6), it is possible that DHCP are under-reporting occupational exposures (8, 9). Avoiding occupational exposures to blood is the primary way to prevent transmission of BBPs to DHCP, and the methods proved to be effective to reduce the risk of occupational exposures have included modifications of work practices, adoption of devices with safety features and the use of standard precautions (1).

A cross-sectional study to determine the risk factors of injury and infection in dental clinics in Riyadh, Saudi Arabia conducted in 2015 revealed that infection by airborne microorganisms during the course of dental work was relatively high. About 26% of dentists in government clinics reported having been infected with airborne microorganisms (e.g., influenza). The reported infection rate by blood-borne pathogens was low. Furthermore, the study emphasizes

the importance of dentists' knowledge of occupational safety (viral survival, transmission, and sterilization) as well as their compliance with infection control management practices and guidelines in reducing the risk of injury and infection (8). In a literature review on transmission of blood-borne pathogens in US dental health care settings conducted in 2012, the authors concluded that transmission of BBPs in dental settings since 2003 were considerably rare, and that in cases of pathogen transmission, failure to adhere to Centers for Disease Control and Prevention recommendations for infection control in dental settings likely led to disease transmission identified in the studied reports (here; hepatitis B virus and hepatitis C virus) (6). These findings emphasize the importance of dental infection prevention recommendations, including standard precautions, to prevent BBP transmission and infection by airborne microorganisms in DHCS.

According to a study aimed to assess needs in dental infection control and occupational safety in the Moscow metropolitan region of the Russian Federation, published in "The journal of contemporary dental practice" in 2012, there has been a considerable increase in HIV and other blood-borne pathogens in the Russian Federation in the recent past, resulting in the need for reassessment of infection control measures in dentistry (5). Unlike Norway and the US, the Russian Federation adherence to the basic control measures released by the Centers for Disease Control and Prevention (CDC) is not clear (10), and the previous infection control and safety (IC&S) standards in the country were published in the 1980s. As of today, there are no national guidelines for infection control in DHCS in the Russian Federation. The results from this study indicated a disparity in the practice of infection control and safety procedures, and the need for formulation of nationwide dental safety standards (5).

In Norway, common guidelines for infection control have now been established for the dental faculties across the country, compiled by an interdisciplinary working group composed of representatives from the dental faculties at the three universities offering a master's degree program in dentistry (the Dental Faculty at UiO, Institute of Clinical Dentistry at UiB, and the Institute of Clinical Dentistry at UiT), the Norwegian Dental Association, and the Norwegian institute of public health. Increased internationalization, and increased incidence of antibiotic resistance have highlighted the need for these common guidelines. The aim of the guidelines is to set a standard in infection control in dentistry for all patients and DHCP regardless of infection status (11). With the Russian Federation lacking such national and standardized

guidelines for DHCS, the aim of this study was to evaluate the knowledge of risk of infection in dental clinics in Arkhangelsk region in the Russian Federation.

2. Material and Methods

Knowledge, implementation, guidelines and routines are four main key words regarding infection prevention. We did a cross sectional study on the knowledge of risk of infection during dental treatment in the Russian Federation using a structured anonymous online-questionnaire. The well-composed questionnaire consisting of 32 questions was used in the current study (see appendix 1). The online questionnaire was distributed to the last-year dental students, dentists and dental specialists working at the state medical university of Arkhangelsk, and dentists working in public and private clinics. The data were collected from March to April 2018.

Our questionnaire relayed on the standards and recommendations published by the CDC (12). In addition to the demographic questions, the questionnaire containing 25 questions divided into five main clinical domains relevant to infection control in dental practice; the dentist or student's use of protective wear (5 questions), personal hygiene (5 questions), routines regarding sterilization of the unit/working surface (6 questions), the clinics sterile and autoclavation methods (4 questions), and vaccination and management of sharp instruments (5 questions).

Each question was scored from 0 to 1, with 0 points indicating suboptimal practice and 1 point indicating good practice. The total score of each candidate was then calculated and ranged from 0%-65% indicating suboptimal infection control routines, 65%-85% indicating intermediate infection control routines, and 85%-100% indicating good infection control routines. Each group representing a selective risk for infection based on the routines for infection control.

Our questionnaire was first written in Norwegian, then translated in to English and Russian. The Russian version was translated back to English for quality verification. The questionnaire was presented in both languages (Russian and English) to the participants. The survey was made available online to be reachable to as many respondents as possible.

Only last year dental students and practicing dentists in Arkhangelsk were involved in the study. The project was approved by the local ethical committee in Northern State Medical University (NSMU), Arkhangelsk, Russian Federation.

3. Results

The questionnaire was distributed to approximately 500 dentists and 100 last year dental students at the Faculty of Dentistry, NSMU. Of those we got 87 responses, which gives a response rate of 14.5%. Some of the respondents did not respond to all the questions in the questionnaire.

Table 1 shows the characteristics of those who answered the questionnaire. Most of the respondents were female (78.2%) dentists (60.9%), in the age of 23-32 (71.3%). Of the dentists who answered, over half of these (54.7%) had only worked in the public sector the last 12 months.

Table 1 – Participants characteristics

CHARACTERISTICS	NUMBER	%
GENDER		
MALE	19	21.8
FEMALE	68	78.2
AGE		
23-32 YEARS	62	71.3
33-42 YEARS	11	12.6
43-52 YEARS	9	10.3
53-62 YEARS	4	4.6
OCCUPATION/PROFESSIONAL STATUS		
DENTISTRY STUDENT $9^{TH}/10^{TH}$ SEMESTER	34	39.1
DENTIST	53	60.9
DENTISTS PRACTICE SITE PAST 12 MONTHS		
PRIVATE	19	35.8
PUBLIC	29	54.7
PRIVATE AND PUBLIC	5	9.3

Table 2 shows the correct answer for each question in the questionnaire used in the current study. Some questions had multiple answers considered as correct. Correct answers are based on the CDC guidelines for infection prevention in dental setting (12).

After we got the data to all our questions, it was decided to exclude some of the questions, as they did not give enough information regarding good or suboptimal hygiene. After excluding the invalid questions, we were left with 25 questions.

Table 2 - Correct answer for each question

1. When do you change your face mask?		2. Is there a routine for use of gloves at your clinic?	
-Between every patient	1	-Yes	1
-When it is dirty	0	-No	0
-I don't change	0		
-I don't use	0		
3. How often do you change gloves?		4. Is it a routine for change of clinic clothes?	
-Between every patient	1	-Yes	1
-I use a single pair the whole day	0	-No	0
-When they are dirty	0		
-I don't use glove	0		
5. How often do you change clinic clothes?		6. How often do you wash your hands between each patient?	
-Every day	1	-Always	1
-2-4 times a week	0	-Sometimes	0
-When there are visible signs of blood	0	-Never	0
-Once a week or less	0		
7. How often do you disinfect your hands between each patient?		8. Do you wear watches, rings or other arm-accessories?	
-Always	1	-Always	0
-Sometimes	0	-Sometimes	0
-Never	0	-Never	1
9. Do you perform hand hygiene before handling sterile equipment?		10. Do you perform hand hygiene after handling contaminated equipment?	
-Always	1	-Always	1
-Never	0	-Never	0
-Sometimes	0	-Sometimes	0

11. How often is your unit disinfected?		12. How often do you rinse through the suction on your unit?	
-Between every patient	1	-Between every patient	1
-At the beginning and the end of the clinic day	0	-Once a day	0.5
-Less frequently than any of the above	0	-2-3 times a week	0
-I don't know	0	-I don't know	0
13. Are there any routines for flushing the hand pieces or air/water piece at your clinic?		14. How often do your flush the hand piece or air/water piece?	
-Yes	1	-Between every patient	1
-No	0	-Once a day	1
		-2-3 times a week	0
		-I don't know	0
15. How often do you wash the filters on your unit?		16. How often do you change the filters in the dental chair	
-Every day	1	-Every month	1
-Every week	1	-Every year	0
-Every month	0	-Every second year	0
-Every year	0	-Less often then every second year	0
-Less often than once a year	0	-Don't change	0
-I don't know	0		
17. How do you clean your dental hand piece and other devices attached to air/waterlines?		18. Does your clinic have a dedicated room for cleaning and sterilization of dental instruments?	
-Cleaning with surface disinfectant	0	-Yes	1
-Run for 30sec before dental treatment	0	-No	0
-Autoclaving	1		
-None of the above	0		
19. Type of autoclavation		20. What indicator is used to monitor the performance of autoclaves?	
-Dry heat – oven type (160C – 60-120min)	0	-Biological	1
-Dry heat – rapid heat transfer (191C – 6-12 min)	0	-Mechanical	0
-Steam-autoclavation 121C 20 min	1	-Chemical	1
-Steam-autoclavation 134C – 3,5-5min	1	-None of the above	0
		-I don't know	0

-None of the above -I don't know	 0 0		
21. Are you vaccinated against Hepatitis B virus (HBV)		22. Is there a protocol for percutaneous injuries within your practice?	
-Yes -No -I don't know	1 0 0	-Yes -No -I don't know	1 0 0
23. Do you routinely document percutaneous injuries within your practice?		24. Do you use a puncture container for disposal of sharp instruments at your clinic?	
-Always -Sometimes -Never -Haven't had any percutaneous injuries in the practice	1 0 0 1	-Always -Sometimes -Never -My clinic doesn't have it	1 0 0 0
25. Do you use a needle recapping device/needle holder in your dental practice?			
-Always -Sometimes -Never	1 0 0		

The data shows that study participants have good knowledge in some clinical domains while intermediate or suboptimal knowledge on others. Table 3 displays the percentage of correct answers for each question. From the 25 questions, the respondents showed good routines on 14 questions (56%), intermediate routines on 3 questions (12%) and suboptimal routines on 8 questions (32%).

Table 3 – Rate of scorable answers to each question

Question/domain	**Correct answer (%)**
Protective wear	
1. Change face mask between every patient.	56.3
2. Routine for use of gloves at clinic.	100
3. Change gloves between every patient.	100
4. Routine for change of clinic wear at clinic.	8

5. Change clinic clothes every day.	4.6
Mean	**53.8**

Personal hygiene	
6. Washes hands between every patient.	84.9
7. Disinfects hands between every patient.	49.4
8. Never wears watches, rings or other arm accessories during treatments.	54
9. Perform hand hygiene before handling sterile equipment.	96.5
10. Perform hand hygiene after handling contaminated equipment.	90.8
Mean	**75.1**

Unit/Work surface	
11. Unite disinfected between every patient.	85.1
12. Rinse through suction between every patient	89.7
13. Routines for flushing the hand pieces or air/water piece at clinic.	88.5
14. Flush the hand piece or air/water piece between every patient/once a day.	93.1
15. Washes filters on unit every day/once a week.	43.7
16. Change filters in dental chair every month.	30
Mean	**71.7**

Sterile/autoclave	
17. Clean hand piece and other devices attached to air waterlines by autoclaving.	77
18. Dedicated room for cleaning and sterilization of dental instruments at clinic.	93
19. Type of autoclavation: Steam-autoclavation 121C for 20 min or Steam-autoclavation 134C for 3,5-5min.	72.4
20. Biological and chemical indicator used to monitor the performance of autoclaves.	63.2
Mean	**76.4**

Vaccination/sharp instruments	
21. Vaccinated against Hepatitis B virus (HBV)	90.7
22. Protocol for percutaneous injuries within practice.	87.2
23. Routinely document percutaneous injuries within practice.	75.8
24. Use of puncture container for disposal of sharp instruments at clinic.	86.2
25. Use of needle recapping device/needle holder at clinic.	87.2
Mean	**85.4**

4. Discussion

The study is a questionnaire-based survey on the knowledge of risk of infections in dental setting among dentists and dental students in Arkhangelsk. Some challenges encountered in the study regarding the distribution of the questionnaire and collecting the data needs to be mentioned. It was decided to present the information about the study on the university homepage which could give the study a good platform to recruit participants. It was voluntary to participate, and the majority of dentist who did answer most probably had some connection to the university. From a total of 100 students and 500 dentists who had the opportunity to participate, only 14,5% did. Due to the lack of high participation rate, it would be difficult to generalize the result obtained in this study to the majority of the students and clinicians working in Arkhangelsk.

On the domain regarding protective wear the mean score was 53,8%, suggesting suboptimal infection control routines. In Norway, dentists generally adhere to the common national guidelines for infection control in dental practice. However, in other countries, like Russia, no national guidelines exist and clinicians tend to have a subjective manner to dental infection control measures and occupational safety (5).

Table 3 shows that the average percentage for changing of face mask between each patient is about 56%, suggesting that almost half of the respondents use the same mask for more than one patient. Aerosols are small particles that is found in the air in high concentrations in dental clinics. When performing sub- or supragingival scaling for example, the DHCP is exposed to bacteria from the oral cavity of their patient and the only protection in such circumstances is the face mask and goggles. The mask could be a source of infection if not changed regularly between patients (13).

Regarding infection control routine for the use of gloves at the dental clinic and how frequent they should be changed, the data suggest that all the respondents have a good routine for gloves use, and that they change gloves between every patient. Guidelines from the CDC stated that changing of gloves is the easiest way to prevent infection from the patient to the DHCP and from DHCP to the patient (14).

A designated clinical wear is paramount to protect the DHCP from bacteria, blood, saliva and other contaminated fluids during dental treatment procedures. The clinical uniform is exposed to many particles during a work day, and it is therefore advised to change this every day and not to combine private clothing with clinical wear (11). Only 8% of the participants responded that there is a routine for changing clinical uniform regularly. Furthermore, only 4,6% responded that they change their clinic clothes every day. These results suggest suboptimal infection control routines on these matters. Transmission of bacterial substances are easily facilitated when the clinical wear is contaminated, for example, in a one-week used gown, instead of changing them regularly (11). One of clinical wear's main function is to prevent and reduce the spread of microorganisms between DHCP, patients and others at a clinic. If there are lack of proper knowledge in the importance of regularly changing clinical wear, then clinical wear would be a source of infection. A DHCP combining private and work clothing could be a possible carrier for microorganisms (15).

On the domain regarding knowledge on personal hygiene measures, the mean score was 75.1%, indicating intermediate knowledge in infection control measures in this domain. A total of about 85% of the participants indicated that they always wash their hands between each patient. This indicates good routines on this matter. However, only 49,4% responded that they disinfect their hands with, for example, ethanol-based disinfection between every patient, which indicated suboptimal routines on this matter. The main reason why ethanol-based disinfection was brought to the market was that many DHCP where suffering from skin dermatitis due to overdoing hand washing. Ethanol based hand disinfection is shown to remove bacteria just as good as a well-performed hand wash if performed correctly, and the risk of getting contact dermatitis is reduced (16). Skin dermatitis is a known and potentially severe problem amongst DHCP who wash their hands several times during a workday, and can lead to open wounds and cracks in the skin, resulting in a potential entry point for pathogens (17).

Guidelines defined by CDC consider watches, rings and other accessories as a source of contamination and the operator in the dental clinic should not wear this during patient treatment sessions (18). This is especially when doing open surgery due to higher infection risk (18). Table 3 shows that 54% of the respondents use private hand accessories when treating patients. Amongst these, 36% were females and the majority of them were in the age

group above 32. This might indicate that the elder generation of DHCP lack knowledge about the risks of infection transmission associated with wearing hand accessories during dental treatments (18). The majority of the students and younger dentists, approximately 60%, responded that they do not use hand accessories. Although the overall percentage in this domain is high, improvement is still needed.

Dental equipment, which has been sterilized, could be easily contaminated if not handled with care. To perform a proper hand wash and use gloves when dealing with these instruments is considered a good practice by CDC guidelines (11, 12). Table 3 shows that the majority (95,4%) of the study participants are practicing a good routine on this matter.

About 91% of the participants responded that they perform a proper hand hygiene after handling contaminated equipment, indicating good practice on this matter. The most effective way for pathogens to transmit to the DHCP is either from the patient directly or through instruments used in patient's mouth (22).

In the domain containing questions regarding sterilization of the unit and the working surface, the mean score was 71.7%. This score is considered as intermediate knowledge in infection control routines. The percentage of participants that reported that they do unit disinfection between every patient was about 85%, for suction rinse between every patient was about 90%, while for the routines for flushing hand-pieces it was about 89%, and for flushing of hand-pieces between every patient was about 93%. On the other hand, questions regarding cleaning of dental chair/surfaces and changing of filters in the water system were answered quite poorly, with a mean score of about 44% and 30%, respectively.

Approximately 85% answered that they disinfect their unit between every patient. About 14% responded that their unit was disinfected at the beginning and the end of the clinic day, while a little over 1% didn't know how often it was disinfected. The majority of those who answered that their unit was not disinfected between every patient were dentists (76.9%).

For routines regarding rinse of suction, it turned out to be the students who bear the poorest knowledge. Even though most of the respondents were dentists (60.9%), the majority of those with an answer showing suboptimal knowledge were students (66.7%). The same tendency

could be seen from the questions regarding routines for flushing hand-pieces, frequency of flushing hand-pieces and method for cleaning hand-pieces, with a score of 60% and 50%, respectively, and 55% in disfavor of the students. Suction rinse and flushing of hand-pieces are considered as important actions in infection control to remove the biofilm containing bacteria like Legionella spp., which potentially can contaminate both patients and DHCP, from the dental unit water line (19, 20). With these results in mind, it looks like the students practice the best routines when it comes to the most fundamental routines, such as unit disinfection, but have the poorest routines when it comes to more advanced routines, like rinse of suction and flush of hand-pieces. Possible reasons for the differences seen between dental students and dentists regarding the execution of infection control routines could be the lack of common guidelines, the students working more independently than dentists, without help from assistants, or lack of instruction and training regarding infection control during the course of their study.

When it comes to the questions regarding cleaning and change of filters, the data indicated suboptimal routines generally for both dental students and dentists with a score of 43.7% and 30%, respectively. Maintenance of filters is very important for protection of the outer environment, especially from waste containing mercury (11).

When it comes to differences in knowledge of infection control and risk of infection between age groups, results showed that the oldest participants scored the best result. For instance, regarding change of filter, 75% in the age group 53-62 answered that they changed filters once a month, which is considered as correct. While in the other age groups, the correct answer ranged from 24.2% to 33.3%. The same tendency was also observed for question related to cleaning of filters, where age group 53-62 and 43-52 scored 75% and 77.8%, respectively, (washing filters at least once a week), while age group 23-32 and 33-42 scored 35.5% and 45.5%, respectively. This pattern could suggest that knowledge about infection control is acquired with more experience, rather than taught throughout the course of education.

Regarding sterilization and autoclavation, the mean score was 76,4%, indicating intermediate knowledge in infection control routines in this domain. Only 77% of the respondents replied

that they clean hand-pieces and other devices attached to air water lines by autoclaving, and 72% replied that steam autoclaving is the autoclaving method used at their clinic. About 63% of the participants indicated that biological and/or chemical indicators are used to monitor the performance of the autoclaves, indicating a suboptimal routine on this matter. However, 93% responded that there is a dedicated room for cleaning and sterilization of dental instruments at their clinic, indicating a good routine.

A total of 77% responded that they clean dental hand-pieces and other devices attached to air water lines by autoclaving, indicating intermediate routine on this matter. However, only about 17% responded that they only clean their hand-pieces and other devices attached to air water lines with surface disinfectant solutions, while 2,3% combined surface disinfectant solutions with flushing the devices for 30 seconds before dental treatment. About 3,5% responded that they usually do not clean the devices by any of the aforementioned methods. Of the students, only 68% responded correctly, whereas 83% of the dentists responded in a good manner. The age group with the lowest score was from 23 to 32 years, and the age group with the highest score was from 53 to 62 years, with 71% and 100% correct answers, respectively. A dental hand-piece is an internally hollow equipment which is frequently used during dental treatments, and can harvest patient materials (21). It has been demonstrated that viable infectious virus, such as Herpes Simplex Virus (HSV), and other microorganisms can survive and be recovered from dental hand-pieces after external application of disinfectant (21, 22). Cleaning of dental hand pieces with surface disinfection solution is therefore not sufficient to prevent infection transmission. It is recommended to properly clean and heat sterilize the hand-pieces after each use (12).

It is worth mentioning that one possible cause for the poor score among dental students could be that some of the students might have interpreted the question incorrectly because of the way it was formulated. For example, the question about how they clean the equipment could have been formulated to how the equipment is cleaned at the clinic. It is anticipated that most students, and to a lesser extent dentists, are responsible for disinfection of hand-pieces and other devices attached to air water lines, but it is also a possibility that they might have dedicated personnel for sterilization and autoclaving of the instruments and the dental school. Aside from this, other reasons could be lack of knowledge per se on how the instruments should be cleaned after use.

93% responded that there is a dedicated room for cleaning and sterilization of dental instruments at their clinic, which results in an overall good routine. All age groups showed good routines, except the age group 43-52 years which showed intermediate routines, with only 78% reporting a correct answer. According to the CDC guidelines, there should be a dedicated area for sterilization of instruments, and instruments should not be stored in areas where contaminated instruments are held or cleaned (3). Studies have shown that the contamination of aerosols in the air can spread throughout the entire room during certain dental treatments e.g. when using high speed turbine or ultrasonic scaler (13, 23). A dedicated room for handling and sterilization of instruments will decrease the risk of contaminating clean and sterile equipment.

On the question regarding autoclavation methods, 72% of the participants responded that they use steam autoclaving, indicating intermediate knowledge in infection control routines on this matter. The proportion of respondents who answered correctly seems to increase with age, and ranged from 69% in the age group 23-32 years, to 100% for the age group 53-62 years. About 7% responded that they use dry heat autoclavation at their clinic, with the majority of these being dentists. About 21% responded that they don't know which autoclavation method is used at their clinic. According CDC guidelines, both steam and dry sterilization are considered acceptable ways of sterilizing dental equipment, provided that operating parameters, such as sterilization time and temperature, recommended by the manufacturer of the sterilizing equipment are followed (3). With this taken into consideration, 79% of the respondents responded in a good manner, still resulting in intermediate knowledge in infection control routines on this matter.

When asked what type of indicator is used to monitor the performance of autoclaves, about 46% responded that they use a chemical indicator, and about 17% responded that they use a biological indicator, giving a total of 63% responding correctly, resulting in a suboptimal routine on this matter. About 5% responded that they use mechanical indicator, and 2% responded that they don't use any of the aforementioned indicators. As many as 30% responded that they don't know what type of indicators are used. Not only does this indicate suboptimal routines on this matter, but also suggests a lack of knowledge among as many as one third of the respondents on this subject. This is of concern considering that monitoring of

the autoclaves is of great importance to assure adequate sterilization of dental equipment, and it is considered a crucial step in preventing infection transmission during treatment. In this issue, the age group 53-62 years scored the lowest, with 50% of the respondents answering correctly, whereas the age group 43-53 years provided the highest score, with 89% of the respondents answering correctly.

Regarding vaccination and managing of harp instruments, the mean score was 85%, indicating good routines in total on this domain. About 90% of the participants responded that they are vaccinated against Hepatitis B virus (HBV), about 86% responded that there is a protocol for percutaneous injuries within their practice, 86% responded that there is a use of special container for disposal of sharp instruments at their clinic, and about 86% responded that there is a use of needle recapping device and/or needle holder at their clinic, all indicating good knowledge in infection control routines on these matters. However, only 43% responded that they routinely document percutaneous injuries within their practice, and 33% responded that they've never had a percutaneous injury. With a total of 76% of the respondents practicing in a good manner on this matter, this indicates intermediate knowledge in infection control routines in this domain.

HBV immunization is the most efficient measure to prevent HBV infection transmission to both DHCP and patients during dental treatment (1, 24). About 90% of the participants responded that they are vaccinated against HBV. However, 6% responded that they are not vaccinated and the majority of them were female dental students between 23-32 years old. The remaining 4% responded that they don't know if they are vaccinated against HBV, all of them female dental students and again between 23-32 years old. These numbers indicate a good knowledge in infection control routine in total in this domain. According to CDC guidelines, all DHCP should be offered HBV vaccination during training and before contamination with blood (3). Therefore, dental students should be offered HBV vaccination during their training before they start with patient treatments. In 1992, WHO recommended vaccination of all newborns and children under 1 year of age against HBV, and in 1998 vaccination of newborns was implemented in the prophylactic immunization program in Russia. In 2001, immunization of adolescents at 13 years of age was added to the schedule, and in 2006 mass immunization of the Russian population was started as part of a nationwide program. By 2010, almost half of the entire adult Russian population were immunized (25).

There is a possibility that some of the youngest non-vaccinated respondents in fact are vaccinated against HBV through the Russian prophylactic immunization program without being aware of it. Also, there is a possibility that some of the respondents who replied that they are not vaccinated, abstained from vaccination, e.g. due to personal preferences. It was attempted to find information about whether dental students in the Russian Federation are offered vaccination against HBV through their study program, but no information about this was found available in the English language online.

About 86% of the participants responded that there is a protocol for percutaneous injuries at their clinic, indicating a good routine on this matter. About 3% responded that there is no such protocol at their clinic, all of them female dentists. About 10% responded that they don't know if there is a protocol for percutaneous injuries at their clinic, with an equal number of dentists and students. According to CDC guidelines, all DHCP, including students, should be taught strategies to prevent percutaneous injuries and the principles of post-exposure management, and certain interventions have to be initiated promptly to be effective following a percutaneous injury, e.g. post exposure prophylaxis (3), which emphasizes the importance of a protocol for these types of injuries.

Documentation of percutaneous injuries in dental health care settings are important to accurately track them, and to survey their frequency and types for further investigation to find solutions to prevent them from happening (26). According to CDC guidelines, all exposure to blood should be reported as soon as possible (3). When the study participants were asked if they routinely document percutaneous injuries within their practice, 43% responded that they always do, and 33% responded that they've never had a percutaneous injury, resulting in a total of 76% respondents answering correctly, which indicate an overall intermediate knowledge in infection control routine on this matter. About 13% responded that they never document percutaneous injuries, while 11% responded that they sometimes do. Studies have shown that one reason for not reporting percutaneous injuries, is unawareness of the risks associated, or believes that it carries a low risk (27). Of the 33% who responded that they have never had a percutaneous injury, a little over 50% were female dental students, most of them in the age group 23-32 years. Percutaneous injuries among dentists have been found to increase with years of clinical experience (28), although experience, as measured by the years in practice, does not appear to affect the risk of injury among general dentists (1).

On the question regarding puncture resistant container for disposal of sharp instruments at the clinic, a total of 86% responded that they always use it, indicating a good knowledge in infection control routine on this matter. About 7% responded that they sometimes use it, while 2% responded that they never use it. On the other hand, 5% responded that they are not aware that their clinics have a container for this purpose, of these, the majority were dental students. According to CDC guidelines, is recommended that contaminated materials are disposed in designated containers to facilitate safe containment and disposal (29). Using puncture resistant container can result in safer behavior and prevent exposure (26).

When the participants were asked if they use a needle recapping device in their clinic, about 86% responded that they always do, which results in an overall good knowledge in infection control routine on this matter. A report study carried out at the Matsumoto Dental University Hospital from 2005 to 2010 found that occupational injuries were mainly caused by sharp instrument injuries, with syringe needles being the most common instrument causing them. It was found that most dentists and dental students were injured during treatment, unlike dental hygienists, who were injured during cleaning after treatment (28). A needle recapping device is an easy measure to potentially prevent percutaneous injuries, and makes it easy to keep track on the syringe needle at all times. It is of concern that only 76% of the dental students use this device during treatments. There is a need to implement a good infection control routines early on during their practice, so that safe practice and infection prevention measures can be carried out effectively early on in their career.

In this study, infection control routines among last year dental students and dentists were assessed to evaluate the knowledge of risk of infection during dental treatments. In conclusion, the participants showed suboptimal knowledge regarding routines on protective wear, intermediate knowledge regarding routines on personal hygiene, unit and work surface, sterile and autoclave, and good knowledge regarding routines on vaccination and managing of sharp instruments. In general, both students and dentists showed intermediate knowledge, with a mean score of 73% and 76%, respectively. To carry out good routines for infection control in DHCS, the DHCP need to have adequate knowledge about the hazards and the risks of infection transmission in DHCS, as well as the appropriate attitude towards infection control. Hence, failure to adhere to infection control measures could be due to lack of knowledge, inappropriate attitude towards infection control, or a combination of both. This

study does not distinguish between these two factors, and the results can only indicate a lack of knowledge among the participants. The results in this study highlight the need for national guidelines in DHCS, and emphasizes the importance of further instruction and implementation of infection control during the course of education, as well as continuous refreshing of knowledge and training in the subject throughout the practice of DHCP.

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Appendix I

Опрос

Survey regarding infection control in dental health care settings in dental practices in Arkhangelsk, Russia / Опрос об инфекционном контроле в работе в стоматологических учреждениях здравоохранения в г.Архангельске, Россия

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1. Gender/ Пол

- Female / Женский
- Male / Мужской

2. Age / Возраст.

- 23-32
- 33-42
- 43-52
- 53-62
- Over 62 / Более 62

3. Occupation/professional status / Профессия

- Dentistry student 9th or 10th semester / Студент-стоматолог 9-го или 10-го семестра

- Dentist / Врач-стоматолог

4. Which of the following best describes your practice site in the past 12 months? / Какое из следующих примеров лучше всего описывает вашу практическую деятельность за последние 12 месяцев?

- Private / Частная практика
- Public / Государственная практика
- Dentistry student at the university of Arkhangelsk / Студент-стоматологв университете Архангель

5. Which of these personal protective wears/equipment do you use at the clinic? (You can give multiple answers) / Какие из данных индивидуальных средств вы используете в клинике? (Вы можете дать несколько ответов):

- Gloves / Перчатки
- Shoe cower / Бахилы
- Mask / Маска
- Apron / Халат
- Gown/clinic clothes / Медицинский костюм
- Hair cover (cap)/hair tie / Медицинская шапочка
- Eye wear (glasses, plastic masks or shields) / Очки, пластиковые экраны

6. When do you change your face-mask during the clinic day / Как часто вы меняете маску во время приема:

- Between every patient / между каждым пациентом
- When it is dirty/stained / когда она становится грязной
- I don't change it / я ее не меняю
- I don't use face-mask / я не использую маску

7. Regarding the hair cap/hair tie, do you use it / Вы используете медицинскую шапочку:

- All the time / всегда
- Sometimes / иногда
- only when attending surgery / только при посещении операционной
- I don't use hair cap/hair tie / я ее не использую

8. Is there a routine for using of gloves at your clinic / Используете ли вы перчатки во время приема?

- Yes / Да
- No / Нет

9. During a clinic day, how often do you change gloves / Как часто вы меняете перчатки во время приема?

- Between every patient / между каждым пациентом
- I use a single pair the whole day / я использую одну пару целый день
- When they are visibly dirty/worn / когда они сильно загрязнены / изношены
- I do not use gloves / я не пользуюсь перчатками

10. At your clinic, is it a routine for change of gown/clinic clothes every day / Вы меняете свою медицинскую одежду каждый день?

- Yes / Да
- No / Нет

11. How often do you change your gown/clinic clothes / Как часто вы меняете свою медицинскую одежду?

- every day / каждый день
- 2-4 times a week / 2-4 раза в неделю
- when there are visible signs of blood or other fluids on it / когда на ней видны признаки крови или других жидкостей
- once a week or less / раз в неделю или менее

12. How often do you wash your hands between each patient / Вы моете руки между каждым пациентом:

- Always / Всегда
- Sometimes / Иногда
- Never / Никогда

13. How often do you disinfect your hands (with ethanol) between patients / Как часто вы дезинфицируете руки между пациентами (с использованием этанола)?

- Always / Всегда
- Sometimes / Иногда
- Never / Никогда

14. Do you wear watches, rings or other arm-accessories/jewelry during clinical treatment of patients / Вы носите часы, кольца или другие украшения во время клинического приема:

- Always / Всегда
- Sometimes / Иногда
- Never / Никогда

15. Do you perform hand hygiene (hand wash/disinfect/both) before

handling sterile equipment / Выполняете ли вы гигиену рук (мытье рук / дезинфекцию / оба)перед использованием стерильного оборудования?

- Always / Всегда
- Sometimes / Иногда
- Never / Никогда

16. Do you perform hand hygiene (hand wash/disinfect/both) after handling contaminated equipment / Выполняете ли вы гигиену рук (мытье рук /дезинфекция/ оба) после использования загрязненного оборудования?

- Always / Всегда
- Sometimes / Иногда
- Never / Никогда

17. Who disinfects the working surface at your unit / Кто дезинфицируетвашу стоматологическую установку?

- I do / я делаю
- My secretary does / ассистент
- Other, specify / другое, укажите:

18. How often is your unit disinfected / Как часто выдезинфицируете

стоматологическую установку?

- Between every patient / между каждым пациентом
- At the beginning and at the end of the clinic day / в начале и в конце рабочего дня
- Less frequently than any of the above / реже, чем любой из вышеперечисленных
- I don't know / я не знаю

19. How often do you rinse through the suction on your unit / Как часто вы смазываете наконечники?

- Between every patient / между каждым пациентом
- Once a day / один раз в день
- 2-3 times a week / 2-3 раза в неделю
- I don't know / я не знаю

20. Are there any routines for flushing the hand-pieces or air/water piece at your clinic / Существуют ли какие-либо правила для очищения наконечников в вашей клинике?

- Yes / Да
- No / Нет

21. How often do you flush the hand-pieces or air/water piece / Как

часто вы делаете очищение наконечников?

- Between every patient / между каждым пациентом
- Once a day / один раз в день
- 2-3 times a week / 2-3 раза в неделю
- I don't know / я не знаю

22. How do you clean your dental hand pieces and other devices attached to air waterlines / Как вы обрабатываете наконечники и другие мелкиеинструменты (файлы, боры)?

- Cleaning with surface disinfectant solutions / очистка растворами поверхностных дезинфицирующих средств
- Run for 30s before dental treatment / обработка за 30 секунд до лечения зубов
- Autoclaving / автоклавирование
- None of the above / ни один из вышеперечисленных

23. How often do you wash the filters on your unit / Как часто вы моете фильтры на своей установке?

- Every day / каждый день
- Every week / каждую неделю
- Every month / каждый месяц
- Every year / каждый год

- Less often than once a year / реже одного раза в год
- I don't know / я не знаю

24. How often do you change the filters in the dental chair/unit / Как часто вы меняете фильтры в стоматологическом кресле:

- Every month / каждый месяц
- Every year / каждый год
- Every second year / каждый второй год
- Less often than every second year / реже чем каждый второй год
- Don't change / не меняйте

25. Does your clinic have a dedicated room for the cleaning and sterilization of dental instruments / Имеется ли в вашей клинике специальный кабинет для обработки и стерилизации стоматологических инструментов?

- Yes / Да
- No / Нет

26. Which of these autoclavation methods is used at your clinic / Какие из этих методов стерилизации используются в вашей клинике?

- Dry heat - oven type (160ºC – 60-120min) / сухожаровой

шкаф (160ºC - 60-120 мин)

- ☐ Dry heat - rapid heat transfer (191ºC – 6-12min) / сухожаровой шкаф (191ºC - 6-12 минут)
- ☐ Steam-autoclavation 121ºC 20 min / автоклавирование (121ºC 20 мин)
- ☐ Steam-autoclavation 134ºC 3.5-5 min / автоклавирование (134ºC 3,5-5 мин)
- ☐ None of the above / ни один из вышеперечисленных
- ☐ I don't know / я не знаю

27. What indicator is used to monitor the performance of autoclaves / Какой индикатор используется для контроля стерилизации?

- ◯ Biological / биологический
- ◯ Mechanical / механический
- ◯ Chemical / химический
- ◯ None of the above / ни один из вышеперечисленных
- ◯ I don't know / я не знаю

28. Are you vaccinated against Hepatitis B virus (HBV) / Вы вакцинированы против вируса гепатита B (HBV)?

- ◯ Yes / да
- ◯ No / нет

- I don't know / я не знаю

29. Is there a protocol for percutaneous injuries within your practice / Существует ли в вашем учреждении протокол о травмах?

- Yes / да
- No / нет
- I don't know / я не знаю

30. Do you routinely document percutaneous injuries within your practice /Регулярно ли вы документируете травмы в своей практике?

- Always / всегда
- Sometimes / иногда
- Never / никогда
- Haven´t had any percutaneous injuries in the practice / в практике не было никаких травм

31. Do you use a puncture resistant container for disposal of sharp instruments at your clinic / Используете ли вы контейнер для удаления острых инструментов в вашей клинике?

- Always / всегда
- Sometimes / иногда

- Never / никогда
- My clinic doesn't have a container for this purpose / в моей клиники нет контейнера для этой цели

32. Do you use a needle recapping device/needle holder in your dental practice /Используете ли вы шприцы / иглодержатели в своей стоматологической практике?

- Always / всегда
- Sometimes / иногда
- Never / никогда

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