

CORRELATION BETWEEN COMPLIANCE WITH PROTECTIVE GLOVES AND THE LEVEL OF KNOWLEDGE ON INFECTION CONTROL IN YOUNG DENTAL PRACTITIONERS IN IASI, ROMANIA

Livia Bobu¹, Catalina Iulia Saveanu^{1*}, Carina Balcos¹, Magda Barlean², Alice Murariu¹

¹“Gr. T. Popa” U.M.Ph. - Iași, Romania, Faculty of Dentistry, Department of Surgicals

²“Gr. T. Popa” U.M.Ph. - Iași, Romania, Faculty of Dentistry, Department of Implantology, Removable prosthesis, Denture technology

*Corresponding author; *e-mail*: catalina.saveanu@umfiasi.ro

All authors contributed equally to this article

ABSTRACT

The **aim** of the present study was to assess the compliance with protective gloves in young dental practitioners in Iasi, Romania, in correlation with their knowledge on infection control. **Material and methods:** Cross-sectional, questionnaire-based study included 70 subjects aged 22-28 years, attending years IV, V and VI of the Faculty of Dental Medicine within the “Grigore T. Popa” University of Medicine and Pharmacy in Iasi. **Results:** 83.33% of the respondents reported they wear protective gloves for all patients, regardless of the procedure and 65% of them change gloves after each patient. 55% of the subjects stated they wash their hands both before applying and after removing the gloves. 20% of the students said they had received full vaccination against hepatitis B and 42% of them rated the risk of hepatitis B transmission in the dental office as moderate. **Conclusion:** Additional training programs targeting young dental practitioners are required for a better implementation of the Universal/Standard Precautions.

Key words : infection control, gloves compliance, B hepatitis, level of knowledge, dental practitioners.

INTRODUCTION

Most microorganisms that colonize the human oral cavity and respiratory tract, such as hepatitis B virus (HBV), hepatitis C virus (HCV), human immunodeficiency virus (HIV), herpes simplex virus type 1, influenza viruses and many other viruses and bacteria can be transmitted in the dental office. Dental team members, including dental students, are at increased risk of contracting these viruses [1].

The hepatitis B virus poses a special risk to dental practitioners. They can become infected with HBV from a patient as a result of accidental exposure either through percutaneous injuries with syringe needles or other sharp instruments, or through

aerosols contaminated with blood, saliva or gingival secretions. It is estimated that, in case of an accidental injury with a needle contaminated with HBV, the probability of infection is 6-30%. [2]. Hepatitis B virus infections are at least 3 times more common among dentists than in the general population, and in the case of dental surgeons are estimated to be at least 6 times more common [3]. For this reason, vaccination is recommended for the dental staff performing tasks that involve contact with blood, blood-contaminated body fluids or sharp instruments [4].

The hepatitis C virus is less contagious than HBV, given that in the event of an

accidental injury with a contaminated needle, the infection develops in only 1.8-6.0% of cases. Because there is not yet a vaccine against HCV, the incidence of occupational hepatitis C among healthcare professionals is increasing [2].

In case of a single accidental percutaneous injury caused by a HIV-contaminated needle, prospective studies worldwide indicate the average risk of developing the infection is only 0.3% (range 0.2%-0.5%). After an exposure of mucous membranes in the eye, nose, or mouth, the risk is approximately 0.1% [5].

In the clinical context, microorganisms can be transmitted through direct contact with blood, oral fluids, or other secretions, indirect contact with contaminated instruments, surgical equipment, or environmental surfaces, or contact with aerosols of oral and respiratory fluids of infected patients [6]. By implementing infection control guidelines in addition to vaccinations and proper post-exposure management, exposure to infections in dental settings can be prevented.

Infection control recommendations for dentistry were first published by the Centers for Disease Control and Prevention (CDC) in 1986 [4] last updated in 2003 [7]. These guidelines recommend careful handling of sharp instruments, use of rubber dams to minimize blood spattering, hand washing, and use of protective barriers (e.g., gloves, masks, protective eyewear, and gowns).

Surgical gloves were introduced in the early years of the 20th in order to protect the hands of medical staff from the strong antiseptic chemicals used during surgery. Nowadays, gloves' wearing has become essential for an effective cross-infection control [8]. Since the 1980's, wearing gloves has become mandatory in order to protect both patient and surgeon from the risk of cross-infection during oral procedures [9,

10, 11]. However, not all practitioners adhere to these rules, and in the case of dental students, compliance with the wearing of protective equipment is even lower, because of the lack of experience and sometimes the lack of necessary knowledge regarding the risk of transmitting diseases in the dental office [12, 13, 14, 15].

In this context, the present study aimed to assess the compliance of young dental practitioners with protective gloves, in relation to their knowledge of the risk of transmission of major blood-borne pathogens in the dental office.

MATERIAL AND METHODS

Cross-sectional, questionnaire-based study included 70 subjects aged 22-28 years, attending years IV, V and VI of the Faculty of Dental Medicine within the "Grigore T Popa" University of Medicine and Pharmacy in Iasi, Romania.

Inclusion criteria: all subjects who gave their informed consent to participate in the study. The questionnaires were anonymous, to ensure impossible identification of the subjects after processing the answers.

Exclusion criteria: subjects who did not give their consent to participate, questionnaires with incomplete answers.

The questionnaire was self-administered and contained 11 closed-ended, single or multiple-choice questions. The questions contained were based on data from the literature on guidelines for the use of personal protective equipment and the application of the concept of Standard Precautions, in order to control the infection in the dental office. The subjects' knowledge regarding the transmission of the main blood-borne pathogens in the dental office was also targeted.

A pilot study on 20 subjects was conducted for questionnaire validation, followed by the reformulation of some of the

questions where appropriate. The first two questions referred to general data - year of study and gender of subjects. The following questions related to the frequency of use of protective gloves, hand hygiene related to the wearing of protective gloves, and the use of other items of protective equipment. The last questions in the questionnaire referred to the protection against B hepatitis through vaccination, and the knowledge about the risk of transmission of the main blood-borne diseases in the dental office.

The data were statistically analyzed using SPSS (Statistical Package for Social Sciences) 21.0. Chi-square test was used to compare the results by gender and year of study, and Spearman coefficient was used for correlation analysis. Finally, Pearson correlation was used for the analysis of the relationship between the level of knowledge about the transmission risk and compliance with protective equipment. The value of the p cutoff point of statistical significance was set at 0.05, for a 95% confidence interval.

RESULTS AND DISCUSSIONS

70 subjects with a mean age of 24.8 (\pm 2.5) years were included in the initial study group. The response rate to the questionnaires was 85.71%, because 10 questionnaires did not have the complete answers, leading to a final number of 60 questionnaires for the analysis of the results. The distribution by gender was 36 (51.42%) females and 24 (48.58%) males. The distribution by year of study was 18 subjects (30%) from year IV, 18 subjects (30%) from year V, and 24 subjects (40%) from year VI.

The frequency of answers to the first three questions concerning compliance with wearing protective gloves and the wear of other protective items is presented in Table 1. 83.33% of the respondents reported they wear protective gloves for all patients, regardless of the procedure, 11.66%

answered that they wear gloves only for patients with infectious diseases, and 5.01% - only in certain clinical procedures. Comparative analysis of the answers by gender and year of study showed statistically significant differences ($p < 0.05$) and a direct moderate correlation ($r = 0.406$ and $r = 0.386$, respectively), with a higher rate of wearing gloves in female subjects and in students attending the final years of study.

88.66% of the investigated young practitioners reported that they change gloves at the end of the working day, 80% change them when damaged, and 65% change them after each patient. A percentage of 65% of the total group stated that they change their gloves both after each patient and when they are damaged, as well as at the end of the working day. Reduced, non-significant differences ($p > 0.05$) were found by gender. Significant differences were found by the year of study ($p < 0.05$), and a direct strong correlation ($r = 0.513$), with final year students changing their gloves more often than fourth year students.

Regarding the use of other elements of personal protective equipment, the subjects included in the study responded in 100% that they use the medical gown, 80% wear protective mask, 46.66% wear goggles, and 8.33% wear capelin. 80% stated that they use the gown + mask, 46.66% - gown + mask + goggles, and 8.33% - all the elements of protective equipment. Reduced, non-significant differences ($p > 0.05$) were found by gender. Chi-square analysis indicates significant differences by the study year ($p < 0.05$), and the Spearman correlation coefficient indicates a moderate direct association between the number of years of study and the wearing of protective equipment ($r = 0.312$).

The frequency of answers to questions 4-5, concerning hand hygiene in relation to wearing protective gloves is presented in

Table 2. 68.33% of the subjects in the study group stated that they wash their hands after removing the gloves, and 61.66% - before applying them. 55% of the subjects stated that they wash their hands both before applying and after removing the gloves, and 35% of the subjects answered that they do not consider it necessary to sanitize the hands in connection with the application of

protective gloves. Statistical analysis indicates significant differences by year of study ($p < 0.05$), and the Spearman correlation coefficient indicates a strong direct proportional association between the number of years of practice and the frequency of hand hygiene in relation to protective gloves ($r = 0.586$). No significant differences were found by gender ($p > 0.05$).

Table 1. Frequency of answers to questions 1-3. Comparative analysis by gender and year of study

Question	Total (%)	% by gender		% by year of study		
		Male	Female	IV	V	VI
1. Do you wear protective gloves when doing clinical activity?						
a). yes, in all patients	83.33	70.83	91.66	72.22	83.33	91.67
b). only in those with infectious diseases	11.66	20.83	5.55	16.66	11.11	8.33
c). only in certain clinical procedures	5.01	8.33	2.77	11.11	5.55	0.00
d). no, I never do	0.00	0.00	0.00	0.00	0.00	0.00
<i>Sig (p)</i>		0.003*		0.005*		
<i>Correl (r)</i>		0.406		0.386		
2. When do you change your protective gloves?						
a). after each patient	65.00	62.50	66.66	27.77	83.33	83.33
b). when damaged	80.00	75.00	83.33	55.55	88.88	91.66
c). at the end of the working day.	86.66	83.33	88.88	66.66	88.88	91.66
a)+b)+c)	65.00					
<i>Sig (p)</i>		0.736		0.004*		
<i>Correl (r)</i>		-		0.513		
3. What other items of personal protective equipment do you wear during the clinical activity?						
a). medical gown	100	100	100	100	100	100
b). protective mask	80	66.66	89	67	83.33	87.50
c). goggles	46.66	37.50	52.78	11	55.55	66.66
d). hair protection	8.33	4.16	11.11	0	5.55	16.66
a)+b)	80					
a)+b)+c)	46.66					
a)+b)+c)+d)	8.33					
<i>Sig (p)</i>		0.603		0.004*		
<i>Correl (r)</i>		-		0.312		

*significance ($p < 0.05$)

Removal of accessories before applying gloves was declared by 28.33% of subjects. Most of the subjects (36.67%) stated that they remove only some of the accessories, and 35% answered that they do not remove them before applying gloves. Significant differences were found by year of study

($p < 0.05$), with a strong direct correlation between the number of years of practice and the likelihood of removing accessories before applying gloves ($r = 0.694$). No significant differences were found by gender ($p > 0.05$).

Table 2. Frequency of answers to questions 4-5. Comparative analysis by gender and year of study

Question	Total (%)	% by gender		% by year of study		
		Male	Female	IV	V	VI
4. When do you wash your hands?						
a). before applying gloves	61.66	58.33	63.88	33.33	55.55	87.50
b). after removing the gloves	68.33	66.66	69.44	44.44	61.11	91.66
c). I consider it unnecessary because the gloves provide sufficient protection	35.00	58.33	19.44	50	38.88	20.83
a)+b)	55.00	54.16	55.55	33.33	55.55	70.83
<i>Sig (p)</i>		0.021*		0.003*		
<i>Correl (r)</i>		0.218		0.586		
5. Do you remove your accessories (watch, jewelry) before applying gloves?						
a). yes, I do	28.33	25.00	30.55	5.55	22.22	50.00
b). no, I don't	35.00	37.50	33.33	77.77	22.22	12.50
c). yes, but only some of them.	36.67	37.50	36.11	16.66	55.55	37.50
<i>Sig (p)</i>		0.421		0.001*		
<i>Correl (r)</i>		-		0.694		

*significance ($p < 0.05$)

The results of the knowledge assessment analysis regarding the risk of transmission of the main blood-borne pathogens in the dental office are presented in Table 3. When asked about vaccination against hepatitis B, only 20% of subjects stated that they had received full vaccination. Most of them (45%) said they had the vaccine, but not full, 3.33% did not get the vaccine at all, and 31.66% said they did not know exactly what their vaccine status was. Non-significant

differences were found by gender or year of study ($p > 0.05$).

Most subjects (41.66%) considered the risk of hepatitis B transmission in the dental office to be moderate, 35% rated it as low, and 8.33% as high. Significant differences were found by year of study ($p < 0.05$), with direct weak association ($r = 0.126$) between the number of years of practice and the assessed risk of hepatitis B transmission. Non-significant differences were found by gender ($p > 0.05$).

The risk of hepatitis C transmission in the dental office was assessed as low by 38.33% of the subjects, and another 38.33% of them rated it as moderate. Significant differences were found by year of study ($p < 0.05$), with moderate direct correlation between the number of years of study and the assessed risk of hepatitis C ($r = 0.307$).

The risk of HIV transmission in the dental office was estimated to be low by 36.66% of the subjects and 33.33% rated it as moderate. Reduced, non-significant differences ($p > 0.05$) were found by gender and year of study.

Table 3. Frequency of answers to questions 6-9. Comparative analysis by gender and year of study

Question	Total (%)	% by gender		% by year of study		
		Male	Female	IV	V	VI
6. Are you vaccinated against hepatitis B?						
a). yes, full vaccine	20.00	16.66	22.00	17.00	16.66	25.00
b). yes, but not full vaccine	45.00	45.83	44.00	44.00	50.00	41.66
c). no, I am not	3.33	4.16	2.77	0.00	5.55	4.16
d). I do not know.	31.66	33.33	30.55	38.88	27.77	29.16
<i>Sig (p)</i>		0.638		0.285		
<i>Correl (r)</i>		-		-		
7. What do you think is the risk of hepatitis B transmission in the dental office?						
a). low	35.00	37.50	33.33	44.44	33.33	29.16
b). moderate	41.66	41.66	41.66	33.33	44.44	45.83
c). high	8.33	8.33	8.33	5.55	5.55	12.50
d). I do not know.	15.00	12.50	17.00	17.00	16.66	12.50
<i>Sig (p)</i>		0.890		0.016*		
<i>Correl (r)</i>		-		0.126		
8. What do you think is the risk of hepatitis C transmission in the dental office?						
a). low	38.33	35.00	41.66	50.00	38.88	29.16
b). moderate	38.33	37.00	39.66	22.22	38.88	50.00
c). high	7.00	6.33	7.66	5.55	5.55	8.33
d). I do not know.	16.33	21.66	11.00	22.00	16.66	12.50
<i>Sig (p)</i>		0.756		0.011*		
<i>Correl (r)</i>		-		0.307		
9. What do you think is the risk of HIV transmission in the dental office?						
a). low	36.66	38.33	35.00	33.33	38.88	37.50
b). moderate	33.33	35.00	31.66	27.77	27.77	41.66
c). high	13.00	10.66	15.33	11.11	16.66	12.50

d). I do not know.	17.00	16.00	18.00	28.00	16.66	8.33
<i>Sig (p)</i>		0.816		0.421		
<i>Correl (r)</i>		-		-		

*significance ($p < 0.05$)

Significant correlations were found between compliance with personal protective equipment and the level of knowledge on the transmission of main blood-borne pathogens in the dental office

(Table 4), with a direct strong association between wearing protective gloves and knowledge on hepatitis B and hepatitis C transmission risk.

Table 4. The results of the correlation analysis between the wearing of protective equipment and the knowledge on blood-borne pathogens transmission

Question	Do you wear gloves?		When do you change gloves?		When do you wash your hands?		Other elements of prot. equipment	
	<i>p</i>	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>	<i>r</i>
Hepatitis B vaccination	0.036	0.315	0.211	-	0.027	0.418	0.048	0.263
Knowledge on hepatitis B risk	0.007	0.515	0.025	0.436	0.037	0.316	0.032	0.326
Knowledge on hepatitis C risk	0.018	0.473	0.037	0.315	0.022	0.426	0.030	0.421
Knowledge on HIV risk	0.043	0.125	0.076	-	0.060	-	0.047	0.153

*significance ($p < 0.05$)

Infection control is a very important aspect in medical practice and must be kept in mind during the activity in the dental office. Adherence to the Concept of Standard Precautions and compliance with the norms and standards recommended by the competent bodies in the field is an essential premise for the development of dental activity in safe conditions for both the patient and the medical team.

Overall, compliance with wearing protective gloves in the dental office can be appreciated as good: 83.33% of subjects said they wear protective gloves for all patients. The experience in the practical activity was proven by the fact that the percentage of

those who wear gloves for all patients was higher in sixth year students (91.67%).

Hepatitis B vaccination, an effective primary prevention measure, was reported by only 20% of subjects, with a large proportion of others stating that they did not get the full vaccine or that they did not know their vaccine status. The dental team comes into frequent contact with saliva and blood, fluids that can transmit pathogens. Many practitioners have experienced accidental exposure to blood or other contaminated fluids at least once during dental activity, and vaccination is the most effective method of protection.

Personal protective equipment is an essential measure of infection control, an

integral part of the Concept of Standard Precautions. Out of the total number of subjects included in the study, less than half stated that they wear the complete equipment, and these were mainly the students from the final years, with more practical experience in the dental office.

A similar study, conducted in 2015 in Bulgaria [16] on a group of final year students as well as practitioners, showed a protective glove wear rate of 91.5%. Hand hygiene before applying gloves and after removing gloves was reported by 74.5% and 91.5% of subjects, respectively.

A study conducted in Saudi Arabia in 2015, which included students in years IV, V and VI [17], showed that 98.5% of them responded that they always wear gloves, 91.6% wear protective gown, and 90.8% wear protective mask. 99.6% of subjects said they change their gloves after each patient.

In Brazil, a study conducted in 2006 [18] on a group of final-year students indicated a hepatitis B vaccination rate of 90.8% (full vaccine). 99.5% of subjects reported wearing protective gloves for each patient, 100% reported wearing a protective mask and 84.2% reported wearing goggles.

The study conducted by Ramich in 2017 in Germany [19] included dental students of the final year. The results indicated that 33% of the subjects rated the risk blood-borne diseases transmission in the dental office as high. 93.8% of them stated that they always

wear gloves during the clinical activity, and 98.2% stated that they change gloves after each patient. 87.3% reported wearing a mask, and 66.7% reported wearing goggles.

A similar study in Yemen (2015) [20] including dental students in years IV and V showed that 50% of them were protected by vaccination against hepatitis B. 96.6% said they wear protective gloves and 96.5% said they change gloves after each patient, but only 47% reported washing their hands after removing gloves.

Dental staff, including students, are at high risk of exposure to cross-infections with blood-borne pathogens (HBV, HCV, HIV) [21]. This risk is increased in the case of percutaneous injuries caused by the instruments used. Such infections can be prevented by applying specific precautions and by implementing recommendations for infection control, along with vaccination and appropriate post-exposure management [22].

CONCLUSIONS

Most of the dental students included in the present study were compliant with the wearing of protective gloves and other items of personal protective equipment and were aware of the risk of transmission of major blood-borne pathogens in the dental office. For a better implementation of the Universal / Standard Precautions, additional training programs targeting young dental practitioners are required.

REFERENCES

1. Al-Essa N.A., AlMutairi M.A., To what extent do dental students comply with infection control practices? *The Saudi Journal for Dental Research* 2017; 8: 67-72.
2. Szymańska J., Microbiological risk factors in dentistry. Current status of knowledge. *Ann Agric Environ Med* 2005; 12: 157-163.
3. Cottone J.A., Puttaiah R., Hepatitis B infection. Current status in dentistry. *Dent Clin N Am* 1996; 40: 293-307.
4. Centers for Disease Control. Recommended infection-control practices for dentistry. *MMWR Morb Mortal Wkly Rep* 1986; 35:237.
5. Centers for Disease Control and Prevention. Summary of Infection Prevention Practices in Dental Settings: Basic Expectations for Safe Care. Atlanta, GA: Centers for Disease Control and Prevention, US Dept of Health and Human Services; October 2016.

6. Centers for Disease Control and Prevention. Guidelines for infection control in dental health care settings; 2003.
7. Kohn W.G., Harte J.A., Malvitz D.M., Collins A.S., Cleveland J.L., Eklund K.J., Guidelines for infection control in dental health care settings—2003. *J Am Dent Assoc* 2004; 135:33-47.
8. Laheij A., Kistler J.O., Belibasakis G.N., Välimaa H., de Soet J.J., Healthcare-associated viral and bacterial infections in dentistry. *J Oral Microbiol.* 2012; 4: 10.
9. British Dental Association. Advice Sheet A12: Infection control in dentistry. London: BDA, 1996.
10. UK Health Departments. Guidance for clinical healthcare workers: protection against infection with blood-borne viruses. Wetherby: Department of Health, 1998.
11. Ali F., Chandra P., Patil K., Tahasildar S., Double gloving in dentistry: A review. *IAJD* 2016; 7(1): 38-40.
12. Su J., Deng X.H., Sun Z., A 10-year survey of compliance with recommended procedures for infection control by dentists in Beijing. *Int Dent J* 2012; 62(3):148–53.
13. Mutters N.T., Ha`gele U., Hagenfeld D., Hellwig E., Frank U., Compliance with infection control practices in an university hospital dental clinic. *GMS Hyg Infect Control* 2014; 9(3), Doc18.
14. Rahman B., Abraham S.B., Alsalami A.M., Alkhaja F.E., Najem S.I., Attitudes and practices of infection control among senior dental students at college of dentistry, university of Sharjah in the United Arab Emirates. *Eur J Dent* 2013; 7(Suppl. 1):15–9.
15. Murariu A., Dinu C., Agop Forna D., Stefanescu V., Topor G., Forna N.C., Fotea S., Gurau G., Iordache C., Composite resins – multifunctional restorative material and practical approaches in dental field. *Materiale Plastice.* 2020; 57 (2): 276-284.
16. Balcheva M., Panov V.E., Madjova C., Balcheva G., Occupational infectious risk in dentistry – awareness and protection. *Journal of IMAB – Annual Proceeding (Scientific Papers)* 2015; 21(4): 995-999.
17. Al-Maweri S.A., Tarakji B., Shugaa-Addin B., Al-Shamiri M., Alaizari M.A., Infection control: Knowledge and compliance among Saudi undergraduate dental students. *GMS Hygiene and Infection Control* 2015; 10.
18. De Souza R.A., Namen F.M., Galan J., Vieira C., Sedano H.O., Infection Control Measures Among Senior Dental Students in Rio de Janeiro State, Brazil. *Journal of Public Health Dentistry* 2006; 66(4):282-284.
19. Ramich T., Eickholz P., Wicker S., Work-related infections in dentistry: risk perception and preventive measures. *Clin Oral Invest* 2017; 21: 2473-2479.
20. Halboub E.S., Al-Maweri S.A., Al-Jamaei A.A., Tarakji B., Al-Soneidar W.A., Knowledge, Attitudes and Practice of Infection Control among Dental Students at Sana` University, Yemen. *Journal of International Oral Health* 2015; 7(5): 15-19.
21. Anders P.L., Townsend N.E., Davis E.L., McCall W.D., Observed infection control compliance in a dental school: A natural experiment. *American Journal of Infection Control* 2016; 44: e153-e156.
22. Barlean M.C., Popescu E., Balcos C., Bobu L., Macovei G., Barlean L., Prevention of healthcare associated infections by compliance to blood borne pathogens transmission protocols in the dental offices in Iasi. *RJOR* 2019; 11(1): 66-72.