Biosafety in Dentistry: conduct of students before and after an educational intervention

Amanda Lívia Lopes*; Lorrany Gabriela Rodrigues; Lívia Guimarães Zina***; Andréa Clemente Palmier***; Fabiana Vargas-Ferreira***; Mauro Henrique Nogueira Guimarães de Abreu***; Mara Vasconcelos*****

* Dental graduate, Federal University of Minas Gerais
** Dental undergraduate student, Federal University of Minas Gerais
*** Professor, Department of Social and Preventive Dentistry, Faculty of Dentistry / Federal University of Minas Gerais

Received December 04, 2018. Approvado May 10, 2019.

ABSTRACT

The objective of this study was to evaluate the knowledge of and adherence to biosafety and infection control norms of dental students. This was a cross-sectional descriptive study carried out with students from 4th to 10th semester, enrolled in the second half of 2017. An educational intervention to reinforce biosafety knowledge was implemented through the distribution of information flyers to students and poster placement in areas of high pedestrian circulation. Sociodemographic and biosafety information was collected before and after the intervention using a validated questionnaire. Descriptive and bivariate analyses were performed with the chi-square test using SPSS software, version 19. The research was approved by the Research Ethics Committee. The sample consisted of 653 students, most of them female, between the 7th and 10th semesters, with a mean age of 22.6 years. Before and after the intervention, more than 80% always used physical protection barriers. The frequency of environment disinfection and use of personal protection equipment decreased after the intervention. Always performing instrument washing increased from 95.4% to 96.6% after the intervention, while sterilization decreased from 100% to 98.8%. There was an association between the use of personal protection equipment with being women and with semester ($p < 0.001$). We conclude that students in initial semesters more often adhere to biosafety standards. Knowledge about biosafety was not satisfactory for infection control even after the educational intervention.

Descriptors: Infection Control. Containment of Biohazards. Teaching. Sterilization. Personal Protection Equipment.

1 INTRODUCTION

Biosafety is a set of actions that contribute to the prevention, reduction, or elimination of the risks inherent to professional practice, especially in health. Of great importance, dental professionals must have constant updated knowledge about biosafety procedures and standards. The application of

biosafety norms involves knowledge, responsibility, determination, organization, and discipline[1].

To eliminate or reduce the risks in the dental environment, biosafety measures must be adopted by both clinicians and students in dental schools, promoting safety and comfort during the execution of clinical activities[2].

Healthcare professionals and students are constantly exposed to occupational hazards, whether chemical, physical, mechanical, or biological. Percutaneous injuries that may occur during procedures may directly interfere with the clinical work process[3].

The risk of contamination may increase when the professional or student neglects the biosafety protocols. To avoid cross-contamination, preventive measures against the transmission of pathogenic microorganisms must be adopted, and for this, thorough knowledge about biosafety measures and practices are essential. Any measure that decreases the occurrence of incidents are of value to reduce the health risks of patients and professionals[4,5].

Although biosafety measures for professional and patient safety are well established, some factors affect their proper compliance. Lack of knowledge, faulty sterilization methods, bacterial viral resistance, and the lack of care with risky situations contribute to the increase in infection rates[6].

In dental schools, the knowledge about biosafety, use of personal protective equipment (PPE), and prevention of occupational accidents increase with course progression. Data from a study with students enrolled in the first, fifth, and last semester of three faculties emphasize the importance to promote a formative process on biosafety from the beginning of dental school, seeking a solid theoretical base that guarantees students a high confidence in clinical activities[2,7].

Therefore, the objective of the present study was to evaluate the knowledge of and adherence to biosafety and infection control standards of undergraduate students in dental school.

2 MATERIALS E METHODS

This study involved students from the Dental School of the Federal University of Minas Gerais (UFMG) enrolled from the 4th to the 10th semester, in the second half of 2017. An intervention that sought to reinforce biosafety knowledge was implemented with the distribution of informative flyers to students before the beginning of dental clinic and the display of educational posters in places of high flow of people. The poster highlighted the correct procedures in biosafety, use of PPE, disinfection of the work environment, and washing, sterilization and storage of instruments.

Socioeconomic and biosafety information was collected through a questionnaire adapted from Martins (2016)[8] before the intervention and after three months. Variables included sex, semester, and habits with personal protection, disinfection of the work environment, washing of instruments, attitudes, and knowledge. Responses were organized on a Likert-type scale. Analyzes were performed in SPSS software, version 19. Descriptive analysis was performed using absolute (n) and relative (%) frequencies. For the bivariate analysis, the chi-square test ($p < 0.05$) was used. This research was approved by the Ethics Committee of UFMG (Opinion No. 1,575,644, CAAE: 42723315.3.0000.5149).

3 RESULTS

The sample comprised 323 undergraduate students in Dentistry before the intervention and 330, after. More than 70% of participants were female and more than half were between the 7th

and 10th semester (Table 1). The mean age was similar between the before and after groups, 22.6 (± 2.62) years, ranging from 19 to 49 years.

Table 2 describes the characteristics related to individual protection. The masks use was reported by almost all students after the intervention. However, safety glasses were used sometimes/never before the intervention by 32.0% and no improvement was observed with the intervention (35.0%).

Table 1. Characteristics of dental students from UFMG before (n = 323) and after (n = 330) the information intervention

Variables	**Before intervention**		**After intervention**	
	n	%	n	%
Sex				
Male	69	21.4	75	23.2
Female	254	78.6	248	76.8
Semester				
4º to 6º	153	47.4	147	45.5
7º to 10º	170	52.6	176	54.4

Table 2. Use of personal protective equipment by dental students from UFMG before (n = 323) and after (n = 330) the intervention

Variables	Before intervention		After intervention	
	n	%	n	%
Use of mask				
Always	314	97.0	324	98.2
Sometimes/never	9	3.0	6	1.8
Use of safety glasses				
Always	219	68.0	209	65.0
Sometimes/never	104	32.0	113	35.0
Use of surgical cap				
Always	303	94.0	311	94.2
Sometimes/never	20	6.0	19	5.8

The frequency of handpiece disinfection was done sometime or never by 5.9% before the intervention and after the intervention there was a reduction to 4.6%. In contrast, 26.0% of

the students never or sometimes performed the disinfection of the triple syringe (table 3).

Before the intervention, 87.6% of students always applied the mechanical barrier to the equipment, and after, a decrease to 84.0% was observed. The handpiece was always covered with the barrier by 74.3% before, and by 69.0% after the intervention. The same was found for the triple syringe: before the intervention it was always covered by more than 97% of the students and after the intervention, 95.1% covered the syringe (table 4).

Table 3. Disinfection procedures performed by dental students from UFMG before (n = 323) and after the intervention (n = 330)

Variables	Before intervention		After intervention	
	n	%	n	%
Disinfection of surfaces before procedures				
Always	258	79.9	235	71.2
Sometimes / never	65	20.1	95	28.8
Disinfection of the light reflector				
Always	235	72.8	230	70.8
Sometimes / never	88	27.2	95	29.2
Disinfection of the handpiece				
Always	304	94.1	314	95.4
Sometimes / never	19	5.9	15	4.6
Disinfection of the chair				
Always	312	96.6	306	92.7
Sometimes / never	11	3.4	24	7.3
Disinfection of the triple syringe				
Always	247	76.5	243	73.9
Sometimes / never	76	23.5	86	26.1
Disinfection of the dental spittoon				
Always	77	23.8	59	18.2
Sometimes / never	246	76.2	266	81.8
Disinfection of the instrument table				
Always	309	95.7	312	94.8
Sometimes / never	14	4.3	17	5.2

Table 4. Placement of mechanical barriers performed by dental students from UFMG before (n = 323) and after the intervention (n = 330)

Variables	Before intervention		After intervention	
	n	%	n	%
Mechanical barrier on surfaces				
Always	283	87.6	273	84.0
Sometimes / Never	40	12.4	52	16.0
Mechanical barrier on light reflector				
Always	285	88.2	304	93.5
Sometimes / Never	38	11.8	21	6.5
Mechanical barrier on handpiece				
Always	240	74.3	225	69.0
Sometimes / Never	83	25.7	101	31.0
Mechanical barrier on chair				
Always	310	96.0	317	97.2
Sometimes / Never	13	4.0	9	2.8
Mechanical barrier on the triple syringe				
Always	315	97.8	310	95.1
Sometimes / Never	7	2.2	16	4.9
Mechanical barrier on instrument table				
Ever	269	83.3	273	83.7
Sometimes / Never	54	16.7	53	16.3
Replacement of barriers between patients				
Always	288	89.2	277	85.0
Sometimes / Never	35	10.8	49	15.0
Removal of all barriers after finishing the service				
Always	307	95.1	309	95.1
Sometimes / Never	16	4.9	16	4.9

Table 5 shows the frequency of instrument washing and sterilization, which were always performed by 95.4% of the students before the intervention and by 96.6% after the intervention, not reaching the recommended 100.0%. Sterilization was done by all students before the intervention and after, 4 students reported sometimes sterilizing the instruments.

The use of PPE was always done by 65.6% and 62.3%, respectively before and after the intervention. Always using PPE was associated with sex ($p < 0.001$) and period ($p < 0.001$). Female students showed higher rate of PPE use (71.3%) compared to males (44.9%) as well as students in the 4th compared to the last semester (73.9% and 37.5%, respectively) (Table 6).

Before the intervention, 95.7% of the students in the 4th semester and 67.5% of the last semester placed a cover in the hand-piece ($p < 0.001$). After the intervention, the frequency of handpiece protection decreased as students progressed through the course (table 7).

All 4th semester students used a cover in the triple syringe before the intervention, and in the last semester the frequency reduced to 95.0%. A similar situation was found after the intervention ($p < 0.001$) (table 8).

Table 5. Washing and sterilization of instruments performed by dental students from UFMG before (n = 323) and after (n = 330) the intervention

Variables	Before intervention		After intervention	
	n	%	n	%
Washing before sterilization				
Always	308	95.4	315	96.6
Sometimes / Never	15	4.6	11	3.4
Disinfection of instruments before washing				
Always	249	77.1	160	49.5
Sometimes / Never	74	22.9	163	50.5
Sterilization of materials before use				
Always	323	100.0	322	98.8
Sometimes / Never	0	0	4	1.2

Table 6. Association between the use of mask, cap, and glasses (PPI) before and after the intervention and independent variables (sex and semester) of dental students from UFMG

Variables		**EPI before**		**p**		**EPI after**		**p**
	n	Always n (%)	Sometimes/Never n (%)		n*	Always n (%)	Sometimes/Never n (%)	
		212 (65.6)	111 (34.4)			201 (62.3)	121 (37.7)	
Sex				<0.001				0.024
Female	254	181 (71.3)	73 (28.7)		253	166 (65.6)	87 (34.4)	
Male	69	31 (44.9)	38 (55.1)		77	39 (51.3)	37 (48.7)	
Semester				<0.001				0.012
4º	46	34 (73.9)	12 (26.1)		42	33 (78.6)	9 (21.4)	
5º	50	40 (80.0)	10 (20.0)		51	34 (66.7)	17 (33.3)	
6º	57	45 (78.9)	12 (21.1)		54	39 (72.2)	15 (27.8)	
7º	42	27 (64.3)	15 (35.7)		47	31 (66.0)	16 (34.0)	
8º	50	26 (52.0)	24 (48.0)		44	23 (52.3)	21 (47.7)	
9º	38	25 (65.8)	13 (34.2)		58	30 (51.7)	28 (48.3)	
10º	40	15 (37.5)	25 (62.5)		33	15 (45.5)	18 (54.5)	

*Missing data

Table 7. Association between covering of the hand piece and independent variables (sex and semester) before and after the intervention of the dental students from UFMG

Variables	Covering of the handpiece (before)			p	Covering of the handpiece (after)			p
	n	No n (%)	Yes n (%)		n*	No n (%)	Yes n (%)	
Sex				*0.481*				*0.946*
Female	254	63 (24.8)	191 (75.2)		251	78 (31.1)	173 (68.9)	
Male	69	20 (29.0)	49 (71.0)		75	23 (30.7)	52 (69.3)	
Semester				*<0.001*				*<0.001*
4º	46	2 (4.3)	44 (95.7)		42	1 (2.4)	41 (97.6)	
5º	50	4 (8.0)	46 (92.0)		50	7 (14.0)	43 (86.0)	
6º	57	16 (28.1)	41(71.9)		53	9 (17.0)	44 (83.0)	
7º	42	7 (16.7)	35 (83.3)		48	20 (41.7)	28 (58.3)	
8º	50	21 (42.0)	29 (58.0)		44	20 (45.5)	24 (54.5)	
9º	38	20 (52.6)	18 (47.4)		58	26 (44.8)	32 (55.2)	
10º	40	13 (32.5)	27 (67.5)		31	18 (58.1)	13 (41.9)	

Table 8. Association between covering of the triple syringe and independent variables (sex and semester) before and after the intervention of Dental students from UFMG

Variables	Covering of the triple syringe (before)			p	Covering of the triple syringe (after)			p
	n	No n (%)	Yes n (%)		n*	No n (%)	Yes n (%)	
Sex				*<0.001*				*0.846*
Female	253	2 (0.8)	251 (99.2)		251	12 (4.8)	239 (95.2)	
Male	69	5 (7.2)	64 (92.8)		75	4 (5.3)	71 (94.7)	
Semester				*0.031*				*<0.001*
4º	46	0 (0)	46 (100.0)		42	0 (0)	42 (100.0)	
5º	50	0 (0)	50 (100.0)		50	0 (0)	50 (100.0)	
6º	57	0 (0)	57(100.0)		53	0 (0)	53 (100.0)	
7º	42	0 (0)	42 (100.0)		48	4 (8.3)	44 (91.7)	
8º	50	4 (8.0)	46 (92.0)		44	3 (6.8)	41 (93.2)	
9º	37	1 (2.7)	36 (97.3)		58	3 (5.2)	55 (94.8)	
10º	40	2 (2.5)	38 (95.0)		31	6 (19.4)	25 (80.6)	

Knowledge about biosafety was reported by 53.6% before and by 44% after the intervention.

Before the intervention, the main source of knowledge about biosafety was reported to be the dental course by 287 (88.9%) of the 323 participants, which increased after the intervention to 297 (91.4%) of the 325 respondents. Before the intervention, 85.5% of the students reported that there was no professor orientation (enforcement) during the clinical activities, a response maintained after the

intervention by 76.8% of the interviewees.

4 DISCUSSION

This study allowed several analyzes and the factors with the greatest impact on biosafety were detailed. A total of 330 students from the 4th to the 10th semester answered the survey. More than 70% were female, which is probably due to the predominance of women in dentistry courses demonstrated in studies conducted in other Brazilian educational institutions[4,8-10].

Most students always used mask (98.2%) and cap (94.2%), but only 65.0% always wore safety glasses, similar to other studies[1,11-13]. The use of PPE is mandatory for all procedures, including cleaning the environment and reprocessing of instruments, besides being an efficient protective barrier[14,15]. Female students use PPE more often than males, according to a study conducted at the same institution[8]. This finding might be related to the greater fear by women of hurting patients or themselves, and thus respecting biosafety rules more.

Before the intervention, 79.9% of the students disinfected the work surfaces, deceasing to only 71.2%. An even lower frequency was observed in the dentistry course of the Federal University of Paraíba[4]. The disinfection of the handpiece was performed by 94.1% of the students before and by 95.4% after the intervention. A similar result was found in a study carried out with undergraduate students from another university, in which 97.1% of the respondents disinfected the handpiece between patients[17]. Before the intervention, 76.5% always performed the disinfection of the triple syringe, and after 73.9%. The handpiece/high-speed motor and the triple syringe are an important source of contamination because of their close contact with the oral cavity during procedures[17,18]. The recommended guidelines for disinfection is using 70% alcohol (medium level desinfection), a product with tuberculocidal, bactericidal, fungicidal, and viruscidal activities, but not sporicidal activity[19].

Mechanical barrier protection of the instruments was done always by 87.6% of the students before the intervention, and after, by only 84.0%. Findings were similar for the handpiece (before 74.3% and after 69.0%) and the triple syringe (before 97.8% and after 95.1%). Similar results were found in the Dentistry course at the Federal University of Paraíba, where 73.5% of the students always used physical protection, and the handpiece and triple syringe were some of the least protected items[4]. Before the intervention, 95.7% of the 4th semester students always protected the handpiece and only 67.5% in the last semester did this procedure. Similarly, before the intervention, 100% of the students of the 4th semester covered the syringe and in the last semester, the frequency was reduced to 95.0%. After the educational intervention, the frequency of handpiece and triple syringe covering decreased as students advanced in the course. Another study observed that the cleaning behavior of students in the 5th semester for handpieces and syringes was worse than those of the other students[4].

Ninety-five percent of students always washed the instruments before the intervention, and after it increased to 96.6%. Pimentel et al. (2012)[4] observed that washing instruments prior to sterilization was often performed by 86.2% and 10.3% washed instruments when dirt was visible.

Before the intervention, 100% of the students always sterilized the instruments and after, a reduction to 98.8% was found. Other studies also showed that sterilization is

performed around 98% to 99.1%[1,4]. In a study in the state of Rio de Janeiro, more than 60% of students and dentists perform sterilization as one of the methods to avoid cross-contamination[20]. Sterilization should be performed on all items that get in contact with blood and mucous membranes, as it completely eliminates all forms of microorganisms present, including bacterial spores[19,21].

Before the intervention, 53.6% of the students reported that they were aware of the guidelines and after, only 44.0% reported the knowledge. In the study by Schroeder et al., (2010)[9], 75.35% of the students knew about biosafety norms and only 9.15% did not know them.

The faculty of dentistry was reported as being the source of knowledge about biosafety by 287 of the 323 participants (88.9%) before the intervention and after, 297 of 325 (91.4%) reported the same aspect. Souza et al., (2017)[22] showed that students from the Federal University of Pernambuco supported the use of social networks such as Facebook (94.3%), WhatsApp (100%), and Instagram (88.7%) as a means of studying Biosafety.

Although the educational intervention was not aiming teachers, there was an improvement in their attitude. Prior to the intervention, 85.5% of the students reported that professors did not make biosafety considerations in the clinic. After, 76.8% answered that there was no orientation (reinforcement).

The results found in this study may be related to fact that the Biosafety instruction is given in the initial periods of the Dentistry course of the Federal University of Minas Gerais, or that safety procedures are more closely monitored by the teachers in the initial semesters.

5 CONCLUSION

In this study, it was observed that the students of the Faculty of Dentistry of the Federal University of Minas Gerais adhered more frequently to the biosafety norms in their initial semesters compared to the students in the last semesters. Among the PPE items analyzed, glasses were the least used. Knowledge about biosafety was not sufficient for infection control, even after the educational intervention. These data point to the need for greater control and application effectiveness of biosafety norms and principles in university teaching, which has an important role in the orientation and monitoring of students to ensure that biosafety norms are implemented in the daily clinical practice, guaranteeing protection and quality of dental care.

RESUMO

Biossegurança em Odontologia: conduta dos estudantes antes e após uma ação educativa

The objective of this study was to evaluate the knowledge of and adherence to biosafety and infection control norms of dental students. This was a cross-sectional descriptive study carried out with students from 4th to 10th semester, enrolled in the second half of 2017. An educational intervention to reinforce biosafety knowledge was implemented through the distribution of information flyers to students and poster placement in areas of high pedestrian circulation. Sociodemographic and biosafety information was collected before and after the intervention using a validated questionnaire. Descriptive and bivariate analyses were performed with the chi-square test using SPSS software, version 19. The research was approved by the Research Ethics Committee. The sample consisted of 653 students, most of them female, between the 7th and 10th semesters, with a mean age of 22.6 years. Before and after the intervention, more than 80% always used physical protection barriers. The frequency

of environment disinfection and use of personal protection equipment decreased after the intervention. Always performing instrument washing increased from 95.4% to 96.6% after the intervention, while sterilization decreased from 100% to 98.8%. There was an association between the use of personal protection equipment with being women and with semester ($p < 0.001$). We conclude that students in initial semesters more often adhere to biosafety standards. Knowledge about biosafety was not satisfactory for infection control even after the educational intervention.

Descriptors: Infection Control. Containment of Biohazards. Teaching. Sterilization. Personal Protection Equipment.

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Correspondence to:
Lorrany Gabriela Rodrigues
e-mail: lorranygrodrigues@gmail.com
Rua Jornalista Wilson Angelo, 71/03 São Luiz
31.310-220 Belo Horizonte/MG Brazil